[ORAL ARGUMENT NOT YET SCHEDULED]

No. 16-1298

IN THE UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

NATURAL RESOURCES DEFENSE COUNCIL, INC. AND
POWDER RIVER BASIN RESOURCE COUNCIL,

Petitioners,

v.

UNITED STATES OF AMERICA AND
NUCLEAR REGULATORY COMMISSION,

Respondents.

PETITION FOR REVIEW OF FINAL ORDER OF THE UNITED STATES
NUCLEAR REGULATORY COMMISSION

JOINT APPENDIX – VOLUME 1

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Friday, October 07, 2016

STRATA ENERGY

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1	NATURAL RESOURCES DEFENSE COUNCIL/POWDER RIVER BASIN RESOURCE COUNCIL'S REQUEST FOR EXTENSION OF TIME TO FILE REQUEST FOR HEARING/ PETITION FOR LEAVE TO INTERVENE IN NRC REVIEW OF STRATA ENERGY'S ROSS IN SITU URANIUM LICENSE APP . . . (PKG ML11223A260)	08/10/2011	ML11223A261
2	CERT OF SERVICE FOR NATURAL RESOURCES DEFENSE COUNCIL/POWDER RIVER BASIN RESOURCE COUNCIL'S REQUEST FOR EXTENSION OF TIME TO FILE REQUEST FOR HEARING/PETITION FOR LEAVE TO INTERVENE IN NRC REVIEW OF STRATA ENERGY'S ROSS IN SITU . . . (PKG ML11223A260)	08/10/2011	ML11223A262
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6	NRC STAFF'S RESPONSE IN SUPPORT OF STRATA ENERGY MOTION FOR RECONSIDERATION OF THE SECRETARY'S DECISION GRANTING NATURAL RESOURCES/POWDER RIVER'S MOTION FOR EXTENSION OF TIME; NOTICES OF APPEARANCE OF MOLLY B. MARSH AND CARRIE SAFFORD ON BEHALF OF NRC	08/23/2011	ML11235A681
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144	NRC STAFF RESPONSE TO NATURAL RESOURCES DEFENSE COUNCIL'S AND POWDER RIVER BASIN RESOURCE COUNCIL'S JOINT MOTION TO RESUBMIT CONTENTIONS AND ADMIT ONE NEW CONTENTION IN RESPONSE TO STAFF'S SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT	06/03/2013	ML13154A529
145	STRATA ENERGY, INC'S RESPONSE TO NATURAL RESOURCE DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL NEW AND AMENDED CONTENTIONS ON DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT (FILED AS CORRECTED VERSION - ORIGINAL WAS SUBMISSION ID 24640)	06/03/2013	ML13154A534
146	NATURAL RESOURCES DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL'S JOINT MOTION FOR LEAVE TO FILE EXCESS PAGES IN THEIR REPLY TO NRC STAFF AND STRATA IN SUPPORT OF THEIR MOTION FOR NEW/AMENDED CONTENTIONS FILED MAY 6, 2013	06/12/2013	ML13163A206
147	ORDER (GRANTING REQUEST TO EXCEED PAGE LIMIT)	06/13/2013	ML13164A063
148	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S COMBINED REPLY IN SUPPORT OF MOTION TO RESUBMIT CONTENTIONS & ADMIT ONE NEW CONTENTION IN RESPONSE TO STAFF'S SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT	06/17/2013	ML13168A589

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
149	NRC STAFF HEARING FILE UPDATE - JULY, 2013	07/02/2013	ML13183A080
150	PETITIONERS' MANDATORY DISCLOSURE REPORT UNDER 10 CFR § 2.336 - JULY, 2013	07/02/2013	ML13183A157
151	APPLICANT STRATA ENERGY, INC'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES	07/02/2013	ML13184A003
152	MEMORANDUM AND ORDER (RULING ON MOTION TO RESUBMIT CONTENTIONS AND TO ADMIT A NEW CONTENTION)	07/26/2013	ML13207A237
153	NRC STAFF'S AUGUST 2013 UPDATE TO HEARING FILE AND DISCLOSURES	08/02/2013	ML13214A227
154	PETITIONERS' MANDATORY DISCLOSURE REPORT UNDER 10 CFR § 2.336	08/02/2013	ML13214A238
155	APPLICANT STRATA ENERGY, INC'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES	08/02/2013	ML13214A428
156	NRC STAFF'S NOTICE TO THE BOARD REGARDING ADDITIONAL MANDATORY DISCLOSURES RELATING TO NEW/AMENDED CONTENTIONS	08/05/2013	ML13217A361

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
157	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S MOTION FOR LEAVE TO REQUEST PARTIAL RECONSIDERATION OF THE BOARD'S MEMORANDUM AND ORDER OF JULY 26, 2013, OR ALTERNATIVELY, TO FILE AMENDED CONTENTION	08/05/2013	ML13217A439
158	MEMORANDUM AND ORDER (SUSPENDING SCHEDULE FOR SUBMITTING DISPOSITIVE MOTIONS REGARDING ENVIRONMENTAL CONTENTION 4/5A)	08/07/2013	ML13219A820
159	STRATA ENERGY, INC.'S MOTION FOR EXTENSION OF TIME TO RESPOND TO NATURAL RESOURCE DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL'S MOTION FOR RECONSIDERATION	08/08/2013	ML13220B066
160	ORDER (GRANTING MOTION FOR EXTENSION OF TIME TO RESPOND TO MOTION FOR RECONSIDERATION OR TO AMEND CONTENTION)	08/09/2013	ML13221A099
161	NATURAL RESOURCES DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL'S UNOPPOSED MOTION TO AMEND THE REVISED GENERAL SCHEDULE IN THE MATTER OF STRATA ENERGY, INC.	08/12/2013	ML13224A159

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
162	NRC STAFF RESPONSE TO NATURAL RESOURCES DEFENSE COUNCIL'S AND POWDER RIVER BASIN RESOURCE COUNCIL'S MOTION FOR LEAVE TO REQUEST PARTIAL RECONSIDERATION OF THE BOARD'S MEMORANDUM AND ORDER OF JULY 26, 2013, OR ALTERNATIVELY, TO FILE AMENDED CONTENTION	08/15/2013	ML13227A330
163	STRATA ENERGY'S RESPONSE TO NRDC'S AND PRBRC'S MOTION FOR LEAVE TO REQUEST PARTIAL RECONSIDERATION OF THE BOARD'S MEMORANDUM AND ORDER OF JULY 26, 2013, OR ALTERNATIVELY, TO FILE AMENDED CONTENTION	08/19/2013	ML13231A188
164	ORDER (CORRECTING CITATIONS IN LBP-13-10)	08/21/2013	ML13233A120
165	MEMORANDUM AND ORDER (DENYING MOTION FOR RECONSIDERATION OF LBP-13-10 RULING REGARDING ENVIRONMENTAL CONTENTION 4/5A OR, ALTERNATIVELY, TO ADMIT AMENDED CONTENTION)	08/27/2013	
166	PETITIONERS' MANDATORY DISCLOSURE REPORT UNDER 10 CFR § 2.336 - SEPTEMBER, 2013	09/03/2013	ML13246A220
167	APPLICANT STRATA ENERGY, INC'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES - SEPTEMBER, 2013	09/03/2013	ML13246A466

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
168	NRC STAFF'S SEPTEMBER 2013 UPDATE TO HEARING FILE AND DISCLOSURES	09/03/2013	ML13246A487
169	NRC STAFF'S NOTICE TO THE BOARD OF CHANGE IN FINAL ENVIRONMENTAL IMPACT STATEMENT ISSUANCE DATE	09/03/2013	ML13246A492
170	NOTICE OF ATOMIC SAFETY AND LICENSING BOARD RECONSTITUTION	09/10/2013	ML13253A311
171	PETITIONERS' MANDATORY DISCLOSURE REPORT UNDER 10 CFR § 2.336, OCTOBER, 2013	10/02/2013	ML13275A131
172	NRC STAFF HEARING FILE UPDATE - OCTOBER, 2013	10/02/2013	ML13275A165
173	STRATA MANDATORY UPDATE TO MANDATORY DISCLOSURES - OCTOBER, 2013	10/02/2013	ML13275A540
174	MEMORANDUM AND ORDER (REVISED GENERAL SCHEDULE)	10/07/2013	ML13280A466
175	NOTICE OF THE SECRETARY (REGARDING AGENCY SHUTDOWN)	10/10/2013	
176	NOTICE OF THE SECRETARY LIFTING SUSPENSION OF ADJUDICATORY ACTIVITY	10/17/2013	ML13290A508

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
177	STRATA ENERGY, INC.'S MOTION FOR EXTENSION OF TIME TO RESPOND TO LICENSING BOARD'S 2013 GENERAL ORDER REGARDING GOVERNMENT SHUTDOWN AND AFFECTED FILING DEADLINES	10/21/2013	ML13294A644
178	STRATA ENERGY INC.'S OBJECTION TO LICENSING BOARD'S OCTOBER 7, 2013 DETERMINATION NOT TO PERMIT SUMMARY DISPOSITION MOTIONS	10/22/2013	ML13295A689
179	MEMORANDUM AND ORDER (RULING ON TIME EXTENSION MOTION AND SETTING SCHEDULE FOR RESPONSES TO OBJECTION TO LICENSING BOARD'S OCTOBER 7, 2013 REVISED GENERAL SCHEDULE)	10/23/2013	ML13296A469
180	NRC STAFF'S RESPONSE TO STRATA ENERGY, INC'S OBJECTION TO LICENSING BOARD'S OCTOBER 7, 2013 REVISED GENERAL SCHEDULE	10/29/2013	ML13302C201
181	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S RESPONSE TO STRATA ENERGY INC.'S OBJECTION TO THE LICENSING BOARD'S OCTOBER 7, 2013 ORDER	10/29/2013	ML13302C204
182	NRC STAFF'S NOVEMBER 2013 HEARING FILE UPDATE	11/01/2013	ML13305A117
183	NRDC'S AND PRBRC'S MONTHLY DISCLOSURES - NOVEMBER, 2013	11/04/2013	ML13308B184

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
184	STRATA ENERGY'S MANDATORY DISCLOSURE UPDATE - NOVEMBER, 2013	11/04/2013	ML13308C218
185	NRC STAFF'S LETTER TO THE BOARD RE FSEIS ISSUANCE DATE	11/04/2013	ML13308C541
186	MEMORANDUM AND ORDER (REVISED GENERAL SCHEDULE)	11/06/2013	ML13310A590
187	NRDC'S AND PRBRC'S DECEMBER, 2013 DISCLOSURES	12/02/2013	ML13336A612
188	NRC STAFF'S DECEMBER 2013 HEARING FILE UPDATE	12/02/2013	ML13336A652
189	APPLICANT STRATA ENERGY, INC'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES - DECEMBER, 2013	12/12/2013	ML13346A100
190	NRC STAFF TRANSMITTAL OF STRATA ROSS HEARING FILE AND MANDATORY DISCLOSURES, HEARING FILE INDEX, UPDATE - DECEMBER 31, 2013	12/31/2013	ML13365A093
191	PETITIONERS' MANDATORY DISCLOSURE REPORT UNDER 10 CFR SECTION 2.336.	01/02/2014	ML14007A642
192	MEMORANDUM AND ORDER (REQUESTING UPDATE ON ISSUANCE DATE FOR FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT)	01/15/2014	ML14015A363

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
193	NRC STAFF'S NOTICE TO THE BOARD OF FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT ISSUANCE DATE	01/24/2014	ML14024A457
194	MEMORANDUM AND ORDER (REQUESTING PREHEARING CONFERENCE SCHEDULING INFORMATION)	01/29/2014	ML14029A203
195	PETITIONERS' MANDATORY DISCLOSURE REPORT UNDER 10 CFR § 2.336 - FEBRUARY, 2014	02/03/2014	ML14034A119
196	STRATA ENERGY'S MANDATORY DISCLOSURES - FEBRUARY, 2014	02/03/2014	ML14034A125
197	NRC STAFF'S HEARING FILE UPDATE - FEBRUARY, 2014	02/03/2014	ML14034A234
198	MEMORANDUM AND ORDER (SCHEDULING PREHEARING CONFERENCE)	02/04/2014	ML14035A187
199	TRANSCRIPT OF FEBRUARY 25, 2014 PRE-HEARING TELEPHONE CONFERENCE	02/25/2014	ML14057A689
200	STRATA ENERGY, INC.'S MANDATORY DISCLOSURES - FEBRUARY, 2014	02/28/2014	ML14059A437
201	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S NOTICE REGARDING MATTERS RAISED AT THE FEBRUARY 25, 2014 TELEPHONIC CONFERENCE	02/28/2014	ML14059A536

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
202	PETITIONERS' MANDATORY DISCLOSURE - MARCH, 2014	03/04/2014	ML14063A376
203	MEMORANDUM AND ORDER (RULING ON PROCEDURAL MATTERS RAISED AT PREHEARING CONFERENCE)	03/04/2014	ML14063A377
204	NRC STAFF'S MARCH 2014 UPDATE TO HEARING FILE AND DISCLOSURES	03/04/2014	ML14063A519
205	NOTICE OF WITHDRAWAL OF MOLLY BARKMAN MARSH AND NOTICE OF APPEARANCE OF CHRISTOPHER HAIR, BOTH ON BEHALF OF NRC STAFF	03/27/2014	ML14086A441
206	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S JOINT MOTION TO MIGRATE OR AMEND CONTENTIONS, AND TO ADMIT NEW CONTENTIONS IN RESPONSE TO STAFF'S FINAL SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT [PKG # ML14091A001]	03/31/2014	ML14091A002
207	SECOND DECLARATION OF CHRISTOPHER E. PAINE IN SUPPORT OF THE NRDC & PRBRC'S JOINT MOTION TO MIGRATE OR AMEND CONTENTIONS, AND TO ADMIT NEW CONTENTIONS IN RESPONSE TO THE FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT [PKG # 14091A001]	03/31/2014	ML14091A003

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
208	JOINT THIRD DECLARATION OF DR. RICHARD ABITZ AND FIRST DECLARATION OF DR. LANCE LARSON IN SUPPORT OF THE NRDC & PRBRC'S JOINT MOTION TO MIGRATE OR AMEND CONTENTIONS, AND TO ADMIT NEW CONTENTIONS IN RESPONSE TO THE FSEIS [PKG # ML14091A001]	03/31/2014	ML14091A004
209	NRC STAFF'S HEARING FILE UPDATE - APRIL, 2014	04/02/2013	ML14092A305
210	INTERVENORS' MANDATORY DISCLOSURE REPORT UNDER 10 CFR §2.336	04/02/2014	ML14092A515
211	APPLICANT STRATA ENERGY, INC.'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES	04/02/2014	ML14093A011
212	MEMORANDUM AND ORDER (COMPUTATION OF TIME FOR FILING 10 C.F.R. § 2.1213(A) STAY APPLICATION)	04/04/2014	ML14094A357
213	NATURAL RESOURCES DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL'S UNOPPOSED MOTION TO AMEND THE REVISED GENERAL SCHEDULE IN THE MATTER OF STRATA ENEREGY, INC.	04/07/2014	ML14097A228
214	NRC STAFF LETTER TO THE ATOMIC SAFETY AND LICENSING BOARD REGARDING DELAY IN LICENSE ISSUANCE	04/07/2014	ML14097A473

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
215	MEMORANDUM AND ORDER (REGARDING REQUESTS FOR EXTENSION OF TIME)	04/08/2014	ML14098A444
216	STRATA ENERGY, INC.'S RESPONSE TO ATOMIC SAFETY AND LICENSING BOARD PANEL'S APRIL 8, 2014 MEMORANDUM AND ORDER REGARDING EXTENSIONS OF TIME AND AMENDMENT OF THE GENERAL SCHEDULE	04/09/2014	ML14099A559
217	NATURAL RESOURCE DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL'S RESPONSE TO THE BOARD'S APRIL 8, 2014 MEMORANDUM AND ORDER	04/10/2014	ML14100A657
218	NRC STAFF'S RESPONSE TO BOARD ORDER REGARDING REQUESTS FOR EXTENSION OF TIME	04/11/2014	ML14101A285
219	MEMORANDUM AND ORDER (GRANTING MOTION FOR EXTENSION OF TIME TO FILE RESPONSES/REPLY TO PENDING NEW/AMENDED CONTENTIONS MOTION AND SETTING SCHEDULE/PARAMETERS FOR PARTIES TO PROVIDE PROPOSED REVISED GENERAL SCHEDULE)	04/14/2014	ML14104A668

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
220	NRC STAFF RESPONSE TO NATURAL RESOURCES DEFENSE COUNCIL'S AND POWDER RIVER BASIN RESOURCE COUNCIL'S JOINT MOTION TO MIGRATE OR AMEND CONTENTIONS, AND TO ADMIT NEW CONTENTIONS IN RESPONSE TO STAFF'S FINAL SUPPLEMENTAL DEIS [PACKAGE # ML14104B676]	04/14/2014	ML14104B677
221	ATTACHMENT TO NRC STAFF RESPONSE TO JOINT INTERVENOR'S MOTION ON CONTENTIONS - AFFIDAVIT OF KATHRYN JOHNSON CONCERNING DRAFTING ERROR IDENTIFIED BY JOINT INTERVENORS IN THE STRATA ROSS FSEIS [PACKAGE # ML14104B676]	04/10/2014	ML14104B678
222	JOINT RESPONSE TO THE BOARD'S APRIL 14, 2014 MEMORANDUM AND ORDER	04/21/2014	ML14111A434
223	NOTICE OF APPEARANCE OF RICHARD S. HARPER	04/22/2014	ML14112A195
224	NRC STAFF'S NOTICE TO THE BOARD REGARDING SUPPLEMENTAL SAFETY EVALUATION REPORT	04/22/2014	ML14112A259
225	NRC STAFF'S NOTICE TO THE BOARD REGARDING ERRATA TO FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT	04/23/2014	ML14113A417

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
226	APPLICANT STRATA ENERGY, INC'S RESPONSE TO NATURAL RESOURCE DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL NEW AND AMENDED CONTENTIONS ON FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT	04/23/2014	ML14113A499
227	NRC STAFF'S NOTICE OF LICENSE ISSUANCE	04/25/2014	ML14115A333
228	STRATA ENERGY, INC.'S PROPOSED AMENDMENT TO GENERAL HEARING SCHEDULE	04/29/2014	ML14119A340
229	INTERVENORS' MANDATORY DISCLOSURE REPORT UNDER 10 CFR § 2.336	05/02/2014	ML14122A291
230	NRC STAFF HEARING FILE UPDATE MAY 2014	05/02/2014	ML14122A471
231	APPLICANT STRATA ENERGY, INC.'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES	05/02/2014	ML14122A482
232	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S REPLY IN SUPPORT OF MOTION TO MIGRATE OR AMEND CONTENTIONS, AND TO ADMIT NEW CONTENTIONS	05/07/2014	ML14127A267
233	MEMORANDUM AND ORDER (REGARDING GENERAL SCHEDULE AND SITE VISITS/LIMITED APPEARANCE SESSION/EVIDENTIARY HEARING)	05/09/2014	ML14129A269

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
234	APPLICANT STRATA ENERGY, INC'S RESPONSE TO ATOMIC SAFETY AND LICENSING BOARD PANEL'S MAY 2014 ORDER REGARDING SITE VISITS	05/19/2014	ML14139A350
235	MEMORANDUM AND ORDER (RULING ON MOTION TO MIGRATE/AMEND EXISTING CONTENTIONS AND ADMIT NEW CONTENTIONS REGARDING FINAL SUPPLEMENT TO GENERIC ENVIRONMENTAL IMPACT STATEMENT)	05/23/2014	ML14143A184
236	MEMORANDUM AND ORDER (REVISED GENERAL SCHEDULE)	05/23/2014	ML14143A196
237	NRC STAFF RESPONSE TO MAY 23, 2014 MEMORANDUM AND ORDER (REVISED GENERAL SCHEDULE)	05/28/2014	ML14148A471
238	MEMORANDUM AND ORDER (REQUEST FOR SCHEDULING INFORMATION)	05/29/2014	ML14149A300
239	NRC STAFF'S RESPONSE TO MEMORANDUM AND ORDER OF MAY 29, 2014	05/29/2014	ML14149A515
240	LICENSEE STRATA ENERGY, INC.'S RESPONSE TO LICENSING BOARD MEMORANDUM AND ORDER OF MAY 29, 2014	05/30/2014	ML14150A179
241	NRC STAFF HEARING FILE UPDATE	05/30/2014	ML14150A198
242	JOINT INTERVENORS' RESPONSE TO THE BOARD'S MAY 29, 2014 ORDER	05/30/2014	ML14150A243

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
243	ADMITTED CONTENTIONS MANDATORY DISCLOSURES UPDATE	05/30/2014	ML14150A495
244	APPLICANT STRATA ENERGY, INC'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES	05/30/2014	ML14150A570
245	MEMORANDUM AND ORDER (GRANTING REQUESTS TO REVISE DISPOSITIVE MOTION BRIEFING SCHEDULE; REVISED GENERAL SCHEDULE)	06/02/2014	ML14153A405
246	LICENSEE STRATA ENERGY, INC'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES	06/02/2014	ML14153A502
247	NRC STAFF'S JUNE 2014 UPDATE TO HEARING FILE AND DISCLOSURES	06/02/2014	ML14153A550
248	MEMORANDUM AND ORDER (REQUESTING FURTHER SITE VISIT INFORMATION)	06/09/2014	ML14160A928
249	NATURAL RECOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S MOTION FOR SUMMARY DISPOSITION ON ENVIRONMENTAL CONTENTION 1 (WITH 2 ATTACHMENTS) [PACKAGE # ML14164A496]	06/13/2014	ML14164A496
250	NRC STAFF'S MOTION FOR SUMMARY DISPOSITION OF CONTENTION 4/5A	06/13/2014	ML14164A636
251	LICENSEE STRATA ENERGY, INC.'S MOTION FOR SUMMARY DISPOSITION	06/13/2014	ML14164A649

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
252	STRATA ENERGY, INC.'S REPORT ON SITE TOURS (WITH 2 ATTACHMENTS) [PACKAGE # ML14174B273]	06/23/2014	ML14174B273
253	MEMORANDUM AND ORDER (OPPORTUNITY FOR PARTY COMMENTS ON SITE VISIT REPORT)	06/26/2014	ML14177A382
254	STRATA ENERGY, INC.'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES [PACKAGE # ML14183B131 - 15 DOCUMENTS]	07/02/2014	ML14183B131
255	INTERVENORS' MANDATORY DISCLOSURE REPORT - JULY 2014	07/02/2014	ML14183B357
256	NRC STAFF HEARING FILE UPDATE - JULY 2014	07/02/2014	ML14183B589
257	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S OPPOSITION TO MOTIONS FOR SUMMARY DISPOSITION OF CONTENTION 4/5A (WITH EXHIBITS) [PACKAGE # ML14183B591 - 2 DOCUMENTS]	07/02/2014	ML14183B591
258	STRATA ENERGY, INC.'S RESPONSE IN OPPOSITION TO INTERVENORS' MOTION FOR SUMMARY DISPOSITION	07/03/2014	ML14184B534

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
259	NRC STAFF ANSWER TO NATURAL RESOURCES DEFENSE COUNCIL'S AND POWDER RIVER BASIN RESOURCE COUNCIL'S MOTION FOR SUMMARY DISPOSITION ON CONTENTION 1 (WITH 3 ATTACHMENTS) [PACKAGE # ML14184B535]	07/03/2014	ML14184B535
260	NRC STAFF RESPONSE TO JUNE 26, 2014 MEMORANDUM AND ORDER (OPPORTUNITY FOR PARTY COMMENTS ON SITE VISIT REPORT)	07/10/2014	ML14191B275
261	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S RESPONSE TO BOARD'S JUNE 26, 2014 ORDER	07/11/2014	ML14192B019
262	MEMORANDUM AND ORDER (REQUESTING ADDITIONAL INFORMATION RE SITE VISITS)	07/14/2014	ML14195A177
263	NRC STAFF RESPONSE TO JULY 14, 2014 MEMORANDUM AND ORDER (REQUESTING ADDITIONAL INFORMATION RE SITE VISITS)	07/17/2014	ML14198A122
264	MEMORANDUM AND ORDER (RULING ON SUMMARY DISPOSITION MOTION REGARDING ENVIRONMENTAL CONTENTION 4/5A)	07/25/2014	ML14206A888
265	MEMORANDUM AND ORDER (PROVIDING ADMINISTRATIVE DIRECTIVES ASSOCIATED WITH EVIDENTIARY HEARING AND LIMITED APPEARANCE SESSION)	07/25/2014	ML14206A906

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
266	NOTICE OF HEARING (NOTICE OF EVIDENTIARY HEARING AND OPPORTUNITY TO PROVIDE ORAL AND WRITTEN LIMITED APPEARANCE STATEMENTS)	07/25/2014	ML14206A915
267	STRATA ENERGY, INC'S UNOPPOSED MOTION TO AMEND THE GENERAL SCHEDULE	07/29/2014	ML14210A582
268	STRATA ENERGY, INC'S AMENDED UNOPPOSED MOTION TO AMEND THE GENERAL SCHEDULE	07/31/2014	ML14212A216
269	INTERVENORS' MANDATORY DISCLOSURE REPORT	08/04/2014	ML14216A494
270	NRC STAFF HEARING FILE UPDATE AUGUST 2014	08/04/2014	ML14216A659
271	STRATA ENERGY, INC'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES (WITH 4 EXHIBITS. UPDATE AND EXHIBITS 1-3 IN PKG ML14216A746, EXHIBIT 4 , BROKEN DOWN INTO 8 SUBMISSIONS (4A-4H), IN PKG ML14217A355. LINKS FOR BOTH BELOW	08/04/2014	ML14216A746
272	MEMORANDUM AND ORDER (RULING ON MOTION TO AMEND GENERAL SCHEDULE; REVISED GENERAL SCHEDULE)	08/07/2014	ML14219A310

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
273	MEMORANDUM AND ORDER (RULING ON SUMMARY DISPOSITION MOTION REGARDING ENVIRONMNTAL CONTENTION 1)	08/12/2014	ML14224A523
274	NRC STAFF'S LETTER TO THE LICENSING BOARD REGARDING SECOND ERRATA TO THE FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT.	08/14/2014	ML14226A895
275	SEI009B - FSEIS VOL 2, APP C TO END	08/24/2014	ML14236A013
276	SEI007 - NUREG-1569 STANDARD REVIEW PLAN FOR IN SITU LEACH URANIUM EXTRACTION LICENSE APPLICATIONS	08/24/2014	ML14236A005
277	SEI011 - WDEQ-LQD NON-COAL CHAPTER 11, IN SITU MINING	08/24/2014	ML14236A004
278	SEI010 - SAFETY EVALUATION REPORT FOR THE STRATA ENERGY, INC. ROSS ISR PROJECT; ML14002A107	08/24/2014	ML14236A012
279	SEI006 - BEN SCHIFFER CV	08/24/2014	ML14236A011
280	SEI004B - NRC JULY 10, 2009 MEMORANDUM SUPPORTING DATA; ML091770385	08/24/2014	ML14236A010
281	SEI014A - ROSS TR VOL 1A, SEC 1 THRU 2.8	08/24/2014	ML14236A009

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
282	SEI002 - RALPH KNODE CV	08/24/2014	ML14236A008
283	SEI014B - ROSS TR VOL 1B, SEC 2.9 THRU 2.11	08/24/2014	ML14236A007
284	SEI012B - WDEQ-LQD GUIDELINE 4, IN SITU MINING, OCTOBER 28, 2013	08/24/2014	ML14236A006
285	SEI008 - REGULATORY GUIDE 4.14, RADIOLOGICAL EFFLUENT AND ENVIRONMENTAL MONITORING AT URANIUM MILLS	08/24/2014	ML14236A020
286	SEI013 - WDEQ-LQD GUIDELINE 8, HYDROLOGY	08/24/2014	ML14236A019
287	SEI009A - FSEIS VOL 1, COVER THRU APP B	08/24/2014	ML14236A018
288	SEI004A - NRC JULY 10, 2009 MEMORANDUM; ML091770187	08/24/2014	ML14236A017
289	SEI003 - DIAGRAM DEPICTING AIR-LIFT DEVELOPMENT OF ISR WELLS	08/24/2014	ML14236A016
290	SEI012A - WDEQ-LQD GUIDELINE 4, IN SITU MINING, MARCH 2000	08/24/2014	ML14236A015
291	SEI014C - ROSS TR VOL 2, SEC 3 THRU 11	08/24/2014	ML14236A014
292	SEI014H - ROSS TR VOL 4B, ADDENDA 2.7-G THRU 2.7-H	08/24/2014	ML14236A027

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
293	SEI014E - ROSS TR VOL 3B, ADDENDA 2.6-C	08/24/2014	ML14236A026
294	SEI014F - ROSS TR VOL 3C, ADDENDA 2.6-C THRU 2.7-C	08/24/2014	ML14236A025
295	SEI014G - ROSS TR VOL 4A, ADDENDA 2.7-D THRU 2.7-F	08/24/2014	ML14236A024
296	SEI014J - ROSS TR VOL 5B, ADDENDA 2.7-K THRU 2.9-A	08/24/2014	ML14236A023
297	SEI014D - ROSS TR VOL 3A, ADDENDA 1.2-A THRU 2.6-B	08/24/2014	ML14236A022
298	SEI014I - ROSS TR VOL 5A, ADDENDA 2.7-I THRU 2.7-J	08/24/2014	ML14236A021
299	SEI014L - ROSS TR VOL 6A, ADDENDA 2.9-C THRU 2.9-D	08/24/2014	ML14236A034
300	SEI014K - ROSS TR VOL 5C, ADDENDA 2.9-B	08/24/2014	ML14236A033
301	SEI014O - ROSS TR VOL 6D, ADDENDA 4.2A CONT	08/24/2014	ML14236A032
302	SEI014N - ROSS TR VOL 6C, ADDENDA 4.2A	08/24/2014	ML14236A031
303	SEI014P - ROSS TR VOL 6E, ADDENDA 4.2B THRU 6.4A	08/24/2014	ML14236A030
304	SEI015 - NRC LICENSE SUA-1601; ML14069A335	08/24/2014	ML14236A029

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305	SEI014M - ROSS TR VOL 6B, ADDENDA 3.1A	08/24/2014	ML14236A028
306	SEI017 - ROSS ER RAI RESPONSES; ML121030465	08/24/2014	ML14236A041
307	SEI016E - ROSS ER VOL 3, ADDENDA 3.5-A THRU 4.6-A; ML110130351	08/24/2014	ML14236A040
308	SEI020E - EXHIBIT 3 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A361	08/24/2014	ML14236A039
309	SEI019 - ROSS ORE ZONE POTENTIOMETRIC SURFACE AND REGIONAL MONITOR WELL LOCATION MAP	08/24/2014	ML14236A038
310	SEI020D - EXHIBIT 2 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A358	08/24/2014	ML14236A037
311	SEI016C - ROSS ER VOL 3, ADDENDA 1.6-A THRU ADDENDA 3.3-F; ML110130346	08/24/2014	ML14236A049
312	SEI016A - ROSS ER VOL 1, CVR THRU SEC 3.5; ML110130342	08/24/2014	ML14236A048
313	SEI020B - APPENDIX C DRAWING TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A360	08/24/2014	ML14236A047
314	SEI016D - ROSS ER VOL 3, ADDENDA 3.4-A THRU 3.4-B; ML110130348	08/24/2014	ML14236A046

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315	SEI020C - EXHIBIT 1 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A356	08/24/2014	ML14236A045
316	SEI018 - COMPARISON BETWEEN REGULATORY GUIDELINES AND PARAMETERS ANALYZED BY STRATA	08/24/2014	ML14236A044
317	SEI016B - ROSS ER VOL 2, SEC 3.6 THRU GLOSSARY; ML110130344	08/24/2014	ML14236A043
318	SEI020A - PRELIMINARY BASELINE SAMPLING PLAN FOR THE ROSS ISR URANIUM RECOVERY PROJECT; ML14217A357	08/24/2014	ML14236A042
319	SEI020G - EXHIBIT 5 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A363	08/24/2014	ML14236A036
320	SEI020F - EXHIBIT 4 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A359	08/24/2014	ML14236A035
321	SEI021 - WDEQ CORRESPONDENCE ON THE PRELIMINARY BASELINE SAMPLING PLAN FOR THE ROSS ISR URANIUM RECOVERY PROJECT; ML14217A362	08/24/2014	ML14236A062
322	SEI040 - MIKE GRIFFIN CV	08/24/2014	ML14236A061
323	SEI029 - FIGURE TO ACCOMPANY HAL DEMUTH AND ERROL LAWRENCE INITIAL WRITTEN TESTIMONY	08/24/2014	ML14236A060

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324	SEI028 - ERROL LAWRENCE CV	08/24/2014	ML14236A059
325	SEI031 - NATIONAL MINING ASSOCIATION'S (NMA) GENERIC ENVIRONMENTAL REPORT (GER) IN SUPPORT OF THE NRC'S GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR IN SITU URANIUM RECOVERY FACILITIES; ML080170159	08/24/2014	ML14236A058
326	SEI038 - DECISION OF THE TCEQ EXECUTIVE DIRECTOR REGARDING URANIUM ENERGY CORPORATION'S PERMIT NO UR03075	08/24/2014	ML14236A057
327	SEI032 - TYPICAL ISR PROCESS DIAGRAM	08/24/2014	ML14236A056
328	SEI023 - FEBRUARY 17, 2010 NRC PUBLIC MEETING SUMMARY; ML100620649	08/24/2014	ML14236A055
329	SEI043 - RAY MOORES CV	08/24/2014	ML14236A054
330	SEI025 - BASELINE GROUNDWATER CHARACTERIZATION COMPARISON TO OTHER LICENSED ISR FACILITIES IN WYOMING	08/24/2014	ML14236A053
331	SEI024 - APRIL 13, 2013 NRC PUBLIC MEETING SUMMARY; ML101310096	08/24/2014	ML14236A070
332	SEI036 - MOORE RANCH FSEIS; ML102290470	08/24/2014	ML14236A069

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333	SEI034 - EPA AQUIFER EXEMPTION APPROVAL; ML14183B140	08/24/2014	ML14236A068
334	SEI035 - IAEA-TECDOC-720	08/24/2014	ML14236A067
335	SEI041 - AUGUST 19, 1999 NDEQ LETTER TO CROW BUTTE	08/24/2014	ML14236A066
336	SEI033 - PRE-LICENSING WELL CONSTRUCTION, LOST CREEK ISR URANIUM RECOVERY PROJECT; ML091520101	08/24/2014	ML14236A065
337	SEI037 - NUREG/CR-6733, A BASELINE RISK-INFORMED, PERFORMANCE-BASED APPROACH FOR IN SITU LEACH URANIUM EXTRACTION LICENSEES - FINAL REPORT, JULY 2001; ML012840152	08/24/2014	ML14236A064
338	SEI027 - HAL DEMUTH CV	08/24/2014	ML14236A063
339	SEI030 - USGS WATER-SUPPLY PAPER 2220, BASIC GROUND-WATER HYDROLOGY, 1983	08/24/2014	ML14236A052
340	SEI022 - OCTOBER 29, 2009 NRC PUBLIC MEETING SUMMARY; ML093370598	08/24/2014	ML14236A051
341	SEI005 - BEN SCHIFFER INITIAL WRITTEN TESTIMONY	08/25/2014	ML14237A661

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342	SEI042 - RAY MOORES INITIAL WRITTEN TESTIMONY	08/25/2014	ML14237A660
343	SEI039 - MIKE GRIFFIN INITIAL WRITTEN TESTIMONY	08/25/2014	ML14237A659
344	SEI001 - RALPH KNODE INITIAL WRITTEN TESTIMONY	08/25/2014	ML14237A658
345	SEI044 - MAY 11, 2010 RESPONSE TO K. SWEENEY FROM BRADLEY JONES REGARDING 612009 LETTER TO COMMISSION REGARDING NRC REGULATORY ISSUE SUMMARY 2009-05	08/25/2014	ML14237A657
346	SEI026 - HAL DEMUTH AND ERROL LAWRENCE INITIAL WRITTEN TESTIMONY OF	08/25/2014	ML14237A656
347	STRATA INITIAL STATEMENT OF POSITION	08/25/2014	ML14237A665
348	STRATA FINAL EXHIBIT LIST	08/25/2014	ML14237A666
349	NRC004 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF KATHRYN JOHNSON (AUG. 25, 2014)	08/25/2014	ML14237A608
350	NRC002 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF JOHARI MOORE (AUG. 25, 2014)	08/25/2014	ML14237A607

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351	NRC003 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF JOHN SAXTON (AUG. 25, 2014)	08/25/2014	ML14237A606
352	NRC005 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF ANTHONY BURGESS (AUG. 25, 2014)	08/25/2014	ML14237A605
353	NRC006A - DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE ROSS ISR PROJECT (CHAPTERS 1-3) (MARCH 2013)	08/25/2014	ML14237A616
354	NRC006B - DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE ROSS ISR PROJECT (CHAPTER 4-APPENDIX B) (MARCH 2013)	08/25/2014	ML14237A615
355	NRC007 - GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR IN SITU LEACH URANIUM MILLING FACILITIES (CHAPTERS 1-4) (MAY 2009)	08/25/2014	ML14237A614
356	NRC014 - WYOMING STATE ENGINEER’S OFFICE (JUNE 2011), REGULATIONS AND INSTRUCTIONS PART III: WATER WELL MINIMUM CONSTRUCTION STANDARDS	08/25/2014	ML14237A630
357	NRC019 - ND RESOURCES (1982), ASSESSMENT OF RESTORATION ACTIVITIES, SUNDANCE PROJECT	08/25/2014	ML14237A630

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
358	NRC008 - GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR IN SITU LEACH URANIUM MILLING FACILITIES (CHAPTERS 5-12 AND APPENDICES A-G) (MAY 2009)	08/25/2014	ML14237A628
359	NRC012 - AFFIDAVIT OF JOHN L. SAXTON CONCERNING JOINT INTERVENORS' MOTION FOR SUMMARY DISPOSITION OF CONTENTION 1 (JULY 3, 2013)	08/25/2014	ML14237A638
360	NRC018 - NUCLEAR DYNAMICS (1980), RESTORATION REPORT, SUNDANCE PROJECT	08/25/2014	ML14237A637
361	NRC016 - ND RESOURCES (1977), NUBETH JOINT VENTURE ENVIRONMENTAL REPORT, SUPPORTIVE INFORMATION TO APPLICATION FOR SOURCE MATERIAL LICENSE, SUNDANCE PROJECT	08/25/2014	ML14237A636
362	NRC020 - STAUB ET AL. (1986), NUREG/CR-3967, "ANALYSIS OF EXCURSIONS AT SELECTED IN SITU URANIUM MINES IN WYOMING AND TEXAS"	08/25/2014	ML14237A635
363	NRC017 - NUCLEAR DYNAMICS (1978), QUARTERLY REPORT, SUMMARY OF WATER QUALITY PROGRAM	08/25/2014	ML14237A634
364	NRC010 - ERRATA NO. 1 TO ROSS FSEIS (APR. 23, 2014)	08/25/2014	ML14237A633

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
365	NRC013 - NRC (2003), NUREG-1748, "ENVIRONMENTAL REVIEW GUIDANCE FOR LICENSING ACTIONS ASSOCIATED WITH NMSS PROGRAMS"	08/25/2014	ML14237A632
366	NRC015 - DRISCOLL, F.G. (1986), GROUNDWATER AND WELLS, JOHNSON SCREENS	08/25/2014	ML14237A631
367	NRC011 - ERRATA NO. 2 TO ROSS FSEIS (AUG. 14, 2014)	08/25/2014	ML14237A627
368	NRC009 - NRC RECORD OF DECISION FOR THE ROSS URANIUM IN-SITU RECOVERY PROJECT (APR. 24, 2014)	08/25/2014	ML14237A626
369	NRC021 - NRC (2003), NUREG-1620, "STANDARD REVIEW PLAN FOR THE REVIEW OF A RECLAMATION PLAN FOR MILL TAILINGS SITES UNDER TITLE II OF THE URANIUM MILL TAILINGS RADIATION CONTROL ACT OF 1978"	08/25/2014	ML14237A702
370	NRC024 - CROW BUTTE RESOURCES (2002), MINE UNIT 1 GROUNDWATER STABILITY DATA	08/25/2014	ML14237A701
371	NRC025 - NRC (2001), LICENSE AMENDMENT 11 FOR THE CROW BUTTE FACILITY	08/25/2014	ML14237A700
372	NRC022 - CROW BUTTE RESOURCES (2000), MINE UNIT 1 RESTORATION REPORT SUBMITTAL AND REQUEST FOR LICENSE AMENDMENT	08/25/2014	ML14237A699

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
373	NRC023 - CROW BUTTE RESOURCES (2001), RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION RELATED TO MINE UNIT 1 GROUNDWATER RESTORATION COMPLETION AT CROW BUTTE PROJECT	08/25/2014	ML14237A698
374	NRC028 - PRI (2004), SMITH RANCH-HIGHLAND PROJECT, A WELLFIELD GROUND WATER RESTORATION INFORMATION	08/25/2014	ML14237A708
375	NRC029 - CAMECO (2012), HIGHLAND URANIUM PROJECT, 2011–2012 ANNUAL REPORT FOR PERMIT 603	08/25/2014	ML14237A707
376	NRC027 - NRC (2004), SMITH RANCH-HIGHLAND PROJECT, NRC REVIEW OF A-WELLFIELD GROUND WATER RESTORATION REPORT	08/25/2014	ML14237A706
377	NRC030 - COGEMA (2005), RESPONSE TO LQD/DEQ COMMENTS ON IRIGARAY WELLFIELD RESTORATION REPORT	08/25/2014	ML14237A705
378	NRC026 - NRC (2003), LICENSE AMENDMENT 15, WELLFIELD #1 RESTORATION ACCEPTANCE	08/25/2014	ML14237A704
379	NRC0034 - NRC (2006B), LETTER REGARDING NRC REVIEW OF IRIGARAY MINE RESTORATION REPORT	08/25/2014	ML14237A715

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
380	NRC035 - WDEQ (2005), POSTMINING GROUNDWATER RESTORATION DEMONSTRATION FOR THE IRIGARAY MINE, CHANGE NO. 34	08/25/2014	ML14237A714
381	NRC032 - COGEMA (2006B), SUMMARY TABLE, RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON IRIGARAY MINE RESTORATION REPORT	08/25/2014	ML14237A713
382	NRC031 - COGEMA (2006A), RESPONSE TO NRC REQUESTS FOR ADDITIONAL INFORMATION ON IRIGARAY MINE RESTORATION REPORT	08/25/2014	ML14237A712
383	NRC033 - NRC (2006A), TECHNICAL EVALUATION REPORT, REVIEW OF IRIGARAY MINE RESTORATION REPORT, PRODUCTION UNITS 1 THROUGH 9	08/25/2014	ML14237A711
384	NRC041 - URANIUM ONE (2012), WILLOW CREEK PROJECT, MONTHLY EXCURSION REPORT FOR SELECTED MONITOR WELLS	08/25/2014	ML14237A724
385	NRC037 - BORCH ET AL (2012), "DETERMINATION OF CONTAMINANT LEVELS AND REMEDIATION EFFICACY IN GROUNDWATER AT A FORMER IN-SITU RECOVERY URANIUM MINE"	08/25/2014	ML14237A723
386	NRC039 - WDEQ (2011), LETTER OF CONFERENCE AND CONCILIATION, EXCURSION AT CAMECO RESOURCES WELL CM-32	08/25/2014	ML14237A722

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387	NRC038 - NRC (2009C), REGULATORY ISSUE SUMMARY 2009-05, URANIUM RECOVERY POLICY	08/25/2014	ML14237A721
388	NRC042 - NRC (2007), NUREG/CR-6870, "CONSIDERATION OF GEOCHEMICAL ISSUES IN GROUNDWATER RESTORATION AT URANIUM IN-SITU LEACH MINING FACILITIES"	08/25/2014	ML14237A720
389	NRC036 - AFFIDAVIT OF KATHRYN JOHNSON CONCERNING DRAFTING ERROR IDENTIFIED BY JOINT INTERVENORS IN THE STRATA ROSS FSEIS (APR. 10, 2014)	08/25/2014	ML14237A719
390	NRC040 - URANIUM ONE (2010), IRIGARAY-CHRISTENSEN RANCH MINE, UNIT 5 RESPONSE	08/25/2014	ML14237A718
391	NRC043 - NRC (2014), ISR WELLFIELD GROUND WATER QUALITY DATA, IRIGARAY MINE UNIT 1	08/25/2014	ML14237A717
392	NRC001 - TESTIMONY OF JOHARI MOORE, JOHN SAXTON, KATHRYN JOHNSON, AND ANTHONY BURGESS (AUG. 25, 2014)	08/25/2014	ML14237A732
393	NRC STAFF EXHIBIT LIST	08/25/2014	ML14237A731
394	NRC STAFF’S INITIAL STATEMENT OF POSITION	08/25/2014	ML14237A730

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395	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCES COUNCIL'S NOTICE OF ERRATA STATEMENT ON EXHIBIT LIST AND ML ACCESSION NUMBER FOR JTI025.	08/29/2014	ML14241A592
396	JTI025 - DAVIS, J.A., AND GARY PAGE CURTIS. CONSIDERATION OF GEOCHEMICAL ISSUES IN GROUNDWATER RESTORATION AT URANIUM IN-SITU LEACH MINING FACILITIES. DIVISION OF FUEL, ENGINEERING, AND RADIOLOGICAL RESEARCH, OFFICE OF NUCLEAR REGULATORY RESEARCH, NRC	01/31/2007	ML14241A593
397	JOINT INTERVENORS' CORRECTED EXHIBIT LIST	08/29/2014	ML14241A594
398	JOINT INTERVENORS HEARING EXHIBITS LIST FOR SEPTEMBER-OCTOBER EVIDENTIARY HEARING ON ENVIRONMENTAL ISSUES.	08/25/2014	ML14237A621
399	JTI013 - MATZKE, B.D., J.E. WILSON, L.L. NUFFER, S.T. DOWSON, R.O. GILBERT, N.L. HASSIG, J. E. HATHAWAY, C.J. MURRAY, L.H. SEGO, B.A. PULSIPHER, B. ROBERTS, AND S. MCKENNA, 2007, VISUAL SAMPLE PLAN, VERSION 5.0, USER'S GUIDE, PNNL-16939, PACIFIC.....	06/30/2010	ML14237A653
400	JTI002 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF RICHARD ABITZ (AUG. 25, 2014)	08/25/2014	ML14237A619

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401	JTI004 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF LANCE LARSON (AUG. 25, 2014)	08/25/2014	ML14237A620
402	JTI005 - ISR STORYMAP APPLICATION: HTTP://ISL-URANIUM-RECOVERY-IMPACTS-NRDC.ORG/WILLOW-CREEK/; HTTP://ISL-URANIUM-RECOVERY-IMPACTS-NRDC.ORG/SMITH-HIGHLAND/; HTTP://WWW.NRC. GOV/INFO-FINDER/MATERIALS/URANIUM/LICENSED-FACILITIES/WILLOW-CREEK...	03/31/2009	ML14237A655
403	JTI006 - EPA, 2009. STATISTICAL ANALYSIS OF GROUNDWATER MONITORING DATA AT RCRA FACILITIES, UNIFIED GUIDANCE, EPA530/R-09-007, EPA OFFICE OF RESOURCE CONSERVATION AND RECOVERY	03/31/2009	ML14237A647
404	JTI007 - U.S. NUCLEAR REGULATORY COMMISSION (NRC), 2003, STANDARD REVIEW PLAN FOR IN SITU LEACH URANIUM EXTRACTION LICENSE APPLICATIONS, NUREG-1569, OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS, WASHINGTON DC	06/30/2014	ML14237A650
405	JTI008 - NRC, APRIL 1980, REGULATORY GUIDE 4.14: RADIOLOGICAL EFFLUENT AND ENVIRONMENTAL MONITORING AT URANIUM MILLS, REVISION 1, OFFICE OF STANDARDS DEVELOPMENT, WASHINGTON, DC.	04/25/1980	ML14237A640

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
406	JTI009 - ABITZ, R. J. AND B. DARLING, 2010. ANTHROPOGENIC INDUCED REDOX DISEQUILIBRIUM IN URANIUM ORE ZONES, GEOLOGICAL SOCIETY OF AMERICA ABSTRACTS W/PROGRAMS, VOL. 42.	12/31/2010	ML14237A648
407	JTI010 - LAAKSOHARJU, M., J. SMELLIE, E. TULLBORG, M. GIMENO, J. MOLINERO, I. GURBAN, AND L. HALLBECK, 2008, HYDROGEOCHEMICAL EVALUATION AND MODELING PERFORMED WITHIN THE SWEDISH SITE INVESTIGATION PROGRAMME, APPLIED GEOCHEMISTRY, V. 23, NO. 7.	03/04/2008	ML14237A645
408	JTI011 - LAPHAM, WAYNE W., AND FRANCESKA D. WILDE, AND MICHAEL T. KOTERBA, U.S. GEOLOGICAL SURVEY (USGS), WATER-RESOURCES INVESTIGATIONS REPORT 96-4233, "GUIDELINES AND STANDARD PROCEDURES FOR STUDIES OF GROUND-WATER QUALITY: SELECTION AND.....	08/25/2014	ML14237A642
409	JTI012 - BROOKINS, D.G., 1988, EH-PH DIAGRAMS FOR GEOCHEMISTRY, SPRINGER-VERLAG, NEW YORK.	02/28/1998	ML14237A643
410	JTI013 - MATZKE, B.D., J.E. WILSON, L.L. NUFFER, S.T. DOWSON, R.O. GILBERT, N.L. HASSIG, J.E. HATHAWAY, C.J. MURRAY, L.H. SEGO, B.A. PULSIPHER, B. ROBERTS, AND S. MCKENNA, 2007, VISUAL SAMPLE PLAN, VERSION 5.0, USER'S GUIDE, PNNL-16939, PACIFIC.....	06/30/2010	ML14237A653

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411	JTI014 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF LANCE LARSON (AUG. 25 2014).	06/08/1994	ML14237A641
412	JTI015 - URANIUM ENERGY CORP (UEC), GOLIAD PROJECT PRODUCTION AREA AUTHORIZATION APPLICATION FOR: PRODUCTION AREA-1 (PA-1), AUGUST 27, 2008.	08/27/2008	ML14237A644
413	JTI016 - URANIUM ENERGY CORP (UEC), GOLIAD PROJECT PRODUCTION AREA AUTHORIZATION APPLICATION FOR: PRODUCTION AREA-1 (PA-1), UPDATE, MARCH 27, 2009.	03/27/2009	ML14237A652
414	JTI017 - TEXAS WATER COMMISSION (TWC), 1988, PRODUCTION AREA AUTHORIZATION FOR KINGSVILLE DOME MINING PROJECT, PERMIT UR02827-001, PRODUCTION AREA UR02827-011, APRIL 12, 1988.	08/25/2014	ML14237A651
415	JTI018 - NRC, APRIL 1980, REGULATORY GUIDE 4.14: RADIOLOGICAL EFFLUENT AND ENVIRONMENTAL MONITORING AT URANIUM MILLS, REVISION 1, OFFICE OF STANDARDS DEVELOPMENT, WASHINGTON, DC.	06/28/1990	ML14237A654
416	JTI019 - TABLE 2.7-4 FROM URI 1983C.	11/20/1987	ML14237A639
417	JTI020 - TEXAS COMMISSION ON ENVIRONMENTAL QUALITY, 2006, KINGSVILLE DOME MINE, PRODUCTION AREA 3.	05/04/2006	ML14237A646

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418	JTI021 - GARCIA DATA SHEETS.	08/25/2014	ML14237A649
419	JTI022 - CURTIS, G. P., J. A. DAVIS, AND D. L. NAFTZ 2006. SIMULATION OF REACTIVE TRANSPORT OF URANIUM (VI) IN GROUNDWATER WITH VARIABLE CHEMICAL CONDITIONS, WATER RESOUR. RES., 42, W04404	04/07/2006	ML14237A693
420	JTI023 - EXXONMOBILE, "HIGHLAND URANIUM MILL SITE, FINAL SITE CLOSURE PROPOSAL, " CASPER, WYOMING, AUGUST 3, 2010.	08/03/2010	ML14237A695
421	JTI024 - ZHOU, PING, AND BAOHUA GU. "EXTRACTION OF OXIDIZED AND REDUCED FORMS OF URANIUM FROM CONTAMINATED SOILS: EFFECTS OF CARBONATE CONCENTRATION AND PH," ENVIRONMENTAL SCIENCE & TECHNOLOGY 39.12 2005): 4435-4440.	04/01/2005	ML14237A669
422	JTI025 - DAVIS, J. A., AND GARY PAGE CURTIS. CONSIDERATION OF GEOCHEMICAL ISSUES IN GROUNDWATER RESTORATION AT URANIUM IN-SITU LEACH MINING FACILITIES. ..... INCORRECTLY SUBMITTED AS COPYRIGHT - RESUBMITTED UNDER ML14241A593	01/01/2007	ML14237A672del

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
423	JTI026 - RAILROAD COMMISSION OF TEXAS, SURFACE MINING AND RECLAMATION DIVISON, "URANIUM ENERGY CORPORATION (UEC), WEESATCHIE PROJECT, GOLIAD COUNTY, URANIUM EXPLORATION PERMIT NO. 123, INSPECTION REPORT," MARCH 27, 2007.	03/27/2007	ML14237A679
424	JTI027 - USGS, 2013, GROUNDWATER DEPLETION IN THE UNITED STATES (1900 - 2008), SCIENTIFIC INVESTIGATION REPORT 2013-5079, U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA.	12/31/2013	ML14237A691
425	JTI028 - USGS, 1998, STRATEGIC DIRECTIONS FOR THE U.S. GEOLOGICAL SURVEY GROUND-WATER RESOURCES PROGRAM, REPORT TO CONGRESS, NOVEMBER 30, 1998, U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA.	11/30/1998	ML14237A674
426	JTI029 - ENERGY INFORMATION ADMINISTRATION, OFFICE OF COAL, NUCLEAR, ELECTRIC AND ALTERNATE FUELS, U.S. DEPARTMENT OF ENERGY (DOE), "DECOMMISSIONING OF U.S. URANIUM PRODUCTION FACILITIES," DOE/EIA-0592 (FEBRUARY 1995).	02/28/1995	ML14237A670

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427	JTI030 - NRC, TECHNICAL BASIS FOR ASSESSING URANIUM BIOREMEDIATION PERFORMANCE, OFFICE OF NUCLEAR REGULATORY RESEARCH, NUREC/CR-6973, AUGUST 2008.	08/01/2008	ML14237A692
428	STRATA ENERGY, INC. NOTICE OF ERRATA FOR INITIAL STATEMENT OF POSITION	09/05/2014	ML14248A529
429	APPLICANT STRATA ENERGY, INC'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES	09/02/2014	ML14245A651
430	NRC STAFF HEARING FILE UPDATE - SEPTEMBER 2014	09/02/2014	ML14245A156
431	INTERVENORS' MANDATORY DISCLOSURE REPORT	09/03/2014	ML14246A125
432	JTI031 - WESTERN WATER CONSULTANTS, INC. "ASSESSMENT RESTORATION ACTIVITIES: SUNDANCE PROJECT," JAN. 22, 1982.	01/22/1982	ML14237A685
433	JTI032 - NUBETH JOINT VENTURE. "ENVIRONMENTAL REPORT SUPPORTIVE INFORMATION TO APPLICATION FOR SOURCE MATERIAL LICENSE, IN SITU SOLUTION MINING TEST SITE, SUNDANCE PROJECT, CROOK COUNTY, WYOMING. 1976.	12/16/1977	ML14237A696

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434	JTI033 - NRC. NRC STAFF RESPONSE TO NATURAL RESOURCES DEFENSE COUNCIL'S AND POWDER RIVER BASIN RESOURCE COUNCIL'S JOINT MOTION TO MIGRATE OR AMEND CONTENTIONS, AND TO ADMIT NEW CONTENTIONS IN RESPONSE TO STAFF'S FINAL SUPPLEMENTAL DRAFT ENVIRONMENTAL....	04/14/2014	ML14237A683
435	JTI034 - NRC, FINAL ENVIRONMENTAL STATEMENT RELATED TO OPERATION OF IRIGARY URANIUM SOLUTION MINING PROJECT, NUREG-0481, SEPTEMBER, 1978.	09/30/1978	ML14237A681
436	JTI035 - TECHNICAL EVALUATION REPORT, CHRISTENSEN RANCH MINE UNITS 2 THROUGH 6 RESTORATION REPORT, URANIUM ONE USA, INC., WILLOW CREEK ISR FACILITY, OCTOBER 23, 2012.	08/25/2014	ML14237A675
437	JTI036 - WRIGHT ENVIRONMENTAL SERVICES INC. AND TELESTO SOLUTIONS, INC. "2012 STATUS UPDATE CASING LEAK INVESTIGATION C, E AND F WELLFIELDS SMITH RANCH-HIGHLAND OPERATIONS." FEBRUARY 20, 2013.	08/25/2014	ML14237A676
438	JTI037 - W. F. KEARNEY, DIRECTOR SHE, URANIUM ONE AMERICAS. "PERMIT TO MINE NO. 478; CHRISTENSEN RANCH PROJECT MINE UNIT 5 - NON-SIGNIFICANT REVISION; REVISED MONITORING PLAN FOR MINE UNIT 5-2 AREA." MAY 10, 2012.	08/25/2014	ML14237A668

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439	JTI038 - TIM MCCULLOUGH, MANAGER SITE SHE, URANIUM ONE USA INC. "WILLOW CREEK ISR PROJECT - PERMIT TO MINE NO. 478, 2013 ANNUAL REPORT - RESPONSE TO WDEQ-LQD COMMENTS." APRIL 15, 2014.	04/15/2014	ML14237A677
440	JTI039 - INTERA. "APPLICATION FOR ALTERNATE CONCENTRATION LIMITS FOR THE SMITH RANCH-HIGHLAND MINE UNIT-B IN-SITU URANIUM RECOVERY FACILITY, CONVERSE COUNTY, WYOMING." MAY 22, 2013.	05/22/2013	ML14237A682
441	JTI040 - ANASTASI, FRANK S., AND ROY E. WILLIAMS. "AQUIFER RESTORATION AT URANIUM IN SITU LEACH SITES." INTERNATIONAL JOURNAL OF MINE WATER 3.4 1984): 29-37.	12/31/2014	ML14237A687
442	JTI041 - JOHNSON, RAYMOND H. "REACTIVE TRANSPORT MODELING FOR THE PROPOSED DEWEY BURDOCK URANIUM IN-SITU RECOVERY MINE,EDGEMONT, SOUTH DAKOTA, USA." (2011).	08/25/2014	ML14237A671
443	JTI042 - JOHNSON, RAYMOND H., AND HLANGANANI TUTU. "REACTIVE TRANSPORT MODELING AT URANIUM IN SITU RECOVERY SITES: UNCERTAINTIES IN URANIUM SORPTION ON IRON HYDROXIDES." RELIABE MINE WATER TECHNOLOGY (2013): 377-382.	08/25/2014	ML14237A678

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444	JTI043 - STEWART, BRANDY D., ET AL. "INFLUENCE OF URANYL SPECIATION AND IRON OXIDES ON URANIUM BIOGEOCHEMICAL REDOX REACTIONS." GEOMICROBIOLOGY JOURNAL 28.5-6 (2011): 444-456.	08/25/2014	ML14237A673
445	JTI044 - GARY R. KONWINSKI, PROJECT MANAGER, LICENSING BRANCH 1, URANIUM RECOVERY FIELD OFFICE, REGION IV, NRC. "ENVIRONMENTAL ASSESSMENT (EA) FOR MALAPAI RESOURCES, CHRISTENSEN RANCH IN SITU LEACH SATELLITE OPERATION." MAY 4, 1988.	05/04/1988	ML14237A688
446	JTI045 - JON F. WINTER, MANAGER ENVIRONMENTAL & REGULATORY AFFAIRS, WYOMING, URANIUM ONE. "MONITOR WELL 5MW66 AND CHRISTENSEN RANCH." SEPTEMBER 21, 2010.	08/25/2014	ML14237A686
447	JTI046 - JOHN MCCARTHY, MANAGER, SAFETY, HEALTH AND ENVIRONMENTAL AFFAIRS, POWER RESOURCES, SMITH RANCH-HIGHLAND URANIUM PROJECT. "SOUTHWEST AREA HYDROLOGIC TEST: NRC LICENSE SUA-1548, DOCKET NO. 40-8964." FEBRUARY 21, 2007.	08/25/2014	ML14237A690
448	JTI047 - USGS. "WHAT IS GROUNDWATER?" OPEN-FILE REPORT 93-643. REPRINTED APRIL 2001.	08/25/2014	ML14237A680

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449	JTI048 - BLANC, ELODIE, ET AL. "MODELING US WATER RESOURCES UNDER CLIMATE CHANGE." EARTH'S FUTURE 2.4 (2014): 197-224.	02/24/2014	ML14237A684
450	JTI049 - DROUGHT-STRICKEN TEXAS TOWN TURNS TO TOILETS FOR WATER BY SHELLEY KOFLER, MAY 06, 2014, NATIONAL PUBLIC RADIO, HTTP://WWW.NPR.ORG/2014/05/06/309101579/DROUGHT-STRICKEN-TEXAS-TOWN-TURNS-TO-TOILETS-FOR-WATER.	05/06/2014	ML14237A694
451	JTI050 - GILLETTE REGIONAL WATER SUPPLY PROJECT, WEBSITE ACCESSED AUGUST 25,	08/25/2014	ML14237A689
452	NATURAL RESOURCES DEFENSE COUNCIL'S AND POWDER RIVER BASIN RESOURCE COUNCIL'S STATEMENT OF POSITION SUPPORTING ENVIRONMENTAL CONTENTIONS 1, 2, AND 3.	08/25/2014	ML14237A617
453	MEMORANDUM AND ORDER (CLARIFYING EVIDENTIARY MATERIALS)	09/10/2014	ML14253A248
454	NRC045 - WDEQ (2012) LETTER RE ROSS ISR PROJECT GROUNDWATER RECLASSIFICATION	08/03/2012	ML14255A407
455	NRC046 - STUMM AND MORGAN (1996) STEADY STATE V EQUILIBRIUM (PAGES 79-8)	09/12/2014	ML14255A404

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456	NRC047 - STONE AND TRUAX (2014), IN-SITU RECOVERY URANIUM MINING RESTORATION CHALLENGES.	04/09/2014	ML14255A403
457	NRC048 - WDEQ (1993), WATER QUALITY RULES AND REGULATIONS, CHAPTER 8, QUALITY STANDARDS FOR WYOMING GROUNDWATER	09/12/2014	ML14255A405
458	NRC049 - WDEQ (2005), WATER QUALITY RULES AND REGULATIONS, CHAPTER 8, QUALITY STANDARDS FOR WYOMING GROUNDWATER	09/12/2014	ML14255A400
459	NRC050 - NRC (1985), NUREG-CR-3709, METHODS OF MINIMIZING GROUND-WATER CONTAMINATION FROM IN SITU LEACH URANIUM MINING	09/12/2014	ML14255A402
460	NRC051 - WDEQ (1978), LETTER ON CHRISTENSEN RANCH RESTORATION	01/07/2013	ML14255A401
461	NRC044 - REBUTTAL TESTIMONY OF JOHARI MOORE, JOHN SAXTON, KATHRYN JOHNSON, AND ANTHONY BURGESS.	09/12/2014	ML14255A505
462	NRC STAFF REBUTTAL STATEMENT OF POSITION.	09/12/2014	ML14255A506
463	NRC STAFF REVISED EXHIBIT LIST - SEPTEMBER 12, 2014.	09/12/2014	ML14255A507
464	SEI050 - FEIS FOR THE POWDER RIVER BASIN OIL AND GAS PROJECT, CHAPTER 3.	01/31/2003	ML14255A385

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465	SEI051 - FEIS FOR THE WEST ANTELOPE II COAL LEASE, VOL 1	09/12/2014	ML14255A384
466	SEI052 - FEIS FOR THE EAGLE BUTTE WEST COAL LEASE.	08/31/2007	ML14255A386
467	SEI053 - FEIS FOR THE MAYSDORF COAL LEASE	04/30/2014	ML14255A387
468	STRATA REBUTTAL EXHIBIT LIST FOR SEPTEMBER-OCTOBER 2014 EVIDENTIARY HEARING ON ENVIRONMENTAL ISSUES.	09/12/2014	ML14255A389
469	SEI045 - BEN SCHIFFER REBUTTAL TESTIMONY.	09/12/2014	ML14255A502
470	SEI046 - HAL DEMUTH AND ERROL LAWRENCE REBUTTAL TESTIMONY	09/12/2014	ML14255A503
471	SEI047 - RALPH KNODE REBUTTAL TESTIMONY.	09/12/2014	ML14255A501
472	SEI048 - RAY MOORES REBUTTAL TESTIMONY	09/12/2014	ML14255A500
473	SEI049 - MIKE GRIFFIN REBUTTAL TESTIMONY.	09/12/2014	ML14255A504
474	STRATA ENERGY, INC., REBUTTAL STATEMENT OF POSITION	09/12/2014	ML14255A508
475	NOTICE (REGARDING WEAPONS AT ATOMIC SAFETY AND LICENSING BOARD PROCEEDING).	09/16/2014	ML14259A070

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476	NRC044-R - NRC STAFF'S REVISED REBUTTAL TESTIMONY	09/18/2014	ML14261A441
477	NRC STAFF'S REVISED REBUTTAL STATEMENT OF POSITION	09/18/2014	ML14261A442
478	NRC STAFF REVISED EXHIBIT LIST	09/18/2014	ML14261A443
479	LETTER FROM NRC STAFF TO PARTIES REGARDING STAFF'S REVISED STATEMENT OF POSITION AND PREFILED REBUTTAL TESTIMONY	09/18/2014	ML14261A444
480	STRATA ENERGY, INC. NOTICE OF ERRATA FOR REBUTTAL STATEMENT OF POSITION	09/19/2014	ML14262A054
481	MEMORANDUM (RESPONDING TO MOTION FOR CLARIFICATION)	09/19/2014	ML14262A223
482	JTI COVER STATEMENT FOR REVISED EXHIBITS.	09/16/2014	ML14259A586
483	JTI EXHIBIT LIST- REVISED 9-16-14.	09/16/2014	ML14259A582
484	JTI OPENING POSITION STATEMENT - REVISED.	09/16/2014	ML14259A580
485	JTI001-R - TESTIMONY OF RICHARD ABITZ (AUG. 25, 2014).	09/16/2014	ML14259A587
486	JTI003-R - TESTIMONY OF LANCE LARSON (AUG. 24, 2014).	09/16/2014	ML14259A583

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487	JTI005A-R - 1-356, NRC DATABASE SPREADSHEETS.	09/16/2014	ML14259A578
488	JTI005B-R - REPRESENTATIVE .PDFS OF STORY MAPS, REFERENCED BELOW ISR STORYMAP APPLICATION.	09/16/2014	ML14259A577
489	JTI051-R - PRE-FILED REBUTTAL TESTIMONY OF DR. RICHARD ABITZ.	09/16/2014	ML14259A585
490	JTI052-R - PRE-FILED REBUTTAL TESTIMONY OF DR. LANCE LARSON.	09/16/2014	ML14259A581
491	REVISED JTIS RESPONSE STATEMENT IN SUPPORT OF ENVIRONMENTAL CONTENTIONS 1, 2, & 3.	09/16/2014	ML14259A579
492	JTI - ERRATA STATEMENT FOR CORRECTING CITATION.	09/16/2014	ML14259A588
493	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S MOTION FOR CLARIFICATION OF THE BOARD'S SEPTEMBER 10, 2014 ORDER.	09/16/2014	ML14259A592
494	STRATA ENERGY, INC. MOTIONS IN LIMINE	09/23/2014	ML14266A659
495	MEMORANDUM AND ORDER (ADDITIONAL PREHEARING ITEMS)	09/24/2014	ML14267A381

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496	NRC STAFF ANSWER TO JOINT INTERVENORS’ MOTION FOR CLARIFICATION AND RESPONSE TO STRATA’S MOTION IN LIMINE REGARDING ADMISSIBILITY OF STORY MAP APPLICATIONS	09/24/2014	ML14267A531
497	NRC STAFF’S OCTOBER 2014 UPDATE TO HEARING FILE AND DISCLOSURES	09/25/2014	ML14268A459
498	NATURAL RESOURCES DEFENSE COUNCIL’S & POWDER RIVER BASIN RESOURCE COUNCIL’S OPPOSITION TO MOTIONS IN LIMINE	09/26/2014	ML14269A119
499	NRC STAFF REVISED EXHIBIT LIST	09/30/2014	ML14273A313
500	NRC STAFF REVISED EXHIBIT LIST - CERTIFICATE OF SERVICE	09/30/2010	ML14273A313
501	NRC STAFF REVISED EXHIBIT NRC016R - NUBETH JOINT VENTURE ENVIRONMENTAL REPORT	09/30/2014	ML14273A395
502	NRC STAFF EXHIBIT NRC052 - EPA 2010 "MONITORED NATURAL ATTENUATION OF INORGANIC CONTAMINANTS IN GROUND WATER" VOLUME 3, PP. 53 THROUGH 68	10/01/2014	ML14274A133
503	INTERVERNORS' NOTICE OF RE-FILING EXHIBIT JTI-055R	10/01/2014	ML14274A173

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504	JTI-055R - IRIGARAY AND CHRISTENSEN RANCH ENVIRONMENTAL MONITORING STATION LOCATIONS	10/01/2014	ML14274A174
505	JTI UPDATED EXHIBIT LIST - OCTOBER 1, 2014	10/01/2014	ML14274A656
506	JTI005B-R2 - REPRESENTATIVE .PDFS OF STORY MAPS CREATED BY DR. LARSON, FROM THE NRC DATA	10/01/2014	ML14274A657
507	JTI005A-R2 - 1-356, NRC ISL DATABASE SPREADSHEETS, .PDFS OF NRC DATA	10/01/2014	ML14274A658
508	TRANSCRIPT OF SEPTEMBER 28, 2014 LIMITED APPEARANCE SESSION	09/28/2014	ML14275A178
509	APPLICANT STRATA ENERGY, INC.'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES - OCTOBER 2014	10/02/2014	ML14275A473
510	NRC STAFF NOTICE OF ERRATA TO EXHIBIT NRC044-R (NRC STAFF'S REBUTTAL TESTIMONY) AND REVISED EXHIBIT LIST	09/26/2014	ML14269A338
511	NRC044-R2 - NRC STAFF'S REBUTTAL TESTIMONY	09/28/2014	ML14271A003
512	NRC STAFF REVISED EXHIBIT LIST - SEPTEMBE 28, 2014	09/28/2014	ML14271A004

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513	NRC STAFF NOTICE OF FILING EXHIBIT NRC044-R2 (NRC STAFF'S REBUTTAL TESTIMONY) AND REVISED EXHIBIT LIST	09/20/2014	ML14271A005
514	LIMITED APPEARANCE STATEMENT OF JOAN SOWADA	09/09/2014	ML14254A455
515	LIMITED APPEARANCE STATEMENT OF DAVE AND DEBBIE STOETZEL	09/10/2014	ML14254A461
516	LIMITED APPEARANCE STATEMENT OF JERI BAKER	09/11/2014	ML14255A053
517	LIMITED APPEARANCE STATEMENT OF KATHY DURRUM	09/15/2014	ML14258A664
518	LIMITED APPEARANCE STATEMENT OF LISA AND GREG LOERZEL	09/22/2014	ML14265A410
519	LIMITED APPEARANCE STATEMENT OF BERNARD FOX	09/24/2014	ML14268A515
520	LIMITED APPEARANCE STATEMENT OF CARLA RAE MARSHALL	09/24/2014	ML14268A523
521	LIMITED APPEARANCE STATEMENT OF SYLVIA LAMBERT	09/24/2014	ML14268A529
522	LIMITED APPEARANCE STATEMENT OF JOHN PAPPAN	09/25/2014	ML14272A067
523	LIMITED APPEARANCE STATEMENT OF JACE DECORY	09/25/2014	ML14272A022

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524	LIMITED APPEARANCE STATEMENT OF REBECCA LEAS	09/27/2014	ML14272A220
525	LIMITED APPEARANCE STATEMENT OF JOYE BRAUN	09/28/2014	ML14272A498
526	LIMITED APPEARANCE STATEMENT OF JOHN DALE	09/28/2014	ML14272A523
527	LIMITED APPEARANCE STATEMENT OF CHRISIANE LOSCH-DECORY	09/28/2014	ML14272A510
528	LIMITED APPEARANCE STATEMENT OF CARMEN MCINTYRE	09/28/2014	ML14272A248
529	LIMITED APPEARANCE STATEMENT OF JAY AND WILMA TOPE	09/28/2014	ML14272A483
530	NRC REVISED EXHIBIT LIST - OCTOBER 1, 2014	10/01/2014	ML14274A659
531	MEMORANDUM AND ORDER (TRANSCRIPT CORRECTIONS)	10/08/2014	ML14281A235
532	TRANSCRIPT OF SEPTEMBER 30, 2014 HEARING	09/30/2014	ML14279A153
533	TRANSCRIPT OF OCTOBER 1, 2014 HEARING	10/07/2014	ML14280A199
534	NATURAL RESOURCES DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL'S UNOPPOSED MOTION TO AMEND THE DEADLINE FOR SUBMISSION OF TRANSCRIPT CORRECTIONS	10/14/2014	ML14287A656

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535	ORDER (GRANTING MOTION FOR EXTENSION OF TIME TO SUBMIT TRANSCRIPT CORRECTIONS)	10/15/2014	ML14288A212
536	JOINT TRANSCRIPT CORRECTIONS	10/16/2014	ML14289A406
537	NOTICE OF WITHDRAWAL FOR RICHARD HARPER	10/16/2014	ML14289A409
538	OFFICIAL EXHIBIT - JTI001-R-00-BD01 - TESTIMONY OF RICHARD ABITZ (AUG. 25, 2014).	09/16/2014	ML14282A405
539	OFFICIAL EXHIBIT - JTI002-00-BD01 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF RICHARD ABITZ (AUG. 25,, 2014)	08/25/2014	ML14281A697
540	OFFICIAL EXHIBIT - JTI003-R-00-BD01 - TESTIMONY OF LANCE LARSON (AUG. 24, 2014).	09/16/2014	ML14282A403
541	OFFICIAL EXHIBIT - JTI004-00-BD01 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF LANCE LARSON (AUG. 25, 2014).	08/25/2014	ML14281A698
542	OFFICIAL EXHIBIT - JTI005A-R-00-BD01 - 1-356, NRC DATABASE SPREADSHEETS.	09/16/2014	ML14282A396
543	OFFICIAL EXHIBIT - JTI005A-R2-00-BD01 - 1-356, NRC ISL DATABASE SPREADSHEETS, PDFS OF NRC DATA.	10/01/2014	ML14282A410

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544	OFFICIAL EXHIBIT - JTI005B-R-00-BD01 - REPRESENTATIVE .PDFS OF STORY MAPS, REFERENCED BELOW ISR STORYMAP APPLICATION.	09/16/2014	ML14282A392
545	OFFICIAL EXHIBIT - JTI005B-R2-00-BD01 - 1-36, REPRESENTATIVE .PDFS OF STORY MAPS CREATED BY DR. LARSON, FROM THE NRC DATA.	10/01/2014	ML14282A409
546	OFFICIAL EXHIBIT - JTI006-00-BD01 - EPA, 2009. STATISTICAL ANALYSIS OF GROUNDWATER MONITORING DATA AT RCRA FACILITIES, UNIFIED GUIDANCE, EPA530/R-09-007, EPA OFFICE OF RESOURCE CONSERVATION AND RECOVERY.	03/31/2014	ML14281A719
547	OFFICIAL EXHIBIT - JTI011-00-BD01 - LAPHAM, WAYNE W., AND FRANCESKA D. WILDE, AND MICHAEL T. KOTERBA, USGS, WATER-RESOURCES INVESTIGATIONS REPORT 96-4233, GUIDELINES AND STANDARD PROCEDURES FOR STUDIES OF GROUND-WATER QUALITY: SELECTION AND	08/25/2014	ML14281A714
548	OFFICIAL EXHIBIT - JTI013-00-BD01 - MATZKE, B.D., J.E. WILSON, L.L. NUFFER, S.T. DOWSON, R.O. GILBERT, N.L. HASSIG, J.E. HATHAWAY, ... S. MCKENNA, 2007, VISUAL SAMPLE PLAN, VERSION 5.0, USER'S GUIDE, PNNL-16939, PACIFIC NORTHWEST NATIONAL LAB	06/30/2014	ML14281A724

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549	OFFICIAL EXHIBIT - JTI014-00-BD01 - U.S. DOE, FERNALD FIELD OFFICE, CHARACTERIZATION OF BACKGROUND WATER QUALITY FOR STREAMS AND GROUNDWATER, FERNALD ENVIRONMENTAL MANAGEMENT PROJECT, REMEDIAL INVESTIGATION AND FEASIBILITY STUDY, MAY 1994.	06/08/2014	ML14281A713
550	OFFICIAL EXHIBIT - JTI015-00-BD01 - URANIUM ENERGY CORP (UEC), GOLIAD PROJECT PRODUCTION AREA AUTHORIZATION APPLICATION FOR: PRODUCTION AREA-1 (PA-1), AUGUST 27, 2008.	08/27/2014	ML14281A716
551	OFFICIAL EXHIBIT - JTI016-00-BD01 - URANIUM ENERGY CORP (UEC), GOLIAD PROJECT PRODUCTION AREA AUTHORIZATION APPLICATION FOR: PRODUCTION AREA-1 (PA-1), UPDATE, MARCH 27, 2009.	03/27/2014	ML14281A723
552	OFFICIAL EXHIBIT - JTI017-00-BD01 - TEXAS WATER COMMISSION (TWC), 1988, PRODUCTION AREA AUTHORIZATION FOR KINGSVILLE DOME MINING PROJECT, PERMIT UR02827-001, PRODUCTION AREA UR02827-011, APRIL 12, 1988.	08/25/2014	ML14281A722
553	OFFICIAL EXHIBIT - JTI018-00-BD01 - TEXAS WATER COMMISSION (TWC), 1990, PRODUCTION AREA AUTHORIZATION 3 FOR KINGSVILLE DOME MINING PROJECT, PERMIT UR02827-001, PRODUCTION AREA UR02827-021, JUNE 28. 1990.	06/28/2014	ML14282A285

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554	OFFICIAL EXHIBIT - JTI019-00-BD01 - TABLE 2.7-4 FROM URI 1983C.	11/20/1987	ML14281A712
555	OFFICIAL EXHIBIT - JTI020-00-BD01 - TEXAS COMMISSION ON ENVIRONMENTAL QUALITY, 2006, KINGSVILLE DOME MINE, PRODUCTION AREA 3.	05/04/2006	ML14281A718
556	OFFICIAL EXHIBIT - JTI021-00-BD01 - GARCIA DATA SHEETS.	08/25/2014	ML14281A721
557	OFFICIAL EXHIBIT - JTI023-00-BD01 - EXXONMOBILE, "HIGHLAND URANIUM MILL SITE, FINAL SITE CLOSURE PROPOSAL, " CASPER, WYOMING, AUGUST 3, 2010.	08/03/2010	ML14282A319
558	OFFICIAL EXHIBIT - JTI025-R-00-BD01 - DAVIS, J. A., AND GARY PAGE CURTIS. CONSIDERATION OF GEOCHEMICAL ISSUES IN GROUNDWATER RESTORATION AT URANIUM IN-SITU LEACH MINING FACILITIES. DIVISION OF FUEL, ENGINEERING, AND RADIOLOGICAL RESEARCH	01/31/2007	ML14282A347
559	OFFICIAL EXHIBIT - JTI026-00-BD01 - RAILROAD COMMISSION OF TEXAS, SURFACE MINING AND RECLAMATION DIVISON, "URANIUM ENERGY CORPORATION (UEC), WEESATCHIE PROJECT, GOLIAD COUNTY, URANIUM EXPLORATION PERMIT NO. 123, INSPECTION REPORT, MARCH 27, 2007	03/27/2007	ML14282A303

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
560	OFFICIAL EXHIBIT - JTI027-00-BD01 - USGS, 2013, GROUNDWATER DEPLETION IN THE UNITED STATES (1900 - 2008), SCIENTIFIC INVESTIGATION REPORT 2013-5079, U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA.	12/31/2013	ML14282A315
561	OFFICIAL EXHIBIT - JTI028-00-BD01 - USGS, 1998, STRATEGIC DIRECTIONS FOR THE U.S. GEOLOGICAL SURVEY GROUND-WATER RESOURCES PROGRAM, REPORT TO CONGRESS, NOVEMBER 30, 1998, U.S. DEPARTMENT OF THE INTERIOR, U.S. GEOLOGICAL SURVEY, RESTON, VIRGINIA.	11/30/1998	ML14282A298
562	OFFICIAL EXHIBIT - JTI029-00-BD01 - ENERGY INFORMATION ADMINISTRATION, OFFICE OF COAL, NUCLEAR, ELECTRIC AND ALTERNATE FUELS, U.S. DEPARTMENT OF ENERGY (DOE), "DECOMMISSIONING OF U.S. URANIUM PRODUCTION FACILITIES," DOE/EIA-0592 (FEBRUARY 1995).	02/28/1995	ML14282A295
563	OFFICIAL EXHIBIT - JTI030-00-BD01 - NRC, TECHNICAL BASIS FOR ASSESSING URANIUM BIOREMEDIATION PERFORMANCE, OFFICE OF NUCLEAR REGULATORY RESEARCH, NUREC/CR-6973, AUGUST 2008.	08/01/2008	ML14282A316

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564	OFFICIAL EXHIBIT - JTI031-00-BD01 - WESTERN WATER CONSULTANTS, INC. "ASSESSMENT RESTORATION ACTIVITIES: SUNDANCE PROJECT," JAN. 22, 1982.	01/22/1982	ML14282A309
565	OFFICIAL EXHIBIT - JTI032-00-BD01 - NUBETH JOINT VENTURE. "ENVIRONMENTAL REPORT SUPPORTIVE INFORMATION TO APPLICATION FOR SOURCE MATERIAL LICENSE, IN SITU SOLUTION MINING TEST SITE, SUNDANCE PROJECT, CROOK COUNTY, WYOMING. 1976.	12/16/1977	ML14282A320
566	OFFICIAL EXHIBIT - JTI033-00-BD01 - NRC STAFF RESPONSE TO NATURAL RESOURCES DEFENSE COUNCIL'S AND POWDER RIVER BASIN RESOURCE COUNCIL'S JOINT MOTION TO MIGRATE OR AMEND CONTENTIONS, AND TO ADMIT NEW CONTENTIONS IN RESPONSE TO STAFF'S FSDEIS	04/14/2014	ML14282A307
567	OFFICIAL EXHIBIT - JTI034-00-BD01 - NRC, FINAL ENVIRONMENTAL STATEMENT RELATED TO OPERATION OF IRIGARY URANIUM SOLUTION MINING PROJECT, NUREG-0481, SEPTEMBER, 1978.	09/30/1978	ML14282A305
568	OFFICIAL EXHIBIT - JTI035-00-BD01 - TECHNICAL EVALUATION REPORT, CHRISTENSEN RANCH MINE UNITS 2 THROUGH 6 RESTORATION REPORT, URANIUM ONE USA, INC., WILLOW CREEK ISR FACILITY, OCTOBER 23, 2012.	10/23/2012	ML14282A299

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
569	OFFICIAL EXHIBIT - JTI036-00-BD01 - WRIGHT ENVIRONMENTAL SERVICES INC. AND TELESTO SOLUTIONS, INC. "2012 STATUS UPDATE CASING LEAK INVESTIGATION C, E AND F WELLFIELDS SMITH RANCH-HIGHLAND OPERATIONS." FEBRUARY 20, 2013.	08/25/2014	ML14282A300
570	OFFICIAL EXHIBIT - JTI037-00-BD01 - W. F. KEARNEY, DIRECTOR SHE, URANIUM ONE AMERICAS. "PERMIT TO MINE NO. 478; CHRISTENSEN RANCH PROJECT MINE UNIT 5 - NON-SIGNIFICANT REVISION; REVISED MONITORING PLAN FOR MINE UNIT 5-2 AREA." MAY 10, 2012.	08/25/2014	ML14282A293
571	OFFICIAL EXHIBIT - JTI038-00-BD01 - TIM MCCULLOUGH, MANAGER SITE SHE, URANIUM ONE USA INC. "WILLOW CREEK ISR PROJECT - PERMIT TO MINE NO. 478, 2013 ANNUAL REPORT - RESPONSE TO WDEQ-LQD COMMENTS." APRIL 15, 2014.	08/25/2014	ML14282A301
572	OFFICIAL EXHIBIT - JTI039-00-BD01 - INTERA. "APPLICATION FOR ALTERNATE CONCENTRATION LIMITS FOR THE SMITH RANCH-HIGHLAND MINE UNIT-B IN-SITU URANIUM RECOVERY FACILITY, CONVERSE COUNTY, WYOMING." MAY 22, 2013.	05/22/2013	ML14282A306
573	OFFICIAL EXHIBIT - JTI041-00-BD01 - JOHNSON, RAYMOND H. "REACTIVE TRANSPORT MODELING FOR THE PROPOSED DEWEY BURDOCK URANIUM IN-SITU RECOVERY MINE,EDGEMONT, SOUTH DAKOTA, USA." (2011).	08/25/2014	ML14282A296

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574	OFFICIAL EXHIBIT - JTI044-00-BD01 - GARY R. KONWINSKI, PM, LICENSING BRANCH 1, URANIUM RECOVERY FIELD OFFICE, REGION IV, NRC. "ENVIRONMENTAL ASSESSMENT (EA) FOR MALAPAI RESOURCES, CHRISTENSEN RANCH IN SITU LEACH SATELLITE OPERATION MAY 4, 1988	05/04/1988	ML14282A312
575	OFFICIAL EXHIBIT - JTI045-00-BD01 - JON F. WINTER, MANAGER ENVIRONMENTAL & REGULATORY AFFAIRS, WYOMING, URANIUM ONE. "MONITOR WELL 5MW66 AND CHRISTENSEN RANCH." SEPTEMBER 21, 2010.	08/25/2014	ML14282A310
576	OFFICIAL EXHIBIT - JTI046-00-BD01 - JOHN MCCARTHY, MANAGER, SAFETY, HEALTH AND ENVIRONMENTAL AFFAIRS, POWER RESOURCES, SMITH RANCH-HIGHLAND URANIUM PROJECT. "SOUTHWEST AREA HYDROLOGIC TEST: NRC LICENSE SUA-1548, DOCKET NO. 40-8964. FEBRUARY 21, 2007	08/25/2014	ML14282A314
577	OFFICIAL EXHIBIT - JTI047-00-BD01 - USGS. "WHAT IS GROUNDWATER?" OPEN-FILE REPORT 93-643. REPRINTED APRIL 2001.	08/25/2014	ML14282A304
578	OFFICIAL EXHIBIT - JTI051-R-00-BD01 - PRE-FILED REBUTTAL TESTIMONY OF DR. RICHARD ABITZ.	09/16/2014	ML14282A404
579	OFFICIAL EXHIBIT - JTI052-R-00-BD01 - PRE-FILED REBUTTAL TESTIMONY OF DR. LANCE LARSON.	09/16/2014	ML14282A401

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580	OFFICIAL EXHIBIT - JTI053-00-BD01 - CROW BUTTE RESOURCES, MINE UNIT 1 RESTORATION REPORT, JAN. 10, 2000 (VIOLATION HISTORY).	01/10/2000	ML14282A361
581	OFFICIAL EXHIBIT - JTI054-00-BD01 - LICENSE SUA-1341, DOCKET NO. 40-8502, WILLOW CREEK PROJECT QUARTERLY PROGRESS REPORT OF MONITOR WELLS ON EXCURSION STATUS - 2ND QTR. 2012.	07/27/2012	ML14282A364
582	OFFICIAL EXHIBIT - JTI056-00-BD01 - LICENSE SUA-1341, DOCKET NO. 40-8502, WILLOW CREEK PROJECT, MINE UNIT 2-6 GROUNDWATER RESTORATION.	07/08/2013	ML14282A363
583	OFFICIAL EXHIBIT - JTI057-00-BD01 - GARY CURTIS BIOGRAPHY FROM USGS WEBSITE, COPIED FROM HTTPS://PROFILE.USGS.GOV/GPCURTIS.	09/12/2014	ML14282A366
584	OFFICIAL EXHIBIT - JTI060-00-BD01 - YABUSAKI ET AL., ASSESSING THE POTENTIAL FOR BIORESTORATION OF URANIUM IN SITU RECOVERY SITES.	09/12/2014	ML14282A365
585	OFFICIAL EXHIBIT - JTI062-R-00-BD01 - GROUND WATER QUALITY SAMPLES OBTAINED FROM CHRISTENSEN RANCH MINE UNIT 5 EXCURSION WELL 5MW-66.	09/12/2014	ML14282A372

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586	OFFICIAL EXHIBIT - NON-PUBLIC - JTI009-00-BD01 - ABITZ, R. J. AND B. DARLING, 2010. ANTHROPOGENIC INDUCED REDOX DISEQUILIBRIUM IN URANIUM ORE ZONES, GEOLOGICAL SOCIETY OF AMERICA ABSTRACTS W/PROGRAMS, VOL. 42.	12/31/2010	ML14281A720
587	OFFICIAL EXHIBIT - NON-PUBLIC - JTI010-00-BD01 - LAAKSOHARJU, M., J. SMELLIE, E. TULLBORG, M. GIMENO, J. MOLINERO, I. GURBAN, AND L. HALLBECK, 2008, HYDROGEOCHEMICAL EVALUATION AND MODELING PERFORMED WITHIN . . . . , APPLIED GEOCHEMISTRY, V. 23 NO. 7.	03/04/2008	ML14281A717
588	OFFICIAL EXHIBIT - NON-PUBLIC - JTI012-00-BD01 - BROOKINS, D.G., 1988, EH-PH DIAGRAMS FOR GEOCHEMISTRY, SPRINGER-VERLAG, NEW YORK.	02/28/1988	ML14281A715
589	OFFICIAL EXHIBIT - NON-PUBLIC - JTI022-00-BD01 - CURTIS, G. P., J. A. DAVIS, AND D. L. NAFTZ 2006. SIMULATION OF REACTIVE TRANSPORT OF URANIUM (VI) IN GROUNDWATER WITH VARIABLE CHEMICAL CONDITIONS, WATER RESOUR. RES., 42, W04404	04/07/2006	ML14282A317

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590	OFFICIAL EXHIBIT - NON-PUBLIC - JTI024-00-BD01 - ZHOU, PING, AND BAOHUA GU. "EXTRACTION OF OXIDIZED AND REDUCED FORMS OF URANIUM FROM CONTAMINATED SOILS: EFFECTS OF CARBONATE CONCENTRATION AND PH," ENVIRONMENTAL SCIENCE AND TECH 39.12 2005): 4435-4440	04/01/2005	ML14282A294
591	OFFICIAL EXHIBIT - NON-PUBLIC - JTI040-00-BD01 - ANASTASI, FRANK S., AND ROY E. WILLIAMS. "AQUIFER RESTORATION AT URANIUM IN SITU LEACH SITES." INTERNATIONAL JOURNAL OF MINE WATER 3.4 1984): 29-37.	12/31/1984	ML14282A311
592	OFFICIAL EXHIBIT - NON-PUBLIC - JTI042-00-BD01 - JOHNSON, RAYMOND H. AND HLANGANANI TUTU. "REACTIVE TRANSPORT MODELING AT URANIUM IN SITU RECOVERY SITES: UNCERTAINTIES IN URANIUM SORPTION ON IRON HYDROXIDES." RELIABE MINE WATER TECHNOLOGY (2013): 377-382	08/25/2014	ML14282A302
593	OFFICIAL EXHIBIT - NON-PUBLIC - JTI043-00-BD01 - STEWART, BRANDY D., ET AL. "INFLUENCE OF URANYL SPECIATION AND IRON OXIDES ON URANIUM BIOGEOCHEMICAL REDOX REACTIONS." GEOMICROBIOLOGY JOURNAL 28.5-6 (2011): 444-456.	08/25/2014	ML14282A297

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594	OFFICIAL EXHIBIT - NON-PUBLIC - JTI048-00-BD01 - BLANC, ELODIE, ET AL. "MODELING US WATER RESOURCES UNDER CLIMATE CHANGE." EARTH'S FUTURE 2.4 (2014): 197-224.	02/24/2014	ML14282A308
595	OFFICIAL EXHIBIT - NON-PUBLIC - JTI049-00-BD01 - DROUGHT-STRICKEN TEXAS TOWN TURNS TO TOILETS FOR WATER BY SHELLEY KOFLER, MAY 06, 2014, NPR, HTTP://WWW.NPR.ORG/2014/05/06/309101579/DROUGHT-STRICKEN-TEXAS-TOWN-TURNS-TO-TOILETS-FOR-WATER.	05/06/2014	ML14282A318
596	OFFICIAL EXHIBIT - NON-PUBLIC - JTI050-00-BD01 - GILLETTE REGIONAL WATER SUPPLY PROJECT, WEBSITE ACCESSED AUGUST 25,	08/25/2014	ML14282A313
597	OFFICIAL EXHIBIT - NON-PUBLIC - JTI058-00-BD01 - FOX ET AL. 2006, X-RAY ABSORPTION SPECTROSCOPY IDENTIFIES CALCIUM-URANYL-CARBONATE COMPLEXES AT ENVIRONMENTAL CONCENTRATIONS (FULL-TEXT COPYRIGHTED MATERIAL).	12/31/2006	ML14282A367
598	OFFICIAL EXHIBIT - NON-PUBLIC - JTI059-00-BD01 - KELLY ET AL. 2006, X-RAY ABSORPTION SPECTROSCOPY IDENTIFIES CALCIUM-URANYL-CARBONATE COMPLEXES AT ENVIRONMENTAL CONCENTRATIONS (FULL-TEXT COPYRIGHTED MATERIAL).	09/12/2014	ML14282A360

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599	OFFICIAL EXHIBIT - NON-PUBLIC - JTI061-00-BD01 - HUA ET AL. 2006, KINETICS OF URANIUM(VI) REDUCTION BY HYDROGEN.	12/31/2006	ML14282A369
600	OFFICIAL EXHIBIT - JTI055-R-00-BD01 - IRIGARAY AND CHRISTENSEN RANCH ENVIRONMENTAL MONITORING STATION LOCATIONS.	04/30/2014	ML14301A407
601	OFFICIAL EXHIBIT - NRC001-00-BD01 - TESTIMONY OF JOHARI MOORE, JOHN SAXTON, KATHRYN JOHNSON, AND ANTHONY BURGESS (AUG. 25, 2014).	08/25/2014	ML14282A346
602	OFFICIAL EXHIBIT - NRC002-00-BD01 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF JOHARI MOORE (AUG. 25, 2014).	08/25/2014	ML14281A692
603	OFFICIAL EXHIBIT - NRC003-00-BD01 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF JOHN SAXTON (AUG. 25, 2014).	08/25/2014	ML14281A690
604	OFFICIAL EXHIBIT - NRC004-00-BD01 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF KATHRYN JOHNSON (AUG. 25, 2014).	08/25/2014	ML14281A693
605	OFFICIAL EXHIBIT - NRC005-00-BD01 - STATEMENT OF PROFESSIONAL QUALIFICATIONS OF ANTHONY BURGESS (AUG. 25, 2014).	08/25/2014	ML14281A689

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606	OFFICIAL EXHIBIT - NRC006A-00-BD01 - DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE ROSS ISR PROJECT (CHAPTERS 1-3) (MARCH 2013).	03/31/2013	ML14281A696
607	OFFICIAL EXHIBIT - NRC006B-00-BD01 - DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT FOR THE ROSS ISR PROJECT (CHAPTER 4-APPENDIX B) (MARCH 2013).	03/31/2013	ML14281A695
608	OFFICIAL EXHIBIT - NRC007-00-BD01 - GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR IN SITU LEACH URANIUM MILLING FACILITIES (CHAPTERS 1-4) (MAY 2009).	05/31/2009	ML14281A694
609	OFFICIAL EXHIBIT - NRC008-00-BD01 - GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR IN SITU LEACH URANIUM MILLING FACILITIES (CHAPTERS 5-12 AND APPENDICES A-G) (MAY 2009).	05/31/2009	ML14281A701
610	OFFICIAL EXHIBIT - NRC009-00-BD01 - NRC RECORD OF DECISION FOR THE ROSS URANIUM IN-SITU RECOVERY PROJECT (APR. 24, 2014).	04/24/2014	ML14281A699
611	OFFICIAL EXHIBIT - NRC010-00-BD01 - ERRATA NO 1 TO ROSS FSEIS (APR 23, 2014).	08/25/2014	ML14281A707
612	OFFICIAL EXHIBIT - NRC011-00-BD01 - ERRATA NO. 2 TO ROSS FSEIS (AUG. 14, 2014).	08/25/2014	ML14281A700

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613	OFFICIAL EXHIBIT - NRC012-00-BD01 - AFFIDAVIT OF JOHN L SAXTON CONCERNING JOINT INTERVENORS MOTION FOR SUMMARY DISPOSITION OF CONTENTION 1.	07/03/2014	ML14281A711
614	OFFICIAL EXHIBIT - NRC013-00-BD01 - NRC 2003 NUREG 1748 ENVIRONMENTAL REVIEW GUIDANCE FOR LICENSING ACTIONS ASSOCIATED WITH NMSS PROGRAMS.	08/30/2003	ML14281A705
615	OFFICIAL EXHIBIT - NRC014-00-BD01 - WYOMING STATE ENGINEER'S OFFICE (JUNE 2011), REGULATIONS AND INSTRUCTIONS PART III: WATER WELL MINIMUM CONSTRUCTION STANDARDS.	08/25/2014	ML14281A703
616	OFFICIAL EXHIBIT - NRC015-00-BD01 - DRISCOLL, F.G. (1986), GROUNDWATER AND WELLS, JOHNSON SCREENS.	08/25/2014	ML14281A704
617	OFFICIAL EXHIBIT - NRC016-R-00-BD01 - NUBETH JOINT VENTURE ENVIRONMENTAL REPORT.	09/30/2014	ML14282A407
618	OFFICIAL EXHIBIT - NRC017-00-BD01 - NUCLEAR DYNAMICS 1978 QUARTERLY REPORT SUMMARY OF WATER QUALITY PROGRAM.	08/31/1978	ML14281A708
619	OFFICIAL EXHIBIT - NRC018-00-BD01 - NUCLEAR DYNAMICS 1980 RESTORATION REPORT SUNDANCE PROJECT.	08/25/2014	ML14281A710

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620	OFFICIAL EXHIBIT - NRC019-00-BD01 - ND RESOURCES (1982), ASSESSMENT OF RESTORATION ACTIVITIES, SUNDANCE PROJECT.	01/22/1982	ML14281A702
621	OFFICIAL EXHIBIT - NRC020-00-BD01 - STAUB ET AL. (1986), NUREG/CR-3967, "ANALYSIS OF EXCURSIONS AT SELECTED IN SITU URANIUM MINES IN WYOMING AND TEXAS".	08/25/2014	ML14281A709
622	OFFICIAL EXHIBIT - NRC021-00-BD01 - NRC (2003), NUREG-1620 "STANDARD REVIEW PLAN FOR THE REVIEW OF A RECLAMATION PLAN FOR MILL TAILINGS SITES UNDER TITLE II OF THE URANIUM MILL TAILINGS RADIATION CONTROL ACT OF 1978".	06/30/2003	ML14282A325
623	OFFICIAL EXHIBIT - NRC022-00-BD01 - CROW BUTTE RESOURCES (2000), MINE UNIT 1 RESTORATION REPORT SUBMITTAL AND REQUEST FOR LICENSE AMENDMENT.	01/14/2000	ML14282A322
624	OFFICIAL EXHIBIT - NRC023-00-BD01 - CROW BUTTE RESOURCES (2001), RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION RELATED TO MINE UNIT 1 GROUNDWATER RESTORATION COMPLETION AT CROW BUTTE PROJECT.	08/24/2001	ML14282A321
625	OFFICIAL EXHIBIT - NRC024-00-BD01 - CROW BUTTE RESOURCES (2002), MINE UNIT 1 GROUNDWATER STABILITY DATA.	10/11/2002	ML14282A324

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626	OFFICIAL EXHIBIT - NRC025-00-BD01 - NRC (2001), LICENSE AMENDMENT 11 FOR THE CROW BUTTE FACILITY	06/26/2001	ML14282A323
627	OFFICIAL EXHIBIT - NRC026-00-BD01 - NRC (2003), LICENSE AMENDMENT 15, WELLFIELD #1 RESTORATION ACCEPTANCE.	02/12/2003	ML14282A326
628	OFFICIAL EXHIBIT - NRC027-00-BD01 - NRC (2004), SMITH RANCH-HIGHLAND PROJECT, NRC REVIEW OF A-WELLFIELD GROUND WATER RESTORATION REPORT.	06/29/2004	ML14282A328
629	OFFICIAL EXHIBIT - NRC028 -00-BD01 - PRI (2004), SMITH RANCH-HIGHLAND PROJECT A WELLFIELD GROUND WATER RESTORATION INFORMATION.	08/25/2014	ML14282A330
630	OFFICIAL EXHIBIT - NRC029-00-BD01 - CAMECO (2012), HIGHLAND URANIUM PROJECT 2011-2012 ANNUAL REPORT FOR PERMIT 603.	07/31/2012	ML14282A329
631	OFFICIAL EXHIBIT - NRC030-00-BD01 - COGEMA (2005), RESPONSE TO LQD/DEQ COMMENTS ON IRIGARAY WELLFIELD RESTORATION REPORT.	05/04/2005	ML14282A327
632	OFFICIAL EXHIBIT - NRC031-00-BD01 - COGEMA (2006A), RESPONSE TO NRC REQUESTS FOR ADDITIONAL INFORMATION ON IRIGARAY MINE RESTORATION REPORT.	08/25/2014	ML14282A334

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633	OFFICIAL EXHIBIT - NRC032-00-BD01 - COGEMA (2006B), SUMMARY TABLE RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION ON IRIGARAY MINE RESTORATION REPORT	08/11/2006	ML14282A335
634	OFFICIAL EXHIBIT - NRC033-00-BD01 - NRC (2006A),TECHNICAL EVALUATION REPORT, REVIEW OF IRIGARAY MINE RESTORATION REPORT PRODUCTION UNITS 1 THROUGH 9.	08/25/2014	ML14282A331
635	OFFICIAL EXHIBIT - NRC034-00-BD01 - NRC (2006B), LETTER REGARDING NRC REVIEW OF IRIGARAY MINE RESTORATION REPORT.	09/20/2006	ML14282A337
636	OFFICIAL EXHIBIT - NRC035-00-BD01 - WDEQ (2005), POSTMINING GROUNDWATER RESTORATION DEMONSTRATION FOR THE IRIGARAY MINE, CHANGE NO. 34.	03/23/2006	ML14282A336
637	OFFICIAL EXHIBIT - NRC036-00-BD01 - AFFIDAVIT OF KATHRYN JOHNSON CONCERNING DRAFTING ERROR IDENTIFIED BY JOINT INTERVENORS IN THE STRATA ROSS FSEIS (APR. 10, 2014).	04/10/2014	ML14282A340
638	OFFICIAL EXHIBIT - NON-PUBLIC - NRC037-00-BD01 - BORCH ET AL (2012), DETERMINATION OF CONTAMINANT LEVELS AND REMEDIATION EFFICACY IN GROUNDWATER AT A FORMER IN-SITU RECOVERY URANIUM MINE.	08/25/2014	ML14282A344

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639	OFFICIAL EXHIBIT - NRC038-00-BD01 - NRC (2009C), REGULATORY ISSUE SUMMARY 2009-05, URANIUM RECOVERY POLICY.	04/29/2009	ML14282A342
640	OFFICIAL EXHIBIT - NRC039-00-BD01 - WDEQ (2011), LETTER OF CONFERENCE AND CONCILIATION, EXCURSION AT CAMECO RESOURCES WELL CM-32.	05/17/2011	ML14282A343
641	OFFICIAL EXHIBIT - NRC040-00-BD01 - URANIUM ONE (2010), IRIGARAY-CHRISTENSEN RANCH MINE, UNIT 5 RESPONSE.	08/25/2014	ML14282A339
642	OFFICIAL EXHIBIT - NRC041-00-BD01 - URANIUM ONE (2012), WILLOW CREEK PROJECT, MONTHLY EXCURSION REPORT FOR SELECTED MONITOR WELLS.	05/13/2012	ML14282A345
643	OFFICIAL EXHIBIT - NRC042-00-BD01 - NRC (2007), NUREG/CR-6870, "CONSIDERATION OF GEOCHEMICAL ISSUES IN GROUNDWATER RESTORATION AT URANIUM IN-SITU LEACH MINING FACILITIES".	01/31/2007	ML14282A341
644	OFFICIAL EXHIBIT - NRC043-00-BD01 - NRC (2014), ISR WELLFIELD GROUND WATER QUALITY DATA, IRIGARAY MINE UNIT 1.	08/25/2014	ML14282A338
645	OFFICIAL EXHIBIT - NRC044-R2-00-BD01 - NRC STAFF REBUTTAL TESTIMONY	09/28/2014	ML14282A406

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646	OFFICIAL EXHIBIT - NRC045-00-BD01 - WDEQ (2012) LETTER RE ROSS ISR PROJECT GROUNDWATER RECLASSIFICATION	08/03/2012	ML14282A359
647	OFFICIAL EXHIBIT - NRC046-00-BD01 - STUMM AND MORGAN (1996) STEADY STATE V EQUILIBRIUM (PAGES 79-8)	09/12/2014	ML14282A356
648	OFFICIAL EXHIBIT - NRC047-00-BD01 - STONE AND TRUAX (2014), IN-SITU RECOVERY URANIUM MINING RESTORATION CHALLENGES.	04/09/2014	ML14282A355
649	OFFICIAL EXHIBIT - NRC048-00-BD01 - WDEQ (1993), WATER QUALITY RULES AND REGULATIONS, CHAPTER 8, QUALITY STANDARDS FOR WYOMING GROUNDWATER	09/12/2014	ML14282A357
650	OFFICIAL EXHIBIT - NRC049-00-BD01 - WDEQ (2005), WATER QUALITY RULES AND REGULATIONS, CHAPTER 8, QUALITY STANDARDS FOR WYOMING GROUNDWATER	09/12/2014	ML14282A352
651	OFFICIAL EXHIBIT - NRC050-00-BD01 - NRC (1985), NUREG-CR-3709, METHODS OF MINIMIZING GROUND-WATER CONTAMINATION FROM IN SITU LEACH URANIUM MINING	09/12/2014	ML14282A354
652	OFFICIAL EXHIBIT - NRC051-00-BD01 - WDEQ (1978), LETTER ON CHRISTENSEN RANCH RESTORATION	01/07/2013	ML14282A353

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653	OFFICIAL EXHIBIT - NRC052-00-BD01 - EPA 2010 NMA INORGANICS VOLUME 3 PP 53 THROUGH 68.	09/30/2010	ML14282A408
654	OFFICIAL EXHIBIT - SEI001-00-BD01 - RALPH KNODE INITIAL WRITTEN TESTIMONY.	08/25/2014	ML14282A288
655	OFFICIAL EXHIBIT - SEI002-00-BD01 - RALPH KNODE CV.	08/24/2014	ML14281A624
656	OFFICIAL EXHIBIT - SEI003-00-BD01 - DIAGRAM DEPICTING AIR-LIFT DEVELOPMENT OF ISR WELLS.	08/24/2014	ML14281A632
657	OFFICIAL EXHIBIT - SEI004A -00-BD01 - NRC JULY 10, 2009 MEMORANDUM; ML091770187.	07/10/2009	ML14281A633
658	OFFICIAL EXHIBIT - SEI004B-00-BD01 - NRC JULY 10, 2009 MEMORANDUM SUPPORTING DATA; ML091770385.	08/24/2014	ML14281A626
659	OFFICIAL EXHIBIT - SEI005-00-BD01 - BEN SCHIFFER INITIAL WRITTEN TESTIMONY.	08/25/2014	ML14282A292
660	OFFICIAL EXHIBIT - SEI006-00-BD01 - BEN SCHIFFER CV.	08/24/2014	ML14281A627
661	OFFICIAL EXHIBIT - SEI007-00-BD01 - NUREG-1569 STANDARD REVIEW PLAN FOR IN SITU LEACH URANIUM EXTRACTION LICENSE APPLICATIONS.	08/24/2014	ML14281A621

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662	OFFICIAL EXHIBIT - SEI008-00-BD01 - REGULATORY GUIDE 4.14, REVISION 1, "RADIOLOGICAL EFFLUENT AND ENVIRONMENTAL MONITORING AT URANIUM MILLS".	08/24/2014	ML14281A636
663	OFFICIAL EXHIBIT - SEI009A-00-BD01 - FSEIS VOL 1, COVER THRU APP B.	04/23/2014	ML14281A634
664	OFFICIAL EXHIBIT - SEI009B-00-BD01 - FSEIS VOL 2, APP C TO END.	08/24/2014	ML14281A629
665	OFFICIAL EXHIBIT - SEI010-00-BD01 - SAFETY EVALUATION REPORT FOR THE STRATA ENERGY, INC. ROSS ISR PROJECT; ML14002A107.	08/24/2014	ML14281A628
666	OFFICIAL EXHIBIT - SEI011-00-BD01 - WDEQ-LQD NON-COAL CHAPTER 11, IN SITU MINING.	08/24/2014	ML14281A620
667	OFFICIAL EXHIBIT - SEI012A-00-BD01 - WDEQ-LQD GUIDELINE 4, IN SITU MINING, MARCH 2000.	08/24/2014	ML14281A631
668	OFFICIAL EXHIBIT - SEI012B-00-BD01 - WDEQ-LQD GUIDELINE 4, IN SITU MINING, OCTOBER 28, 2013.	10/28/2013	ML14281A622
669	OFFICIAL EXHIBIT - SEI013-00-BD01 - WDEQ-LQD GUIDELINE 8, HYDROLOGY.	08/24/2014	ML14281A635
670	OFFICIAL EXHIBIT - SEI014A-00-BD01 - ROSS TR VOL 1A, SEC 1 THRU 2.8.	08/24/2014	ML14281A625

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671	OFFICIAL EXHIBIT - SEI014B-00-BD01 - ROSS TR VOL 1B, SEC 2.9 THRU 2.11	12/31/2010	ML14281A623
672	OFFICIAL EXHIBIT - SEI014C-00-BD01 - ROSS TR VOL 2, SEC 3 THRU 11.	08/24/2014	ML14281A630
673	OFFICIAL EXHIBIT - SEI014D-00-BD01 - ROSS TR VOL 3A, ADDENDA 1.2-A THRU 2.6-B.	08/24/2014	ML14281A638
674	OFFICIAL EXHIBIT - SEI014E-00-BD01 - ROSS TR VOL 3B, ADDENDA 2.6-C.	08/24/2014	ML14281A642
675	OFFICIAL EXHIBIT - SEI014F-00-BD01 - ROSS TR VOL 3C, ADDENDA 2.6-C THRU 2.7-C.	08/24/2014	ML14281A641
676	OFFICIAL EXHIBIT - SEI014G-00-BD01 - ROSS TR VOL 4A, ADDENDA 2.7-D THRU 2.7-F.	08/24/2014	ML14281A640
677	OFFICIAL EXHIBIT - SEI014H-00-BD01 - ROSS TR VOL 4B, ADDENDA 2.7-G THRU 2.7-H	08/24/2014	ML14281A643
678	OFFICIAL EXHIBIT - SEI014I-00-BD01 - ROSS TR VOL 5A, ADDENDA 2.7-I THRU 2.7-J.	08/24/2014	ML14281A637
679	OFFICIAL EXHIBIT - SEI014J-00-BD01 - ROSS TR VOL 5B, ADDENDA 2.7-K THRU 2.9-A.	08/24/2014	ML14281A639
680	OFFICIAL EXHIBIT - SEI014K-00-BD01 - ROSS TR VOL 5C, ADDENDA 2.9B.	08/24/2014	ML14281A649

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681	OFFICIAL EXHIBIT - SEI014L-00-BD01 - ROSS TR VOL 6A, ADDENDA 2.9-C THRU 2.9-D.	08/24/2014	ML14281A650
682	OFFICIAL EXHIBIT - SEI014M-00-BD01 - ROSS TR VOL 6B, ADDENDA 3.1A.	08/24/2014	ML14281A644
683	OFFICIAL EXHIBIT - SEI014N-00-BD01 - ROSS TR VOL 6C, ADDENDA 4.2A.	08/24/2014	ML14281A647
684	OFFICIAL EXHIBIT - SEI014O-00-BD01 - ROSS TR VOL 6D, ADDENDA 4.2A CONT.	08/24/2014	ML14281A648
685	OFFICIAL EXHIBIT - SEI014P-00-BD01 - ROSS TR VOL 6E, ADDENDA 4.2B THRU 6.4A.	08/24/2014	ML14281A646
686	OFFICIAL EXHIBIT - SEI015-00-BD01 - NRC LICENSE SUA‐1601; ML14069A335.	04/24/2014	ML14281A645
687	OFFICIAL EXHIBIT - SEI016A-00-BD01 - ROSS ER VOL 1, CVR THRU SEC 3.5; ML110130342.	08/24/2014	ML14281A666
688	OFFICIAL EXHIBIT - SEI016B-00-BD01 - ROSS ER VOL 2, SEC 3.6 THRU GLOSSARY; ML110130344.	08/24/2014	ML14281A660
689	OFFICIAL EXHIBIT - SEI016C-00-BD01 - ROSS ER VOL 3, ADDENDA 1.6-A THRU ADDENDA 3.3-F; ML110130346.	12/31/2010	ML14281A667
690	OFFICIAL EXHIBIT - SEI016D-00-BD01 - ROSS ER VOL 3, ADDENDA 3.4-A THRU 3.4-B; ML110130348.	08/24/2014	ML14281A664

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
691	OFFICIAL EXHIBIT - SEI016E-00-BD01 - ROSS ER VOL 3, ADDENDA 3.5-A THRU 4.6-A; ML110130351.	08/24/2014	ML14281A656
692	OFFICIAL EXHIBIT - SEI017-00-BD01 - ROSS ER RAI RESPONSES; ML121030465.	08/24/2014	ML14281A658
693	OFFICIAL EXHIBIT - SEI018-00-BD01 - COMPARISON BETWEEN REGULATORY GUIDELINES AND PARAMETERS ANALYZED BY STRATA.	08/24/2014	ML14281A662
694	OFFICIAL EXHIBIT - SEI019-00-BD01 - ROSS ORE ZONE POTENTIOMETRIC SURFACE AND REGIONAL MONITOR WELL LOCATION MAP.	08/19/2014	ML14281A654
695	OFFICIAL EXHIBIT - SEI020A-00-BD01 - PRELIMINARY BASELINE SAMPLING PLAN FOR THE ROSS ISR URANIUM RECOVERY PROJECT; ML14217A357.	08/31/2010	ML14281A659
696	OFFICIAL EXHIBIT - SEI020B-00-BD01 - APPENDIX C DRAWING TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A360.	11/29/2010	ML14281A665
697	OFFICIAL EXHIBIT - SEI020C-00-BD01 - EXHIBIT 1 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A356.	08/24/2014	ML14281A663
698	OFFICIAL EXHIBIT - SEI020D-00-BD01 - EXHIBIT 2 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A358.	08/17/1977	ML14281A653

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
699	OFFICIAL EXHIBIT - SEI020E-00-BD01 - EXHIBIT 3 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A361.	08/17/1977	ML14281A655
700	OFFICIAL EXHIBIT - SEI020F-00-BD01 - EXHIBIT 4 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A359.	08/20/2010	ML14281A651
701	OFFICIAL EXHIBIT - SEI020G-00-BD01 - EXHIBIT 5 TO THE PRELIMINARY BASELINE SAMPLING PLAN; ML14217A363.	08/10/2010	ML14281A652
702	OFFICIAL EXHIBIT - SEI021-00-BD01 - WDEQ CORRESPONDENCE ON THE PRELIMINARY BASELINE SAMPLING PLAN FOR THE ROSS ISR URANIUM RECOVERY PROJECT; ML14217A362.	08/31/2010	ML14281A680
703	OFFICIAL EXHIBIT - SEI022-00-BD01 - OCTOBER 29, 2009 NRC PUBLIC MEETING SUMMARY; ML093370598.	12/08/2009	ML14281A668
704	OFFICIAL EXHIBIT - SEI023-00-BD01 - FEBRUARY 17, 2010 NRC PUBLIC MEETING SUMMARY; ML100620649.	03/04/2010	ML14281A672
705	OFFICIAL EXHIBIT - SEI024-00-BD01 - APRIL 13, 2013 NRC PUBLIC MEETING SUMMARY; ML101310096.	05/13/2010	ML14281A688

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
706	OFFICIAL EXHIBIT - SEI025-00-BD01 - BASELINE GROUNDWATER CHARACTERIZATION COMPARISON TO OTHER LICENSED ISR FACILITIES IN WYOMING.	08/24/2014	ML14281A670
707	OFFICIAL EXHIBIT - SEI026-00-BD01 - HAL DEMUTH AND ERROL LAWRENCE INITIAL WRITTEN TESTIMONY OF.	08/25/2014	ML14282A286
708	OFFICIAL EXHIBIT - SEI027-00-BD01 - HAL DEMUTH CV.	08/24/2014	ML14281A681
709	OFFICIAL EXHIBIT - SEI028-00-BD01 - ERROL LAWRENCE CV.	08/24/2014	ML14281A677
710	OFFICIAL EXHIBIT - SEI029-00-BD01 - FIGURE TO ACCOMPANY HAL DEMUTH AND ERROL LAWRENCE INITIAL WRITTEN TESTIMONY.	12/31/1983	ML14281A678
711	OFFICIAL EXHIBIT - SEI030-00-BD01 - USGS WATER-SUPPLY PAPER 2220, BASIC GROUND-WATER HYDROLOGY, 1983.	12/31/1983	ML14281A669
712	OFFICIAL EXHIBIT - SEI031-00-BD01 - NATIONAL MINING ASSOCIATION'S (NMA) GENERIC ENVIRONMENTAL REPORT (GER) IN SUPPORT OF THE NRC'S GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR IN SITU URANIUM RECOVERY FACILITIES; ML080170159.	11/30/2007	ML14281A676
713	OFFICIAL EXHIBIT - SEI032-00-BD01 - TYPICAL ISR PROCESS DIAGRAM.	08/24/2014	ML14281A673

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
714	OFFICIAL EXHIBIT - SEI033-00-BD01 - PRE-LICENSING WELL CONSTRUCTION, LOST CREEK ISR URANIUM RECOVERY PROJECT; ML091520101.	07/24/2009	ML14281A683
715	OFFICIAL EXHIBIT - SEI034-00-BD01 - EPA AQUIFER EXEMPTION APPROVAL; ML14183B140.	05/15/2013	ML14281A686
716	OFFICIAL EXHIBIT - SEI035-00-BD01 - IAEA-TECDOC-720.	08/24/2014	ML14281A685
717	OFFICIAL EXHIBIT - SEI036-00-BD01 - MOORE RANCH FSEIS; ML102290470.	08/31/2010	ML14281A687
718	OFFICIAL EXHIBIT - SEI037-00-BD01 - NUREG/CR-6733, A BASELINE RISK-INFORMED, PERFORMANCE-BASED APPROACH FOR IN SITU LEACH URANIUM EXTRACTION LICENSEES - FINAL REORT, JULY 2001.	08/24/2014	ML14281A682
719	OFFICIAL EXHIBIT - SEI038-00-BD01 - DECISION OF THE TCEQ EXECUTIVE DIRECTOR REGARDING URANIUM ENERGY CORPORATION'S PERMIT NO UR03075.	11/06/2008	ML14281A675
720	OFFICIAL EXHIBIT - SEI039-00-BD01 - MIKE GRIFFIN INITIAL WRITTEN TESTIMONY.	08/25/2014	ML14282A289
721	OFFICIAL EXHIBIT - SEI040-00-BD01 - MIKE GRIFFIN CV.	08/24/2014	ML14281A679

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
722	OFFICIAL EXHIBIT - SEI041-00-BD01 - AUGUST 19, 1999 NDEQ LETTER TO CROW BUTTE.	08/19/2014	ML14281A684
723	OFFICIAL EXHIBIT - SEI042-00-BD01 - RAY MOORES INITIAL WRITTEN TESTIMONY.	08/25/2014	ML14282A291
724	OFFICIAL EXHIBIT - SEI043 -00-BD01 - RAY MOORES CV.	08/24/2014	ML14281A671
725	OFFICIAL EXHIBIT - SEI044-00-BD01 - MAY 11, 2010 RESPONSE TO K. SWEENEY FROM BRADLEY JONES REGARDING 612009 LETTER TO COMMISSION REGARDING NRC REGULATORY ISSUE SUMMARY 2009-05.	05/11/2010	ML14282A287
726	OFFICIAL EXHIBIT - SEI045-00-BD01 - BEN SCHIFFER REBUTTAL TESTIMONY.	09/12/2014	ML14282A382
727	OFFICIAL EXHIBIT - SEI046-00-BD01 - HAL DEMUTH AND ERROL LAWRENCE REBUTTAL TESTIMONY.	09/12/2014	ML14282A385
728	OFFICIAL EXHIBIT - SEI047-00-BD01 - RALPH KNODE REBUTTAL TESTIMONY.	09/12/2014	ML14282A378
729	OFFICIAL EXHIBIT - SEI048-00-BD01 - RAY MOORES REBUTTAL TESTIMONY.	09/12/2014	ML14282A375
730	OFFICIAL EXHIBIT - SEI049-00-BD01 - MIKE GRIFFIN REBUTTAL TESTIMONY.	09/12/2014	ML14282A388

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
731	OFFICIAL EXHIBIT - SEI050-00-BD01 - FEIS FOR THE POWDER RIVER BASIN OIL AND GAS PROJECT, CHAPTER 3.	01/31/2003	ML14282A349
732	OFFICIAL EXHIBIT - SEI051-00-BD01 - FEIS FOR THE WEST ANTELOPE II COAL LEASE, VOL 1.	09/12/2014	ML14282A348
733	OFFICIAL EXHIBIT - SEI052-00-BD01 - FEIS FOR THE EAGLE BUTTE WEST COAL LEASE.	08/31/2007	ML14282A350
734	OFFICIAL EXHIBIT - SEI053-00-BD01 - FEIS FOR THE MAYSDORF COAL LEASE.	04/30/2007	ML14282A351
735	MEMORANDUM AND ORDER (ADOPTING TRANSCRIPT CORRECTIONS AND CLOSING EVIDENTIARY RECORD)	10/28/2014	ML14301A324
736	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S PROPOSED FINDINGS OF FACT & CONCLUSIONS OF LAW FOR ENVIRONMENTAL CONTENTIONS 1, 2 AND 3	11/03/2014	ML14307B719
737	NRC STAFF NOTICE OF APPEARANCE OF DAVID M. CYLKOWSKI	11/03/2014	ML14307B731
738	STRATA ENERGY, INC'S MONTHLY UPDATE TO INITIAL MANDATORY DISCLOSURES - NOVEMBER 2014	11/03/2014	ML14307B733
739	NRC STAFF'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW	11/03/2014	ML14307B763

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
740	STRATA ENERGY, INC'S PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW	11/03/2014	ML14307B764
741	STRATA ENERGY, INC. NOTICE OF ERRATA FOR PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW	11/12/2014	ML14316A609
742	STRATA ENERGY, INC'S REPLY TO NRC STAFF'S AND JOINT INTERVENORS' PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW	11/17/2014	ML14321A895
743	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S RESPONSES TO NRC STAFF'S AND SEI'S PROPOSED FINDINGS OF FACT & CONCLUSIONS OF LAW FOR ENVIRONMENTAL CONTENTIONS 1, 2 AND 3	11/17/2014	ML14321A898
744	NRC STAFF'S NOTICE OF ERRATUM TO PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW	11/17/2014	ML14321A901
745	NRC STAFF'S REPLY PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW	11/17/2014	ML14321A902
746	NRC STAFF'S CORRECTED NOTICE OF ERRATUM TO PROPOSED FINDINGS OF FACT AND CONCLUSIONS OF LAW	11/20/2014	ML14324A091
747	MEMORANDUM (REVISION TO GENERAL SCHEDULE)	01/06/2015	ML15006A303

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
748	INITIAL DECISION (RULING ON JOINT INTERVENORS' ENVIRONMENTAL CONTENTIONS 1-3) LBP-15-3	01/23/2015	ML15023A566
749	MEMORANDUM AND ORDER (PROVIDING PARTIES' PROPOSED QUESTIONS FOR THE OFFICIAL RECORD)	01/27/2015	ML15027A624
750	NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S PETITION FOR REVIEW OF ASLB'S INITIAL DECISION DENYING ENVIRONMENTAL CONTENTIONS 1 THROUGH 3, AND INTERLOCUTORY DECISIONS DENYING ENVIRONMENTAL CONTENTIONS 4/5A AND 6/7	02/17/2015	ML15048A103
751	EXHIBITS 1 - 5 SUPPORTING NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S PETITION FOR REVIEW OF ASLB'S INITIAL DECISION	02/17/2015	ML15048A105
752	EXHIBITS 6 - 10 SUPPORTING NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S PETITION FOR REVIEW OF ASLB'S INITIAL DECISION	02/17/2015	ML15048A113
753	EXHIBITS 11 - 15 SUPPORTING NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S PETITION FOR REVIEW OF ASLB'S INITIAL DECISION	02/17/2015	ML15048A120

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RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
754	EXHIBITS 16 - 20 SUPPORTING NATURAL RESOURCES DEFENSE COUNCIL'S & POWDER RIVER BASIN RESOURCE COUNCIL'S PETITION FOR REVIEW OF ASLB'S INITIAL DECISION	02/17/2015	ML15048A128
755	BRIEF OF APPLICANT STRATA ENERGY, INC IN OPPOSITION TO THE NATURAL RESOURCES DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL PETITION FOR REVIEW OF LBP-15-3 [PACKAGE WITH 4 DOCUMENTS]	03/16/2015	ML15075A508
756	NRC STAFF'S ANSWER TO JOINT INTERVENORS' PETITION FOR REVIEW OF LBP-15-3	03/16/2015	ML15075A518
757	REPLY OF NRDCL & PRBRC IN SUPPORT OF PETITION FOR REVIEW OF ASLB'S INITIAL DECISION DENYING ENVIRONMENTAL CONTENTIONS 1 THROUGH 3, AND INTERLOCUTORY DECISIONS DENYING ENVIRONMENTAL CONTENTIONS 4/5A AND 6/7	03/26/2015	ML15085A233
758	ORDER OF THE SECRETARY	06/15/2015	ML15166A505
759	NATURAL RESOURCES DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL'S NOTICE OF FILING	02/19/2016	ML16050A136
760	UPDATED NOTICE OF APPEARANCE FOR HOWARD CRYSTAL	04/26/2016	ML16117A428

RECORD ID	DOCUMENT DESCRIPTION	DOCUMENT DATE	ACCESSION NUMBER
761	NATURAL RESOURCES DEFENSE COUNCIL AND POWDER RIVER BASIN RESOURCE COUNCIL'S NOTICE OF FILING (PKG. W/ 2 DOCUMENTS)	04/27/2016	ML16118A485
762	COMMISSION MEMORANDUM AND ORDER (CLI-16-13)	06/29/2016	ML16181A107
763	NUREG-1910 SUPP 5 W/ERRATA, “ENVIRONMENTAL IMPACT STATEMENT FOR THE ROSS ISR PROJECT IN CROOK COUNTY, WYOMING: SUPPLEMENT TO THE GENERIC ENVIRONMENTAL IMPACT STATEMENT FOR IN-SITU LEACH URANIUM MILLING FACILITIES” (FINAL REPORT).	02/28/2014	ML14056A096
764	ROSS RECORD OF DECISION FOR THE PROPOSED ROSS URANIUM IN-SITU RECOVERY (ISR) PROJECT IN CROOK COUNTY, WYOMING (ROSS PROJECT)	04/24/2014	ML14073A107
765	SOURCE AND BYPRODUCT MATERIALS LICENSE SUA-1601: STRATA ENERGY INC., ROSS ISR PROJECT	04/24/2016	ML14069A335
766	UPDATED ROSS RECORD OF DECISION FOR ROSS IN SITU URANIUM RECOVERY PROJECT	09/28/2016	ML16230A021

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

COMMISSIONERS:

Stephen G. Burns, Chairman
Kristine L. Svinicki
William C. Ostendorff
Jeff Baran

In the Matter of STRATA ENERGY, INC. (Ross *In Situ* Uranium Recovery Project)	Docket No. 40-9091

CLI-16-13

MEMORANDUM AND ORDER

This decision addresses a petition for review relating to a materials license application for an *in situ* uranium recovery facility in Crook County, Wyoming filed by Strata Energy, Inc.[1] Natural Resources Defense Council and Powder River Basin Resource Council (together, "Joint Intervenors") have petitioned for review of the Atomic Safety and Licensing Board's Initial

[1] *Natural Resources Defense Council's & Powder River Basin Resource Council's Petition for Review of Atomic Safety and Licensing Board's January 23, 2015 Initial Decision Denying Environmental Contentions 1 Through 3, and Interlocutory Decisions Denying Environmental Contentions 4/5A and 6/7* (Feb. 17, 2015) (Petition); *see also* Exs. SEI014A to SEI014P, Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report (Dec. 2010) (Technical Report); Exs. SEI016A to SEI016E, Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report (Dec. 2010) (Environmental Report).

Decision on their admitted contentions.[2] Joint Intervenors also challenge three earlier interlocutory Board decisions that found several contentions inadmissible.[3] For the reasons stated below, we deny review.

I. BACKGROUND

Strata proposes to build and operate an *in situ* recovery and processing facility for uranium known as the Ross Project.[4] As described in its application, the proposed operation will consist of two steps: recovering mineralized uranium from the ore body and processing the uranium-rich solution into yellowcake.[5] Uranium recovery will be accomplished by injecting an oxidizing solution, or "lixiviant," into the ore-bearing sandstone through a series of injection wells.[6] The lixiviant oxidizes and mobilizes the uranium as it moves through the ore body, after which it is removed from the ore body by recovery wells.[7] The "pregnant," or mineral-rich,

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[2] LBP-15-3, 81 NRC 65 (2015).

[3] LBP-13-10, 78 NRC 117 (2013); Memorandum and Order (Denying Motion for Reconsideration of LBP-13-10 Ruling Regarding Environmental Contention 4/5A or, Alternatively, to Admit Amended Contention) (Aug. 27, 2013) (unpublished) (Reconsideration Order); Memorandum and Order (Ruling on Motion to Migrate/Amend Existing Contentions and Admit New Contentions Regarding Final Supplement to Generic Environmental Impact Statement) (May 23, 2014) (unpublished) (FSEIS Order).

[4] Letter from Andrew Simpson, Strata Energy, Inc. to Keith McConnell, NRC (Jan. 4, 2011) (submitting application consisting of Environment Report (Exs. SEI016A to SEI016E) and Technical Report (Exs. SEI014A to SEI014P)) (ADAMS accession no. ML110120055); *see also* Strata Energy, Inc., Ross In Situ Recovery Uranium Project, Crook County, WY; Notice of Materials License Application, Opportunity to Request a Hearing and to Petition for Leave to Intervene, and Commission Order Imposing Procedures for Document Access to Sensitive Unclassified Non-Safeguards Information for Contention Preparation, 76 Fed. Reg. 41,308 (Jul. 13, 2011).

[5] *See* Ex. SEI014A, Technical Report, § 1.7, at 1-6.

[6] *Id*.

[7] *Id*.

lixiviant is then transferred to a central processing plant to be processed into uranium yellowcake.[8]

The *in situ* uranium recovery process is used throughout Wyoming, South Dakota, Nebraska, and New Mexico. Recognizing the widespread use of this technology in this region of the country, the Staff prepared a generic environmental impact statement (GEIS) to address aspects of the environmental analysis for these facilities that are similar across sites.[9]

This licensing proceeding began in January 2011, when Strata filed an application for the Ross Project. As proposed by Strata, the Ross Project would occupy 1,721 acres (696 hectares) in the northern half of a larger area within the Nebraska–South Dakota–Wyoming Uranium Milling Region known as the Lance District.[10] The project would consist of a central processing facility and 15–25 wellfield modules comprising a total of 1,400–2,200 recovery and injection wells.[11] Strata is also “actively exploring” the entire Lance District for potential satellite uranium recovery facilities, but had not yet submitted a license application for any of these facilities at the time of the Board’s decision.[12] A license application, whether for a separate license or for a license amendment to expand the Ross facility, is subject to a separate safety

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[8] *Id.* at 1-6 to 1-7.

[9] *See* Exs. NRC007 to NRC008, “Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Final Report,” NUREG-1910, Vols. 1-2 (May 2009) (GEIS).

[10] *See* Exs. SEI009A to SEI009B, “Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming, Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities Final Report,” NUREG-1910, Supp. 5 (Feb. 2014), § 2.1.1 at 2-3 (FSEIS). The FSEIS describes the Lance District as an area “90-km^2 [56 mi^2]”—which is an incorrect conversion (90 square kilometers is 35 square miles). The exact size of the district is not relevant to this appeal.

[11] *Id*. at 2-9.

[12] *Id*. at 2-3 to 2-4.

and environmental review, and Joint Intervenors or other members of the public would have an opportunity to request a hearing with respect to any such application.[13]

At the outset of the proceeding Joint Intervenors sought and were granted a hearing on four contentions—all initially challenging Strata's environmental report.[14] The admitted contentions were:

> Contention 1: The application fails to adequately characterize baseline groundwater quality.
>
> Contention 2: The application fails to analyze the environmental impacts that will occur if Strata cannot restore groundwater to primary or secondary limits.
>
> Contention 3: The application fails to include adequate hydrological information to demonstrate Strata's ability to prevent mining fluids from migrating into adjacent groundwater.
>
> Contention 4/5A: The application fails to adequately assess cumulative impacts of the proposed action and the planned Lance District expansion projects.[15]

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[13] In the time since the Board's initial decision approving the license, Strata has requested a license amendment to expand into the Kendrick expansion area. *See* Strata Energy Inc., Kendrick Expansion Area Amendment to SUA-1601 (Mar. 20, 2015) (ML15096A141 (package)) (Kendrick Expansion Amendment). That license amendment request is under review, and a notice of opportunity to request a hearing was published in the *Federal Register*. *See* Strata Energy Inc., Ross *In Situ* Recovery Project; License amendment request and notice of opportunity to request a hearing, 81 Fed. Reg. 10,285 (Feb. 29, 2016) (Kendrick Hearing Notice). Joint Intervenors did not submit a petition to intervene in the Kendrick proceeding. Further, the Staff has started the environmental scoping process for the Kendrick request. *See* Strata Energy, Inc. Kendrick Expansion Area *In Situ* Uranium Recovery Project; Scoping notice, 81 Fed. Reg. 12,143 (Mar. 8, 2016) (Kendrick Scoping Notice). Joint Intervenors have submitted scoping comments on the environmental review for the Kendrick expansion area. *See* E-mail from Shannon Anderson, Powder River Basin Resource Council, to NRC (Apr. 22, 2016) (ML16117A369) (transmitting Letter from Howard Crystal, representing Natural Resources Defense Council, to Cindy Bladey, NRC (Apr. 22, 2016) (Kendrick Project Scoping Comments)).

[14] LBP-12-3, 75 NRC 164, 210 (2012). On appeal we affirmed the Board's standing determination and did not address contention admissibility. CLI-12-12, 75 NRC 603 (2012).

[15] *See* LBP-12-3, 75 NRC at 212.

Following the issuance of the Staff's Draft Supplemental Environmental Impact Statement (DSEIS), Joint Intervenors filed a "motion to resubmit" their original contentions and to add a new contention (Contention 6).[16] In LBP-13-10, the Board "migrated" Contentions 1-3 as challenges to the Staff's DSEIS because the DSEIS discussion of the subject matter of each contention was substantially the same as in Strata's environmental report.[17] With respect to Contention 4/5A, however, the Board found that the information in the DSEIS differed significantly from the information in the environmental report.[18] The Board ruled that the migration tenet did not apply and Joint Intervenors should have submitted a new or amended contention, addressing all the admissibility factors.[19] Therefore, it held that Contention 4/5A would continue as a challenge to Strata's environmental report.[20] The Board later denied a motion for reconsideration of its ruling with respect to Contention 4/5A, stating that Joint Intervenors had made no showing on either the good cause or admissibility factors.[21]

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[16] *Natural Resources Defense Council's & Powder River Basin Resource Council's Joint Motion to Resubmit Contentions & Admit One New Contention in Response to Staff's Supplemental Draft Environmental Impact Statement* (May 6, 2013) (Motion to Resubmit Contentions); *see also* Exs. NRC006A to NRC006B, "Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities," NUREG-1910, Supp. 5 (Draft Report for Comment) (Mar. 2013).

[17] LBP-13-10, 78 NRC at 151. Under the "migration tenet," where the information in the Staff's environmental review document is "sufficiently similar" to the material in the applicant's environmental report, an existing contention based on the application can be "migrated," or deemed to apply to the Staff's review document as it did to the application. *Id.* at 132-33 (citations omitted). As the Board explained, this case management practice obviates the need for intervenors to file an essentially identical contention challenging the Staff's document followed by a motion to dismiss the existing contention as moot. *Id*. at 133 n.8.

[18] *Id*. at 141-44.

[19] *Id.* at 143.

[20] *Id*.

[21] Reconsideration Order at 4-6.

The Board also declined to admit Joint Intervenors' proposed Contention 6, which argued that the Staff's NEPA analysis should consider the development of the entire Lance District as the federal action.[22] The Board found that Contention 6 was inadmissible because Joint Intervenors had not shown that plans to develop additional *in situ* recovery facilities in the region were sufficiently advanced or interconnected with the proposed action so as to trigger NEPA's requirement that they be submitted in a single environmental impact statement with the proposed license.[23] The Board further reasoned that the contention should have been filed with Joint Intervenors' initial petition to intervene because the environmental report identified the potential for Strata to develop the entire Lance District.[24]

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[22] LBP-13-10, 78 NRC at 150.

[23] *Id*. at 144-50. As noted above, Strata has now filed an application to expand its operations into the Kendrick area, contiguous to the Ross site, and the Joint Intervenors have filed scoping comments in that proceeding. *See supra* note 13. Joint Intervenors also submitted a "Notice of Filing" asking that we consider their scoping comments as part of the record in this proceeding. *See Natural Resources Defense Council and Powder River Basin Resource Council's Notice of Filing* (Apr. 27, 2016). The record for this proceeding, however, is closed and Joint Intervenors have not addressed the criteria for reopening the record in 10 C.F.R. § 2.326. Further, had Joint Intervenors filed a motion to reopen the record based on their scoping comments, it does not appear that they would have been able to meet the standards. Motions to reopen must, among other things, "demonstrate that a materially different result would be or would have been likely had the newly proffered evidence been considered initially." 10 C.F.R. § 2.326(a)(3). In their scoping comments Joint Intervenors reiterate the claim (among other things) that the Staff's analysis of the environmental impacts in this proceeding is defective because "the entire project should be considered in a single EIS." Kendrick Project Scoping Comments at 2. But, as discussed in more detail below, the Staff's EIS for the Ross project considered the cumulative impacts of the construction of possible satellite facilities, such as Kendrick, including impacts to geology and soils (*see* Ex. SEI009A, FSEIS, ch. 5 at 5-18 to 5-19), and surface and groundwater impacts (Ex. SEI009A, FSEIS ch. 5 at 5-20 to 5-29). Moreover, much of the Joint Intervenors' scoping commentary either does not address cumulative impacts or simply raises concerns with respect to the Kendrick area that were fully litigated with respect to the Ross facility—such as containment of mining fluids, baseline water quality characterization, and restoration impacts (*see* Kendrick Project Scoping Comments, at 6-7). We decline to make Joint Intervenors' scoping comments part of the record here.

[24] LBP-13-10, 78 NRC at 149-50.

The Staff completed its Final Supplemental Environmental Impact Statement (FSEIS) in February 2014 and issued the license in April 2014.[25] Shortly after the Staff completed the FSEIS, Joint Intervenors again sought to migrate or amend their contentions and offered a proposed Contention 7, which reiterated the claims of Contention 6.[26] In May 2014, the Board "migrated" Contentions 1 and 3, admitted an amended Contention 2, and again declined to migrate or amend Contention 4/5A.[27] The Board also found Contention 7 inadmissible because it was not based on new information.[28] Soon thereafter, the Board granted the Staff's and Strata's motions for summary disposition of Contention 4/5A.[29]

The Board held a hearing in the fall of 2014 on Contentions 1, 2, and 3.[30] In its Initial Decision following the hearing, the Board modified one license condition to require Strata to

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[25] *See* Exs. SEI009A to SEI009B, FSEIS; Ex. SEI015, Materials License SUA-1601 (Apr. 24, 2014) (License).

[26] *Natural Resources Defense Council's & Powder River Basin Resource Council's Joint Motion to Migrate or Amend* Contentions*, and to Admit New Contentions in Response to Staff's Final Supplemental Draft Environmental Impact Statement* (Mar. 31, 2014) (Motion to Migrate Contentions to FSEIS); *see also Second Declaration of Christopher E. Paine in Support of the Natural Resources Defense Council & Powder River Basin Resource Council's Joint Motion to Migrate or Amend Contentions, and to Admit New Contentions in Response to the Final Supplemental Environmental Impact Statement* (Mar. 31, 2014) (Second Paine Declaration). Joint Intervenors referred to their proposed contention as "Contention 5" because they had only four contentions pending in the proceeding. *See* Motion to Migrate Contentions to FSEIS, at 33 n.13. The Board, however, designated the contention "Contention 7" to maintain a consistent numbering system.

[27] *See* FSEIS Order at 19.

[28] *Id*. at 14-16, 20.

[29] Memorandum and Order (Ruling on Summary Disposition Motion Regarding Environmental Contention 4/5A) (July 25, 2014) (unpublished) (Summary Disposition Order).

[30] Notice of Hearing (Notice of Evidentiary Hearing and Opportunity To Provide Oral and Written Limited Appearance Statements), 79 Fed. Reg. 44,471 (July 31, 2014).

properly abandon certain historic drill holes outside the wellfield perimeter.[31] In all other respects, the Board ruled in favor of Strata and the NRC Staff on all three contentions.[32]

Joint Intervenors have petitioned for review of the Board's Initial Decision with respect to all three contentions.[33] They also seek review of the Board's interlocutory decisions refusing to migrate or amend Contention 4/5A and refusing to admit Contentions 6 and 7.[34] As detailed below, we find that Joint Intervenors have not raised a substantial question of law or identified a clear factual error and we deny their petition.

II. DISCUSSION

A. Standard of Review

We will grant a petition for review at our discretion, upon a showing that the petitioner has raised a substantial question as to whether:

> (i) a finding of material fact is clearly erroneous or in conflict with a finding as to the same fact in a different proceeding;
>
> (ii) a necessary legal conclusion is without governing precedent or is a departure from or contrary to established law;

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[31] *See* LBP-15-3, 81 NRC at 143-44. Strata did not appeal the Board's imposition of this license condition. In December 2015, Strata requested a license amendment to further modify the affected license condition, License Condition 10.12. *See* Letter from Michael Griffin, Strata Energy, to NRC Document Control Desk (Dec. 23, 2015) (regarding request to amend License Condition 10.12) (ML16020A370). *See also Natural Resources Defense Council and Powder River Basin Resource Council's Notice of Filing* (Feb. 19, 2016), attachment B, Letter from Howard Crystal, Meyer Glitzenstein & Eubanks, LLP, to NRC Document Control Desk (Feb. 17, 2016) (opposing license amendment request). The Staff published a notice of the license amendment request on the NRC public website, along with the opportunity to request a hearing on the amendment. *See* http://www.nrc.gov/about-nrc/regulatory/adjudicatory/hearing-license-applications.html#acc_docketing. Because this license amendment request has a separate opportunity to request a hearing and is not part of this proceeding, we do not need to further consider this issue here.

[32] LBP-15-3, 81 NRC at 153-54.

[33] *See* Petition at 1.

[34] *See id.*

(iii) a substantial and important question of law, policy, or discretion has been raised;

(iv) the conduct of the proceeding involved a prejudicial procedural error; or

(v) any other consideration that we may deem to be in the public interest.[35]

We review questions of law *de novo*; and we defer to the Board's findings with respect to the underlying facts unless the findings are "clearly erroneous."[36] The standard for showing "clear error" is a difficult one to meet: to do so, a petitioner must demonstrate that the Board's determination is "not even plausible" in light of the record as a whole.[37] For this reason, where a petition for review relies primarily on claims that the Board erred in weighing the evidence in a merits decision, we seldom grant review.[38] We defer to the Board on issues of contention admissibility unless there is an error of law or abuse of discretion.[39] Moreover, we generally leave to the Board's judgment whether a proposed contention has a sufficient factual basis to be admitted for hearing.[40]

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[35] 10 C.F.R. § 2.341(b)(4).

[36] *Honeywell International, Inc*. (Metropolis Works Uranium Conversion Facility), CLI-13-1, 77 NRC 1, 18-19 (2013) (citing *David Geisen*, CLI-10-23, 72 NRC 210, 224-25 & n.61 (2010) and *Private Fuel Storage, LLC* (Independent Spent Fuel Storage Installation), CLI-03-8, 58 NRC 11, 26 (2003)).

[37] *See, e.g.*, *Shaw Areva MOX Services, LLC* (Mixed Oxide Fuel Fabrication Facility), CLI-15-9, 81 NRC 512, 519 (2015) (citations omitted).

[38] *See, e.g.*, *DTE Electric Co*. (Fermi Nuclear Power Plant, Unit 3), CLI-14-10, 80 NRC 157, 162-63 (2014); *Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc*. (Pilgrim Nuclear Power Station), CLI-12-1, 75 NRC 39, 45-46 (2012).

[39] *Southern Nuclear Operating Co*. (Vogtle Electric Generating Plant, Units 3 and 4), CLI-09-16, 70 NRC 33, 35 (2009); *Calvert Cliffs 3 Nuclear Project, LLC and Unistar Nuclear Operating Services, LLC* (Calvert Cliffs Nuclear Power Plant, Unit 3), CLI-09-20, 70 NRC 911, 914 (2009).

[40] *Entergy Nuclear Operations, Inc*. (Indian Point, Units 2 and 3), CLI-15-6, 81 NRC 340, 354-55 (2015); *Crow Butte Resources Inc*. (Marsland Expansion Area), CLI-14-2, 79 NRC 11, 26 (2014).

B. Contentions Rejected Prior to Hearing

Joint Intervenors seek review of the interlocutory Board decisions relating to three contentions dispositioned prior to hearing: Contention 4/5A, which the Board declined to update as a challenge to the DSEIS and FSEIS; and Contentions 6 and 7, which were never admitted in the proceeding.[41] We find that Joint Intervenors have not raised a substantial question with respect to these decisions.

1. Proposed Contentions 6 and 7

a. Joint Intervenors' Proposed Contentions

Joint Intervenors first challenge the Board's decisions rejecting proposed Environmental Contention 6 (challenging the DSEIS) and Environmental Contention 7 (the same contention, challenging the FSEIS).[42] As discussed above, Joint Intervenors argued in these contentions that the Staff's NEPA analyses should have considered Strata's development plans for the entire Lance District in a single EIS.[43] Joint Intervenors claimed that Strata had "segmented" the Lance District development to mask the actual environmental consequences of its long-term plans and to expedite the licensing process.[44] To support their contentions, Joint Intervenors cited Council on Environmental Quality (CEQ) regulations providing that proposals that "are related to each other closely enough to be, in effect, a single course of action shall be evaluated

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[41] *See* Petition at 4, 7-10 (challenging LBP-13-10, Reconsideration Order, and FSEIS Order). A petitioner who has been granted intervention and has other contentions pending in the proceeding may not seek immediate review of the Board's contention admissibility rulings. *See, e.g.*, *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-13-3, 77 NRC 51, 54 (2013).

[42] Petition at 7-10.

[43] *See* Motion to Resubmit Contentions at 19-23; Motion to Migrate Contentions to FSEIS at 33-39.

[44] Motion to Resubmit Contentions, at 19-23; *Declaration of Christopher E. Paine on Behalf of the Natural Resources Defense Council & Powder River Basin Resource Council in Support of Contentions 4/5A and 6*, (May 6, 2013) (Paine Declaration).

in a single impact statement" and that proposals should be considered a single course of action where they have "similarities that provide a basis for evaluating their environmental consequences together."[45] Joint Intervenors also argued that the Supreme Court has ruled in *Kleppe v. Sierra Club* that "when several proposals for … actions that will have a cumulative or synergistic environmental impact upon a region are pending concurrently before an agency, their environmental consequences must be considered together."[46] In support of their contentions, Joint Intervenors cited various public statements and press releases from Strata's corporate parent indicating that Strata intends to file consecutive applications to develop the entire Lance District.[47]

b. The Board's Rulings on Contentions 6 and 7

In LBP-13-10, when the Board considered this claim with respect to Contention 6, it concluded that Strata's expansion plans were not sufficiently well-developed to constitute a "proposal" that the NRC must consider in its review of the Ross Project.[48] The Board found that the lack of additional "proposals"—actual applications for other facilities—undermined Joint Intervenors' reliance on both *Kleppe* and the CEQ regulations they cited.[49] It observed that the Supreme Court held in *Kleppe* that NEPA "does not require an agency to consider the possible environmental impacts of less imminent actions when preparing the [environmental] impact

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[45] Motion to Resubmit Contentions at 19 (quoting 40 C.F.R. §§ 1502.4(a) and 1508.25(a)).

[46] *Id*. (citing *Kleppe v. Sierra Club*, 427 U.S. 390, 410 (1976)).

[47] *See id.* at 20-21; Paine Declaration at 14-31 (unnumbered). The press releases referred to in the Paine Declaration are dated between October 2010 and March 2013. *See id*. at 14 (unnumbered).

[48] LBP-13-10, 78 NRC at 144-50.

[49] *Id.* at 145-46.

statement on proposed actions."[50] In addition, the Board cited Commission precedent that holds "to bring NEPA into play, a possible future action must at least constitute a 'proposal' pending before the agency (i.e., ripeness), and must be in some way interrelated with the action that the agency is actively considering (i.e., nexus)."[51]

The Board next analyzed Joint Intervenors' claim against the three types of actions described in the relevant CEQ regulation: connected, cumulative, and similar.[52] In the "connected action" portion of its analysis, the Board applied the "independent utility" test devised by the U.S. Court of Appeals for the Ninth Circuit in *Thomas v. Peterson*.[53] This test holds that related actions should be discussed together when each would have no independent utility without the other.[54] The Board found that this was not the case here—the Ross Project has "independent utility" without the possible expansion sites.[55] While the Board noted that it would be economically and operationally efficient if the processing facility built for the Ross Project were used for satellite facilities, it found that this efficiency fell short of showing that the proposed facility would have no independent utility if the satellite facilities were never built.[56]

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[50] *Id*. at 145 (quoting *Kleppe,* 427 U.S. at 410 & n.20).

[51] LBP-13-10, 78 NRC at 146 (quoting *Duke Energy Corp*. (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-14, 55 NRC 278, 295 (2002)).

[52] *Id.* at 147 (citing 40 C.F.R. § 1508.25(a)).

[53] *Id.* (discussing *Thomas v. Peterson*, 753 F.2d 754, 758-59 (9th Cir. 1985)).

[54] *Thomas,* 753 F.2d at 758-59. In *Thomas v. Peterson*, the Ninth Circuit held that in assessing the environmental impacts of a timber road, the U.S. Forest Service must consider the impacts of the timber sales that the road was designed to facilitate. But in that case, the timber sales could not take place without the road and the road had no independent utility apart from the timber sales. *Id.* Other federal courts continue to apply this test. *See, e.g.*, *Webster v. United States Dep't of Agriculture*, 685 F.3d 411, 426 (4th Cir. 2012).

[55] LBP-13-10, 78 NRC at 148.

[56] *Id.* The Board also noted that both the DSEIS and the Environmental Report acknowledged that the processing facility for the Ross Project will be designed to have a processing capacity four times greater than would be needed for the expected production of the Ross Project alone.

The Board concluded that Joint Intervenors had not shown a genuine dispute with respect to the "connected action" aspect of the CEQ's regulation.[57] The Board further declined to consider whether the expansion sites might fit the CEQ regulations' categories of "cumulative" and "similar" projects, because Joint Intervenors nevertheless had failed to show that the information on which their claims were based had not been "previously available."[58] Therefore the Board determined that the proposed contention could not satisfy the good cause factors in 10 C.F.R. § 2.309(c).[59]

In Contention 7, Joint Intervenors reasserted the same claims with respect to the FSEIS as Contention 6 had made with respect to the DSEIS.[60] In support of their motion, Joint Intervenors argued that Strata's parent company had continued to publicly disclose Strata's plans to develop satellite facilities within the Lance District, including in a May 2013 statement that exploratory drilling had commenced in the areas surrounding the Ross Project area.[61]

The Board found that Contention 7 failed to meet the good cause criteria because it was not based on new information.[62] The Board noted that the public documents Joint Intervenors

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Id. (citing Ex. NRC006A, DSEIS, § 2.1.1.1, at 2-13 and Ex. SEI016A, Environmental Report, § 1.1, at 1-4).

[57] *Id.* at 149 (citing 10 C.F.R. § 2.309(f)(1)(vi)).

[58] *Id.* at 149-50.

[59] *Id.* Petitioners who file a new or amended contention filed after the deadline for filing a petition for intervention must demonstrate good cause by showing that their contention is based on information that was not previously available, materially different from the information that was previously available, and filed in a timely fashion after the information becomes available. 10 C.F.R. § 2.309(c)(i), (ii), (iii).

[60] Motion to Migrate Contentions to FSEIS, at 33-40.

[61] *Id.* at 35-36.

[62] FSEIS Order at 14-16.

cited to support the contention were dated from March 2013 through March 2014.[63] And only the last of these, a March 2014 presentation from Strata's parent company, was dated within thirty days of Joint Intervenors' motion.[64] The Board concluded that the presentation was not materially different from previously available information and that Joint Intervenors had not satisfied the good cause factors under 10 C.F.R. § 2.309(c).[65]

c. *Review Denied With Respect to Proposed Contentions 6 and 7*

On appeal, Joint Intervenors argue that the Board's rulings erroneously conflated the merits of the contention with its admissibility and that the Board erred in not finding good cause for filing Contentions 6 and 7 after the deadline for filing the initial intervention petition.[66] Joint Intervenors argue that the Board required them to prove that the Lance District's development is a single project, when the contention admissibility factors only require "a concise statement of the alleged facts."[67]

With respect to whether Contention 7 was based on new information, we observe that Strata disclosed the potential for future satellite facilities in its application.[68] Moreover, it is apparent that Joint Intervenors were aware of these facilities from the fact that they raised the

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[63] *Id.* at 15-16.

[64] *Id*. at 16. *See* Second Paine Declaration at 16-18 (discussing http://www.pel.net.au/images/peninsul---aingoequei.pdf).

[65] FSEIS Order at 16.

[66] Petition at 8.

[67] *Id.*; *see also* 10 C.F.R. § 2.309(f)(1)(v).

[68] Ex. SEI016A, Environment Report, at 1-20 to 1-21. "The proposed Ross ISR Project is intended to be just the first of several ISR project sites to be developed in the area. If these other sites are developed, it is likely that they will serve as ancillary or satellite facilities to the proposed Ross project site, with all satellite facilities using the same [central processing plant]." *Id*. at 2-8.

question of cumulative impacts from these facilities in their initial Contention 4/5A.[69] The Board's conclusion that Joint Intervenors already knew enough to formulate their contentions, and should have done so at the time that the application was filed, was reasonable.

Nor do we discern any error of law in the Board's ruling that the expansion plans would have to be in a sufficiently advanced stage to be considered a "proposal" for action that "bring[s] NEPA into play."[70] The Board's ruling with respect to the scope of the federal action rested on Supreme Court authority in *Kleppe* as well as our own agency case law, as discussed above.[71] While the Ross Project FSEIS appropriately discussed the cumulative impacts of potential satellite facilities, a single environmental impact statement on the development of the entire Lance District would be speculative at this time.[72]

Finally, contrary to Joint Intervenors' arguments on appeal, we do not find that the Board strayed into "weighing the merits" in considering the admissibility of these proposed contentions.[73] Joint Intervenors had the burden to demonstrate the admissibility of their

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[69] *See Petition to Intervene and Request for Hearing by the Natural Resources Defense Council & Powder River Basin Resource Council*, at 28-29 (Oct. 27, 2011).

[70] *Id*. at 146 (quoting *McGuire & Catawba*, CLI-02-14 at 295); *see also Webster*, 685 F.3d at 426-27 (agency of the U.S. Department of Agriculture was not required to consider the possible development of a water treatment facility in deciding whether to approve construction of a dam, when no such facility had been proposed).

[71] *Kleppe*, 427 U.S. at 410; *McGuire & Catawba*, CLI-02-14, 55 NRC at 295.

[72] *See* Ex. SEI009A, FSEIS, § 5.2.1.1, at 5-5 to 5-8 (discussion of potential satellite facilities and other past or future in situ recovery facilities within 50 miles (80 kilometers) of the proposed project). And the filing of a license amendment request to expand the current Strata Facility, which occurred after the issuance of the Board's decision, does not alter the fact that the Board's ruling was appropriate at the time. *See* Kendrick Expansion Amendment. The FSEIS considered the cumulative impacts of future satellite facilities, such as the proposed Kendrick expansion. *See generally* Ex. SEI009A, FSEIS § 5.2. Joint Intervenors have not provided any basis for us to question this analysis as it applies to this proceeding.

[73] *See* Petition at 8.

contention, including establishing a factual predicate for its claims.[74] Here, the Board had to determine whether there was a sufficient factual basis for the contention in the face of the contrary evidence that no concrete proposals to develop additional sites were pending before the agency at that time. Its discussion relates to the "genuine dispute" element of the contention admissibility factors—not the merits of the underlying claim.[75] We usually defer to a Board's judgment as to whether a contention's proponent has provided adequate support to raise a genuine dispute of material fact.[76] We see no reason to change this practice here; we find that Joint Intervenors have not raised a substantial question with respect to Contentions 6 and 7.[77]

2. Contention 4/5A

Joint Intervenors seek review of the Board's decisions declining to admit their "resubmitted" Contention 4/5A as a challenge to the DSEIS, and later, as a challenge to the FSEIS.[78] As admitted, Contention 4/5A argued that the application failed to consider cumulative impacts on groundwater quantity and quality from satellite facilities that Strata eventually intends

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[74] *See Luminant Generation Co., LLC* (Comanche Peak Nuclear Power Plant, Units 3 and 4), CLI-11-9, 74 NRC 233, 243-44 (2011) (in rejecting a contention that failed to identify inadequacies in the applicant's Mitigative Strategies Report, the board did not impermissibly weigh the merits to find that the Mitigative Strategies Report was sufficient).

[75] *See* 10 C.F.R § 2.309(f)(vi); *see also AmerGen Energy Company, LLC* (Oyster Creek Nuclear Generating Station), CLI-09-7, 69 NRC 235, 276-77 (2009) (the board did not impermissibly weigh the merits in finding that petitioners had provided no factual support for their proposed safety contention).

[76] *Indian Point*, CLI-15-6, 81 NRC at 354-55.

[77] We note that the Staff intends to prepare a supplemental EIS, rather than an environmental assessment, for the Kendrick expansion, which will consider potential impacts of construction, operation, and restoration of the site. *See* Kendrick Scoping Notice, 81 Fed. Reg. at 12.144. Joint Intervenors—along with any other interested groups or members of the public—may participate in the separate proceeding regarding the license amendment request for the Kendrick expansion. *See* Kendrick Expansion Amendment and Kendrick Hearing Notice, 81 Fed. Reg. at 10,285.

[78] Petition at 4, 9-10.

to develop surrounding the Ross site.[79] The Board's refusal to migrate or amend Contention 4/5A led to its eventual summary disposition because a challenge to the environmental report was no longer material once the Staff had completed its FSEIS.[80]

Joint Intervenors' challenge with respect to Contention 4/5A, however, only addresses the Board's ruling in LBP-13-10 with respect to good cause.[81] They argue that because the Board itself found that the DSEIS information "differed significantly" from the material in the environmental report, this should be enough to show "good cause" for filing under 10 C.F.R. § 2.309(c), because the information was not "previously available."[82] Joint Intervenors argue that even if their "Motion to Resubmit" their contentions lacked a "formalistic invocation of the 2.309(c) factors," the Board erred in denying their motion for reconsideration of LBP-13-10, which included such a recitation.[83] But good cause was only one basis on which the Board refused to admit Joint Intervenors' "resubmitted" contentions on the DSEIS—the Board also noted that, in addition to demonstrating good cause, Joint Intervenors needed to satisfy "the section 2.309(f)(1) admissibility factors … to provide the foundation for a new or amended contention."[84]

Even if Joint Intervenors were correct with respect to their argument on appeal related to good cause, they do not argue that the Board erred with respect to the admissibility factors. Because the DSEIS provided new information on cumulative impacts to address the

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[79] LBP-12-3, 75 NRC at 212.

[80] *See* Summary Disposition Order at 14-15.

[81] Petition at 9; *see* 10 C.F.R. § 2.309(c).

[82] Petition at 9.

[83] *Id.*

[84] *See* LBP-13-10, 78 NRC at 143.

deficiencies identified in Contention 4/5A, Joint Intervenors needed to challenge that analysis specifically to show that a genuine dispute remained concerning cumulative impacts. And as "the Board is the appropriate arbiter of such fact-specific questions of contention admissibility, we will not second-guess the Board's evaluation of factual support for [a] contention, absent an error of law or abuse of discretion," which Joint Intervenors have not shown here.[85] We therefore decline to take review of the Board's decisions in LBP-13-10, the Reconsideration Order, and the FSEIS Order with respect to Contention 4/5A.

C. Contentions Decided on the Merits

1. Contention 1

a. Background of Contention 1

In Contention 1, Joint Intervenors claimed that Strata's groundwater quality monitoring program was inadequate to describe the baseline—or existing—water quality of the various aquifers underlying the Ross site:

> The FSEIS fails to comply with 10 C.F.R. §§ 51.90-94, 10 C.F.R. Part 40, Appendix A, and NEPA because it lacks an adequate description of the present baseline (i.e., original or pre-mining) groundwater quality and fails to demonstrate that groundwater samples were collected in a scientifically defensible manner, using proper sampling methodologies. The FSEIS's departure from NRC guidance serves as additional evidence of these regulatory violations.[86]

Joint Intervenors argued that if the site is not adequately characterized, the potential impacts of the proposed facility cannot adequately be measured.[87] We agree that the baseline

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[85] *NextEra Energy Seabrook, LLC* (Seabrook Station, Unit 1), CLI-12-5, 75 NRC 301, 326-27 (2012).

[86] FSEIS Order, app. A (citing Ex. SEI007, Standard Review Plan for *In Situ* Leach Uranium Extraction License Applications, NUREG-1569, §§ 2.7.1, 2.7.3, 2.7.4 (2003) (NUREG-1569)).

[87] *See, e.g.*, Ex. JTI001-R, Pre-filed Direct Testimony of Dr. Richard Abitz Supporting Joint Intervenors' Contentions 1 and 3, at 7 (Abitz Direct Testimony).

environmental conditions at a site like Strata must be considered as part of the Staff's NEPA analysis.[88] As we discuss in more detail below, the Board found Strata's and the NRC Staff's description of the environmental baseline to be sufficient to support the NEPA analysis in the FSEIS.[89] Joint Intervenors' appeal does not raise an issue that causes us to disturb the Board's determination here.

An applicant for an *in situ* uranium recovery license must describe the hydrology of the proposed site to predict the potential effect such a facility would have on adjacent groundwater and surface waters as required by NEPA.[90] To do this, the applicant must establish a pre-licensing groundwater monitoring program to provide baseline data sufficient to describe the overall quality of the groundwater.[91] This requirement is also codified in Criterion 7 of Part 40, Appendix A, which requires that "at least one full year prior to any major site construction, a preoperational monitoring program must be conducted to provide complete baseline data."[92]

Accordingly, Strata conducted a groundwater monitoring program over a two-year period, the results of which were incorporated into the FSEIS.[93] Strata's pre-licensing groundwater monitoring activities consisted of six monitoring well clusters, with at least four

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[88] The Board explained that there was some "uncertainty" concerning the terms "baseline" and "background" and whether these terms are interchangeable. *See* LBP-15-3, 81 NRC at 75-76 n.2. The Board used "baseline" to refer to the prelicensing site characterization and "background" for the values that will be established post licensing. *Id.* We use the Board's terminology.

[89] *See* LBP-15-3, 81 NRC at 111.

[90] *See* 10 C.F.R. pt. 40, app. A, Criterion 7; *see also*, Ex. SEI007, NUREG-1569, § 2.7.1.

[91] *See* Ex. NRC001, NRC Staff's Initial Testimony, at 3-4 (Staff Testimony); *see also* Ex. SEI007, NUREG-1569, § 2.7.1, at 2-23 to 2-26.

[92] 10 C.F.R. pt. 40, app. A; *see also* LBP-15-3, 81 NRC at 89-90.

[93] *See generally* Ex. SEI009A, FSEIS, § 3.5.3.3; Ex. SEI009B, FSEIS, app. C (complete sampling data).

wells in each cluster to collect samples from the ore zone, the aquifers immediately overlying and underlying the ore zone, and the surficial aquifer.[94] In addition to the samples collected through its own monitoring, Strata used samples from existing water-supply wells located within or adjacent to the Ross site and data from a former research and development operation during the 1970s to characterize the baseline groundwater quality. Staff incorporated all this information into the FSEIS.[95]

Joint Intervenors' expert Dr. Richard Abitz testified that the distribution of the wells used for groundwater sampling did not collect data "representative of overall site conditions," which led to the flawed characterization of the site.[96] Moreover, Dr. Abitz said that Strata's wells concentrated on the mineralized areas within the aquifer instead of sampling water through the entire thickness of the aquifer, resulting in data that indicated more contamination in the groundwater than is actually there.[97] Dr. Abitz argued that higher baseline contaminate levels would "allow[] for a substantially more degraded aquifer after restoration" that would preclude the use of the mined aquifer in the future for domestic, livestock, or agricultural needs.[98] To address this concern, Joint Intervenors urged that the baseline water quality be established through more rigorous protocols—such as those set forth in NRC regulations for post-licensing, preoperational background monitoring or such as the Environmental Protection Agency's

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[94] Ex. SEI009A, FSEIS, § 3.5.3.3, at 3-37 to 3-38. The Board explained that the monitored aquifers, or horizons, were the ore zone, the aquifer underlying the ore zone (referred to as the deep monitoring unit), the aquifer overlaying the ore zone (referred to as the shallow monitoring unit) and the surficial aquifer. *See* LBP-15-3, 81 NRC at 89.

[95] Ex. SEI009A, FSEIS, § 3.5.3.3, at 3-38. The research and development operation, known as Nubeth Joint Venture, operated from August 1978 through April 1979 and was decommissioned in 1983. *Id*. § 2.1.1, at 2-11.

[96] *See* Ex. JTI001-R, Abitz Direct Testimony, at 10, 16-17.

[97] *Id*. at 10, 21-22.

[98] *Id.* at 11, 24.

"Statistical Analysis of Groundwater Monitoring Data at [Resource Conservation and Recovery Act (RCRA)] Facilities."[99]

b. The Board's Ruling on Contention 1

The Board rejected as a matter of law Joint Intervenors' argument that the FSEIS site characterization must conform to the more rigorous criteria that specifically apply to post-licensing, preoperational monitoring.[100] In reviewing this contention, the Board explained the difference between pre-licensing site characterization for NEPA purposes and the post-licensing activities used to set restoration values and to detect excursions during operations.[101] After receiving a license, a licensee collects groundwater samples from the production and injection wells to establish post-licensing, preoperational background levels for various chemical constituents, which are then used to set restoration goals.[102] At that time, the licensee also installs monitoring wells at the perimeter of each wellfield, which are used to detect leaks during operations.[103] The Board cited the Standard Review Plan for *In Situ* Leach Uranium Recovery Facilities and Regulatory Guide 4.14 to distinguish between the groundwater monitoring necessary for pre-license site characterization (baseline), and the post-licensing, pre-operation monitoring that will be used for monitoring and site restoration.[104] Further, the Board relied on

[99] *See id.* at 7-10, 35-40; Tr. at 428 (Abitz); *see also* Ex. JTI006, EPA, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities Unified Guidance (Mar. 2009).

[100] LBP-15-3, 81 NRC at 91-92. That is, the criterion of 10 C.F.R. pt. 40, app. A, Criterion 5 and Criterion 7A do not specifically apply to site characterization under NEPA.

[101] *Id*. at 89-90; *see also* Ex. SEI009A, FSEIS, § 2.1.1.1, at 2-25.

[102] LBP-15-3, 81 NRC at 76, 90; *see also* 10 C.F.R. pt. 40, app. A, Criterion 5B(5).

[103] LBP-15-3, 81 NRC at 76, 90-91; *see also* 10 C.F.R. pt. 40, app. A, Criterion 7A.

[104] LBP-15-3, 81 NRC at 90-91 (citing Ex. SEI007, NUREG-1569, § 2.7; Ex. SEI008, Regulatory Guide 4.14 (Rev. 1), Radiological Effluent and Environmental Monitoring at Uranium Mills (Apr. 25, 1980)). Staff Guidance documents such as standard review plans are entitled to "'special weight.'" *Yankee Atomic Electric Co*. (Yankee Nuclear Power Station), CLI-05-15, 61 NRC 365,

our decision in *Hydro Resources*, where we stated that conducting the more detailed post-licensing analysis "to establish definitively the groundwater quality baselines and upper control limits" is "consistent with industry practice and NRC methodology"; and, in fact, this analysis cannot be completed until after licensing, when an *in situ* leach well field has been installed.[105] The Board held that the fact that Strata's groundwater monitoring (on which the FSEIS relied) did not conform to post-licensing monitoring or other, more rigorous, procedures did not undermine the sufficiency of the site characterization *per se*.[106]

This conclusion, however, did not end the Board's inquiry into Contention 1—the Staff was still required to show that the FSEIS sufficiently described the site. The Board next considered Joint Intervenors' specific arguments that the FSEIS's description of the groundwater at the Ross Project site was inaccurate or incomplete for the purposes of NEPA.[107] After a detailed discussion of each purported defect, the Board ruled in favor of the Staff and Strata on each point.[108]

c. *Petition for Review of Contention 1*

(1) NO SUBSTANTIAL QUESTION OF LEGAL ERROR IN CONTENTION 1

Joint Intervenors argue that the Board erroneously held that it is permissible to defer "meaningful" or "accurate" baseline characterization until after the license is issued.[109] Joint

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375 n.26 (2005) (quoting *Long Island Lighting Co*. (Shoreham Nuclear Power Station, Unit 1), ALAB-900, 28 NRC 275, 290 (1988)).

[105] LBP-15-3, 81 NRC at 91 (citing *Hydro Resources, Inc*. (P.O. Box 777, Crownpoint, New Mexico 87313), CLI-06-1, 63 NRC 1, 6 (2006)).

[106] *Id*. at 91-92.

[107] *Id*. at 93-110.

[108] *Id*. We do not provide a discussion of the technical arguments resolved in Staff's favor that are not the subject of Joint Intervenors' petition.

[109] Petition at 10-11.

Intervenors have not raised a “substantial question” of law with respect to the applicable standards for site characterization—their claim mischaracterizes the Board’s ruling. The Board did not rule that “meaningful” baseline characterization may be deferred until the post-licensing period. Rather, it held that the groundwater monitoring used to describe the environmental conditions at the site for NEPA purposes need not conform to the groundwater monitoring requirements applicable to an operating facility.[110] The two standards serve different purposes.

Joint Intervenors argue generally that NEPA requires the collection of accurate information prior to making a decision.[111] While we agree that the information in the FSEIS must be accurate, in this instance Joint Intervenors equate accuracy with the volume of data collected. Joint Intervenors provide no justification for challenging the validity of the Staff’s NEPA analysis beyond a call for the collection of additional data.[112] But our regulations do not require licensees or the Staff to conduct the additional sampling that Joint Intervenors request before the issuance of a license. Joint Intervenors have not shown that additional groundwater sampling is necessary to characterize the existing site conditions or the expected environmental impacts of the proposed operation. While it is always possible to gather more data, at some point the Staff must “move forward with decisionmaking.”[113] And, as explained below, Joint Intervenors do not raise a substantial question relating to the Board’s fact finding with respect to Strata’s site characterization. Given that the Board based its legal ruling on precedent and

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[110] LBP-15-3, 81 NRC at 91-92.

[111] Petition at 11.

[112] *Id*. at 12-14.

[113] *Entergy Nuclear Generation Co. and Entergy Nuclear Operations, Inc.* (Pilgrim Nuclear Power Station), CLI-10-11, 71 NRC 287, 315 (2010) (quoting *Town of Winthrop v. Federal Aviation Administration*, 535 F.3d 1, 11 (1st Cir. 2008)).

applicable Staff guidance, we see no substantial question of law relating to NEPA's site characterization requirements.

Joint Intervenors additionally argue that the Board improperly shifted the burden of proof to Joint Intervenors.[114] We disagree. The Board acknowledged that the Staff has the burden to prove the sufficiency of the FSEIS.[115] When considering challenges to how the Board weighed the evidence, we "defer to the Board's expertise as the fact finder and decline to substitute the judgment [of an Intervenor's expert] for that of the Board."[116]

(2) No Substantial Question of Factual Error in Contention 1

We also decline to take review of Joint Intervenors' factual challenges with respect to Contention 1. Although Joint Intervenors raised many challenges to Strata's site characterization before the Board, their petition (and thus our decision today) focuses on only two.[117]

Joint Intervenors first claim that the monitoring wells were not "located and distributed in a manner designed to collect data representative of overall site conditions."[118] Joint Intervenors aver that "no one disputed" that Strata's approach "was neither designed to, nor did, collect representative baseline water quality data."[119]

We see no "clear error" in the Board's fact finding relating to this complex issue. Contrary to Joint Intervenors' assertion, the Staff and Strata vigorously disputed Joint

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[114] Petition at 11-12.

[115] LBP-15-3, 81 NRC at 84-85.

[116] *See, e.g., Oyster Creek*, CLI-09-7, 69 NRC at 266.

[117] Petition for Review at 11-14.

[118] *Id.* at 12 (citing Ex. JTI001-R, Abitz Direct Testimony, at 16).

[119] *Id*. at 13.

Intervenors' claim that the site characterization was insufficient.[120] Moreover, the Board cited ample record support for its conclusions. It observed that Strata's collection methods had generated "362 groundwater samples (with 16,000 chemical and radiological parameters)."[121] The Board also noted that "the number and location of wells was based on factors such as [Wyoming Department of Environmental Quality] guidelines, … having consistent/continuous water-bearing intervals above and below mineralization, satisfactory confining layer thickness, proximity to existing drilling data, sufficient spatial distribution for development of potentiometric data, and landowner considerations."[122] The Board also discussed Joint Intervenors' evidence, specifically the testimony of their expert Dr. Abitz.[123] In considering the record here, the Board found that there was no evidence of "actual bias (or an attempt to induce a biased result)" in the number and location of wells.[124] Given that the Board considered and weighed the evidence from all parties, and based on our review of Joint Intervenors' petition, we will not second guess the Board's conclusion that the number of samples and location of wells were sufficient to support the Staff's FSEIS.

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[120] *See* Ex. NRC001, Staff Testimony at 12-14 ("Because the location and placement of Strata's wells and the sampling and analytical methods used were consistent with those described in Section 2.7 [of the Standard Review Plan], the Staff found that the quality of the baseline groundwater data presenting in the FSEIS was adequate for use in assessing the Ross Project's potential environmental impacts."); Ex. SEI005, Initial Written Testimony of Ben Schiffer, at 9 ("In my experience and opinion, 16,000 results from more than 362 groundwater samples provides a representative, quantitative description of the baseline groundwater quality within and adjacent to the project boundary. As importantly in my opinion, these data more than meet the intent of NEPA ….").

[121] LBP-15-3, 81 NRC at 93-94. The Board cited *Pilgrim*, wherein we held that NEPA does not require that unlimited resources be devoted to information-gathering so long as the result is reasonable. *Pilgrim,* CLI-10-11, 71 NRC at 315.

[122] LBP-15-3, 81 NRC at 94 n.19 (citing Ex. SEI016A, Environmental Report, at 3-101 and Ex. SEI045, Rebuttal Testimony of Ben Schiffer, at 15).

[123] *Id*. at 93-95.

[124] *Id*. at 94.

Joint Intervenors next dispute the Board's finding that Strata's well screening intervals were "appropriate" for site characterization.[125] That is, they claim that Strata's sampling wells were designed to draw water only through the parts of the ore zone aquifer that contain "stacked ore horizons" (uranium deposits), thereby biasing the results toward higher concentrations of uranium and radium-226.[126] Joint Intervenors generally assert that the wells should be screened through the entire thickness of the aquifer.[127]

The Board found that Strata's well screening intervals did not inappropriately bias the results of its site characterization activities.[128] The Board acknowledged that the wells did not draw water from the entire thickness of the ore zone aquifer.[129] Nevertheless, it found the results were not biased because some of the wells were located in the nonmineralized parts of the aquifer, and, for those wells located in the mineralized zones, the screened intervals were "long enough to collect groundwater from nonmineralized layers between ore horizons."[130] It concluded that the well screening protocol used by Strata was sufficient for site characterization.[131]

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[125] Petition for Review at 13-14.

[126] *Id*.; *see also* JTI001-R, Abitz Direct Testimony, at 21-22. The Board explained that "'well screening' denotes the use, at the intake portion of a well, of a porous filter that allows groundwater to be sampled from a targeted aquifer or a specific horizon within an aquifer." *See* LBP-15-3, 81 NRC at 97 n.23.

[127] Petition for Review at 13-14.

[128] LBP-15-3, 81 NRC at 98-99.

[129] *Id*. at 98.

[130] *Id.* at 99.

[131] *Id*. at 98-100. Joint Intervenors also claimed before the Board that the Standard Review Plan requires that wells be "fully screened" through the "entire thickness of the aquifer," but, as the Board pointed out, the Standard Review Plan section in question only applies to the perimeter monitoring wells that are to be installed to detect excursions, not for site characterization. *See Id.* at 98-99 (citing Ex. SEI007, NUREG-1569, § 5.7.8.3, at 5-42 to 5-43).

Joint Intervenors do not show clear error in the Board's finding of fact with respect to well screening intervals. The Board provided a plausible explanation why the well screening protocols would not unduly bias the groundwater sampling results, and well screening was just one sub-issue of many the Board considered with respect to this contention. It is apparent that the Board considered evidence and arguments from both sides of each of Joint Intervenors' specific technical complaints, including the two they discuss in their petition for review.

We decline to review a board's "plausible decision that rests on carefully rendered findings of fact," even where the record includes evidence that supports a different view.[132] We therefore find that Joint Intervenors have not raised a substantial question with respect to the Board's findings of fact on Contention 1.

2. Contention 2

a. Background of Contention 2

In Contention 2, Joint Intervenors argued that the FSEIS did not consider the extent to which groundwater will be degraded due to the establishment of alternate concentration limits for hazardous constituents after site restoration:

> The FSEIS fails to meet the requirements of 10 C.F.R. §§ 51.90-94 and NEPA because it fails to evaluate the virtual certainty that the applicant will be unable to restore groundwater to primary or secondary limits in that the FSEIS does not provide and evaluate information regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an [alternate concentration limit] in accordance with 10 C.F.R. Part 40, App. A, Criterion 5B(5)(c).[133]

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[132] *Private Fuel Storage*, CLI-03-8, 58 NRC at 25-26.

[133] FSEIS Order, app. A.

Joint Intervenors maintained that alternate concentration limits are inevitable at the Ross Project site because no decommissioned *in situ* uranium recovery facility has ever met primary or secondary standards for all contaminants.[134]

As explained with respect to Contention 1, *in situ* recovery facility licensees must establish restoration goals for hazardous constituents in groundwater through post-licensing, pre-operational testing.[135] Under the terms of its license, Strata must restore the groundwater in each wellfield to regulatory limits.[136] The first option for any given constituent is background (the level present prior to operations), which the Board termed the "primary" standard.[137] The "secondary" standard to which the contention refers is a maximum contaminant level provided for certain constituents in Part 40, Appendix A, Table 5C.[138] If the licensee cannot meet primary or secondary standards for a particular constituent after restoration efforts, it may file a license amendment request for a site-specific alternate concentration limit for that constituent.[139] To receive the license amendment, the licensee must demonstrate both that the concentration of the particular hazardous constituent is as low as reasonably achievable and that the alternate concentration limit presents no significant hazard to human health or the environment, in accordance with factors listed in Criterion 5B(6). These factors include potential adverse effects to groundwater and to hydraulically connected surface water, current and future uses of the

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[134] *See* Motion to Migrate Contentions to FSEIS, at 23-25.

[135] *See generally*, 10 C.F.R. pt. 40, app. A, Criterion 7A.

[136] *See* Ex. SEI015, License, at 7 (License Condition 10.6).

[137] *See* LBP-15-3, 81 NRC at 114 (citing 10 C.F.R. pt. 40, app. A, Criterion 5B(5)(a)).

[138] 10 C.F.R. pt. 40, app. A, Criterion 5B(5)(b), Table 5C; *see also* LBP-15-3, 81 NRC at 114. The values provided in Table 5C are the Maximum Constituent Levels set by the Environmental Protection Agency in 40 C.F.R. pt. 192, Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings.

[139] 10 C.F.R. pt. 40, app. A, Criterion 5B(5)(c).

ground and surface waters, and possible cumulative effects with other sources of contamination.[140] The license amendment application would also be subject to an opportunity for interested persons to request a hearing.

In admitting the contention at the outset of the proceeding, the Board rejected the Staff's argument that the environmental effects of possible alternate concentration limits are too uncertain for consideration in the FSEIS.[141] The Board acknowledged that the Staff "likely" could not determine prior to licensing the facility what alternate concentration limits would be approved for a particular wellfield after restoration.[142] But the Board reasoned that the Staff could perform a bounding analysis to consider the range of alternate concentration limits that have been approved historically.[143]

The Staff accordingly included a discussion of three approved aquifer restorations in the FSEIS.[144] These three restorations could give only a general idea of the range of possible future alternate concentration limits for the Ross Project because they had all been approved at a time when the Staff used a different interpretation of "secondary" standard than it now uses.[145]

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[140] *Id*., Criterion 5B(6).

[141] LBP-12-3, 75 NRC at 197.

[142] *Id.*

[143] *Id*.

[144] Ex. SEI009A, FSEIS, § 4.5.1.3, at 4-45 to 4-46.

[145] Crow Butte Wellfield 1 restoration was approved in 2003 (*see* Ex. NRC026, Letter from Daniel M. Gillen, NRC, to Michael L. Griffen, Crow Butte Resources, Inc., License Amendment 15, Crow Butte Resources *In Situ* Leach Facility, License No. SUA-1534, Wellfield #1 Restoration Acceptance (Feb. 12, 2003) (Crow Butte Wellfield 1 Approval)). Smith Ranch-Highland Wellfield A was approved in 2004 (*see* Ex. NRC027, Letter from Gary S. Janosko, NRC to W. F. Kearney, Power Resources, Inc., License Amendment 15, Crow Butte Resources *In Situ* Leach Facility, License No. SUA-1534, Wellfield #1 Restoration Acceptance (June 29, 2004)). Irigaray Mine Units 1-9 restoration was approved in 2006 (*see* Ex. NRC034, Letter from Gary S Janosko, NRC, to Donna L. Wichers, COGEMA Mining, Inc., Review of Cogema Mining,

Prior to 2009, the Staff considered the "secondary standard" to be coextensive with the "pre-operational class of use" established by the state, which—as the Board's decision acknowledges—is not accurate.[146] Alternate concentration limits were not considered necessary at the three sites discussed in the FSEIS bounding analysis because they all met the "pre-operational class of use" standard following restoration.[147] Therefore, those licensees did not have to meet the more stringent criteria—set forth at Part 40, Appendix A, Criterion 5B(6)—that apply at the Ross site.[148] In contrast, before any alternate concentration limit could be approved for any constituent at the Ross Project site, Strata would have to show that its concentration is as low as reasonably achievable and meets the other criteria set forth in Criterion 5B(6). For this reason, the FSEIS bounding analysis provides a conservative basis for predicting the likely range of alternate concentration limits that might be approved following restoration of the Ross Project site.

The FSEIS states that for the three sites discussed in the bounding analysis, most of the groundwater quality constituents were either restored to post-licensing, preoperational background levels or to "class I (domestic use)" standards.[149] In addition, where elevated levels

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Inc., Irigaray Mine Restoration Report, Production Units 1 Through 9, Source Materials License SUA-1341 (Sept. 20, 2006)).

[146] *See* LBP-15-3, 78 NRC at 116 n.46; *see also* Ex. SEI009A, FSEIS, § 4.5.1.3, at 4-45.

[147] After a 2009 Regulatory Issue Summary found this interpretation to be in error, the Staff has used the concentrations set forth in 10 C.F.R. pt. 40, app. A, Table 5C as the secondary standard. Ex. NRC038, NRC Regulatory Issue Summary 2009-05, Uranium Recovery Policy Regarding: (1) the Process for Scheduling Licensing Reviews of Applications for New Uranium Recovery Facilities and (2) the Restoration of Groundwater at Licensed Uranium *In Situ* Recovery Facilities, at 3 (Apr. 29, 2009).

[148] Ex. SEI009A, FSEIS, § 4.5.1.3, at 4-45.

[149] *Id.* at 4-48. The state department of environmental quality determines the water quality standards. The Wyoming Department of Environmental Quality has standards for Class I (domestic use), Class II (agricultural use), or Class III (livestock use).

of certain hazardous constituents persisted after restoration, this did not change the class of use.[150] The FSEIS concludes that, given the relative success of past restorations, the impacts to groundwater quality in the exempted portion of the aquifer and the confined aquifers surrounding the exempted aquifer would be small following restoration at the Ross Project site.[151]

The Board found that the Staff's approach in the FSEIS, as supplemented by the record in this proceeding, "adequately identifies the potential impacts" of an alternate concentration limit, should one be necessary for the Ross project.[152] The Board found that the Staff's determination that impacts would be small was supported by the fact that the mined portion of the aquifer has been permanently exempted as a source of drinking water and "there have been no reported instances of an excursion from an [*in situ* uranium recovery] facility negatively impacting drinking water."[153] The Board concluded that the record supported the Staff's ultimate conclusion that the likely impact due to alternate concentration limits is small:

> [T]he FSEIS, as supplemented by the uranium bounding analysis discussed in this decision, adequately identified the potential environmental impacts of an [alternate concentration limit] should an [alternate concentration limit] be necessary for the Ross Project site. Furthermore, the preponderance of the evidence before the Board supports the FSEIS determination that the

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[150] *Id.*

[151] *Id.* The FSEIS explains that operations will be conducted within an area defined by an aquifer exemption permit granted by the Wyoming Department of Environmental Quality and approved by the Environmental Protection Agency. *See id.*, § 2.1.1.1, at 2-27; *see also* Ex. SEI0034, Letter from Derrith R. Watchman-Moore, U.S. Environmental Protection Agency, Region 8, to Kevin Frederick, Wyoming Department of Environmental Quality, aquifer exemption approval: Strata Energy (May 15, 2013). The area covered by the exemption permit is referred to as the exempted aquifer but is actually a portion of the mined (ore zone) aquifer.

[152] LBP-15-3, 81 NRC at 133. The FSEIS omitted the uranium concentration approved for two of the three sites discussed (Smith Ranch-Highland facility and Irigaray Mine Units 1-9). *See* Ex. SEI009A, FSEIS, § 4.5.1.3, at 4-46. But this information was provided in the Staff's testimony. *See* Ex. NRC001, Staff Initial Testimony, at 33; *see also* LBP-15-3, 81 NRC at 117.

[153] LBP-15-3, 81 NRC at 132.

> restoration-associated impacts on groundwater quality within the Ross Projects site [ore zone] aquifer and surrounding aquifers will be SMALL.[154]

b. Claims of Factual Error in Resolution of Contention 2

On appeal, Joint Intervenors argue that the Board made several errors in affirming the Staff's conclusion that the potential environmental impacts from alternate concentration limits would be small.[155] At bottom, these arguments amount to disagreements with how the Board weighed the evidence.

(1) CLAIM THAT BOARD RELIED ON EVIDENCE NOT IN THE RECORD

Joint Intervenors argue that the Board erred in relying on evidence that was not in the record—specifically, a "transport model" relating to the restoration approval for the Crow Butte Resources wellfield 1 in Nebraska (one of the examples used in the Staff's "bounding analysis" for the Ross Project).[156] As explained below, Joint Intervenors show no clear error in the Board's decision, nor do they raise a substantial question of prejudicial procedural error in the Board's decision not to require documentary evidence related to transport modeling at the Crow Butte site.

In Contention 2, Joint Intervenors claimed that the Staff will approve any number as an alternate concentration limit, provided the licensee first reasonably attempts to meet primary or secondary limits.[157]

At the hearing, the Staff denied that its practice is to set alternate concentration limits based on how much effort the licensee has expended. The Staff's witness, Dr. Johnson, stated

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[154] *Id.* at 133.

[155] Petition at 16-21.

[156] *Id*. at 16-17.

[157] *See e.g.*, Ex. JTI003-R, Pre-Filed Testimony of Dr. Lance Larson on Contentions 2 and 3, at 22 (Aug. 25, 2014) (Larson Direct Testimony).

that the Staff generally evaluates the "transport that would go on from the location within the [exempted] area out to that exempted boundary, the boundary of the exempted aquifer."[158] In other words, the Staff evaluates whether the contaminants would naturally attenuate to primary or secondary levels by the time the groundwater reaches the boundary of the exempted portion of the aquifer.[159] Joint Intervenors' expert requested to see the "transport model" used by the Staff for the Crow Butte site.[160] In response, Dr. Johnson replied that the documents supporting the Crow Butte license amendment approval had been included in the Staff's exhibits.[161] On appeal, Joint Intervenors argue that the Board erred because its conclusion rested in part on "a non-existent transport model."[162]

We find no Board error here; the Board appropriately relied on the Staff's and Strata's testimony in reaching its decision.[163] Contrary to Joint Intervenors' assertions, the Staff provided extensive documentation to support its use of the Crow Butte analysis to support its NEPA review here.[164] The Staff never claimed to have a document called a "transport model"

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[158] Tr. at 617 (Johnson); *see* LBP-15-3 at 121.

[159] *See* Tr. at 559-60, 617 (Johnson).

[160] *Id.* at 618 (Larson and Johnson).

[161] *Id.* at 618-19 (Larson and Johnson).

[162] Petition at 16-17 (citing LBP-15-3, 81 NRC at 121).

[163] *See* LBP-15-3, 81 NRC at 121 (citing Tr. at 617 (Johnson)). It is not error for a board to rely on witness testimony. *See, e.g., Oyster Creek*, CLI-09-7, 69 NRC at 268.

[164] Staff provided several documents supporting its approval of the Crow Butte restoration. *See, e.g.,* Ex. NRC022, Letter from Stephen P. Collings, Crow Butte Resources, Inc., to John Surmeier, NRC, Mine Unit 1 Restoration Report Submittal and Request for License Amendment (Jan. 14, 2000); Ex. NRC023, Letter from Stephen P. Collings, Crow Butte Resources, Inc., to Melvyn Leach, NRC, Mine Unit 1 Restoration; Response to Request For Additional Information (Aug. 24, 2001); Ex. NRC024, Letter from Michael L. Griffin, Crow Butte Resources, Inc. to Daniel M. Gillen, NRC, Mine Unit I Groundwater Stability Data (Oct. 11, 2002); Ex. NRC026, Crow Butte Wellfield 1 Approval.

on the record—the Board's discussion of the Staff's testimony, as cited by Joint Intervenors, refers to "transport modeling," not a "transport model."[165] While the Board certainly could have asked the parties to produce additional documentary evidence, it was not required to do so. The Staff's testimony regarding its practice when approving previous restorations provided a reasonable basis for determining how the Staff would address a request for an alternate concentration limit at the Ross Project site, and Joint Intervenors have not raised a substantial question regarding the Board's reliance on the Staff's practice here.

(2) CLAIM THAT BOARD MISINTERPRETED THE DATA CONCERNING RESTORATION APPROVAL OF SMITH RANCH-HIGHLAND SITE

Joint Intervenors next argue that the Board misinterpreted the evidence concerning the Smith Ranch-Highland facility, Wellfield A, the restoration of which the Staff approved in 2004.[166] Specifically, they argue that the Board mistakenly interpreted testimony of their expert Dr. Larson to refer to groundwater samples taken during the period when groundwater was still undergoing active restoration, when the data actually was gathered during the "stability" period (that is, after active restoration when the licensee was attempting to ascertain whether hazardous constituent concentrations had stabilized).[167]

Joint Intervenors' argument points to no material error. The Board found that Dr. Larson's data was not relevant because it reflected site conditions prior to the time the Staff approved the restoration.[168] The focus of Contention 2 was the reasonable range of alternate

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[165] Petition at 16 (quoting LBP-15-3, 81 NRC at 121). Moreover, the term "transport modeling" was not used by the Staff expert in discussing the Staff's work with the Board—the Board introduced the term to refer to the Staff's work as part of the discussion in LBP-15-3. *See* LBP-15-3, 81 NRC at 121.

[166] Petition at 17-18.

[167] *Id*. (citing Ex. JTI005A-R2, NRC ISL Database Spreadsheets, at 227-32).

[168] LBP-15-3, 81 NRC at 123-24.

concentration limits that might be approved at the Ross Project site *after* its restoration is approved. Regardless of whether Dr. Larson's data came from the restoration period or the stability period, its relevance to Contention 2 is minimal because only the concentrations that the Staff actually approved for restoration matter to the bounding analysis.[169]

(3) CLAIM THAT BOARD IGNORED EVIDENCE OF EXCURSIONS

Joint Intervenors next argue that the Board "dismissed evidence of mining fluid excursions impacting water in vertically or horizontally adjacent aquifers outside the exempted areas."[170] Joint Intervenors cite four paragraphs of the Board's decision to support their claims, and they are correct that the Board does not discuss vertical or horizontal excursions in those four paragraphs.[171]

The evidence that Joint Intervenors cite, however, relates to excursions at sites for which restoration had not been approved.[172] Joint Intervenors do not explain how vertical or horizontal excursions at these sites are relevant to Contention 2, which concerns elevated hazardous constituent levels that may linger on the site after restoration has been approved.

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[169] Joint Intervenors also argue that the Board confused Staff testimony concerning a different site with the evidence concerning Smith Ranch-Highland Wellfield A. Petition at 18. This is incorrect. The Board simply pointed to the Staff's discussion of the other site to show that it is inappropriate to average the results of samples taken during restoration because only the concentrations at the end of the restoration process (at the point of Staff approval) are relevant to the question of what concentrations the Staff might approve at the Ross Project site. *See* LBP-15-3, 81 NRC at 123-24.

[170] *See* Petition at 18-19.

[171] *Id.* at 18 (citing ¶¶ 4.98-4.101, LBP-15-3, 81 NRC at 126-28).

[172] *See* Ex. JTI036, 2012 Status Update Casing Leak Investigation C, E, and F Wellfields Smith Ranch-Highland Operations, at 59-85 (Feb. 20, 1013). Joint Intervenors' Petition also refers to pages 61-62 of Ex. JTI005B-R2, which is only 35 pages long. *See* Petition at 19 n.21. We observe that most of the pages of this exhibit discuss a project (Willow Creek/Christensen Ranch) that the Board found not to be relevant to Contention 2 because site restoration has not been approved. *See* LBP-15-3, 81 NRC at 126-27. The exhibit also discusses shallow aquifer contamination at Smith Highland Ranch due to excursions during operations, but that issue is likewise not relevant to Contention 2.

On appeal, Joint Intervenors do not cite any testimony or pleading to support their claim that excursions during operations or restoration relate to Contention 2. We do not consider cursory, unexplained legal arguments, and we will not speculate about what a pleading is supposed to mean.[173] Therefore, Joint Intervenors have not identified a Board error that would warrant granting their petition for review.

(4) Claim That Board Unjustifiably Relied on Exemption and on Future Processes to Protect the Aquifer

Joint Intervenors also argue that the Board erred in relying on the aquifer exemption granted by Wyoming and the license amendment process as additional support for upholding the Staff's conclusion that impacts from alternate concentration limits will be small.[174]

We find that Joint Intervenors have not raised a substantial question with respect to the Board's findings. As an initial matter, the fact that the mined portion of the aquifer is permanently exempted as a source of drinking water and the possibility of a future hearing on an alternate concentration limit were only two factors the Board discussed in concluding that the FSEIS discussion of post restoration impacts was reasonable. Moreover, contrary to Joint Intervenors' suggestion, these factors support the FSEIS's conclusion that any elevated hazardous constituent levels left at the Ross Site following restoration would have a small overall environmental impact.

Our regulations and license amendment process require that no alternate concentration limit be approved without meeting safety criteria, regardless of whether any intervenor has

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[173] *See, e.g.*, *Entergy Nuclear Vermont Yankee, LLC and Entergy Nuclear Operations, Inc*. (Vermont Yankee Nuclear Power Plant), CLI-10-17, 72 NRC 1, 30 (2010); *Commonwealth Edison Co*. (Zion Nuclear Power Station, Units 1 and 2), CLI-99-4, 49 NRC 185, 194 (1999) (quoting *Kansas Gas and Electric Co*. (ALAB-279, 1 NRC 559, 576 (1975)).

[174] Petition at 19-20.

contested the matter.[175] If a licensee fails to show that a proposed alternate concentration limit meets the standards of Criterion 5B(6), then it will have to restore to primary or secondary limits.[176] Moreover, Joint Intervenors and any other interested party will have the opportunity to submit contentions and request a hearing on any future license amendment related to alternate concentration limits, should such an amendment become necessary for this site.

Joint Intervenors' argue that because the future concentration limits are unknown, the Staff cannot show that it meets NEPA now and that the Staff did not provide sufficient information to support its finding that the environmental impacts will be small.[177] However, Joint Intervenors have not pointed to any specific matter where the Board refused to consider their arguments and supporting evidence. It was appropriate for the Board to rely on the testimony from the Staff's experts describing how the Staff reviews secondary concentration limits in license amendment applications. And the Board also modified a license condition in response to Joint Intervenors' concerns that unplugged exploratory wells (or boreholes) existing on the site could cause vertical excursions during operations.[178] The Board's narrowly tailored relief appropriately addresses the concerns raised by Joint Intervenors.

In sum, Joint Intervenors have not identified clear error in the Board's factual findings relating to post-restoration contamination levels in the mined aquifers. None of their arguments call into question the Board's judgment that the FSEIS, as supplemented by the hearing record,

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[175] *See generally*, 10 C.F.R. pt. 40, app. A, Criterion 5B(5).

[176] *See* Ex. SEI015, License, at 7-8 (License Condition 10.6).

[177] *See* Petition at 19-20.

[178] *See* LBP-15-3, 81 NRC at 143-44. The Board modified License Condition 10.2, which requires the licensee to locate and properly abandon historic exploratory wells or boreholes that may exist on the site. The Board expanded the reach of the License Condition to include wells outside the perimeter monitoring ring and downgradient of the wellfield. *Id.*

reasonably concluded that the impact of hazardous constituents persisting in the aquifer after restoration would be small.

c. Claims of Legal Error in Resolution of Contention 2

Joint Intervenors raise one legal argument with respect to Contention 2: that the Staff's issuance of the license prior to the hearing and Board decision violates NEPA.[179] They argue that if the hearing record and Board decision are necessary to complete, or even correct, the environmental record, then the license must be vacated and remanded to the Staff so that it may consider the complete NEPA analysis prior to deciding whether to issue the license.[180] To support their claim, Joint Intervenors point to the Board's agreement with their concern that Staff's analysis was flawed in some respects.[181] Joint Intervenors argue that the Board simply "declar[ed] these violations cured" by its decision, violating the "fundamental NEPA precepts that data may not be utilized simply to 'justify[ ] decisions already made.'"[182]

Joint Intervenors fail to raise a substantial question for our review because the Board found the Staff's environmental impact determinations to be well-founded. Our adjudicatory proceedings, as we recently discussed in *Crow Butte Resources, Inc.*, contemplate that a Board or the Commission may appropriately modify, condition, or revoke a license, if required by the circumstances of a particular proceeding.[183] Here, the Board evaluated the Staff's analysis and determined that, with the additional information considered at the hearing and in the Staff's pre-filed testimony, the environmental impacts of the proposed licensing action were appropriately

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[179] Petition at 14-16.

[180] *Id*. at 14-15.

[181] *Id*. at 14 (citing LBP-15-3, 81 NRC at 122, 124-26).

[182] *Id.* at 15 (citing 40 C.F.R. § 1502.2(g)).

[183] *Crow Butte Resources, Inc*. (*In Situ* Leach Facility, Crawford, Nebraska), CLI-15-17, 82 NRC 33, 40 (2015).

identified.[184] And, after identifying several gaps in the Staff's analysis, the Board determined that modifying a license condition was the appropriate approach to address Joint Intervenors' concerns about groundwater protection.[185] While we agree with Joint Intervenors that remanding, or staying, the license would have been appropriate had the Board determined that the Staff's analysis did not adequately consider the environmental consequences of this licensing action, there is no need for such action here. Here the Board's modification of the environmental record of decision did not change, in any material aspect, the Staff's ultimate determination that impacts to groundwater in the OZ aquifer and surrounding aquifers would be SMALL. Instead, the Board merely modified the record of decision to include a revised license condition and additional analyses that were placed on the record before the Board by various parties.[186] We have previously held that a Board's hearing, hearing record, and subsequent decision on a contested environmental matter augment the environmental record of decision developed by the Staff with respect to this issue[187] and Joint Intervenors have not persuaded us to abandon this practice. Not only have Joint Intervenors failed to demonstrate Board error in reaching this decision, but we find that the environmental record of decision, as modified by the Board supports the issuance of a license to Strata.[188]

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[184] *See* LBP-15-3, 81 NRC at 133.

[185] *Id.* at 143-44.

[186] *Indian Point*, CLI-15-6, 81 NRC at 387-88 ("When a hearing is held on a proposed action, 'the initial decision of the presiding officer or the final decision of the Commissioners acting as a collegial body will constitute the record of decision.' …We have consistently interpreted our regulations to provide that environmental impact statements are modified by any subsequent Board or Commission decision."); *see Hydro Resources, Inc.* (P.O. Box 15910, Rio Rancho, NM 87174), CLI-01-4, 53 NRC 31, 53 (2001).

[187] *Indian Point*, CLI-15-6, 81 NRC at 388.

[188] It is well settled that parties challenging an agency's NEPA process are not entitled to relief unless they demonstrate harm or prejudice. Joint Intervenors have not done so here because the Board concluded that the Staff's analysis of the reasonably foreseeable impacts from

Therefore, we decline to take review of the Board's legal and factual rulings with respect to Contention 2.

3. Contention 3

In Contention 3, Joint Intervenors argued that Strata and the Staff failed to demonstrate that the mined aquifer is isolated and that Strata can prevent fluid migration outside the production zone during operations:

> CONTENTION: The FSEIS fails to assess [adequately] the likelihood and impacts of fluid migration to the adjacent groundwater, as required by 10 C.F.R. §§ 51.90-94 and NEPA, and as discussed in NUREG-1569 § 2.7, in that:
>
> 1. The FSEIS fails to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes, including the adequacy of applicant's plans to mitigate possible borehole-related migration impacts by monitoring wellfields surrounding the boreholes and/or plugging the boreholes.
>
> 2. There was insufficient information for the NRC staff to make an informed fluid migration impact assessment given that the applicant's six monitor-well clusters and the 24-hour pump tests at four of these clusters provided insufficient hydrological information to demonstrate satisfactory groundwater control during planned high-yield industrial well operations.[189]

All of Joint Intervenors' challenges to the Board's decision on Contention 3 relate to how the Board weighed the evidence. Based upon our review of the record, we find that none of Joint Intervenors' arguments raise a substantial question with respect to the Board's factual findings.

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alternate concentration limits was fundamentally correct. *Nw. Coal. for Alts. to Pesticides (NCAP)* v. *Lyng.* 844 F.2d 588, 594 (9th Cir. 1988).

[189] *See* FSEIS Order, app. A, at 1; *see also* Ex. JTI003-R, Larson Direct Testimony, at 49-51, 54-61; Ex. JTI001-R, Abitz Direct Testimony, at 45-49.

a. Historic Boreholes

There are nearly 1500 historic exploratory boreholes on the site, most of which have not been properly abandoned (plugged) and over 100 of which have not yet been located.[190] As the Board observed, the FSEIS acknowledges that boreholes that have not been properly abandoned could cause vertical excursions—leaks to overlying or underlying aquifers—and that vertical excursions are more difficult to recover than horizontal excursions.[191]

On appeal, Joint Intervenors argue that the Board relied too heavily on a license condition requiring the licensee to "attempt to locate and abandon" the boreholes within the perimeter of each wellfield, a provision they argue is essentially unenforceable.[192] Joint Intervenors argue that Strata's witness acknowledged at hearing that it may not be able to fill all the boreholes, and that the Staff witness stated that the Staff would be "powerless to act" unless it can show that Strata's violation was "willful."[193]

As an initial matter, Joint Intervenors' petition mischaracterizes the hearing testimony. Contrary to Joint Intervenors' arguments, Strata's witness stated that Strata might not be able to locate every borehole prior to performing the pre-operational pump test, but that the boreholes "should show up in that pump test."[194] In addition, our enforcement process does not require

[190] LBP-15-3, 81 NRC at 137 (citing Tr. at 679-80 (Knode)).

[191] *Id*. (citing FSEIS, § 4.5.1.2, at 4-37).

[192] Petition at 22. Joint Intervenors refer to License Condition 10.12, which the Board modified to include boreholes outside the perimeter well ring if the wells extend into the first underlying aquifer and are downgradient of the Wellfield. The modified condition requires the licensee to fill boreholes from the perimeter monitoring ring to the closer of the Ross Project license area boundary or the outer boundary of the exempted aquifer. *See* LBP-15-3, 81 NRC at 143-44. The licensee has requested an amendment to this condition, which is subject to a separate opportunity to request a hearing. *See supra*, note 31.

[193] Petition at 22.

[194] Tr. at 766 (Griffin); *see also* Ex. NRC001, Staff Initial Testimony, at 49 ("The Staff determined that after performing hydrologic tests to demonstrate confinement of the ore aquifer and routine

that a violation be "willful" for the Staff to take enforcement action.[195] The NRC has a well-developed enforcement process that considers both willful and non-willful violations by NRC licensees and applicants.[196] A licensee's failure to correct a violation once identified could result in a notice of violation.[197]

We find that the Board appropriately considered Joint Intervenors' evidence and arguments with respect to boreholes. The Board found that the license condition requiring Strata to "attempt" to locate the boreholes was sufficient because the NRC does not assume that a licensee will ignore its obligations and other license conditions will help to assure Strata's compliance.[198] In its decision, the Board discussed License Condition 10.13, which requires Strata to conduct additional pumping tests to ensure isolation of the aquifers prior to beginning production of a wellfield; and License Condition 11.5, which requires Strata to immediately cease operations if a vertical excursion is detected.[199] The Board found that these license conditions provide additional incentive for Strata to locate and abandon the boreholes.[200] Moreover, License Condition 10.12 requires Strata to "document its efforts" to find and fill the

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excursion monitoring, a drill hole not abandoned would be detected and proper corrective actions would be undertaken.")

[195] At the hearing, both Staff's witness and Staff's counsel acknowledged that the witness was not qualified to testify regarding the specifics of the NRC's enforcement process. *See* Tr. at 765 (Mr. Saxton) ("I don't know the exact procedure"); *id.* at 766 (Ms. Monteith) ("I don't believe that our witnesses are qualified to testify to the enforcement process.").

[196] *See, e.g.*, "Nuclear Regulatory Commission Enforcement Manual," Rev. 9, (Dec. 2015) (ML102630150).

[197] *See* Nuclear Regulatory Commission Enforcement Manual, Rev. 9 (2013) (updated Sept. 8, 2015), § 2.2.3, at 100-01.

[198] LBP-15-3, 81 NRC 140-41 (citing *GPU Nuclear, Inc.* (Oyster Creek Nuclear Generating Station), CLI-00-6, 51 NRC 193, 207 (2000)).

[199] LBP-15-3, 81 NRC at 141 (citing Ex. SEI015, License, at 9, 13).

[200] *Id*. at 140 (citing Ex. SEI015, License, at 13-14).

boreholes, enabling Staff to assess whether Strata's efforts were in good faith.[201] Given that the Board considered the contrary evidence and explained its reasoning, the Board's conclusion that these factors, taken together, will ensure the licensee's compliance with the requirement to find and plug historic boreholes was reasonable.

b. Pumping Tests

Next, Joint Intervenors argue that the Board disregarded evidence that chemical analyses of the groundwater following Strata's prelicensing pumping tests indicate that the aquifer is not confined.[202] As the Board explained, Strata performed an aquifer test—or pumping test—in each monitoring well cluster to confirm that the ore zone aquifer was confined. According to the prefiled testimony of Strata's witness, Ray Moores, this test involves pumping the well installed in the ore zone aquifer at a constant rate.[203] Pressure transducers installed in the wells in the ore zone, the overlying aquifer, and the underlying aquifer measure and record the water level in each well on one minute intervals.[204] According to Mr. Moores, "by evaluating responses, or lack thereof, recorded in the [overlying and underlying aquifer] wells it was also possible to measure the integrity of the confining intervals above and below the [ore zone] aquifer."[205] Mr. Moores stated that the transducers were sufficiently sensitive to detect "a leaky aquifer even over short pumping durations."[206] He acknowledged that the pumping tests can

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[201] *See* Ex. SEI015, License, at 9.

[202] Petition at 23.

[203] Ex. SEI042, Initial Written Testimony of Ray Moores, at 5 (Aug. 25, 2014) (Moores Testimony); *see also* LBP-15-3, 81 NRC at 144-46.

[204] Ex. SEI042, Moores Testimony at 5. The tests were used to evaluate a variety of ore zone characteristics as well as confirming confinement. *Id*.

[205] *Id.*

[206] *Id*. at 6.

only demonstrate confinement over the immediate area, not the entire Ross Project area.[207] For this reason, License Condition 10.13 requires additional tests prior to opening each wellfield.[208]

According to the prefiled testimony of Joint Intervenors' expert Dr. Abitz, changes in the levels of sodium and sulfate in the water from the ore zone aquifer following the tests indicate that water from the ore zone aquifer had been diluted with water from the overlaying aquifer, which has naturally lower levels of these chemicals.[209] The Board, however, found that Dr. Abitz's interpretation was "mere speculation," and it concluded that the "better explanation" for the variable levels of these constituents was the natural differences in the minerals within the ore zone.[210]

In challenging the Board's decision, Joint Intervenors claim that the Board's conclusion inherently contradicts its conclusion with respect to Contention 1, wherein the Board found that the site had been adequately characterized through its prelicensing monitoring program.[211] Joint Intervenors argue that "if the results of groundwater tests in the [ore zone] will 'vary considerably' depending on the mineral content where they are located then [Strata] and Staff failed to demonstrate that the limited groundwater data collected meaningfully characterized the baseline."[212]

We do not see any inherent contradiction between the Board's findings on Contentions 1 and 3. The FSEIS does not state that water quality is consistent throughout each aquifer—the

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[207] *Id.*

[208] *See* Ex. SEI015, License, at 9.

[209] Ex. JTI001-R, Abitz Direct Testimony, at 49-50.

[210] LBP-15-3, 81 NRC at 147.

[211] Petition at 23.

[212] *Id.*

groundwater monitoring data in Appendix C shows that the concentrations of the constituents tested vary between the wells.[213] At most, the pumping test results show that the picture of the Ross Project site groundwater could be painted with a finer brush—it does not show that more data is necessary to characterize the site and evaluate the environmental impacts of the proposed project. The Board's factual finding resolved two competing technical opinions, which is a matter where the Commission ordinarily defers to the Board's judgment.[214] Based upon our review of the record, we conclude that the Board's interpretation of the pumping test results is reasonable and that Joint Intervenors have failed to identify a clear factual error on the Board's part.

c. Selection of Excursion Indicators (Excursion Monitoring Parameters)

Joint Intervenors also argue that the Board erred in declining to require Strata to use uranium as an excursion indicator—one of the characteristics specifically monitored at the perimeter of a wellfield to ensure that mining fluids have not escaped the area of operation.[215] Specifically, Joint Intervenors argue that the Board recognized that there is "uncertainty" about the movement of uranium in groundwater, and that it was therefore "error for the Board to conclude that the Staff had appropriately found the impacts from excursions will be small based on excursion parameters that will *not include monitoring for uranium*."[216] Further, Joint Intervenors argue that the Board erroneously shifted the burden to Joint Intervenors to show

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[213] *See* Ex. SEI09B, FSEIS, app. C.

[214] *See, e.g.*, *Oyster Creek*, CLI-09-7, 69 NRC at 264; *Louisiana Energy Services, L.P.* (National Enrichment Facility), CLI-05-28, 62 NRC 721, 723 (2005).

[215] Petition at 24.

[216] *Id*.

that uranium should be used, rather than requiring the Staff and Strata to show why it should not.[217]

Joint Intervenors miss the Board's point with respect to the excursion indicators. As the Board noted, the FSEIS explains that most *in situ* uranium recovery facilities will use chloride, conductivity, and total alkalinity because "[t]hese constituents move through the aquifer faster than other water-quality parameters."[218] In other words, the excursion indicators are selected because they will provide the earliest warning of a problem, not because they are the chemicals of most concern in groundwater protection. The Board agreed with Staff that the "uncertainly" surrounding the behavior of uranium in various chemical environments (that is, whether it will be adsorbed or remain in solution) is a reason not to use uranium as an excursion indicator.[219] The Board, after weighing the parties' evidence, concluded that

> the case for using uranium as an excursion indicator for the Ross Project [was] not compelling, particularly given Joint Intervenors' failure to present any convincing site-specific evidence to counter the Staff['s] and [Strata's] showings that chloride and the other

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[217] *Id.*

[218] *See* LBP-15-3, 81 NRC 148 n.73. At least three excursion indicators must be used at each wellfield, and the FSEIS explains why chloride, conductivity, and alkalinity are usually selected:

> [C]hloride is selected because it does not interact strongly with the minerals in the ore zone; it is easily measured; and chloride concentrations are significantly increased during ISR operations. Conductivity, which is correlated to total dissolved solids (TDS), is also considered a good excursion indicator because of the high concentrations of dissolved constituents in the lixiviant as compared to the surrounding aquifers. . . . Total alkalinity (carbonate plus bicarbonate plus hydroxide) is used as an indicator in wellfields where sodium bicarbonate or carbon dioxide is used in the lixiviant.

Ex. SEI009A, FSEIS, § 2.1.1.2, at 2-31; *see also* Ex. NRC001, Staff Testimony, at 72-73. Strata's license provides that sulfate will be used as the default excursion indicator in lieu of chloride only in the aquifer underlying the ore zone aquifer, because of the naturally high chloride in that aquifer. *See* Ex. SEI015, License, at 13 (License Condition 11.4).

[219] LBP-15-3, 81 NRC at 149-50.

> indicators proposed for use by [Strata] and accepted by the Staff would be effective excursion indicators at Ross.[220]

Joint Intervenors' petition does not point to any evidence that demonstrates factual error in the Board's finding that "uranium is not as effective a tool for providing a timely alert regarding a lixiviant excursion."[221] Although Joint Intervenors claim generally that Drs. Abitz and Larson demonstrated that "uranium may move through the aquifer more quickly than chloride and the other excursion indicator constituents," they cite nothing for that proposition.[222] In fact, Dr. Abitz's testimony, which the Board discussed, argues that uranium would be a good indicator because the "levels of uranium in the lixiviant are generally three to four orders of magnitude greater than true baseline; and increases in chloride, alkalinity and [total dissolved solids] in the aquifer will be less than one or two orders of magnitude."[223] But, at most, this testimony would show that if uranium is present, it might be easier to detect than the selected excursion indicators—not that it would be detected earlier than the indicators Strata plans to monitor.

In addition, we do not find that the Board improperly shifted the burden of proof. The Board discussed the parties' prefiled and hearing testimony with respect to this issue, and it appropriately considered the various parties' positions—it simply found the Staff's and Strata's positions more persuasive.[224] Joint Intervenors have not provided any basis for us to review the Board's factual findings with respect to the excursion indicators.

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220 *Id.* at 150.

221 *Id.*

222 Petition at 7, 24.

223 LBP-15-3, 81 NRC at 149 n.76 (quoting Ex. JTI001-R, Abitz Direct Testimony, at 43).

224 *See id*. at 148-50.

d. Evidence of Excursions at Other Sites

Finally, Joint Intervenors argue that the Board "discounted" evidence of excursions at other *in situ* uranium recovery sites because of the aquifer exemption.[225] They argue that regardless of the exemption, the aquifer is still part of the "affected environment, impacts to which must be disclosed and considered in the FSEIS."[226]

We do not find that the Board disregarded the evidence. The Board's conclusion relied on the licensee's ability to detect and recover excursions (in addition to the fact that the aquifer is exempted from human consumption) to conclude that the potential environmental impacts from operations is small.[227] In addition, the FSEIS discusses the possibility of excursions and describes recovery measures that are imposed by License Condition 11.5.[228] Joint Intervenors have not shown either that the Board erred in its findings of fact or that the FSEIS failed to consider all potential environmental impacts from the proposed facility.

[225] Petition at 24-25 (citing LBP-15-3, 81 NRC at 150-52).

[226] *Id*. at 25.

[227] LBP-15-3, 81 NRC at 151.

[228] *See* Ex. SEI009A, FSEIS, § 4.5.1.2, at 4-41 to 4-43.

III. CONCLUSION

For the foregoing reasons, we *deny* the petition for review.

IT IS SO ORDERED.

For the Commission

NRC SEAL **/RA/**

Annette L. Vietti-Cook
Secretary of the Commission

Dated at Rockville, Maryland,
this 29th day of June, 2016

Commissioner Baran, Concurring in Part and Dissenting in Part

I concur in part with and dissent in part from the Commission's decision.

I join the majority in the decision except for the subsection that denies review of the Joint Intervenors' claim that the Board erred in resolving Contention 2 by allowing its Initial Decision to supplement the Final Supplemental Environmental Impact Statement (FSEIS) after issuance of the license. I respectfully dissent from this portion of the decision. I would grant review of this claim and order the Staff to cure the deficiency in its environmental analysis.

With respect to Contention 2, Joint Intervenors contend that the Staff's issuance of the license prior to the hearing and Board decision violates NEPA.[1] They argue that if the hearing record and Board decision are necessary to complete or correct the environmental record, then the license must be vacated and remanded to the Staff so that it may consider the complete NEPA analysis prior to deciding whether to issue the license.[2] In response to the Joint Intervenors' claims regarding the need to suspend the license, the Board found that there was not yet a final agency action because the "agency's NEPA record of decision remains open, and is subject to adjudicatory supplementation relative to matters associated with any pending admitted NEPA contention, at least until the hearing record is closed and the final agency adjudicatory decision is issued."[3] To support their claim on appeal, Joint Intervenors point to the Board's agreement with their concern that Staff's environmental analysis was flawed in some respects.[4] Joint Intervenors argue that the Board simply "declar[ed] these violations cured" by

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[1] *Natural Resources Defense Council's & Powder River Basin Resource Council's Petition for Review of Atomic Safety and Licensing Board's January 23, 2015 Initial Decision Denying Environmental Contentions 1 Through 3, and Interlocutory Decisions Denying Environmental Contentions 4/5A and 6/7* (Feb. 17, 2015), at 14-16 (Petition).

[2] *Id*. at 14-15.

[3] LBP-15-3, 81 NRC 65, 122 n.49 (2015).

[4] Petition at 14 (citing LBP-15-3, 81 NRC at 122, 124-26).

its decision, "violat[ing] the fundamental NEPA precepts that data may not be utilized simply to 'justify[ ] decisions already made.'"[5] I believe that the Joint Intervenors raise a substantial question for our review.

The Staff's practice in materials cases is to issue a license before the completion of contested hearings on environmental matters. Section 2.1202(a) provides:

> During the pendency of any hearing under this subpart, consistent with the NRC staff's findings in its review of the application or matter which is the subject of the hearing and as authorized by law, the NRC Staff is expected to promptly issue its approval or denial of the application….[6]

It appears that the Staff reads this regulatory provision to require it to issue a license when it completes its safety review and issues the Final Environmental Impact Statement. However, in the adjudicatory context, the Commission has held that its decisions and Licensing Board decisions can supplement[7] the NEPA analysis to correct deficiencies in such an analysis.[8] Allowing adjudicatory decisions to supplement the NEPA analysis means that, where there are contested environmental matters, the NEPA process is not complete until any admitted environmental contentions are resolved. Thus, the Staff's current practice, in some instances, conflicts with a core requirement of NEPA—that the decisionmaker consider all environmental impacts of an action *before* making a decision.[9]

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[5] *Id.* at 15 (emphasis omitted) (quoting 40 C.F.R. § 1502.2(g)).

[6] 10 C.F.R. § 2.1202(a).

[7] Here, I am using the term "supplement" as it is used in the Commission case law, not as it is used in 10 C.F.R. § 51.92.

[8] *See, e.g.*, *Entergy Nuclear Operations, Inc.* (Indian Point, Units 2 and 3), CLI-15-6, 81 NRC 340, 387-88 (2015).

[9] Petition at 15 (citing *Robertson v. Methow Valley Citizens Council*, 490 U.S. 332, 349 (1989)).

In my view, this conflict requires the Commission to clarify its supplementation doctrine to account for situations like this one. Several options are available to avoid this conflict. For example, the Staff could wait until the end of the hearing process on contested environmental contentions prior to issuing a license. In this circumstance, a Board or Commission decision could revise the NEPA analysis prior to the issuance of the license, which would ensure that the decisionmaker considers the complete NEPA analysis prior to the completion of the federal action. Alternatively, if the Staff issues a license upon completion of its environmental review but before the completion of any hearing challenging that review, then a subsequent Board or Commission decision finding a flaw in the NEPA analysis or process may require the suspension or vacatur of the license pending Staff action to cure the NEPA deficiency. In these circumstances, the adjudicatory decision or proceedings cannot supplement the NEPA environmental document or Record of Decision after the fact because the licensing action has already been taken in reliance on the NEPA analysis.

Here, the license has already been issued and the Board found aspects of the FSEIS to be deficient. The Board evaluated the Staff's environmental analysis and determined that, only with the additional information considered at the hearing, were the environmental impacts of the proposed licensing action appropriately identified.[10] Because the Board found a deficiency in the NEPA analysis, the agency did not have an adequate environmental analysis at the time it decided whether to issue the license. Thus, the Staff's decision to issue the license was not informed by an adequate NEPA analysis.

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[10] *See* LBP-15-3, 81 NRC at 133.

In federal court, a violation of NEPA, by itself, is not always sufficient to justify suspending or revoking the license.[11] However, the Commission has a responsibility to ensure that the Staff complies with NEPA. The agency should not undermine NEPA's core requirement of fully informed decisionmaking by failing to grapple with the problem of pairing a regulation that allows a materials license to be issued prior to adjudicatory hearings with an adjudicatory doctrine that permits the NEPA environmental review to be supplemented by adjudications completed after issuance of the license. We should not endorse a practice that would likely result in future after-the-fact supplementation of the NEPA analysis. Therefore, I would order the Staff to revise the Record of Decision in this case to include all relevant information, including the change to the license condition made by the Board and the additional information the Board found necessary to supplement the FSEIS in response to Contention 2, so that the Director of the Office of Nuclear Materials Safety and Safeguards could make a fully informed decision on whether to reaffirm, modify, condition, or revoke the license. If the Staff did not revise the Record of Decision and make a decision on whether to reaffirm, modify, condition, or revoke the license within 30 days, then I would order the Staff to suspend the license until such steps are taken.

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[11] *See Monsanto Co. v. Geertson Seed Farms*, 561 U.S. 139, 157-58 (2010) (injunction not automatic or default remedy to cure NEPA violation); *Nw. Coal. for Alts. to Pesticides v. Lyng*, 844 F.2d 588, 595 (9th Cir. 1988); *Cty. of Del Norte v. United States*, 732 F.2d 1462, 1467 (9th Cir. 1984); *Cent. Delta Water Agency v. U.S. Fish & Wildlife Serv*., 653 F. Supp. 2d 1066, 1086-87 (E.D. Cal. 2009); *Muhly v. Espy*, 877 F. Supp. 294, 300 (W.D. Va. 1995).

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

LBP-12-3

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

G. Paul Bollwerk, III, Chair
Dr. Richard F. Cole
Dr. Kenneth L. Mossman

In the Matter of	Docket No. 40-9091-MLA
STRATA ENERGY, INC.	ASLBP No. 12-915-01-MLA-BD01
(Ross In Situ Recovery Uranium Project)	February 10, 2012

MEMORANDUM AND ORDER
(Ruling on Standing and Contention Admissibility)

Strata Energy, Inc., (SEI) has applied to the Nuclear Regulatory Commission (NRC) for a combined source and Atomic Energy Act (AEA) section 11e(2) byproduct materials license pursuant to 10 C.F.R. Part 40 that would authorize SEI to construct and operate an in situ recovery (ISR) uranium project at the Ross site in Crook County, Wyoming. On October 27, 2011, two public interest organizations, the Natural Resources Defense Council (NRDC) and the Powder River Basin Resource Council (PRBRC), hereinafter referred to as Joint Petitioners, together filed a hearing request seeking to intervene in that licensing proceeding to challenge SEI's application, in particular certain aspects of its environmental report (ER). SEI and the NRC staff oppose the petition on the grounds that Joint Petitioners have failed to establish their standing to intervene and have not submitted an admissible contention.

For the reasons set forth below, we find that Joint Petitioners have provided sufficient support to establish their standing "as of right" to intervene in this adjudicatory proceeding and have proffered four admissible contentions. As a consequence, we grant their intervention

petition and outline certain procedural and administrative directives regarding further litigation of the admitted contentions.

I. BACKGROUND

A. SEI's Application and Joint Petitioners' Intervention Request

On January 4, 2011, SEI submitted an application pursuant to 10 C.F.R. Part 40 for a combined source and section 11e(2) byproduct materials license.[1] See Letter from Anthony Simpson, Chief Operating Officer, SEI, to Keith McConnell, Deputy Director, Decommissioning and Uranium Recovery Licensing Directorate, Division of Waste Management and Environmental Protection, NRC Office of Federal and State Materials and Environmental Management Programs (Jan. 4, 2011) at 1 (ADAMS Accession No. ML110120055). SEI proposes to construct and operate an in situ leach recovery facility adjacent to the ranching community of Oshoto in eastern Wyoming. See 1 [SEI], [ER], Ross ISR Project [NRC] License Application, Crook County, Wyoming at 1-8 (Dec. 2010) (ADAMS Accession No. ML110130342) [hereinafter SEI ER].

On July 13, 2011, the Commission published a notice of opportunity to request a hearing and to petition for leave to intervene regarding the licensing proceeding for the Ross ISR project. See [SEI], Ross [ISR] Uranium Project, Crook County, WY; Notice of Materials License Application, Opportunity to Request a Hearing and to Petition for Leave to Intervene, and

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[1] As outlined by the Commission in its decision in Sequoyah Fuels Corp. (Gore, Oklahoma Site), CLI-03-15, 58 NRC 349 (2003), section 11e(2) byproduct material is that material, as defined by AEA section 11e(2), 42 U.S.C. § 2014e(2), that is "the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content." This byproduct material category was created in 1978 by the Uranium Mill Tailings and Reclamation Act to afford the NRC regulatory jurisdiction over mill tailings at active and inactive uranium milling sites. See Sequoyah Fuels, CLI-03-15, 58 NRC at 353-54.

Commission Order Imposing Procedures for Document Access to Sensitive Unclassified Non-Safeguards Information for Contention Preparation, 76 Fed. Reg. 41,308 (July 13, 2011). The notice allowed any person whose interest might be affected by the proposed SEI ISR project to file such a request and petition, in accordance with 10 C.F.R. § 2.309, within sixty days of the notice. Subsequently, in response to a request by Joint Petitioners, the Commission extended the time to file a hearing petition by forty-five days. See Commission Order (Aug. 17, 2011) (unpublished). Joint Petitioners then submitted a hearing request regarding the SEI license application on October 27, 2011. See Petition to Intervene and Request for Hearing by [Joint Petitioners] (Oct. 27, 2011) [hereinafter Intervention Petition]. Acting on an October 31, 2011 referral memorandum from the Secretary of the Commission, on November 2 the Chief Administrative Judge established this Licensing Board to rule on the Joint Petitioners' hearing request and to conduct any hearing as warranted. See Memorandum from Annette Vietti-Cook, NRC Secretary, to E. Roy Hawkens, Chief Administrative Judge, Atomic Safety and Licensing Board Panel, Request for Hearing with Respect to Notice of Opportunity for Hearing Regarding Materials License Application for [SEI] Ross [ISR] Uranium Project, Docket No. 40-9091 (Oct. 31, 2011); [SEI]; Establishment of Atomic Safety and Licensing Board, 76 Fed. Reg. 69,295 (Nov. 8, 2011).

Thereafter, this Board granted a joint request by the participants for additional time to file their respective answers and reply brief. See Licensing Board Memorandum and Order (Initial Prehearing Order) (Nov. 3, 2011) at 2 (unpublished) [hereinafter Initial Prehearing Order]. Adhering to that revised filing schedule, on December 5, 2011, SEI and the staff submitted their answers to the Joint Petitioners' hearing request. See Applicant [SEI's] Response to [Joint Petitioners] Request for a Hearing and Petition to Intervene (Dec. 5, 2011) [hereinafter SEI Answer]; NRC Staff Response to Petition to Intervene and Request for Hearing by [Joint

Petitioners] (Dec. 5, 2011) [hereinafter Staff Answer]. Joint Petitioners followed with their reply to both answers on December 15, 2011. See [Joint Petitioners] Reply to Responses by [SEI] and the NRC Staff to Petition to Intervene and Request for Hearing (Dec. 15, 2011) [hereinafter Joint Petitioners Reply]. In accord with several Board scheduling orders,[2] on December 20, 2011, the Board convened an initial prehearing conference in the Licensing Board Panel's Rockville, Maryland hearing room. During this session, the Board heard oral presentations from the participants regarding the disputed matters of whether Joint Petitioners have established their standing to intervene in this proceeding and the admissibility of their five proffered contentions. See Tr. at 1-175.

B. ISR Process

The technical report (TR) portion of SEI's application describes the ISR process as consisting of two steps: extracting uranium from the underground ore body and processing the recovered solution into yellowcake. See 1 [SEI], [TR], Ross ISR Project [NRC] License Application, Crook County, Wyoming (Dec. 2010) at 1-6 to -7 (ADAMS Accession No. ML110130333). In the first step, an aqueous recovery solution, called lixiviant, is injected into the ore-bearing sandstone via injection wells. The lixiviant solution consists of an oxidant such as hydrogen peroxide or oxygen, a complexing agent such as sodium bicarbonate or carbon dioxide, and native groundwater. As it is pumped through the ore body, the lixiviant oxidizes and dissolves uranium contained in the ore. Recovery wells pump the pregnant (uranium-containing) lixiviant back to the surface.

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[2] Licensing Board Memorandum and Order (Initial Prehearing Conference Directives and Guidance) (Dec. 13, 2011) at 1-2 (unpublished); Licensing Board Memorandum and Order (Scheduling Initial Prehearing Conference; Opportunity for Limited Appearance Statements) (Dec. 8, 2011) at 2 (unpublished); Licensing Board Memorandum (Date for Initial Prehearing Conference) (Nov. 15, 2011) at 1 (unpublished).

At the surface, the pregnant lixiviant undergoes ion exchange at the facility's central processing plant (CPP) to extract the uranium from the lixiviant using a uranium-specific resin. Finally, the uranium is removed from the resin and precipitated into a slurry that is filtered and dried into yellowcake. The lixiviant and resin are then recycled for continued use.[3]

As the SEI ER indicates, the process of constructing and later operating the facility will involve round-the-clock onsite activities, particularly during the construction phase. The construction and operation of the facility also will generate additional traffic (and any associated dust) on the Ross site and on local roads as materials and supplies are brought into the facility and dried uranium yellowcake and waste materials, including section 11e(2) byproduct material, are transported out of the facility for, respectively, further conversion into more enriched products or disposal. See 2 SEI ER at 4-14 to -29, 4-99, 4-105 to -106, 5-58 (ADAMS Accession No. ML110130344).

II. ANALYSIS

A. Joint Petitioners' Standing

1. Standards Governing Standing

For an individual or organization to be deemed a "person whose interest may be affected by the proceeding" under AEA section 189a, 42 U.S.C. § 2239(a)(1)(A), so as to have standing "as of right" such that party status can be granted in an agency adjudicatory proceeding, the

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[3] The ISR process, which sometimes is also referred to as the in situ leach (ISL) process, has been similarly described by other licensing boards. See Powertech (USA), Inc. (Dewey-Burdock In Situ Uranium Recovery Facility), LBP-10-16, 72 NRC __, __-__ (slip op. at 7-8) (Aug. 5, 2010); Crow Butte Res., Inc. (In Situ Leach Facility, Crawford, Nebraska), LBP-08-24, 68 NRC 691, 704 (2008), aff'd in part, rev'd in part, and remanded, CLI-09-9, 69 NRC 331 (2009) [hereinafter Crow Butte II]. The ISL and ISR processes are the same, with ISR being a newer term. See Dewey-Burdock, LBP-10-16, 72 NRC at __ n.28 (slip op. at 7 n.28).

intervention petition must include a statement of (1) the petitioner's name, address, and telephone contact information; (2) the nature of the petitioner's right under the AEA to be made a party; (3) the nature of the petitioner's interest in the proceeding, whether property, financial or otherwise; and (4) the possible effect of any decision or order that might be issued in the proceeding on the petitioner's interest. See 10 C.F.R. § 2.309(d)(1)(i)-(iv). In assessing this information to determine whether the petitioner has established its standing, the Commission generally applies contemporaneous judicial standing concepts in section 189a adjudicatory proceedings, inquiring whether the participant has established that (1) it has suffered or will suffer a distinct and palpable injury that constitutes injury-in-fact within the zones of interest arguably protected by the governing statutes (e.g., the AEA, the National Environmental Policy Act of 1969 (NEPA), 42 U.S.C. § 4321, et seq.); (2) the injury is fairly traceable to the challenged action; and (3) the injury is likely to be redressed by a favorable decision. See Yankee Atomic Elec. Co. (Yankee Nuclear Power Station), CLI-96-1, 43 NRC 1, 6 (1996). An organization that asserts it has standing to intervene in its own right, i.e., organizational standing, must establish a discrete institutional injury to the organization's interests, which must be based on something more than a general environmental or policy interest in the subject matter of the proceeding. See International Uranium (USA) Corp. (White Mesa Uranium Mill), CLI-01-21, 54 NRC 247, 252 (2001). Alternatively, an entity may seek to demonstrate its standing to intervene on behalf of its members, i.e., representational standing, but that entity must then show it has an individual member who can fulfill all the necessary standing elements and who has authorized the organization to represent his or her interests. See Vermont Yankee Nuclear Power Corp. (Vermont Yankee Nuclear Power Station), CLI-00-20, 52 NRC 151, 163 (2000).

Finally, in assessing a petition to determine whether these elements are met, which a presiding officer must do even if there are no objections to a petitioner's standing, there are a number of important benchmarks that we are to apply. Initially, "the petitioner bears the burden to provide facts sufficient to establish standing." PPL Bell Bend, LLC (Bell Bend Nuclear Power Plant), CLI-10-7, 71 NRC 133, 139 (2010). Generally speaking, to meet this burden it is sufficient "if the petitioner provides plausible factual allegations that satisfy each element of standing." U.S. Army Installation Command (Schofield Barracks, Oahu, Hawaii, and Pohakuloa Training Area, Island of Hawaii, Hawaii), LBP-10-4, 71 NRC 216, 229 (2010) (citing Lujan v. Defenders of Wildlife, 504 U.S. 555, 561 (1992)), aff'd, CLI-10-20, 72 NRC __ (Aug. 12, 2010). Moreover, in assessing whether a petitioner has demonstrated its standing, a licensing board is to "construe the petition in favor of the petitioner."[4] Georgia Inst. of Tech. (Georgia Tech Research Reactor, Atlanta, Georgia), CLI-95-12, 42 NRC 111, 115 (1995). At the same time, however, if a petitioner's factual claims in support of its standing are contested, untenable, conjectural, or conclusory, a board need not uncritically accept such assertions, but may weigh those informational claims and exercise its judgment about whether the standing element at issue has been satisfied. See Schofield Barracks, LBP-10-4, 71 NRC at 230 & n.14 (citing Bell Bend, CLI-10-7, 71 NRC at 139; Consumers Energy Co. (Palisades Nuclear Plant), CLI-07-18, 65 NRC 399, 410 (2007); Commonwealth Edison Co. (Zion Nuclear Power Station, Units 1 and 2), CLI-00-5, 51 NRC 90, 98 (2000)).

[4] There is also a precept that a board must afford latitude to a pro se petitioner in considering that petitioner's pleadings, see PPL Bell Bend, LLC (Bell Bend Nuclear Power Plant), LBP-09-18, 70 NRC 385, 396-97 (2009), aff'd on other grounds, CLI-10-7, 71 NRC at 141, which is not a consideration here in that Joint Petitioners are represented by counsel.

We apply these general rules and guidelines in evaluating the Joint Petitioners' standing presentation. Because each of the Joint Petitioners claims standing on the same basis, we consider the Joint Petitioners' standing to intervene together.

2. Ruling on Standing

DISCUSSION: Intervention Petition at 3-8; SEI Answer at 29-44; Staff Answer at 8-13; Joint Petitioners Reply at 2-12; Tr. at 10-51.

RULING: In their initial hearing request, Joint Petitioners provided some information about the activities and interests of NRDC and PRBRC and their members that suggest they might be seeking organizational intervention status. See Intervention Petition at 3-4, 8; see also id. Declarations at 1-2 (Declaration of Linda Lopez (Oct. 20, 2011) (on behalf of NRDC)); id. at 3-5 (Declaration of Wilma Tope (Oct. 24, 2011) (on behalf of PRBRC)).[5] Their counsel represented at the December 20 oral argument that this was indeed the case. See Tr. at 11. It is apparent, however, that for both of these organizations, the general environmental and policy interests that they champion -- the former on a national level and the latter on a more regional/local basis -- and that they assert could be degraded or impaired by the licensing action at issue here are "of the sort [that] repeatedly have [been] found insufficient for organizational standing." White Mesa, CLI-01-21, 54 NRC at 252; see Cogema Mining, Inc. (Irigaray and Christensen Ranch Facilities), LBP-09-13, 70 NRC 168, 191 (2009) (concluding PRBRC lacks organizational standing).

[5] In citing these declarations, as well as the other declarations provided in support of Joint Petitioners' hearing request, we will reference the comprehensive "Bates" numbering that is provided for all the declarations attached to their intervention petition rather than the numbering for the particular declaration.

As a consequence, any demonstration of standing by Joint Petitioners will have to be on the basis of their claims regarding representational standing.[6] To this end, they rely on the declaration of a single individual, Pamela Viviano, who claims, among other things, membership in both NRDC and PRBRC and states that those organizations are authorized to represent her interests in this proceeding. See Intervention Petition, Declarations at 6 (Declaration of Pamela Viviano (Oct. 21, 2011)) [hereinafter Viviano Declaration].

In a materials licensing action, for the purpose of ascertaining if a hearing requestor has standing based on radiological impacts, "whether a petitioner could be affected by the licensing action must be determined on a case-by-case basis, taking into account the petitioner's distance from the source, the nature of the licensed activity, and the significance of the radioactive source." Schofield Barracks, CLI-10-20, 72 NRC at __ (slip op. at 3) (footnote omitted). And the standing regime to which we must look in the first instance is whether, in lieu of the usual injury and causation showings, the petitioner has been able to establish "promixity plus" by showing "(1) that the proposed licensing action involves a 'significant source' of radiation, which has (2) an 'obvious potential for offsite consequences.'" Id. at __ (slip op. at 3-4) (footnote omitted) (quoting Sequoyah Fuels Corp. (Gore, Oklahoma Site), CLI-94-12, 40 NRC 64, 75 n.22 (1994)). If these elements of proximity-based standing are not demonstrated, then standing must be established according to traditional standing principles

[6] In their hearing petition, Joint Petitioners represent that their organizations have members who have visited and plan to visit the Devils Tower National Monument, which is some ten miles from the proposed Ross facility, and are interested in preserving the site's viewshed and aesthetic integrity. See Intervention Petition at 8. To the extent this assertion is intended as an additional basis for Joint Petitioners' organizational standing claim, it provides no information that would bolster any effort to establish such standing. Alternatively, if this claim is intended as a basis for representational standing, it lacks the necessary supporting declarations from the unnamed members identifying themselves, outlining their interests, and authorizing Joint Petitioners to represent them in this proceeding. See Palisades, CLI-07-18, 65 NRC at 409.

that, along with the usual showing of redressability, require a specific showing of injury and causation. See id. at __ (slip op. at 4); see also Exelon Generation Co. (Peach Bottom Atomic Power Station, Units 2 and 3), CLI-05-26, 62 NRC 577, 581 (2005).

Before us, Joint Petitioners have made no attempt to establish that any “promixity plus” presumption should be applicable to the licensing action they are challenging. See Crow Butte Res., Inc. (North Trend Expansion Project), LBP-08-6, 67 NRC 241, 272-73 (2008), aff'd as to ruling on standing, CLI-09-12, 69 NRC 535, 544-48 (2009) [hereinafter Crow Butte I]. As a consequence, we must look to the traditional standing precepts of injury and causation, as well as redressibility, to determine whether Joint Petitioners have made a sufficient factual and legal demonstration regarding their standing to intervene.

Toward that end, relying upon the terms of Ms. Viviano’s affidavit as well as allegations provided in the three technical affidavits submitted as support for Joint Petitioners’ five contentions and the technical and environmental reports accompanying SEI’s application, Joint Petitioners seek to establish that the injury, causation, and redressibility elements of standing have been met. More specifically, Joint Petitioners contend that several different injuries to Ms. Viviano that can be caused by the activities associated with the proposed Ross ISR facility will be redressible if Joint Petitioners are allowed to challenge the requested authorization in this proceeding. In particular, Joint Petitioners claim that impacts arising from aquifer/surface water contamination, traffic and dust, light pollution, and property value decline associated with Ms. Viviano’s residential and investment properties, as well as the cumulative effects of this ISR project and other past and future ISR and non-ISR projects that are in the vicinity of the Ross facility and Ms. Viviano’s residential and investment properties, are more than sufficient to establish their representational standing. On each count, however, SEI and the staff disagree

and assert that Joint Petitioners have failed to establish Ms. Viviano's standing and, concomitantly, their representational standing.

a. Allegations Regarding Aquifer/Surface Water Contamination, Property Value Decline, and Cumulative Impacts Fail to Provide a Basis for Standing

In reviewing the five items upon which Joint Petitioners assert Ms. Viviano's (and their) standing rests, we are skeptical as to whether three -- aquifer/surface contamination, property value decline, and cumulative impacts -- afford Joint Petitioners any support for their representational standing claim. With respect to aquifer contamination, Ms. Viviano in her sworn affidavit indicates that she resides on a ranch approximately ten miles to the northeast of the Ross facility and owns a piece of investment property some seven miles to the southeast of the facility and that these properties have wells with depths of between 300 and 700 feet that provide a potable water supply from the Inyan Kara aquifer.[7] See Viviano Declaration at 6-8. Although the Ross facility will, according to the SEI application, seek to extract uranium from an ore body in the Lance/Fox Hills aquifer that, at the facility site, is approximately 4000 feet above the Inyan Kara aquifer, SEI claims there is at least a 1000 foot layer of impermeable shale (the Pierre Shale) between the Lance/Fox Hills aquifer and the Inyan Kara aquifer.[8] See 1 SEI ER at 3-77 (fig. 3.3-5); see also SEI Oral Argument Exh. 1.[9] Ms. Viviano declares, however, that

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[7] Although Ms. Viviano's affidavit does not specify the name of the aquifer that serves her residential and investment properties, in Joint Petitioners' reply brief and at the oral argument it was acknowledged that the aquifer is the Inyan Kara aquifer. See Joint Petitioners Reply at 6; Tr. at 121.

[8] At the site of Ms. Viviano's properties, the Inyan Kara aquifer lies near the surface. SEI has provided information indicating that by the time the Inyan Kara aquifer has reached the Ross site to the west of her properties, that aquifer has plunged to a depth of some 4000 feet and is overlaid by the Pierre Shale and other strata, including the near-surface Lance/Fox Hills layer. See SEI Answer at 33; see also SEI Oral Argument Exh. 1.

[9] With respect to the SEI oral argument exhibit referenced above, this item, along with (continued...)

she is concerned about contamination of the Inyan Kara aquifer by reason of a connection between these aquifers based on the 5000-plus oil and gas bore holes she maintains exist both within and beyond the Ross project area and extend to depths of six-to-seven thousand feet, many of which she asserts have been improperly plugged and abandoned.[10] See Viviano Declaration at 6, 8; Joint Petitioners Reply at 6 & n.1.

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[9](...continued)
two other so-called "exhibits," were filed by SEI on December 16, four days before the scheduled oral argument. In a submission that accompanied these items, SEI indicated that they "are intended to provide the Licensing Board and all parties appropriate points of reference based on information included in [SEI's] license application when discussing standing and admissible contentions during the course of the scheduled oral argument." Submission of Oral Argument Exhibits (Dec. 16, 2011) at 1. That filing also indicated that "[SEI] has consulted with both [Joint Petitioners] and NRC Staff counsel on this filing and received no objections, although [Joint Petitioners] reserve[] [their] right to object to the substance of the exhibits at a later time." Id. at 2. Just before beginning the participants' oral argument presentations, the Board raised with Joint Petitioners' counsel the question whether they had any objection to the items, which in addition to being submitted electronically were brought into the hearing room on poster boards, and was advised that "[w]e didn't see it until Friday afternoon and we will want to talk about how that exhibit could be interpreted today, which we can do in the course of argument." Tr. at 10. As a consequence, although these items were not admitted as evidentiary exhibits, they were referenced and discussed by the participants and the Board during the argument.

We would add as well that, as was represented by SEI in its December 16 submission, two of the "exhibits" were based upon one or more figures from the SEI ER, albeit with shadings, call-outs, and additional background mapping added for enhancement. See SEI Oral Argument Exh. 1 (based on 1 SEI ER at 3-75 (fig. 3.3-3), 3-76 (fig. 3.3-4), 3-77 (fig. 3.3-5)); SEI Oral Argument Exh. 2 (based on 1 SEI ER at 3-199 (fig. 3.4-1)). This, however, does not appear to be the case relative to a major portion of the third item, which seems to have been created for the argument. See SEI Oral Argument Exh. 3 (windrose figure based on SEI ER addendum 3.6-B, Site-Specific Meteorology and Climatology Data (rev. Feb. 2011) at 21 (fig. 6)) (ADAMS Accession No. ML11321A153), with no ER attribution for map with accompanying callouts).

[10] In her affidavit, Ms. Viviano also indicates she is concerned that the large amounts of water used in the ISR processing and restoration phases will draw down the Fox Hills aquifer and, concomitantly, the aquifers above it. See Viviano Declaration at 7. Whatever relevance this assertion might have relative to Joint Petitioners' contentions, in particular their contention 4, it fails to provide any basis for representational standing since at the Ross site the Inyan Kara aquifer that is the source of water for her properties is located well below the Fox Hills aquifer. See supra n.8; see also 1 SEI ER at 3-77 (fig. 3.3-5); SEI Oral Argument Exh. 1.

In this instance, however, we do not consider dispositive either the SEI claim regarding the impermeability of the intervening shale formation or Ms. Viviano's allegation that the bore hole information upon which she relies would be sufficient to establish the requisite "plausible path" between the Lance/Fox Hills and Inyan Kara aquifers in the vicinity of the Ross site.[11] Rather, we consider important in this context the circumstance that both Ms. Viviano's home and investment properties, located ten and seven miles from the Ross facility, are locations "upgradient of the proposed mining area." Dewey-Burdock, LBP-10-16, 72 NRC at __ (slip op. at 18). Acknowledging that the gradient-induced groundwater flow in the area is from east to west, i.e., away from Ms. Viviano's properties and toward the proposed Ross facility, see Tr. at 17, Joint Petitioners assert that this is not a relevant factor because the issue is not whether her particular wells have the potential to be contaminated, but whether the aquifer from which her wells draw their water will be contaminated, see Tr. at 18.[12] We disagree. As the

[11] Certainly, the question of the extent of possible groundwater contamination as the basis for standing has been the focus of several recent board determinations in ISR licensing cases. For petitioners claiming to be using water from the same aquifer that was to be employed as the uranium ore source, whether living at a distance of one mile or fifty miles from the facility in question, licensing boards have found that a "plausible pathway" connecting the proposed mining operation to their water source has been shown with plausible factual allegations so as to establish the petitioner's standing. See Dewey-Burdock, LBP-10-16, 72 NRC at __ (slip op. at 16); Crow Butte II, LBP-08-24, 68 NRC at 709 & n.77; Crow Butte I, LBP-08-6, 67 NRC at 281-82. On the other hand, when the ore zone and petitioner's water source exist in separate aquifers, the injury/causation question is whether there is an interconnection between these aquifers. In such circumstances, board approaches have been more varied. Although standing has been found in several instances, see Crow Butte II, LBP-08-24, 68 NRC at 708-10; Crow Butte I, LBP-08-6, 67 NRC at 278-80, 282-84, 288-89, one board concluded that the circumstances involved did not support a determination that the petitioners had established their right to intervene, see Dewey-Burdock, LBP-10-16, 72 NRC at _-_ (slip op. at 16-18).

[12] In this regard, although Joint Petitioners had access to three individuals with academic and professional qualifications in the areas of hydrology, geology, and biochemistry, see Intervention Petition, Declarations at 11 (Declaration of Robert E. Moran on Behalf of [Joint Petitioners] (Oct. 24, 2011)) [hereinafter Moran Declaration]; id. at 69-72 (Declaration of Dr. Ronald L. Sass on Behalf of [Joint Petitioners] (Oct. 25, 2011)) [hereinafter Sass Declaration];

(continued...)

Dewey-Burdock board observed, when petitioners "considerably upgradient of the mining area . . . fail to explain how contaminated material from the [ISR] site might plausibly enter their drinking water, they fail to demonstrate they fulfill the causation element necessary to establish their standing." Dewey-Burdock, LBP-10-16, 72 NRC at __ (slip op. at 18).[13] And this is particularly so when, as is the case in this instance, the challenged allegation lacks any relevant scientific or technical support.[14] See Schofield Barracks, LBP-10-4, 71 NRC at 230 n.14.

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[12](...continued)
id. at 105-06 (Declaration of Dr. Richard Abitz on Behalf of [Joint Petitioners] (Oct. 23, 2011)) [hereinafter Abitz Declaration], the focus of their supporting experts' affidavits is contamination at the Ross facility site, with no specific mention of the possibility of, or mechanics that might be involved in, water contamination at the site of Ms. Viviano's wells that are upgradient and some miles away from the proposed Ross facility.

[13] Admittedly, our determination here may raise concerns about a "slippery upslope" to the degree our decision, in conjunction with the Dewey-Burdock ruling, could be construed to suggest that a petitioner with a well located on property upgradient of an ISR facility cannot be found to have standing relative to that facility based on potential groundwater contamination. This is not the case. Of course, as would be the situation with a petitioner located downstream from such a facility, see Crow Butte I, LBP-08-6, 67 NRC at 288-89 (standing found for petitioner fishing river sixty miles downstream from proposed ISR facility expansion alleged to allow drainage into river from operations), a petitioner situated downgradient might be able to provide a less exacting explanation to establish the plausibility of the possible harmful waterborne impacts asserted to establish its standing. So too, a petitioner whose property is upgradient but nonetheless located in close proximity to a proposed ISR facility may be able to establish its plausible pathway with a less particularized showing. See id. at 281 (petitioner with well within 1.5 miles of proposed facility expansion boundary found to have standing). But as the distance increases from the ISR facility, the petitioner with an upgradient water source must expect that it will be called upon to deal with the factual circumstances that exist and provide the board with some analysis, which is missing in this instance, as to how any contamination will come to affect any wells alleged to be impacted by the facility, given the distance involved. See Dewey-Burdock, LBP-10-16, 72 NRC at __ (slip op. at 14).

[14] Although Joint Petitioners' technical experts certainly do suggest that the various oil and gas bore holes may have provided a mechanism for interconnection of the Lance/Fox Hills and Inyan Kara aquifers, they provide nothing that addresses the question of how, given their upgradient location, see supra p. 13, Ms. Viviano's particular wells might be affected via such an interconnection. The same is true for the map depicting oil and gas wells greater than 4600 feet provided as an attachment in support of Joint Petitioners' reply pleading, see Joint Petitioners Reply attach. 1, which denotes the closest oil and gas wells as being approximately four miles and six miles to the west of Ms. Viviano's residential and investment properties,
(continued...)

Moreover, in our estimation the same result appends to the question of surface water contamination, which has played a significant role in standing determinations in recent ISR cases as well. See, e.g., Crow Butte I, LBP-08-6, 67 NRC at 284-87. In her declaration, Ms. Viviano does state that contaminated leach solution spills, leaks, and excursions "could cause contamination of our well water, as well as the surface waters that run northeast from the mining area." Viviano Declaration at 7. Unrefuted, however, is information from SEI indicating that Ms. Viviano's residential and investment properties either are (1) not downstream from the Little Missouri River that receives any surface water flow from the vicinity of the Ross facility; or (2) located in a totally different river basin from the Ross project. See SEI Answer at 36; see also 1 SEI ER at 3-199 (fig. 3.4-1); SEI Oral Argument Exh. 2. Thus, to the degree her otherwise unexplained statement was intended to imply that surface water contamination from the facility will reach her properties, it fails to establish the requisite plausible pathway.

Regarding the matter of a possible decline in property values for Ms. Viviano's residential and investment properties, in her affidavit Ms. Viviano states that

> another potential impact is that the value of [our residential] property will drop, due to the close proximity of a uranium operation . . . , [or] the pool of potential buyers could shrink, as many people are not willing to buy close to a uranium operation. Therefore, we could suffer a negative financial impact from reduced property values due to the proposed site.

Viviano Declaration at 8. She expresses similar concerns about her investment property, particularly given the importance of an uncontaminated "working well" in maintaining the property's value, also asserting that "[a] loss of value in this property will result in the loss of much of our invested retirement money, and thus cause us a great deal of economic hardship for our future retirement." Id. Joint Petitioners maintain that these assertions about loss of

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[14](...continued) respectively.

property values are sufficient to establish Ms. Viviano's standing in this proceeding so as to allow them, as her representative, to litigate all their proffered contentions.[15]

In our view, however, what is necessary is a showing from the petitioner (or the individual it seeks to represent) that the purported economic loss has some objective fundament, rather than being based solely on the petitioner's (or affiant's) perception of the economic loss in light of the proposed licensing action. See Pac. Gas & Elec. Co. (Diablo Canyon Power Plant Independent Spent Fuel Storage Installation), LBP-02-23, 56 NRC 413, 432 (generic, unsubstantiated claims regarding health, safety, and property devaluation impacts are insufficient to establish standing), aff'd, CLI-03-1, 57 NRC 1 (2003). This nonsubjective showing could, for example, be provided by demonstrating the value of property at a comparable distance from another ISR facility had dropped from what it was prior to the submission of a license application. Alternatively such a showing might be based on actual sales/offers before and after the licensing proposal at issue in the proceeding, or by providing the declaration of a local realtor or property appraiser who furnishes an independent assessment of the property's value before and after the licensing action was proposed before the agency.[16] Nothing like this is included in Ms. Viviano's affidavit or with Joint Petitioners'

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[15] In so doing, Joint Petitioners acknowledge the existing case law that standing claims based on economic impacts, such as Ms. Viviano's, are only cognizable in agency proceedings with regard to NEPA-based concerns. See Tr. at 19-20; see also Houston Lighting & Power Co. (Allens Creek Nuclear Generating Station), ALAB-582, 11 NRC 239, 242 (1980) (citing Tennessee Valley Auth. (Watts Bar Nuclear Plant, Units 1 and 2), ALAB-413, 5 NRC 1418, 1420-21 (1977)).

[16] A more subjective appraisal of declining property values might be permissible in, for instance, the context of a licensing action associated with an applicant or facility shown to have engaged in a "continuous and pervasive" course of illegal conduct. Friends of the Earth, Inc. v. Laidlaw Environmental Services (TOC), Inc., 528 U.S. 167, 184 (2000). Nothing presented to us in this instance, however, provides a plausible ground for permitting an otherwise unsubstantiated assessment of property values to establish the basis for Ms Viviano's (and Joint Petitioners') standing.

other filings. As such, in this instance we cannot accord Ms. Viviano, or Joint Petitioners as her representatives, standing based on economic loss.

Also unavailing is Joint Petitioners' assertion of standing based on cumulative impacts. Joint Petitioners made no claims about the cumulative impacts of the Ross facility relative to other past, present, and future local ISR and non-ISR facilities as a grounds for standing in their initial hearing petition. But in the wake of the staff's acknowledgment in its answer that, in staff's estimation, at least portions of Joint Petitioners' contentions 4 and 5 regarding cumulative impacts are admissible as they relate to what SEI has indicated is a proposed future Lance District expansion of the Ross Project facility, Joint Petitioners in their reply brief also proffer these impacts as a potential standing basis. Compare Intervention Petition at 3-8 with Joint Petitioners Reply at 6-10. Although both SEI and the staff contend that a concern about NEPA-related cumulative impacts cannot be a basis for standing, see Tr. at 33-34, 41-44, even if we assume cumulative impacts can be the basis for standing, there is still a significant problem with Joint Petitioners' attempt to interpose such impacts as grounds for standing here. Nothing in Ms. Viviano's affidavit indicates she has a concern that she will suffer any harm relative to purported cumulative impacts associated with any past, existing, or proposed ISR or non-ISR facilities.[17]

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[17] In her affidavit, Ms. Viviano does make reference to a "long history of spills, leaks, and excursions of the contaminated leach solutions" at ISR sites in Wyoming, Nebraska, and Texas, and a concern about groundwater restoration at undesignated ISR sites in Wyoming, as well as about aquifer depletion at otherwise undesignated ISR sites. Viviano Declaration at 6-8. These claims regarding the ISR process are much too imprecise to provide an appropriate basis for standing relative to any purported cumulative impacts on Ms. Viviano or her properties. So too, her claims regarding the impact of oil and gas drilling bore holes, see id. at 6-7, are associated with her particular concerns about contamination of the Inyan Kara aquifer rather than any cumulative impacts.

b. Allegations Regarding Traffic and Dust and Light Pollution Do Provide a Basis for Standing

While Joint Petitioners' showings regarding aquifer/surface water contamination, property value decline, and cumulative impacts fail to establish Ms. Viviano's, and thus Joint Petitioners', standing, Joint Petitioners' assertion regarding standing based upon the discussion in Ms. Viviano's affidavit about traffic and dust proves to be more fruitful. In this regard, Ms. Viviano's affidavit states:

> Another potential negative impact from this site would be the increase in traffic on our road during the construction of the site and the operational phase. These roads are dirt and gravel, and any traffic results in a dust problem. The increased traffic would cause a health hazard to us and to all those with homes along these roads.

Viviano Declaration at 8. As this statement makes apparent, the concern expressed relates to the possibility of dust from increased traffic associated with construction or operation of the site as it relates to those, including Ms. Viviano, with homes along the roads that might experience such traffic.[18] In their reply brief, Joint Petitioners further assert that while SEI and the staff claimed that Ms. Viviano's residence is too far from the Ross project to suffer any real impact, this

> ignore[s] the fact that a number of unpaved roads in the project vicinity may see substantially increased traffic, including D Road and New Haven Road (or Oshoto County Road). These roads connect Ms. Viviano's property to the nearby towns of Gillette and Moorcroft, and she uses them regularly to come to and from her property. The proposed Ross Project will likely increase traffic

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[18] Joint Petitioners hearing request describes this concern as outlined in Ms. Viviano's affidavit as "increased traffic and dust (along with health problems that may result from dust)." Intervention Petition at 6. And notwithstanding Ms. Viviano's expressed concern about "all those with homes along these roads," Viviano Declaration at 8, our concern in making a standing determination is with the impact on Ms. Viviano, who is the only person that has provided information indicating she has given authorization to Joint Petitioners to represent her interests. See supra n.6.

> and dust on the these roads, and Ms. Viviano will suffer injury as a result.

Joint Petitioners Reply at 5.

A descriptive shortcoming exists with respect to Joint Petitioners' reply brief suggestion that Ms. Viviano, by reason of driving in the vicinity of the Ross facility, will incur negative health impacts from fugitive dust. Ms. Viviano's affidavit says nothing about any concern she might have regarding harmful impacts that relate to her driving near the facility. And while a petitioner has some latitude to supplement or cure a standing showing in its reply pleading, any additional arguments should be supported by either the declaration that accompanied the original hearing request or a supplemental affidavit. See South Carolina Elec. & Gas Co. (Virgil C. Summer Nuclear Station, Units 2 and 3), CLI-10-1, 71 NRC 1, 7 (2010) (reply pleading and supplemental declarations appropriately clarified original affidavits). In this instance, however, Ms. Viviano's only affidavit makes no mention of her driving in the vicinity of the facility,[19] or of any harm from

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[19] Although it was suggested at the oral argument in support of this reply brief assertion that the county roadways to the west of Ms. Viviano's residence that run past the Ross facility are Ms. Viviano's "only way to access I-90, which is to the south," Tr. at 12, given where Ms. Viviano lives, this does not account for the availability of a route from her residence to the east that eventually goes south out of Hulett to I-90, see Tr. at 14. In any event, we have no allegations from Ms. Viviano indicating whether, and to what extent, she utilizes either of these routes.

such an activity,[20] so as to provide support for Joint Petitioners' representational standing on the basis of contacts by Ms. Viviano with the Ross project area.[21]

The same is not true for Ms. Viviano's assertion that a standing-cognizable dust impact will occur relative to increased traffic on the dirt road that abuts her residential property. While acknowledging that traffic along certain local roads will increase in both the construction and operational phases of the Ross facility, see 2 SEI ER at 4-18 to -19, the SEI ER also indicates that this traffic during construction and operations, particularly truck traffic, is likely to generate fugitive dust and that various dust mitigation measures will need to be implemented, including (1) speed limits for SEI employees and contractors traveling to and from the facility on local access roads; (2) strategically-placed dust control water loadout facilities within the Ross project

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[20] Although a nonspeculative showing regarding increased traffic accidents could be another impact of increased road usage that might establish standing, see White Mesa, CLI-01-21, 54 NRC at 253, this concern was not raised in Ms. Viviano's affidavit or Joint Petitioners' filings. Moreover, while fugitive dust generated onsite at a facility, particularly during construction, can be a concern in the vicinity of a facility, see AREVA Enrichment Servs., LLC (Eagle Rock Enrichment Facility), LBP-11-26, 74 NRC __, __-__ (slip op. at 58-68) (Oct. 7, 2011), Ms. Viviano's declaration makes no mention of fugitive dust impacts from the facility (as opposed to dust from facility-related traffic using the road that she asserts goes by her property). Further, although disputing whether wind direction data provided by SEI, which shows that at Oshoto for a one-year period between January 2010 and January 2011 the prevailing winds were not in the direction of either of Ms. Viviano's properties, accurately reflects the actual situation on a daily, monthly, and seasonal basis, see Tr. at 47 (discussing SEI Oral Argument Exh. 3), Joint Petitioners have provided us with no grounds, other than the generally windswept nature of eastern Wyoming, that suggest fugitive dust from the Ross facility will have a health and safety impact on Ms. Viviano's investment or residential properties that are at least seven miles away from the Ross facility.

[21] During the December 20 oral argument, Joint Petitioners referred several times to the possibility of submitting supplements to support various claims. See Tr. at 14, 22, 48. The time for such supplementation, however, was when Joint Petitioners submitted their reply brief. While the seven days generally afforded a petitioner to file its reply under the agency's rules of practice, see 10 C.F.R. § 2.309(h)(2), is relatively short, the impact of this abbreviated time frame was mitigated somewhat in this instance by the participants' agreement regarding the schedule for their post-hearing petition filings that afforded additional time both to SEI and the staff to file their answers to Joint Petitioners' hearing request (fourteen additional days) and to Joint Petitioners to file their reply (three additional days). See Initial Prehearing Order at 2.

area's access roads; (3) use of dust suppression chemicals; and (4) selection of road surface materials that will minimize fugitive dust. See id. at 4-89 to -90, 4-91, 4-93, 5-58 to -59, 5-60 to -61. Thus, notwithstanding the claims of SEI and the staff to the contrary, see Tr. at 30-32, 37-40, the health-impact potential of facility traffic-associated dust, if properly pled, could provide a basis for standing. Cf. White Mesa, CLI-01-21, 54 NRC at 253 (given facility produces wet sludge, allegations regarding dust impacts associated with driving past milling facility on a daily basis are unfounded conjecture).

And in that regard, we recognize that despite the fact the ER makes no mention of any traffic increase to the northeast via the dirt New Haven Road,[22] the road that eventually goes past Ms. Viviano's residence before heading to the southeast (as County Road 105) toward the town of Hulett (estimated 2009 population 516, see id. at 3-378 (tbl. 3.10-1)),[23] we cannot say that it is implausible that the proposed Ross facility will generate some increase in traffic via this northeast route in the form of trucks or workers' passenger vehicles. This, in combination with Ms. Viviano's unrebutted averment that "any traffic results in a dust problem" on the road abutting her property and the Commission's admonition to "construe the petition in favor of the petitioner," Georgia Tech Research Reactor, CLI-95-12, 42 NRC at 115, is, in our view,

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[22] That the New Haven Road is, in fact "dirt and gravel" as Ms. Viviano asserts, is apparent from the 2011-12 American Automobile Association Wyoming/Colorado roadmap. See 10 C.F.R. § 2.337(f)(1).

[23] The SEI ER only indicates that the traffic increase associated with the Ross project, which the ER acknowledges could be three-fold during construction, is anticipated to be on the portions of the New Haven Road (County Road 164) and the D Road (County Road 68) going south from the facility, toward the east/west-running Interstate 90 and the cities of Moorcroft and Gillette (estimated 2009 populations 926 and 28,726, respectively, see 2 SEI ER at 3-378 (tbl. 3.10-1)). See id. at 4-18 to -20, 4-31 to -32 (tbls. 4.2-1 & 4.2-2).

sufficient to establish the injury and causation elements necessary to afford Ms. Viviano standing relative to this dust impact claim.[24]

The other purported harm outlined in Ms. Viviano's affidavit that we conclude is sufficient to establish her standing is the possibility of light pollution. In her declaration she states that "lights from operating [the Ross facility] on a 24[-]hour schedule could interfere with the clear views of the night skies that we now enjoy."[25] Viviano Declaration at 8. And as is the case with fugitive dust, light pollution is a matter of concern as a proposed nuclear materials facility undergoes agency licensing review. See Eagle Rock, LBP-11-26, 74 NRC at __-__ (slip op. at 101-02). Indeed, the SEI ER analysis of potential visual and scenic resources notes the possibility of lights associated with the facility creating a visual impact at night and discusses mitigation measures to address such impacts on eleven residences that lie within a two-mile visual resource study area surrounding the proposed facility. See, e.g., 2 SEI ER at 3-348, 4-106, 5-58 (during wellfield construction, nighttime operation of lighted drill rigs is possible, increasing the potential for visual impact, which can be mitigated by minimizing nighttime drilling, turning any lights away from nearby residences, and restricting proximity of

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[24] We would add that Ms. Viviano's averment that the environmental contentions proffered by Joint Petitioners will better position the agency to "fully review the possible impacts of [SEI's] proposed ISL mining and milling project and based on [Joint Petitioners] and their experts' information, may address concerns and mitigate impacts to our water, land, and other resources," Viviano Declaration at 8-9, is an assertion that is sufficient to fulfill the redressibility element of the standing requirement in a case such as this in which environmental/NEPA-related matters are raised by the petitioners. See Detroit Edison Co. (Fermi Nuclear Power Plant, Unit 3), LBP-09-16, 70 NRC 227, 242-43, aff'd, CLI-09-22, 70 NRC 932 (2009).

[25] Ms. Viviano's affidavit makes no mention of light pollution relative to her investment property. See Viviano Declaration at 8. Also, although the visual impact of the Ross facility upon the Devils Tower National Monument, located some eleven miles to the east of the facility, see 1 SEI ER at 3-18 (tbl. 3.1-6), is the subject of one of Joint Petitioners' contentions, see section II.B.2.e infra, the visual impact of the facility at Devils Tower is not an asserted basis for Ms. Viviano's standing.

rigs to residences). Relative to Ms. Viviano's concern, however, in its answer SEI declares that Ms. Viviano's showing in this regard is deficient because she fails to provide anything to support the supposition in her affidavit that the facility would generate enough light to cause an impact at her property or to account for the regional topography, which precludes her from seeing the facility from her residence. See SEI Answer at 43-44; see also Staff Answer at 12; SEI Oral Argument Exh. 3.

In this instance, we do not find Joint Petitioners' failure to challenge the applicant's showing that the Ross facility is not visible from Ms. Viviano's property is a fatal deficiency relative to her standing, given the fact that, as anyone knows who has ever seen a search light sweeping the night sky, light pollution can still be observed from a source that is out of the line of sight. Nor do we find dispositive the assertion that the lack of a particularized showing that Ross facility-generated light can be viewed from her property establishes the lack of plausibility for her claim about visual impacts on her property given (1) the SEI ER's acknowledgment that this facility located in the relatively flat and unpopulated confines of eastern Wyoming will have a visual impact that includes night illumination; and (2) the Commission's admonition to "construe the petition in favor of the petitioner," Georgia Tech Research Reactor, CLI-95-12, 42 NRC at 115. Under these circumstances, we consider her showing adequate to establish her standing.[26]

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[26] In fact, what is most disconcerting with regard to Joint Petitioners' attempt to establish this visual impact as an adequate grounds for standing is Ms. Viviano's statement in her affidavit that "the skies in our area are free of any lights, as the closest town of approximately 400 people is over 10 miles away." Viviano Declaration at 8. SEI suggested during oral argument that the town of Hulett referred to by Ms. Viviano in her affidavit actually is at a distance of less than eight miles from her residence, see Tr. at 29, a claim that appears to be borne out by Google Maps and Mapquest searches of the distance from her address (as provided in her affidavit) to Hulett. See 10 C.F.R. § 2.337(f)(1). Based on the information now before us, it is not clear to the Board how Hulett, with its lighted residences and retail businesses that seemingly are two miles closer to the east, apparently produces no discernable (continued...)

Thus, although the issue of standing is a close one, we conclude Ms. Viviano's allegations regarding dust and traffic and light pollution are sufficient to provide a basis for deeming her a "person whose interest may be affected" by this proceeding in accord with AEA section 189a.[27] This, in turn, provides the grounds by which Joint Petitioners, as her

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[26](...continued)
light pollution at her residence. Nonetheless, given we have no particulars about the light emissions from either Hulett to the east or the Ross industrial facility to the west (with whatever light mitigation measures it might employ), we do not consider this sufficient to vitiate fatally the sufficiency of her light pollution-based standing showing.

[27] Given the latitude afforded the agency to define who is an "affected person" within the meaning of AEA section 189a, 42 U.S.C. § 2239(a), see Calvert Cliffs 3 Nuclear Project, LLC (Calvert Cliffs Nuclear Plant, Unit 3), CLI-09-20, 70 NRC 911, 917 n.27 (2009), and the challenge a petitioner generally would have in establishing "proximity plus" or traditional standing relative to aerial and groundwater releases, it does not seem untoward for the Commission to consider adopting, at least for the initial construction/operation authorization of major nuclear material facilities, including uranium recovery (e.g., ISR mining) and fuel cycle (e.g., uranium conversion/enrichment and fuel fabrication) sites, a standing regime that mirrors the one applicable to the construction/operation of power reactor facilities by which persons living or having substantial contacts within a fifty-mile radius of the facility are afforded standing, see id. at 916-17. There does not appear to be a "standing zone" for major materials facilities that is readily analogous to the reactor fifty-mile zone, which (perhaps not surprisingly) encompasses roughly the emergency planning zone intended to address pathways associated with the ingestion of contaminated water or food, see NRC & Federal Emergency Management Agency, Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants, NUREG-0654/FEMA-REP-1, at 10-17, 5-3 (rev. 1 Nov. 1980), available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0654/r1/. Nonetheless, some past actions by the staff in the context of materials licensing environmental justice (EJ) assessments suggests this task is not necessarily impractical. See Policy Statement on the Treatment of [EJ] Matters in NRC Regulatory and Licensing Actions, 69 Fed. Reg. 52,040, 52,047-48 (Aug. 24, 2004); Office of Nuclear Material Safety and Safeguards, [NRC], NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs at C-4 (2003) [hereinafter NUREG-1748]. A reasonable distance from these major materials facilities could be established, perhaps a radius of as much as twenty miles, within which anyone living or having substantial contacts would be afforded standing, assuming the individual provided an affidavit or other supporting information establishing his or her residential location or significant contacts within that area, in addition to any other required standing prerequisites under section 2.309(d)(1) and applicable agency case law. As is the case with reactors, having such a standing zone for major nuclear materials facilities would avoid the need to engage in a detailed review of allegations about possible plausible pathways for radiological or other impacts. For materials facilities, this is likely to stave off the parsing of items, such as
(continued...)

acknowledged representatives, can establish their standing in this particular ISR facility licensing proceeding.

B. Admissibility of Joint Petitioners' Contentions

With Joint Petitioners having established their standing, we turn to the question of the admissibility of their five proffered contentions.[28]

1. Contention Admissibility Standards

Section 2.309(f)(1) of the Commission's rules of practice specifies the requirements that must be met if a contention is to be deemed admissible. Specifically, a contention must provide (1) a specific statement of the legal or factual issue sought to be raised; (2) a brief explanation of its basis; (3) a concise statement of the alleged facts or expert opinions, including references to specific sources and documents, that support the petitioner's position and upon which the petitioner intends to rely at hearing; and (4) sufficient information demonstrating that a genuine dispute exists in regard to a material issue of law or fact, including references to specific portions of the application that the petitioner disputes, or in the case when the application is alleged to be deficient, the identification of such deficiencies and supporting reasons for this belief. See 10 C.F.R. § 2.309(f)(1)(i), (ii), (v), (vi). In addition, the petitioner must demonstrate that the issue raised in the contention is both "within the scope of the proceeding" and "material to the findings the NRC must make to support the action that is involved in the proceeding." Id.

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[27](...continued)
belowground hydrologic routes or aboveground dust or light pollution, that are, in the best of circumstances, difficult to plot with precision.

[28] In doing so, we recognize the well-established precept that there is no "contention-based" requirement mandating that to have standing, besides showing that a cognizable injury is associated with a proposed licensing action and that granting the relief sought will address that injury, a petitioner also must establish a link between that injury and the issues it wishes to litigate in challenging an application. See Crow Butte II, CLI-09-9, 69 NRC at 339-40; Yankee Nuclear, CLI-96-1, 43 NRC at 6.

§ 2.309(f)(1)(iii), (iv). Failure to comply with any of these requirements is grounds for dismissing a contention. See Summer, CLI-10-1, 71 NRC at 7 & n.33. As is pertinent to this proceeding, NRC case law has further developed these requirements, as summarized below:

a. Challenges Outside Scope of Proceeding

All proffered contentions must be within the scope of the proceeding as defined by the Commission in its initial hearing notice and order referring the proceeding to the Licensing Board. See 10 C.F.R. § 2.309(f)(1)(iii); Florida Power & Light Co. (Turkey Point Nuclear Generating Plant, Units 3 and 4), CLI-00-23, 52 NRC 327, 329 (2000); Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), ALAB-825, 22 NRC 785, 790-91 (1985). As a consequence, any contention that falls outside the specified scope of the proceeding must be rejected. See Pac. Gas & Elec. Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), CLI-11-11, 74 NRC __, __ (slip op. at 11) (Oct. 12, 2011).

b. Need for Adequate Factual Information or Expert Opinion

It is the petitioner's obligation to present factual allegations and/or expert opinion necessary to support its contention. See 10 C.F.R. § 2.309(f)(1)(v); USEC, Inc. (American Centrifuge Plant), CLI-06-10, 63 NRC 451, 457 (2006). While a board may appropriately view a petitioner's supporting information in a light favorable to the petitioner, failure to provide such information regarding a proffered contention requires that the contention be rejected. See Arizona Pub. Serv. Co. (Palo Verde Nuclear Stations, Units 1, 2, and 3), CLI-91-12, 34 NRC 143, 155 (1991). Neither mere speculation nor bare or conclusory assertions, even by an expert, alleging that a matter should be considered will suffice to allow the admission of a proffered contention. See Fansteel, Inc. (Muskogee, Oklahoma Site), CLI-03-13, 58 NRC 195, 203 (2003). If a petitioner neglects to provide the requisite support for its contentions, it is not within the board's power to make assumptions or draw inferences that

favor the petitioner, nor may the Board supply information that is lacking. See Crow Butte I, CLI-09-12, 69 NRC at 553; Palo Verde, CLI-91-12, 34 NRC at 155. Likewise, simply attaching material or documents as a basis for a contention, without setting forth an explanation of that information's significance, is inadequate to support the admission of the contention. See Fansteel, CLI-03-13, 58 NRC at 204-05.

c. Insufficient Challenges to the Application

All properly formulated contentions must focus on the license application in question, challenging either specific portions of or alleged omissions from the application (including the safety analysis report/TR and the ER) so as to establish that a genuine dispute exists with the applicant on a material issue of law or fact. See 10 C.F.R. § 2.309(f)(1)(vi). Any contention that fails directly to controvert the application or that mistakenly asserts the application does not address a relevant issue will be dismissed. See Crow Butte I, CLI-09-12, 69 NRC at 557; American Centrifuge Plant, CLI-06-10, 63 NRC at 462-63.

2. Joint Petitioners' Contentions

Turning to the admissibility of Joint Petitioners' contentions under these standards, initially we observe that while Joint Petitioners have acknowledged that "this is a NEPA case" and that all of their contentions are challenges to the SEI application based on asserted NEPA-related deficiencies, Tr. at 20, for each contention they have attempted to add an AEA caveat. In an effort to "preserve any future challenges" they may wish to bring under the AEA, Joint Petitioners contend that, given the NEPA-related shortcoming identified in each contention, if the Commission were to issue a license to SEI with that deficiency unresolved, the agency would be violating the AEA's mandate to issue only licenses that are not inimical to the common defense and security and the public health and safety. Intervention Petition at 15-16 (contention 1), 19 (contention 2), 24 (contention 3), 26 (contention 4), and 32 (contention 5).

Such a "bootstrap" approach is neither necessary nor appropriate relative to contentions that Joint Petitioners themselves characterize as firmly footed in NEPA. If Joint Petitioners are unable to prevail under NEPA with respect to the issues they raise in their contentions, then the AEA will not afford them additional solace. Consequently, we consider all these contentions as raising environmental/NEPA issues, and thus we label them and rule upon their admissibility as such, a task to which we turn below. In each instance, we begin by reciting the contention as it is specified in Joint Petitioners' hearing request.

a. Environmental Contention 1: The application fails to adequately characterize baseline (i.e., original or pre-mining) groundwater quality.

CONTENTION: The application fails to comply with 10 C.F.R. § 51.45, 10 C.F.R. Part 40, Appendix A, and NEPA because it lacks an adequate description of the present baseline (i.e., original or premining) groundwater quality and fails to demonstrate that groundwater samples were collected in a scientifically defensible manner, using proper sampling methodologies. The ER's departure from NRC guidance serves as additional evidence of these regulatory violations. NRC, NUREG-1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications, §§ 2.7.1, 2.7.3, 2.7.4 (2003).

DISCUSSION: Intervention Petition at 10-15; SEI Answer at 44-47; Staff Answer at 16-21; Joint Petitioners Reply at 15-18; Tr. at 51-78.

RULING: Admissible, as denominated in Appendix A to this decision, in that this contention and its foundational support are sufficient to establish a genuine material dispute adequate to warrant further inquiry.

The question framed by this contention -- whether NRC regulations and NEPA require a groundwater baseline characterization for an ISR site -- is not new to NRC adjudications. In the Dewey-Burdock ISR proceeding, in admitting a contention raising this issue, the board concluded that the applicant and staff were incorrect in their assertions that such information was not required, particularly the applicant's assertion that 10 C.F.R. § 40.32(e) prohibited the applicant from gathering complete information on baseline water quality. See Dewey-Burdock,

LBP-10-16, 72 NRC at __-__ (slip op. at 63-64). SEI and the staff essentially renew these objections here, with SEI contending (and the staff agreeing) that, regardless of whether the Dewey-Burdock ruling was correct, a subsequent agency rulemaking regarding what are impermissible activities at an ISR site prior to agency authorization to begin "construction" establishes that wellfield development, including the type of water quality assessment being sought by Joint Petitioners, is prohibited. See SEI Answer at 20-21 (citing Licenses, Certifications, and Approvals for Materials Licensees, 76 Fed. Reg. 56,951 (Sept. 15, 2011)); Tr. at 71.

As revised in September 2011, the regulatory provisions involved, section 40.32(e) and the Part 40 definition section, section 40.4, provide, respectively, that grounds for license denial exist if, prior to issuance of a license to possess and use source and byproduct materials for uranium milling, there is "commencement of construction" by an applicant, 76 Fed. Reg. at 56,964 (to be codified at 10 C.F.R. § 40.32(e)). Further, "construction" is defined as

> the installation of wells associated with radiological operations (e.g., production, injection, or monitoring well networks associated with in-situ recovery or other facilities), the installation of foundations, or inplace assembly, erection, fabrication, or testing for any structure, system, or component of a facility or activity subject to the regulations in this part that are related to radiological safety or security. The term ''construction'' does not include:
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> . . . .
>
> (2) Site exploration, including necessary borings to determine foundation conditions or other preconstruction monitoring to establish background information related to the suitability of the site, the environmental impacts of construction or operation, or the protection of environmental values;
>
> . . . .
>
> (9) Taking any other action that has no reasonable nexus to:
> (i) Radiological health and safety, or
> (ii) Common defense and security . . . ,

and "commencement of construction" is defined as

> taking any action defined as ''construction'' or any other activity at the site of a facility subject to the regulations in this part that has a reasonable nexus to:
> (1) Radiological health and safety; or
> (2) Common defense and security . . . .

Id. at 56,963-64 (to be codified at 10 C.F.R. § 40.4 (definitions of "Commencement of construction" and "Construction")).

Both SEI and the staff assert that the only way to gain the type of information needed to establish a groundwater baseline such as Joint Intervenors desire would require drilling wells that would violate these provisions, as well as the dictates of Part 40, App. A, Criterion 7, and the guidance in the staff's standard review plan for ISR applications, NUREG-1569. See SEI Answer at 18-20; Staff Answer at 16-18. On the other hand, Joint Petitioners argue that the combination of (1) the requirement in 10 C.F.R. § 51.45(b) that an ER contain "a description of the environment affected"; (2) Appendix A, Criterion 7's direction to an applicant to furnish "baseline data"; (3) Appendix A, Criterion 5B(5)(a)'s proviso that with regard to subsequent groundwater restoration, a hazardous constituent must not exceed the "background concentration" of that constituent; and (4) the Dewey-Burdock board's rejection of the SEI/staff section 40.32(e) interpretation of "construction" all point to the need now for a baseline water quality assessment of the type SEI has declared it need not prepare, at least until after it receives its license. See Joint Petitioners Reply at 15-18.

In this circumstance, we conclude that the Dewey-Burdock board's resolution of the legal question of the interpretation of "construction" under section 40.32(e) was correct and that the subsequent rulemaking revision did not change this result. In this regard, contrary to the assertions of SEI and the staff, we are unable to conclude that the September 2011 rulemaking has the definitive effect they claim. Indeed, relative to the final rule's language regarding the

"commencement of construction," the statement of considerations accompanying the final rule provides the following colloquy:

> Comment: One commenter states that the proposed regulations fail to state whether the installation of monitoring wells, a significant component of uranium recovery facilities, including in situ leach facilities, is a "construction" activity or is exempted from the definition of "construction."
>
> Response: Installation of monitoring wells that are only intended to be used to collect background data or perform background aquifer testing would be permissible. However, monitoring wells that are part of an ISR wellfield monitoring network would not be permissible because such facilities are necessary to ensure the radiological health and safety of the public and that the licensed facility is operating within standards determined by the NRC; therefore, these wells have a reasonable nexus to radiological health and safety.

76 Fed. Reg. at 56,956-57. While this agency response indicates that drilling monitoring wells that are part of the "wellfield monitoring network" would be considered construction activity, it also states that a monitoring well intended to collect "background data or perform background aquifer testing" would not fall into that category. As a consequence, we agree with the Dewey-Burdock board that, like the petitioners in that proceeding, Joint Petitioners here have framed an admissible contention that has a factual dispute, i.e., the adequacy of the baseline water quality description in the SEI ER and whether SEI must take any additional steps to fulfill its legal responsibility under 10 C.F.R. § 51.45 to provide information in its ER outlining a description of the existing water quality baseline sufficient to enable the staff to prepare its own environmental impact statement. Accordingly, we conclude that this contention should be admitted for further litigation in this proceeding.

b. Environmental Contention 2: The application fails to analyze the environmental impacts that will occur if [SEI] cannot restore groundwater to primary or secondary limits.

CONTENTION: The application fails to meet the requirements of 10 C.F.R. § 51.45 and NEPA because it fails to evaluate the virtual certainty that [SEI] will be unable to restore groundwater to primary or secondary limits.

DISCUSSION: Intervention Petition at 16-19; SEI Answer at 47-49; Staff Answer at 21-23; Joint Petitioners Reply at 18-21; Tr. at 81-110.

RULING: Admissible, as denominated in Appendix A to this decision, in that this contention and its foundational support are sufficient to establish a genuine material dispute adequate to warrant further inquiry.

With this contention, Joint Petitioners allege that when the time comes for the Ross site to cease operations, SEI (or its successor in interest) will be unable to restore the groundwater either to baseline quality (primary) or to drinking water quality (secondary) standards. This is so, according to Joint Petitioners, because no previous ISL/ISR mining operation has been able to restore groundwater to baseline standards and, therefore, Joint Petitioners declare in their contention, it is a "virtual certainty" that SEI will be unable to do so, necessitating an alternate concentration limit (ACL). See Intervention Petition at 16, 17. As a consequence, Joint Petitioners contend that SEI would be required to request that the Commission set an ACL for aqueous contaminants, see 10 C.F.R. Part 40, App. A, Criterion 5B(5)(c). And because restoring groundwater to a quality that is no lower than the ACL would necessarily result in a degradation of groundwater quality from pre-mining baseline conditions, Joint Petitioners assert that the SEI ER must outline the environmental impacts of such an ACL.

SEI disputes this claim that an ACL is inevitable, see SEI Answer at 49; Tr. at 95, 96, with both SEI and the staff also attempting to characterize Joint Petitioners' argument as resting in some fashion on the presumption that SEI will violate NRC regulations, see SEI Answer

at 48; Staff Answer at 22-23, an assumption that the Commission has instructed licensing boards not to make, see, e.g., GPU Nuclear, Inc. (Oyster Creek Nuclear Generating Station), CLI-00-6, 51 NRC 193, 207 (2000). While the latter characterization is flawed, in that SEI would still be in compliance with NRC regulations if it restores the site to an agency-approved ACL, this argument misses the point of Joint Petitioners' allegation. Under the agency's regulations implementing NEPA, the ER is to discuss any "irreversible and irretrievable commitments of resources which would be involved in the proposed action." 10 C.F.R. § 51.45(b)(5). Although, as SEI points out, the water in the aquifer that is the subject of an ISR project is, under the federal exemption and state permitting processes that govern underground injection control projects, unsuitable now or in the future as a source of drinking water, see SEI Answer at 13-18, at the same time the ISR process will further degrade the pre-operational or baseline quality of the water, unless it can be restored. And unless the baseline can be restored, there will be an "irreversible and irretrievable" commitment of a resource the parameters of which must, under NEPA and agency regulations, be outlined in the applicant's ER.

Also questioned by SEI is Joint Petitioners' assertion that an ISL/ISR restoration back to baseline has never occurred, pointing to the example of the Nubeth research and development project, the predecessor to the Ross project at this same site, the restoration of which was, SEI asserts, the subject of final agency action. See 3 SEI Answer at 46. But when contrasted with the supporting statements of Drs. Moran and Abitz regarding the issues and problems with aquifer restoration at the Nubeth project and other ISR projects, see Moran Declaration at 35, 26-28; Abitz Declaration at 11-12, this merely highlights a material factual dispute relative to the participants' positions on this point.

Thus, Joint Petitioners' contention appears to be a candidate for admission. Another challenge remains, however. While NEPA requires that the NRC consider the reasonably

foreseeable environmental impacts of the proposed licensing action, the agency need not consider remote and speculative impacts, particularly if the impact cannot easily be estimated at the current time, and an appropriate future opportunity will exist for the agency to analyze the impact. See Sierra Club v. Marsh, 769 F.2d 868, 878 (1st Cir. 1985). And in this regard, there are two elements that potentially are fatal to the admissibility of Joint Petitioners' contention, i.e., determining the parameters of an ACL, given that such a limitation is generally set as part of the decommissioning process for an ISR facility, and the fact that the sufficiency of any ACL, when requested, can be contested in a future hearing.

To fashion an adequate evaluation of the environmental effects of being able to restore the groundwater quality to an ACL, there would need to be some determination about what that ACL would be.[29] But, as SEI and the staff assert, see Tr. at 92-94, 105, given the differences that exist among well fields, it likely cannot be known at this juncture exactly what alternative concentration will be deemed necessary to protect human health and the environment under the nineteen factors of Appendix A, Criterion 5B(6). Joint Petitioners, on the other hand, suggest that the magnitude of the endeavor could be narrowed to a range of possible ACLs based on the historical experience of other ISL/ISR sites. See Tr. at 83-85. What this essentially calls for is a bounding analysis, something that is not unheard of in the context of NEPA analyses and does not seem untoward in this instance, given the importance of NEPA as a mechanism for providing information regarding the parameters of "irreversible and irretrievable" resource commitments. As such, we do not consider this concern a reason for precluding this contention's admission.

[29] The other factor of importance in such an analysis, the parameters of baseline/current water quality, presumably will be generated in the context of admitted environmental contention 1.

Nor is this contention's admission impeded by the fact that, as both SEI and the staff acknowledge, see Staff Answer at 22 n.43; Tr. at 103, 109-10, SEI will be required to submit a license amendment request to the Commission if it wishes to utilize an ACL. Joint Petitioners then would have an opportunity to petition for a new hearing regarding the sufficiency of the SEI request.[30] But as Joint Petitioners point out, see Tr. at 107-09, the ability of any interested person to obtain an AEA hearing at that point would not provide the relief Joint Petitioners should be able to obtain now, consistent with NEPA, i.e., a public explanation of the impacts of being unable to restore the mined aquifer to primary or secondary baseline and, instead, having to use an ACL, as that alternate limitation might be implemented per a reasonable bounding analysis.

We thus find this contention should be admitted for further litigation in this proceeding.[31]

c. Environmental Contention 3: The application fails to include adequate hydrogeological information to demonstrate [SEI's] ability to contain fluid migration.

CONTENTION: The application fails to provide sufficient information regarding the hydrogeological setting of the area to meet the requirements of 10 C.F.R. § 51.45, 10 C.F.R. Part 40, Appendix A, Criteria 4(e) and 5G(2), and NEPA. The application also runs afoul of NUREG-1569 § 2.6, which provides guidance for complying with the mandatory rules. The application similarly fails to assess the likelihood and impacts of fluid migration to the adjacent surface water and groundwater, as required by 10 C.F.R. § 51.45 and NEPA, and as discussed in NUREG-1569 § 2.7.

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[30] By all appearances, this also would be the point at which the topic of the possible use of new water quality restoration technology, which Dr. Abitz discusses in his declaration, see Abitz Declaration at 12-13, would be appropriately raised in connection with the Ross facility.

[31] In doing so, we emphasize again that, assuming it is properly derived, utilizing an ACL is not a violation of any agency regulation, see supra p. 33, and, as such, this contention is not a vehicle for Joint Petitioners to seek to establish that a satisfactory ACL cannot be adopted or that SEI will be unable to comply with any ACL that might be instituted, matters that would be the subject for any future license amendment proceeding if the use of an ACL is, in fact, proposed by SEI.

DISCUSSION: Intervention Petition at 19-24; SEI Answer at 49-52; Staff Answer at 23-27; Joint Petitioners Reply at 21-24; Tr. at 110-24.

RULING: Admitted in part, as outlined in the discussion below and denominated in Appendix A to this decision, in that a portion of this contention and its foundational support are sufficient to establish a genuine material dispute adequate to warrant further inquiry.

Although we have determined that Joint Petitioners have failed to provide information about a number of asserted impacts associated with the Ross facility, including groundwater and surface water migration, that are sufficient to demonstrate standing relative to Ms. Viviano, see section II.A.2.a supra, our standing findings are not necessarily dispositive of our determination on a contention that raises similar concerns. Thus, we look anew at Joint Petitioners' environmental contention 3, which likewise raises hydrological concerns.

And in doing so, we find, as SEI and the staff assert, that the declarations of Drs. Moran, Sass, and Abitz do not provide support for that portion of this issue statement, i.e., the first two sentences, that challenges the adequacy of the SEI application's analysis of geology/seismology relative to 10 C.F.R. Part 40, Appendix A, Criteria 4(e), 5G(2), and section 2.6 of NUREG-1569. As such, this aspect of the contention lacks sufficient support to show that a genuine dispute exists on a material issue of law or fact. See 10 C.F.R. § 2.309(f)(1)(vi).

On the other hand, we disagree with the SEI and staff claims regarding the inadequacy of Joint Petitioners' hydrology-based challenges to the application, as embodied in the last sentence of the contention. The declarations of Drs. Moran, Sass, and Abitz contain detailed discussions regarding boreholes and aquifer isolation in the immediate vicinity of the Ross facility that raise questions about the groundwater hydrology associated with the site as detailed in the SEI application sufficient to establish a material issue of fact in accord with the pleading

requirements of section 2.309(f)(1)(vi). See Moran Declaration at 15-21; Sass Declaration at 72-74, 78-80; Abitz Declaration at 106-10.

We thus admit this contention, albeit limited to its groundwater hydrology-related aspects outlined in the third sentence of the contention.

d. Environmental Contention 4: The application fails to adequately document negative impacts on groundwater quantity.

CONTENTION: The application violates 10 C.F.R. § 51.45 and NEPA by failing to properly analyze the project's impacts on groundwater quantity. Furthermore, the application presents conflicting information on groundwater consumption, precluding accurate evaluation of the project's impacts in this area.

DISCUSSION: Intervention Petition at 24-26; SEI Answer at 52-53; Staff Answer at 27-28; Joint Petitioners Reply at 24-26; Tr. at 124-36.

RULING: Admitted in part, as denominated in Appendix A to this decision, in that the contention presents a genuine material dispute adequate to warrant further inquiry regarding the ER's analysis of the cumulative impacts of SEI's proposed mining activities at the Ross site and other nearby sites in the Lance District expansion on groundwater quantity.

With this contention and the accompanying supporting explanation, Joint Petitioners question various aspects of the SEI ER discussion regarding groundwater quantity impacts. Specifically, they assert that the ER is deficient because it "fails to analyze how much water will be used by the Ross operations in the long term and instead only offers several partial and conflicting estimates of possible groundwater consumption." Intervention Petition at 25. Additionally, Joint Petitioners state that SEI's proposed additional ISL/ISR facilities in the so-called Lance District expansion area to the north and south of the Ross project will compound the project's effects on groundwater depletion. See id.

Also in this regard, Joint Petitioners' expert Dr. Moran offers specific criticisms of SEI's water use and restoration analysis. He points to two different and unreconciled measures of

water consumption in different parts of SEI's ER. See Moran Declaration at 31-32. Further, Dr. Moran argues that the low annual precipitation in the Ross facility area means that "recharging the aquifers and recovery of local water levels may require much longer periods of time than are predicted in the Application, especially if numerous other ISL projects are approved." Id. at 32.

SEI opposes admission of environmental contention 4, insisting that 10 C.F.R. § 51.45, which governs the contents of the environmental report, does not require the level of detail about groundwater consumption that Joint Petitioners demand. SEI also argues that the hearing petition does not present a sufficient dispute with the sections of the ER discussing groundwater consumption.

In contrast, the staff supports the admission of environmental contention 4 in part, agreeing with Joint Petitioners that the cumulative impact on groundwater quantity of the Ross project, in conjunction with that of SEI's other proposed ISL/ISR operations in the Lance District expansion, must be considered before granting the license.

We find that portion of Joint Petitioners' environmental contention 4 regarding the cumulative impact on groundwater quantity of the Ross project and the planned Lance District expansion satisfies the admissibility requirements of 10 C.F.R. § 2.309. This portion of the contention presents a material dispute with SEI's application that is within the scope of this licensing proceeding. See Dewey-Burdock, LBP-10-16, 74 NRC at __-__ (slip op. at 68-69) (admitting similar contention). Joint Petitioners also corroborate this portion of their contention challenging the SEI ER with expert support. To the extent that SEI disagrees with Joint Petitioners' criticisms of its groundwater analysis, those disagreements are matters to be decided on the merits, not at the contention admissibility stage. On the other hand, we consider all other claims raised by Joint Petitioners in the context of this contention, including concerns about the computer modeling methodology utilized by SEI to calculate groundwater quantity

impacts, inadmissible as lacking sufficient factual or expert support and as failing to establish a material factual or legal dispute. See 10 C.F.R. § 2.309(f)(1)(v), (vi); section II.B.1.b-c supra.

> e. Environmental Contention 5: The application fails to adequately assess cumulative impacts of the proposed action in conjunction with other industrial activities in the area, and fails to evaluate adverse environmental effects resulting from an insufficient decommissioning bond and the disposal of 11e(2) byproduct material. It also does not properly consider impacts to visual resources at the nearby Devils Tower National Monument and improperly tiers to NRC's flawed [generic environmental impact statement (GEIS)] for ISL uranium mining.

CONTENTION: The application violates 10 C.F.R. § 51.45, NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA because it fails to consider cumulative impacts that may result from [SEI's] proposed ISL uranium mining operations in conjunction with oil and gas drilling and other ISL uranium mining operations, all of which exist in the project vicinity and are likely to continue and expand in the foreseeable future. The application also violates these authorities because it does not provide an adequate analysis of the foreseeable impacts and negative environmental effects that will result in the likely event that [SEI's] decommissioning bond is insufficient to achieve its purpose, as well as those impacts related to disposal of 11e(2) byproduct material. Finally, the application violates NEPA because the ER tiers to NRC's flawed and unsupportable GEIS for ISL uranium mining.

DISCUSSION: Intervention Petition at 27-32; SEI Answer at 53-59; Staff Answer at 29-37; Joint Petitioners Reply at 26-32; Tr. at 137-67.

For ease of discussion, we will separate Joint Petitioners' environmental contention 5 into its five component allegations: inadequate cumulative impacts analysis (5A); inadequate decommissioning bond (5B); disposal of section 11e(2) byproduct material (5C); visual impacts at Devils Tower National Monument (5D);[32] and improper tiering to the NRC GEIS for ISL mining (5E).

(i) RULING on Environmental Contention 5A, Inadequate Cumulative Impacts Analysis: Admitted in part, as dominated in Appendix A to this decision, in that the

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[32] Although the title of this contention makes reference to the failure properly to consider the impacts of the Ross facility upon Devils Tower visual resources, the contention itself makes no mention of this matter.

contention and its foundational support, as it relates to cumulative impacts associated with the Lance District expansion, are sufficient to establish a material dispute adequate to warrant further inquiry.

NRC regulations implementing NEPA require the agency to consider the cumulative impacts of a proposed licensing action, i.e., those that result from the incremental effects of the proposed action in conjunction with past, present, and reasonably foreseeable future actions. In particular, the definitions in 10 C.F.R. § 51.14(b) incorporate the CEQ regulations that define the scope of an environmental impact statement (EIS) to include cumulative impacts, see 40 C.F.R. §§ 1508.7, 1508.25(c). To assist the staff with preparing its cumulative impacts analysis, the staff guidance document for environmental reports requests that license applicants include their own cumulative impacts analysis. See NUREG-1748, at 6-4.

SEI and the staff state that license applicants do not have a specific duty under section 51.45 to analyze cumulative impacts in their environmental reports. See SEI Answer at 54; Staff Answer at 29. This claim does not, however, conform with the provisions of Part 51 governing the consideration of "impacts" on the environment, which is to include cumulative impacts.[33] Accordingly, because the staff uses the ER as the basis for its EIS, and because hearing petitioners are required to style their NEPA contentions against the ER, see 10 C.F.R. § 2.309(f)(2), a contention would be admissible if it raises a genuine dispute with the sufficiency of the cumulative impacts analysis, or the lack thereof, in the ER. See, e.g., Progress Energy

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[33] Under 10 C.F.R. § 51.45(b)(1), "impacts" on the environment are to be discussed, and under 40 C.F.R. § 1508.25(c), which is one of the CEQ provisions section 51.45(b) indicates is to be used to implement the NRC's responsibilities under NEPA section 102(2) to prepare an EIS, "cumulative impacts" are included within the scope of the impacts to be assessed. Not surprisingly, therefore, SEI includes in its ER a subchapter on "Cumulative Effects." See 1 SEI ER at 2-17 to -44. The subchapter considers such impacts as transportation, noise, air and water quality, socioeconomic conditions, and past, current, and planned mineral development. The analysis also considers, in varying levels of detail, whether and how the proposed Ross project will interact with other activities in the vicinity of the project.

Florida, Inc. (Levy County Nuclear Power Plant, Units 1 and 2), LBP-09-10, 70 NRC 51, 102 (2009) (admitting cumulative impacts contention relative to applicant's ER), aff'd in part and rev'd in part on other grounds, CLI-10-2, 71 NRC 27 (2010); Southern Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site), LBP-07-3, 65 NRC 237, 258-59 (2007) (same).

In support of their contention, Joint Petitioners lodge three major criticisms regarding the ER with respect to cumulative impacts.[34] First, Joint Petitioners claim that "the ER does not consider the impacts of past activities, including uranium exploration and ISL testing." Intervention Petition at 28. Second, they assert that "the ER does not consider the full cumulative scope of the Ross-Lance project contemplated by [SEI]," because the reasonably foreseeable impacts of the additional satellite facilities that SEI proposes to construct in the Lance District expansion are not adequately analyzed in conjunction with the Ross project. Id. at 28-29. Finally, Joint Petitioners echo their argument from environmental contention 4 that the combined SEI operations will have cumulative impacts on water quantity that are not discussed in the ER and additionally allege that water quality impacts will result from cumulative disposal of liquid waste via deep-well injection. See id. at 29.

Regarding their first claim, Joint Petitioners are incorrect in their assertion that the ER does not consider past ISL/ISR activities. The ER provides a history of prior uranium exploration and testing, see 1 SEI ER at 1-5 to -7, and, as Joint Petitioners' hearing request acknowledges, the ER contains multiple references to the boreholes that remain from prior drilling at the site, see Intervention Petition at 21-23; see also 1 SEI ER at 3-10, 3-47; 2 id. at 4-61 to -63. For its part, SEI states that because the groundwater was restored when the earlier Nubeth research and development (R&D) ISR project was decommissioned, there are no

[34] We note that Joint Petitioners' claim regarding the impacts of other industrial sites in the vicinity of the proposed Ross facility is not footed in EJ concerns.

cumulative impacts with the Ross project, and Joint Petitioners provide nothing to contradict SEI on this score. And while Joint Petitioners' supporting affiant Dr. Moran opines in his declaration that "the application fails to adequately present the true extent of historical exploration drilling, borehole abandonment details, R&D testing, changes to groundwater water quality, and interconnections of geologic strata," Moran Declaration at 12, his declaration contains no alleged facts to support this opinion. Consequently, this claim does not raise a genuine dispute with SEI's application. See Fansteel, CLI-03-13, 58 NRC at 203.

With respect to the scope of SEI's Lance District expansion, SEI states in its ER that it intends to construct and operate additional ISR facilities in the Lance District expansion surrounding the Ross site. See 1 SEI ER at 1-19 to -20, 2-23. SEI indicates that these additional facilities would likely operate as satellites of the Ross facility and would utilize the same CPP that SEI proposes to construct for the Ross project. See id. at 2-23. And with respect to cumulative impacts, SEI states:

> Absent any site-specific features that could preclude development of these other sites (e.g., historical and cultural resources), ISR operations at additional sites likely will result in essentially the same potential impacts analyzed in this ER for the Proposed Action. Development of these sites may act to produce cumulative effects by increasing or prolonging the impacts analyzed for the Proposed Action, but the impacts will be distributed proportionately throughout the region of influence and therefore are not expected to significantly increase the severity of any impact.

Id. Joint Petitioners allege that this discussion is inadequate, particularly with regard to the lack of specificity about SEI's planned satellite facilities, and the potential impacts resulting from the Ross facility's CPP being used for SEI's additional facilities and possibly those of third parties. See Intervention Petition at 28-29. The staff agrees that this portion of the contention is admissible. See Staff Answer at 29-30, 31.

We conclude relative to the matter of cumulative impacts associated with the Lance District expansion that Joint Petitioners have raised a genuine dispute as to the sufficiency of SEI's cumulative impacts analysis, supported by fact and expert opinion, that is material to the findings the NRC must make before granting a license to SEI. Certainly, given the size of the Lance District expansion relative to the Ross permit area, see 1 SEI ER at 1-249 (fig. 1.2-3), and the possible use of the Ross CPP in connection with that expansion, the potential for cumulative impacts seems apparent.

As to the cumulative impacts of SEI's proposed ISR facilities on groundwater quantity, for the reasons outlined in our discussion regarding environmental contention 4 above, see section II.B.2.d supra, this portion of environmental contention 5A likewise is admissible. Regarding the impacts on groundwater quality from liquid waste disposal, Dr. Moran observes that SEI plans to dispose of liquid waste via deep disposal wells into the Deadwood and Flathead formations. See Moran Declaration at 35; 2 SEI ER at 4-66. He does not, however, analyze the cumulative impacts of long-term disposal of that waste along with that of SEI's planned additional facilities and nearby industrial projects that also dispose of liquid waste into these formations. Although SEI did not directly address this deep disposal claim, the staff asserts in response that the groundwater in these formations is already unusable and, therefore, Joint Petitioners do not raise a genuine dispute with the application. See Staff Answer at 31. We disagree, at least insofar as this concern relates to potential impacts associated with the Lance District expansion. Joint Petitioners have put forward a specific criticism of the ER that is material to the question of whether SEI has met its requirement to consider all significant environmental impacts of the proposed action. The staff's objection that there will in fact be no environmental impact is a question for the merits, not one that is relevant to admissibility.

Based on the foregoing, we conclude that environmental contention 5A concerning the cumulative impacts of the full scope of SEI's proposed Lance District expansion project is admissible. Moreover, as we discussed above, see section II.B.2.d supra, we also find admissible a portion of environmental contention 4 that concerns cumulative impacts associated with SEI's present and future Lance District expansion operations on groundwater quantity. As a consequence, we will consolidate with environmental contention 5A that portion of environmental contention 4 that alleges SEI has failed to consider cumulative impacts, with the language of this consolidated environmental contention forth in Appendix A to this decision.

(ii) RULING on Environmental Contention 5B, Inadequate Decommissioning Bond: Inadmissible, in that this contention and its foundational support lack adequate factual or expert support and fail to establish a genuine dispute on a material issue of law or fact. See 10 C.F.R. § 2.309(f)(1)(v), (vi); section II.B.1.b-c supra.

Joint Petitioners base this contention, which asserts that SEI's ER must consider the reasonably foreseeable environmental impacts of its potential failure to finance adequately its decommissioning activities, on the declaration of their expert Dr. Moran. Dr. Moran provides a general critique of the financial assurance calculations of prior ISL facility operators and argues that SEI's "financial assurance calculations should be made by some independent party" and "should also consider the actual reclamation and restoration costs incurred, long-term, from a statistical sampling of the previously-licensed ISL sites." Moran Declaration at 44-45. We note initially that Dr. Moran is a hydrogeologist and geochemist, see id. at 11, and nothing in his declaration indicates that he has expertise with decommissioning bonds, surety arrangements, or financial analysis of any kind. But even putting aside any questions about his qualifications to provide an opinion regarding these financial assurance matters, Dr. Moran does not allege any specific inadequacies in SEI's calculation of the amount of its decommissioning bond.

Moreover, his references to prior problems involving the estimation of decommissioning costs are inadequate to establish a likelihood that the amount of SEI's decommissioning bond will be insufficient. See Crow Butte II, LBP-08-24, 68 NRC at 756 (contention seeking decommissioning bond increase based on Wyoming Department of Environmental Quality directive to applicant's subsidiary to increase surety bond at another ISL facility lacks sufficient support).

This portion of environmental contention 5 thus lacks alleged facts or expert opinion sufficient to support the contention, see 10 C.F.R. § 2.309(f)(1)(v), and fails to show that a genuine dispute exists with the application, see id. § 2.309(f)(1)(vi).

(iii) RULING on Environmental Contention 5C, Disposal of Section 11e(2) Byproduct Material: Inadmissible, in that this contention and its foundational support lack adequate factual or expert support and fail to establish a genuine dispute on a material issue of law or fact. See 10 C.F.R. § 2.309(f)(1)(v), (vi); section II.B.1.b-c supra.

Joint Petitioners claim it is foreseeable that no facility for the disposal of section 11e(2) byproduct material will be available when SEI seeks to dispose of such material. Yet, they provide no alleged facts or expert opinion to support their assertion that the lack of a disposal site is reasonably foreseeable. By contrast, SEI's ER contains a review of the disposal capacity of four existing section 11e(2) byproduct material disposal facilities. See 2 SEI ER at 4-168 to -169. Because Joint Petitioners provide no information to suggest that these facilities will be unavailable, their contention fails as lacking adequate factual and expert support, and as failing to raise a genuine dispute with the application. See 10 C.F.R. § 2.309(f)(1)(v), (vi).

(iv) RULING on Environmental Contention 5D, Visual Impacts at Devils Tower National Monument: Inadmissible, in that this contention and its foundational

support lack factual or expert support and fail to establish a genuine dispute on a material issue of law or fact. See 10 C.F.R. § 2.309(f)(1)(v), (vi); section II.B.1.b-c supra.

Besides a sentence citing section 51.45 as authority for the ER's asserted need to fully address visual and aesthetic impact, Joint Petitioners' hearing request contains only three sentences as the asserted basis for this contention. The first states that SEI "fails to properly consider the visual and aesthetic impacts that the project would have on Devils Tower." Intervention Petition at 31. But this challenge to the adequacy of the ER's visual and aesthetics impacts discussion fails to specify what is inadequate about that ER discussion. Nor do Joint Petitioners provide any factual or expert support for the additional allegation in the basis' second sentence that "[t]he industrial activity at the project site could tarnish the Monument's viewshed" from ten miles away. Intervention Petition at 31. To be sure, in reply to SEI's response that it conducted a full visual and aesthetic impacts discussion,[35] see SEI Answer

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[35] For its part, the staff notes that in the ER's visual impacts assessment, the ER specifically mentions the Devils Tower monument, declaring that "'[t]he proposed project area is not visible from the visitor's center or hiking trails around the monument.'" Staff Answer at 35 (quoting 2 SEI ER at 4-105). While this ER statement, which is not specifically contested by Joint Petitioners, would appear to address the question of Ross facility visual impacts for those on the ground at Devils Tower, it does not speak to the question of the visual impacts for those who might be above ground level. And in that regard, the SEI ER recognizes that "[a]lthough the Devils Tower National Monument and surrounding area is classified as a Class II [visual resource management (VRM)] area [(i.e., one in which the existing character of the landscape should be retained and the level of characteristic landscape change should be low so as not to attract the attention of the casual observer)], the Ross ISR project will only be visible to climbers scaling the volcanic neck." 2 SEI ER at 3-349; see also id. at 3-348 (defining objectives for Class II VRM area); U.S. Nat'l Park Serv., Devils Tower National Monument - Climbing Information, http://www.nps.gov/deto/planyourvisit/climbing.htm (last visited Jan. 24, 2012). But Joint Intervenors likewise did not raise any specific concerns about the visual impacts of the facility upon those who might climb the western-looking face of Devils Tower, and it is not the Board's responsibility to provide support for their contention so as to make it admissible. See Crow Butte I, CLI-09-12, 69 NRC at 553 & n.81; Commonwealth Edison Co. (Zion Station, Units 1 and 2), ALAB-226, 8 AEC 381, 406 (1974). That being said, and recognizing that the number of individuals visually impacted above ground level may be a small proportion of those who visit the Devils Tower site, we nonetheless are aware of nothing that relieves the staff of the obligation to afford environmental impact statement consideration of the visual impacts of

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at 58 (citing SEI ER at sections 3.9, 4.9, and 5.9), Joint Petitioners do declare that this ER analysis "neglects to address the site-specific impacts at Devils Tower, as do the programmatic discussions in NRC's GEIS for ISL uranium mining." Joint Petitioners Reply at 30 (citing NRC Office of Federal and State Materials and Environmental Management Programs and Wyoming Department of Environmental Quality Land Quality Division, [GEIS] for [ISL] Uranium Milling Facilities, NUREG-1910 (May 2009)). Joint Petitioners, however, fail to provide any citation to what it is among the GEIS programmatic discussions that the ER neglects to address, leaving it to the Board to identify the grounds that support their contention, which is something we need not do. See Fansteel, CLI-03-13, 58 NRC at 204-05; see also Entergy Nuclear Generation Co. (Pilgrim Nuclear Power Station), CLI-09-11, 69 NRC 529, 534 (2009) ("The Commission should not be expected to sift unaided through . . . documents filed before the Board to piece together and discern a party's argument and the grounds for its claims") (internal quotations omitted).

Finally, in the third sentence of their basis statement Joint Petitioners cite a single case, LaFlamme v. FERC, 852 F.2d 389, 399-403 (9th Cir. 1988), for the proposition that the agency must adequately consider impacts to visual and aesthetic resources in its NEPA review. In that case, however, there was clear evidence that the construction of a hydroelectric dam would impair the aesthetic qualities of the appurtenant river. Here, as we have already noted, Joint Petitioners lack a statement of supporting facts or expert opinion to establish how the Ross project would impair the visual resources at Devils Tower. Such support, rather than mere speculation, is required for an admissible contention under 10 C.F.R. § 2.309(f)(1). See Fansteel, CLI-03-13, 58 NRC at 203.

[35](...continued)
the Ross facility upon a climber's view of the surrounding landscape. This seems particularly so, given the obvious effort expended to obtain that elevated visual perspective.

The contention thus falls short of the requirements in 10 C.F.R. § 2.309(f)(1)(v), (vi) that a petitioner provide factual or expert support for a contention and show the existence of a genuine dispute with the application by reference to specific portions of the application.

(v) RULING on Environmental Contention 5E, Improper Tiering to the GEIS for ISL Mining: Inadmissible, in that this contention and its foundational support lack factual or expert support and fail to establish a genuine dispute on a material issue of law or fact. See 10 C.F.R. § 2.309(f)(1)(v), (vi); section II.B.1.b-c supra.

As the staff acknowledges, in contrast to the GEIS associated with power reactor license renewals that has been incorporated into the agency's regulations, see 10 C.F.R. Part 51, Subpart A, App. B, the GEIS for ISL mining can be the subject of an appropriate challenge in an adjudicatory proceeding. See Tr. at 152. In support of this contention claiming that the SEI ER is deficient because it seeks to tier to a GEIS that is wholly inadequate, Joint Petitioners provide a string of citations to SEI's ER in which SEI references the ISL mining GEIS. See Intervention Petition at 31. Nowhere, however, do Joint Petitioners explain specifically which alleged GEIS flaws are reproduced and/or relied upon by SEI. Instead, Joint Petitioners direct us to the many comments they submitted on the draft and final GEIS, which they have included as six exhibits to their petition totaling 126 pages, see Intervention Petition, exhs. 1-6, and advise us that Joint Petitioners "incorporated them by reference" to avoid any "burden" that "such a litany" would impose on the Board, Tr. at 141.

Joint Petitioners have not put forward adequate grounds for their claim that the SEI application is flawed because it tiers to the agency's GEIS for ISL mining. In their petition, Joint Petitioners fail to link any of their past criticisms to specific provisions of the ER, and we decline to pore through the attachments to their intervention submission to assemble the basis for such

a contention. See Fansteel, CLI-03-13, 58 NRC at 204-05; see also Pilgrim, CLI-09-11, 69 NRC at 534.

In lieu of providing an explicit connection between the alleged flaws in the GEIS and the references to the GEIS in SEI's ER, Joint Petitioners essentially invite us to declare the ER guilty by association with the GEIS. Without more, this is an inadequate basis for the contention and fails to provide the necessary factual or expert support for the contention. Moreover, because Joint Petitioners fail to point to specific flaws in SEI's application, the contention fails to raise a genuine dispute on a material issue of fact.

III. PROCEDURAL/ADMINISTRATIVE MATTERS

Having determined in section II above that Joint Petitioners NRDC and PRBRC have established standing and have set forth at least one admissible contention, they are admitted as parties to this proceeding. Consequently, below we set forth procedural guidance for further litigation regarding their admitted contentions.

A. General Guidance

Given there was no request in Joint Petitioners' hearing petition that the Board ask the Commission for permission to conduct this proceeding under the procedures specified in 10 C.F.R. Part 2, Subpart G, see Crow Butte I, CLI-09-12, 69 NRC at 571-73, unless all parties agree that this proceeding should be conducted pursuant to 10 C.F.R. Part 2, Subpart N, this proceeding will be conducted in accordance with the procedures of 10 C.F.R. Part 2, Subparts C and L. Assuming all the parties currently do not consent to conducting this proceeding under Subpart N, the parties should conduct a conference within ten days of the date of this issuance to discuss their particular claims and defenses and the possibility of

settlement or resolution of any part of this proceeding and to make arrangements for the required disclosures under 10 C.F.R. § 2.336(a).[36]

The Board will oversee the discovery process through status reports and/or conferences, and expects that each of the parties will comply with the process to the maximum extent possible, with the understanding that failing to do so will result in appropriate Board sanctions.[37]

Pursuant to 10 C.F.R. § 2.332(d), the Board is to consider the staff's projected schedule for completion of its safety and environmental evaluations in developing the hearing schedule. Accordingly, on or before Tuesday, February 21, 2012, the staff shall submit to the Board through the E-Filing system a written estimate of its projected schedule for completion of its safety and environmental evaluations, including but not limited to its best estimate of the dates for issuance of any open item and final safety evaluation reports and the draft and final environmental impact statements relative to the Ross facility.

The Board will then conduct a prehearing conference to discuss initial discovery disclosures, scheduling, and other matters on a date to be established by the Board in a subsequent order. The parties should be prepared to address the following matters at the prehearing conference:

1. Estimates (discussed during the parties' conference) regarding when this case will be ready for an evidentiary hearing.

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[36] Among the items to be discussed is whether the staff's section 2.336(b) hearing file can be provided electronically via the NRC web site sooner than thirty days from the date of this issuance.

[37] In this regard, when a party claims a privilege and withholds information otherwise discoverable under the rules, the party shall expressly make the claim and describe the nature of what is not being disclosed to the extent that, without revealing what is sought to be protected, other parties will be able to determine the applicability of the privilege or protection. The claim and identification of privileged materials must occur within the time provided for disclosing withheld materials. See 10 C.F.R. § 2.336(a)(3), (b)(5).

2. Establishing time limits for updating mandatory disclosures under 10 C.F.R. § 2.336(d) and for updating the hearing file under 10 C.F.R. § 2.1203(c).
3. Whether any party intends to assert a privilege or protected status for any information or documents otherwise required to be disclosed herein and, if so, proposals for the submission of privilege logs under 10 C.F.R. § 2.336(a)(3), (b)(5), procedures and time limits for challenges to such assertions, and the development of a protective order and nondisclosure agreement.
4. Whether any of the parties anticipates submitting a motion for summary disposition regarding any of the admitted contentions and the timing and page length of such a motion and responses thereto.
5. Establishing time limits for various evidentiary hearing-related filings, including:
    a. The final list of potential witnesses for each contention pursuant to 10 C.F.R. § 2.336(a)(1).
    b. Any unanimous request, pursuant to 10 C.F.R. § 2.310(h), to handle any specific contention under 10 C.F.R. Part 2, Subpart N.
    c. Any motion for cross-examination under 10 C.F.R. § 2.1204(b).
    d. The parties' initial written statements of position and written direct testimony with supporting affidavits pursuant to 10 C.F.R. § 2.1207(a)(1), along with consideration of (i) whether the parties should file simultaneously or sequentially, and, if sequentially, which party should file first; and (ii) the timing of filing of written responses, rebuttal testimony, and in limine motions relative to direct or rebuttal testimony.
6. The items outlined in 10 C.F.R. § 2.329(c)(1)-(3).

7. The possibility of settling any of the contentions, in whole or in part, including the status of any current settlement negotiations and the utility of appointing a settlement judge pursuant to 10 C.F.R. § 2.338(b).
8. Whether a site visit would be appropriate and helpful to the Board in the resolution of the contentions.
9. Any other procedural or scheduling matters the Board may deem appropriate.

IV. CONCLUSION

For the reasons set forth above, we conclude that in challenging SEI's application for authorization to construct and operate the Ross ISR facility, Joint Petitioners have established their representational standing and have provided four admissible contentions. As a consequence, their hearing request is granted and they are admitted as parties to this proceeding. The text of their admitted contentions is set forth in Appendix A to this decision.

For the foregoing reasons, it is this tenth day of February 2012, ORDERED, that:

1. Having established their standing to participate in this proceeding, relative to the contentions specified in paragraph two below, the hearing request of Joint Petitioners NRDC and PRBRC is granted and those petitioners are admitted as parties to this proceeding.

2. The following of Joint Petitioners' contentions are admitted for litigation in this proceeding: Environmental Contention 1, Environmental Contention 2, Environmental Contention 3, and Environmental Contention 4/5A.

3. The following of Joint Petitioners' contentions are rejected as inadmissible for litigation in this proceeding: Environmental Contention 5B, Environmental Contention 5C, Environmental Contention 5D, and Environmental Contention 5E.

4. The parties are to take the actions required by section III above in accordance with the schedule established therein.

5. In accordance with the provisions of 10 C.F.R. § 2.311, as it rules upon an intervention petition, any appeal to the Commission from this memorandum and order must be taken within ten (10) days after it is served.

THE ATOMIC SAFETY
AND LICENSING BOARD

/RA/

G. Paul Bollwerk, III
CHAIR

/RA/

Richard F. Cole
ADMINISTRATIVE JUDGE

/RA/

Kenneth L. Mossman
ADMINISTRATIVE JUDGE

Rockville, Maryland

February 10, 2012

APPENDIX A

ADMITTED CONTENTIONS

1. Environmental Contention 1: The application fails to adequately characterize baseline (i.e., original or pre-mining) groundwater quality.

   CONTENTION: The application fails to comply with 10 C.F.R. § 51.45, 10 C.F.R. Part 40, Appendix A, and NEPA because it lacks an adequate description of the present baseline (i.e., original or premining) groundwater quality and fails to demonstrate that groundwater samples were collected in a scientifically defensible manner, using proper sampling methodologies. The ER's departure from NRC guidance serves as additional evidence of these regulatory violations. NRC, NUREG-1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications, §§ 2.7.1, 2.7.3, 2.7.4 (2003).

2. Environmental Contention 2: The application fails to analyze the environmental impacts that will occur if SEI cannot restore groundwater to primary or secondary limits.

   CONTENTION: The application fails to meet the requirements of 10 C.F.R. § 51.45 and NEPA because it fails to evaluate the virtual certainty that SEI will be unable to restore groundwater to primary or secondary limits.

3. Environmental Contention 3: The application fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.

   CONTENTION: The application fails to assess the likelihood and impacts of fluid migration to the adjacent groundwater, as required by 10 C.F.R. § 51.45 and NEPA, and as discussed in NUREG-1569 § 2.7.

4. Environmental Contention 4/5A: The application fails to adequately assess cumulative impacts of the proposed action and the planned Lance District expansion project.

   CONTENTION: The application violates 10 C.F.R. § 51.45, NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA because it fails to consider adequately cumulative impacts, including impacts on water quantity, that may result from SEI's proposed ISL uranium mining operations planned in the Lance District expansion project.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

G. Paul Bollwerk, III, Chair
Dr. Richard F. Cole
Dr. Kenneth L. Mossman

In the Matter of	Docket No. 40-9091-MLA
STRATA ENERGY, INC.	ASLBP No. 12-915-01-MLA-BD01
(Ross In Situ Recovery Uranium Project)	March 25, 2013

MEMORANDUM AND ORDER
(Revised General Schedule)

By letter dated March 21, 2013, the NRC staff has advised the Licensing Board that the staff has issued its draft supplemental environmental impact statement (SEIS) for this 10 C.F.R. Part 40 licensing proceeding. Also, according to that letter, as of that date the staff "has notified the parties that the [draft] SEIS is publicly available and has provided them with the [ADAMS] Accession number." Letter from Emily Monteith, NRC Staff Counsel, to Licensing Board at 1 (Mar. 21, 2013). The issuance of this draft SEIS follows the staff's March 1 actions issuing the safety evaluation report (SER) for this proceeding and making the parties aware of the SER's public availability via the agency's ADAMS database system. See Letter from Emily Monteith, NRC Staff Counsel, to Licensing Board at 1 (Mar. 4, 2013).

In accord with the Licensing Board's initial prehearing order in this proceeding, see Licensing Board Memorandum and Order (Initial Prehearing Order) (Nov. 3, 2011) at 4 n.3 (unpublished); see also Licensing Board Memorandum and Order (Recent Part 2 Changes and General Schedule Revisions) (Aug. 12, 2012) at 2–3 (unpublished), and as has been reflected

in the various versions of the general schedule for this proceeding, see, e.g., Licensing Board Memorandum and Order (Revised General Schedule) (Dec. 11, 2012) app. A at 1–2 (unpublished) [hereinafter December 2012 General Schedule], Joint Intervenors[1] have thirty days from the date on which the SER and the draft SEIS are issued within which to submit new or amended contentions relating to those staff documents. Although the date of the staff's issuance of its SER required no revision to the most recent version of this proceeding's general schedule as that schedule established the date for Joint Intervenors' filings relative to the SER,[2] the staff's draft SEIS has been made available a week earlier than was provided for in that schedule. Accordingly, to reflect this earlier draft SEIS issuance date, the Board has revised the appropriate portions of the general schedule for this adjudicatory proceeding, which is included as Appendix A to this issuance.

[1] Joint Intervenors are the Natural Resources Defense Council (NRDC) and the Powder River Basin Resource Council (PRBRC).

[2] Although the staff made its SER available on March 1, 2013, one day later than was reflected in the most recent version of this proceeding's general schedule, see December 2012 General Schedule at 1, by operation of the agency's rules of practice, see 10 C.F.R. § 2.306(a), the date for submitting any new or amended contentions regarding the SER would be the same as that provided for in the schedule, i.e., Monday, April 1, 2013.

In accordance with 10 C.F.R. § 2.329(e), any objections to, or other comments regarding, this memorandum and order shall be filed within five days after it is served.

It is so ORDERED.

FOR THE ATOMIC SAFETY
AND LICENSING BOARD

/RA/

G. Paul Bollwerk, III, Chair
ADMINISTRATIVE JUDGE

Rockville, Maryland

March 25, 2013

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

LBP-13-10

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

G. Paul Bollwerk, III, Chairman
Dr. Richard F. Cole
Dr. Kenneth L. Mossman

In the Matter of	Docket No. 40-9091-MLA
STRATA ENERGY, INC.	ASLBP No. 12-915-01-MLA-BD01
(Ross In Situ Recovery Uranium Project)	July 26, 2013

MEMORANDUM AND ORDER
(Ruling on Motion to Resubmit Contentions
and to Admit a New Contention)

Previously, in a February 2012 ruling, this Licensing Board admitted four contentions submitted by Joint Intervenors[1] challenging certain National Environmental Policy Act of 1969 (NEPA)-related/environmental aspects of the pending request of Strata Energy, Inc., (SEI) for a 10 C.F.R. Part 40 license authorizing SEI to possess and use the nuclear source material that would be generated by its operation of an in situ uranium recovery (ISR) facility on the Ross ISR Uranium Project site.[2] See LBP-12-3, 75 NRC 164, 210, aff'd in part and review declined,

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[1] Joint Intervenors are public interest groups the Natural Resources Defense Council (NRDC) and the Powder River Basin Resource Council.

[2] Not unexpectedly, contentions regarding matters associated with how the NEPA-related aspects of the agency's licensing review process are being carried out often are referred to as "environmental" contentions. While recognizing that, if properly framed, a matter associated with the environment (e.g., disposal of radiologically contaminated waste water) can be the foundational support for a contention (e.g., groundwater contamination from radiologically contaminated waste water) that raises concerns regarding what would generally be considered a "safety" issue under the Atomic Energy Act (AEA), cf. LBP-12-3, 75 NRC at 192 (rejecting attempt to "bootstrap" NEPA-related contentions into AEA safety contentions
(continued...)

CLI-12-12, 75 NRC 603 (2012) (affirming standing ruling and declining review as to contention admissibility rulings). Some thirteen months later, the Nuclear Regulatory Commission (NRC) staff issued its draft of a supplement to the agency's generic environmental impact statement (EIS) on ISR facilities providing the staff's preliminary NEPA-mandated assessment of the SEI license application. See Letter from Emily Monteith, NRC Staff Counsel, to Licensing Board at 1 (Mar. 21, 2013); see also Office of Federal and State Materials and Environmental Management Programs, NRC, [Draft EIS] for the Ross ISR Project in Crook County, Wyoming; Supplement to the Generic [EIS] for In-Situ Leach Uranium Milling Facilities, NUREG-1910 (supp. 5 Mar. 2013) (ADAMS Accession No. ML13078A036) [hereinafter DSEIS]. Thereafter, Joint Intervenors filed a motion seeking to (1) "resubmit" their four pending environmental contentions in light of the staff's draft supplemental EIS (DSEIS); and (2) admit an additional NEPA-related contention. See [Joint Intervenors'] Motion to Resubmit Contentions & Admit One New Contention in Response to Staff's [DSEIS] (May 6, 2013) at 1–2 [hereinafter Joint Intervenors Motion]. SEI and the staff oppose the motion on both counts. [SEI] Response to [Joint Intervenors'] New and Amended Contentions on [DSEIS] (June 3, 2013) at 1 [hereinafter SEI Response]; NRC Staff's Response to [Joint Intervenors'] Motion to Resubmit Contentions and Admit One New Contention in Response to Staff's [DSEIS] (June 3, 2013) at 1 [hereinafter Staff Response].

For the reasons stated herein, we grant Joint Intervenors' motion to "resubmit" as to three of their four admitted contentions and deny their request to admit a new contention.

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[2](...continued)
by asserting failure to fulfill NEPA responsibilities violates AEA), in this instance, when referring to Joint Intervenors' contentions, we will use the terms "NEPA-related" and "environmental" interchangeably.

I. BACKGROUND

Because a detailed exposition of the regulatory and procedural background of this proceeding can be found in the Board's decision admitting Joint Intervenors' four NEPA-related contentions, see LBP-12-3, 75 NRC at 174–76, we pick up the narrative thread here by noting that in its April 2012 initial scheduling order, the Board outlined the process whereby, in accordance with 10 C.F.R. § 2.309(c),[3] Joint Intervenors could seek to amend those contentions or submit new issue statements to reflect developments in this proceeding. See Licensing Board Memorandum and Order (Prehearing Conference and Initial Scheduling Order) (Apr. 10, 2012) at 4 (unpublished) [hereinafter Initial Scheduling Order]. One such development recognized in that issuance was the staff's release of its DSEIS for the proposed Ross ISR facility.[4] See id. App. A, at 1. With the release of that staff document in late March 2013, after jointly seeking and gaining an extension of the filing deadlines for motions for new/amended contentions and the associated responses set forth in the Board's previous scheduling orders, see Licensing Board Memorandum and Order (Revised General Schedule) (Apr. 12, 2013) at 1–3 (unpublished) [hereinafter Revised General Schedule], the parties filed several pleadings consistent with the revised schedule. These consisted of the previously referenced motion from

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[3] This proceeding was instituted before changes to various provisions of 10 C.F.R. Part 2, including section 2.309(c), became effective in September 2012. See Amendments to Adjudicatory Process Rules and Related Requirements; Final Rule, 77 Fed. Reg. 46,562, 46,562 (Aug. 3, 2012). Nonetheless, as the Board advised the parties, in the absence of a Board order continuing some aspect of the proceeding under the prior rules, the September 2012 Part 2 revisions are applicable in this proceeding. See Licensing Board Memorandum and Order (Requesting Scheduling Input) (Aug. 7, 2012) at 1–3 (unpublished); see also Licensing Board Memorandum and Order (Recent Part 2 Changes and General Schedule Revisions) (Aug. 21, 2012) at 1–3 (unpublished).

[4] Another was the staff's issuance of its safety evaluation report (SER) for the proposed Ross ISR facility, see Initial Scheduling Order App. A, at 1, which occurred in late February 2013, see Letter from Emily Monteith, NRC Staff Counsel, to Licensing Board at 1 (Mar. 4, 2013), but which did not engender any new/amended contention filing from Joint Intervenors.

Joint Intervenors seeking to "resubmit" their four admitted NEPA-related contentions and have a new environmental contention admitted for litigation and the SEI and staff responses opposing those requests, along with a reply from Joint Intervenors to the SEI and staff answers, see [Joint Intervenors'] Reply in Support of Motion to Resubmit Contentions & Admit One New Contention in Response to Staff's [DSEIS] (June 17, 2013) [hereinafter Joint Intervenors Reply].

II. ANALYSIS

A. Standards Governing the Admission of New/Amended Contentions

The ability of a petitioner or intervenor to have a contention accepted into a proceeding for further litigation, whether as part of its initial hearing petition or thereafter, rests upon whether the submitter can satisfy the twin precepts of timeliness and admissibility. Section 2.309 of the agency's Rules of Practice, which sets forth the standards governing contention admission, speaks to both of these elements. Below, we outline how each of these factors plays a role in the admission of a post-initial hearing petition, i.e., a new or amended, contention.

1. "Good Cause" for the Submission of New/Amended Contentions

Under section 2.309(c)(1), after the section 2.309(b) deadline has passed for submitting an initial hearing petition with one or more accompanying contentions, a petitioner/intervenor that wishes either to (1) amend an already submitted or admitted contention; or (2) gain the admission of a new contention must file a motion for leave to file such a new or amended contention. Further, under section 2.309(c)(1), the timing of the submission of a new/amended contention comes into play to the extent that consideration of whether a new/amended contention can be admitted/adopted is dependent on whether, regardless of the issue statement's substantive sufficiency, a presiding officer can conclude that the

petitioner/intervenor has demonstated "good cause" for its post-initial hearing petition deadline filing, based on the following three factors:

> (i) The information upon which the filing is based was not previously available;
> (ii) The information upon which the filing is based is materially different from information previously available; and
> (iii) The filing has been submitted in a timely fashion based on the availability of the subsequent information.

10 C.F.R. § 2.309(c)(1)(i)–(iii).

While these first two "good cause" factors relate to the nature of the information that is being employed as the basis for the new/amended contention, the third concerns the timeliness of the submission of that information in support of a request to admit the new/amended contention. This factor involves the question whether the new/amended contention and the associated information that is the basis for the contention, even if newly available and materially different from any information that was previously available, nonetheless were seasonably submitted. And, in contrast to section 2.309(b)'s provisions relating to an initial hearing petition, see 10 C.F.R. § 2.309(b) (defining the timeliness of an initial hearing petition in different situations as being filed between twenty and sixty days after certain specified events), section 2.309(c)(1)(iii) does not stipulate what is considered "timely." As it turns out, the degree to which the new/amended contention and its otherwise newly available and materially different supporting information will be considered timely submitted is, as in this case, generally defined by the presiding officer as a specific period following the "triggering event" that makes the not previously available/materially different information available so as to be the basis for the new/amended contention.[5] See Revised General Schedule at 1 (noting filing time for

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[5] As is made clear in the discussion in the statement of considerations supporting the September 2012 Part 2 rule change, see 77 Fed. Reg. at 46,571–72, the time for submitting a new/amended contention motion based on information that would be newly available, materially (continued...)

new/amended contentions initially set at thirty days after triggering event, such as issuance of DSEIS); see also Licensing Board Memorandum and Order (Initial Prehearing Order) (Nov. 3, 2011) at 4 n.3 (unpublished) (to be considered timely, motions seeking admission of new/amended contentions should be filed within thirty days of the date upon which the information that is the basis of the motion becomes available).

2. Admissibility of New/Amended Contentions

As is the case with a contention submitted in support of an initial hearing petition, under section 2.309(c)(4) a new or amended contention generally must meet the six admissibility factors specified in section 2.309(f)(1), which in relevant part require that for each contention the submitter:

> (i) Provide a specific statement of the issue of law or fact to be raised or controverted, . . . ;
> (ii) Provide a brief explanation of the basis for the contention;
> (iii) Demonstrate that the issue raised in the contention is within the scope of the proceeding;
> (iv) Demonstrate that the issue raised in the contention is material to the finding the NRC must make to support the action that is involved in the proceeding;
> (v) Provide a concise statement of the alleged facts or expert opinions which support the requestor's/petitioner's position on the issue and on which the petitioner intends to rely at hearing . . . ;
> (vi) . . . [P]rovide sufficient information to show that a genuine dispute exists with the applicant/licensee on a material issue of law or fact . . . .

10 C.F.R. § 2.309(f)(1)(i)–(vi); see also LBP-12-3, 75 NRC at 190–91.

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[5](...continued)
different, and otherwise timely submitted given the information's availability can be extended if the extension request is based on "good cause," as that term is defined in 10 C.F.R. § 2.307, or the presiding officer approves the parties' stipulation of a different filing time. In this instance, the parties jointly sought and obtained an extension of the Board's general schedule deadline for filing new/amended contention motions and the associated responsive pleadings relative to the staff's DSEIS. See Revised General Schedule at 2–3.

3. Application of the "Migration" Tenet

Although a motion addressing the section 2.309(c)(1) and (f)(1) factors described in sections II.A.1 and .2 above generally must be submitted to permit the admission of a new/amended contention, there is a recognized exception for licensing proceedings in the case of NEPA-related contentions. Such contentions initially are based on the environmental report (ER) submitted by the applicant to fulfill its NEPA-related responsibilities under 10 C.F.R. Part 51 to provide the staff with information and analysis that will inform the staff's NEPA review. See 10 C.F.R. § 2.309(f)(2). And if the staff in preparing its NEPA impact statement does indeed adopt the ER-associated information/analysis that was challenged as inadequate, or, alternatively, maintains the same omission that was alleged to be in the ER,[6] it has been acknowledged that the issues those ER-based admitted contentions raise can essentially transmute into challenges to the staff's NEPA statement.[7] See Private Fuel Storage, LLC

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[6] It has been recognized that the issues framed in contentions challenging an application generally encompass two categories, i.e., those that allege an informational or analytical omission from the application and those that allege that the information/analysis in the application is inadequate (as opposed to missing). See Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-08, 56 NRC 373, 382–83 (2002) ("There is, in short, a difference between contentions that merely allege an 'omission' of information and those that challenge substantively and specifically how particular information has been discussed in a license application."); see also Powertech USA, Inc. (Dewey-Burdock In Situ Uranium Recovery Facility), LBP-13-09, 78 NRC __, __–__ (slip op. at 11–12) (July 22, 2013) (providing general discussion about contentions of omission and contentions of adequacy).

[7] Consistent with the general principle that, because the primary responsibility to address and comply with AEA safety-related requirements resides with a license applicant, so that the application, not the staff's application review, is the focus of any safety-related contentions, see The Curators of the University of Missouri (TRUMP-S Project), CLI-95-8, 41 NRC 386, 396 (1995); TRUMP-S Project, CLI-95-1, 41 NRC 71, 121–22 (1995), issuance of the staff's SER generally would not trigger this migration tenet. Rather, if anything in the staff's SER is considered as impacting an admitted license application-based safety contention or creating a new safety concern, as a general rule that matter would need to be raised, relative to an admitted safety contention, in the context of the merits disposition of the already admitted safety contention or, in the case of a new issue (and presuming such a staff safety review-triggered

(continued...)

(Independent Spent Fuel Storage Installation), LBP-01-23, 54 NRC 163, 172 n.3 (2001); see also La. Energy Servs., LP (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 84 (1998). Somewhat ironically, however, this migration tenet reflects a situation that, strictly speaking, is in juxtaposition to what is contemplated as necessary under the “not previously available” and “materially different” provisos of section 2.309(c)(1)(i)–(ii) governing new/amended contention admission. This is because the invocation of this tenet has the effect of automatically “amending” the contention to substitute the staff's environmental review impact statement information/analysis (relative to a contention of adequacy) or lack of information/analysis (relative to a contention of omission) as the foundational support for the contention without filing a new/amended contention motion addressing either the section 2.309(c)(1) or (f)(1) factors.[8] This tenet is applicable, however, only if the information in the staff's post-ER NEPA statement is “sufficiently similar to the information in the ER,” i.e., essentially in pari materia with the ER information/analysis, or lack of information/analysis, that is the focus of the contention.[9] See S.

[7](...continued)
contention is admissible), as a wholly new safety contention.

[8] The “migration tenet” serves a useful administrative efficiency purpose in that it dispenses with the need for (1) the applicant/staff to file a dismissal/dispositive motion, with the accompanying party filings and Board decision, so as to have the admitted contention declared moot; and (2) the intervenor to file a new/amended contention, with the accompanying briefing and Board decision, so as to have the wording of the previously admitted contention changed to reflect that the issue statement's focus is now the staff's environmental document rather than the applicant's ER.

[9] The critique of the impact of a staff environmental document on an already-admitted ER-based environmental contention usually goes to whether (1) a contention of omission can migrate or has been cured, to the degree that purported missing information/analysis has been provided so that a summary disposition/dismissal motion may be appropriate for the admitted contention and a new contention is necessary to challenge the fresh information/analysis; or (2) a contention of adequacy can migrate or, because of information/analysis changes, can be sustained as a new/amended contention. Nonetheless, it also is possible that the staff's environmental document might contain no information/analysis on a matter that was addressed in the ER and was the subject of an admitted contention of adequacy challenging the ER
(continued...)

Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site), LBP-08-2, 67 NRC 54, 63–64 (2008); see also Dewey-Burdock, LBP-13-09, 78 NRC at _–_ (slip op. at 10–11); Detroit Edison Co. (Fermi Nuclear Power Plant, Unit 3), LBP-12-23, 76 NRC _, _ (slip op. at 29) (Nov. 9, 2012); Progress Energy Fla., Inc. (Levy County Nuclear Power Plant, Units 1 and 2), LBP-11-01, 73 NRC 19, 26 (2011).

On the other hand, post-ER an intervenor would need to file a motion to amend an already-admitted contention or to admit a new contention if the information in the staff's NEPA statement is sufficiently different from the information in the ER that supported the original contention's admission. See Vogtle, LBP-08-2, 67 NRC at 63–64. And a new/amended contention regarding portions of the staff's post-ER NEPA statement that differ from the ER also must meet the "good cause" and contention admissibility standards of section 2.309(c)(1) and (f)(1) to be admitted. See Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-28, 56 NRC 373, 382 (2002) ("While a contention contesting an applicant's [ER] generally may be viewed as a challenge to the NRC Staff's subsequent draft EIS, new claims must be raised in a new or amended contention."); Vogtle, LBP-08-2, 67 NRC at 64 (explaining that, if the portion of the ER that an admitted contention challenges is not sufficiently similar to the [draft EIS], "an intervenor attempting to litigate an issue based on expressed concerns about the [draft EIS] may need to amend the admitted contention or, if the information in the [draft EIS] is sufficiently different from that in the ER that supported the contention's admission, submit a new contention").

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[9](...continued)
information/analysis. In such an instance, an intervenor challenge to the adequacy of an ER's information/analysis seemingly would, for all practical purposes, envelop a challenge based on the total of lack of such information/analysis (assuming the challenge was not that the information/analysis should not be in ER), thereby permitting a contention of adequacy to migrate into a contention of omission.

B. Post-DSEIS Litigability of Joint Intervenors' "Resubmitted" Contentions

With respect to the four ER-based contentions that were admitted by the Board in ruling on their initial hearing petition, Joint Intervenors have filed a motion that "resubmits" these contentions as purportedly litigable post-DSEIS issue statements. Further, Joint Intervenors have proffered these previously admitted contentions with essentially the same language that was found admissible, with two exceptions: Everywhere the term "application" was used in the admitted contention, they have substituted the term "DSEIS," thereby referencing the staff's draft supplemental EIS, and they have added citations to 10 C.F.R. §§ 51.70, 51.71, to reflect that fact that these contentions now challenge the staff's DSEIS rather than the SEI ER.[10] See Joint Intervenors Motion at 6 n.3, 10 n.7, 13 n.9, 16 n.10. Joint Intervenors also have filed additional expert statements -- the declarations of Dr. Richard Abitz and Christopher E. Paine -- that they assert support these "resubmitted" contentions. See id. at 6, 10, 13, 16; see also id. unnumbered attach. 1 (Second Declaration of Dr. Richard Abitz on Behalf of [Joint Intervenors] (May 6, 2013)) [hereinafter Abitz Declaration]; id. unnumbered attach. 2 (Declaration of Christopher E. Paine on Behalf of [Joint Intervenors] in Support of Contentions 4/5A and 6 (May 6, 2013)) [hereinafter Paine Declaration].

Joint Intervenors refer to these four contentions as being "amended." Id. at 1. Nonetheless, in connection with these issue statements Joint Intervenors make no mention of the "good cause" provisions of section 2.309(c)(1) or the section 2.309(f)(1) admissibility standards that are applicable to all new or amended contentions. It thus seems apparent that for these four contentions they are seeking to employ, albeit without specifically invoking it by

[10] Although Joint Intervenors' proposed "resubmitted" contentions retained their admitted contention's references to 10 C.F.R. § 51.45, which describes the requirements applicable to an ER, that citation is no longer relevant in an instance when an admitted ER-related contention migrates to a challenge to the staff's DSEIS. Accordingly, that citation will be removed from any of the contentions we conclude are subject to the migration tenent.

name, the "migration tenet" discussed in section II.A.3 above. Of course, as the section II.A.3 discussion makes clear, and as Joint Intervenors themselves acknowledge, see id. at 2, in such instances it is not necessary to file a motion seeking to amend the contention. On the other hand, there is nothing in the agency's rules of practice that precludes an intervenor from submitting a motion that attempts to invoke that tenet, which Joint Intervenors seemingly have done here, or a board from considering that precept's application in response to such a motion, which we do now.[11]

1. Environmental Contention 1:[12] The DSEIS fails to adequately characterize baseline (i.e., original or pre-mining) groundwater quality.

CONTENTION: The DSEIS fails to comply with 10 C.F.R. §§ 51.70 and 71, 10 C.F.R. Part 40, Appendix A, and NEPA because it lacks an adequate description of the present baseline (i.e., original or pre-mining) groundwater quality and fails to demonstrate that groundwater samples were collected in a scientifically defensible manner, using proper sampling methodologies. The DSEIS's departure from NRC guidance serves as additional evidence of these regulatory violations. NRC, NUREG-1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications, §§ 2.7.1, 2.7.3, 2.7.4 (2003).

DISCUSSION: Joint Intervenors Motion at 5–9; SEI Response at 8–11; Staff Response at 8–14; Joint Intervenors Reply at 8–12.

RULING: In the context of admitting this contention, the Board found unpersuasive SEI's and the staff's arguments that, under 10 C.F.R. § 51.45, SEI was not required (and

[11] Although the Board did not establish a filing schedule for such a "resubmission" motion, which, unlike a section 2.309(c) new/amended contention request, is not specifically contemplated under the agency's procedural rules, we have no difficulty in concluding that, having been submitted within the Board-established time frame for new/amended contention motions regarding the staff's DSEIS, Joint Intervenors' "resubmission" motion was timely.

[12] Because of an apparent concern about preserving litigation issues, see Joint Intervenors Motion at 2, Joint Intervenors have renumbered their four resubmitted contentions by giving each the additional alpha designator "A." Because the question before us is whether these contentions are suitable for migration and renumbering these contentions would, in our estimation, have no impact on any future appellate issues that might be raised regarding their litigability, we see no reason to change the previous numbering system.

perhaps was even precluded under section 40.32(e) from seeking) to establish a baseline water quality for the Ross facility site until after any grant of a Part 40 license to SEI. Moreover, given this and the information provided in support of Joint Intervenors' contention regarding the adequacy of SEI's showing in its ER concerning such a baseline, the Board concluded there was a genuine dispute about a material issue concerning whether SEI in its ER had in fact provided the staff with sufficient information concerning facility baseline water quality so as to allow the staff to provide an adequate NEPA assessment of the impacts of facility operation on water quality. See LBP-12-3, 75 NRC at 195. In seeking to "resubmit" this contention, Joint Intervenors declare that in its DSEIS the staff has simply carried this problem forward by utilizing SEI information that does not meet the 10 C.F.R. Part 40, App. A, Criterion 5B(5)(a) and Criterion 7 standards on "background" groundwater constituents and "complete baseline data" for an ISR site, as those are to be implemented pursuant to the staff's NUREG-1569 guidance to applicants to provide "[r]easonably comprehensive" water sampling data shown to be "collected by acceptable sampling procedures," Office of Nuclear Material Safety and Safeguards, NRC, Standard Review Plan for In Situ Leach Uranium Extraction License Applications, NUREG-1569, at 2-24 (June 2003) [hereinafter NUREG-1569], so as to furnish the baseline water quality data needed for an adequate staff NEPA analysis. Further, according to Joint Intervenors, it still is apparent from the DSEIS that SEI and the staff intend to postpone collecting the information that possibly could meet these Part 40, Appendix A standards (using methods that might satisfy the staff's NUREG-1569 guidance) until after a license is issued to SEI, which Joint Intervenors assert is too late to satisfy the staff's NEPA responsibilities. See Joint Intervenors Motion at 7, 8–9. For its part the staff, while noting that its DSEIS does contain "baseline" water quality data, states that the data required by Appendix A "is not required to be

provided at this time and does not yet exist," Staff Response at 10, a conclusion with which SEI appears to agree, see SEI Response at 10–11.

Under the circumstances, we find that the central analytical deficiency alleged by Joint Intervenors' environmental contention 1 with regard to the SEI ER applies with equal force to the DSEIS. As a consequence, the migration tenet applies and this contention, as specified in Appendix A to this issuance with the substituted references to the DSEIS, moves forward as an admitted post-DSEIS issue statement.[13]

2. Environmental Contention 2: The DSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits.

CONTENTION: The DSEIS fails to meet the requirements of 10 C.F.R. §§ 51.70, 51.71 and NEPA because it fails to evaluate the virtual certainty that the applicant will be unable to restore groundwater to primary or secondary limits.

DISCUSSION: Joint Intervenors Motion at 10–12; SEI Response at 11–15; Staff Response at 14–18; Joint Intervenors Reply at 12–15.

RULING: In initially considering this challenge to the SEI ER, the Board noted that the point of contention was not whether SEI would be unable to restore groundwater quality to primary or secondary limits following the conclusion of operations at the Ross facility, but whether such a happenstance would be a nonspeculative "'irreversible and irretrievable commitment[] of resources'" such that the ER needed to provide an impacts analysis of such an occurrence. LBP-12-3, 75 NRC at 196 (quoting 10 C.F.R. § 51.45(b)(5)); see NEPA § 102(2)(C)(v), 42 U.S.C. § 4332(2)(C)(v). The Board concluded that, based on their showing

[13] In its response to Joint Intervenors' motion, SEI indicated that if this contention advances for further litigation, it intends to file a dispositive motion. See SEI Response at 11 n.5. The parties are reminded that such a motion (or motions) and any responsive filings should comply with the Board-specified administrative directives and schedule governing summary disposition motions. See Licensing Board Memorandum and Order (Prehearing Conference and Initial Scheduling Order) (Apr. 10, 2012) at 5–7 (unpublished); Revised General Schedule App. A, at 1.

relative to the section 2.309(f)(1) admissibility factors, Joint Intervenors had established a genuine dispute on a material issue concerning the need for such an analysis so as to merit the admission of environmental contention 2. Moreover, in doing so, the Board addressed several arguments proffered by SEI and the staff as to why such an analysis, which Joint Intervenors' claimed would require consideration of the impacts associated with utilizing a 10 C.F.R. Part 50, App. A, Criterion 5B(5)(c) alternate concentration limit (ACL), was not a viable possibility as a legal or technical matter. These included the assertion that an ACL could not be accurately generated until the post-operational decommissioning process, a claim that the Board noted did not account for the possible creation of a bounding analysis based on the historical experience at other ISR sites. See id. at 197.

In "resubmitting" this contention, Joint Intervenors maintain that nothing in the DSEIS constitutes a substantive change relative to the deficiency that environmental contention 2 identified as existing in the ER. The staff, however, points to the following DSEIS discussion as addressing the purported lack of an analysis of the impacts of a failure by SEI to restore groundwater quality to primary or secondary limits:

> The GEIS noted that water quality in the [ore zone (OZ)] aquifer would be degraded during ISR operations (NRC, 2009). A licensee would be required, by its [Wyoming Department of Environmental Quality] Permit to Mine and would be by its NRC license, to initiate aquifer-restoration activities to restore the OZ aquifer to preoperational conditions, if possible. If the aquifer cannot be returned to post-licensing, pre-operational conditions described in [supplemental EIS (SEIS)] Section 2.1.1.1, the NRC would require that the aquifer meet the U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs) provided in 10 CFR Part 40, Appendix A, Table 5C or Alternate Concentration Limits (ACLs), as approved by NRC (10 CFR Part 40; NRC, 2009b). For these reasons, the NRC determined in the GEIS that potential impacts to water quality of the uranium-bearing aquifer (i.e., ore zone, production zone or unit, or mineralized zone) as a result of ISR operations would be expected to be SMALL and temporary (NRC, 2009).

Staff Response at 17 (quoting DSEIS at 4-32 (emphasis in original)). This, according to the staff, is the impacts analysis that Joint Intervenors' environmental contention 2 claimed was missing from the ER. As such, the staff asserts, it is the adequacy of this assessment that Joint Intervenors must contest, requiring that they show a genuine material dispute with this analysis in accord with the section 2.309(f)(1)(vi).

It is true that this statement in the DSEIS does, in a general way, address the issue of the environmental impact if SEI cannot restore groundwater to primary or secondary limits. It also is apparent, however, that the DSEIS does not, as the ER did not, address the matter that is the crux of the concern engendered in admitted environmental contention 2, i.e., given that reasonably foreseeable environmental impacts are to be outlined in an agency's NEPA statement and that an ACL realistically may be necessary at the time of facility decommissioning, within a reasonable range, what is that ACL likely to look like and what are the associated environmental impacts associated with such an ACL. As a consequence, because we consider this matter as admitted relative to the SEI ER to still be at issue relative to the staff's DSEIS, we find the migration tenet is applicable so as to allow this contention to move forward in this litigation post-DSEIS.

Nonetheless, given (1) Joint Intervenors' recognition that the claim posited by this contention is that the "DSEIS require[s] a bounding analysis and explanation of the environmental impacts that result from the eventual adoption of an ACL rather than primary or secondary groundwater standards," Joint Intervenors Motion at 12; and (2) the Commission's admonition that, in appropriate circumstances, a board should endeavor to define the scope of a contention in light of the foundational support that leads to its admission, see Crow Butte Res., Inc. (North Trend Expansion Project), CLI-09-12, 69 NRC 535, 553 (2009) (observing that to define scope of admitted contention properly, board should have specified which bases were

admitted); see also Pub. Serv. Co. of N.H. (Seabrook Station, Units 1 and 2), ALAB-899, 28 NRC 93, 97 (1988) ("The reach of a contention necessarily hinges upon its terms coupled with its stated bases."), aff'd sub nom. Mass. v. NRC, 924 F.2d 311 (D.C. Cir. 1991), we conclude the terms of environmental contention 2 can be outlined here with more specificity as follows:

> Environmental Contention 2: The DSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits.
>
> CONTENTION: The DSEIS fails to meet the requirements of 10 C.F.R. §§ 51.70, 51.71 and NEPA because it fails to evaluate the virtual certainty that the applicant will be unable to restore groundwater to primary or secondary limits in that the DSEIS does not provide and evaluate information regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an Alternative Concentration Limit (ACL) in accordance with 10 C.F.R. Part 40, App. A, Criterion 5B(5)(c).

Thus, as set forth above and in Appendix A to this issuance, this contention, as clarified, will move forward as an admitted post-DSEIS issue statement.

3. Environmental Contention 3: The DSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.

CONTENTION: The DSEIS fails to assess the likelihood and impacts of fluid migration to the adjacent groundwater, as required by 10 C.F.R. §§ 51.70, 51.71 and NEPA, and as discussed in NUREG-1569 § 2.7.

DISCUSSION: Joint Intervenors Motion at 13–15; SEI Response at 15–18; Staff Response at 18–22; Joint Intervenors Reply at 15–18.

RULING: In admitting a portion of environmental contention 3 as originally proffered by Joint Intervenors, the Board concluded that a sufficient showing had been made regarding their particular claims about the adequacy of the ER discussion concerning "boreholes and aquifer isolation in the immediate vicinity of the Ross facility." LBP-12-3, 75 NRC at 199. And in doing so, we referred to several portions of the supporting declarations of Drs. Moran, Sass, and Abitz

regarding the implications of numerous purportedly unplugged boreholes and the results of SEI pumping tests relative to an assessment of the fluid migration impacts that might attain from operation of the Ross facility. See id. at 199. In seeking to "resubmit" this contention, Joint Intervenors assert that, as is made evident by the declaration of Dr. Abitz supporting their motion, the DSEIS discussion of boreholes and SEI pump tests makes it apparent that the thrust of Joint Intervenors' claim regarding this alleged deficiency remains intact so as to maintain this aspect of this contention. See Joint Intervenors Motion at 14.

We agree and, in accord with the migration tenet, will move the contention forward for post-DSEIS litigation on that basis.[14] Further, given (1) Joint Intervenors' recognition that this contention originally was intended to reflect their "precise concern" about the "risks of fluid migration due to the thousands of drillholes in the area," id., as well as the fact that the focus of Dr. Abitz's technical disagreements with the DSEIS concerns boreholes and the SEI pump tests, see Abitz Declaration at 16–17; and (2) the Commission's direction to provide contention

[14] In various instances relative to this and the other three contentions that are the subject of Joint Intervenors' resubmittal motion, SEI makes the argument that the staff's SER and/or one or more of SEI's post-hearing petition contention admission licensing review submissions to the staff, whether in response to a staff request for additional information (RAI) or otherwise, have the consequence of rendering the resubmitted contention moot or untimely under section 2.309(c)(1). See SEI Response at 9–10, 12–13, 15–16, 19–20. Expressing no view on whether it is possible for an SER to moot an environmental contention, to the degree this SEI argument is footed in NEPA-related RAIs, assertions of contention mootness or untimeliness based on such documents generally should be raised prior to the issuance of a staff environmental document (like the DSEIS here). Such a timely filed motion would be based on the SER or applicant information having become available and having mooted or otherwise enervated the admitted environmental contention as it alleges an omission/analysis deficiency relative to the ER so as to require the filing of a new/amended contention that has not been properly proffered. In the absence of such a motion filed prior to the staff environmental document, the staff SER or such applicant information generally would become relevant as impacting an admitted environmental contention only to the degree the SER or applicant information is actually utilized as part of a subsequent staff environmental document. Moreover, the timeliness of a new/amended contention motion relating to that information seemingly would be determined based on the availability of the staff's environmental document, rather than the SER or the applicant's information, as the filing "trigger" for the motion.

focus, see supra p. 15, which we note seems particularly apropos at this advanced stage of the proceeding, we conclude this contention's terms can be outlined here with more specificity as follows:

> Environmental Contention 3: The DSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.
>
> CONTENTION: The DSEIS fails to assess adequately the likelihood and impacts of fluid migration to the adjacent groundwater, as required by 10 C.F.R. §§ 51.70, 51.71 and NEPA, and as discussed in NUREG-1569 § 2.7, in that:
>
> 1. The DSEIS fails to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes, including the adequacy of applicant's plans to mitigate possible borehole-related migration impacts by monitoring wellfields surrounding the boreholes and/or plugging the boreholes.
>
> 2. There was insufficient information for the NRC staff to make an informed fluid migration impact assessment given that the applicant's six monitor-well clusters and the 24-hour pump tests at four of these clusters provided insufficient hydrological information to demonstrate satisfactory groundwater control during planned high-yield industrial well operations.

Further, in making this designation, which moves this issue statement forward as an admitted post-DSEIS issue statement as set forth above and in Appendix A to this issuance, we note that we do not agree with Joint Intervenors' claim that this contention also encompasses the more general issue of whether the natural hydrological connections between area aquifers pose a risk of fluid migration. To be sure, Dr. Abitz in his second declaration seeks to formulate challenges to the DSEIS based on asserted data gaps in the conceptual and numerical hydrologic models in the SEI application and claims about the complex fluvial stratigraphy of the area. See Abitz Declaration at 18. As our contention admission decision's citations to the relevant portions of the declarations of Drs. Moran, Sass, and Abitz indicated, the supporting information we concluded provided the foundational support for an admissible contention relative to fluid migration impacts concerned boreholes and the results of SEI pumping tests. See LBP-12-3, 75 NRC at 199. At the same time, as we indicated in reviewing that contention's

admissibility, we found insufficient to support this contention those portions of the declarations of Drs. Moran, Sass, and Abitz that sought to challenge the adequacy of the ER's analysis of site geology/seismology. See id. at 198. Dr. Abitz's data/modeling/stratigraphy concerns appear to be an attempt to revive these matters based on the DSEIS, which would require that they be proffered in the context of a new/amended contention supported by a showing that addresses the section 2.309(c) "good cause" and section 2.309(f)(1) admissibility requirements. Because Joint Intervenors have made no such showing, we need not give this more expansive claim further consideration in the context of this contention.

4. Environmental Contention 4/5A: The DSEIS fails to adequately assess cumulative impacts of the proposed action and the planned Lance District expansion project.

CONTENTION: The DSEIS violates 10 C.F.R. §§ 51.70, 51.71 and NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA because it fails to consider adequately cumulative impacts, including impacts on water quantity, that may result from the proposed ISL uranium mining operations planned in the Lance District expansion project.

DISCUSSION: Joint Intervenors Motion at 15–18; SEI Response at 19–20; Staff Response at 22–25; Joint Intervenors Reply at 18–20.

RULING: We admitted this issue statement combining Joint Intervenors' environmental contentions 4 and 5A insofar as they claimed that the SEI ER lacked a sufficient analysis of the cumulative impacts associated with the potential operation of several ISR facilities in the Lance District, of which the Ross facility site is but one portion. In doing so, the Board did not explicitly limit the scope of the cumulative impacts analysis at issue. But the Board did expressly denote groundwater quantity and quality as the matters for which adequate information had been submitted to support this contention's admission. See LBP-12-3, 75 NRC at 200, 203–04. In now seeking to "resubmit" this contention, from among the more than a dozen subject matter areas discussed in the staff's DSEIS section 5 cumulative impacts analysis, see DSEIS at x–xi,

Joint Intervenors, as well as Dr. Abitz as the supporting declarant, specifically reference only groundwater quantity and quality as the cumulative impact matters that continue to be inadequately analyzed. See Joint Intervenors Motion at 17–18; Abitz Declaration at 20–22. Consequently, in light of the Commission's direction to provide contention focus, see supra p. 15, if we were to find that this contention should pass through for further litigation via the migration tenet, we would limit its scope to groundwater quantity and quality cumulative impacts only.

As it turns out, however, we do not need to impose this limitation on this contention as "resubmitted" by Joint Intervenors because we conclude that the migration tenet is not applicable, given that the substantive basis of the cumulative impacts analysis asserted to be inadequate in the ER differs significantly from that provided in the DSEIS so that a new or amended contention would be required to frame an admissible contention. As we noted in our decision admitting this contention,

> With respect to the scope of SEI's Lance District expansion, SEI states in its ER that it intends to construct and operate additional ISR facilities in the Lance District expansion surrounding the Ross site. See 1 [SEI, ER, Ross ISR Project [NRC] License Application, Crook County, Wyoming at 1-19 to -20, 2-23 (Dec. 2010) (ADAMS Accession No. ML110130342) [hereinafter ER]]. SEI indicates that these additional facilities would likely operate as satellites of the Ross facility and would utilize the same CPP that SEI proposes to construct for the Ross project. See id. at 2-23. And with respect to cumulative impacts, SEI states:
>
> > Absent any site-specific features that could preclude development of these other sites (e.g., historical and cultural resources), ISR operations at additional sites likely will result in essentially the same potential impacts analyzed in this ER for the Proposed Action. Development of these sites may act to produce cumulative effects by increasing or prolonging the impacts analyzed for the Proposed Action, but the impacts will be distributed proportionately throughout the region of influence

> and therefore are not expected to significantly increase the severity of any impact.
>
> Id.

LBP-12-3, 75 NRC at 203. Joint Intervenors claimed then that, in light of their own showing regarding this contention, SEI's reliance on this cumulative impacts discussion simply framed a "disagreement over the degree and quality of cumulative impact analysis required in [SEI]'s ER" that should be settled in litigating the merits of its contention, [Joint Intervenors'] Reply to Responses by [SEI] and the NRC Staff to Petition to Intervene and Request for Hearing (Dec. 15, 2011) at 27, a criticism they reiterate relative to the groundwater cumulative impacts analysis that is now in the staff's DSEIS, see Joint Intervenors Reply at 19–20. But, as the staff suggests, based as it is on an analysis of (1) anticipated groundwater quantity restoration in light of uranium recovery operations in the Lance District; and (2) post-Lance District ISR groundwater quality based on conditions asserted to have existed following restoration of the earlier Nubeth Joint Venture ISR exploratory project that operated within the Ross facility site during the 1970s and 1980s, see DSEIS at 5-22 to -27, the DSEIS discussion of the cumulative impacts of groundwater quantity and quality differs substantially from the SEI ER approach, a differentiation that is further evidenced by Joint Intervenors' attempt to challenge the propriety of the staff's use of qualitative labeling -- i.e., SMALL, MEDIUM, and LARGE -- to characterize those impacts, see Joint Intervenors Motion at 17–18; Joint Intervenors Reply at 19–20.

As a consequence, the migration tenet is not applicable for this contention, so that a showing, even in the alternative,[15] regarding the section 2.309(f)(1) admissibility factors (as well

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[15] As was noted above, see supra section II.A.3, an admitted ER-based environmental contention's sponsor is not required to "resubmit" or otherwise make a filing regarding such a contention following issuance of the staff's environmental document if the contention properly is subject to the migration tenet. Nonetheless, if there is any question about whether that tenet is applicable, in the absence of a timely analysis of the section 2.309(c)(1) and (f)(1)

(continued...)

as the section 2.309(c) "good cause" factors) was needed to provide the foundation for a new or amended contention contesting the adequacy of the staff's DSEIS showing regarding cumulative groundwater quantity and quality impacts.

Because such a showing is lacking, this contention (as it is set forth in Appendix A to this decision) remains as originally admitted, see LBP-12-3, 75 NRC at 212, with its focus on the adequacy of the SEI ER. And in that regard, to what degree this contention's pre-DSEIS concern regarding the ER can now be amended to center on the DSEIS, or, in the absence of such an amendment, remains relevant or material to the environmental portion of this proceeding so as to be a litigable post-DSEIS issue statement are matters that the parties may wish to address in the context of additional motions submitted in accord with the proceeding's existing general schedule or as otherwise might be appropriate in light of this ruling.

C. Admissibility of Joint Intervenors' New Contention

> Environmental Contention 6: NRC has failed to properly define the scope of the proposed major federal action here, which encompasses a much larger project in the same geographic area, as revealed in the DSEIS and in documents drafted by Strata's Australian parent company, Peninsula Energy, Ltd.
>
> CONTENTION: The DSEIS violates 10 C.F.R. §§ 51.70 and 71, NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA because it fails to consider the environmental impacts of, and appropriate

[15](...continued)
new/amended contention precepts by the contention's sponsor, a board is not obligated to determine whether those new/amended contention requirements could have been met relative to the "migrated" environmental contention. See Boston Edison Co. (Pilgrim Nuclear Power Station), ALAB-816, 22 NRC 461, 465-68 (1985). Accordingly, a contention's sponsor may choose not to make any submission regarding an admitted ER-based environmental contention it believes properly will migrate and can simply await an applicant or staff filing challenging the contention's continued viability in light of the staff's environmental document. But if there is any question about whether an admitted contention merits a new/amended contention motion relative to the staff's environmental document, the best approach seemingly would be to make a filing that treats the contention as if it were new/amended or, perhaps most prudently, argues in the alternative. In this instance, however, no argument was made regarding the applicability of the section 2.309(c)(1), (f)(1) new/amended contention standards to any of the resubmitted contentions.

> alternatives to, the applicant's actual proposed project, and instead improperly segments the project by framing the Proposed Action under review as only a small part of the Applicant's planned and scheduled In Situ Recovery (ISR) activities in the Lance District.

DISCUSSION: Joint Intervenors Motion at 18–23; SEI Response at 20–23; Staff Response at 25–27; Joint Intervenors Reply at 20–30.

RULING: Inadmissible, in that this contention and its foundational support (1) do not present a genuine dispute on a material issue of law or fact so as to warrant the admission of this contention; or (2) lack the requisite good cause as based on previously available information that was not submitted in a timely fashion given that information's previous availability. See 10 C.F.R. §§ 2.309(c)(1)(i), (iii), (f)(1)(vi).

In support of their new contention, Joint Intervenors primarily rely on NRC and Council on Environmental Quality (CEQ) regulations implementing NEPA along with the United States Supreme Court's decision in Kleppe v. Sierra Club, 427 U.S. 390 (1976). Specifically, Joint Intervenors highlight a CEQ regulatory provision, 40 C.F.R. § 1502.4(a), that provides agencies must "make sure the proposal which is the subject of an [EIS] is properly defined" and directs agencies to use the parameters laid out in 40 C.F.R. § 1508.25 when defining the scope of the EIS. Additionally, section 1502.4(a) states that "[p]roposals or parts of proposals which are related to each other closely enough to be, in effect, a single course of action shall be evaluated in a single impact statement." Id. Citing this regulation and Kleppe, which discusses the scope of an EIS in the context of regional coal-mining projects, Joint Intervenors argue that because the Ross site is just one part of a potentially larger ISR mining expanse, namely the Lance District, in which other areas have been identified by SEI for future development and use, the larger district must be fully assessed within the DSEIS. Joint Intervenors thus assert that the DSEIS must be totally revamped and reissued as a comprehensive EIS that analyzes the Lance District in its entirety. See Joint Intervenors Motion at 19.

Relative to this new contention, the Board notes initially that within its fifty-page cumulative impacts section, the DSEIS considers the cumulative impacts of the Lance District and the other potential ISR sites therein.[16] See DSEIS at 5-1 to -51. The staff thus has recognized, at least to some degree, the potential impacts of these other sites, in conjunction with the Ross site, if SEI applies for and receives NRC licenses and subsequently operates ISR facilities at these additional locations within Lance District area. Moreover, the cumulative impacts associated with these sites is the subject of previously admitted environmental contention 4/5A, discussed in section II.B.4 above. Therefore, to the extent Joint Intervenors are concerned that the cumulative impacts of the other potential ISR mining areas within the Lance District have not been properly considered in this proceeding, this is an issue they already have placed before the Board, albeit, as we also noted in section II.B.4 above, at this point only in the context of a challenge to the SEI ER.

That being said, we also observe that to the degree Joint Intervenors focus on the nature of the “proposal” before the agency as supposedly providing a basis for admitting this new contention, the CEQ regulations and, more specifically, the Kleppe case are not necessarily supportive of their position here. In Kleppe, the Supreme Court explained that under NEPA § 102(2)(C), 42 U.S.C. § 2332(2)(C), which requires that an agency create an EIS, “the moment at which an agency must have a final statement ready ‘is the time at which it makes a recommendation or report on a proposal for federal action.’” Kleppe, 427 U.S. at 405–06 (quoting Aberdeen & Rockfish R.R. Co. v. Students Challenging Regulatory Agency Procedures, 422 U.S. 289, 320 (1975)). The Court then emphasized that an EIS should be

[16] The other sites are the Ross Amendment Area 1, which would expand the existing Ross site to the north and west, and the Kendrick, Richards, and Barber Satellite Amendment areas, which are located essentially in a contiguous line to the south of the Ross site. See DSEIS at 2-3 to -4, 5-3, 5-5.

issued to include other related actions only when those related actions have been formally proposed and are pending before the relevant agency, and noted that NEPA "does not require an agency to consider the possible environmental impacts of less imminent actions when preparing the impact statement on proposed actions." Id. at 410 & n.20; see id. at 410 ("[W]hen several proposals for . . . actions that will have cumulative or synergistic environmental impact upon a region are pending concurrently before an agency, their environmental consequences must be considered together." (emphasis added)). So too, in its McGuire decision, the Commission recognized this precept concerning the scope of the EIS regarding related actions by stating that "to bring NEPA into play, a possible future action must at least constitute a 'proposal' pending before the agency (i.e., ripeness), and must be in some way interrelated with the action that the agency is actively considering (i.e., nexus)." Duke Energy Corp. (McGuire Nuclear Station, Units 1 and 2; Catawba Nuclear Station, Units 1 and 2), CLI-02-14, 55 NRC 278, 295 (2002).

For their part, SEI and the staff focus on the "ripeness" element of this analysis. In this regard, SEI argues that Joint Intervenors' assertion that the staff's NEPA statement associated with the Ross site licensing process must encompass the entire Lance District "fails to account for the manner in which NRC regulates its licensees and evaluates proposed license/license amendment/license renewal applications." SEI Response at 21. According to SEI, the applicant is required to propose a particular licensing action, which, in this instance, is the licensing of the Ross ISR site. That "proposal," in turn, becomes the subject of the agency's licensing review process, assuming it is within the agency's regulatory jurisdiction, and so defines the scope of the licensing proceeding for the purpose of that process, including the agency's NEPA review. Consequently, as SEI has applied for an NRC license for the Ross ISR site, that site must be the focus of the staff's NEPA analysis. Id. at 22–23.

SEI is correct that a licensing strategy whereby an applicant seeks initial ISR licensing authorization to mine a particular area on which a central processing plant (CPP) is located, followed thereafter by additional license amendments to cover ISR activities on contiguous or nearby areas, has been employed previously under the agency's ISR facility licensing regime. See Crow Butte Resources, Inc. (Marsland Expansion Area), LBP-13-6, 77 NRC __, __, __ (slip op. at 2, 3) (May 10, 2013). Nonetheless, particularly in light of the staff's determination to analyze the cumulative impacts associated with the Lance District, the ability of an ISR facility applicant to proceed with its "proposal" in this manner as an administrative matter is hardly definitive in resolving the question raised by Joint Intervenors in positing environmental contention 6.

Instead, consistent with the "nexus" component of the Commission's McGuire analysis, with this contention Joint Intervenors assert that, regardless of its existing cumulative impacts analysis, the DSEIS, in the words of environmental contention 6, "improperly segments" the project so that the staff fails to meet its NEPA obligation to prepare a comprehensive SEIS that encompasses all the individual ISR sites that SEI has indicated could be developed within the overall Lance District area. As their support for this improper segmentation claim, Joint Intervenors provide a declaration prepared by Christopher Paine, NRDC Senior Policy Advisor, wherein Mr. Paine principally discusses various press releases from SEI's corporate parent, Peninsula Energy, Ltd., (PEL) that reference the Lance District and the company's plans for its use. According to Joint Intervenors, these indicate that the Ross ISR site is merely one component of the multi-part, interconnected Lance District project, the entirety of which is slated for ISR development. See Joint Intervenors Motion at 19–20; Paine Declaration at unnumbered pp. 14–28.

In assessing this improper segmentation claim as it seeks to provide the grounds for a litigable contention, we look to 40 C.F.R. § 1508.25(a), the CEQ regulation that outlines the scope or range of actions that should be considered in an EIS and which NRC's Part 51 regulations recognize should be used in implementing NEPA section 102(2), see 10 C.F.R. § 51.14(b). Under section 1508.25(a), three types of actions are to be considered in looking to the scope of an EIS: connected, cumulative, and similar. Further, to determine whether actions are "connected" such that they "should" be discussed in the same EIS, section 1508.25(a)(1) indicates that an agency is to consider whether the actions (1) "automatically trigger" other actions that may require an EIS; (2) "[c]annot or will not proceed unless other actions are taken previously or simultaneously"; or (3) "[a]re interdependent parts of a larger action and depend on the larger action for their justification." 40 C.F.R. § 1508.25(a)(1)(i)–(iii). "Cumulative" actions, on the other hand, are those that "when viewed with other proposed actions have cumulatively significant impacts" so that they "should" be discussed in the same EIS. Id. § 1508(a)(2). And finally "similar" actions are those that, "when viewed with other reasonably foreseeable or proposed agency actions, have similarities that provide a basis for evaluating their environmental impacts together, such as common timing or geography," so that the agency "may wish to analyze them together." Id. § 1508(a)(3).

With respect to whether the Ross ISR site and the other Lance District ISR sites are "connected" proposals per section 1508.25(a)(2), in this instance the relevant criterion appears to be whether, in accord with paragraph (iii), the requisite "interdependence" exists among the various actions at issue. See Joint Intervenors Motion at 22. And in making this determination, courts generally have looked to see whether the first action (in this instance, the Ross ISR facility) has "independent utility," Thomas v. Peterson, 753 F.2d 754, 759 (9th Cir. 1985); see also McGuire, CLI-02-14, 55 NRC at 297 ("[W]hen developing an EIS, an agency must consider

the impact of other proposed projects 'only if the projects are so interdependent that it would be unwise or irrational to complete one without the other.'") (quoting Webb v. Gorsuch, 699 F.2d 157, 161 (4th Cir. 1983))). Moreover, in seeking to demonstrate such interdependence between the Ross ISR site and the potential development of the other ISR sites in the Lance District to the degree necessary to obtain the admission of environmental contention 6, Joint Intervenors have offered various indicia of support.

One is their statement, made without any referenced support, that "the [CPP] to be developed under the 'Ross Project' may not even constitute an economically viable investment without the revenue assumptions based on exploiting these additional 'production units.'" Id. at 20. While recognizing that a board may appropriately view a petitioner's supporting information in a light favorable to the petitioner, see Ariz. Pub. Serv. Co. (Palo Verde Nuclear Station, Units 1, 2, and 3), CLI-91-12, 34 NRC 143, 155 (1991), it is also the case that neither mere speculation nor bare or conclusory assertions, even by an expert, will suffice to allow the admission of a proffered contention, see Fansteel, Inc. (Muskogee, Oklahoma Site), CLI-03-13, 58 NRC 195, 203 (2003). Given that Joint Intervenors have provided nothing concrete to support the central premise of this statement that the Ross CPP "may" not be economically viable without licensing/operating the other proposed ISR facilities in the Lance District, we find this assertion to be wholly inadequate to support the admission of this contention.

Another is Joint Intervenors' reference to the fact that, as the DSEIS and, indeed, the ER acknowledge, see DSEIS at 2-13; 1 ER at 1-4, the CPP for the Ross facility is planned to have "four times the capacity justified by proven reserves" on the Ross ISR site, thereby allowing loaded ion exchange resins from the other potential Lance District ISR sites to be brought to the Ross facility for processing. Joint Intervenors Reply at 26. But denoting aspects of the Ross facility licensing proposal that will permit economic and operational efficiency if SEI successfully

carries out its apparent plan to have other Lance District ISR sites licensed is not the same as showing that the Ross ISR facility itself lacks any "independent utility" such that its licensing and operation would not go forward absent the licensing and operation of the other Lance District ISR sites.

Also provided as support are numerous references to the fact that SEI's apparent strategy will be to move forward in the near term with licensing the other ISR projects within the Lance District. See Joint Intervenors Motion at 21; Joint Intervenors Reply at 26 n.20. Joint Intervenors highlight in this regard a PEL press release statement indicating that employing a stratagem whereby, once the Ross ISR site is licensed, the contiguous Lance District ISR sites will be licensed via amendments to the Ross license is a strategy that "'will significantly reduce the permitting process and timing.'" Joint Intervenors Motion at 20 (quoting Press Release, PEL Definitive Feasibility and Expanded Economic Studies Confirm the Viability of the Lance ISR Projects (Dec. 21, 2011), http://www.pel.net.au/images/peninsul---singaefehu.pdf). In addition, within Mr. Paine's supporting declaration are various statements suggesting that the apparent SEI plan eventually to license all the potential ISR sites in the Lance District is "economically-driven," including his reference to a November 2012 PEL press release stating that the schedule under which the staff provided SEI with a draft license for the Ross facility is consistent with the "'project economics'" and evidences the fact that the planned expansion "is highly likely to occur." Paine Declaration at unnumbered pp. 24–25 (emphasis in original) (quoting Press Release, PEL, Peninsula Receives Draft Source Material License (Nov. 8, 2012), http://www.pel.net.au/images/peninsul---aimohgaeto.pdf). While these assertions all support the premise that there is a strong likelihood that PET/SEI intend that eventually all the Lance District ISR sites will be licensed and operating, they are not the same as showing, as would be pertinent to the question of whether the Ross ISR facility is a "connected" action as defined in

section 1508.25(a)(2), that the Ross facility lacks any independent utility in the absence of the completion of the other Lance District ISR sites.

Consequently, as to whether the "connected" action aspect of section 1508.25(a)(2) supports this improper segmentation contention's admissibility, because Joint Intervenors have failed to meet the contention admissibility requirement of 10 C.F.R. § 2.309(f)(1)(vi) by not providing sufficient supporting information to show that a genuine dispute exists on the material issue of whether the Ross ISR facility is an interdependent part of the larger Lance District project, we cannot admit their improper segmentation contention on that basis.

As to the "cumulative" and "similar" elements of the section 1508.25(a) scoping analysis, of which only the latter is even mentioned by Joint Intervenors, albeit without elaboration, see Joint Intervenors Motion at 19, to whatever degree they might be a more fruitful source of support for this contention so as to meet the section 2.309(f)(1) admissibility criteria,[17] they nonetheless face a significant barrier under section 2.309(c)(1)(i), (iii), to the degree those criteria require that the information supporting the new contention was not previously available and that the contention was timely submitted based on the availability of the "not previously available" supporting information. Putting aside whether Joint Intervenors may have been justified in failing previously to lodge a new segmentation contention based on the

[17] For instance, the fact that the staff previously supported the need for a cumulative impacts analysis, see LBP-12-3, 75 NRC at 200, 203, which it now has provided in the DSEIS regarding the other Lance District ISR sites, at least suggests that, consistent with section 1508.25(a)(2)(ii), there are "cumulative actions" that might need full NEPA consideration in the same impact statement. Further, while the courts have recognized that the permissive "may" language of section 1508.25(a)(2)(iii) affords an agency more discretion in making a choice about whether a single EIS is the "best way" to assess "similar" actions, Klamath-Siskiyou Wildlands Ctr. v. BLM, 387 F.3d 989, 1001 (9th Cir. 2004), the geographic proximity of the Ross ISR site to the other Lance District ISR sites and the apparent timing of the future licensing actions for these other ISR sites vis á vis the Ross ISR site seemingly would be relevant in determining whether they are "similar" actions under that provision so as to merit consideration in a single impact statement.

interdependence of the Ross ISR site and other Lance District ISR sites as "connected" actions, from the information provided in the SEI ER regarding the other potential Lance District ISR sites, see 1 ER at 2-8 to -9, 2-14, 2-23, as well the information in the various PEL press releases dating back to October 2010 that are cited by Mr. Paine in his declaration accompanying Joint Intervenors' June 2013 motion,[18] it is clear that by the time of the filing of their October 2011 hearing petition or perhaps shortly thereafter, Joint Intervenors could have sought to raise the question of whether, in accord with section 1508.25(a)(2)–(3), the Ross ISR site and the other Lance District ISR sites did constitute "cumulative" or "similar" actions such that a single SEIS addressing all potential Lance District ISR sites was appropriate. Having failed to do so at that time, we are unable to conclude that, under the section 2.309(c)(1)(i), (iii) criteria, good cause exists for their current motion seeking to interpose such a new segmentation issue now.

In sum, relative to NEPA and the relevant CEQ regulations and case law interpreting that environmental enactment so as to require that a comprehensive EIS be issued when actions are "connected," Joint Intervenors have failed to present a showing supporting environmental contention 6 sufficient to create a genuine dispute about the material issue of whether the Ross ISR facility and the other potential ISR facilities in the Lance District are

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[18] We note that Joint Intervenors, indicating they discovered the various PEL press releases in preparing to comment on the truncated scope of the staff's DSEIS, maintain that, given the SEI and staff "shell game" of asserting that the Ross ISR facility and the other Lance District ISR sites are entirely separate for NEPA purposes, they had no reason to seek such information until it was too late to challenge the project's scope. Joint Intervenors Reply at 22. Given that SEI disclosed in its application that PEL was its parent, see 1 ER at 1-7, and, as we referenced above, provided information outlining its intent to develop multiple ISR sites within the Lance District, we fail to see how Joint Intervenors then lacked the basic ingredients needed to seek the foundational information required to frame and adequately support a segmentation contention in the context of challenging the SEI ER, which clearly did not provide the breadth of information Joint Intervenors now assert needs to be compiled to generate a comprehensive SEIS encompassing the entire Lance District.

interdependent such that a comprehensive SEIS encompassing the Lance District is now required in the context of licensing the Ross ISR facility. See 10 C.F.R. § 2.309(f)(1)(vi). Further, on the question of whether the Ross ISR facility licensing proceeding and the potential licensing of the other Lance District ISR sites are "cumulative" or "similar" actions under the applicable CEQ guidance and associated caselaw so as to mandate a single SEIS now, Joint Intervenors likewise have failed to show that, under the standards in section 2.309(c)(1)(i), (iii), good cause exists for their post-hearing petition environmental contention 6. Thus, having failed to meet either the contention admissibility standards set forth in 10 C.F.R. § 2.309(f)(1) or the "good cause" provision of section 2.309(c)(1), this contention must be rejected.[19]

III. CONCLUSION

In considering Joint Intervenors' May 6, 2013 request that "resubmitted" versions of their four already-admitted NEPA-related contentions referencing the staff's DSEIS be accepted for further litigation in this proceeding, based on the application of the "migration" tenet applicable to environmental contentions that are footed in an applicant's ER, the Board (1) approves Joint Intervenors' request as to environmental contentions 1, 2, and 3, as set forth in Appendix A to this decision; and (2) denies their request as to environmental contention 4/5A, thereby leaving intact the previously admitted contention (also set forth in Appendix A) as it references the applicant's ER. Further, finding that new environmental contention 6 also proffered with Joint

[19] Although SEI holds out the promise that "interested stakeholders will have ample opportunity to file challenges to . . . potential future project sites if and when [SEI] submits a license amendment application to the NRC for its review," SEI Response at 23 (footnote omitted), given the apparent staff practice relative to such amendments of attempting to fulfill its NEPA responsibilities in the context of an environmental assessment rather than an SEIS, see Licensing Board Order (Initial Prehearing Conference and Scheduling Order), Crow Butte Resources, Inc. (Marsland Expansion Area), Docket No. 40-8943-MLA-2 (June 14, 2013), at 5 n.3 (unpublished), the degree to which the types of impacts Joint Intervenors are concerned about here will, in the first instance, be the subject of future consideration remains to be seen.

Intervenors' May 6 submission fails to meet either the "good cause" or admissibility requirements of 10 C.F.R. § 2.309(c)(1)(I), (iii), (f)(1)(vi), we deny Joint Intervenors' request to admit that new contention for litigation in this proceeding.

For the foregoing reasons, it is this twenty-sixth day of July 2013, ORDERED, that:

1. As Joint Intervenors' May 6, 2013 motion seeks to resubmit Environmental Contentions 1, 2, and 3, the motion is granted in that those three contentions, as set forth in Appendix A to this issuance, are accepted for further litigation.

2. As Joint Intervenors' May 6, 2013 motion seeks to resubmit Environmental Contention 4/5A, the motion is denied.

3. As Joint Intervenors' May 6, 3013 motion seeks the admission of new Environmental Contention 6, the motion is denied.

THE ATOMIC SAFETY
AND LICENSING BOARD

/RA/
G. Paul Bollwerk, III, Chair
ADMINISTRATIVE JUDGE

/RA/
Richard F. Cole
ADMINISTRATIVE JUDGE

/RA/
Kenneth L. Mossman
ADMINISTRATIVE JUDGE

Rockville, Maryland

July 26, 2013

APPENDIX A

ADMITTED CONTENTIONS

1. Environmental Contention 1: The DSEIS fails to adequately characterize baseline (i.e., original or pre-mining) groundwater quality.

   CONTENTION: The DSEIS fails to comply with 10 C.F.R. §§ 51.70 and 71, 10 C.F.R. Part 40, Appendix A, and NEPA because it lacks an adequate description of the present baseline (i.e., original or pre-mining) groundwater quality and fails to demonstrate that groundwater samples were collected in a scientifically defensible manner, using proper sampling methodologies. The DSEIS's departure from NRC guidance serves as additional evidence of these regulatory violations. NRC, NUREG-1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications, §§ 2.7.1, 2.7.3, 2.7.4 (2003).

2. Environmental Contention 2: The DSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits.

   CONTENTION: The DSEIS fails to meet the requirements of 10 C.F.R. §§ 51.70, 51.71 and NEPA because it fails to evaluate the virtual certainty that the applicant will be unable to restore groundwater to primary or secondary limits in that the DSEIS does not provide and evaluate information regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an Alternative Concentration Limit (ACL) in accordance with 10 C.F.R. Part 40, App. A, Criterion 5B(5)(c).

3. Environmental Contention 3: The DSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.

   CONTENTION: The DSEIS fails to assess adequately the likelihood and impacts of fluid migration to the adjacent groundwater, as required by NEPA, and as discussed in NUREG-1569 § 2.7, in that:

   1. The DSEIS fails to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes, including the adequacy of applicant's plans to mitigate possible borehole-related migration impacts by monitoring wellfields surrounding the boreholes and/or plugging the boreholes.

   2. There was insufficient information for the NRC staff to make an informed fluid migration impact assessment given that the applicant's six monitor-well clusters and the 24-hour pump tests at four of these clusters provided insufficient hydrological information to demonstrate satisfactory groundwater control during planned high-yield industrial well operations.

4. Environmental Contention 4/5A: The application fails to adequately assess cumulative impacts of the proposed action and the planned Lance District expansion project.

CONTENTION: The application violates 10 C.F.R. § 51.45, NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA because it fails to consider adequately cumulative impacts, including impacts on water quantity, that may result from SEI's proposed ISL uranium mining operations planned in the Lance District expansion project.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

G. Paul Bollwerk, III, Chairman
Dr. Richard F. Cole
Dr. Kenneth L. Mossman

In the Matter of	Docket No. 40-9091-MLA
STRATA ENERGY, INC.	ASLBP No. 12-915-01-MLA-BD01
(Ross In Situ Recovery Uranium Project)	August 27, 2013

MEMORANDUM AND ORDER
(Denying Motion for Reconsideration of LBP-13-10 Ruling Regarding Environmental Contention 4/5A or, Alternatively, to Admit Amended Contention)

Pending before the Licensing Board is an August 5, 2013 motion filed by Joint Intervenors[1] requesting that, in the first instance, the Board reconsider its recent ruling in LBP-13-10, 78 NRC __ (July 26, 2013), with respect to their admitted environmental contention 4/5A, which concerns the adequacy of the National Environmental Policy Act (NEPA)-related analysis being provided regarding the cumulative impacts of the development and operation of other potential in situ recovery (ISR) sites by applicant Strata Energy, Inc., (SEI) in the vicinity of the SEI Ross ISR site that is the subject of this proceeding. See [Joint Intervenors'] Motion for Leave to Request Partial Reconsideration of the Board's Memorandum and Order of July 26, 2013, or Alternatively, to File Amended Contention (Aug. 5, 2013) [hereinafter Reconsideration/Amendment Motion]. Specifically, Joint Intervenors ask that the Board reconsider its determination not to permit the "resubmission" (i.e., migration) of that

[1] Joint Intervenors are the Natural Resources Defense Council and the Powder River Basin Resource Council.

contention so as to frame a challenge to the cumulative impacts analysis in the Nuclear Regulatory Commission (NRC) staff's draft supplemental environmental impact statement (DSEIS) rather than that in the SEI environmental report (ER), which is the focus of this contention as originally admitted. See id. at 4–8. Alternatively, in their motion, Joint Intervenors ask that the Board, in accordance with the provisions of 10 C.F.R. § 2.309(c), permit them to amend this contention so as to frame a challenge to the staff's DSEIS cumulative impacts analysis. See id. at 8–10. SEI and the staff oppose both of these requests.

For the reasons set forth below, we deny Joint Intervenors' motion for reconsideration/to amend.

I. BACKGROUND

A description of the circumstances leading up to the issuance of LBP-13-10 can be found in the background discussion included in that decision. See LBP-13-10, 78 NRC at __ (slip op. at 3–4). With that July 26 decision, the Board granted Joint Intervenors' request to "resubmit" three of their four admitted environmental contentions, namely contentions 1, 2, and 3, and denied their request to admit a new environmental contention 6. See id. at __ (slip op. at 32-33), App. A. Further, regarding Joint Intervenors' fourth admitted issue statement, environmental contention 4/5A challenging the adequacy of the SEI ER's analysis of the cumulative impacts on groundwater quality and quantity associated with the operation of several other potential SEI ISR facilities in the Lance District, of which the Ross ISR site is one portion, the Board found that this contention did not meet the criteria for migration from an ER-based concern to a challenge footed in the adequacy of the staff's DSEIS. See id. at __–__, __ (slip op. at 19-22, 32). Specifically, the Board concluded that

> the DSEIS discussion of the cumulative impacts of groundwater quantity and quality differs substantially from the SEI ER

> approach . . . [such that] the migration tenet is not applicable for this contention, so that a showing, even in the alternative, regarding the section 2.309(f)(1) admissibility factors (as well as the section 2.309(c) "good cause" factors) was needed to provide the foundation for a new or amended contention contesting the adequacy of the staff's DSEIS showing regarding cumulative groundwater quantity and quality impacts.

Id. at __ (slip op. at 21) (footnote omitted).

On August 5, Joint Intervenors filed the previously referenced motion seeking, in the alternative, (1) reconsideration of the Board's determination not to allow environmental contention 4/5A to migrate so as to become a challenge to the adequacy of the cumulative impacts analysis in the staff's DSEIS; or (2) to amend environmental contention 4/5A to provide for such a challenge. See Reconsideration/Amendment Motion at 1. SEI and the staff have filed pleadings opposing both these requests. See [SEI's] Response to [Joint Intervenors'] Motion for Leave to Request Partial Reconsideration of the Board's Memorandum and Order of July 26, 2013, or Alternatively, to File Amended Contention (Aug. 19, 2013) at 1; NRC Staff Response to [Joint Intervenors'] Motion for Leave to Request Partial Reconsideration of the Board's Memorandum and Order of July 26, 2013, or Alternatively, to File Amended Contention (Aug. 15, 2013) at 1.

II. ANALYSIS

As outlined in 10 C.F.R. § 2.323(e), a reconsideration request like Joint Intervenors' can be granted only "upon a showing of compelling circumstances, such as the existence of a clear and material error in a decision, which could not have reasonably been anticipated, that renders the decision invalid." Recognizing the applicability of this standard, Joint Intervenors assert that the "compelling circumstances . . . which could not have reasonably been anticipated" associated with the Board's LBP-13-10 ruling regarding environmental contention 4/5A are that

the result that attained regarding environmental contentions 1, 2, and 3 — i.e., that the Board agreed that those contentions would be allowed to migrate from SEI ER-based challenges to staff DSEIS-based issue statements — was not found to be appropriate for environmental contention 4/5A. And in this regard, while indicating that they disagree with the Board's determination that, in contrast to the other three contentions, "the differences between the cumulative impacts discussion in the DSEIS and the ER make [environmental contention 4/5A] ineligible for migration," Joint Intervenors declare that the focus of their reconsideration request is actually on "the Board's next step." Reconsideration/Admission Motion at 5. Joint Intervenors maintain that "having found [environmental contention 4/5A] ineligible for migration precisely because the DSEIS contained new, 'materially different' information than the ER, the Board should have applied the standards that govern such an outcome, i.e., whether Intervenors are entitled to amend this [c]ontention" because it meets the "good cause" requirements of 10 C.F.R. § 2.309(c). Id. at 5–6. If the Board had done so, Joint Intervenors claim that "it would have taken no further analysis for the Board to have concluded that [c]ontention 4/5A satisfies the 10 C.F.R. § 2.309(c) criteria," thereby resulting in the contention's admission as a challenge to the staff's DSEIS cumulative impacts analysis. Id. at 6. Moreover, Joint Intervenors assert this was a result they "could not reasonably have anticipated" so as to support Board reconsideration and a determination to "consider [Joint Intervenors'] [c]ontention 4/5A as submitted on May 6, 2013 as an Amended Contention." Id. at 7–8.

In outlining their reasoning why reconsideration is merited in this instance, Joint Intervenors have also highlighted a "clear and material error" in their understanding of what is required for the admission of a new or amended contention that ultimately is fatal to their claim that Board reconsideration is appropriate. Even assuming Joint Intervenors are correct that the circumstances surrounding their revised environmental contention 4/5A would have been

sufficient to meet the "good cause" requirements of section 2.309(c)(1),[2] that alone is not enough to establish their issue statement's admissibility as an amended or new contention. As the Board pointed out quite clearly in its July 26 decision, the inapplicability of the migration tenet to the environmental contention 4/5A required a showing by Joint Intervenors "regarding the section 2.309(f)(1) admissibility factors (as well as the section 2.309(c) 'good cause' factors) . . . to provide the foundation for a new or amended contention contesting the adequacy of the staff's DSEIS showing regarding cumulative groundwater quantity and quality impacts." LBP-13-10, 78 NRC at __ (slip op. at 21–22); see also id. at __ (slip op. at 6) (citing 10 C.F.R. § 2.309(c)(4)); 10 C.F.R. § 2.309(f)(2). Yet, nowhere in their original "resubmission" motion or, indeed, in their subsequent reconsideration motion have Joint Intervenors made any attempt to carry what is clearly their burden to establish that each of the section 2.309(f)(1) factors would be met relative to their claim that the staff's DSEIS cumulative impacts analysis is deficient so as to warrant the admission of an amended contention. We thus see no basis for reconsidering our LBP-13-10 ruling regarding the resubmission/migration of Joint Intervenors' environmental contention 4/5A.[3]

As to Joint Intervenors' alternative proposal that their unsuccessful "resubmitted" contention request now be considered a request to admit an amended contention, this suffers

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[2] This would presume, for instance, that the Board's finding that the migration tenet did not apply because the staff's DSEIS cumulative impacts analysis differed "significantly" from the SEI ER's approach, see LBP-13-10, 78 NRC at __ (slip op. at 21), is (as Joint Intervenors appear to assume, see Reconsideration/Amendment Motion at 5–6) the functional equivalent of the "materially" different standard of 10 C.F.R. § 2.309(c)(1)(ii).

[3] Of course, from Joint Intervenors' perspective, this determination likewise may "'clearly exalt form over substance.'" Reconsideration/Amendment Motion at 6 (quoting U.S. Army (Jefferson Proving Ground Site), LBP-04-01, 59 NRC 27, 29 (2004)). Nonetheless, particularly in the face of the legal and technical resources that apparently are available to Joint Intervenors, we see no reason for the Board to generate an analysis of each of the six section 2.309(f)(1) contention admissibility factors on its own, essentially out of whole cloth.

from the same deficiency that plagues their reconsideration motion. Even assuming Joint Intervenors can establish the requisite "good cause" under section 2.309(c)(1),[4] Joint Intervenors have made no showing that they have met their burden regarding the six admissibility factors in section 2.309(f)(1). We thus see no ground for admitting their post-DSEIS revised version of environmental contention 4/5A as an amended contention.

Consequently, Joint Intervenors' August 5 motion for reconsideration of our ruling in LBP-13-10 regarding environmental contention 4/5A or, alternatively, for the admission of an amended contention is denied.

Finally, with regard to the schedule for filing any dispositive motions concerning environmental contention 4/5A, the parties should submit such motions and responses in accord with the general schedule provisions that apply to environmental contentions 1, 2, and 3. See Licensing Board Memorandum and Order (Regarding Requested Extension of Time for

[4] We note, however, that particularly suspect in this regard is Joint Intervenors' assertion that "good cause" exists for such a request under section 2.309(c)(1)(i) because the information "not previously available" was "the fact that the Board would not permit [c]ontention 4/5A to simply migrate from the ER to the DEIS." Reconsideration/Amendment Motion at 8–9; see LBP-13-10, 78 NRC at __ & n.15 (slip op. at 21–22 & n.15) (noting that if any question exists, best approach would be to argue in the alternative regarding post-environmental statement migration or amendment of admitted environmental contention).

Filing Summary Disposition Motions; Revised General Schedule) (Aug. 16, 2013) at 4–5, App. A at 1 (unpublished).

It is so ORDERED.

THE ATOMIC SAFETY
AND LICENSING BOARD

/RA/

G. Paul Bollwerk, III, Chairman
ADMINISTRATIVE JUDGE

/RA/

Richard F. Cole
ADMINISTRATIVE JUDGE

/RA/

Kenneth L. Mossman
ADMINISTRATIVE JUDGE

Rockville, Maryland

August 27, 2013

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

G. Paul Bollwerk, III, Chairman
Dr. Richard F. Cole
Dr. Craig M. White

In the Matter of	Docket No. 40-9091-MLA
STRATA ENERGY, INC.	ASLBP No. 12-915-01-MLA-BD01
(Ross In Situ Recovery Uranium Project)	May 23, 2014

MEMORANDUM AND ORDER
(Ruling on Motion to Migrate/Amend Existing Contentions and Admit New Contentions Regarding Final Supplement to Generic Environmental Impact Statement)

On February 28, 2014, the Nuclear Regulatory Commission (NRC) staff issued the final supplement to the agency's generic environmental impact statement (EIS) on in situ recovery (ISR) projects intended to provide the staff's National Environmental Policy Act (NEPA)-mandated assessment of the license application of Strata Energy, Inc., (SEI) to possess and use nuclear source and section 11(e).2 byproduct material in the context of SEI's operation of its proposed Ross ISR Uranium Project site. See Office of Federal and State Materials and Environmental Management Programs, NRC, [EIS] for the Ross ISR Project in Crook County, Wyoming; Supplement to the Generic [EIS] for In-Situ Leach Uranium Milling Facilities, NUREG-1910 (supp. 5 Feb. 2014) (ADAMS Accession No. ML14056A096) [hereinafter FSEIS]. Now pending with the Licensing Board is Joint Intervenors'[1] March 31 motion seeking to (1) migrate or amend the four already-admitted contentions in this proceeding

[1] Joint Intervenors are the Natural Resources Defense Council and the Powder River Basin Resource Council.

so as to carry them forward in light of the staff's final supplement to the ISR generic EIS; and (2) admit two new contentions based on the staff's final supplement to the generic EIS. See [Joint Intervenors] Joint Motion to Migrate or Amend Contentions and to Admit New Contentions in Response to Staff's Final Supplemental Draft [EIS] (Mar. 31, 2014) [hereinafter Joint Intervenors Motion]. In filings dated April 14 and 23, respectively, the staff and SEI have responded to this submission. Given the basis for their admission, the staff does not challenge the migration of two of the existing contentions but does argue for the dismissal of the other two existing contentions and the two new contentions, while SEI asserts that neither of the new contentions meet the Part 2 admissibility requirements nor should the four existing contentions be allowed to migrate or be amended so as to be subject to further litigation in this proceeding. See NRC Staff Response to [Joint Intervenors'] Joint Motion to Migrate or Amend Contentions, and to Admit New Contentions in Response to Staff's Final Supplemental Draft [EIS] (Apr. 14, 2014) at 1 [hereinafter Staff Response]; Applicant [SEI's] Response to [Joint Intervenors] New and Amended Contentions on [FSEIS] (Apr. 23, 2014) at 1 [hereinafter SEI Response].

For the reasons set forth herein, we will (1) allow Joint Intervenors' existing environmental contentions 1, 2, and 3 to proceed for further litigation as FSEIS-related contentions, but will allow their currently-admitted environmental contention 4/5A to proceed only as an environmental report (ER)-related contention; and (2) dismiss their two new contentions as failing to fulfill the "good cause" requirement of 10 C.F.R. § 2.309(c).

I. BACKGROUND

The previous history of this proceeding is set forth in some detail in the Board's respective February 2012 and July 2013 rulings on Joint Intervenors' October 2011 initial hearing petition, see LBP-12-3, 75 NRC 164, 210, aff'd in part and review declined, CLI-12-12,

75 NRC 603 (2012) (affirming standing ruling and declining review as to contention admissibility rulings), and their May 2013 motion to have their four admitted contentions continue forward for litigation given the staff's March 2013 draft supplement to the agency's generic ISR EIS and to admit a new contention, LBP-13-10, 78 NRC 117, 129 (2013), reconsideration denied, Memorandum and Order (Denying Motion for Reconsideration of LBP-13-10 Ruling Regarding Environmental Contention 4/5A or, Alternatively, to Admit Amended Contention) (Aug. 27, 2013) (unpublished). As such, we take up where we left off with our July 2013 decision in which we determined that (1) three of Joint Intervenors' admitted contentions, i.e., environmental contentions 1, 2 and 3, that concern adequate baseline groundwater quality characterization, appropriate environmental impacts analysis of a failure to restore groundwater to primary or secondary limits, and groundwater fluid migration containment, had properly migrated to become challenges to the staff's DSEIS; (2) previously admitted environmental contention 4/5A, concerning cumulative impacts associated with the planned Lance District expansion project, had not migrated as a challenge to the staff's DSEIS and thus remained as contesting the SEI ER only; and (3) new environmental contention 6, concerning a purported staff failure to define properly the scope of the proposed major federal action given Lance District expansion project, was not admissible. See LBP-13-10, 78 NRC at 135–50. As was the case with the DSEIS, however, the Board's general schedule acknowledged that Joint Intervenors could file a motion seeking the admission of new/amended contentions relative to the issuance of the staff's FSEIS and established a schedule for such a filing. See, e.g., Licensing Board Memorandum and Order (Revised General Schedule) (Nov. 6, 2013) app. A, at 1 (unpublished). Joint Intervenors' pending motion, which hues to that schedule, was followed by responsive filings from the staff

and SEI, noted previously, and Joint Intervenors' reply to those staff and SEI responses,[2] see [Joint Intervenors'] Reply in Support of Motion to Migrate or Amend Contentions, and to Admit New Contentions (May 7, 2014) [hereinafter Joint Intervenors Reply].

II. ANALYSIS

A. Standards Governing the Admission of New/Amended Contentions

We will not repeat the extensive discussion we provided in our July 2013 decision regarding the standards that apply to the admission of new/amended contentions or the migration of existing contentions from contentions challenging an applicant's ER, to contentions contesting a DSEIS, to contentions disputing the FSEIS. See LBP-13-10, 78 NRC at 130–34. Suffice it to say that we will again apply these standards to Joint Intervenors' post-FSEIS contentions.

B. Post-FSEIS Litigability of Joint Intervenors' Admitted Contentions

1. Environmental Contention 1: The FSEIS fails to adequately characterize baseline (i.e., original or pre-mining) groundwater quality.

CONTENTION: The FSEIS fails to comply with 10 C.F.R. §§ 51.90-94, 10 C.F.R. Part 40, Appendix A, and NEPA because it lacks an adequate description of the present baseline (i.e., original or pre-mining) groundwater quality and fails to

[2] Acting on the unopposed requests of Joint Intervenors and SEI, the Board did grant a ten-day extension to SEI to file its response to Joint Intervenors' motion and a seven-day extension to Joint Intervenors to file their reply to the SEI and staff responses. See Licensing Board Memorandum and Order ((Granting Motion for Extension of Time to File Responses/Reply to Pending New/Amended Contentions Motion and Setting Schedule/Parameters for Parties to Provide Proposed Revised General Schedule) (Apr. 14, 2014) at 4 (unpublished). Given the existing general schedule, these extensions had the potential to delay the evidentiary hearing slated to begin in late September 2014, but with the issuance of this decision on this date that schedule for the hearing remains on track. See Licensing Board Memorandum and Order (Revised General Schedule) (May 23, 2014) app. A, at 2 (unpublished); see also Licensing Board Memorandum and Order (Regarding General Schedule and Site Visits/Limited Appearance Session/Evidentiary Hearing) (May 9, 2014) at 2–3 (unpublished).

demonstrate that groundwater samples were collected in a scientifically defensible manner, using proper sampling methodologies. The FSEIS's departure from NRC guidance serves as additional evidence of these regulatory violations. NRC, NUREG-1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications, §§ 2.7.1, 2.7.3, 2.7.4 (2003).

DISCUSSION: Joint Intervenors Motion at 7–9, 19–23; Staff Response at 11–14; SEI Response at 6–13; Joint Intervenors Reply at 6–9.

RULING: As we noted in our July 2013 DSEIS-related contentions order, in the context of admitting this contention, the Board (1) found sufficiently open to question SEI's and the staff's arguments that, under 10 C.F.R. § 51.45, SEI was not required (and perhaps was even precluded under section 40.32(e) from seeking) to establish a baseline water quality for the Ross facility site until after any grant of a Part 40 license to SEI; and (2) given the information provided in support of Joint Intervenors' contention regarding the adequacy of SEI's showing in its ER concerning such a baseline, there was a genuine dispute about the material issue of whether SEI in its ER had in fact provided the staff with sufficient information concerning facility baseline water quality so as to allow the staff to provide an adequate NEPA assessment of the impacts of facility operation on water quality. See LBP-13-10, 78 NRC at 135–36. Additionally, we found that the central analytical deficiency alleged by Joint Intervenors' environmental contention 1 with regard to the SEI ER, i.e., that SEI and the staff improperly intend to postpone until after licensing collecting the information that could meet the 10 C.F.R. Part 40, App. A, Criterion 5B(5)(a) and Criterion 7 standards on "background" groundwater constituents and "complete baseline data" for an ISR site, as those are to be implemented pursuant to the staff's NUREG-1569 guidance to applicants to provide "'[r]easonably comprehensive' water sampling data shown to be 'collected by acceptable sampling procedures,'" applied with equal force to the DSEIS analysis. See id. at 136 (quoting Office of Nuclear Material Safety and Safeguards, NRC, Standard Review Plan for In Situ Leach Uranium Extraction License Applications,

NUREG-1569, at 2-24 (June 2003)). As a consequence, we concluded the migration tenet applied and allowed the contention to proceed as an admitted post-DSEIS issue statement. See id. Joint Intervenors now assert that, notwithstanding a staff terminology change from "baseline" to "post-licensing pre-operational testing," this contention should now migrate into an FSEIS-related contention for essentially the same reasons. The staff does not object to this issue statement's migration as an FSEIS-related contention, albeit continuing to champion the staff's previous objections to the contention, see Staff Response at 11, while SEI maintains that the contention should be dismissed as based on a "mistaken legal conclusion that NRC regulations permit the gathering of detailed wellfield and monitor well quality data prior to issuance of an [ISR facility] license," SEI Response at 7.

As was the case with the DSEIS-related contention, we have no difficulty in concluding this contention regarding pre-mining groundwater quality should migrate as an FSEIS-related contention and thus do not need to consider the need for a contention amendment to accomplish this transition. Certainly, SEI's (and the staff's) arguments regarding the legal merits of the contention do not suggest a different result and, in fact, are better suited to a dispositive motion, which up to this point SEI has declined to file.[3] Similarly, the staff's concerns about the applicability of 10 C.F.R. Part 40 or its Appendix A to this environmental contention or whether references in the affidavit proffered by Joint Intervenors in support of this contention to Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) practices and requirements relative to post-licensing, pre-operation baseline data within a disturbed zone are an improper attempt to

[3] Of course, up to this point, SEI did not have an operative license authorizing construction activities at the Ross facility, which it now has. See Letter from Christopher C. Hair, NRC Staff Counsel, to Licensing Board at 1–2 (Apr. 25, 2014) (NRC Staff Notice of License Issuance).

expand the scope of this contention are matters we think likewise should be pretermitted to the subsequent merits-associated consideration of the contention, whether via summary disposition or an evidentiary hearing.

Thus, as set forth in Appendix A to this issuance,[4] this contention will move forward pursuant to the migration tenet as an admitted post-FSEIS issue statement, thereby ameliorating the need to address Joint Intervenors' amendment arguments.

2. Environmental Contention 2: The FSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits.

> CONTENTION: The FSEIS fails to meet the requirements of 10 C.F.R. §§ 51.90-94 and NEPA because it fails to evaluate the virtual certainty that the applicant will be unable to restore groundwater to primary or secondary limits in that the FSEIS does not provide and evaluate information regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an Alternative Concentration Limit (ACL) in accordance with 10 C.F.R. Part 40, App. A, Criterion 5B(5)(c).

DISCUSSION: Joint Intervenors Motion at 9–13, 23–26; Staff Response at 14–20; SEI Response at 13–17; Joint Intervenors Reply at 12–15.

RULING: In its initial determination admitting this contention relative to the SEI ER, the Board noted that the point of contention was not whether SEI would be unable to restore groundwater quality to primary or secondary limits following the conclusion of operations at the Ross facility, but whether such a happenstance would be a nonspeculative "'irreversible and irretrievable commitment[] of resources'" such that the ER needed to provide an impacts analysis of such an occurrence. LBP-12-3, 75 NRC at 196 (quoting 10 C.F.R. § 51.45(b)(5)); see NEPA § 102(2)(C)(v), 42 U.S.C. § 4332(2)(C)(v). In concluding that Joint Intervenors had

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[4] As proposed by Joint Intervenors, this contention made reference to 10 C.F.R. § 51.95, which, being applicable to production and utilization facilities such as power reactors, is not applicable to the Ross ISR facility. As a consequence, we have removed that reference from this and Joint Intervenors' other proposed post-FSEIS contentions.

established a genuine dispute on a material issue concerning the need for such an analysis so as to merit the admission of environmental contention 2, the Board addressed several arguments proffered by SEI and the staff as to why such an analysis, which Joint Intervenors claimed would require consideration of the impacts associated with utilizing a 10 C.F.R. Part 50, App. A, Criterion 5B(5)(c) alternate concentration limit (ACL), was not a viable possibility as a legal or technical matter. In particular was the assertion that an ACL could not be accurately generated until the post-operational decommissioning process, a claim that the Board noted did not account for the possible creation of "a reasonable bounding analysis" based on the historical experience at other ISR sites. LBP-12-3, 75 NRC at 197. Thereafter, in its July 2013 ruling regarding migration of this contention post-DSEIS, the Board found that, notwithstanding some staff discussion in the DSEIS that generally addressed the issue of the environmental impact if SEI cannot restore groundwater to primary or secondary limits, it was apparent that the DSEIS likewise did not address "the matter that is the crux of the concern engendered in admitted environmental contention 2, i.e., . . . what is that ACL likely to look like and what are the [] environmental impacts associated with such an ACL." LBP-13-10, 78 NRC at 138. We thus concluded that environmental contention 2 would migrate, although we took steps to clarify its scope. See id. at 138–39.

With regard to the FSEIS, Joint Intervenors assert that this contention should either migrate or, based on the information provided in support of their motion, move forward as an amended contention. While SEI once again proffers various legal arguments as to why this contention should not have been admitted initially, the staff asserts that neither the migration nor the amendment outcome is appropriate because the staff has included in the FSEIS (at 4-46) an extended discussion of three historical aquifer restoration activities that received NRC approval, including examples of hazardous constituent concentration values that the

agency found protective of human health and the environment. According to the staff, these historical concentration value ranges provide "an idea of what a range of possible ACLs for the Ross Project might look like, and accordingly are representative of the impacts that might result should Strata be unable to restore the Ross wellfields to post-licensing, pre-operational values." Staff Response at 17 (footnote omitted).

Observing again that SEI's arguments are best consigned to a dispositive motion, we further find that the extended nature of the staff's historical discussion is the type of additional new analysis that renders the migration tenet inapposite, so as to require a timely contention amendment. But unlike their previous filing regarding the staff's DSEIS, Joint Intervenors have made at least some attempt to justify this contention's continuation relative to the standards in section 2.309(f)(1) in light of the additional staff analysis.

Given our previous section 2.309(f)(1) findings regarding this contention, the critical element at this post-FSEIS juncture is whether, in light of the staff's further analysis, Joint Intervenors have provided (1) "alleged facts or expert opinions which support [Joint Intervenors'] position on the issue," 10 C.F.R. § 2.309(f)(1)(v); and (2) "sufficient information to show that a genuine dispute exists with the [staff] on a material issue of law or fact," id. § 2.309(f)(1)(vi). In this instance, Joint Intervenors' supporting declarants, Drs. Arbitz and Larson, have proffered a number of concerns regarding the additional information provided in the staff's FSEIS. Of particular relevance in this context, however, are the specific questions they have raised about each of the staff's purportedly representative historical aquifer restoration activities, including contesting (1) the lack of any quantitative analysis of the impacts of (a) the increased radium-226 and uranium concentrations at the Crow Butte facility, and (b) the increased uranium and heavy metal concentrations at the Smith Ranch-Highland facility; and (2) relative to the nine wellfields involved at the Irigaray facility, the use of a composite average "baseline" and

restoration uranium concentration to derive a post-restoration uranium concentration that is substantially lower than the individual wellfield average post-restoration uranium concentrations as calculated using the initial average "baseline" concentrations for each individual wellfield, a data set that more accurately reflects the reality of post-restoration groundwater impacts. See Joint Intervenors Motion unnumbered attach. 2, at 21–26 (Joint Third Declaration of Dr. Richard Abitz and First Declaration of Dr. Lance Larson on Behalf of [Joint Intervenors] (Mar. 31, 2014)) [hereinafter Abitz/Larson Declaration]. Given these declarations, we have no problem in concluding that the section 2.309(f)(1)(v), (vi) factors are met so as to merit the admission of an amended environmental contention 2 to specify a challenge to the staff's FSEIS.

In admitting this amended contention, we again emphasize, as the contention's wording indicates, that its focus is whether the FSEIS properly "provide[s] and evaluate[s] information regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an Alternative Concentration Limit (ACL) in accordance with 10 C.F.R. Part 40, App. A, Criterion 5B(5)(c)." As such, "this contention is not a vehicle for Joint Intervenors to seek to establish that a satisfactory ACL cannot be adopted or that SEI will be unable to comply with any ACL that might be instituted, matters that would be the subject for any future license amendment proceeding if the use of an ACL is, in fact, proposed by SEI." LBP-12-3, 75 NRC at 198 n.31.

3. Environmental Contention 3: The FSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.

CONTENTION: The FSEIS fails to assess [adequately] the likelihood and impacts of fluid migration to the adjacent groundwater, as required by 10 C.F.R. §§ 51.90-94 and NEPA, and as discussed in NUREG-1569 § 2.7, in that:

1. The FSEIS fails to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes, including the adequacy of applicant's plans to mitigate possible borehole-related migration impacts by monitoring wellfields surrounding the boreholes and/or plugging the boreholes.

2. There was insufficient information for the NRC staff to make an informed fluid migration impact assessment given that the applicant's six monitor-well clusters and the 24-hour pump tests at four of these clusters provided insufficient hydrological information to demonstrate satisfactory groundwater control during planned high-yield industrial well operations.

DISCUSSION: Joint Intervenors Motion at 13–15, 26–29; Staff Response at 20–22; SEI Response at 17–19; Joint Intervenors Reply at 9–12.

RULING: In our July 2013 ruling that this hydrology contention properly migrated from one challenging the SEI ER to one contesting the staff's DSEIS, based on our initial contention admission determination that the adequately supported technical dispute was over the risks of fluid migration due to purportedly numerous unplugged boreholes and the alleged inadequacy of SEI's 24-hour pump tests at four of its six monitor-well clusters to provide the staff with sufficient information to make an informed fluid migration impact assessment about whether there would be sufficient groundwater control during SEI's planned well operations, we found that the DSEIS discussion of these subjects was such that Joint Intervenors' adequacy claims remained intact. Further, seeking to abide by the Commission's direction to provide contention focus when appropriate, we incorporated these concerns into the language of the contention to ensure that its admitted scope was clear. See LBP-13-10, 78 NRC at 140–41. Now, looking to the portions of the FSEIS that address the matters of unplugged borehole fluid migration and pump test adequacy, we see no material change that would preclude this issue statement from again migrating so as to frame a challenge to the FSEIS.

While endorsing this migration, we note that the focus of this contention remains the same as when it was admitted, i.e., "the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes" and whether SEI's "six monitor-well clusters and the 24-hour pump tests at four of these clusters provided insufficient information to demonstrate satisfactory groundwater control during planned high-yield industrial well

operations" so as to provide "insufficient information for the NRC staff to make an informed fluid migration impact assessment." While a proper assessment of these questions will undoubtedly involve some consideration of technical matters that could have broader implications for possible groundwater migration at the Ross facility generally, ultimately the focal point of the matters for litigation under this contention are the unplugged borehole and 24-hour pump test items specified in the contention.

Accordingly, as set forth in Appendix A to this issuance, this contention will move forward as an admitted post-FSEIS issue statement.

4. Environmental Contention 4[/5A]:[5] The FEIS fails to adequately assess cumulative impacts of the proposed action and the planned Lance District expansion project.

CONTENTION: The application violates 10 C.F.R. § 51.90-94[,] NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA because it fails to consider adequately cumulative impacts, including impacts on water quantity, that may result from [SEI's] proposed ISL uranium mining operations planned in the Lance District expansion project.

DISCUSSION: Joint Intervenors Motion at 15–17, 29–31; Staff Response at 23–24; SEI Response at 19–20; Joint Intervenors Reply at 15–16.

RULING: The Board had initially admitted this issue statement combining Joint Intervenors' environmental contentions 4 and 5A insofar as they claimed that the SEI ER lacked a sufficient analysis of the cumulative impacts associated with the potential operation of several ISR facilities in the Lance District. See LBP-12-3, 75 NRC at 200, 203–04. Thereafter, in its July 2013 ruling, the Board concluded that this contention was not eligible to migrate because "the DSEIS discussion of the cumulative impacts of groundwater quantity and quality differs substantially from the SEI ER approach." LBP-13-10, 78 NRC at 142. Additionally, the Board

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[5] Although Joint Intervenors have labeled this issue statement "Environmental Contention 4," to maintain citation continuity we will refer to it as admitted, which was as "Environmental Contention 4/5A."

concluded that the DSEIS-related contention proffered by Joint Intervenors was not eligible for admission as a new or amended contention because they had failed to address the good cause and admissibility factors in section 2.309(c)(1), (f). See id. at 143–44.

Given our July ruling, we again conclude that the migration tenet is not applicable because the staff discussion that caused us to conclude that initially admitted contention was not migrated to the DSEIS is included in the FSEIS, see FSEIS at 5-22 to -30, so that a new or amended contention would be required to frame an admissible contention.

As part of their March 31 pleading, Joint Intervenors likewise have included a motion to amend the contention. To be considered timely under section 2.309(c)(1), motions for the admission of new or amended contentions "should be filed within thirty days of the date upon which the information that is the basis of the motion becomes available to the . . . intervenor." Joint Intervenors alternative request is not timely because the information on which it is based was made available to Joint Intervenors considerably more than thirty days before the motion. In addition to providing as a basis for their contention information about the potential cumulative impacts in the Lance District that was available prior to the DSEIS, Joint Intervenors also use calculations of water consumption from the DSEIS. See Abitz/Larson Declaration at 40–42. This reliance on pre-DSEIS and DSEIS information is clear evidence that the information upon which the contention is based was available considerably more than thirty days before the motion was filed. Nor do Joint Intervenors explain whether any new information was made available after the DSEIS or FSEIS was issued, or why the amended contention was filed after the deadline for submitting new/amended DSEIS-related contentions.

For these reasons, environmental contention 4/5A is not eligible to be migrated or to be admitted as an amended contention. As such, the admitted contention, which is set forth in Appendix A to this decision, continues to reference the SEI ER, which, as we noted in our July

2013 decision, leaves its continuing efficacy in some doubt. See LBP-13-10, 78 NRC at 143–44.

C. Admissibility of Joint Intervenors' New Contentions

1. [Environmental Contention 7]:[6] The FSEIS fails to properly define the scope of the proposed major federal action here, which encompasses a much larger project in the same geographic area.

CONTENTION: The FSEIS violates 10 C.F.R. §§ 51.90-94 and NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA, because it fails to consider the environmental impacts of, and appropriate alternatives to, the applicant's actual proposed project, and instead improperly segments the project by framing the Proposed Action under review as only a small part of the Applicant's planned and scheduled In Situ Recovery (ISL) activities in the Lance District.

DISCUSSION: Joint Intervenors Motion at 33–39; Staff Response at 25–27; SEI Response at 20–27; Joint Intervenors Reply at 17–20.

RULING: Inadmissible, in that this contention lacks the requisite good cause for its submission as being based on previously available information that was not submitted in a timely fashion given that information's previous availability. See 10 C.F.R. § 2.309(c).

In its July 2013 ruling, the Board declined to admit environmental contention 6, the Intervenors' proposed identical DSEIS-associated new contention regarding improper segmentation of the staff's NEPA analysis relative to the possible SEI ISR activities in the nearby Lance District. See LBP-13-10, 78 NRC at 144. In that order, the Board explained that the staff had recognized in the DSEIS, at least to some degree, the potential impacts of other sites in the Lance District, in conjunction with the Ross site. The Board found, however, that Joint Intervenors improper segmentation claim did not meet the standards for admission of a new contention as either a "connected," "cumulative," or "similar" action under

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[6] Although Joint Intervenors number this issue statement "FEIS Contention 5," to maintain a consistent numbering arrangement, we will refer to this contention by the label "Environmental Contention 7" since it is presented as a new contention.

40 C.F.R. § 1508.25(a). The Board concluded initially that the contention did not merit further analysis on the basis that the Ross facility was “connected” to the other Lance District ISR sites pursuant to section 1508.25(a)(1) because Joint Intervenors had failed to provide adequate support under section 2.309(f)(1)(vi) to establish there was a genuine dispute about whether the Ross facility was an interdependent part of any larger Lance District project. See id. at 147–49. Furthermore, on the question of whether the Lance District sites might require NEPA consideration in connection with the Ross facility site as “cumulative” or “similar” under section 1508.25(a)(2)-(3), the Board ruled that Joint Intervenors had failed to meet the timeliness requirements of section 2.309(c)(1)(i), (iii) in that the information potentially supporting their claims was available at the time Joint Intervenors submitted their October 2011 hearing petition, or shortly thereafter. See id. at 149–50. Consequently, the Board declined to admit environmental contention 6.

Against this background, new environmental contention 7, an FSEIS-related version of the previously rejected DSEIS-related environmental contention 6, also is not timely under section 2.309(c).[7] To be considered timely in this proceeding in accordance with section 2.309(c)(iii), a motion for the admission of a new or amended contention “should be filed within thirty days of the date upon which the information that is the basis of the motion becomes available to the . . . intervenor.” Licensing Board Order (Initial Prehearing Order) at 4 (Nov. 3, 2011) (citing 10 C.F.R. § 2.309(f)(2), which notes that any motion to admit a new or amended contention must conform to the requirements of section 2.309(c)). Joint Intervenors base all but

[7] Under 10 C.F.R. § 2.309(c), good cause exists for the submission of a new or amended contention after the deadline for filing an initial hearing petition when “(i) [t]he information upon which the filing is based was not previously available; (ii) [t]he information upon which the filing is based is materially different from information previously available; and (iii) [t]he filing has been submitted in a timely fashion based on the availability of the subsequent information.”

one of their renewed claims on information that was available in 2013 disclosures of SEI and SEI's parent company, see Joint Intervenors Motion, unnumbered attach. 1, at 11 (referring to "prior and contemporaneous disclosures to investors by Strata's corporate parent . . . in March 2013" and the "Lance Project Development Update" published on May 24, 2013) (Second Declaration of Christopher E. Paine in Support of [Joint Intervenors'] Joint Motion to Migrate or Amend Contentions, and to Admit New Contentions in Response to the [FSEIS] (Mar. 31, 2014)), none of which was submitted in accordance with the terms of the Board's directive that a new or amended contention must be filed within thirty days of a purported triggering event. The only new information presented by Joint Intervenors in support of their current motion that would meet the thirty-day requirement comes from a March 2014 presentation by Peninsula Energy Limited stating that the company is "constructing a 2.3 [million pounds] per annum ISR operation in 2 stages" with an "initial mine life [of] 22 years and a "potential 70+ years of mine life." Id. at 16. As is the case with the other post-DSEIS information cited by Joint Intervenors relative to the scope and nature of plans for the Ross facility and the Lance District, this information does not differ materially from the information available at the time the DSEIS was issued and Joint Intervenors' essentially identical DSEIS-related contention was submitted, thus contravening the mandate of section 2.309(c)(1)(ii) that "materially different information" must be the basis for a new contention that has the requisite "good cause."[8]

We thus deny Joint Intervenors' request to admit its "new" environmental contention 7.

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[8] Also in that regard, we note that the staff stated in Appendix B to its FSEIS that, "[i]f the NRC approves the Ross Project license application, Strata would only be authorized to operate on the Ross Project site, so development of the wider area described by the commenter would not be a direct consequence of licensing the Ross Project," FSEIS app. B, at B-20, a limitation on the geographic scope of the project that further brings into question whether Joint Intervenors' proposed contention is admissible as presenting a genuine dispute on a material issue of law or fact under section 2.309(f)(1)(vi).

2. [Environmental Contention 8]:[9] The FSEIS is improperly framed as a Supplemental EIS, rather than a separate EIS tiered from the Generic EIS for In-Situ Leach Uranium Milling Facilities.

CONTENTION: The FSEIS violates 10 C.F.R. Part 51 and NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA, because the NRC Staff process for development of the document improperly treated the analysis as a Supplemental EIS, rather than preparing an EIS, which would have required a scoping process to properly delineate the scope of the action at issue.

DISCUSSION: Joint Intervenors Motion at 39–44; Staff Response at 27–33; SEI Response at 27–30; Joint Intervenors Reply at 20–24.

RULING: Inadmissible, in that this contention does not meet the standards for timely submission of a new contention as set forth in 10 C.F.R. § 2.309(c).

As explained above, a request for the admission of a new contention should be filed within thirty days of the date upon which the information that is the triggering basis of the motion becomes available to the intervenor. Joint Intervenors' new proposed environmental contention 8, which raises a procedural challenge to the staff's action in preparing its FSEIS as a supplement to, rather than as a full EIS tiered off of, the agency's generic ISR EIS, is based principally on information in an NRC Office of the Inspector General (OIG) audit report that was issued in August 2013. See Joint Intervenors Motion at 41 & n.18 (citing NRC OIG, Audit of NRC's Compliance With 10 CFR Part 51 Relative to Environmental Impact Statements, OIG-13-A-20 (Aug. 20, 2013) (ADAMS Accession No. ML13232A192)). Further, according to Joint Intervenors, submitting environmental contention 8 prior to issuance of the OIG report would have been useless because "the Board would simply have deferred to the NRC Staff claims that preparing a 'supplement' to the GEIS is an appropriate way to proceed," while Joint Intervenors' delay in submitting the contention until the staff's issuance of its FSEIS was

[9] Although Joint Intervenors number this issue statement "FEIS Contention 6," to maintain a consistent numbering arrangement, we will refer to this contention by the label "Environmental Contention 8" since it is presented as a new contention.

justified because "Intervenors hoped NRC would bring itself into compliance with NEPA and the applicable regulatory scheme by actually conducting the scoping process that the IG report details is required." Joint Intervenors Motion at 43.

As Joint Intervenors point out, see id. at 42, the regulatory definition outlining the basis for issuing a supplemental EIS is readily available in 40 C.F.R. § 1502.9 and 10 C.F.R. § 51.92. Accordingly, if Joint Intervenors believed that the DSEIS did not meet this definition, they could have filed a new contention at the time the DSEIS was issued. Moreover, as "good cause" bases for delaying such a filing until issuance of the FSEIS, Joint Intervenors' claims regarding possible Board inaction absent an IG report and their "hope" for a staff self-correction are wholly without merit. Consistent with section 2.309(c), and particularly with regard to what is essentially a legal issue like the one framed by this contention, the responsibility of a party that possesses new information that constitutes the basis for a new or amended contention is to bring that information and the issue statement it supports to the Board's attention promptly, regardless of what it believes the Board will or will not do in the face of that information,[10] or what it hopes the staff might or might not do in response to that information.

Thus, Joint Intervenors' claim that its new environmental contention 8 was not "ripe" for submission until issuance of the FSEIS is without substance, so that their contention is not timely under section 2.309(c) and must be dismissed.

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[10] We note as well that, carrying Joint Intervenors' argument in this regard to its logical conclusion suggests that, had the NRC OIG not issued its report, Joint Intervenors would have been unable to interpose this legal argument on their own, a result we doubt they would endorse.

III. CONCLUSION

Joint Intervenors' environmental contentions 1, 2, and 3, now reframed as challenges to the staff's FSEIS, will pass through for further litigation, environmental contentions 1 and 3 because of the migration tenet and environmental contention 2 because it qualifies as an amended contention. On the other hand, their environmental contention 4/5A is not eligible for migration or amended, and so remains as an ER-related issue statement only, while their environmental contentions 7 and 8, which have been submitted for admission as new contentions, must be dismissed as lacking the requisite "good cause" under section 2.309(c) for submission after the deadline for filing an initial hearing petition.

For the foregoing reasons, it is this twenty-third day of May 2014, ORDERED, that:

1. As Joint Intervenors' March 31, 2014 motion seeks to migrate Environmental Contentions 1 and 3, and amend Environmental Contention 2, the motion is <u>granted</u> in that those three contentions, as set forth in Appendix A to this issuance, are accepted for further litigation as FSEIS-related contentions.

2. As Joint Intervenors' March 31, 2014 motion seeks to migrate or amend Environmental Contention 4/5A, the motion is <u>denied</u>, and, as set forth in Appendix A to this issuance, that contention remains in this proceeding as an ER-related contention.

3. As Joint Intervenors' March 31, 2014 motion seeks the admission of new Environmental Contentions 7 and 8, the motion is denied.

THE ATOMIC SAFETY
AND LICENSING BOARD

R/A

____
G. Paul Bollwerk, III, Chair
ADMINISTRATIVE JUDGE

R/A

____
Richard F. Cole
ADMINISTRATIVE JUDGE

R/A

____
Craig M. White
ADMINISTRATIVE JUDGE

Rockville, Maryland

May 23, 2014

APPENDIX A

ADMITTED CONTENTIONS

1. Environmental Contention 1: The FSEIS fails to adequately characterize baseline (i.e., original or pre-mining) groundwater quality.

   CONTENTION: The FSEIS fails to comply with 10 C.F.R. §§ 51.90-94, 10 C.F.R. Part 40, Appendix A, and NEPA because it lacks an adequate description of the present baseline (i.e., original or pre-mining) groundwater quality and fails to demonstrate that groundwater samples were collected in a scientifically defensible manner, using proper sampling methodologies. The FSEIS's departure from NRC guidance serves as additional evidence of these regulatory violations. NRC, NUREG-1569, Standard Review Plan for In Situ Leach Uranium Extraction License Applications, §§ 2.7.1, 2.7.3, 2.7.4 (2003).

2. Environmental Contention 2: The FSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits.

   CONTENTION: The FSEIS fails to meet the requirements of 10 C.F.R. §§ 51.90-94 and NEPA because it fails to evaluate the virtual certainty that the applicant will be unable to restore groundwater to primary or secondary limits in that the FSEIS does not provide and evaluate information regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an Alternative Concentration Limit (ACL) in accordance with 10 C.F.R. Part 40, App. A, Criterion 5B(5)(c).

3. Environmental Contention 3: The FSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.

   CONTENTION: The FSEIS fails to assess [adequately] the likelihood and impacts of fluid migration to the adjacent groundwater, as required by 10 C.F.R. §§ 51.90-94 and NEPA, and as discussed in NUREG-1569 § 2.7, in that:

   1. The FSEIS fails to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes, including the adequacy of applicant's plans to mitigate possible borehole-related migration impacts by monitoring wellfields surrounding the boreholes and/or plugging the boreholes.

   2. There was insufficient information for the NRC staff to make an informed fluid migration impact assessment given that the applicant's six monitor-well clusters and the 24-hour pump tests at four of these clusters provided insufficient hydrological information to demonstrate satisfactory groundwater control during planned high-yield industrial well operations.

4. Environmental Contention 4/5A: The application fails to adequately assess cumulative impacts of the proposed action and the planned Lance District expansion project.

CONTENTION: The application violates 10 C.F.R. § 51.45, NEPA, and the Council on Environmental Quality's (CEQ) implementing regulations for NEPA because it fails to consider adequately cumulative impacts, including impacts on water quantity, that may result from SEI's proposed ISL uranium mining operations planned in the Lance District expansion project.

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

LBP-15-3

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before the Licensing Board:

G. Paul Bollwerk, III, Chairman
Dr. Craig M. White

In the Matter of	Docket No. 40-9091-MLA
STRATA ENERGY, INC.	ASLBP No. 12-915-01-MLA-BD01
(Ross In Situ Recovery Uranium Project)	January 23, 2015

INITIAL DECISION
(Ruling on Joint Intervenors' Environmental Contentions 1-3)

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS

ACL	Alternate Concentration Limit
AEA	Atomic Energy Act
AEC	Attenuation Environmental Company
ALARA	As Low As Reasonably Achievable
CAB	Commission-Approved Background
CBR	Crow Butte Resources, Inc.
CD	Compact Disc
CEO	Chief Executive Officer
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPP	Central Processing Plant
CV	Curriculum Vitae
DM	Deep-Monitoring Zone or Unit
DSEIS	Draft Supplemental Environmental Impact Statement
DVD	Digital Video Disc
EC	Environmental Contention
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
FSEIS	Final Supplemental Environmental Impact Statement
FSME	Office of Federal and State Materials and Environmental Management Programs
GEIS	Generic Environmental Impact Statement
ISR	In Situ Recovery
IX	Ion Exchange
JEC	Johnson Environmental Concepts
JTI	Joint Intervenors
LC	License Condition
MCL	Maximum Contaminant Level
NEPA	National Environmental Policy Act of 1969
NMSS	Office of Nuclear Material Safety and Safeguards
NRC	U.S. Nuclear Regulatory Commission
NRDC	Natural Resources Defense Council
OZ	Ore Zone

.pdf	Portable Document Format
PRBRC	Powder River Basin Resource Council
R&D	Research and Development
RCRA	Resource Conservation and Recovery Act
RES	Office of Nuclear Regulatory Research
SA	Surficial Aquifer
SEI	Strata Energy, Inc.
SM	Shallow-Monitoring
SPQ	Statement of Personal Qualifications
SRP	Standard Review Plan
TCEQ	Texas Commission on Environmental Quality
TDS	Total Dissolved Solids
TR	Technical Report
TWC	Texas Water Commission
UCL	Upper Control Limit
URL	Universal Resource Locator
USDW	Underground Source of Drinking Water
USGS	United States Geological Survey
WDEQ	Wyoming Department of Environmental Quality

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I. INTRODUCTION

1.1 On January 4, 2011, Strata Energy, Inc., (SEI) applied to the Nuclear Regulatory Commission (NRC) for a combined license to possess and use source and Atomic Energy Act (AEA) section 11e(2) byproduct materials pursuant to 10 C.F.R. Part 40 so as to authorize SEI to construct and operate a facility for the in situ recovery (ISR) of uranium at the Ross ISR Uranium Project (Ross Project) site in Crook County, Wyoming. This Initial Decision presents the Licensing Board's findings and conclusions relative to the three remaining admitted contentions in this proceeding, which were the subject of a September 30-October 1, 2014 evidentiary hearing. Those three National Environmental Policy Act (NEPA) environmental contentions (ECs), which were proffered by the Natural Resources Defense Council (NRDC) and the Powder River Basin Resource Council (PRBRC), hereinafter referred to as Joint Intervenors, were titled as follows:

> [EC] 1: The [final supplement to the NRC's generic environmental impact statement on ISR projects (FSEIS)] fails to adequately

> characterize baseline (i.e., original or pre-mining) groundwater quality.
>
> [EC] 2: The FSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits.
>
> [EC] 3: The FSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.

[Licensing Board] Notice of Hearing (Notice of Evidentiary Hearing and Opportunity To Provide Oral and Written Limited Appearance Statements), 79 Fed. Reg. 44,471, 44,471 (July 31, 2014).

1.2 For the reasons set forth below, in the face of Joint Intervenors' challenges to the FSEIS in EC 1, EC 2, and EC 3, the Board finds that the NRC staff, in conjunction with SEI, has carried its burden of proof to demonstrate the adequacy of the FSEIS in accordance with 10 C.F.R. Part 51. The Board thus concludes that Joint Intervenors' three contentions cannot be sustained and enters a ruling on the merits of each contention in favor of the staff and SEI.

II. BACKGROUND

A. ISR Process

1. General Description

2 .1 As described in the staff's FSEIS, the ISR process extracts uranium from layers of permeable uranium-bearing sandstone (also known as the ore zone (OZ) or ore body) that are hydrologically isolated between layers of shale that prevent the vertical migration of mining fluids beyond the OZ. An injection well is used to insert a lixiviant into an ore body. The lixiviant consists of native groundwater and chemicals, specifically an oxidant such as hydrogen peroxide or oxygen and a complexing agent such as sodium bicarbonate or carbon dioxide. As the lixiviant is pumped through the OZ, the chemicals in the lixiviant dissolve the uranium from

the rock within the aquifer. Groundwater carrying the uranium-rich, or pregnant, lixiviant is then drawn out of the aquifer by pumping the lixiviant back to the surface via a recovery well. The pregnant lixiviant is then transferred to a central processing plant (CPP) where the uranium is extracted from the solution in columns that use an ion-exchange (IX) process by which the uranium is transferred to resin beads. The resulting barren solution is then recharged with complexing and oxidizing agents before being re-injected into the OZ to recover additional uranium. As for the uranium extracted from the lixiviant, it is eluted (i.e., washed) from the resin beads and precipitated into a solid material called yellowcake, which is packaged into NRC/United States Department of Transportation-approved fifty-five gallon steel drums and transported offsite by truck to an NRC-licensed uranium conversion facility. See Ex. SEI009A, at xix, 2-3, 2-9 (Office of Federal and State Materials and Environmental Management Programs (FSME), NRC, [Environmental Impact Statement (EIS)] for the Ross ISR Project in Crook County, Wyoming; Supplement to the Generic [EIS] for In-Situ Leach Uranium Milling Facilities, Final Report, NUREG-1910 (supp. 5 Feb. 2014)) [hereinafter FSEIS 9A].[1]

2 .2 The Ross Project is to consist of fifteen to twenty-five specific groups of wells, or wellfield modules, that in total would encompass 1400 to 2200 injection and recovery wells. The wellfield modules are connected via piping to a central collection facility, referred to as a module building or header house, from which the pregnant lixiviant is transferred to the CPP and from which the lixiviant recharged in the CPP is re-injected into the OZ aquifer. A ring of monitoring wells would surround the perimeter of the wellfields tapping into the OZ aquifer as well as the overlying and underlying aquifers to provide warning if lixiviant is migrating outside the OZ. See id. at xix, 2-9.

[1] See infra note 5 for an explanation of the exhibit numbering protocol used in this decision.

2. Sampling and Monitoring Wells

2 .3 In addition to the wells employed for production purposes described above, there are a number of other sampling and/or monitoring wells involved in the Ross Project licensing, operations, and restoration/decommissioning processes that are relevant to the issues before the Board. Although we will describe these in more detail below in our discussion of Joint Intervenors' contentions, the following provides an overview:

2 .4 Historical boreholes. Within the Ross Project permit boundary, approximately 1500 boreholes exist that were constructed and abandoned prior to the commencement of SEI's exploration and site characterization studies for the Ross Project. Most of these historical boreholes were drilled in the 1970s in conjunction with ISR exploration, development, and site characterization efforts by the Nubeth Joint Venture (Nubeth). Analyses of groundwater collected by Nubeth in conjunction with its activities were included as part of the Ross site characterization study.[2] See FSEIS 9A, at 2-11, 2-26; see also infra section IV.C.4.2, 3.a.

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[2] In the course of the parties' dispute regarding, in particular, issue statement EC 1, there was some uncertainty about the labels to be applied to the activities associated with, and the data coming from, SEI's pre-licensing groundwater monitoring associated with compliance with the dictates of 10 C.F.R. Part 40, Appendix A, Criterion 7, as contrasted to those SEI activities conducted to comply with the post-licensing dictates of Appendix A, Criteria 5B and 7A. The staff has chosen to label those activities conducted under Criterion 7 prior to license issuance as "pre-licensing, site characterization" and those conducted under Criteria 7A and 5B as "post-licensing, pre-operational." See FEIS 9A, at 2-25. We have attempted to utilize this terminology as well.

Additionally, although the term "baseline" was initially utilized by the staff to describe the data being sought both pre- and post-licensing for regulatorily-significant constituent concentrations, see NRC Staff Response to Petition to Intervene and Request for Hearing by [Joint Intervenors] (Dec. 5, 2011) at 17 n.40 (both pre- and post-operational monitoring programs provide "baseline" data) [hereinafter Staff Intervention Response], in its FSEIS the staff has seemingly eschewed that term, see FSEIS 9A, at 5-28 n.† (tbl. 5.4) (although values identified as "baseline" by Nubeth, "that term is not used" in FSEIS). The same is true for the term "background" as it is used to refer to groundwater monitoring. Compare Staff Intervention Response at 22 ("Criterion 5B(5) thus sets a primary standard of background concentration"), with FSEIS 9A, at B-22 (Criterion 5B(5)(a) "Commission approved background [in this SEIS,
(continued...)

2 .5 Monitoring well clusters. Six monitoring well clusters, each consisting of at least four wells, were constructed for SEI's site characterization study. At least one well in each cluster was completed in the OZ aquifer, one in the deep monitoring (DM) aquifer below the OZ horizon and one each in the shallow monitoring (SM) and surficial (SA) aquifers overlying the OZ horizon. Wells in the six clusters were used to perform pumping tests and for the collection of samples used to characterize the pre-licensing groundwater quality. See FSEIS 9A, at 2-25; see also infra sections IV.A.2, IV.C.4.2, 3.b.

2 .6 Wellfield production and injection wells. A subset of the production and injection wells to be drilled within the boundaries of the ISR wellfield is to be used to sample groundwater from the OZ aquifer prior to the commencement of operations to establish hazardous constituent "Commission approved background" (CAB) concentrations pursuant to Criterion 5B(5)(a) of 10 C.F.R. Part 40, Appendix A. Wells used to establish these background values will be the same ones used to measure post-mining restoration success and stabilization. See FSEIS 9A, at 2-26; see also infra section IV.A.3.

2 .7 Perimeter monitoring wells. As was noted above, perimeter monitoring wells will be constructed post-licensing but prior to the commencement of ISR operations and will be located about 400 feet from the edge of an ISL wellfield but inside the boundary of the exempted aquifer. Perimeter wells will be completed in the SM, OZ and DM aquifers and

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[2](...continued)
'post-licensing, pre-operational'] concentrations"). But see NRC Staff's Initial Statement of Position (Aug. 25, 2014) at 16-17 (applicant's pre-licensing, site-characterization "baseline" water quality information used to describe existing ISR site groundwater conditions while post-licensing, preoperational background water quality information is gathered to generate "background" data before wellfield operations begin) [hereinafter Staff Initial Position Statement]. Nonetheless, given that the term "baseline" is used in Criterion 7 and the term "background" is used in Criterion 5B(5)(a), we have tried to use those descriptors when discussing circumstances involving those criteria. We have not, however, attempted to re-characterize the terms when they were used by the parties in their pleadings and testimony.

samples collected from each aquifer prior to the commencement of ISL mining will be used to establish the groundwater protection upper control limits (UCLs) for detecting excursions of lixiviant after operations have begun. See FSEIS 9A, at 2-26; see also infra section IV.A.3.

B. Contention Admission, Migration, and Summary Disposition

2 .8 On October 27, 2011, Joint Intervenors filed an intervention petition seeking to challenge SEI's Ross Project application and, in particular, certain aspects of its environmental report (ER). SEI and the staff opposed the hearing request on the grounds that Joint Intervenors had failed to establish their standing to intervene and had not submitted an admissible contention. In a February 12, 2012 ruling, the Licensing Board concluded that Joint Intervenors both had standing and had submitted four admissible contentions: EC 1, EC 2, and EC 3, as well as EC 4/5A, which asserted that the ER failed to assess adequately the cumulative impacts of the proposed action and the purportedly planned Lance District expansion project, of which the Ross Project is one part. See LBP-12-3, 75 NRC 164, 210, aff'd in part and review declined, CLI-12-12, 75 NRC 603 (2012). The Commission subsequently affirmed the Board's standing ruling, but declined to accept review of SEI's challenges to the Board's admission of EC 1 and EC 2 because, as is required in 10 C.F.R. § 2.311(d)(1), SEI had failed to perfect its appeal by challenging the validity of the Board's admissibility rulings regarding EC 3 and EC 4/5A as well. See CLI-12-12, 75 NRC at 614.

2 .9 With the staff's March 2013 issuance of its Ross facility-related draft supplement to the agency's generic environmental impact statement on ISR projects (DSEIS), see Ex. SEI006A (FSME, NRC, [EIS] for the Ross ISR Project in Crook County, Wyoming; Supplement to the Generic [EIS] for In-Situ Leach Uranium Milling Facilities, Draft Report for Comment, NUREG-1910 (supp. 5 Mar. 2013)) [hereinafter DSEIS 6A], Joint Intervenors filed a motion seeking to (1) "resubmit" their four pending environmental contentions in light of the staff's

DSEIS; and (2) admit an additional NEPA-related contention, EC 6, challenging the scope of the staff's DSEIS as improperly segmenting the major federal project by not taking into account all planned activities in the larger Lance District. In a July 26, 2013 determination, the Board concluded that (1) new contention EC 6 was not admissible as having failed to meet both the contention admissibility standards of 10 C.F.R. § 2.309(f)(1) and the "good cause" provision of section 2.309(c)(1); (2) EC 4/5A was not eligible to "migrate" to a contention contesting the DSEIS and so, without a new/amended contention, would remain a challenge to the SEI ER; and (3) EC 1, EC 2, and EC 3 were qualified to migrate as challenges to the DSEIS. See LBP-13-10, 78 NRC 117, 151 (2013), reconsideration and motion to admit amended EC 4/5A denied, Licensing Board Memorandum and Order (Denying Motion for Reconsideration of LBP-13-10 Ruling Regarding Environmental Contention 4/5A or, Alternatively, to Admit Amended Contention) (Aug. 23, 2013) (unpublished).

2 .10 The February 2014 issuance of the staff's Ross facility-related FSEIS brought another request by Joint Intervenors to "migrate" their existing DSEIS- or ER-based contentions as challenges to the FSEIS, or to admit new/amended contentions relative to those issue statements, as well as a request to admit another new contention, EC 7, challenging the scope of the staff's FSEIS as improperly segmenting the major federal project by not taking into account all planned activities in the larger Lance District.[3] The Board again found that migration was appropriate for EC 1 and EC 3 and that EC 2 could move forward as an amended

[3] On April 25, 2014, the staff notified the Board that, in addition to issuing the record of decision associated with its FSEIS, in accord with 10 C.F.R. § 2.1202(a), the SEI license had been issued, effective immediately. See Letter from Christopher C. Hair, NRC Staff Counsel, to Licensing Board (Apr. 25, 2014) at 1–2 & n.1; see also Ex. NRC009 (Andrew Persinko, FSME, NRC, [NRC] Record of Decision for the Ross Uranium [ISR] Project in Crook County, Wyoming (Apr. 24, 2014); Ex. SEI015 (NRC Materials License SUA-1601 (Apr. 24, 2014)) [hereinafter SEI License]. Although section 2.1213(a) afforded Joint Intervenors the opportunity to seek a stay of this staff action, no such request was filed.

contention contesting the FSEIS, but that EC 4/5A could neither migrate nor be amended as challenging the FSEIS and that EC 7 was not admissible as a new contention. See Licensing Board Memorandum and Order (Ruling on Motion to Migrate/Amend Existing Contentions and Admit New Contentions Regarding Final Supplement to Generic Environmental Impact Statement) (May 23, 2014) at 19 (unpublished) [hereinafter FSEIS Order].

2 .11 Under the proceeding's general schedule, the parties then had an opportunity to move for summary disposition regarding any of the four admitted contentions. See Licensing Board Memorandum and Order (Granting Requests to Revise Dispositive Motion Briefing Schedule; Revised General Schedule) (June 2, 2014) attach. A, at 2 (unpublished). By motions dated June 13, 2014, SEI and the staff sought summary disposition of EC 4/5A while Joint Intervenors requested that summary disposition be entered in their favor regarding EC 1. In a July 25 ruling, the Board granted the SEI/staff motions relative to EC 4/5A, but in a separate August 12 determination, the Board concluded that there were material facts in dispute regarding EC 1 so as to preclude the grant of summary disposition. See Licensing Board Memorandum and Order (Ruling on Summary Disposition Motion Regarding Environmental Contention 4/5A) (July 25, 2014) at 14–15 (unpublished); Licensing Board Memorandum and Order (Ruling on Summary Disposition Motion Regarding Environmental Contention 1) (Aug. 12, 2014) at 22–23 (unpublished).

C. Evidentiary Hearing on EC 1, EC 2, and EC 3

2 .12 Thereafter, in preparation for the 10 C.F.R. Part 2, Subpart L simplified evidentiary hearing on EC 1, EC 2, and EC 3, SEI, the staff, and Joint Intervenors filed initial and rebuttal position statements and prefiled direct and rebuttal testimony and supporting

exhibits on August 25 and September 12, 2014, respectively.[4] Relative to this prefiled evidentiary material, however, in a September 10 issuance the Board identified several items that needed clarification and found that one prefiled exhibit provided by Joint Intervenors in support of EC 2, JTI005,[5] would not admissible because it consisted of a listing of four Internet universal resource locator (URL) citations that represented a web-based "storymap" application and the underlying database information.[6] To address the Board's concerns, Joint Intervenors subsequently submitted revised versions of this prefiled exhibit, to which SEI responded with a

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[4] [SEI's] Initial Statement of Position (Aug. 25, 2014) [hereinafter SEI Initial Position Statement]; [SEI] Notice of Errata for Initial Statement of Position (Sept. 5, 2014); Staff Initial Position Statement; [Joint Intervenors'] Statement of Position Supporting [EC] 1, 2 and 3 (Aug. 25, 2014) [hereinafter Joint Intervenors Initial Position Statement]; SEI's Rebuttal Statement of Position (Sept. 12, 2014) [hereinafter SEI Rebuttal Position Statement]; NRC Staff's Rebuttal Statement of Position (Sept. 12, 2014); NRC Staff's Rebuttal Statement of Position[-Revised] (Sept. 18, 2014); [Joint Intervenors'] Response Statement in Support of [EC] 1, 2 and 3 (Sept. 12, 2014); [Joint Intervenors'] Response Statement in Support of [EC] 1, 2 and 3-Revised (Sept. 16, 2014) [hereinafter Joint Intervenors Rebuttal Position Statement].

[5] As entered into the record and incorporated into the agency's ADAMS-associated electronic hearing docket, the official exhibit number for each evidentiary item in this proceeding reflects a three-letter party identifier (i.e, SEI, NRC, JTI); followed by three numeric characters to reflect its number; an additional letter (e.g., A, B, etc.) that, if used, indicates it is one part of a multi-part exhibit; another alpha character (i.e., -R) to indicate whether the exhibit was revised after its original submission as a prefiled exhibit (e.g., admitted exhibit JTI005-R would be a revised version of prefiled exhibit JTI005); followed by a two-character numeric identifier (i.e., 00) that identifies the exhibit as being used in a contested case (as opposed to a mandatory/uncontested proceeding (i.e., MA)); followed by the designation BD01, which indicates that this Licensing Board (i.e., BD01) was involved in its identification and/or admission. Accordingly, the official designation for this prefiled exhibit, as ultimately admitted, is JTI005A-R2-00-BD01, which reflects the fact, as is explained below, see infra note 53, that the prefiled version of this exhibit was refiled as a multi-part exhibit, the "A" portion of which was twice amended by the time of its admission. For ease of reading, however, we will refer to all exhibits admitted in this proceeding without the final six characters that make up their official designation.

[6] The Board advised Joint Intervenors that to have the material from these websites incorporated into the record, Joint Intervenors needed to provide portable document format (.pdf) formatted screen shots of the appropriate pages from these sites. See Licensing Board Memorandum and Order (Clarifying Evidentiary Materials) (Sept. 10, 2014) at 1–3 (unpublished).

motion in limine that the Board advised would be considered at an appropriate time during the evidentiary hearing.[7]

2 .13 Pursuant to the proceeding's general schedule, see Licensing Board Memorandum and Order (Ruling on Motion to Amend General Schedule; Revised General Schedule) (Aug. 7, 2014) app. A, at 2 (unpublished) [hereinafter General Schedule Order], on September 30-October 1, 2014, the Board held an evidentiary hearing regarding contentions

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[7] In response to the Board's September 10, 2014 order, on September 16 Joint Intervenors filed two new prefiled exhibits, JTI005A-R and JTI005B-R, providing storymaps generated via the use of the application websites and the database information underlying those storymaps, along with a motion asking for additional clarification regarding the Board's directives concerning prefiled exhibit JTI005. This included a request that, notwithstanding Joint Intervenors' efforts to submit .pdf screenshots of relevant portions of the information from the application websites, because of the interactive nature of the application websites created by Joint Intervenors' expert witness supporting EC 2, the Board should, as it would with a chart or graph prepared by an expert witness, admit as exhibits the entirety of the storymap applications and the database of information upon which they are based. In a September 19 order, the Board declined to provide the requested relief. The Board instead stated again that the non-static nature of the websites, as illustrated by Joint Intervenors' acknowledgment that its EC 2 witness could modify the information input utilized to generate the storymaps, precluded the Board, in the absence of a stand-alone compact disc/digital video disc (CD/DVD) that would allow the Board or the parties to run a "locked down" version of the applications, from simply allowing the websites and the storymaps they could generate from being considered as evidentiary material. See Licensing Board Memorandum and Order (Responding to Motion for Clarification) (Sept. 19, 2014) at 1–5 (unpublished). The Board did indicate, however, that during the evidentiary hearing, if in response to a Board question it became necessary for Joint Intervenors' EC 2 witness to generate an additional storymap from the website applications, so long as the manner in which the storymap was generated was shown to the parties (which the display technology being employed by the Board for the hearing would permit) and the resulting storymap was rendered into a .pdf document and provided to the other parties and the Board as a marked exhibit, the Board would consider admitting the material into the evidentiary record. See id. at 5–6.

SEI responded with a September 23 in limine motion, which the staff supported, asking that the Board preclude in toto the use of Joint Intervenors' storymap exhibits. In a September 24 issuance, the Board set a schedule for staff and Joint Intervenor motion responses and indicated that the Board would entertain arguments during the evidentiary hearing regarding the admissibility of any storymap-related exhibits. See Licensing Board Memorandum and Order (Additional Prehearing Items) (Sept. 24, 2014) at 4 (unpublished); see also infra note 53.

EC 1, EC 2, and EC 3 in Gillette, Wyoming.[8] See Tr. at 260–794. After providing the parties with an opportunity to submit proposed joint transcript corrections, on October 28, 2014, the Board issued an order adopting transcript corrections and closing the evidentiary record. See Licensing Board Memorandum and Order (Adopting Transcript Corrections and Closing Evidentiary Record) (Oct. 28, 2014) at 1–2 (unpublished) [hereinafter Transcript Corrections Order].[9]

2 .14 In accord with 10 C.F.R. § 2.1209 and this proceeding's general schedule, see General Schedule Order app. A, at 2, on November 3, 2014, the parties filed their proposed findings of fact and conclusions of law, and the parties' reply findings of fact and conclusions of law followed on November 17, 2014.[10]

[8] In addition, the Board conducted a 10 C.F.R. § 2.315(a) limited appearance session in Sundance, Wyoming, on September 28, 2014, see Tr. at 1–49 (Sept. 28, 2014), and Judges Bollwerk and White participated in site visits to the SEI Ross Project and the Uranerz Energy Corp. Nichols Ranch ISR facilities on September 29 and October 2, respectively.

[9] In citing to the evidentiary hearing transcript in this decision, we are referencing the transcript as modified by the transcript corrections adopted by the Board. See Transcript Corrections Order app. A.

[10] See [SEI's] Proposed Findings of Fact and Conclusions of Law (Nov. 3, 2014) [hereinafter SEI Findings]; [SEI] Notice of Errata for Proposed Findings of Fact and Conclusions of Law (Nov. 12, 2014); NRC Staff's Proposed Findings of Fact and Conclusions of Law (Nov. 3, 2014) [hereinafter Staff Findings]; NRC Staff's Corrected Notice of Erratum to Proposed Findings of Fact and Conclusions of Law (Nov. 20, 2014); [Joint Intervenors'] Proposed Findings of Fact and Conclusions of Law for [EC] 1, 2, and 3 (Nov. 3, 2014) [hereinafter Joint Intervenors Findings]; [SEI's] Reply to NRC Staff's and Joint Intervenors' Proposed Findings of Fact and Conclusions of Law (Nov. 17, 2014) [hereinafter SEI Reply Findings]; NRC Staff's Reply Proposed Findings of Fact and Conclusions of Law (Nov. 17, 2014) [hereinafter Staff Reply Findings]; [Joint Intervenors'] Responses to NRC Staff's and SEI's Proposed Reply Findings of Fact and Conclusions of Law for [EC] 1, 2, and 3 (Nov. 17, 2014) [hereinafter Joint Intervenors Reply Findings].

III. APPLICABLE LEGAL STANDARDS

3 .1 The contentions at issue here — EC 1, EC 2, and EC 3 — arise under the National Environmental Policy Act of 1969 and the NRC regulations implementing the agency's responsibilities pursuant to the Act. See 42 U.S.C. § 4321 et seq.; 10 C.F.R. Pt. 51. Together, this statute and the corresponding agency regulations govern an applicant's and the staff's roles in considering the environmental effects of a proposed agency ISR licensing action under 10 C.F.R. Part 40. Additionally, the Council on Environmental Quality (CEQ) has implemented regulations that provide guidance on agency compliance with NEPA, see 40 C.F.R. Pt. 1500, that, while not binding on the NRC when the agency has not expressly adopted them, are entitled to considerable deference. See Limerick Ecology Action, Inc. v. NRC, 869 F.2d 719, 725, 743 (3d Cir. 1989).

A. NEPA Requirements

3 .2 NEPA requires federal agencies to take a "hard look" at the environmental impacts of a proposed action, as well as reasonable alternatives to that action. See La. Energy Servs., L.P. (Claiborne Enrichment Center), CLI-98-3, 47 NRC 77, 87–88 (1998). This "hard look" is intended to "'foster both informed agency decision-making and informed public participation'" so as to ensure that the agency does not act upon "'incomplete information, only to regret its decision after it is too late to correct.'" Id. at 88 (quoting Marsh v. Or. Natural Res. Council, 490 U.S. 360, 371 (1989)). This "hard look" is, however, subject to a "rule of reason" in that consideration of environmental impacts need not address "all theoretical possibilities," but rather only those that have some "reasonable possibility" of occurring. Long Island Lighting Co. (Shoreham Nuclear Power Station, Unit 1), ALAB-156, 6 AEC 831, 836 (1973).

3 .3 With regard to such reasonably foreseeable impacts, "NEPA does not call for certainty or precision, but an estimate of anticipated (not unduly speculative) impacts." La.

Energy Servs., L.P. (National Enrichment Facility), CLI-05-20, 62 NRC 523, 536 (2005). As a consequence, agencies are given broad discretion "to keep their inquiries within appropriate and manageable boundaries." Claiborne, CLI-98-3, 47 NRC at 103. Therefore, in preparing an EIS, which "is not intended to be 'a research document,'" Entergy Nuclear Generation Co. (Pilgrim Nuclear Power Station), CLI-10-22, 72 NRC 202, 208 (2010) (quoting Town of Winthrop v. FAA, 535 F.3d 1, 13 (1st Cir. 2008)), NEPA does not call upon the staff to make an "'examination of every conceivable aspect of federally licensed projects,'" Private Fuel Storage, L.L.C., CLI-02-25, 56 NRC 340, 349 (2002) (quoting Claiborne, CLI-98-3, 47 NRC at 103). Nor is there a "NEPA requirement to use the best scientific methodology, and NEPA [']"should be construed in the light of reason if it is not to demand"['] virtually infinite study and resources." Entergy Nuclear Generation Co. (Pilgrim Nuclear Power Station), CLI-10-11, 71 NRC 287, 315 (2010) (quoting NRDC v. Hodel, 865 F.2d 288, 294 (D.C. Cir. 1988) (quoting NRDC v. Morton, 458 F.2d 827, 837 (D.C. Cir. 1972))) (footnotes omitted).

3 .4 Finally, "in the context of an NRC adjudicatory proceeding, even if an [EIS] prepared by the Staff is found to be inadequate in certain respects, the Board's findings, as well as the adjudicatory record, 'become, in effect, part of the [final EIS].' Thus, the Board's ultimate NEPA judgments can be made on the basis of the entire adjudicatory record in addition to the Staff's [final EIS]." See S. Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site), LBP-09-7, 69 NRC 613, 632 (2009) (quoting Hydro Res., Inc. (P.O. Box 15190, Rio Rancho, NM 87174), CLI-01-4, 53 NRC 31, 53 (2001), and citing La. Energy Servs., L.P., LBP-05-13, 61 NRC 385, 404 (2005), aff'd, CLI-06-22, 64 NRC 37 (2006), petition for review denied sub nom. Nuclear Infor. & Res. Serv. v. NRC, 509 F.3d 562 (D.C. Cir. 2007)), petition for review denied, CLI-10-5, 71 NRC 90 (2010).

B. 10 C.F.R. Part 51 Requirements Associated with Groundwater Information

3 .5 Under the NRC's Part 51 regulations governing the agency's implementation of NEPA, an applicant for a license to possess and use source and AEA section 11(e)2 byproduct material for the purpose of in situ uranium recovery must submit an ER with its application. See 10 C.F.R. §§ 40.31(f), 51.60(b); see also Office of Nuclear Regulatory Research (RES), NRC Regulatory Guide 3.46 (Task FP 818-4), Standard Format and Content of License Applications, Including Environmental Reports, for In Situ Uranium Solution Mining at vi (June 1982) (ADAMS Accession No. ML003739441) [hereinafter Reg. Guide 3.46].[11] More specifically, the ER must "contain a description of the proposed action, a statement of its purposes, [and] a description of the environment affected," 10 C.F.R. § 51.45(b), and it must discuss:

> (1) The impact[s] of the proposed action on the environment . . . in proportion to their significance;
> (2) Any adverse environmental effects which cannot be avoided should the proposal be implemented;
> (3) Alternatives to the proposed action . . . ;
> (4) The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and
> (5) Any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

Id. § 51.45(b)(1)-(5). Relative to groundwater, the applicant's ER is to provide information that will inform the staff's NEPA analysis of, among other things, environmental effects of the proposed action, and alternatives to the proposed action, including alternatives available to reduce or avoid adverse environmental effects. See Reg. Guide 3.46, at 3.46-7, 3.46-9, 3.46-17 to -20, 3.46-28.

[11] The Licensing Board takes official notice of this NRC regulatory document in accord with 10 C.F.R. § 2.337(f).

3 .6 The agency's NEPA regulations also require that the staff prepare an EIS in connection with a license to possess and use source and AEA section 11(e)2 byproduct material for the purpose of in situ uranium recovery. See 10 C.F.R. § 51.20(b)(8); see also FSEIS 9A, at iii. In the case of ISR projects, in May 2009, the agency issued NUREG-1910, a generic EIS for ISR uranium recovery facilities that assesses potential ISR facility construction/operation/decommissioning impacts in four specific Western United States regions, including the Nebraska-South Dakota-Wyoming region in which the Ross Project is located, and so provides a starting point for the agency's NEPA analyses for site-specific license applications for new ISR facilities. See FSEIS 9A, at iii. For the initial licensing of each individual ISR facility, however, the staff will first prepare a DSEIS, see 10 C.F.R. § 51.70, see also Ex. NRC007, at 1-29 (1 FSME, NRC, and Land Quality Division, Wyoming Department of Environmental Quality (WDEQ), NUREG-1910, Generic Environmental Impact Statement (GEIS) for In-Situ Leach Uranium Milling Facilities (May 2009)) [hereinafter GEIS], which addresses, among other topics, "the matters specified in [section] 51.45," 10 C.F.R. § 51.71(a). Although a DSEIS may rely in part on the ER, the regulations require the staff to "independently evaluate and be responsible for the reliability of all information used in the [DSEIS]." Id. § 51.70(b). The DSEIS is then distributed for public comment and, based on the comments received, a review of information provided by the applicant, and supplemental independent information and analysis, the staff prepares and issues an FSEIS. See id. §§ 51.73, 51.91; see also GEIS at 1-29 to -30.

3 .7 Relative to an individual ISR facility, when the staff formulates its DSEIS and FSEIS conclusions regarding the environmental impacts of a proposed action or alternative actions, the staff uses as guidance a standard scheme to categorize or quantify the impacts. See, e.g., 10 C.F.R. Pt. 51, App. B, tbl. B-1 n.3. This standard was created using the approach

outlined in CEQ regulations indicating that agencies should consider both the context and intensity of impacts. See Ex. NRC013, at 4-14 (Office of Nuclear Material Safety and Safeguards (NMSS), NRC, NUREG-1748, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs (Aug. 2003)) (citing 1 RES, NRC, NUREG-1437, [GEIS] for License Renewal of Nuclear Plants at 1-4 to -5 (May 1996) (citing 40 C.F.R. § 1508.27)) [hereinafter NUREG-1748]. This standard employs three levels of impacts — SMALL, MODERATE, and LARGE — that are defined as follows:

> SMALL - Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE - Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE - Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

See FSEIS 9A, at xx-xxi.[12]

C. Burden of Proof in NEPA Context

3 .8 As the proponent of the agency action at issue, an applicant generally has the burden of proof in a licensing proceeding. See 10 C.F.R. § 2.325. The statutory obligation of complying with NEPA, however, rests with the NRC. See, e.g., Duke Power Co. (Catawba Nuclear Station, Units 1 and 2), CLI-83-19, 17 NRC 1041, 1049 (1983). Consequently, when NEPA contentions are involved, the burden shifts to the staff. See Progress Energy Fl., Inc. (Levy County Nuclear Power Plant, Units 1 and 2), CLI-10-2, 71 NRC 27, 34 (2010); see also S. Nuclear Operating Co. (Early Site Permit for Vogtle ESP Site), CLI-07-17, 65 NRC 392, 395 (2007) (stating "NRC hearings on NEPA issues focus entirely on the adequacy of the Staff's

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[12] In describing and analyzing staff environmental impact findings in this decision, we follow the agency's regulatory protocol of denoting these terms in CAPITAL letters.

work"). Nonetheless, because "the Staff, as a practical matter, relies heavily upon the Applicant's ER in preparing the EIS, should the Applicant become a proponent of a particular challenged position set forth in the EIS, the Applicant, as such a proponent, also has the burden on that matter." La. Energy Servs., L.P. (Claiborne Enrichment Center), LBP-96-25, 44 NRC 331, 339 (1996) (citing Pub. Serv. Co. of N.H. (Seabrook Station, Units 1 and 2), ALAB-471, 7 NRC 477, 489 n.8 (1978)), rev'd on other grounds, CLI-97-15, 46 NRC 294 (1997). And relative to factual matters, to carry that burden, the staff and/or the applicant must establish that its position is supported by a preponderance of the evidence. See Pac. Gas & Elec. Co. (Diablo Canyon Nuclear Power Plant, Units 1 and 2), ALAB-763, 19 NRC 571, 577 & n.22 (citing cases), rev. declined, CLI-84-14, 20 NRC 285 (1984).

IV. FINDINGS AND CONCLUSIONS

A. Contention EC 1

4 .1 As set forth by the Board in its May 2014 order recognizing the migration of EC 1 as an FSEIS-related contention, that issue statement provides:

> [EC] 1: The FSEIS fails to adequately characterize baseline (i.e., original or pre-mining) groundwater quality.
>
> CONTENTION: The FSEIS fails to comply with 10 C.F.R. §§ 51.90-94, 10 C.F.R. Part 40, Appendix A, and NEPA because it lacks an adequate description of the present baseline (i.e., original or pre-mining) groundwater quality and fails to demonstrate that groundwater samples were collected in a scientifically defensible manner, using proper sampling methodologies. The FSEIS's departure from NRC guidance serves as additional evidence of these regulatory violations. NRC, NUREG-1569, Standard Review Plan [(SRP)] for In Situ Leach Uranium Extraction License Applications, §§ 2.7.1, 2.7.3, 2.7.4 (2003).

FSEIS Order app. A, at 1.

1. Witnesses and Evidence Presented

4 .2 SEI, the staff, and Joint Intervenors presented a total of eight witnesses in connection with EC 1 during the September 30-October 1 evidentiary hearing in support of their respective positions on the adequacy of the FSEIS as it addresses the baseline groundwater quality at the Ross ISR Project site. Those witnesses presented written direct and rebuttal testimony, with supporting exhibits, and gave oral testimony at the evidentiary hearing.[13]

a. SEI

4 .3 SEI presented four witnesses in support of its position on EC 1 at the evidentiary hearing: Ralph Knode, Hal Demuth, Errol Lawrence, and Ben Schiffer. See Tr. at 298–369, 437–76.

4 .4 Ralph Knode, SEI Chief Executive Officer (CEO), holds a Bachelor of Arts degree in geology from Amherst College. He has previously held ISR mine construction or operations positions with Uranium One, Inc., Joint Venture Inkai, Power Resources, Inc., Crow Butte Resources, Inc., (CBR) and Uranerz Exploration and Mining. At SEI, Mr. Knode oversees all licensing actions as well as the design, engineering, and construction of the wellfields and the ore recovery facilities; financial planning and budgetary matters; land and mineral acquisition; the development and implementation of health and safety programs; and interaction

[13] See Tr. at 260–476; Ex. SEI001, at 4–9 (Initial Written Testimony of Ralph Knode) [hereinafter Knode Initial Testimony]; Ex. SEI047, at 3–5 (Rebuttal Testimony of Ralph Knode) [hereinafter Knode Rebuttal Testimony]; Ex. SEI005, at 4–22 (Initial Written Testimony of Ben Schiffer) [hereinafter Schiffer Initial Testimony]; Ex. SEI045, at 3–17 (Rebuttal Testimony of Ben Schiffer) [hereinafter Schiffer Rebuttal Testimony]; Ex. SEI0026, at 8–13 (Initial Written Testimony of Hal Demuth and Errol Lawrence) [hereinafter Demuth/Lawrence Initial Testimony]; Ex. SEI046, at 3–6 (Rebuttal Testimony of Hal Demuth and Errol Lawrence) [hereinafter Demuth/Lawrence Rebuttal Testimony]; Ex. NRC001, at 3–27 (NRC Staff's Initial Testimony) [hereinafter Staff Initial Testimony]; Ex. NRC044-R2, at 3–16 (NRC Staff's Rebuttal Testimony) [hereinafter Staff Rebuttal Testimony]; Ex. JTI001-R, at 6–40 (Pre-Filed Direct Testimony of Dr. Richard Abitz Supporting Joint Intervenors' Contentions 1 and 3)) [hereinafter Abitz Initial Testimony]; Ex. JTI051-R, at 2–16 (Pre-Filed Rebuttal Testimony of Dr. Richard Abitz Supporting Joint Intervenors' Contentions 1 and 3) [hereinafter Abitz Rebuttal Testimony].

with landowners and other stakeholders. See Knode Initial Testimony at 3–4; Ex. SEI002, at 1–3 (Ralph Knode Curriculum Vitae (CV)).

4 .5 Ben Schiffer holds a Bachelor of Arts degree in geology from Whitman College and is a licensed professional geologist in the State of Wyoming. Currently, as a senior geologist and project manager at WWC Engineering, he is the coordinator for the team responsible for SEI's ISR permit application with responsibility for all permitting activities, including well installation and instrumentation, aquifer testing, groundwater modeling and geologic characterization. Also, he has served as a geologist/hydrogeologist at EDE Consultants, a geologist at Cogema Mining, Inc., and a field technician with KECK Geologic Consortium. See Schiffer Initial Testimony at 4; Ex. SEI006, at 1 (Ben Schiffer CV).

4 .6 Hal Demuth graduated from the University of Tulsa with a Bachelor of Science degree in petroleum engineering and from the University of Idaho with a Master of Science degree in hydrogeology. He is a senior engineer/hydrologist and principal of Petrotek Engineering Corp. At the Ross Project, he has overseen preparation of the permit application for the deep disposal wells as well as provided peer review of the hydrogeologic sections of the license application. Mr. Demuth was employed previously as a senior engineer/hydrologist at Harlan & Associates, Inc.; as a research assistant at the University of Idaho; and as a drilling/reservoir engineer at Tenneco Exploration & Production, Inc. See Demuth/Lawrence Initial Testimony at 3–4; Ex. SEI027, at 1 (Hal Demuth CV).

4 .7 Errol Lawrence, who has a Bachelor of Science degree in geology from Northern Arizona University and a Master of Science degree in engineering geology from the Colorado School of Mines, is a senior hydrogeologist/permitting specialist employed by Petrotek Engineering Corp. Mr. Lawrence has been employed at HydroSolutions as a hydrogeologic consultant; by Geraghty & Miller, Inc., as a project scientist; by the United States Geologic

Survey as a geologist; by Pogo Producing Company as an exploration geologist; and by Dresser Atlas as a wireline engineer. A registered professional geologist in Wyoming and Texas, Mr. Lawrence participated in the detailed review of the groundwater model for the Ross Project. See Demuth/Lawrence Initial Testimony at 3–4; Ex. SEI028, at 1 (Errol Lawrence CV).

b. NRC Staff

4 .8 At the hearing, evidence regarding staff's position relative to EC 1 was presented by three witnesses: Johari Moore, John Saxton, and Dr. Kathryn Johnson. See Tr. at 371–99, 437–76.

4 .9 Johari Moore has a Bachelor of Science degree in physics from Florida A&M University and a Master of Science degree in nuclear engineering and radiological sciences from the University of Michigan. Ms. Moore was the lead environmental review project manager for the Ross Project in FSME's Division of Waste Management and Environmental Protection, Environmental Review Branch. See Staff Initial Testimony at 1; Ex. NRC002, at 1 (Johari Aziza Moore Statement of Professional Qualifications (SPQ)).

4 .10 John Saxton, who holds a Bachelor of Science degree in geological engineering from the Colorado School of Mines and a Master of Science degree in geology from the University of New Mexico and is a licensed environmental professional in Connecticut, is a hydrogeologist with the FSME Uranium Recovery Licensing Branch, State and Materials and Environmental Management Programs. He was the project manager and technical reviewer in the area of hydrogeology for staff's safety review of the Ross Project license application. See Staff Initial Testimony at 1–2; Ex. NRC003, at 1–2 (John L. Saxton SPQ).

4 .11 Dr. Kathryn Johnson was awarded a Bachelor of Science degree in chemistry and mathematics from Black Hills State, a Master of Science degree in chemistry from Iowa State University, and a Ph.D in geology from the South Dakota School of Mines and

Technology. A geochemist employed by Attenuation Environmental Company (AEC) and the owner/principal of Johnson Environmental Concepts (JEC), Dr. Johnson served as the subject matter expert regarding water quality and as the principal editor of all sections on geology, soils, and hydrology for the Ross Project DSEIS and FSEIS. See Staff Initial Testimony at 2; Ex. NRC004, at 1–2 (Kathryn O. Johnson CV).

c. Joint Intervenors

4 .12 Dr. Richard Abitz testified on behalf of Joint Intervenors at the hearing regarding EC 1. See Tr. at 404–36, 437–76.

4 .13 Dr. Richard Abitz holds a Bachelor of Arts degree in geology from Humboldt State University and Master of Science and Ph.D. degrees in geology from the University of New Mexico. As the principal geochemist and owner of Geochemical Consulting Services, LLC, Dr. Abitz provides analysis of chemical and radiological data, modeling of soil and water systems, and risk assessments relative to projects involving hazardous and radiological materials. Dr. Abitz previously has been retained by Native American tribes and environmental organizations to provide consultation and expert testimony associated with the Church Rock, Crown Point, and Crow Butte ISR facilities, among others. See Abitz Initial Testimony at 1; Ex. JTI002, at 1 (Richard J. Abitz SPQ).

d. Finding Regarding Witness Qualifications

4 .14 Based on the foregoing, and the respective background and experience of the proffered witnesses, the Board finds that each of these individuals is qualified to testify relative to the subject of the adequacy of the FSEIS discussion on the baseline groundwater quality at the Ross Project site.

2. Description of Baseline Groundwater Quality Monitoring Program at Ross Site

4 .15 In accord with 10 C.F.R. § 51.45(b) and the associated staff SRP guidance in NUREG-1569 regarding site hydrology, an applicant for a uranium ISR license is required to provide data from a groundwater monitoring program that is sufficient to establish a pre-licensing site characterization baseline for assessing the potential effects of facility operations on local groundwater quality. See Ex. SEI007, at 2-20 to -26 (NMSS, NRC, [SRP] for In Situ Leach Uranium Extraction License Applications, NUREG-1569 (June 2003)) [hereinafter NUREG-1569]. In this instance, to help provide that baseline, SEI established a pre-licensing groundwater monitoring program that consists of six monitoring well clusters located across the Ross Project area. See FSEIS 9A, at 3-37; Ex. SEI016A, at 3-101 (1 SEI, Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report (Dec. 2010)) [hereinafter ER 16A]. The six well clusters each consisted of at least four wells, with each well completed in a separate, consistent stratigraphic horizon (i.e., rock layer) intended to provide a portion of the data necessary for hydrogeologic characterization of the proposed Ross Project area. The monitored horizons/zones consisted of (beginning with the deepest) (1) the first water-bearing sandstone layer underlying the uranium ore-bearing sands, operationally termed the deep monitoring or DM unit; (2) the uranium ore-bearing sandstone, operationally termed the ore zone or OZ unit, which is separated from the DM unit by a ten- to fifty-foot thick shale layer; (3) the first water-bearing sandstone layer overlying the OZ, operationally termed the shallow monitoring or SM unit, which is separated from the OZ by a twenty- to eighty-foot thick confining shale horizon; and (4) the surficial aquifer, operationally termed the SA unit, which is separated from the SM by a sequence of thin sands, shales, and silts. See FSEIS 9A, at 3-31 to -37; ER 16A, at 3-101. The data generated by this monitoring program, along with data from existing water supply wells and from wells used during the Nubeth research and development

(R&D) operation on the Ross Project site,[14] were the basis for the SEI baseline site characterization effort. See FSEIS 9A, at 3-38.

3. Scope of Regulatory Program Governing Groundwater Quality Monitoring for Purpose of Complying with NEPA

4 .16 Criterion 7 of 10 C.F.R. Part 40, Appendix A, requires that an applicant establish a pre-licensing monitoring program that is used to provide "complete baseline data" on the ISR site and its environs.[15] For the Ross Project, as described in Board Finding 4.15 above, this is the data from the six monitoring well clusters, in conjunction with the existing water supply well and historic Nubeth well data. In addition, to establish the existing hazardous constituent concentrations in the OZ aquifer, which can be used subsequently to set 10 C.F.R. Part 40, Appendix A, Criterion 5B(5) CABs for aquifer restoration performance assessment and Criterion 7A UCLs for excursion detection, in condition 11.3 to the SEI license the staff has

[14] Having received permission from the WDEQ and the NRC in 1976 and 1978, respectively, Nubeth constructed and operated an R&D operation located within what is now the Ross Project area. The operation consisted of a single "five-spot" well pattern, consisting of four injection wells and one recovery well, and a small facility with an IX column/elution/precipitation circuit capable of producing yellowcake slurry. "Buffer" wells, designed to keep the lixiviant within the well pattern, were meant to form a hydraulic control barrier. Nubeth operated between August 1978 and April 1979, recovering small amounts of uranium stored in solution, but was shutdown prematurely because of injection rate limitations that caused a buildup of fine material and organic matter in the wellfield. After recovery testing, restoration activities regarding the "five-spot" were completed in February 1983, with Nubeth receiving WDEQ restoration approval in April 1983 and with the WDEQ and NRC decommissioning approval processes completed by 1986. See FSEIS 9A, at 2-11.

[15] Although the Part 40, Appendix A criteria were developed for conventional uranium milling facilities, they have since been applied in limited fashion to ISR facilities. See Hydro Res., Inc. (2929 Coors Road, Suite 101, Albuquerque, NM 87120), CLI-99-22, 50 NRC 3, 8–9 (1999) ("While, as a general matter, Part 40 applies to [ISR] mining, some of the specific requirements in Part 40, such as many of those found in Appendix A, address hazards posed only by conventional uranium milling operations, and do not carry over to [ISR] mining.") (footnote omitted). The issues in this proceeding arguably make a strong case for a redraft of that appendix to address specifically ISR mining facilities, which involve a very different process. See infra note 21 (recent staff draft SRP addresses separately uranium milling and heap leach facilities).

specified the criteria governing a post-licensing pre-operational well monitoring and analysis program to establish background water quality data for the OZ, DM, and SM aquifers. See FSEIS 9A, at 6-9 to -10. This would include data from wells placed into the OZ and perimeter monitoring wells around each wellfield per SEI license condition (LC) 11.3, and could include data from the wells used to collect the pre-licensing site-characterization data. See id. at 6-10; see also SEI License at 12–13.

4 .17 At the crux of this contention is the issue whether, to comply with NEPA's requirement to make an adequate pre-licensing assessment of environmental impacts, more extensive monitoring of the type (albeit perhaps different from or beyond that) found in the post-licensing, pre-operational system specified in LC 11.3 is required as a part of the SEI Appendix A, Criterion 7 pre-licensing site characterization monitoring program to provide "complete baseline data."[16]

4 .18 In responding to this issue, the staff contends that the baseline groundwater information that an applicant is required to provide pre-licensing to comply with Criterion 7 is not the information that a licensee is required to provide after licensing, but before wellfield

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[16] The staff described the SEI pre-license baseline data collection in section 6.3 of the FSEIS as follows:

> Pre-licensing, site-characterization monitoring of surface water and ground water was completed by the Applicant in 2009, 2010, and 2011. The Applicant also provided supplemental environmental-monitoring data in 2012. The acquired data were then used to characterize the Ross Project area according to the requirements in 10 CFR Part 40, Appendix A, Criterion 7.

FSEIS 9A, at 6–9 (citations omitted). The staff also explained that it followed guidance in section 2.7 of the NUREG-1569 standard review plan, staff Regulatory Guide 4.14, and WDEQ guidelines. See Staff Initial Testimony at 8 (Johnson, Moore, Saxton); Staff Rebuttal Testimony at 3–6 (Saxton). The data from the monitoring well network and the other supply wells are provided in FSEIS appendix C, characterized in FSEIS section 3.5.3.3, and compared to the WDEQ's and EPA's water-quality standards for constituents in table 3.8 of the FSEIS. See Staff Initial Testimony at 7 (Johnson, Moore, Saxton).

operation, to help establish UCLs for excursion monitoring and the Criterion 5B(5) CABs for restoration performance assessment. See Staff Initial Position Statement at 16–17. In addition to citing section 2.7 of its NUREG-1569 standard review plan guidance and Regulatory Guide 4.14 as support for this proposition, see id. at 13, the staff placed significant reliance on the Commission's decision in Hydro Resources, Inc., see id. at 18–19, in which the Commission stated:

> Waiting until after licensing (although before mining operations begin) to establish definitively the groundwater quality baselines and upper control limits is . . . 'consistent with industry practice and NRC methodology,' given the sequential development of in situ leach well fields. The site-specific data to confirm proper baseline quality values, and confirm whether existing rock units provide adequate confinement cannot be collected until an in situ leach well field has been installed . . . .

Hydro Res, Inc., (P.O. Box 777, Crownpoint, New Mexico 87313), CLI-06-1, 63 NRC 1, 6 (2006) (footnote omitted). Also of import, the staff asserts, is that by its terms Appendix A, Criterion 7A, which mandates that (1) a "licensee shall establish a detection monitoring program needed for the Commission to set the site-specific groundwater protection standards in paragraph 5B(1) of this appendix"; and (2) the detection monitoring program "must be in place when specified by the Commission in . . . license conditions," directly connects the Criterion 5B(5) monitoring program to the license condition-based program required by Criterion 7A. See Staff Findings at 18–19. Further, SEI argued that the so-called 10 C.F.R. § 40.32(e) "construction rule" bars an ISR license applicant from installing a complete wellfield and associated monitor well networks, such as that required under SEI's LC 11.3, until after a license is issued. See SEI Initial Position Statement at 17. Ultimately, however, both the staff and SEI agree that under Criterion 5B(5), "Commission-approved background" cannot be established until after an ISR license has been issued, and thus the staff did not err in making

its NEPA impacts assessment based on the pre-licensing baseline water quality information provided by SEI. See Staff Findings at 16; SEI Reply Findings at 4–5.

4 .19 In light of the Commission's Hydro Resources decision and the language of Appendix A, Criterion 7A, we are unable to discern a legal basis for concluding that the Appendix A, Criterion 7 pre-licensing monitoring program for the purpose of establishing existing characterization values for certain site groundwater constituents must be co-extensive with the Criterion 7A pre-operational monitoring, license condition-based program intended to provide the information needed for setting Appendix A, Criterion 5B groundwater protection standards and UCLs.[17] At the same time, nothing in Appendix A, Criteria 5B, 7, or 7A precludes an inquiry, based on a well-pled contention, into whether the particular measures used in an applicant's pre-licensing program were adequate to provide the necessary information to characterize properly the environmental impacts of employing an ISR mining process in the aquifers below a proposed site. As a consequence, we turn to Joint Intervenors' specific concerns about the pre-licensing monitoring program employed by SEI and used by the staff in preparing the FSEIS to determine whether the staff's NEPA impact analysis is deficient because inadequate sampling protocols (and the resulting inadequate information) were used and/or additional monitoring information was required.

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[17] We find less convincing SEI's argument that the 10 C.F.R. § 40.32(e) "construction rule" requires this result. As we have previously noted, Part 40's definition provision indicates that "construction" does not include "[s]ite exploration, including . . . preconstruction monitoring to establish background information related to . . . the environmental impacts of construction or operation, or the protection of environmental values." See LBP-12-3, 75 NRC at 193–94; see also 10 C.F.R. § 40.4 (definition of "Construction"). To the degree the agency requires certain monitoring procedures to provide the information needed for its NEPA impacts analysis, we find nothing in this definition that would preclude the installation of wells or the use of monitoring protocols as needed to provide that data.

4. Joint Intervenors' Specific Technical Concerns about SEI's Preconstruction Monitoring Program

4 .20 Joint Intervenors posed a number of technical issues that they asserted are implicated by their EC 1 claim regarding the adequacy of the FSEIS discussion of baseline water quality. See Joint Intervenors Findings at 21–34. Citing sampling methods recommended in the 2009 United States Environmental Protection Agency (EPA) Unified Guidance for establishing baseline at sites subject to the Resource Conservation & Recovery Act (RCRA), 42 U.S.C. § 6901 et seq., or the Comprehensive Environmental Compensation and Liabilities Act (CERCLA), id. §§ 9601, 9675, Joint Intervenors witness Dr. Abitz maintained that a proper sampling plan should include (1) collecting a minimum of eight to ten samples per well from sampling wells randomly sited throughout the study area; (2) utilizing proper methods for well drilling and sample collection and analysis; (3) employing sampling wells located up the hydraulic gradient from the OZ; and (4) using proper scientific and statistical methods to establish baseline values. See Abitz Initial Testimony at 6–8 (citing Ex. JTI006 (Office of Resource Conservation and Recovery, EPA, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, Unified Guidance, EPA 530/R-09-007 (Mar. 2009)) [hereinafter EPA Unified Guidance]). According to Dr. Abitz SEI and the staff failed to employ these methods, leaving the FSEIS discussion and analysis significantly wanting.

a. Inadequacies in Monitoring Well Deployment

4 .21 One of Joint Intervenors' concerns was the way in which SEI implemented its groundwater monitoring program, both in terms of the number of wells and their location. See Joint Intervenors Findings at 21–22; see also id. at 33–34 (asserting more accurate quantification of baseline data is possible using standard statistical practices such as random grid sampling, statistically significant number of sampling locations, and proper statistical tests in accord with EPA Unified Guidance and Department of Energy procedures for characterizing

stream and groundwater baseline water quality). In his initial testimony, citing the EPA Unified Guidance, Dr. Abitz asserted that SEI's program was too limited in that SEI and the staff failed to show that the program used "standard statistical practices for the environmental industry." Abitz Initial Testimony at 23. And when coupled with the suggestion that the agency's NEPA process would benefit from such "a scientifically and statistically sound sampling regime," id. at 14, i.e., to adopt what are potentially "best practices," and so thereby avoid what they characterize as reliance on "a statistically invalid, biased set of non-representative groundwater samples," id. at 21, Joint Intervenor's plea to have the applicant and staff employ various revised testing and analysis protocols is not without some attraction.

4 .22 As the Commission has made apparent, however, NEPA does not require the adoption of best practices, particularly in the face of a potentially significant resource commitment, see Pilgrim, CLI-10-11, 71 NRC at 315, a concern that EPA has acknowledged applies to groundwater monitoring, see EPA Unified Guidance at 5-2 ("Due to the cost of management, mobilization, field labor, and especially laboratory analysis, groundwater monitoring can be an expensive endeavor."). Nor does it appear that the EPA RCRA/CERCLA guidelines, which the staff and SEI assert are directed at the need for background water quality data for groundwater monitoring and detection rather than NEPA environmental site characterization, see Staff Findings at 25, SEI Findings at 29–30, have been adopted wholesale for regulatory assessment purposes by other federal or state agencies. See Schiffer Rebuttal Testimony at 11–13 (comparing Bureau of Land Management coal lease application NEPA baseline groundwater characterizations to Ross Project and noting SEI monitoring program was in compliance with WDEQ requirements and guidelines). Further, the six monitoring clusters and the twenty-nine existing water supply wells located within or adjacent to the Ross Project boundary that were used by SEI and the staff, along with the historic Nubeth R&D site

information, to characterize the Appendix A, Criterion 7 baseline for the Ross Project site generated some 362 groundwater samples (with over 16,000 chemical and radiological parameters).[18] See Schiffer Initial Testimony at 8–9; see also Staff Initial Testimony at 6–8 (Johnson, Moore, Saxton). Accordingly, in the absence of some evidence of actual bias (or an attempt to induce a biased result) associated with SEI's well siting or sampling activities,[19] see infra Board Finding 4.107, we find no basis on the evidentiary record before us for declaring those sampling protocols to be so facially deficient as to require that they be redone in accord with Joint Intervenors' preferred methodology.[20]

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[18] In this regard, we note that table 3.6 in the FSEIS states that the complete data set for the monitoring well samples reflected in the table is presented in appendix C. See FSEIS 9A, at 3-40. The 41 pages of data in appendix C from the six monitoring well clusters and several water supply wells include information on groundwater collected from the four aquifers (SA, SM, OZ and DM) in 2010 and 2011. See Ex. SEI009B, at C-1 to -43 (FSME, NRC, [EIS] for the Ross ISR Project in Crook County, Wyoming; Supplement to the Generic [EIS] for In-Situ Leach Uranium Milling Facilities, Final Report, NUREG-1910 (supp. 5 Feb. 2014)) [hereinafter FSEIS 9B]. The collection of eight samples from most of the wells over that period, see id., generally seems consistent with the EPA Unified Guidance on the number of well samples referenced by Joint Intervenors.

[19] Relative to random grid sampling, in addition to the problem of whether such a protocol would be consistent with the baseline groundwater quality evaluation purpose of obtaining representative samples from the uranium ore bodies, see Tr. at 465 (Saxton), there also are indications here that the number and location of cluster wells was based on factors such as WDEQ guidelines (including at least one production zone well per square mile), having consistent/continuous water-bearing intervals above and below mineralization, satisfactory confining layer thickness, proximity to existing drilling data, sufficient spatial distribution for development of potentiometric data, and landowner considerations. See ER 16A, at 3-101; see also Schiffer Rebuttal Testimony at 15. These factors effectively counter any suggestion of an overt intent on the part of SEI to bias well location in an effort to make future reclamation program parameters less onerous.

[20] Dr. Abitz also declared that the number of monitoring wells and samples used by SEI were insufficient to conclude with statistical confidence that the water quality in the OZ does not meet the EPA drinking water maximum concentration limits (MCLs) for uranium and radium-226. See Abitz Initial Testimony at 17. Given that the EPA determination only requires that the aquifer not currently serve as a source of drinking water and that the aquifer must contain a commercially producible mineral resource, see Ex. SEI034, at 2 (Letter from Derrih R. Watchman-Moore, Region 8, EPA, to Kevin Frederick, Water Quality Div., WDEQ (May 15,

(continued...)

4 .23 Also with regard to well placement, citing the staff's NUREG-1569 and Regulatory Guide 4.14 guidance, Dr. Abitz indicated that Joint Intervenors' concern was about the purported need for the staff to obtain and consider data from an upgradient well (i.e., a well located on the upstream side of the regional or local groundwater flow). See Abitz Initial Testimony at 7–8 (citing NUREG-1569, at 2-32; Ex. SEI008, at 4.14-2 (Office of Standards Development, NRC, Radiological Effluent and Environmental Monitoring at Uranium Mills, Regulatory Guide 4.14 (rev. 1 Apr. 1980))). While acknowledging that NUREG-1569 and Regulatory Guide 4.14, as well as EPA's RCRA-implementing regulation 40 C.F.R. § 264.97(a)(1)(I) do contain language indicating that water samples taken from one well located hydrologically upgradient are part of the sampling protocol, the staff nonetheless asserted that these provisions do not require such a sample from an ISR facility, as opposed to a uranium milling operation. See Staff Findings at 28–29.

4 .24 Staff witnesses noted initially that Regulatory Guide 4.14, which implements NUREG-1569 acceptance criteria 2.93, see NUREG-1569, at 2-32 ("Monitoring programs to establish background radiological characteristics, including sampling frequency, sampling methods, and sampling location and density are established in accordance with pre-operational monitoring guidance provided in Regulatory Guide 4.14, Revision 1, Section 1.1 (NRC, 1980)."), addresses radiological effluent and environmental monitoring at uranium mills. See Staff

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[20](...continued)
2013)) [hereinafter EPA Exemption Letter], this assertion has no relevance in the context of the agency's licensing of the Ross Project, see Tr. at 465 (Saxton) and so is irrelevant to our resolution of this contention. Moreover, the SEI application, in accordance with NUREG-1569, and the FSEIS each do have a comparison of the water quality measurements from the six cluster wells and the existing private water supply wells vis a vis the EPA MCLs, as well as the EPA secondary standards, and the WDEQ class of use standards, that show some of the cluster well samples and private well samples exceed the EPA MCLs for various parameters such as uranium, radium-226, and gross alpha. See ER 16A, at 3-184 to -195; FSEIS 9A, at 3-42, 3-44; see also Schiffer Rebuttal Testimony at 10, 16–17; Staff Initial Testimony at 26–27 (Johnson, Moore, Saxton).

Rebuttal Testimony at 9 (Johnson, Saxton). According to staff witnesses, although some elements of the guidance, such as well sampling and radiological constituent analysis, can be appropriately applied to ISR facilities, the concept of an upgradient well cannot. See Staff Initial Testimony at 15 (Johnson, Moore, Saxton). Staff witnesses asserted this is because a uranium mill, the original focus of Regulatory Guide 4.14, does not include two key features of an ISR facility. Upgradient water quality, the staff maintained, is not necessarily representative of ISR production zone background water quality because of the way uranium roll-fronts form, i.e., the groundwater upgradient of the ore body contains oxygen and is geochemically distinct from the groundwater in the same horizon through the production zone, which is generally oxygen-deficient. See id. Also, staff witnesses declared, natural hydraulic gradients are not disturbed by the mining process associated with a uranium mill in the way that they are disrupted by the recovery well process used during ISR operation and aquifer restoration. In fact, staff witnesses asserted, as described in FSEIS sections 2.1.1.2 and 4.5.1.2, wellfield groundwater inflow, which is a natural flow gradient disruption, is required at an ISR facility to reduce the likelihood of out-of-the-wellfield excursions. Therefore, staff witnesses concluded, because an upgradient well is not required to establish baseline values at the Ross Project site, the FSEIS does not describe such a well. See Staff Rebuttal Testimony at 9 (Johnson, Saxton).

4 .25 Additionally, according to staff witnesses, even assuming 40 C.F.R. § 264.97(a)(1)(i) has any applicability in a non-RCRA context, that section does not require a determination of background groundwater quality to include sampling of wells that are hydraulically upgradient of the waste management area if non-upgradient well sampling will provide an indication of background groundwater quality that is representative, or more representative, than that provided by upgradient wells. But, staff witnesses maintained, for the same reasons outlined in Board Finding 4.24 above, upgradient wells are not always necessary

and so are not required under this regulation for an ISR project. See Staff Initial Testimony at 15 (Johnson, Moore, Saxton).

4 .26 Although it seems apparent that the agency guidance language in Regulatory Guide 4.14 is misleading and needs to be revised,[21] we agree with the staff that, given the circumstances regarding an ISR facility, an upgradient well is not required for an Appendix A, Criterion 7 site characterization monitoring program for an ISR facility.[22] That being said, we note also that SEI apparently did include an upgradient well (34-7 OZ) among its sampling locations, see Schiffer Rebuttal Testimony at 8 (citing Ex. SEI019 (Ross Ore Zone Potentiometric Surface and Regional Monitor Well Location Map)), and that any concerns about upgradient excursions will be addressed by the system of operational monitoring wells, which will dot the perimeter of the Ross Project wellfields pursuant to condition 11.3(B) of SEI's license. See SEI License at 11; see also Tr. at 327 (Demuth).

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[21] We note also that recently the staff issued for public comment a draft version of NUREG-2126, a standard review plan for conventional uranium mills and heap leach facilities. See [SRP] for Conventional Uranium Mills and Heap Leach Facilities, 79 Fed. Reg. 75,597 (Dec. 18, 2014) (announcing opportunity for comment on draft NUREG-2126). Unlike NUREG-1569, however, draft NUREG-2126 explicitly requires an upgradient monitoring well during site characterization rather than through an unexplicated cross-reference to Regulatory Guide 4.14. Compare NUREG-1569, at 2-32, with NMSS, NRC, [SRP] for Conventional Uranium Mill and Heap Leach Facilities, NUREG-2126, at 2-34 (Draft Report for Comment Nov. 2014) (ADAMS Accession No. ML14325A634). By the same token, in the absence of a revised Regulatory Guide 4.14, some explicit recognition in NUREG-1569 of the non-applicability of the upgradient monitoring well for ISR site characterization purposes seems appropriate.

[22] Given the current language of the staff's NUREG-1569 ISR SRP guidance, although we might well be justified in requiring that, consistent with that guidance, SEI create and utilize such an upgradient monitoring well prior to beginning its operation of the Ross Project, we decline to do so because, in light of the uranium milling-based purpose of the requirement, that action would have no practical impact. Cf. 10 C.F.R. § 2.335(b) (providing for waiver of rule or regulation upon a showing that applying provision at issue "would not serve the purposes for which the rule or regulation was adopted").

b. Aquifer Sampling Intervals

4 .27 In connection with their challenge to the adequacy of the FSEIS water quality data, Joint Intervenors expressed concern about the aquifer sampling intervals used by SEI for its monitor wells. See Joint Intervenors Findings at 22–23. In this regard, Joint Intervenors witness Dr. Abitz asserted that baseline values have been (and will be) biased toward greater concentrations of contaminants because water samples were (and will be) collected from intervals that are "screened only through the part of the [OZ] water horizon that is in contact with the ore zone, rather than the entire column of water in the OZ sand interval."[23] Abitz Initial Testimony at 21. More specifically, Dr. Abitz declared that screen lengths for the six monitor wells in the OZ aquifer were only one-quarter to one-half the thickness of the OZ sand and were centered on the OZ, where water was most likely to have been contaminated by exploration drilling.[24] See id. at 21–22. Asserting that the staff's NUREG-1569 guidance recognizes that "fully screened intervals are more accurate in their representation of the water quality," Dr. Abitz maintained that the SEI data used for the FSEIS analysis was biased given the water samples collected by SEI were not representative of the entire thickness of the OZ aquifer.[25] Id. at 22 (citing NUREG-1569, at 5-43).

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[23] In this context, "well screening" denotes the use, at the intake portion of a well, of a porous filter that allows groundwater to be sampled from a targeted aquifer or a specific horizon within an aquifer. See ER 16A, at 1-54 to -56 (figs. 1.2-8 to -10); see also id. at 3-213 to -218 (figs. 3.4-15 to -20).

[24] According to Dr. Abitz, this screening protocol had "the effect of biasing the groundwater sample to high values for uranium, radium-226 and other uranium progeny and associated ore metals (e.g., arsenic, molybdenum, vanadium, etc[.]) due to the disturbance and oxidation of the ore during well construction and development." Abitz Initial Testimony at 22.

[25] Although Dr. Abitz's testimony references NUREG-1748, the staff's general environmental guidance for licensing actions, see Abitz Initial Testimony at 22 (citing NUREG-1748, at 5-43), as SEI witness Schiffer noted, see Schiffer Rebuttal Testimony at 14–15, it is apparent that what he is referring to is NUREG-1569, the staff's ISR facility SRP.

4 .28 In their initial written testimony, staff witnesses declared that wells used to establish the pre-licensing baseline were "screened over the entire ore-zone aquifer." Staff Initial Testimony at 18 (Johnson, Moore, Saxton). So too, SEI witness Schiffer maintained that no bias has been introduced with respect to the baseline groundwater quality in the mineralized zone because the six pre-license cluster wells in the OZ aquifer were screened in intervals three to twelve times larger than the average mineralized zone thickness and thus represented water quality from a larger interval than the future production and injection wells that will be screened discretely in the mineralized zones. See Schiffer Rebuttal Testimony at 14–15 (citing SEI014A, at 2-200 to -201 (tbl. 2.7-20) (1 SEI, Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report (TR) (Dec. 2010)) [hereinafter TR 14A]). In fact, according to SEI witness Schiffer, this screening across intervals larger than the average mineralized zone thickness likely had the effect of diluting some of the constituents, such as uranium and radium-226, as compared to samples from future wells used to establish CAB. See id. at 14.

4 .29 And with regard to post-licensing monitoring, SEI witness Schiffer maintained that the perimeter monitoring wells that are used to sample water from the OZ aquifer for excursion monitoring and that will also be used to provide sampling data to establish UCLs for excursion monitoring will likewise be screened through the entire thickness of the ore-bearing part of the OZ aquifer.[26] See Schiffer Rebuttal Testimony at 15 (citing Ex. SEI014C, at 5-82 (2 SEI, Ross ISR Project USNRC License Application, Crook County, Wyoming, [TR] (rev. Apr. 2012)) [hereinafter TR 14C]). And by way of contrast, SEI witness Schiffer declared that the

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[26] Although staff witness Saxton initially stated that the perimeter monitoring wells will be screened only on the specific ore horizons, similar to the monitoring wells in the production field, he later clarified that for the Ross Project the perimeter monitoring wells will be "fully screened," Tr. at 382, 398–99, by which the Board understands that the screened interval extends continuously through the entire stack of ore horizons, although not necessarily through the entire OZ aquifer.

monitoring wells in the wellfield sampling water from the OZ aquifer that will be used to establish the Appendix A, Criterion 5B(5)(a) constituent CABs will be narrowly screened to sample water from, and establish CABs for, only a specific ore horizon, i.e., because the OZ contains several vertically stacked ore horizons, a specific well will only sample water from one ore horizon in the stack. See Tr. at 473–74 (discussing TR 14C, at 5-107 (Dec. 2010) (fig. 5.7-10)).

4 .30 In considering Joint Intervenors' challenge to the well screening intervals used for site characterization, we note initially that the table in SEI's TR referenced by SEI witness Schiffer as indicative of SEI's well screening coverage has a column labeled "Screened/Aquifer Thickness" that shows values ranging from between 30 and 110 feet for the wells in each of the six clusters that sampled the OZ aquifer. See TR 14A, at 2-200 to -201 (tbl. 2.7-20);[27] see also ER 16A, at 3-156 to -157 (tbl. 3.4-20). In contrast, the total thickness of the OZ aquifer given in the FSEIS is between 90 and 180 feet. See FSEIS 9A, at 3-34. Thus, the information in these tables, along with the screening intervals for monitoring cluster wells as shown in the gamma log figures in the applicant's TR also referenced by SEI witness Schiffer, see Schiffer Rebuttal Testimony at 14 (citing TR 14A, at 2-257 to -262); see also ER 16A, at 3-213 to -218, appear to support Joint Intervenors' assertion that these wells were screened only through the part of the aquifer containing the stacked ore horizons.

4 .31 That being said, we nonetheless find that there is no deficiency associated with the SEI well-screening protocols employed for pre-licensing site characterization that merits requiring any additional sampling efforts. Initially, we note that the NUREG-1569 guidance

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[27] Although the wells labeled OW1B in table 2.7-20 had narrower screen intervals, these wells, which were designed to mimic production wells and were used as part of the aquifer characterization pumping test, nonetheless were not among the six monitoring well clusters and no water samples from them are listed in FSEIS appendix C. See TR 14C, at 5-82 (rev. Apr. 2012)); ER 16A, at 3-157 (tbl. 3.4-20); FSEIS 9B, app. C. Consequently, those wells are not relevant to this screening interval discussion.

relied upon by Joint Intervenors as supporting fully screened wells is, on its face, applicable to the yet-to-be-implemented perimeter monitoring wells rather than the pre-licensing site characterization wells at issue here. See NUREG-1569, at 5-42 to -43 (as part of section 5.7.8.3 acceptance criteria associated with ensuring that groundwater and surface water excursions are timely detected, indicating that "[f]or most situations the staff favors fully screened monitor wells" because "[f]ully screened monitor wells would assure that excursions will eventually be detected"). Moreover, it is apparent that the screening protocol used by SEI for site characterization sampling was appropriate to that task. As SEI witness Schiffer indicated, the six well clusters were located both within and next to mineralized zones, so that some of these wells sampled groundwater from non-mineralized parts of the OZ aquifer.[28] See Schiffer Rebuttal Testimony at 14. As staff witnesses also indicated, wells that penetrated the OZ had screened intervals long enough to collect groundwater from the non-mineralized layers between ore horizons as well as from ore-rich zones.[29] See Staff Initial Testimony at 18 (citing ER 16A, at 3-156 to -157 (tbl. 3.4-20), 3-213 to -218 (figs. 3.4-15 to -20), and FSEIS 9A, at 3-38) (Johnson, Moore, Saxton). By contrast, the protocols that will be implemented for the OZ wells to establish a CAB will have much narrower screening intervals given that they will be located within individual ore bodies that are only about nine feet thick on average.[30] Likewise,

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[28] The term "non-mineralized" used here is not meant to suggest that there were no ore minerals in the sampled zones, but rather that the zones did not contain enough ore minerals to be economically viable.

[29] SEI witness Schiffer did note that due to the nature of the sampling completions used in the cluster wells, Strata does not propose to use those wells for compliance purposes to develop a CAB, so that water samples from these wells will not be used to calculate target restoration values. See Schiffer Rebuttal Testimony at 14.

[30] SEI and staff witnesses justify using this narrow screening interval technique on OZ wells intended initially to collect CAB-setting samples on the basis that (1) because wells used to collect CAB water samples will later be used for mining, the screen interval is optimized for
(continued...)

the perimeter monitoring wells will, consistent with the staff's NUREG-1569 guidance, be fully screened to sample the entire thickness of the OZ aquifer to maximize the timely detection of lixiviant excursions.[31] See Schiffer Rebuttal Testimony at 14–15. We thus resolve this screening interval matter in favor of the staff and SEI.

c. Averaging Sampling Results

4 .32 Joint Intervenors also challenged the way in which sampling results were presented and analyzed in the FSEIS. See Joint Intervenors Findings at 23–24. Joint Intervenors witness Dr. Abitz stated in his initial testimony that FSEIS tables 3.6 and 3.7 improperly averaged the sampling data collected, grouping together the six cluster wells to report an average and range for each water horizon without describing a proper statistical method for evaluating the individual wells prior to grouping them and calculating an average or range for the aquifer horizon. See Abitz Initial Testimony at 2–23 (citing FSEIS 9A, at 3-40 to -41 (tbls. 3.6 and 3.7)). According to Dr. Abitz, "simple averaging or reporting a range of the values from all wells does not establish baseline unless it can be shown with proper statistical methods that (i) the samples from the individual wells follow a normal or log-normal distribution, and (ii) an analysis of the data variance of each well demonstrates that the wells can be

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[30](...continued)
mining, see Tr. at 343 (Knode); (2) only the narrow interval containing ore will be impacted by mining, so it is appropriate to use water samples from that interval to set restoration standards, see Tr. at 355 (Knode), 385 (Saxton); (3) it is not practical to install a well with a large screen interval for sampling baseline water, then refit it with a narrow screen interval appropriate for mining, then return it to a large screen interval for post-mining restoration, see Tr. at 356 (Knode); and (4) well construction with long screen intervals inside the production wellfield would allow mining fluids and contaminated groundwater to flow between different ore horizons as well as contaminate groundwater between ore horizons, see Tr. at 361 (Knode).

[31] Although staff witness Saxton noted that there is a "difference of opinion" regarding whether a fully screened or partially screened perimeter monitoring well is better able to detect an excursion, he stated that for the Ross Project, the perimeter monitoring wells will be fully screened. Tr. at 397–98.

combined into a single population for statistical calculations." Abitz Initial Testimony at 23. And regarding the latter point, Dr. Abitz maintains that, in fact, the six cluster wells do not fall into a single population with respect to uranium and radium-226. See id.

4 .33 In response, SEI declared that its application, and the FSEIS, are fully consistent with NUREG-1569's acceptance criterion 2.7.3(4) guidance that states the application should list "'[t]he average water quality for each aquifer zone and the range of each indicator in the zone.'" SEI Reply Findings at 28 (quoting NUREG-1569, at 2-26). Further, according to SEI, SEI and staff testimony establish that all recommendations in NUREG-1569, section 2.7, regarding items such as the listing of the average and range of constituent concentrations in each aquifer zone have been satisfied. See id. Finally, SEI notes that appendix C to the FSEIS presents the actual groundwater quality sampling results from the six cluster wells and the existing water supply wells. See id. at 29; see also FSEIS 9B, at C-1 to -43.

4 .34 As was noted earlier, see supra note 18, appendix C to the FSEIS sets forth forty-one pages of well sampling data from the six well clusters and water supply wells, which are summarized in table 3.6, while table 3.7 summarizes historical sampling data from the Nubeth R&D project, which the FSEIS indicates was taken from a 1978 Nubeth water quality program quarterly report to the NRC, see FSEIS 9A, at 3-41 (citing Letter from Albert F. Stoick, Nubeth, Nuclear Dynamics, to L. C. Rouse, Division of Fuel Cycle and Material Safety, NRC encl. (Aug. 31, 1978) (ADAMS Accession No. ML12135A358)). With regard to these tables, the crux of Dr. Abitz's complaint is that "there is no mention of the proper statistical methods for evaluating individual wells prior to grouping them and calculating an average or range for the aquifer horizon." Abitz Initial Testimony at 22–23. Although Dr. Abitz cited undifferentiated portions of the EPA Unified Guidance in support of this statement, see id. at 23 (citing EPA Unified Guidance "Parts II, III and IV; and references therein"), as far as we are aware there is

no NEPA or NRC requirement that the agency, rather than averaging the sampling data as was done by the staff, adopt the more rigorous statistical methodology Dr. Abitz asserts is needed. Moreover, to the degree that Joint Intervenors are concerned about the way in which the staff used the raw data from appendix C and the Nubeth report in preparing tables 3.6 and 3.7, the source information for those tables was available for analysis and critique if they believed the staff's presentation of the data was materially flawed.[32] Consequently, we find in favor of the staff and SEI on this matter as well.

d. Data Bias from SEI Drilling Techniques

4 .35 Sampling data bias purportedly arising from the well drilling techniques employed by SEI was another of Joint Intervenors' concerns. See Joint Intervenors Findings at 24–29. Based on thermodynamic calculations, Joint Intervenors witness Dr. Abitz determined that the concentration of dissolved uranium in groundwater contacting the minerals pyrite and urananite, and having the iron, carbonate, and sulfate contents as reported in FSEIS appendix C, would be "so low that it cannot be detected with present laboratory methods." Abitz Initial Testimony at 18–19. It thus followed, according to Dr. Abitz, that the uranium values given in FSEIS tables 3.6 and 3.7 were biased by the introduction of oxygen prior to collection of the groundwater samples. See id. at 19. In this regard, according to Dr. Abitz, notwithstanding an FSEIS declaration that uranium concentration data from 2009 and 2010 is consistent with data from 2011, he asserts that data given in FSEIS appendix C shows that uranium values from 2011 have decreased since 2010, while radium-226 remains at 2010 levels, which is consistent with the OZ aquifer returning to reducing conditions following disturbance when sampling wells

[32] In making this statement, we are aware that tables 3.6 and 3.7 in their current, more detailed form were first provided in the FSEIS. Nonetheless, the source information that was the basis for those tables was previously specified in the March 2013 DSEIS in support of that document's more abbreviated tables 3.6 and 3.7, see DSEIS 6A, at 3-40 to -41, and so was available for Joint Intervenors' consideration.

are installed and developed.[33] See id. at 24–25. Nor is this trend a coincidental event, Dr. Abitz maintained, being fully consistent with what occurred at a Goliad, Texas ISR site in which decreasing uranium, but not radium-226, sample values could be attributed to ore zone oxidation caused by improper well installation and development techniques. See id. at 26–28. So too, Dr. Abitz asserted, the Ross Project sample-contaminating oxidation was a result of SEI's rotary-drill techniques utilizing conventional drilling fluids, which Dr. Abitz suggested are likely to contain dissolved oxygen, see Tr. at 423, and the air lifting process, which employs compressed atmospheric air to bring water samples to the surface, see Abitz Initial Testimony at 11, 19. Referencing United States Geological Survey (USGS) guidelines on the selection and installation of wells for groundwater quality surveys, Dr. Abitz maintained that an appropriate drilling method would be to use air-rotary drilling with recirculated nitrogen gas, in lieu of air, and a foam surfactant containing oyxgen-eliminating organic constituents. See id. at 18 (citing Ex. JTI011, at 57 (Wayne W. Lapham, et al., USGS, Dep't of the Interior, Guidelines and Standard Procedures for Studies of Ground-Water Quality: Selection and Installation of Wells, and Supporting Documentation, Water-Resources Investigations Report 96-4233 (1997)) [hereinafter USGS Report]).

4 .36 In response, the staff claimed that the technical basis for Dr. Abitz's concern is misplaced. Staff witnesses questioned the assumption underlying Dr. Abitz's calculations of initial uranium concentrations in the undisturbed aquifer, i.e., that a perfect thermodynamic equilibrium exists between the groundwater and the minerals in the aquifer, asserting that thermodynamic equilibrium is never achieved in aquifers due to water recharge and flow. See

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[33] Dr. Abitz explained that once the ore body is oxidized during well installation, the radium-226 released from the uranium ore will not drop out of solution because it is insensitive to redox changes, so a slow decrease in uranium without a decrease in radium-226 would indicate a return to reducing conditions after contaminants had been released by well construction. See Abitz Initial Testimony at 27.

Staff Rebuttal Testimony at 15 (citing Ex. NRC046 (Werner Stumm & James J. Morgan, Aquatic Chemistry § 2.17 (3d ed. 1996))) (Johnson, Saxton). In addition, staff witnesses testified that, contrary to the premise underlying Dr. Abitz's calculations, the kinetics of pyrite oxidation are slow to the degree that pyrite is commonly found in the presence of oxygenated water. Further, in support of this position, citing a recent study at the Smith Ranch-Highland ISR facility in which wells sampled using methods designed to exclude atmospheric oxygen yielded water from the ore zone containing 0.11 milligrams per liter (mg/L) uranium, staff witnesses maintained that because this concentration was at the high end of the range of uranium values measured in the Ross Project monitoring wells, the uranium concentrations measured by SEI in the OZ monitoring wells clearly are within the range of reasonable uranium concentrations possible under unperturbed conditions. See id. at 15–16 (Johnson, Saxton); Tr. at 391 (citing NRC047, at 22 (Jim Stone, et al., [ISR] Uranium Mining Restoration Challenges (Apr. 9, 2014) (slide presentation))) (Johnson).

4 .37 Also in response to Dr. Abitz's claims, staff witness Dr. Johnson stated that the initial water samples from some of the Ross Project wells showing elevated concentrations of contaminants were not used to calculate baseline values. See Tr. at 388. Additionally, Dr. Johnson pointed to other sampling data showing the presence of ammonia, which she claimed only exists under non-oxidizing conditions, thus indicating that oxidation was not an issue. See Tr. at 388–89. Further, although acknowledging that the range of maximum and minimum uranium concentration values over the SEI sampling period was essentially the same, Dr. Johnson also noted that some wells had a slight concentration decrease, while others, including the well that had the highest uranium concentration, showed an increase instead of the decline over the sampling period that would be expected if it had been compromised by oxidation per Dr. Abitz's claim. All of this data, according to Dr. Johnson, indicated there was

no demonstrated systematic bias due to SEI's use of conventional methods of well installation or sampling. See Tr. at 389.

4 .38 For their part, SEI witnesses emphasized that SEI drilling methods would not introduce oxygen. SEI witness Knode described the air lifting technique cited by Dr. Abitz, which involves lowering a pipe below the static water level in the well, usually 50 to 100 feet, then forcing a burst of air from an air compressor down the pipe. This quickly lifts a 50- to 100-foot water column out of the well casing, creating a vacuum into which fresh water from the bottom of the well rushes through the screened interval and removes any residual drilling fluid and fines in the screened interval. Although this may be done repeatedly over several hours until the water coming out of the well is clean and representative of the native water in the screened interval, SEI witness Knode asserted that it could not cause oxidation in the OZ aquifer since air would only be injected some 200 feet above the screened interval. See Knode Initial Testimony at 5, 7–8.

4 .39 With regard to Dr. Abitz's related concern about oxidation via drilling fluids, SEI witness Knode testified that the drilling fluids in the type of mud rotary drilling system used by SEI are specifically designed to form a thin, impermeable layer, referred to in the drilling industry as filter cake, on the walls of the borehole. According to SEI witness Knode, the filter cake is intended to impede the movement of drilling fluids into the surrounding aquifer. He also testified that drilling fluids can be tailored to specific conditions, which is very effective in minimizing or eliminating the movement of drilling fluid into the aquifer to be monitored or mined. See id. at 5. Further, SEI witness Knode declared, during mud rotary drilling, only drilling fluid is introduced into the borehole and, while it is possible that there could be a small amount of air entrained within the drilling fluid, the filter cake would effectively limit how much air would enter the aquifer. Additionally, SEI witness Knode asserted that the pressure of the aquifer, i.e., the level

of the water in the well above the top of the aquifer, would also serve to limit the introduction of air. See id. at 6.

4 .40 Finally, asked whether air-rotary drilling with recirculated nitrogen gas and a foam surfactant containing oyxgen-eliminating organic constituents would be a viable alternative to the mud rotary drilling employed by SEI, SEI witness Demuth declared that “I have never heard of a well being proposed to be installed with nitrogen or even discussed in any fashion for an ISR operation in the United States or anywhere within the world.” Tr. at 366.

4 .41 Based on the evidentiary record before us, the Board is unable to agree with Joint Intervenors’ methodology for calculating the uranium concentration in the undisturbed OZ aquifer,[34] or their resulting conclusion, based on this methodology, that the measurable well sampling values in the FSEIS must be the consequence of significant oxidation contamination. Further, although the Board considers it likely that very small amounts of oxygen are introduced into a target aquifer by mud rotary drilling and the associated use of air lifting, and that this may cause spikes in dissolved uranium, nonetheless, given that (1) the borehole-coating design of drilling fluids, in conjunction with aquifer pressure, should largely prevent the movement of these fluids into the aquifer; and (2) air lifting involves introducing air into a well casing far above the screened interval of the OZ aquifer, any oxidation effect resulting from the use of the standard mud rotary drilling method described by SEI, see Knode Initial Testimony at 4–5, is likely to be both very local and very quickly dissipated by dilution or precipitation of uranium as the water moves back into a reducing environment (as even Dr. Abitz indicates is likely for a “mild disturbance,” Tr. at 466).

[34] In this regard, we agree with the staff’s observations that thermodynamic equilibrium is unlikely to be achieved in the OZ aquifer. See supra Board Finding 4.36. In this context, Dr. Abitz’s use of equations that assume perfect equilibrium seems unrealistic.

4 .42 In addition, regarding the need for agency consideration of the proposed alternative to drilling techniques of air-rotary drilling utilizing recirculated nitrogen gas and a foam surfactant containing oxygen-eliminating organic constituents, we observe that under the NEPA directive to provide a detailed statement of reasonable alternatives to a proposed action, see 42 U.S.C. § 4332(2)(C)(iii), an alternatives discussion need not include "'every possible alternative, but every reasonable alternative.'" Long Island Lighting Co. (Shoreham Nuclear Power Station, Unit 1), CLI-91-2, 33 NRC 61, 71 (1991) (quoting Citizens for a Better Henderson v. Hodel, 768 F.2d 1051, 1057 (9th Cir. 1985) (emphasis added)). Further, reasonable alternatives do not include alternatives that are "impractical[;] . . . that present unique problems; or that cause extraordinary costs." Private Fuel Storage, L.L.C. (Independent Spent Fuel Storage Installation), LBP-03-30, 58 NRC 454, 479 (2003) (citing Airport Neighbors Alliance v. United States, 90 F.3d 426, 432 (10th Cir. 1996); Communities, Inc. v. Busey, 956 F.2d 619, 627 (6th Cir. 1992)). Nor is there a need to consider alternatives that are technologically unproven. See Kelley v. Selin, 42 F.3d 1501, 1521 (6th Cir. 1995); Morton, 458 F.2d at 837 (approving exclusion from alternatives discussion of alternative energy sources that "will be dependent on [future] environmental safeguards and [technological] developments"); Busey, 956 F.2d at 627 (upholding rejection of alternatives that "presented severe engineering requirements" or were "imprudent for reasons including their high cost, safety hazards, [and] operational difficulties").

4 .43 Against this legal backdrop, we note that the 1997 USGS report cited by Dr. Abitz in support of the proposed alternative drilling method states only that "aeration of anoxic ground water can induce local changes in ground-water chemistry," without mentioning the use of nitrogen as a possible drilling fluid. USGS Report at 57. Also, the evidentiary record contains no examples demonstrating (or otherwise supporting) the use of Dr. Abitz's suggested

method. As a consequence, the Board concludes that, in this context, the alternative drilling method proposed by Dr. Abitz is, at least at this juncture, so untested and experimental that it is not a "reasonable alternative" requiring further consideration under NEPA.

e. Data Bias from Additional Wellfield Development

4 .44 In addition to their concerns about the data bias impacts of SEI's pre-licensing drilling activities, the Joint Intervenors questioned as well whether SEI's post-licensing drilling activities will have a negative impact on data collection to establish a post-licensing "true baseline" for excursion control and future remediation. Joint Intervenors Findings at 29–32. As evidence supporting this concern, Dr. Abitz described the circumstances surrounding the Kingsville Dome ISR operation in south Texas, asserting that an improper baseline was established at the Kingsville Dome site for three production areas over a fourteen-year period (1983 to 1998). See Abitz Initial Testimony at 29.

4 .45 According to Dr. Abitz, in August 1983, the initial baseline ranges for uranium and radium-226 were established after the installation of ore zone production wells in the first Kingsville Dome production area. See id. at 30. After additional wellfields were built out, the Texas Water Commission (TWC) (now the Texas Commission on Environmental Quality (TCEQ)) in November 1987 allowed the operator to revise that baseline for the first production area by increasing uranium and radium-226 to maximum values that were approximately ten times higher than the initial 1983 baseline. Thereafter, Dr. Abitz stated, in February 1990, after mining the first production area for approximately 6.5 years, the TWC allowed the operator to establish baseline values at a second adjacent, but downgradient, production area. This TWC action, according to Dr. Abitz, permitted the operator to elevate the uranium baseline value to a maximum value that was 100 times higher than the maximum uranium value used to calculate the production area one initial baseline. Then, in June 1998 the TWC allowed the operator to

establish a baseline for the third production area. Dr. Abitz asserted that this sequence of events clearly shows the deterioration of the baseline values with time when an operator is allowed to develop the baseline for each unit as the wellfields are built out. And as a practical matter, according to Dr. Abitz, this higher baseline allows much higher levels of uranium to pass through the monitor well ring without being reported as an excursion, as is an evident result at Kingsville Dome because of the significant increase in reported uranium levels in 1998 and 2007 at wells just outside and downgradient from the Kingsville Dome facility's monitoring well ring. See Abitz Initial Testimony at 31.

4 .46 In light of the Kingsville Dome situation, Dr. Abitz declared that the Ross facillity FSEIS is deficient for failing to (1) explain how the planned Ross Project post-licensing baseline water quality measurements will not become contaminated by the pre-sampling combined effects of drilling, casing, well development, and testing of hundreds to thousands of injection and recovery wells; and (2) describe the mechanical and chemical effects associated with previous and ongoing exploratory drilling to delineate the boundaries of the other four economically recoverable uranium resources in the Lance District that encompasses the Ross Project. Additionally, Dr. Abitz maintained that the FSEIS is inadequate because it does not address how, in the course of constructing, operating, and restoring numerous individual wellfields in sequence over many years, SEI's license terms will avoid operational wellfields degrading the post-licensing, pre-operational water quality baselines in subsequent adjacent monitoring wells that target the same aquifers. See id. at 28–29. Further, while Dr. Abitz at the hearing conceded that sampling groundwater for post-licensing pre-operational background prior to construction of the entire wellfield is "good," he also re-emphasized that the local environment around newly drilled boreholes will be the site of greatest disturbance and that water collected from that site will be most strongly affected by oxidation. See Tr. at 420. Dr.

Abitz indicated, however, that it would be difficult to estimate how far from a drill hole this oxidation effect might extend. See Tr. at 421.

4 .47 In response to Dr. Abitz's claims regarding wellfield development impacts, the staff asserted his concern is outside the scope of this proceeding because it fails to allege a deficiency in the FSEIS. According to the staff, what Joint Intervenors are contesting is the agency's regulatory scheme that provides for the post-licensing collection of water quality data to establish Appendix A, Criterion 5B(5) constituent CABs. Consequently, the staff declared, Dr. Abitz's claims are in actuality an improper challenge to the agency's regulations. See Staff Reply Findings at 11–12 & n.42 (citing 10 C.F.R. § 2.335(a)).

4 .48 SEI countered by observing that Dr. Abitz's concern about phased wellfield development resulting in degraded water quality in undeveloped wellfields does not account for the requirement in SEI LC 10.7 that a net inward hydraulic gradient be constantly maintained in each operating wellfield or that LC 11.5 requires SEI to perform routine excursion monitoring in each operating wellfield to verify that mining solutions do not migrate away from that wellfield. SEI Reply Findings at 23 (citing SEI License at 8, 13–14). SEI also sought to discount Dr. Abitz's Kingsville Dome example by referencing a 2008 decision regarding the licensing of the Goliad, Texas ISR facility in which the TCEQ executive director stated that he was unaware of a documented case of off-site groundwater contamination within the past thirty years in south Texas. See id. Further, while SEI witness Knode confirmed that for each wellfield the perimeter monitoring ring wells and the monitoring wells in the production field will all be constructed prior to drilling the main suite of injection and recovery wells in a wellfield, see Tr. at 320–21, he also indicated that in his experience, the drilling of numerous monitoring wells and production wells in a wellfield has not caused a noticeable increase in uranium concentration, an observation that was confirmed by SEI witness Demuth based on his

consulting work for other domestic ISR facilities, see Tr. 321–22 (Demuth), 344–45 (Knode, Demuth).

4 .49 In questioning the impact of additional wellfield development on water quality, to the degree that Joint Intervenors are challenging the post-licensing pre-operational water quality testing protocol contemplated by Criterion 5B(5), that would be an improper challenge to the regulation. This Joint Intervenor challenge, however, seems not so much directed at that water quality testing mechanism, as at the fact that the agency's licensing and regulatory process permits phased wellfield development. With this phased development, while monitoring well placement and sampling is completed before production well installation and operation, because well water quality testing for each wellfield is deferred until such time as the licensee decides to initiate wellfield operation, Joint Intervenors nonetheless are concerned that each well drilled for monitoring or production in a particular wellfield will have an impact on subsequent water quality measurements in undeveloped wellfields as they are brought online, resulting in higher constituent CABs for those wellfields.

4 .50 We find this claim unpersuasive for several reasons. First, as we concluded in our ruling regarding the impact of SEI drilling techniques on well sampling, see supra Board Findings 4.41-4.43, we find no basis for Joint Intervenors' concern that such drilling will, in and of itself, create sampling bias. Additionally, to the degree Joint Intervenors' argument, although characterized as about "SEI's well drilling methods," Joint Intervenors Findings at 29, is actually footed in a concern about cross-contamination between operating wellfields and undeveloped wellfields, the inward hydraulic gradient and the perimeter monitoring well network that SEI is required to establish and operate throughout a wellfield's operating life provide the requisite assurance that such contamination will not occur to a degree that it needs to be assessed in the

FSEIS.[35] Therefore, based on the preponderance of the evidence before the Board,[36] this matter is also resolved in favor of the staff and SEI.

f. Data Bias from Nubeth Well Samples

4 .51 Another of Joint Intervenors' claims regarding sampling bias concerned the FSEIS description of Ross Project baseline conditions as that analysis incorporated the results of the previous ISR R&D operations conducted in the late 1970s by Nubeth within the area of the Ross Project. See Joint Intervenors Findings at 32–33 (citing FSEIS 9A, at 3-38). According to testimony by Joint Intervenors witness Dr. Abitz, in 1976 Nubeth initiated a study involving lixiviant injection/extraction into and out of a single well, which was before the first baseline samples were collected in April 1978. The impact some two years later of this 1976 R&D test in the area defined by these baseline monitoring wells is evident, according to Dr. Abitz. Dr. Abitz asserted that some Nubeth wells clearly captured aquifer water samples indicating the lixiviant injection oxidized the OZ, given those samples have high radium-226

[35] We recognize that, given his assertion that heterogeneity in hydraulic conductivity is a fluvial deposit characteristic, Dr. Abitz disagrees with the efficacy of maintaining an inward hydrologic gradient absent a staff showing that the hydraulic conductivity throughout the aquifer is uniform in all directions, and that he likewise rejects the reliability of excursion monitoring because of what he asserts are the invalid statistical methods used to derive the excursion UCLs and the failure to include uranium as an excursion control parameter that will allow uranium to migrate beyond the monitor-well ring and contaminate the surrounding aquifer prior to build out of the next wellfield. See Abitz Rebuttal Testimony at 13. The Board does not agree with Dr. Abitz's criticisms, however, the former being essentially an assertion that the ISR process is not a viable method for mining uranium, while the latter is based on premises questioning the viability of excursion control monitoring that we do not accept. See infra Board Findings 4.147-4.149.

[36] We also find the Kingsville Dome information provided by Joint Intervenors unpersuasive as a basis of support for this water sampling bias challenge. To the degree Joint Intervenors' concern is that the staff will permit periodic water quality "rebaselining" for an operating wellfield (as Joint Intervenors suggest was permitted relative to the first Kingsfield Dome production area), there is no evidence in the record supporting such an assertion. So too, the conflicting information provided by Joint Intervenors and SEI regarding off-site excursions in south Texas ISR facilities fails to provide sufficient support for a finding that the FSEIS is deficient in some material respect so as to require further supplementation.

values in excess of ten mg/L, while other wells had radium-226 values less than three picocuries per liter, but uranium values as high as wells in the oxidized OZ.[37] See Abitz Initial Testimony at 33 (citing FSEIS 9A, at 3-41 (tbl. 3.7)). Based on this information, Dr. Abitz concluded that because the OZ was injected with lixiviant before baseline water quality samples were collected, a pre-industrial baseline does not exist for the Nubeth pilot-scale study, which leaves the FSEIS without a significant component needed as part of the FSEIS site characterization baseline analysis. See id. at 34.

4 .52 Regarding the specifics of Dr. Abitz's Nubeth-related claims, staff witnesses asserted that 1976 pre-industrial groundwater quality data collected prior to Nubeth's single well test and the 1978 samples collected prior to Nubeth's five-spot R&D test were, based on a staff determination they were collected according to industry standards, (1) compiled in FSEIS table 3.7; and (2) as the only available estimates of pre-industrial water quality, used in FSEIS section 3.5.3.3 to assess differences in water quality from the late 1970s to 2010-11. See Staff Initial Testimony at 19–20 (Johnson, Moore, Saxton) (referencing FSEIS 9A, at 3-41). Further, according to staff witnesses, because the purpose of the FSEIS is to characterize the existing groundwater quality conditions in and adjacent to the Ross Project site and to assess the potential impacts to groundwater quality that may occur as the result of ISR operations, if groundwater quality data reported in the FSEIS table 3.6 is biased to high values as a result of impacts from the former Nubeth operation, these "high values," which represent the existing

[37] Dr. Abitz's interpretation of this relationship postulated that samples with high radium-226 and uranium are from parts of the aquifer that were oxidized by the lixiviant injected in 1976. In contrast, samples with low radium-226 values, but still evidencing high uranium values, are from parts of the aquifer that, while not being oxidized, were contaminated by excursions of uranium-rich lixiviant. Further, according to Dr. Abitz, the latter samples have low radium-226 values because radium-226 is less mobile than uranium. Therefore, Dr. Abitz concluded, all the baseline samples at Nubeth were contaminated by uranium released during the initial 1976 test. See Abitz Initial Testimony at 33–34; see also Tr. at 451.

groundwater conditions at the site, are what is important, as opposed to the impacts of past uranium mining activities on water quality. See id. at 20; see also Tr. at 452–53 (Moore). Staff witnesses further asserted that, contrary to Dr. Abitz's characterizations, there is no consistent relationship between levels of uranium and radium-226 in the groundwater and, moreover, the high levels of radium in the Ross Project groundwater existed before any mining took place on the site. See Tr. at 449–50 (Johnson).

4 .53 Regarding the Nubeth data, SEI witness Schiffer stated that the Nubeth site's total area was approximately seven acres, or less than one-half of one percent of the total Ross license area, and that none of the SEI monitoring well clusters fell within the Nubeth site footprint. SEI witness Schiffer also stated that around 1982 Nubeth relinquished ownership of the site's production and project water supply wells to an oil company, which thereafter used the water for enhanced oil recovery using water-flood techniques. Further, according to SEI witness Schiffer, Wyoming Oil and Gas Conservation Commission records show that the two Nubeth wells, along with another oil company well close to the Nubeth site, all of which have been in continuous use since that time, created a cone of depression that encompasses the Nubeth R&D site. The cone of depression, SEI witness Schiffer declared, is essentially a groundwater sink that draws water from the surrounding aquifer into these wells. See Schiffer Initial Testimony at 18–19. SEI witness Moores, in his EC 3-related testimony regarding the Nubeth facility,[38] further declared that between 1979 and 2010, nearly 1.2 billion gallons of water was removed from the aquifer via these wells and then re-injected into underlying aquifers to support enhanced oil recovery, an action that SEI witness Schiffer suggested would have removed any potential contaminants that might have biased pre-licensing water quality characterization for

[38] Because the focus of his testimony concerned EC 3, we describe Mr. Moores' qualifications below in section IV.C.1.a, which we likewise conclude allow us to consider this aspect of his testimony in connection with EC 1.

the Ross site. Moreover, both SEI witnesses Schiffer and Moores agreed that, as a consequence of this groundwater pumping activity, it was virtually impossible that any groundwater had left the immediate vicinity of the Nubeth site to affect Ross site water quality characterization, with SEI witness Moores adding that the large volume of water removed from the aquifer for the past thirty years made it unrealistic to assume that any of the original groundwater from the Nubeth site still existed within the aquifer. See Schiffer Initial Testimony at 19; Ex. SEI042, at 11 (Initial Written Testimony of Ray Moores) [hereinafter Moores Initial Testimony].

4 .54 While Joint Intervenors' concerns about the impact of the Nubeth R&D project on Ross site water quality undoubtedly are a reflection of their position that "baseline" water quality should describe "an aquifer that has not been disturbed by human actions," Joint Intervenors Findings at 13, we conclude that, in this context,[39] the proper role of the NEPA assessment was to characterize the current state of water quality at the Ross site, with whatever Nubeth-related warts that might entail. The staff concluded in that regard that the current water quality of the OZ aquifer is the same as it was during Nubeth's pre-operational sampling. See FSEIS 9A, at 5-29 ("The data presented in Tables 3.6 and 3.7 in SEIS Section 3.5.3 suggest that the current water quality in the ore zone and the SM aquifers are the same as each were at the time of Nubeth's pre-operational sampling."). In our estimation, the preponderance of the evidence in the record, including the 1976 and 1978 data used in creating

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[39] Staff witnesses also noted that in addition to using Nubeth operation historical data as part of staff's characterization of the existing conditions at the Ross Project site, the staff accounted for the impacts of the Nubeth site in the context of the FSEIS section 5.7.2 cumulative impacts analysis, see Staff Initial Testimony at 20–21 (Johnson, Moore, Saxton), an analysis the validity of which, the staff asserted, is not within the scope of EC 1, see Staff Findings at 30.

FSEIS table 3.7,[40] and SEI witnesses' testimony regarding the post-project use of the Nubeth R&D wells, both supports this staff conclusion and resolves this Joint Intervenor challenge in favor of the staff and SEI.

5. Board Conclusions Regarding EC 1

4 .55 The Board concludes that Joint Intervenors have failed to establish the validity of their various challenges, based on alleged noncompliance with 10 C.F.R. §§ 51.90-94, 10 C.F.R. Part 40, Appendix A, and NEPA, to the adequacy of the FSEIS description of the baseline water quality at the Ross ISR site. In this regard, we find initially that the applicant's 10 C.F.R. Part 40, Appendix A, Criterion 7 monitoring program for establishing the existing site characterization baseline values for certain site groundwater constituents prior to the issuance of a Part 40 license for ISR facility construction and operation need not, for the purpose of complying with NEPA and the agency's Part 51 implementing regulations, be conducted so as to also provide the background information needed to set Appendix A, Criterion 5B groundwater protection standards.

4 .56 With respect to Joint Intervenors' specific arguments regarding the purported negative impacts on the FSEIS of the supposed technical inadequacies associated with SEI's monitoring well deployment program (including well numbers and location), SEI's aquifer sampling intervals, the staff's use of sampling results averaging, the sample data bias resulting from SEI's use of standard drilling techniques, the sample data bias resulting from SEI's sequential development of additional wellfields, and the sample data bias associated with using well samples from the Nubeth R&D site, based on a preponderance of the evidence in the record before us, we resolve each of these matters in favor of the staff and SEI.

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[40] In this regard, we do not accept Dr. Abitz's assertions that the uranium and radium-226 values in the 1978 data preclude that data's use by the staff in assessing an appropriate pre-licensing baseline for the Ross Project.

B. Contention EC 2

4 .57 The Board's order regarding the migration of EC 2 as a FSEIS-related contention set forth that issue statement as follows:

> [EC] 2: The FSEIS fails to analyze the environmental impacts that will occur if the applicant cannot restore groundwater to primary or secondary limits.
>
> CONTENTION: The FSEIS fails to meet the requirements of 10 C.F.R. §§ 51.90-94 and NEPA because it fails to evaluate the virtual certainty that the applicant will be unable to restore groundwater to primary or secondary limits in that the FSEIS does not provide and evaluate information regarding the reasonable range of hazardous constituent concentration values that are likely to be applicable if the applicant is required to implement an [alternate concentration limit (ACL)] in accordance with 10 C.F.R. Part 40, App. A, Criterion 5B(5)(c).

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FSEIS Order app. A, at 1.

1. Witnesses and Evidence Presented

4 .58 SEI, the staff, and Joint Intervenors presented eight witnesses at the evidentiary hearing to testify on EC 2 and the adequacy of the FSEIS analysis of environmental impacts should SEI be unable to restore groundwater to primary or secondary limits under 10 C.F.R. Part 40, Appendix A, Criterion 5B(5)(a)-(b), and thus would be required to implement an ACL under Criterion 5B(5)(c). In addition to providing oral testimony, each witness also presented prefiled written direct and/or rebuttal testimony with supporting exhibits.[41]

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[41] See Tr. at 516–648; Knode Initial Testimony at 9–11; Schiffer Initial Testimony at 22–29; Schiffer Rebuttal Testimony at 17-19; Demuth/Lawrence Initial Testimony at 13–18; Demuth/Lawrence Rebuttal Testimony at 6; Staff Initial Testimony at 27–42; Staff Rebuttal Testimony at 16–24; Ex. JTI003-R, at 5-48 (Pre-Filed Testimony of Dr. Lance Larson on Contentions 2 and 3) [hereinafter Larson Initial Testimony]; Ex. JTI052-R, at 2–13 (Pre-Filed Rebuttal Testimony of Dr. Lance Larson on Contentions 2 and 3) [hereinafter Larson Rebuttal Testimony].

a. SEI

4 .59 At the evidentiary hearing, SEI presented four witnesses concerning EC 2: (1) SEI CEO Ralph Knode; (2) Ben Schiffer, WWC Engineering senior geologist and project manager; (3) Hal Demuth, a senior engineer/hydrologist and principal of Petrotek Engineering Corp.; and (4) Errol Lawrence, a Petrotek Engineering Corp. senior hydrologist. See Tr. at 516–29, 612–48.

4 .60 The qualifications of these SEI witnesses were discussed previously by the Board in connection with its ruling on EC 1. See supra section IV.A.1.a.

b. NRC Staff

4 .61 Three witnesses testified at the evidentiary hearing regarding the staff's position on EC 2: (1) Johari Moore, the NRC Ross Project lead environmental review project manager; (2) John Saxton, an NRC Ross Project safety review project manager and hydrogeologist; and (3) Dr. Kathryn Johnson, an AEC/JEC geochemist. See Tr. at 535–62, 612–48.

4 .62 The qualifications of the staff's witnesses were discussed previously by the Board above in connection with its ruling on EC 1. See supra section IV.A.1.b.

c. Joint Intervenors

4 .63 One witness, Dr. Lance Larson, an NRDC science fellow since January 2014, provided testimony at the hearing regarding Joint Intervenors' position with respect to EC 2. See Tr. at 587–648.

4 .64 Dr. Larson received a Bachelor of Engineering degree in environmental engineering from California Polytechnic State University, a Master of Science degree in civil and environmental engineering from the South Dakota School of Mines and Technology, and a dual doctorate in environmental engineering and biogeochemistry from Pennsylvania State University. See Larson Initial Testimony at 2; Ex. JTI004, at 1 (Lance Nichols Larson CV). In

support of Joint Intervenors' claims concerning EC 2, Dr. Larson prepared "storymaps," or visual representations of NRC ISR post-mining groundwater restoration data paired with post-licensing, pre-operational data, all geo-spatially mapped. See Larson Initial Testimony at 22–48. Storymaps, as well as the underlying NRC data, regarding the Smith Ranch ISR uranium mining site units A and B and the Willow Creek Christensen Ranch satellite facility ISR uranium mining site units 2-6 were prepared and admitted into evidence. See Tr. at 741–42; Ex. JTI005A-R2 (ISR Storymap Source Spreadsheet Data) [hereinafter Source Data]; Ex. JTI005B-R2 (ISR Storymaps Application) [hereinafter Storymaps].

d. Finding Regarding Witness Qualifications

4 .65 Based on the foregoing, and the respective background and experience of the proffered individuals, the Board finds that each of these SEI, staff and Joint Intervenor witnesses is qualified to testify relative to the adequacy of the FSEIS analysis of environmental impacts should an ACL be necessary for groundwater restoration.

2. Legal Background for Contention 2

a. NRC Regulations on ISR Groundwater Restoration

4 .66 The requirements for groundwater restoration standards for ISR mining operations are set forth in 10 C.F.R. Part 40, Appendix A, Criterion 5B(5):

> At the point of compliance, the concentration of a hazardous constituent must not exceed—
> (a) The Commission approved background concentration of that constituent in the ground water;
> (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background level of the constituent is below the value listed; or
> (c) An alternate concentration limit established by the Commission.

Thus, three standards are accepted by the Commission as the bases for approval of an ISR operator's groundwater restoration. The first option, which is frequently referred to as "primary

groundwater restoration standards," returns the constituent to background levels. See 10 C.F.R. Pt. 40, App. A, Criterion 5B(5)(a); see also NUREG-1569, at B-1 to -2. Additionally, there is restoration to what is known as "secondary groundwater restoration standards." Initially, this would be restoration of constituent levels to the drinking water limits enumerated in Appendix A, Table 5C. See 10 C.F.R. Pt. 40, App. A, Criterion 5B(5)(b); see also NUREG-1569, at B-2; Staff Initial Testimony at 10–11 (Johnson, Moore, Saxton). Thereafter, and a particular focus of EC 2, would be restoration to an ACL, which is permitted only when restoration to a primary or the secondary Table 5C standard is not "practically achievable." 10 C.F.R. Pt. 40, App. A, Criterion 5B(5)(c), (6); see also NUREG-1569, at B-2.[42]

4 .67 To have an ACL approved, a licensee must demonstrate that the hazardous constituent value is "as low as reasonably achievable, after considering practicable corrective actions, and that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the alternate concentration limit is not exceeded."[43] 10 C.F.R. Pt. 40, App. A, Criterion 5B(6). Moreover, nineteen different factors must be

[42] The Board notes that in referring to "secondary" standards, what Joint Intervenors are referencing is the secondary Table 5C standards. See Petition to Intervene and Request for Hearing by [Joint Intervenors] (Oct. 27, 2011) at 16–17; Larson Initial Testimony at 21.

The Board notes also that a dispute exists among the parties over whether this sequential requirement also extends into the primary and the secondary Table 5C standards. Specifically, the disagreement is whether a licensee must first attempt restoration to primary groundwater restoration standards before restoring groundwater constituents to secondary Table 5C standards or, instead, whether restoration may be achieved directly through satisfaction of the secondary standards. SEI and the staff assert that there is no obligation to first attempt restoration to primary standards. See Staff Reply Findings at 14; SEI Reply Findings at 8. Joint Intervenors disagree. See Joint Intervenors Findings at 40–41. The Board declines to express an opinion on the matter, which is outside of the scope of the issues presented by EC 2.

[43] The agency has issued guidance on how the staff is to assess compliance with the "as low as reasonably achievable" (ALARA) standard. See Ex. NRC021, at 4-34 to -36 (NMSS, NRC, [SRP] for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978, NUREG-1620 (rev. 1 June 2003)).

considered in making the "present and potential hazard" finding requisite to Commission approval of an ACL. See id. Criteria 5B(6)(a)(i)-(ix), (b)(i)-(x).

4 .68 Should an ISR licensee seek to meet its groundwater restoration obligations through an ACL, the licensee must request a license amendment. See Staff Initial Testimony at 30 (Johnson, Moore, Saxton); see also Tr. at 393 (Saxton); Demuth/Lawrence Initial Testimony at 18; Demuth/Lawrence Rebuttal Testimony at 6. In the context of agency consideration of that amendment request, the ACL, with its specific constituent limits, undergoes a NEPA review. See Demuth/Lawrence Initial Testimony at 18; Demuth/Lawrence Rebuttal Testimony at 6.

b. Relevant Requirements for FSEIS

4 .69 In EC 2, Joint Intervenors alleged that the FSEIS violates the agency's NEPA regulations in 10 C.F.R. §§ 51.90–50.94.[44] Section 51.90 imposes the legal requirements applicable to a draft EIS, as specified in section 51.70(b) and 51.71, onto a final EIS. Of particular relevance is section 51.71(d), which states that "[t]he analysis for all draft [EISs (and final EISs by virtue of § 51.90)] will, to the fullest extent practicable, quantify the various factors considered. To the extent that there are important qualitative considerations or factors that cannot be quantified, those considerations or factors will be discussed in qualitative terms." 10 C.F.R. § 51.71(d). Thus, where environmental impacts are practically quantifiable, section 51.71(d) imposes a duty on the agency to discuss them in those terms in the FSEIS.

4 .70 Furthermore, section 51.71(d) states that while license requirements and other environmental quality standards are to be considered in assessing environmental impacts, they

[44] 10 C.F.R. § 51.91 discusses the additional content required in a final EIS compared to a draft EIS. 10 C.F.R § 51.92 outlines when a supplement to a final EIS is required and what it must contain. 10 C.F.R. § 51.93 imposes distribution requirements for a final EIS (and a supplement to a final EIS) and section 51.94 mandates that a final EIS (or supplement to a final EIS) be considered in the agency's decisionmaking.

do not negate the staff's responsibility to consider all environmental effects. See id. ("Consideration will be given to compliance with environmental quality standards and requirements that have been imposed by Federal, State, regional, and local agencies . . . . The environmental impact of the proposed action will be considered in the analysis with respect to matters covered by environmental quality standards and requirements irrespective of whether a certification or license from the appropriate authority has been obtained.") (footnote omitted); see also id. at n.3 ("Compliance with the environmental quality standards and requirements of the Federal Water Pollution Control Act (imposed by EPA or designated permitting states) is not a substitute for, and does not negate the requirement for NRC to weigh all environmental effects of the proposed action, including the degradation, if any, of water quality, and to consider alternatives to the proposed action that are available for reducing adverse effects.").

3. FSEIS Discussion Relative to EC 2

4 .71 FSEIS section 4.5.1.3 (Ross Project Aquifer Restoration) discusses the Ross Project groundwater restoration matters that are relevant to EC 2. In this discussion of restoration, the FSEIS analyzed the environmental impacts of groundwater restoration to shallow aquifers, the OZ and surrounding aquifers, and deep aquifers.[45] See FSEIS 9A, at 4-44 to -48. The FSEIS in this regard also noted that "[w]ater quality is measured at the point of compliance that coincides with the established boundary of the exempted aquifer" and that SEI estimated that restoration of each wellfield at the Ross Project would take eight months. Id. at 2-34, 2-35.

4 .72 On the particular subject of ISR restoration impacts, to serve as reference points, the FSEIS included a one-page discussion of the three post-1980s-approved aquifer

[45] The Ross Project's aquifer-restoration methodology is described in FSEIS section 2.1.1.3. SEI proposes a combination and sequence of (1) groundwater transfer; (2) groundwater sweep; (3) reverse osmosis treatment with permeate injection; (4) groundwater recirculation; and (5) stabilization monitoring. See FSEIS 9A, at 2-35 to -37.

restorations — Crow Butte wellfield 1, Smith Ranch-Highland wellfield A, and Irigaray mine units 1-9 — and their respective impacts on water quality within the exempted aquifer. And with regard to each of these three sites, this historical review outlined the proportion of constituents restored to either post-licensing, pre-operational concentrations, or to the existing Wyoming domestic (Class I), agricultural (Class II), or livestock (Class III) use standards, and/or EPA's drinking water MCLs. Moreover, in the case of the Crow Butte and Irigaray sites, the staff included a discussion of the magnitude by which certain constituents increased from post-licensing, pre-operational concentrations to post-restoration concentrations.[46] See id. at 4-46; see also Staff Initial Testimony at 34 (Johnson, Moore, Saxton).

4 .73 The FSEIS review of Crow Butte wellfield indicated that twenty-three of thirty-four water quality parameters were returned to post-licensing, pre-operational concentrations and two were returned to the Wyoming domestic use standards/EPA drinking water MCLs, and one was returned to the Wyoming agricultural use standards. See Ex. NRC010, at 3–4 (FSME, NRC, NUREG-1910, Supp. 5 (Apr. 23, 2014) (tbl. Errata)) [hereinafter Errata 1]. Concentrations of alkalinity, bicarbonate, calcium, potassium, magnesium, and molybdenum exceeded post-licensing, pre-operational concentrations by six to sixty-five percent. No values were given concerning uranium concentrations. See id.

[46] Previously, the NRC would approve groundwater aquifer restoration for a hazardous constituent that was returned to its pre-operational State-established class of use (i.e., drinking water use, livestock use, or agricultural use in Wyoming). See Tr. at 555 (Saxton); see also NUREG-1569, at 6-9. In 2009, the staff issued a regulatory issue summary stating that the "NUREG-1569 discussion of groundwater restoration to 'pre-operational class of use' as being a secondary standard is not accurate, and is not an appropriate standard to use in evaluating license applications." Ex. NRC038, at 3 (FSME, NRC, NRC Regulatory Issue Summary 2009-05, Uranium Recovery Policy Regarding: (1) The Process for Scheduling Licensing Reviews of Applications for New Uranium Recovery Facilities and (2) The Restoration of Groundwater at Licensed Uranium [ISR] Facilities (Apr. 29, 2009)). As such, although this state class of use standard was applicable to the three sites included in the FSEIS historical analysis, it is no longer utilized. In contrast, EPA drinking water MCL's continue to be an accepted groundwater restoration standard. See 10 C.F.R. Pt. 40, App. A, Criteria 5(B)(5)(b), 5C.

4 .74 According to the FSEIS, restoration of the Smith Ranch-Highland facility's wellfield A returned thirty-one of thirty-five water-quality parameters to post-licensing, pre-operational concentrations or Wyoming's domestic use standards. There was no mention of the percent by which those constituents not returned to pre-operational levels exceeded post-licensing, pre-operational levels of uranium. See FSEIS 9A, at 4-46.

4 .75 Finally, Irigaray mine units 1-9 were discussed in the FSEIS, for which twenty-seven of thirty-five parameters were returned to post-licensing, pre-operational concentrations or Wyoming's domestic use standards. Calcium, magnesium, sodium, bicarbonate, and alkalinity, as well as the measure for conductivity, for which there were no Wyoming class of use standards or EPA MCLs, exceeded post-licensing, pre-operational concentrations by 48 to 680 percent. The FSEIS also indicated that the NRC determined that the concentrations in excess of post-licensing, preoperational levels would not exceed EPA MCLs outside the aquifer-exemption boundary. No mention was made of the specific concentrations of uranium at the site before mining began and after aquifer restoration was approved. See id.

4 .76 Information regarding uranium concentrations for these three sites did, however, come to light in the staff's prefiled testimony. Staff witnesses stated that at these sites "the Commission approved restoration of uranium to values ranging from 4 to 71 times [(X)] post-licensing, pre-operational background values." Staff Initial Testimony at 33 (Johnson, Moore, Saxton). More specifically, the staff witnesses indicated that "the average concentration of uranium in the wellfield(s) for which the Commission issued restoration approval were as follows: (1) Crow Butte Well field 1: 1.73 mg/L, or 18[X] background levels; (2) Smith Ranch-Highland A-Well field: 3.53 mg/L, or 71[X] background levels; and (3) Irigaray Mine Units 1-9: 1.83 mg/L, or 4[X] background levels." Id. (internal citations omitted). The staff

witnesses indicated further that "based upon the available historical record of uranium concentrations at the close of active restoration, if an ACL is requested by Strata for the Ross Project, it is likely to range between 1.7 mg/L and 3.5 mg/L, or 4[X] to 71[X] the post-licensing, pre-operation background values for uranium . . . ." Id. This information the staff considered to be the FSEIS ACL "bounding analysis." See id. at 34.

4 .77 Ultimately the FSEIS concluded that impacts to groundwater in the OZ aquifer and surrounding aquifers for the Ross ISR project would be SMALL. See id. at 4-40 to -41, 4-48. The staff based its determination in this regard on LC 10.6 of SEI's (then-draft) source and byproduct materials license, which requires SEI to restore the OZ aquifer in accordance with 10 C.F.R. Part 40, App. A, Criterion 5B(5), and the legal requirements implicit in an ACL, namely that it must be protective of public health and safety to be approved. See id. at B-16 to -17; see also id. at 4-40 to -41; Staff Initial Testimony at 31, 35 (Johnson, Moore, Saxton); SEI License at 7–8.

4. Issues Raised in EC 2

4 .78 With EC 2, Joint Intervenors challenged two central aspects of the Ross Project FSEIS: (1) the sufficiency of the impacts analysis associated with groundwater restoration; and (2) the staff's conclusion that the impacts on the OZ and surrounding aquifers associated with groundwater restoration would be SMALL. Concerning the sufficiency of the analysis, Joint Intervenors argued that the FSEIS is legally inadequate as it fails to provide and evaluate adequately the historical information regarding the reasonable range of hazardous constituent concentration values that provide the basis for the FSEIS "bounding analysis" showing what might happen if, in restoring Ross site groundwater, SEI is required to use an ACL pursuant to 10 C.F.R. Part 40, Appendix A, Criterion 5B(5)(c), which Joint Intervenors asserted in EC 2 is a "virtual certainty." See Larson Initial Testimony at 8. Additionally, Joint Intervenors contended

that the quantitative data for historical ISR groundwater aquifer restoration efforts suggests that, in the event an ACL is employed, the impacts to the OZ aquifer and surrounding aquifers would be LARGE. See Larson Initial Testimony at 8–16; see also Larson Rebuttal Testimony at 2, 9–10. We consider each of these arguments and their technical bases below.

a. Adequacy of the FSEIS Impacts Analysis and Review of Historical ISR Sites

4 .79 Joint Intervenors initially disputed the adequacy of the FSEIS review of historical ISR sites, i.e., the FSEIS bounding analysis. They alleged that the review is neither comprehensive nor representative of the groundwater impacts that follow the operational conclusion of ISR projects and, as such, holds little value for assessing a future ACL at the Ross Project. Each of Joint Intervenors' specific concerns, as well as the staff and SEI responses, are reviewed below.

4 .80 At the outset, Joint Intervenors asserted that the FSEIS analysis is flawed because it lacks a "risk or dose" calculation to support the conclusion that the elevated concentrations of radium-226 and uranium that have been approved at historic sites, and can be anticipated for a uranium ACL at the Ross Project, pose no threat to human health and the environment. See Joint Intervenors Findings at 49; see also Larson Initial Testimony at 11. The staff argued that Joint Intervenors "have provided no evidence to show, however, how a risk or dose calculation to support the Commission's previous licensing decisions for the three sites discussed in the FSEIS is a necessary component of the bounding analysis called for by the Board in admitting this contention." Staff Reply Findings at 18 (emphasis omitted). Further, the staff asserted that Joint Intervenors have not put forward any legal authority to suggest that NEPA requires the agency to validate a prior licensing determination in its environmental review of a different ISR site. See id. at 19. SEI similarly maintained that Joint Intervenors' argument is without merit because, as part of the ACL-associated license amendment application review

process, the staff will conduct a present or potential hazard analysis and, by definition, no ACL may be approved unless the concentration will not pose a substantial present or potential hazard to human health or the environment. See SEI Reply Findings at 42. Additionally, according to SEI, the small potential risk to human health and safety is clear because (1) uranium recovery will take place only within an aquifer permanently exempted from protection as a drinking water supply, per EPA and WDEQ determinations that the OZ aquifer is not now, and will not in the future, become a drinking water source; and (2) as Joint Intervenors acknowledged, there are not current or anticipated drinking water wells in the licensing area. See id. at 42–43 (citing Tr. at 606 (Larson)).

4 .81 While the Board agrees with Joint Intervenors that, based on the historical record, ACLs are a foreseeable consequence of ISR mining, and thus should be considered in the EIS, we do not agree that NEPA mandates a risk or dose calculation be performed concerning historical or potential ACLs. As we have noted previously, NEPA requires neither the use of the best scientific technology nor what would demand virtually infinite study and resources. See supra Board Finding 3.3. If the substance of the staff's FSEIS bounding analysis withstands scrutiny, which we consider in more detail below, consistent with this touchstone we see no basis for labeling the staff's overall approach in preparing that analysis to be legally flawed under NEPA, particularly given the prospect of another NEPA analysis before an ACL is actually implemented relative to what is otherwise a non-drinking water source.[47] See

[47] Although Joint Intervenors have suggested that EPA has not considered whether the water in the exempted aquifer is of sufficient quality to be used for future drinking water purposes, see Joint Intervenors Findings at 27, as a legal matter, in granting the aquifer exemption EPA made such a determination. Under 40 C.F.R. § 146.4(b)(1), in exempting the aquifer, EPA had to find that the aquifer "cannot now and will not in the future serve as a source of drinking water" because, among other potential factors, it "is mineral, hydrocarbon or geothermal energy producing, or can be demonstrated by a permit applicant as part of a permit application for a Class II or III operation to contain minerals or hydrocarbons that considering their quantity and location are expected to be commercially producible." In deciding to exempt
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Alaska v. Andrus, 580 F.2d 465, 473–74 (D.C. Cir. 1978) ("One of the costs that must be weighed by decisionmakers is the cost of uncertainty — i.e., the costs of proceeding without more and better information. Where that cost has been considered, and where the responsible decisionmaker has decided that it is outweighed by the benefits of proceeding with the project without further delay, the courts may not substitute their judgment for that of the decisionmaker and insist that the project be delayed while more information is sought.")

4 .82 Joint Intervenors also argued that important details from the discussion of groundwater aquifer restoration at Crow Butte wellfield I, Smith Ranch-Highland wellfield A, and Irigaray mine units 1-9 are omitted such that the bounding analysis provides an inaccurate account of the scrutiny employed in appproving an ACL and the success of groundwater restoration after ISR mining operations cease. See Joint Intervenors Findings at 50–55. We consider the circumstances relative to each of these sites below.

4 .83 With respect to Crow Butte, Joint Intervenors asserted that the agency-approved ACL for uranium, 18X above post-licensing, pre-operational concentrations, lacks a scientific or empirical basis for assessing restoration performance.[48] See Joint Intervenors Findings

[47](...continued)
the Ross Project aquifer, EPA stated that the aquifer "is mineral producing and can be demonstrated to contain minerals that, considering their quantity and location, are expected to be commercially producible (40 CFR §146.4(b)(1).)." EPA Exemption Letter at 2. Thus, as granted by EPA, the aquifer exemption includes a determination that the aquifer cannot serve as a future source of drinking water.

[48] Albeit not the subject of any of Joint Intervenors' proposed findings, Joint Intervenors witness Dr. Larson pointed out an error the staff made in the FSEIS regarding Crow Butte's restoration by reporting that post-restoration uranium concentrations increased by 18 percent when, in fact, they increased by 18.8X above the baseline concentration. See Larson Initial Testimony at 11–12. While the staff fixed this error with an errata, see Errata 1, at 4, given that the staff continued to conclude that impacts to groundwater would be SMALL despite the increase in magnitude (an increase of 18X versus 18 percent), see id. at 2, Dr. Larson argued that this is further proof of the staff's cursory review of the environmental impacts at the Ross Project. See Larson Initial Testimony at 12. While no doubt this is the type of error the staff will strive not to repeat, the Board nonetheless finds the matter to be without substance, particularly
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at 50–51; see also Larson Rebuttal Testimony at 5. Joint Intervenors witness Dr. Larson pointed to the staff's initial denial of aquifer restoration approval for Crow Butte, Larson Rebuttal Testimony at 4 (citing Ex. JTI053, at 99 (CBR, Mine Unit 1 Restoration Report (Jan. 10, 2000)) [hereinafter Crow Butte Report]), and then noted the staff's subsequent approval following additional samplings despite those samples' roughly equivalent uranium concentration levels, see id. at 4–5 (citing Crow Butte Report at 125–26). Dr. Larson maintained that approval of concentration levels at 1.73 mg/L, or 18X background levels, was arbitrary, chosen out of expedience, and demonstrated that the agency's determination this was sufficient to protect human health and the environment was a condition-dependent, subjective statement that lacked a scientific or empirical basis. See id. at 5. Thus, instead of serving as a guidepost for what a future authorized ACL might be at the Ross site, Joint Intervenors contended that Crow Butte indicates the "Staff is likely to approve an ACL reflecting whatever contamination remains after SEI has worked on restoration efforts for a period that Staff deems sufficient . . . even if those levels are much higher than at Crow Butte or other sites." Joint Intervenors Findings at 51.

4 .84 The staff disputed any allegation of arbitrary decisionmaking associated with its Crow Butte ACL review. Staff witness Dr. Johnson testified that the staff did not initially approve restoration at Crow Butte unit 1 because it was uncertain whether concentration levels were stable and thus protective of human health and the environment. See Tr. at 615–16. After further monitoring determined that concentrations were indeed stable, the staff approved the restoration. See id. at 616. Dr. Johnson further declared that the staff's ACL decisionmaking is scientific in that the staff completes transport modeling to predict whether a constituent would travel beyond the boundary of the exempted aquifer before approving an aquifer restoration.

[48](...continued)
given that the concentration level is well within the upper limits of the bounding analysis for uranium. See infra Board Finding 4.96.

See id. at 617. Finally, she declared that the approved concentration level of uranium at Crow Butte unit 1 was within the secondary standard in use at the time as imposed on the production zone under Crow Butte's Nebraska state underground injection control permit, and thus the staff assumed the concentration would also be protective outside the production area. See Tr. at 617–18.

4 .85 SEI agreed with the staff that it is incorrect to suggest that staff's approved Crow Butte ACLs lack a scientific or empirical basis given the systematic approach for Crow Butte groundwater restoration outlined in the FSEIS. See SEI Reply Findings at 36–37 (quoting Staff Initial Testimony at 37 (Johnson, Moore, Saxton)). Further, SEI witness Lawrence pointed out relative to the Ross Project that the nineteen required factors the staff must review in making a substantial present or future hazard finding and the requirement that an ACL be ALARA were proof of the staff's rigorous analysis of proposed ACLs. See Demuth/Lawrence Initial Testimony at 16–18. Also of note, according to Mr. Lawrence, is the fact that any ACL application will trigger a NEPA evaluation under 10 C.F.R. Part 51. See id. at 18.

4 .86 While it is not at all apparent that this licensing proceeding is the forum for relitigating the efficacy of prior staff ACL determinations, nonetheless, based on the preponderance of the evidence, the Board concludes that the aquifer restoration approval at Crow Butte was not arbitrary. No testimony or other evidence before us substantiates Joint Intervenors' assertion that the staff failed to undertake a serious review of the Crow Butte wellfield 1 restoration request or effectively counters the staff's testimony that it did not approve the application initially because it could not be certain that the concentration levels were stable, and then later granted the request based on further monitoring and a subsequent determination that those levels had stabilized. We thus find no basis for discounting the Crow Butte data as a legitimate part of the staff's bounding analysis.

4 .87 Joint Intervenors next argued that the FSEIS is inadequate given its discussion of Smith Ranch-Highland wellfield A, which they asserted lacks the requisite detail to satisfy NEPA. See Joint Intervenors Findings at 51. Specifically, while the FSEIS states that thirty-one of thirty-five water-quality parameters at the Smith Ranch-Highland site were returned to baseline, Dr. Larson challenged the adequacy of this discussion because it did not disclose information on constituent concentrations not returned to baseline, most importantly concentrations of uranium and heavy metals. See Larson Initial Testimony at 14.

4 .88 Staff witnesses maintained that the information provided in the FSEIS for this and the other two facilities – the proportion of constituents restored to post-licensing, pre-operational concentrations, to the existing Wyoming domestic use standards, or to EPA's drinking water MCLs – was sufficient. See Staff Initial Testimony at 32 (Johnson, Moore, Saxton). Moreover, in the staff's prefiled testimony, the approved ACL for uranium was provided: 3.53 mg/L, or 71X above post-licensing, pre-operational background levels. See id. at 33 (Johnson, Moore, Saxton).

4 .89 Given that ISR mining is intended to liberate uranium from a mineral deposit so that the uranium can then be extracted from groundwater, we would agree that including information about the post-restoration concentration levels of uranium is an important aspect of any ACL impacts analysis. Yet, despite Joint Intervenors' assertions to the contrary, see Joint Intervenors Findings at 10 ("The defense of the FSEIS must be confined to materials before the agency at the time the FSEIS was issued."), the Board does not find that the absence in the FSEIS of the information on uranium concentrations renders the NEPA process legally deficient. Rather, the post-restoration uranium concentration levels reported in the staff's prefiled

testimony supplements the FSEIS so as to cure any defect in that regard. See supra Board Finding 3.4.[49]

4 .90 Regarding Smith Ranch-Highland wellfield A, Joint Intervenors argued that the environmental impacts have been grossly underestimated by (1) disputing the reported 71X increase in uranium (to 3.53 mg/L), which is the purported high end of the bounding analysis for the Ross Project, see supra Board Finding 4.76; and (2) asserting that the FSEIS fails to include the impacts associated with a 30X increase in arsenic, a 70X increase in selenium, and a 71X increase in uranium.[50] See Joint Intervenors Findings at 51; see also Larson Initial Testimony at 14; Larson Rebuttal Testimony at 5. In this regard, Joint Intervenors witness Dr. Larson pointed to the storymaps, see supra section IV.B.1.c, to further highlight samples he asserts revealed much higher concentration values.[51] Additionally, Joint Intervenors argued that

[49] Although Joint Intervenors suggest that the fact of license issuance calls into question this well-established precept, see Joint Intervenors Findings at 9–10, we see no basis for drawing such a distinction given that the agency's NEPA record of decision remains open, and is subject to adjudicatory supplementation relative to matters associated with any pending admitted NEPA contention, at least until the hearing record is closed and the final agency adjudicatory decision is issued. Certainly, unlike the cases Joint Intervenors rely on, see Joint Intervenors Findings at 9–10 (citing cases), the Board's ruling is merely an initial decision so that no final agency action has taken place thus far. Moreover, Joint Intervenors overlook another critical distinction mentioned in the cases they cite as support: the difference between a fact-finding administrative body, such as this Board, with the authority to develop an evidentiary record, see 10 C.F.R. § 2.332(d) (hearing on environmental issues must await issuance of final EIS), and reviewing adjudicatory and judicial bodies, generally with a more limited record-creating authority. See Fla. Power & Light Co. v. Lorion, 470 U.S. 729, 743–44 (1985) (distinguishing a district court with "factfinding powers" from a reviewing court whose task is "to apply the appropriate [Administrative Procecure Act] standard of review, 5 U.S.C. § 706, to the agency decision based on the record the agency presents to the reviewing court.")

[50] Joint Intervenors presented this information in terms of percent increases, i.e, 3000 percent increase in arsenic, a 7000 percent increase in selenium, and a 7060 percent increase in uranium, see Larson Initial Testimony at 14, but for consistency we refer to these in terms of the factor by which these concentrations increased, i.e., by 30X, 70X, and 71X, respectively.

[51] For example, well MP-4's sampling ranged between 5.5-11.5 mg/L for uranium, a 183X-383X increase, or well MP-5 with post-restoration concentrations ranging between 5.9-11.00 mg/L, an increase of between 148X-275X from baseline. See Larson (continued...)

presenting the range of uranium concentrations determined for individual samples, as opposed to the average of all samples from a wellfield, is necessary to provide a meaningful bounding analysis in that the FSEIS should account for the much higher contamination levels found in individual wells, which is not discussed when the data is presented as an average. See Joint Intervenors Findings at 51 (citing Larson Rebuttal Testimony at 5).

4 .91 The staff responded to this concern by challenging Dr. Larson's analysis of post-restoration uranium concentrations at Smith Ranch-Highland. First, the staff's witnesses noted that Dr. Larson's storymaps include information on Smith Ranch-Highland mine unit B that has not received restoration approval and thus is irrelevant in forecasting a future ACL. See Staff Rebuttal Testimony at 22 (Johnson, Moore, Saxton). Moreover, in another context, staff witnesses explained that while Dr. Larson's approach relies on a range of sampling results collected during the groundwater sweep and during the stability period, this is inappropriate because of the changing and improving nature of the quality of groundwater undergoing restoration, so that Dr. Larson's sampling results do "not reflect the concentrations in the groundwater at the time restoration was approved." Staff Rebuttal Testimony at 24 (Johnson, Moore, Saxton). Staff witnesses claimed that the staff's method, i.e., using data from the final group of water samples for comparison against baseline, is more accurate. See id.

4 .92 Based on the preponderance of the evidence, the Board concludes that the staff's analysis of the post-restoration uranium concentrations at Smith Ranch-Highland wellfield A is adequate for the purposes of NEPA. Because the data from Smith Ranch-Highland unit B is essentially irrelevant in assessing the Ross ACL, given that unit does not have an approved ACL, uranium concentrations based on Dr. Larson's sampling results associated with unit B are not indicative of what a future ACL at the Ross Project site might be.

[51](...continued)
Rebuttal Testimony at 6.

Additionally, the Board does not take issue with the staff's presentation of uranium concentrations in the form of an average, nor do we find fault with the staff calculating that average based solely upon the final concentration levels for uranium when aquifer restoration was approved, both of which appear to be consistent with standard practices.

4 .93 Regarding the purported deficiency in the FSEIS bounding analysis discussion of Irigaray mine units 1-9, Joint Intervenors' concern is that the average baseline concentration of uranium (0.52 mg/L) is skewed because of pre-mining R&D activities at mine unit 1, i.e., the injection of lixiviant that was not restored prior to the collection of baseline samples. See Joint Intervenors Findings at 52–53; see also Larson Initial Testimony at 14–16; Larson Rebuttal Testimony at 11. Furthermore, Joint Intervenors maintained that the staff's averaging of the Irigaray mine units 1-9 baseline concentrations as a single "composite" average inaccurately raised the baseline level because of one higher value outlier. See Joint Intervenors Findings at 53-55; see also Larson Initial Testimony at 15–17 (reporting baseline uranium concentrations in mg/L for mine units 1-9, respectively, of 3.042, 0.130, 0.023, 0.046, 0.020, 0.112, 0.119, 0.041, 0.066). As a result, Joint Intervenors witness Dr. Larson asserted, the overall average uranium concentration at the site appears to have increased from only 0.52 to 1.83 mg/L, a 3.52X increase, i.e., the 4X increase staff used as the lower figure in its bounding analysis. See Larson Initial Testimony at 17. Dr. Larson maintained, however, that this manipulates the data (as was alleged the Nubeth data) so as to "mask the reality of the groundwater impacts of the mining operations," Larson Initial Testimony at 15, and that if wellfields 2-8 were calculated on an individual basis, uranium concentration increased between 16X and 125X above baseline levels, exceeding both the upper and lower bounding limits proffered by the staff (i.e., 4X to 71X), see Larson Rebuttal Testimony at 12.

4 .94 With respect to mine unit 1 (of the nine Irigaray units at issue), the staff's witnesses agreed with Joint Intervenors that its baseline was likely impacted by prior operations.[52] See Staff Initial Testimony at 24 (Johnson, Moore, Saxton); see also Tr. at 641 (Saxton). Nonetheless, staff witnesses attempted to refocus the debate over the significance of this factor, arguing that "[t]he Intervenors do not explain how the FSEIS's documentation of the Commission's restoration approval decision for Irigaray, whether or not the Commission's prior decision was based upon a flawed approach, amounts to a failure to comply with NEPA." Staff Initial Testimony at 41 (Johnson, Moore, Saxton); see also Tr. at 634–36 (Johnson) (stating that Joint Intervenors' argument concerning averaging is an attempt to redo aquifer restoration and thus irrelevant). Staff witnesses further asserted that to recalculate the initial average baseline concentrations for the mine units would be neither practicable nor useful, requiring the staff to re-do the agency's previous technical evaluation using a different baseline averaging assumption, an effort that, even assuming the necessary raw data was available, would involve an outlay of resources disproportionate to the value of the exercise, which is to record what actually occurred when alternate restoration values were approved at Irigaray. See Staff Initial Testimony at 41 (Johnson, Moore, Saxton); see also Tr. at 639–40 (Johnson). Further, noting WDEQ's approval of this methodology in calculating baselines and increases in concentrations,

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[52] In responding to Joint Intervenors' allegations concerning EC 1, the staff's witnesses stated

> the post-licensing, pre-operational baseline for several wells was established for the Irigaray wellfield in 1976-1977 after the pilot project had been conducted in 1975 with the area of [wellfield 1]. This timing, without any subsequent restoration report in the record, suggests that the baseline for Wellfield 1 was likely impacted by the prior pilot project operations.

Staff Initial Testimony at 23–24 (Johnson, Moore, Saxton) (citations omitted). The staff's witnesses did not agree, however, that the impact to the baseline concentration at Irigaray mine unit 1 supports Joint Intervenors' assertion that the Ross Project's baseline is also biased from previous operations. See id. at 24 (Johnson, Moore, Saxton); see also Tr. at 641 (Saxton).

the staff also observed that Joint Intervenors, while appearing to be asserting that either the staff members performing the Ross Project review or those involved with the Irigaray units employed biased data, nonetheless have failed to support their allegations with any evidence suggesting that staff had the requisite intent to manipulate the data. See Staff Reply Findings at 21–22.

4 .95 In reviewing the methodology and calculations drawn from the FSEIS consideration of the Irigaray site, the Board agrees in some respects with Joint Intervenors' concerns. Dr. Larson is correct that including anomalous mine unit 1 in the average background uranium values for the entire Irigaray project unduly lowered the staff's lower limit estimate for post-restoration uranium concentration relative to pre-mining background in the production zone aquifer. Staff witnesses' admission that the Irigaray site's baseline was impacted by earlier unrestored mining activities, see supra Board Finding 4.94, in conjunction with the gross disparity in mine unit 1's baseline concentration as compared to the other eight units, leads the Board to conclude that excluding mine unit 1 from this calculation better serves the purpose of the bounding analysis in assessing what an ACL might look like at the Ross site.

4 .96 Accordingly, using the table Dr. Larson provided in his initial testimony, see Larson Initial Testimony at 15, the average baseline uranium concentration for the eight wellfields (excluding wellfield number 1) is .0696 mg/L. Thus, using only the final sample, the average post-restoration uranium concentration for the other eight wellfields is 1.93 mg/L. See Source Data at 273–345.[53] And employing these figures, the ratio of average post-restoration

[53] This exhibit contains publicly available NRC data regarding ISR site baseline and restoration stability groundwater quality samples. The initial prefiled exhibit, JTI005, was deemed by the Board to be inadmissible for its inclusion of, and reliance on, Internet URL citations. See Board Finding 2.12. Subsequently, Joint Intervenors revised and refiled the prefiled exhibit as a multi-part exhibit, i.e., JTI005A-R, which set forth the source data, and JTI005B-R, which provided the storymaps. See id. Both the source data and storymaps exhibits were admitted into evidence after being amended an additional time before admission,
(continued...)

uranium to background uranium at Irigaray would be twenty-eight. This, in turn, indicates that the more likely range for the ratio of post-restoration to pre-mining uranium concentrations in the production zone would be between 18X (i.e., the next lowest value, which is from the Crow Butte evaluation) and 71X (the highest value, which is from Smith Ranch-Highland evaluation), rather than the 4X to 71X background the staff indicated. While the Board, in making these findings, supplements the FSEIS bounding discussion and the associated uranium bounding analysis, this finding nonetheless does not materially affect the FSEIS impacts analysis as the upper range for likely uranium concentrations remains unchanged.

4 .97 On the other hand, the Board does not agree with Joint Intervenors' assertion that because each mine unit at Irigaray should be evaluated separately, the upper limit of the bounding analysis should be increased from 71X to 125X.[54] Rather, as the Board indicated earlier with respect to Smith Ranch-Highland wellfield A, NEPA does not require that the range of increase from background to post-restoration uranium concentrations be established using the highest value for any individual well unit.[55]

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[53](...continued)
as reflected by their R2 designations, to remove a cover page that provided URL citations that the Board considered inappropriate to the degree the information accessible via those URLs might be considered evidentiary material. See Tr. at 574, 741–42; see also supra note 5.

[54] The Board also observes that it does not agree with Dr. Larson's calculations that the individual mine units suggest that the upper range of the bounding analysis should be expanded to a 125X increase in uranium concentrations. To arrive at the figure of 125X, Dr. Larson averaged the uranium concentrations in water sampled for four successive stability measurements whereas, as the staff asserted and the Board agrees, see supra Board Finding 4.92, the final sample should only be used as it is the most representative of post-restoration water quality. These differing methodological approaches significantly impact the increase at mine unit 3, the unit that under Dr. Larson's calculations yields the greatest (i.e., a purported 125X) ratio for post-restoration water quality relative to background. When averaging only the last samples collected, the increase in uranium concentrations is 68.5X, just below the upper limit of the bounding analysis provided by staff witnesses in their testimony (i.e., 71X). See Source Data at 279–80.

[55] The Board notes that this may appear to be in conflict with its ruling regarding Irigaray
(continued...)

4 .98 Lastly, Joint Intervenors contend that the staff's bounding analysis, and thus the FSEIS, is deficient because it purportedly fails to include quantitative data from other ISR sites, specifically Christensen Ranch mine units 2-6, Smith Ranch-Highland unit B, and Nubeth. See Joint Intervenors Findings at 55–67. With respect to Christensen Ranch, Joint Intervenors witness Dr. Larson presented evidence, in the form of pie charts, a histogram, and storymaps, illustrating what he asserted was severe contamination of the groundwater despite having employed the standard NRC groundwater restoration plan, which is also proposed for the Ross Project. See Larson Initial Testimony at 18–19, 39–41; see also Storymaps at 2–20. Dr. Larson also testified that the last stability round sampling event for the Christensen Ranch wellfields revealed an average groundwater uranium concentration of 3.83 mg/L, up from the average baseline of 0.044 mg/L, or an increase of roughly 87X. See Larson Initial Testimony at 19. Similar quantitative analysis was presented in the form of storymaps for Smith Ranch-Highland unit B. See id. at 43; see also Storymaps at 24–25, 30-31. Regarding the Nubeth ISR R&D project in the 1970s in a portion of the area where the Ross Project is now located, Joint Intervenors witness Dr. Larson acknowledged the FSEIS addressed Nubeth water quality data in tables 3.7 (Project A) and 5.4 (Project B), but maintained that both tables have issues and, in any event, Nubeth data should be included in the bounding analysis as illustrating how unlikely it is that the Ross Project can be restored to either primary or secondary groundwater standards. See Larson Initial Testimony at 9–10 (citing FSEIS 9A, at 3-41 (tbl. 3.7), 5-28 (tbl. 5.4)). Specifically, Dr. Larson asserted that FSEIS table 5.4 results for project B omitted four samples taken post-restoration that, when averaged with the values in the table, showed

[55](...continued)
mine unit 1. Mine unit 1 is being excluded from the averaging due to its unique circumstances, under which even staff witnesses noted that the baseline data was biased. See supra Board Finding 4.94. Because there is no reason to suspect that the other wellfield data was similarly biased, we find nothing inappropriate in calculating the magnitude of increase between background uranium levels and post-restoration levels among all the other well units.

increases in uranium concentrations from baseline by 109 to 2640 percent, much greater than the values the staff provided. See id. Dr. Larson also declared that the consideration of Nubeth project A in table 3.7 is inadequate because it provided pre-test data that is not useful in evaluating what transpired with groundwater restoration after leaching occurred. See id. at 10.

4 .99 The staff disagrees with Joint Intervenors' claims regarding the need to add this data to the FSEIS bounding analysis discussion. Staff witnesses declared that the bounding analysis relies on the best sources of information available in that the three analyzed sites are the only commercial wellfields since the 1980s that have received agency approval for aquifer restoration. See Staff Initial Testimony at 34 (Johnson, Moore, Saxton). Furthermore, staff witnesses maintained that water quality samples from Smith Ranch-Highland unit B and Christensen Ranch mine units 2-6 shed no light on potential future ACLs because the agency has not approved aquifer restoration for those sites.[56] See id.; see also Staff Rebuttal Testimony at 20 (Johnson, Moore, Saxton). As for Nubeth, staff witnesses declared that it was not an analogous site as it was a small R&D operation. Furthermore, they stated that historical records on Nubeth do not provide sufficient information to compare restoration to what would be conducted at the Ross site. See Staff Rebuttal Testimony at 23 (Johnson, Moore, Saxton). Finally, staff witnesses disputed Joint Intervenors' allegation that the data in FSEIS table 5.4 was incomplete, noting that the difference in approach, as contested elsewhere, is Dr. Larson's suggested averaging of all of the measurements taken from samples collected during the groundwater sweep and during the stability period, as opposed to using the final concentration

[56] Regarding the Christensen Ranch satellite facility, the licensee has sought approval for restoration, but the agency has requested additional information and has identified corrective actions necessary to obtain agency approval. See Staff Initial Testimony at 34 (Johnson, Moore, Saxton); Staff Rebuttal Testimony at 20–21 (Johnson, Moore, Saxton). Staff witnesses asserted that this is evidence "that the NRC carefully reviews restoration reports submitted by licensees and does not approve restoration reports until the Staff can make the determination that concentrations of hazardous constituents in the groundwater will be protective of public health and the environment." Staff Rebuttal Testimony at 21 (Johnson, Moore, Saxton).

for comparison against baseline, as was done by the staff. See id. at 24 (Johnson, Moore, Saxton).

4 .100 The Board does not take issue with the staff's decision to limit the bounding analysis to include only those sites whose aquifer restoration has been approved (unlike the Christensen Ranch and Smith Ranch-Highland unit B facilities), see supra Board Finding 4.92, or that are analogous to the Ross Project, which the Nubeth R&D project is not. In addition, the Board does not find the FSEIS discussion of Nubeth or the data in FSEIS tables 3.7 or 5.4 to be inadequate.[57]

4 .101 In sum, the Board finds the FSEIS bounding analysis, as modified by the Board's opinion, including the staff's determination to exclude from that analysis the Christensen Ranch, Smith Ranch-Highland unit B, and Nubeth facilities, to be satisfactory under the dictates of NEPA.[58]

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[57] In this regard, we note that even if we accept the 109 to 2640 percent (1.09X to 26.4X) uranium value increases proposed by Dr. Larson for the Nubeth project, see Larson Initial Testimony at 9, which he indicated the percent change for which were calculated as "(POST-RESTORATION/BASELINE) * 100," id. at 10, these values are well below the maximum 71X increase presented in the FSEIS bounding analysis.

[58] Having found the staff's FSEIS bounding analysis, as supplemented by this decision, to be adequate to fulfill the agency's NEPA responsibilities, the Board notes that the staff apparently considers this analysis to be a "one and done" effort, i.e., the bounding analysis apparently was included in the Ross FSEIS only to address EC 2 as admitted by the Board and will not be replicated for any other ISR facility. See Tr. at 613–14 (Moore). SEI likewise continues to assert that the bounding analysis is unnecessary. See SEI Initial Position Statement at 42–48.

We cannot compel the staff to replicate the bounding analysis it performed in this proceeding as part of its environmental review for any other ISL facility. See Duke Energy Corp. (Catawaba Nuclear Station, Units 1 and 2), CLI-04-6, 59 NRC 62, 74 (2004). Nonetheless, this seems a short-sighted approach that raises unnecessary questions about agency compliance with the dictates of NEPA to provide "a public explanation of the impacts of being unable to restore the mined aquifer to primary or secondary baseline and, instead, having to use an ACL." LBP-12-3, 75 NRC at 197. As the record before us illustrates, no ISR facility has ever requested that all OZ aquifer groundwater hazardous constituents be restored to 10 C.F.R. Part 40, Appendix A, Criterion 5B(5)(a) CAB concentrations or Criterion 5B(5)(b) MCLs, as

(continued...)

b. Adequacy of FSEIS Impacts Determination

4 .102 In the context of EC 2, Joint Intervenors also take issue with the FSEIS conclusion that the impacts associated with groundwater restoration at the Ross Project will be SMALL.[59] See Joint Intervenors Findings at 43–48. The Board first reviews their arguments addressing the temporal nature of the impacts and then considers their concerns regarding the impact's severity.

4 .103 Central to the dispute between Joint Intervenors and the staff and SEI over the duration of the impacts to groundwater is natural attenuation. In this regard, Joint Intervenors witness Dr. Larson referenced data from Smith Ranch-Highland mine unit A and the so-called Borch study, which is a recent study regarding the efficacy of remediation at that Smith Ranch-Highland unit A, to suggest that post-restoration uranium concentrations are either rising within the OZ aquifer or, to the degree they are stable, remain elevated. See Larson Rebuttal Testimony at 8–9 (citing Ex. NRC029, attach. at 52 (tbl. 3-6) (Letter from Ken Garoutte, Cameco

[58](...continued)
those are currently defined. See Tr. at 553 (Saxton). As a result, at this juncture, the agency's experience indicates that an ACL is a foreseeable consequence of ISR mining, the environmental impacts of which seemingly should be addressed at the earliest realistic opportunity using relevant historical information. And we can understand a staff reluctance to add another analytical element to what already is an extensive environmental review effort for initial applications to establish and operate an ISR facility, particularly given the difficulties inherent to trying to incorporate data that was collected some time ago when at least one important regulatory benchmark was somewhat different. See supra note 46. Nonetheless, the bounding analysis information provided by the staff, and particularly that regarding the baseline and post-restoration values of uranium and the range in which those values might increase (i.e., 18X to 71X), arguably provided the agency and the public with a useful insight into the circumstances that may attend an important aspect of the Ross Project's post-operational existence.

[59] In this regard, although Joint Intervenors reference an FSEIS finding that the impacts of the Ross ISR facility on groundwater quality will be "SMALL and temporary," Joint Intervenors Findings at 45 (citing FSEIS 9A, at 4-36), this FSEIS statement is made in the context of discussing impacts regarding Ross Project operations rather than restoration, which is the subject of EC 2. For restoration impacts relative to the OZ aquifer and the surrounding confining aquifers, the FSEIS indicates the impacts would be SMALL. See FSEIS 9A, at 4-48.

Resources, to Lowell Spackman, WDEQ (July 31, 2012) (Power Resources Inc., Highland Uranium Project, WDEQ Permit #603, Annual Report (Jul. 31, 2012))) [hereinafter Highland Project Annual Report]); see also Tr. 628–29 (Larson) (citing Ex. NRC037 (Thomas Borch et al., Determination of contaminant levels and remediation efficacy in groundwater at a former [ISR] uranium mine, 14 J. Envtl. Monitoring 1814 (May 2012)) [hereinafter Borch Study]). Dr. Larson noted that the authors of the Borch study emphasize that declining uranium concentrations at one of the OZ monitoring wells in the Smith Ranch-Highland wellfield A are not necessarily due to natural attenuation, but could be attributed as well to more uranium leaving with groundwater than the influx of uranium. See Larson Rebuttal Testimony at 8. In contrast, the staff pointed to the same study, but focused on two perimeter monitoring wells for Smith Ranch-Highland wellfield A that showed no change in uranium as evidence that "natural attenuation appears to be effective." Tr. at 496–97, 625–28 (Johnson).

4 .104 The evidence provided by Dr. Larson certainly raises questions about the extent to which, in the decade following post-mining remediation, natural geochemical processes are effective in causing uranium concentrations in groundwater within an OZ aquifer to decrease. Nor is the Board persuaded by staff witness assertions that the low concentrations of uranium at the perimeter monitoring wells reported in the Borch study are evidence of successful natural attenuation. Given the natural groundwater flow rate in the study area was estimated at 5.6 feet per year, see Borch Study at 1816, it is unlikely that water in the OZ would have traveled the approximately 300 feet to the perimeter monitoring wells during the thirteen-year sampling period, see id. at 1817. Yet, the Board also finds support for natural attenuation in the Borch study results concerning an intermediate monitoring well, LTM-4, which is located approximately fifty feet downgradient from the wellfield. See id. Water samples from that location showed an increase in chlorine concentrations, but no statistically significant increase in uranium, which the

report suggests "provides some evidence that water from the mine unit has indeed reached LTM 4, but other less soluable minerals are being naturally attenuated." Id. at 1821. Thus, while the role of natural attenuation relative to the OZ itself may be unclear,[60] the Board concludes that the limited data available supports the staff's conclusion that natural processes inhibit the migration of uranium and other contaminants out of the OZ aquifer following restoration and so support the staff's SMALL impacts finding, see FSEIS 9A, at 4-48.[61]

4 .105 Finally, Joint Intervenors disputed the FSEIS conclusion that the impacts to groundwater of the Ross Project fit the definition of SMALL as set forth in the FSEIS, i.e., that "[t]he environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered." FSEIS 9A, at xx. Joint Intervenors asserted that the record does not support this determination. They maintained that,

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[60] In this regard, it may require decades of monitoring to resolve with any certainty the question of natural attenuation's effectiveness given the large distance between the production zone and the non-exempted aquifer, the boundary of which is the "point of compliance" at which water quality is measured, see FSEIS 9A, at 2-34, and the reasonably anticipated slow rate of groundwater migration.

[61] Relative to the staff's conclusions about the SMALL impact of ISR restoration on the OZ aquifer and the surrounding aquifers, see FSEIS 9A, at 4-48, we also note that whether a lack of natural attenuation would have an effect on that conclusion is not apparent, given that aquifer's exempted status and the requirement that it be subjected to Criterion 5B(5) restoration. See infra Board Finding 4.107.

Also relating to temporal impacts, Joint Intervenors argued that, given the past history of ISR groundwater restorations, in referencing the SEI estimate of eight months, see FSEIS 9A, at 2-35, the FSEIS seriously underestimates the time necessary to restore groundwater following the cessation of wellfield operation. See Larson Initial Testimony at 21. The staff asserted that this is outside the scope of EC 2 as admitted and limited by the Board. See Staff Initial Position Statement at 33–34. SEI, on the other hand, questioned the validity of Joint Intervenors' concern by pointing to advances in groundwater restoration technology that have reduced restoration time, see SEI Reply Findings at 38, and to LC 10.6, which explicitly mandates that restoration be completed within eight months, see SEI Rebuttal Position Statement at 27–28. While Joint Intervenor's skepticism of the anticipated timeframe is not untoward, given the length of time groundwater restoration activities have taken at other ISR mining sites, the Board nonetheless agrees with the staff that this concern is outside the scope of EC 2 as admitted.

in addition to the fact that no ISR site aquifer has ever been restored to baseline values, the quantitative data from Nubeth, Smith Ranch-Highland units A and B, and Christensen Ranch all support a determination that the impacts are "large and long term." Joint Intervenors Findings at 69; see Larson Initial Testimony at 36; Larson Rebuttal Testimony at 2–3, 10; see also FSEIS 9A, at xxi ("LARGE" defined as the "[e]nvironmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource considered").

4 .106 The staff responded that Joint Intervenors fail to acknowledge that the SMALL impacts determination follows from the GEIS. In this regard, staff witness Moore asserted that there are no site-specific issues associated with the Ross Project and concluded there was no basis to depart from the GEIS conclusion that, even if an ACL is used as the post-restoration groundwater standard, impacts to groundwater would be SMALL. See Tr. at 548; see also Staff Reply Findings at 17 & n.50. Staff witnesses also declared that the data Joint Intervenors rely on to suggest that the impacts would be "large and long term" is irrelevant, as those values involved sites without groundwater restoration approval or that are not analogous to the Ross Project or included post-restoration data that was unavailable at the time the Commission approved restoration. See Staff Rebuttal Testimony at 20–24 (Johnson, Moore, Saxton); see also Staff Initial Testimony at 38 (Johnson, Moore, Saxton). Finally, the staff asserted that Joint Intervenors have failed to explain how, in accord with the FSEIS definition of LARGE, the impacts from an ACL will be "clearly noticeable" and "sufficient to destabilize important attributes" of the groundwater, given the OZ aquifer is exempted as a United States drinking water (USDW) source. See Tr. at 548–49 (Moore); Staff Reply Findings at 25.

4 .107 The Board concludes that the FSEIS determination that restoration-associated impacts to groundwater in the OZ aquifer and surrounding confining aquifers would be SMALL is supported by the preponderance of the evidence in the record. The Board agrees with the

staff that there has been no showing that the impacts from employing an ACL will be "clearly noticeable" and "sufficient to destabilize important attributes of groundwater." This is particularly the case given that the OZ aquifer is permanently exempted as a drinking water source, see supra note 47, and there have been no reported instances of an excursion from an ISR facility negatively impacting drinking water, see Ex. SEI004A, at 2 (Memorandum from Charles L. Miller, FSME, to the Commission, Staff Assessment of Groundwater Impacts from Previously Licensed In-Situ Uranium Recovery Facilities (July 10, 2009)) (noting that there have been no excursions from ISR sites with "environmental impacts" and that the staff is aware of no instances in which a water supply well has been degraded, discontinued, or relocated due to ISR activities). Furthermore, while the Board does not consider Joint Intervenors' concern to be addressed solely by reliance on the LC 10.6 requirement that SEI restore the OZ aquifer in accordance with 10 C.F.R. Part 40, Appendix A, Criterion 5B(5), and the inherent legal requirements of an ACL, see supra Board Finding 4.77 , it does find that these factors nonetheless support the FSEIS SMALL impacts conclusion. The same is true for the State of Wyoming's standard mandating that there be no change in the class of use of the exempted aquifer. See Tr. at 543 (Saxton). Additionally, there is nothing in the record to suggest that SEI (or the staff) will not act in good faith to ensure that SEI's regulatory responsibilities, including its license conditions, are honored, and the Board cannot assume non-compliance. See, e.g., GPU Nuclear, Inc. (Oyster Creek Nuclear Generating Station), CLI-00-06, 51 NRC 193, 207 (2000) (citing cases); see also infra note 66. Finally, in reaching this conclusion, the Board is mindful that should an ACL be sought, a license amendment would be required, triggering another NEPA review, and a hearing opportunity, which will involve the analysis of more specific water quality data.[62] See supra Board Finding 4.68.

[62] In making this ruling, the Board is also mindful of Joint Intervenors' concern about the (continued...)

5. Board Conclusions Regarding EC 2

4 .108 Based on the findings set forth above, a preponderance of the evidence demonstrates that the FSEIS, as supplemented by the uranium bounding analysis discussed in this decision, adequately identifies the potential environmental impacts of an ACL should an ACL be necessary for the Ross Project site. Furthermore, the preponderance of the evidence before the Board supports the FSEIS determination that the restoration-associated impacts on groundwater quality within the Ross Project site OZ aquifer and surrounding aquifers will be SMALL.

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[62](...continued)
staff's statement that, "'the Staff's conclusion in the FSEIS regarding potential impacts to groundwater from the Ross project assumes that a Commission-approved ACL <u>of any amount</u> would have only a SMALL impact on groundwater at the site.'" Joint Intervenors Findings at 45 (quoting Staff Initial Position Statement at 32–33 and referencing Tr. at 559–61 (Johnson)). According to Joint Intervenors, this reflects "a lack of analysis and a meaningful standard to gauge the environmental impacts of ISL recovery in the exempted aquifer within the [OZ]" and means that "impacts of an ACL within the mined and exempted aquifer could never be considered 'large.'" Joint Intervenors Findings at 45, 46.

The staff did seek to clarify somewhat its position in this regard, indicating that if an ACL is issued, it is based on a regulatory finding that there is not a substantial present or potential hazard to the public health or the environment and, therefore, in the absence of any Ross site specific issues, consistent with the GEIS impacts finding regarding the potential future need for an ACL, any environmental impacts would not rise to the level of LARGE. <u>See</u> Staff Reply Findings at 16–17. Nonetheless, the crux of the staff's position on the impacts of an ACL, i.e., issuance of an ACL must be based on a finding that there is no substantial hazard to the public health or environment and, therefore, any environmental impacts must be SMALL, does, at least on its face, suggest a "resolution by definition" approach.

Ultimately, however, the validation of this staff approach lies in the fact that the ACL process requires another, separate agency judgment about what is an appropriate concentration level for the various hazardous constituents that will remain post-operation in the production aquifer and that this agency assessment is subject to an adjudicatory challenge. An SEI request for an ACL can be contested, as to both its safety and environmental components, when that proposal is made, affording an opportunity for Joint Intervenors (or others) to question before the agency (and seek judicial review regarding any agency decision on) whether the limits proposed by SEI are protective of the public health and the environment (and so result in SMALL impacts).

C. Contention EC 3

4 .109 As outlined by the Board in its order recognizing the migration of EC 3 as a FSEIS-related contention, this issue statement provides:

> [EC] 3: The FSEIS fails to include adequate hydrological information to demonstrate SEI's ability to contain groundwater fluid migration.
>
> CONTENTION: The FSEIS fails to assess [adequately] the likelihood and impacts of fluid migration to the adjacent groundwater, as required by 10 C.F.R. §§ 51.90-94 and NEPA, and as discussed in NUREG-1569 § 2.7, in that:
>
> 1. The FSEIS fails to analyze sufficiently the potential for and impacts associated with fluid migration associated with unplugged exploratory boreholes, including the adequacy of applicant's plans to mitigate possible borehole-related migration impacts by monitoring wellfields surrounding the boreholes and/or plugging the boreholes.
>
> 2. There was insufficient information for the NRC staff to make an informed fluid migration impact assessment given that the applicant's six monitor-well clusters and the 24-hour pump tests at four of these clusters provided insufficient hydrological information to demonstrate satisfactory groundwater control during planned high-yield industrial well operations.

FSEIS Order app. A, at 1.

1. Witnesses and Evidence Presented

4 .110 SEI, the staff, and Joint Intervenors presented a dozen witnesses in connection with EC 3 during the September-October 2014 evidentiary hearing in support of their respective positions on whether the FSEIS discussion and analysis of hydrological information was sufficient to demonstrate SEI's ability to contain groundwater fluid migration. Each of these witnesses also presented written direct and/or rebuttal testimony, with supporting exhibits.[63]

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[63] See Tr. at 671–784; Knode Initial Testimony at 11–13; Knode Rebuttal Testimony at 6–7; Schiffer Initial Testimony at 29–34; Schiffer Rebuttal Testimony at 19–22; Demuth/Lawrence Initial Testimony at 18–21; Demuth/Lawrence Rebuttal Testimony at 6–7;
(continued...)

a. SEI

4 .111 At the evidentiary hearing, SEI presented six witnesses regarding EC 3: (1) SEI CEO Ralph Knode; (2) Ben Schiffer, WWC Engineering senior geologist and project manager; (3) Hal Demuth, a senior engineer/hydrologist and principal of Petrotek Engineering Corp.; (4) Errol Lawrence, a senior hydrologist at Petrotek Engineering Corp.; (5) Michael Griffin, SEI's Vice President of Permitting, Regulatory, and Environmental Compliance; and (6) Ray Moores, a civil engineer/project manager with WWC Engineering. See Tr. at 671–703, 756–84.

4 .112 Following training as a submarine electrical operator in the United States Navy's nuclear power program, Michael Griffin completed more than three years towards a Bachelor of Science degree at the Universities of Utah and South Carolina. Prior to joining SEI, he was a principal with Griffin Consulting, Inc., and worked in various positions in field operations, facility licensing and permitting, regulatory affairs, environmental protection, health physics and industrial safety programs, and radioactive and hazardous waste management with Uranium One, Inc., CBR, Resource Technologies Group, Inc., and Chem-Nuclear Systems, Inc. At the Ross Project, he oversees licensing and permitting activities and the development of environmental, health and safety programs. See Griffin Initial Testimony at 3–4; Ex. SEI040, at 1–4 (Michael Griffin CV).

4 .113 Ray Moores holds Master and Bachelor of Science degrees in civil engineering from the University of Wyoming. A registered professional engineer in Wyoming and Colorado, his main role at the Ross Project has been to prepare the numerical groundwater model,

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[63](...continued)
Ex. SEI039, at 4–6 (Initial Written Testimony of Mike Griffin) [hereinafter Griffin Initial Testimony]; Ex. SEI049, at 3–4 (Rebuttal Testimony of Mike Griffin) [hereinafter Griffin Rebuttal Testimony]; Moores Initial Testimony at 5–11; Ex. SEI048, at 3–6 (Rebuttal Testimony of Ray Moores) [hereinafter Moores Rebuttal Testimony]; Staff Initial Testimony at 42–78; Staff Rebuttal Testimony at 24–39; Abitz Initial Testimony at 40–55; Abitz Rebuttal Testimony at 16–17; Larson Initial Testimony at 49–68; Larson Rebuttal Testimony at 14–24.

including developing the conceptual groundwater model and developing, calibrating, and running operational simulations using the numerical groundwater model. Additionally, he provided technical support for the aquifer tests, assisted with preparation of the license application, and assisted with geotechnical drilling and analysis within the proposed CPP. See Moores Initial Testimony at 3; Ex. SEI043, at 1 (Ray Moores CV).

4 .114 The qualifications of the other four SEI witnesses were discussed previously by the Board above in connection with its ruling on EC 1. See supra section IV.A.1.a.

b. NRC Staff

4 .115 At the hearing, four witnesses provided testimony regarding the staff's position concerning EC 3: (1) the NRC Ross Project lead environmental review project manager Johari Moore; (2) John Saxton, an NRC Ross Project safety review project manager and hydrogeologist; (3) AEC/JEC geochemist Dr. Kathryn Johnson; and (4) Dr. Anthony Burgess, an AEC principal hydrogeologist. See Tr. at 707–40, 756–84.

4 .116 Dr. Anthony Burgess, who is a licensed professional engineer in Washington state, received his Doctor and Bachelor of Science degrees in geology from the University of Durham, United Kingdom. He is currently president of Anthony Burgess Consulting, Inc. Dr. Burgess prepared the sections of the DSEIS and FSEIS that address groundwater issues. See Staff Initial Testimony at 2; Ex. NRC005, at 1, 2 (Burgess SPQ).

4 .117 The qualifications of the other three staff witnesses were discussed previously by the Board above in connection with its ruling on EC 1. See supra section IV.A.1.b.

c. Joint Intervenors

4 .118 During the hearing, two witnesses provided evidence relative to Joint Intervenors' positions on this contention: (1) Dr. Richard Abitz, the principal geochemist and owner of Geochemical Consulting Services, LLC; and (2) NRDC science fellow Dr. Lance Larson. See

Tr. at 748–84. The qualifications of each of these witnesses were previously discussed by the Board above in connection with its rulings on EC 1 and EC 2, respectively. See supra sections IV.A.1.c. and IV.B.1.c.

d. Finding Regarding Witness Qualifications

4 .119 Based on the foregoing, and the respective background and experience of the proffered individuals, the Board finds that each of these SEI, staff, and JTI witnesses is qualified to testify relative to the subject of the adequacy of the FSEIS's hydrological information regarding the containment of groundwater fluid migration.

2. FSEIS Discussion Relative to Contention EC 3

4 .120 Fluid migration is the subject of FSEIS sections 3.5.3.2 and 4.5.1.2. Section 3.5.3.2 provides a description of the local geologic stratigraphy and its relationship to the groundwater hydrology of the area of the Ross Project, as well as outlining the SEI pre-licensing monitoring programs to determine whether there is hydrologic communication, and the associated possibility of excursions, between the OZ layer and the other potentially impacted layers/aquifers across the Ross Project area. The pre-licensing monitoring programs included aquifer pumping tests performed on six well clusters (which SEI referred to as the regional baseline monitor wells). During six twenty-four hour tests and one seventy-three hour test, SEI pumped water from the OZ aquifer while monitoring the SA and SM aquifers (above the OZ) and the DM aquifer (below the OZ) to see whether the pumping had any affect on these aquifers indicative of hydrologic communication. See FSEIS 9A, at 3-37; Ex. SEI014G add. 2.7-F, at 5–6 (4 SEI, Ross ISR Project USNRC License Application, Crook County, Wyoming, [TR] (Apr. 2012)) [hereinafter Aquifer Test Report]. The FSEIS indicated that while no effects from the SEI OZ pumping were measured in any of the wells in the overlying SA or SM horizon, two of the six underlying DM wells declined slightly during the SEI pumping. The staff considered this to be

communication between the OZ and DM aquifers due to drill holes that were installed during previous resource-exploration efforts, but had not yet been located and properly abandoned (i.e., sealed) by SEI. According to the FSEIS, despite the communication, the integrity of the confining layer between the OZ and DM aquifers was established by the fact that the other four DM aquifer wells were not affected by the OZ pumping, including one well (Well 12-18), for which all the nearby exploration drill holes had been located and properly abandoned. See FSEIS 9A, at 3-37; see also id. at 4-42 .

4 .121 Further in this regard, the FSEIS indicates that condition 10.12 of the SEI license provides that to ensure the OZ aquifer remains hydraulically isolated, SEI must first “attempt” to locate and properly abandon all historical drill holes located within each wellfield’s perimeter monitoring well ring prior to conducting the hydrologic wellfield data package testing mandated to begin ISR operations. See id. at 4-42; see also SEI License at 9 (LC 10.12 stating SEI “[p]rior to conducting tests for a wellfield data package, will attempt to locate and abandon all historic drill holes located within the perimeter well ring for the Wellfield”). This license condition is intended to address the presence of some 1682 drill holes known to exist within the Ross site and a half-mile buffer zone outside the Ross permit area as a consequence of a 1970s pilot project undertaken by Nubeth to locate potential uranium ore bodies. See FSEIS 9A, at 3-13, 4-42; Tr. at 679 (Knode). Further, of those 1682 drill holes, 1483 are located within the Ross Project permit area, of which 1354 have been located (as of October 1, 2014) and 108 have been plugged (as of August 1, 2014), while approximately 1382 of the 1483 are located within the somewhat smaller area of the to-be-installed perimeter well-monitoring ring, with 1265 of those having been found by SEI. See Tr. at 679–80 (Knode).

4 .122 FSEIS section 4.5.1.2 describes the environmental impacts to surface and ground water of Ross Project operations and potential mitigation measures. Referencing GEIS

section 4.2.4.2.2.2, see GEIS, at 4.2-22 to -25, the FSEIS indicates in connection with groundwater that horizontal excursions of degraded groundwater outside of the OZ could have a MODERATE to LARGE impact if a large volume of contaminated water leaves the OZ and moves downgradient into a consumption area. The FSEIS indicates further that while most excursions are horizontal and are recovered within months of detection, vertical excursions tend to be more difficult to recover and have remained in excursion status for as long as eight years. The FSEIS also acknowledges that one of the causes of vertical excursions are improperly abandoned drill holes from earlier exploration activities and that condition 10.12 to the SEI license is intended to mitigate potential impacts from the existing drill holes on the Ross site. Additionally, the FSEIS notes that LC 11.3 requires that SEI install monitoring wells around each wellfield to monitor the OZ, SM, and DM aquifers, while LC 11.5 mandates that SEI must cease injecting lixiviant into the uranium production area surrounded by a perimeter monitoring ring if a vertical excursion is detected during operation. Thereafter, SEI can resume injection operations only when SEI demonstrates to the staff's satisfaction that the vertical excursion cannot be attributed to leakage through any abandoned drill hole. Finally, assuming adequate monitoring well excursion detection and SEI groundwater pumping to recover excursions, the FSEIS concludes that the potential impacts of Ross Project operations to groundwater quality in the confined SM and DM aquifers above and below the OZ will be SMALL. See FSEIS 9A, at 4-37, 4-38, 4-42, 4-43; see also SEI License at 9, 12–14.

3. Joint Intervenors' Issues Regarding Groundwater Fluid Migration

4 .123 Relative to their fluid migration contention EC 3, Joint Intervenors have identified what they assert are three flaws in the staff's FSEIS analysis that must be corrected: (1) the FSEIS discounts the risk of fluid migration from unplugged and improperly abandoned boreholes; (2) the FSEIS did not properly assess the risk of fluid migration because the relied-

upon pump tests were inadequate to demonstrate aquifer containment; and (3) the FSEIS impacts analysis concludes inaccurately that lixiviant excursions will be adequately detected. See Joint Intervenors Findings at 72, 78, 79. We consider each of these concerns in turn.

a. Borehole Issue

4 .124 Declaring that the staff has previously designated as appropriate for ISR mining only aquifers that it considered "confined," i.e., bounded by an overlying and underlying geologic unit of relatively low permeability, Dr. Larson provided several examples of unexplained vertical excursions at what he asserted were otherwise staff-designated "confined" sites and stated that undetected, unsealed boreholes appear to be directly related to vertical excursions. See Larson Direct Testimony at 52–54. Joint Intervenors likewise pointed to a 1986 staff-sponsored study of excursions in Wyoming and Texas ISR mines that (1) indicates vertical excursions are "directly related to the intensity of" prior drilling activity that results in improperly plugged and abandoned exploration holes or poorly completed field wells; and (2) describes "standard practice" in addressing a vertical excursion as seeking to locate abandoned open boreholes (along with pressure testing completed wells in a search for defective or broken casings), but observes that the effectiveness of such a procedure depends on the ability to locate all the abandoned holes, which in the case of older holes is often difficult because of the lack of records, the scattering and covering of well cuttings by erosion and vegetation, and the collapse of exposed surface casings, if permanent casings were ever installed. Joint Intervenors Findings at 75 (citing Ex. NRC020, at 30 (W. P. Staub, et al., Oak Ridge National Laboratory, An Analysis of Excursions at Selected In Situ Uranium Mines in Wyoming and Texas, NUREG/CR-3967, ORNL/TM-9956 (July 1986))); see also Abitz Direct Testimony at 46.

4 .125 Against this background, Joint Intervenors criticized the staff's finding that the long-term impacts of excursions will be SMALL. Joint Intervenors asserted that the FSEIS did

not assess adequately the risk of fluid migration from improperly plugged and abandoned boreholes because it assumed that the remaining 1500+ Nubeth boreholes will be located and then properly filled. Given the acknowledged difficulty of locating and filling such old holes, in conjunction with SEI's plan not to try to fill boreholes beyond the perimeter monitoring ring for each wellfield, which may be established at any point within 400 feet of the production wells in a field, Joint Intervenors declare that contamination beyond those wellfield areas is even more likely to be unconfined as it may reach unplugged boreholes SEI does not intend to fill. See Joint Intervenors Findings at 77. Further, Joint Intervenors contend that LC 10.12, as a measure intended to mitigate the impact of any drill hole-related excursion, is inadequate because that condition requires SEI only to "attempt" to locate and fill the boreholes, an attempt that an SEI witness acknowledged might not be successful before ISR operations begin, see Tr. at 766 (Griffin), and that a staff witness stated may only be the subject of an enforcement action if the staff determines that SEI activities associated with not fulfilling the license condition were "willful," Tr. at 764 (Saxton). Moreover, Joint Intervenors asserted, LC 10.12's ineffectiveness as a mitigation measure, in conjunction with the acknowledged difficulty in locating old boreholes like those on the Ross site, established that the FSEIS is deficient because it failed to present a timetable and requirements for borehole location, plugging, and abandonment prior to any wellfield development. See Abitz Initial Testimony at 48.

4 .126 While recognizing Joint Intervenors' arguments regarding the LC 10.12 requirement that SEI "attempt" to locate and abandon all the approximately 1500 drill holes within the Ross permit area, the staff asserted that this concern rests on a mistaken assumption, i.e., that the location and proper filling of these boreholes is critical to the FSEIS conclusion that the environmental impacts associated with fluid migration will be SMALL. Instead, the staff declared, its FEIS impacts conclusion of SMALL "is based not on the finding

and filling of boreholes, as [Joint] Intervenors claim, but on the detection and recovery of potential excursions." Staff Reply Findings at 28; see id. at 29 (stating staff's ultimate conclusion long-term impacts to OZ aquifer outside the exempted area would be SMALL is based on staff's analysis of SEI's ability to recover potential excursions, not assumption all boreholes would be located and filled). The staff thus concluded that, as documented in FSEIS section 3.5.3.2, sufficient safeguards are in place to protect against excursions should SEI be unable to locate and abandon all the Nubeth drill holes within the perimeter well ring. See Staff Findings at 46.

4 .127 The presence of some 1500 pre-existing boreholes within the Ross permit area undoubtedly presents a daunting challenge both in assessing and mitigating the potential environmental impacts of the drill holes. As just noted, the staff places its main reliance in this regard on SEI's excursion detection and recovery efforts. Yet, in considering the evidence before us, we conclude the staff has overly discounted the importance of the license condition requirement that SEI act to locate and properly abandon all historic drill holes within the wellfield perimeter well ring as a factor in finding that long-term fluid migration impacts will be SMALL. The excursion monitoring requirements of LC 11.5, which govern excursion detection and recovery and upon which the staff places so much emphasis as the basis for its FSEIS impact determination, is labeled in the SEI license as one of the "Standard Conditions," see SEI License at 11, and likewise seems to be standard for other ISR licenses, see NRC, Materials License No. SUA-1600, Docket No. 40-09075, at 9, 10–11 (Apr. 8, 2014) (LC 11.5 for Powertech (USA) Inc. Dewey-Burdock Project among "Standard Conditions") (ADAMS Accession No. ML14043A392); NRC, Materials License No. SUA-1597, Docket No. 040-9067, at 10, 12 (amend. No. 3 Aug. 28, 2014) (same for LC 11.5 for Uranez Energy Corp. Nichols

Ranch Project) (ADAMS Accession No. ML14212A457).[64] Nonetheless, there is a "nonstandard" provision in this standard condition, which is a specific reference to the problem of existing boreholes on the Ross site that LC 11.5 in the SEI license addresses as follows:

> If a vertical excursion is detected during operations, then injection of lixiviant into the production area surrounding the monitoring well will cease until the licensee demonstrates to the satisfaction of NRC that the vertical excursion is not attributed to leakage through any abandoned drill hole.

SEI License at 14. While this requirement outlines the appropriate action that must be taken in the event a vertical excusion is identified, as a measure intended to ensure that the facility can operate safety on a continuing basis, it also emphasizes the importance of "Facility Specific" LC 10.12 that requires SEI "[p]rior to conducting tests for a wellfield package . . . [t]o attempt to locate and abandon all historic drill holes located within the perimeter well for the Wellfield." Id. at 9. Indeed, given the number of historic drill holes on the Ross site, see supra Board Finding 4.121, it is not apparent that, in the absence of the additional "locate-and-abandon" condition, to what degree the standard excursion detection and recovery condition would have been adequate to support the staff's FSEIS finding of SMALL long-term impacts outside the OZ exempted area. As a consequence, Joint Intervenors' concern about the extent to which LC 10.12, as it directs SEI to "attempt" to detect and abandon properly the myriad drill holes on the Ross site, will be implemented in such a way as to support adequately the staff's SMALL impact finding is not without significance.

4 .128 Looking then to the substance of that license condition and the activities it engenders, we note initially that pertinent to the issue whether SEI can be counted on to implement LC 10.12 appropriately is the established precept that, in the absence of some showing of substantial prior misdeeds, an applicant/licensee will be presumed to follow the

[64] The Licensing Board takes official notice of these NRC-issued licenses in accord with 10 C.F.R. § 2.337(f).

agency's regulatory requirements, including the directives in its license. See Private Fuel Storage, LLC (Independent Spent Fuel Storage Installation), CLI-01-9, 53 NRC 232, 235 (2001) (stating that "the NRC does not presume that a licensee will violate agency regulations wherever the opportunity arises") (citing GPU Nuclear, Inc. (Oyster Creek Nuclear Generating Station), CLI-00-6, 51 NRC 193, 207 (2000) (declaring the intervenor "also fails to offer documentary support for its argument that [the licensee] is likely to violate our safety regulations. Absent such support, this agency has declined to assume that licensees will contravene our regulations.")). Regardless of this assumption, however, SEI has a clear incentive here to put its best efforts into completing timely and fully the drill hole locate-and-abandon mission imposed by LC 10.12 to avoid the consequences of wellfield operations shutdown under LC 11.5 if SEI fails to identify and fill one or more boreholes.[65] As a consequence, we would anticipate that SEI's "attempt" under LC 10.12 will almost certainly involve (1) finding a very substantial portion, if not all, of the remaining 117 unlocated drill holes within the area bounded by a wellfield's perimeter monitoring well ring; and (2) properly abandoning all the identified drill holes within that perimeter. Moreover, additional measures are in place, including (1) the well abandonment records that SEI must complete and maintain for each borehole as it is located and plugged in compliance with LC 10.12, see Tr. at 736–39 (Saxton), 761 (Schiffer); see also TR 14C, at 3-20 to -21; and (2) the post-license, pre-production pump tests required by LC 10.13 that will help provide SEI and the staff with the requisite assurance regarding the adequacy (and success) of SEI's effort to comply with

[65] Although Joint Intervenors challenged the adequacy of LC 10.12 because there is no specified timetable for carrying out the locate-and-abandon task it imposes, see Joint Intervenors Findings at 77, 87, the schedule for completing this endeavor nonetheless seems clear, i.e., it must be done before SEI conducts the tests for a wellfield data package that SEI must finish prior to beginning facility operation, see supra Board Finding 4.121.

LC 10.12,[66] by indicating whether, for any reason, including undiscovered or inadequately plugged boreholes, the OZ aquifer is hydrologically connected to aquifers above or below, see Tr. at 689–91 (Demuth).[67] We thus conclude that, in most respects, LC 10.12 provides

[66] In undertaking its role to assess whether an applicant/licensee adequately carries out a licensing directive, we likewise are to assume that the staff will be fair and judge the matter of an applicant/licensee's compliance on the merits. See Pub. Serv. Co. of N.H. (Seabrook Station, Units 1 & 2), LBP-89-4, 29 NRC 62, 73 (1989) (citing United States v. Chem. Found., Inc. 272 U.S. 1, 14-15 (1926)), aff'd on other grounds, ALAB-918, 29 NRC 473 (1989), remanded on other grounds sub nom. Mass. v. NRC, 924 F.2d 311 (D.C. Cir.), appeal dismissed as moot, ALAB-946, 33 NRC 245 (1991). Yet, as is the case with SEI, the staff has an additional incentive here, i.e., in the face of extensive prior drilling intrusions into the Ross site, to fully support its predicative finding of SMALL long-term impacts from fluid migration, the staff necessarily must ensure that SEI's LC-required "attempt" to locate and abandon all drill holes within the monitoring well ring embodies a level of effort that maximizes the potential for eliminating excursions, particularly vertical excursions that would reach into the SM or DM aquifers.

Relative to the staff's role, we also observe that we do not believe this condition and the staff (and SEI) activities it contemplates violates the precept that post-hearing resolution of licensing issues must not be employed to obviate the basic findings prerequisite to a license. See Hydro Res., CLI-06-1, 63 NRC at 4. Particularly in the NEPA context, the path SEI and the staff must follow relative to LC 10.12 is sufficiently clear such that continuing to hold this hearing open while it is completed would be an unnecessary extension of the adjudicatory process. See id. at 5–6.

[67] The lack of potential hydrological impact from the numerous historic boreholes on the Ross site are, according to SEI, supported by the fact that its completed borehole abandonment efforts have demonstrated that the drill holes are, to some extent, self-sealing over time and that the pierzometric head in the SM aquifer is nearly 100 feet higher than the OZ aquifer, such that a significant amount of head will be induced into the OZ aquifer if there is an uplugged borehole, thereby limiting the potential for a vertical excursion into the SM aquifer. See SEI Reply Findings at 45 (citing Tr. at 708, 713 (Burgess), 757–58 (Schiffer)). Relative to the second point, the FSEIS does indicate that vertical gradients downwards from the SM to the OZ aquifers could have head differences of as little as 50 feet (or as much as 150 feet), see FSEIS 9A, at 3-35, and the testimony of staff witness Saxton recognized that the injection and removal of fluids within the production zone creates local perturbations in the hydraulic head in the OZ aquifer such that if an undiscovered and unplugged borehole were close to an injection well, the artificially-created head could potentially be great enough to reverse the vertical flow in the old borehole and allow lixiviant to contaminate the SM aquifer, see Tr. at 717–19 (Saxton). Nonetheless, in the unlikely event that a local anomaly generated by an injection would be great enough to overcome the 100-foot average difference needed to reverse the flow between the two aquifers or would occur under the specific circumstance in which the head difference was as small as 50 feet, we would agree with staff witness Saxton that the monitoring program required under LC 11.5, see Tr. at 719 (Saxton), as well as the requirement for lixiviant injection (continued...)

substantial support for the FSEIS conclusion that, despite the nearly 1500 historic boreholes on the Ross Project site, the environmental impacts associated with fluid migration during facility operation will be SMALL.[68]

4 .129 There is, however, one limited respect in which the evidentiary record before us indicates that LC 10.12 is not sufficient. Under its current terms, this condition applies only to drill holes within the "perimeter well ring for the Wellfield," notwithstanding the fact that there are in the neighborhood of 101 boreholes located in the area between the monitoring well ring and the Ross Project boundary, eighty-nine of which have been located. See Tr. at 679–80 (Knode). SEI declares that the potential for fluid migration via boreholes outside the monitoring well ring is minimized by natural hydrologic conditions, along with (1) LC 11.5, which requires immediate horizontal excursion corrective actions; (2) LC 10.7, which requires SEI to maintain a net inward hydraulic gradient in each wellfield between initial lixiviant injection and the start of post-groundwater restoration stabilization monitoring; and (3) the significantly smaller density of boreholes outside the mineralized areas of the Ross site. See SEI Reply Findings at 45–46 (citing SEI License at 8, 13–15). We recognize that, for all these reasons, this beyond-the-wellfield monitoring ring area generally is an area with a lower risk for excursions as compared to the area within the wellfield monitoring ring. More specifically, we are aware that the evidentiary record suggests that most of the Nubeth boreholes bottomed in the OZ aquifer and therefore are not potential conduits for fluids moving from the OZ to the DM horizon. See Tr. at 713 (Burgess). Nonetheless, given that SEI and the staff also attributed the aquifer

[67](...continued)
shutdown if a vertical excursion is detected, provides adequate mitigation measures for this circumstance.

[68] And further reinforcing this conclusion, as the staff and SEI note, is the ongoing monitoring of water levels in the aquifers overlying and underlying the OZ pursuant to LC 11.5 that will provide a continuing check that the aquifers within the wellfield are hydrologically isolated. See Tr. at 700–01 (Lawrence), 719–20 (Saxton).

pumping tests response in the DM aquifer to unplugged boreholes, see FSEIS 9A, at 3-37, some of the Nubeth drill holes apparently did penetrate into the DM aquifer, thus creating the possibility for the downward movement of fluids from the OZ into the DM aquifer.

4 .130 To be sure, excursions outside the perimeter monitoring ring would require significant lateral movement within the OZ aquifer, which during mining and restoration is likely to be detected by the monitoring wells. On the other hand, based on the limited information before us, with the uncertainty about the lack of any rapid decline from the ACL-based concentrations of uranium and other contaminants within the production zones of the OZ aquifer, see supra Board Finding 4.104 & note 60, a decade after restoration any excursions affecting the DM as a consequence of unplugged boreholes beyond the perimeter monitoring well ring may well be difficult to detect and remediate, creating the possibility of long-term impacts from such unfilled boreholes that could be more than SMALL.

4 .131 Accordingly, so that any unfilled boreholes are located and abandoned that go into the DM aquifer or below and are within the area that is (1) downgradient of a wellfield; and (2) between the perimeter monitoring well ring and the closer of (a) the Ross site boundary, or (b) the boundary of the exempted OZ aquifer and the monitoring well ring, thereby ensuring that the staff's assessment that the impacts of such boreholes will be SMALL is fully supported, we revise LC 10.12 to read as follows:[69]

> 10.12 Prior to conducting tests for a wellfield data package, the licensee will attempt to locate and abandon all historic drill holes within:

[69] The Board recognizes that the protective measure we are imposing is not one that addresses a high-probability event. Nonetheless, because there are likely to be only about 100 boreholes potentially involved, see Tr. at 368–69 (Schiffer), this does not seem an inordinate requirement, particularly given it is intended to ensure the integrity of the exempted aquifer area as a buffer. Moreover, with only about 100 drill holes potentially at issue, of which apparently only 12 still need to be located, it could well be that SEI may find it more cost effective simply to locate and fill all the beyond-the-perimeter monitoring ring area drill holes, consistent with its approach to addressing the boreholes within the perimeter monitoring well ring, regardless of their depth.

A) The perimeter well ring for the Wellfield; and

B) To the extent the historic drill holes extend into the first underlying aquifer, the area that is downgradient of the Wellfield and is between the perimeter well ring for the Wellfield and the closer of either

i. The Ross Project license area boundaries shown in figure 1.4-2 of the approved license application; or
ii. The outer boundary of the exempted aquifer as defined by the Class III UIC permit issued by the Wyoming Department of Environmental Quality.

The licensee will document such efforts to identify and properly abandon all drill holes in the wellfield data package.

b. Pre-License Pump Test Issue

4 .132 In challenging the FSEIS analysis of Ross site hydrology, Joint Intervenors also questioned the adequacy of the battery of pre-licensing pump tests performed by SEI to show the hydrologic integrity of the OZ aquifer with respect to the SM and DM aquifers on the Ross site and used by the staff to analyze and reach its FSEIS conclusions about the potential impacts of the facility on local groundwater resources. See Joint Intervenors Findings at 78–79. In this regard, in his initial written testimony Joint Intervenors witness Dr. Abitz asserted that "neither the number of wells tested for hydrological parameters nor the short duration of the pump tests run to date establish adequate hydrological information to demonstrate control of groundwater." Abitz Initial Testimony at 49. Dr. Abitz also declared that "groundwater communication between the SM and OZ horizons is evident in the 24-hour pump test data from well 12-18OZ and the water-quality results for sodium and sulfate." Id. Further, regarding pump test duration, in response to a staff witness observation in his initial written testimony that the well 12-18OZ pump test referred to by Dr. Abitz was a seventy-two-hour test, not a twenty-four-hour test, see Staff Initial Testimony at 67 (Burgess), during the evidentiary hearing Dr. Abitz declared that, given the multi-year extraction process, pumping for seventy-two hours

or even one week would not be sufficient to demonstrate a lack of connectivity between aquifers, see Tr. at 769.

4 .133 As described in the initial written testimony of SEI witness Moores, during each aquifer pump test, the well installed within the OZ aquifer was pumped at a constant rate. Pressure transducers programmed to measure and record the water level in each well at one-minute increments were installed within the pumped OZ well and any OZ observation wells, the SM overlying water-bearing interval well, and the DM underlying water-bearing interval well. After completion of the pumping portion of the test, transducer-recorded water level readings continued at one-minute increments until pumped well water levels recovered to within at least ninety percent of the pre-pumping water level. Once sufficient time had passed for the water levels in the pumped wells to recover, the water-level data from the transducers was downloaded and graphs of drawdown and recovery versus time were developed. See Moores Initial Testimony at 5.

4 .134 These drawdown and recovery versus time graphs are, Mr. Moores testified, the key to understanding aquifer characteristics. Aquifer parameters such as transmissivity and storativity, see infra note 70, can be calculated by fitting the graphs measured during the aquifer test to graphs developed from an idealized model. For the Ross Project aquifer tests, both the drawdown and recovery curves, evaluated using applicable methods, were presented in the final aquifer test report that was part of the technical report submitted in support of SEI's license application. See Moores Initial Testimony at 5 (citing Aquifer Test Report at 1-254). Also, according to Mr. Moores, it was possible to measure the integrity of the confining layers above and below the OZ aquifer in the vicinity of the pumped well by evaluating responses, or lack thereof, recorded in the SM and DM wells. Further, referencing the aquifer test report, Mr. Moores declared that because the data collected during the aquifer tests was adequate to

develop trendlines and curves that allowed the aquifer tests to be successfully analyzed using appropriate empirical methods, the aquifer tests were of sufficient duration to meet their intended purposes. See id. at 5–6.

4 .135 Mr. Moores also indicated that the aquifer test transducers were very sensitive to even slight changes in pressure, as illustrated by the transducer in the 14-18 monitor well cluster in the DM well, which registered a change in head of 0.2 feet that was relatively minimal given the large drawdown in the OZ aquifer. According to Mr. Moores, based on his experience overseeing aquifer tests for coal mines and at other ISR operations, because the transducers are so sensitive, typically indicating aquifer communication very early in aquifer tests, it is possible to see trends that might indicate a leaking aquifer even over short pumping durations. Acknowledging that these trends become more pronounced the longer the aquifer test continues, Mr. Moores nonetheless maintained that any trend can usually be spotted within a few hours after the test begins. See id. at 6.

4 .136 Relative to the number of testing wells, Mr. Moores stated that as part of the license application SEI developed a groundwater model with the twin goals of determining hydrologic parameters (transmissivity, hydraulic conductivity, and storativity)[70] within the OZ and discovering whether there was leakage between the OZ aquifer and the overlying and underlying SM and DM water-bearing units. Combined with input from the WDEQ, this caused SEI to propose pumping tests at each monitor well cluster to obtain more hydrologic data to input into its numerical groundwater model. Prior to conducting the tests, the number and locations of the proposed pumping tests were presented in SEI's baseline sampling and analysis plan and approved by WDEQ. See Moores Rebuttal Testimony at 3 (citing Ex.

[70] Transmissivity is the flow rate of water through a vertical section of an aquifer, while hydraulic conductivity represents a measure of the capacity of a porous medium to transmit water and storativity is used to characterize the capacity of an aquifer to release groundwater from storage in response to a decline in water levels. See FSEIS 9A, at 3-34.

SEI020A, at app. E, at 1 (SEI, Preliminary Baseline Sampling Plan for the Ross ISR Uranium Recovery Project, Crook County, Wyoming (rev. May 13, 2010))). Additionally, Mr. Moores testified that besides the seven pumping tests outlined above, results from two historical pumping tests conducted in 1977 and 1978, which had results similar to the results from the more recent tests, were summarized in the license application and used in the groundwater model to increase the spatial coverage of the measured data. See id. at 3–4; Moores Initial Testimony at 7. Finally, Mr. Moores stated that the seven pumping tests were not designed or intended to demonstrate confinement throughout the entire Ross licensed area and that additional wellfield-scale pumping tests will be conducted prior to ISR operations to demonstrate adequate confinement to conduct ISR operations safely within each wellfield. See Moores Rebuttal Testimony at 4.

4 .137 For their part, staff witnesses asserted that Joint Intervenors' concern about the adequacy of the SEI pump test data to demonstrate aquifer confinement is negated by the fact that "[t]he type of pumping test used, i.e., modified single well pumping tests, are specifically listed in acceptance criterion (3) in Section 2.7.3 of NUREG-1569," the staff's ISR licensing SRP, and that "the pumping tests data were used as guidance for the numerical model of the Ross Project area that was calibrated to observed piezometric heads." Staff Initial Testimony at 63 (Burgess, Saxton) (citing NUREG-1569, at 2-23 to -24 (stating "[a]ny of a number of commonly used aquifer pumping tests may be used including single-well drawdown and recovery tests, drawdown versus time in a single observation well, and drawdown versus distance pumping tests using multiple observation wells")). This, the staff asserted, shows that the SEI pumping tests were tailored to provide accurate Ross site hydrology information. See Staff Reply Findings at 30. Along the same lines, SEI provided a USGS paper on basic groundwater hydrology stating that an aquifer test "in most cases, includes pumping a well at a

constant rate for a period ranging from several hours to several days and measuring the change in water level in observation wells located at different distances from the pumped well." Ex. SEI030, at 34 (Ralph C. Heath, USGS, Basic Ground-Water Hydrology, Water-Supply Paper 2220 (rev. 2004)).

4 .138 After reviewing the evidentiary record associated with Dr. Abitz's concerns regarding the adequacy of SEI's pump test program, we find that the preponderance of the evidence, and in particular the information provided by Mr. Moores, see supra Board Findings 4.133-4.136, supports the conclusion that the SEI pump-testing protocols, including the number and location of the testing wells and the duration of the pumping tests fall, within the appropriate parameters for conducting such tests at this facility.

4 .139 Regarding the additional, earlier referenced issue of whether the SEI pump tests demonstrated that groundwater communication exists between the SM and OZ aquifers on the Ross Project site, see supra Board Finding 4.132, as evidence of such a connection, Joint Intervenors witness Dr. Abitz in his initial testimony provided a graph of sodium concentrations plotted against sulfate concentrations for samples of groundwater collected from the OZ and SM aquifers. According to Dr. Abitz, samples collected at one of the wells screened within the OZ aquifer (14-18OZ) contained the greatest concentrations of sodium and sulfate of any of the water samples, as contrasted with wells in the SM aquifer (14-18SM, 12-18SM, 42-19SM, and 34-18SM), which show low sodium/sulfate concentrations, and thus provided an example of unmixed groundwater from the OZ. In contrast, according to Dr. Abitz, are the analyses of the samples from one of the wells screened to collect water from the OZ aquifer (12-18OZ) that plots sodium/sulfate concentrations within the range of the above-reference samples from the

SM aquifer, which he cites as strong evidence of mixing between the SM and OZ horizons.[71] See Abitz Initial Testimony at 50–51.

4 .140 While staff witnesses Burgess and Johnson recognized that the similarity of water analyses from the OZ aquifer well (12-18OZ) to waters sampled from the SM aquifer wells could, in fact, show the presence of unplugged boreholes in the vicinity of these wells, they go on to assert that "[i]t is more likely that the spread of the OZ data represents natural heterogeneity in the water chemistry, emphasized by the pumping test activities that were taking place during the period of sampling." Staff Initial Testimony at 69.

4 .141 Dr. Abitz's claim that the sodium and sulfate rich water samples from well 14-18OZ are representative of all "unmixed" groundwater in the OZ aquifer is, in the Board's estimation, little more than speculation. That being said, we also recognize that the roughly linear trend and overlap in compositions shown on his graph for various water samples from the SM and OZ aquifers are consistent with mixing. We do not find this convincing evidence of actual horizon mixing via excursions, however, concluding that the better explanation lies in the staff witnesses' assertion that the composition of groundwater in the OZ aquifer may vary considerably depending on the nature of the minerals with which the groundwater is in contact.[72]

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[71] In plotting his graphic representation, Dr. Abitz also asserted that samples from an industrial well (22x-19) were collected from a screened interval that included both the OZ and SM aquifers so that analyses of these samples likewise should provide good examples of what the compositions of mixed OZ and SM groundwaters should look like. See Abitz Initial Testimony at 50. This turns out not to be the case, however, because the portion of the SEI technical report referred to in his testimony states that this well was screened through the OZ and DM aquifers and did not sample groundwater from the SM aquifer. See Staff Initial Testimony at 68 (Burgess, Johnson) (citing TR 14A, at 2-169).

[72] In making this determination, we note that Dr. Abitz's own graph suggests this may be the case. While the four sample plots for most of the OZ and SM wells are clustered in relative proximity, the sample plots for well 12-18OZ, the well plots that Dr. Abitz suggests shows strong evidence of horizon mixing, are the most widely scattered, two being within the low

(continued...)

c. Excursion Detection Issue

4 .142 Finally, as part of their challenge to the staff's FSEIS hydrology impacts assessment, Joint Intervenors have questioned the efficacy of SEI's excursion monitoring program as a means of detecting excursions. See Joint Intervenors Findings at 79–84. One aspect of this concern is that uranium is not being utilized as a chemical indicator of excursions. See id. at 81–83. Dr. Abitz noted that the FSEIS declares the indicators to be used for detecting excursions at the Ross Project will be chloride, conductivity, and total alkalinity because "'[t]hese constituents move through the aquifer faster than other water-quality parameters, and therefore levels above these would indicate excursions before radionuclides and other elements move outside the production (i.e., uranium-recovery) zone.'"[73] Abitz Initial Testimony at 41 (quoting FSEIS 9A, at 4-41 (emphasis omitted)). Citing published experimental studies entered as Joint Intervenors' exhibits,[74] Dr. Abitz maintained that this statement "is inaccurate and

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[72](...continued)
sodium/sulfate range with the other SM well plots and two being closer to the other OZ well plots in the higher sodium/sulfate range. See Abitz Initial Testimony at 50.

[73] The FSEIS indicates in this regard that

> At most in situ uranium-recovery operations, for example, chloride is selected because it does not interact strongly with the minerals in the ore zone; it is easily measured; and chloride concentrations are significantly increased during ISR operations. Conductivity, which is correlated to total dissolved solids (TDS), is also considered a good excursion indicator because of the high concentrations of dissolved constituents in the lixiviant as compared to the surrounding aquifers. Total alkalinity (carbonate plus bicarbonate plus hydroxide) is used as an indicator in wellfields where sodium bicarbonate or carbon dioxide is used in the lixiviant.

FSEIS 9A, 2-31 (citations omitted).

[74] See Abitz Initial Testimony at 42 (citing Ex. JTI022, at 1 (Gary P. Curtis, et al., Simulation of reactive transport of uranium(VI) in groundwater with variable chemical conditions, 42 Water Res. Research W04404 (2006)); Ex. JTI023, at 41 (ExxonMobil, Highland Uranium
(continued...)

presents an oversimplification of the dominant geochemical mechanisms which dictate subsurface transport of soluble uranium (i.e., uranium in the plus-six oxidation state, or U(VI))."[75] Id. Instead, he concluded that "the aqueous uranium-carbonate species formed from lixiviant injection during [ISR] operations will be highly mobile in the groundwater."[76] Id. at 42. As a

[74](...continued)
Mill Site, Final Closure Proposal, Casper, Wyoming (Aug. 3, 2010) (slide presentation)); Ex. JTI024, at 4435 (Ping Zhou & Baohua Gu, Extraction of Oxidized and Reduced Forms of Uranium from Contaminated Soils: Effects of Carbonate Concentration and pH, 39 Env't. Sci. Tech. 4435 (2005))).

[75] Dr. Abitz explained further that

> [w]ithout the presence of carbonate anions, U(VI) as the uranyl ion (UO_2^{+2}) is readily adsorbed to the surfaces of various iron oxides and clays. However, with the introduction of an oxidizing, carbonate-rich lixiviant to enhance U(VI) solubility and mobility in the aquifer, uranium adsorption to iron oxide surfaces decreases, as relatively non-reactive uranyl-carbonate complexes ($UO_2(CO_3)_2^{-2}$ and $UO_2(CO_3)_3^{-4}$) form in solution.

Abitz Initial Testimony at 41–42 (citations omitted).

[76] As the basis for this conclusion, and a criticism of the FSEIS analysis (or lack of analysis) of excursion indicators, Dr. Abitz declared:

> U(VI) subsurface modeling has reported that adsorption of uranium in the subsurface is highly complex and varies spatially and temporally. Outside of reporting water-quality parameters and the slight mention of uranium minerals and pyrite in the fluvial deposits, the FSEIS presents very little about the current subsurface geochemical zonation and, more importantly, is silent on the extent to which mining activities will destroy the reducing geochemical conditions in the exempted aquifer. For example, the FSEIS is silent on the total reductive capacity of the aquifer and fails to estimate the reductive capacity of the aquifer and compare it to the expected amount of oxygen that will be injected into the aquifer to destroy the reducing conditions. This is a fundamental oxygen-balance analysis that would indicate whether sufficient reducing capability remains in the exempted aquifer after restoration to remove U(VI) carbonate species from solution by reductive precipitation to insoluble U(IV). Without this analysis, there is no logical basis to omit uranium as an excursion indicator, as the levels of uranium in the lixiviant are generally three to four

(continued...)

consequence, by not including uranium as a chemical indicator of excursions at perimeter monitoring wells, the FSEIS "fundamentally undermines the conclusions about the environmental impacts of the project on groundwater quality." Id.

4 .143 Discussions regarding this matter by the parties' witnesses in both their written and oral testimony focused on the validity of SEI and staff assertions that excursion indicators such as chloride, alkalinity, sulfate, and electrical conductivity will be detected at monitoring wells before any increase in uranium concentrations, owing principally to natural processes that remove uranium from the groundwater as it moves outward from the ore zone. In response to Dr. Abitz's claim that the presence of lixiviant would enhance the solubility and mobility of U(VI), thereby invalidating staff assumptions that uranium concentrations lag behind more "conservative" indicators such as chloride, staff witness Johnson admitted that uranium is less susceptible to removal by adsorption when it is joined or complexed with carbonate, but argued that, owing to the change in chemical environment, these complexes can break down when groundwater moves out of the OZ. Dr. Johnson also maintained that because the published studies cited by Joint Intervenors are based on controlled experiments, the results may not be applicable to the more complex and variable environments encountered in natural aquifers. See Tr. at 722–24, 728–29.

4 .144 The staff's argument in this regard is that the behavior of uranium during transport in groundwater is not yet well understood, so that its "conservative" nature is not established. Consequently, uranium is not as reliable for detecting excursions as the various aforementioned components of production fluids, a point that has also been made by several

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[76](...continued)

> orders of magnitude greater than true baseline; and increases in chloride, alkalinity and TDS in the aquifer will be less than one or two orders of magnitude.

Abitz Initial Testimony at 42–43 (citations omitted).

documents prepared for, or issued by, the staff.[77] That being said, staff witness Johnson also recognized that the efficacy of possible excursion indicators depends on the geochemical environment of the aquifer system at issue. For instance, she maintained that in the case of the Ross Project, chloride, which is usually considered a conservative indicator, likely will be less effective as an indicator of vertical excursions into the DM aquifer than sulfate because of that underlying groundwater system's high chloride background. In other scenarios, alkalinity or sulfate might be affected by the geochemistry of an aquifer system. Nonetheless, according to Dr. Johnson, those three indicators, along with electric conductivity, are considered more conservative excursion indicators than uranium. See Tr. at 729–31; see also Tr. at 695–97, 702 (Schiffer).

4 .145 On balance, the evidentiary record persuades us that, as compared to other possible indicators such as chloride, alkalinity, sulfate, and electrical conductivity, uranium is not as effective a tool for providing a timely alert regarding a lixiviant excursion from an ISR facility. Yet, this would not necessarily end the matter in the face of convincing evidence that, for any particular facility, the aquifer geochemistry would make uranium equal (or better) as a well monitoring testing indicator. Based on the preponderance of the evidence before the Board, however, we conclude that the case for using uranium as an excursion indicator for the Ross Project is not compelling, particularly given Joint Intervenors' failure to present any convincing site-specific evidence to counter the staff and SEI showings that chloride and the other

[77] See Ex. NRC050, at 5 (W.J. Deutsch, et al., Pac. Nw. Lab., Methods of Minimizing Ground-Water Contamination from In Situ Leach Uranium Mining, NUREG/CR-3709 (Mar. 1985)) (stating "[m]any potential indicators (such as uranium and pH) are not conservative," in that "their values will change rapidly as the lixiviant interacts with the sediment" and "dissolved species that interact with the sediment do not travel as rapidly as the water and, thus, would not be useful as an early indicator of an excursion."); NUREG-1569, at 5-41 (stating "[u]ranium is not considered a good excursion indicator because, although it is mobilized by in situ leaching, it may be retarded by reducing conditions in the aquifer.").

indicators proposed for use by SEI and accepted by the staff would be effective excursion indicators at Ross.[78]

4 .146 Also part of Joint Intervenors' challenge to the adequacy of the FSEIS discussion of excursion detection is their assertion that, given the numerous excursions that have occurred at ISR sites that show uranium does migrate beyond the monitoring well ring, the staff's FSEIS conclusion that excursions can be detected and remedied, and thus the long term impacts from excursions will be SMALL, is unsupported in the record. See Joint Intervenors Findings at 79–81, 84 (referencing excursions at the Smith Ranch-Highland and Kingsville Dome ISR sites and citing FSEIS 9A, at 4-43). Further, according to Dr. Abitz, while the staff recognizes these uranium excursions, its mitigation/corrective action of changing pumping rates to recapture a lixiviant plume fails to have "a credible scientific basis because the FSEIS fails to address the needed detailed analysis on the hydrological properties in the exempted aquifer, redox conditions in the aquifer, the availability of various complexing anions, microbial community structure, and structural heterogeneity of the fluvial deposits." Abitz Initial Testimony at 44–45.

4 .147 In our estimation, however, in making its determination that long-term potential impacts to the OZ aquifer outside the exempted portion would be SMALL, the staff's reliance on the SEI program to detect and recover excursions via groundwater pumping is not misplaced. Because a lateral excursion would only impact the water in a non-EPA exempted aquifer if it extended beyond the monitoring ring at the Ross Project, which must be at least 100 feet inside the boundary of the exempted aquifer, see Tr. at 368–69 (Schiffer), we consider Joint

[78] Moreover, our ruling here does not necessarily foreclose the use of uranium as an excursion indicator at the Ross Project for, as was pointed out by SEI witnesses Schiffer and Griffin, Wyoming regulations require SEI to perform a full chemical analysis of monitoring well water samples, which would include uranium, if a detected excursion has not been recovered within thirty days. See Tr. at 319–20 (Schiffer), 782–83 (Griffin).

Intervenors' focus on vertical excursions, see Joint Intervenors Findings at 79–80, as the crux of their concern. In the case of the Smith Ranch-Highland site, the document Joint Intervenors cite as evidence of the nature and extent of the vertical excursions notes that, while upgradient samples were taken to establish baseline, "[e]stablishing a single baseline class of use for all shallow [aquifers] at [Smith Ranch-Highland] is problematic due to [the] presence of abundant and sporadic natural mineralization." Ex. JTI036, at 9 (Wright Envtl. Servs., Inc. & Telesto Solutions, Inc., 2012 Status Update Case Leak Investigation, C, E and F Wellfields, Smith Ranch-Highland Operations (Feb. 20, 2013)). Because the pre-mining and upgradient water quality was highly variable, this report's authors concluded it was difficult to determine how much of the contamination in these aquifers occurred because of casing leaks during ISR mining and how much can be attributed to natural mineralization and historic surface mining. See id. at 9–12. Indeed, to the degree vertical excursions at Smith-Ranch Highland site were caused by an engineering failure, i.e., a casing leak, rather than by a failure of the basic design of the ISR facility, it provides a questionable example in support of the claim that vertical excursions are inevitable. Moreover, relative to the background data for Garcia Hills wells on the Kingsville Dome ISR site submitted by Joint Intervenors, see JTI021, at unnumbered pp. 2, 3, 6 (Carl F. Crownover, Jordan Labs., Inc., Reports of Analysis (May 12, 1988 & July 13, 2007)), the fact that these wells are "just outside" of the monitoring well ring, Joint Intervenors Findings at 81, suggests that, per the circumstances at the Ross Project, they would still be in the EPA exempted aquifer.

4 .148 Joint Intervenors also reference Dr. Abitz's blanket statement that "[a] monitor well that goes on excursion status does not prevent groundwater contamination outside the exemption zone when corrective actions are implemented, as uranium contamination has moved past the monitor-well ring when an excursion is reported," see id. at 84 (citing Abitz

Rebuttal Testimony at 17). This statement, however, does not account for (1) the evidentiary record before us, as discussed in Board Findings 4.142-4.145 above, indicating that lixiviant indicators such as chloride arrive at the monitoring wells before uranium; (2) the fact that at the Ross Project any horizontal uranium excursion would have to move at least 100 feet past the monitor well ring to exit the exemption zone; and (3) the recovery response that is triggered when an excursion is discovered, which is designed to remediate the problem before contaminants move out of the exempted aquifer.

4 .149 Finally, regarding Joint Intervenors' reference to Dr. Abitz's statement claiming the FSEIS analysis inadequately characterizes the exempted aquifer because it fails to account for "redox conditions in the aquifer, the availability of various complexing anions, microbial community structure, and structural heterogeneity of the fluvial deposits," see id. (citing Abitz Initial Testimony at 45), in the face of the evidence presented by SEI and the staff regarding the particulars of Ross Project and SEI's program for excursion detection and recovery,[79] Joint Intervenors again have not provided an adequate evidentiary basis for the Board to endorse the type of extensive analysis they seek as part of the agency's NEPA review for this (and presumably every other) ISR facility. See supra Board Finding 4.22. In a normal aquifer, what they propose is likely to require years of work by a university research team, a task that would be even more difficult in a mineralized system like the OZ aquifer beneath the Ross site with its

[79] This includes evidence regarding (1) the potential for (a) vertical excursions given the bounding properties of the upper and lower confining units and the hydraulic head difference between the OZ and SM aquifers, see Staff Initial Testimony at 43 (citing FSEIS 9A, at 3-34, 3-37, 4-42) (Burgess, Saxon); see supra note 67, and (b) horizontal excursions given the less-permeable and non-mineralized zones within the OZ sandstones, see FSEIS 9A, at 4-41; (2) SEI's license condition responsibilities to deal with unplugged or improperly plugged boreholes, see SEI License at 9 (LC 10.12); see also supra Board Finding 4.128, excursion detection (LC 11.5), see SEI License at 13–14 (LC 11.5), and mechanical integrity testing for wells on a periodic and as-serviced basis, see id. at 7 (LC 10.5); see also FSEIS 9A, at 2-23; and (3) vertical and horizontal excursion recoveries, see GEIS at 2-46 to -48; Griffin Initial Testimony at 4–5; Griffin Rebuttal Testimony at 4; Knode Initial Testimony at 13; Moores Initial Testimony at 8 (computer modeling).

numerous and profound small scale lateral and vertical heterogeneities. In this context, it may be that Joint Intervenors are seeking to have all ISR operations deferred until scientific research has progressed to the point where a complex hydrogeologic system such as that associated with the Ross Project can be completely understood. The Board, however, does not see a basis for imposing an investigative protocol under NEPA that has the practical effect of leaving essentially open-ended the question of how much information is enough.

4. Board Conclusions Regarding EC 3

4 .150 Based on the findings set forth above, the Board concludes that, with the revision to LC 10.12 outlined in Board Finding 4.131 above, a preponderance of the evidence before the Board demonstrates that (1) with the addition of the Board-directed revision to LC 10.12, the FSEIS adequately analyzes the environmental impacts of fluid migration associated with unplugged exploratory boreholes; and (2) SEI's six monitor-well clusters and the twenty-four-hour pump tests at four of these clusters and its excursion detection and recovery protocols, including the use of excursion indicators other than uranium, have provided sufficient information to demonstrate that the staff's conclusions that groundwater control during Ross Project operations would result in SMALL impacts outside the exempted portion of the OZ in the event of an excursion.

V. SUMMARY FINDINGS AND CONCLUSIONS

5 .1 With respect to Joint Intervenors' EC 1, the Board rules that (1) to comply with NEPA and the agency's Part 51 implementing regulations, the applicant's 10 C.F.R. Part 40, Appendix A, Criterion 7 pre-licensing monitoring program for the purpose of site characterization was not required to be conducted so as to provide the information needed to set Appendix A, Criterion 5B groundwater protection standards, in accord with an

Appendix A, Criterion 7A pre-operational license condition-based monitoring program; and (2) Joint Intervenors' challenges to the adequacy of the FSEIS as it was based on the supposed technical deficiencies associated with SEI's monitoring well deployment program (including well numbers and location), SEI's aquifer sampling intervals, the staff's use of sampling results averaging, the purported data bias resulting from standard SEI drilling techniques, the purported data bias resulting from SEI's sequential development of additional wellfields, and the purported data bias associated with using well samples from the Nubeth R&D site cannot be sustained based on the preponderance of the evidence in the record before the Board. As such, a judgment on the merits regarding EC 1 is entered in favor of the staff and SEI.

5 .2 With respect to Joint Intervenors' EC 2, the Board finds that (1) the bounding analysis provided in section 4.5.1.3 of the FSEIS, as supplemented in the record before this Board, provides sufficient information about a reasonable range of the hazardous constituent concentration values associated with a potential 10 C.F.R. Part 2, Appendix A, Criterion 5B(5)(c) post-operational ACL for that Ross Project so as to provide an appropriate NEPA assessment of the environmental impacts that will occur if SEI cannot restore groundwater to primary or secondary limits in accord with Criterion 5B(5)(a)-(b); and (2) the quantitative data from historical ISR groundwater aquifer restoration efforts used to create the bounding analysis in FSEIS section 4.5.1.3 does not invalidate the FSEIS conclusion that the groundwater impacts of aquifer restoration using an ACL on the exempted OZ aquifer and the surrounding aquifers would be SMALL. We thus conclude that EC 2 is resolved on the merits in favor of the staff and SEI.

5 .3 With respect to Joint Intervenors' EC 3, the Board concludes that (1) with the Board-directed revision to LC 10.12, the FSEIS adequately assesses the risk of fluid migration from unplugged and abandoned boreholes; (2) the FSEIS did not improperly assess the risk of

fluid migration in light of its reliance on SEI pump tests to demonstrate aquifer containment; and (3) the FSEIS impacts analysis is accurate in concluding that various lixiviant indicators other than uranium will serve as accurate excursion indicators and that the SEI detection and recovery protocols will result in SMALL impacts outside the exempted portion of the OZ in the event of an excursion. As a consequence, a judgment on the merits regarding EC 3 is entered in favor of the staff and SEI.

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6 .1 Pursuant to 10 C.F.R. § 2.1210, it is this twenty-third day of January 2015, ORDERED, that:

A. Condition 10.12 to license SUA-1601 is revised as set forth in Board Finding 4.128 above, and Joint Intervenors issue statements EC 1, EC 2, and EC 3 are resolved on the merits in favor of the staff and SEI, and the proceeding before this Board is terminated.

B. In accordance with 10 C.F.R. § 2.1210, this initial decision will constitute a final decision of the Commission 120 days from the date of issuance (or the first agency business day following that date if it is a Saturday, Sunday, or federal holiday, see 10 C.F.R. § 2.306(a)), i.e., on Tuesday, May 26, 2015, unless a petition for review is filed in accordance with 10 C.F.R. § 2.1212, or the Commission directs otherwise. Any party wishing to file a petition for review on the grounds specified in 10 C.F.R. § 2.341(b)(4) must do so within twenty-five (25) days after service of this initial decision. The filing of a petition for review is mandatory for a party to have exhausted its administrative remedies before seeking judicial review. Within 25 days after service of a petition for review,

parties to the proceeding may file an answer supporting or opposing Commission review. Any petition for review and any answer shall conform to the requirements of 10 C.F.R. § 2.341(b)(2)-(3).

THE ATOMIC SAFETY
AND LICENSING BOARD[80]

/RA/

G. Paul Bollwerk, III, Chairman
ADMINISTRATIVE JUDGE

/RA/

Craig M. White
ADMINISTRATIVE JUDGE

Rockville, Maryland

January 23, 2015

[80] Dr. Richard F. Cole, a full-time technical member of the Atomic Safety and Licensing Board Panel who served with distinction beginning in 1973, was a member of this Licensing Board from its inception and participated in the September 28 limited appearance session and the September 30-October 1, 2014 evidentiary hearing. Judge Cole passed away in December 2014 before this decision was finalized.

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

NUREG-1910, Vol. 1

Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities

Chapters 1 through 4

Final Report

Manuscript Completed: May 2009
Date Published: May 2009

Prepared by:

U.S. Nuclear Regulatory Commission
Office of Federal and State Materials and
Environmental Management Programs

Wyoming Department of Environmental Quality
Land Quality Division

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EXECUTIVE SUMMARY

BACKGROUND

The Atomic Energy Act of 1954 and the Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) authorize the U.S. Nuclear Regulatory Commission (NRC) to issue licenses for the possession and use of source material and byproduct material. The statutes require NRC to license facilities that meet NRC regulatory requirements that were developed to protect public health and safety from radiological hazards. *In-situ* leach (ISL) uranium recovery facilities must m3eet NRC regulatory requirements in order to obtain this license to operate.

Generic Environmental Impact Statement (GEIS)

A GEIS is an environmental impact statement that assesses the scope of the environmental effects that would be associated with an action (such as issuing a license for an ISL facility) at numerous sites. The Commission directed the NRC staff to prepare the GEIS to cover as many of the potential uranium recovery sites as possible.

Supplemental Environmental Impact Statement (SEIS)

A supplemental EIS updates or supplements an existing EIS (such as the GEIS). The Commission directed the NRC staff to issue site-specific supplements to the GEIS for each new license application.

NRC designed the licensing process to assure the safe operation of ISL facilities. In addition to information for a safety evaluation review, license applicants must submit an environmental report as part of their license application. Under the NRC's environmental protection regulations in the Code of Federal Regulations, Title 10, Part 51 (10 CFR Part 51), which implement the National Environmental Policy Act (NEPA), issuance of a license to possess and use source material for uranium milling requires an environmental impact statement (EIS) or a supplement to an EIS.

NRC prepared the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (GEIS) to help fulfill this requirement. The GEIS was prepared to assess the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISL facility in four specified geographic areas. The intent of the GEIS is to determine which impacts would be essentially the same for all ISL facilities and which ones would result in varying levels of impacts for different facilities, thus requiring further site-specific information to determine the potential impacts. As such, the GEIS provides a starting point for NRC's NEPA analyses on site-specific license applications for new ISL facilities, as well as for applications to amend or renew existing ISL licenses.

PURPOSE AND NEED

Commercial uranium recovery companies have approached NRC with plans to submit a number of license applications for new uranium recovery facilities and for the restart or expansion of existing facilities in the next several years. The large majority of these potential applications would involve use of the ISL process. The companies have indicated that these new, restarted, and expanded ISL facilities would be located in Wyoming, South Dakota, Nebraska, and New Mexico.

NRC is the regulatory authority responsible for issuing a source material license for an ISL facility in those four states. 10 CFR Part 51 regulations require evaluating the environmental impacts of the ISL facility as part of the licensing process. Recognizing that the technology for ISL uranium milling is relatively standardized, that the applications may be submitted over a relatively short period of time, and that the potential ISL facilities would be located in relatively

discrete regions in the western United States, NRC decided to prepare a GEIS to avoid unnecessary duplicative efforts and to identify environmental issues of concern to focus on in site-specific environmental reviews. In this way, NRC could increase the efficiency and consistency in its site-specific environmental review of license applications for ISL facilities and so provide an option for applicants to use and licensees to continue to use the ISL process for uranium recovery.

THE PROPOSED FEDERAL ACTION AND ALTERNATIVES

In states where NRC is the regulatory authority over the licensing of uranium milling (including the ISL process), NRC has a statutory obligation to assess each site-specific license application to ensure it complies with NRC regulations before issuing a license. The proposed federal action is to grant an application to obtain, renew, or amend a source material license for an ISL facility.

Under NRC's environmental protection regulations at 10 CFR 51.20(b)(8), issuing a license to possess and use source material to a uranium milling facility is identified as a major federal action that requires the preparation of an EIS or a supplement to an EIS. NRC will prepare a SEIS for new ISL facility license applications. NRC will prepare an EA, SEIS or EIS for applications to amend or renew an existing ISL facility license.

> **The Proposed Federal Action**
>
> To grant applications to obtain, renew, or amend source material licenses for an ISL facility.
>
> **Purpose for the Proposed Federal Action**
>
> To provide an option for an applicant to use or a licensee to continue to use ISL technology for uranium recovery

The environmental review requirements for a material license are in 10 CFR Part 51. NRC's public health and safety requirements for ISL facilities are found in 10 CFR Parts 20 and 40. Parts 20, 40, and 51 require applicants to provide NRC with sufficient information to evaluate the impacts to public health and safety and the environment during the life-cycle of the ISL facility. NRC then prepares safety and environmental reviews that are used by NRC officials to decide whether to grant the source material license.

In reviewing an ISL license application, NRC will use the GEIS as starting point for its site-specific environmental reviews. NRC will evaluate site-specific data and information to determine whether the applicant's proposed activities and the site characteristics are consistent with those evaluated in the GEIS. NRC will then determine which sections of the GEIS can be incorporated by reference and which impact conclusions can be adopted in the site-specific environmental review, and whether additional data or analysis is needed to determine the environmental impacts to a specific resource area. Additionally, the GEIS provides guidance in the evaluation for certain impact analyses (e.g., cumulative impacts, environmental justice) for which the GEIS did not make impact conclusions. No decision on whether to license an ISL facility will be made based on the GEIS alone. The licensing decision will be based, in part, on a site-specific environmental analysis that makes use of the GEIS.

Uranium milling techniques are designed to recover the uranium from uranium-bearing ores. Various physical and chemical processes may be used, and selection of the uranium milling technique depends on the physical and chemical characteristics of the ore deposit and the attendant cost considerations. Generally, the ISL process is used to recover uranium from low-grade ores or deeper deposits that are not economically recoverable by conventional mining and milling techniques. In the ISL process, a leaching agent, such as oxygen with sodium carbonate, is added to native groundwater and injected through wells into the subsurface ore body to mobilize the uranium. The leach solution containing the mobilized uranium is pumped from there to the surface processing plant, and then ion exchange separates the uranium from the solution. After additional purification and drying, the resultant product, a mixture of uranium oxides also known as "yellowcake," is placed in 55-gallon drums prior to shipment offsite for further processing.

A range of alternatives was evaluated for inclusion in the GEIS. As defined in the GEIS, the proposed federal action is NRC's determination to grant an application to obtain, renew, or amend a source material license for an ISL facility. Under the no-action alternative, NRC would deny the applicant's or licensee's request. As a result, the new license applicant may choose to resubmit the application to use an alternate uranium recovery method or decide to obtain the yellowcake from other sources. A licensee whose renewal application is denied would have to commence shutting down operations in a timely manner. Denials of license amendments would require the licensee to continue operating under its previously approved license conditions.

Alternative methods for milling uranium were considered as possible alternatives to the ISL process. As stated previously, not all uranium deposits are suitable for ISL extraction. For example, if the uranium mineralization is above the saturated zone (i.e., all of the pore spaces in the ore-bearing rock are not filled with water), ISL techniques may not be appropriate. Likewise, if the ore is not located in a porous and permeable rock unit, it will not be accessible to the leach solution used in the ISL process. Because ISL techniques may not be appropriate in these circumstances, conventional mining (underground or open-pit/surface mining) and milling techniques (conventional milling and heap leaching) are viable alternative technologies.

Inasmuch as the suitability and practicality of using alternative milling methodologies depends on site-specific conditions, a generic discussion of alternative milling methodologies is not appropriate. Accordingly, this GEIS does not contain a detailed analysis of alternative milling methodologies. A detailed analysis of alternative milling methodologies that can be applied at a specific site will be addressed in NRC's site-specific environmental review for individual ISL license applications.

ANALYTICAL APPROACH

The GEIS serves to increase efficiency and eliminate repetitive discussions in NRC's environmental review process by identifying and evaluating environmental impacts that are generic and common to ISL uranium recovery facilities. Information from the GEIS can be summarized and incorporated by reference into the subsequent site-specific environmental review documents. The GEIS also identifies resource areas that need site-specific information to more fully determine the environmental impact to particular resource areas. The site-specific environmental impact analysis also will include any new or significant information necessary to evaluate the ISL facility license application.

For the GEIS, NRC identified the potential environmental impacts associated with the ISL process and the resource areas that could be affected. The general methodology for doing so was to (1) describe the ISL process activity or activities that could affect the resource, (2) identify the resource(s) that can be affected, (3) evaluate past licensing actions and associated environmental review documents and other available information, (4) assess the nature and magnitude of the potential environmental impacts to the resource(s), (5) characterize the significance of the potential impacts, and (6) identify site conditions and mitigation measures that may affect the significance. For some types of impacts analyses (e.g., cumulative impacts, environmental justice evaluations), NRC recognized the difficulty in making determinations in the GEIS, given the location-specific nature of these analyses. For these categories, NRC collected information and conducted initial evaluations, which are documented in the GEIS. The purpose of this information gathering and initial evaluation is intended to provide background data and guidance for the site-specific analyses for these types of impact evaluations.

NRC developed this GEIS based on its experience in licensing and regulating ISL facilities gained during the past 30 years. In the GEIS, NRC does not consider specific facilities, but rather provides an assessment of potential environmental impacts associated with ISL facilities that might be located

The principal geochemical reactions caused by the lixiviant are the oxidation and subsequent dissolution of uranium and other metals from the ore body (Davis and Curtis, 2007). These reactions are effectively the reverse of those that initially caused the uranium deposition. The oxidant (oxygen or hydrogen peroxide) in the lixiviant oxidizes uranium from the relatively insoluble tetravalent state (U^{4+}) to the more soluble hexavalent state (U^{6+}). Once the uranium is in the 6+ oxidation state, the dissolved carbonate/bicarbonate causes the formation of aqueous uranyl-carbonate complexes that maintain oxidized uranium in solution as uranyl ion (UO_2^{2+}).

2.4.1.2 Lixiviant Injection and Production

Dissolved carbonate/bicarbonate lixiviants are created by introducing reagents such as sodium carbonate/bicarbonate or by injecting carbon dioxide gas (CO_2) into the groundwater. Carbon dioxide can also be added for pH control (Table 2.4-1). Lixiviant is pumped down injection wells to the mineralized zones, where it oxidizes and dissolves uranium from the sandstone formation (Figure 2.4-1). The uranium-bearing solution migrates through the pore spaces in the sandstone and is recovered by production wells. This uranium-rich (pregnant) lixiviant is pumped to the processing plant or satellite ion-exchange facility, where the uranium is extracted through a series of chemical processes. Stripped of its uranium, the now-barren lixiviant is recharged with carbonate/bicarbonate and oxidant, and the solution is returned through the injection wells to dissolve additional uranium. This process continues until the operator determines that further uranium recovery is uneconomical.

Lixiviant Selection

The geology and groundwater chemistry determine the proper leaching techniques and chemical reagents ISL milling uses for uranium recovery. For example, if the ore-bearing aquifer is rich in calcium (e.g., limestone or gypsum), alkaline (carbonate) leaching might be used [e.g., as discussed by Hunkin (1977)], acid systems were generally considered unsuitable for Texas deposits because of higher carbonate]. Otherwise, acid (sulfate) leaching might be preferable. The leaching agent chosen for the ISL operation may affect the type of potential contamination and vulnerability of aquifers during and after ISL operations.

For example, acid leaching ISL uranium recovery at Nine Mile Lake and Reno Ranch, Wyoming, presented two major problems: (1) gypsum precipitated on well screens and within the aquifer during uranium recovery, plugging wells and reducing the formation permeability (critical for economic operation) and (2) the precipitated gypsum gradually dissolved after restoration, increasing salinity and sulfate levels in groundwater (Mudd, 2001).

Typical ISL uranium recovery operations in the United States use an alkaline sodium bicarbonate system to remove the uranium from ore-bearing aquifers. Alkaline lixiviants are used in all currently active and proposed ISL facilities in Wyoming, Nebraska, and New Mexico (NRC, 2006, 2004, 1998a, 1997a; Energy Metals Corporation, U.S., 2007) (see Table 2.4-1). Alkaline-based ISL operations are considered to be easier to restore than acid mine sites (Tweeton and Peterson, 1981; Mudd, 1998).

During the uranium recovery process, the groundwater in the production zone becomes progressively enriched in uranium and other metals that are typically associated with uranium in nature. The most common metals are arsenic, selenium, vanadium, iron, manganese, and radium. These and other constituents such as chloride, which is introduced by the ion-exchange resin system, are removed or precipitated from the groundwater during aquifer restoration after uranium recovery is completed. Aquifer restoration is detailed in Section 2.5.

The production wells are normally positioned to pump pregnant lixiviant from a number of injection wells. After processing for the uranium but before reinjection below ground, about 1–3 percent of the lixiviant, called the production bleed, is removed from the circuit and disposed (see Section 2.7.2). The purpose of the production bleed is to ensure that more groundwater is extracted than re-injected. Maintaining this negative water balance helps to ensure that there is a net inflow of groundwater into the well field to minimize the potential movement of lixiviant and its associated contaminants out of the well field.

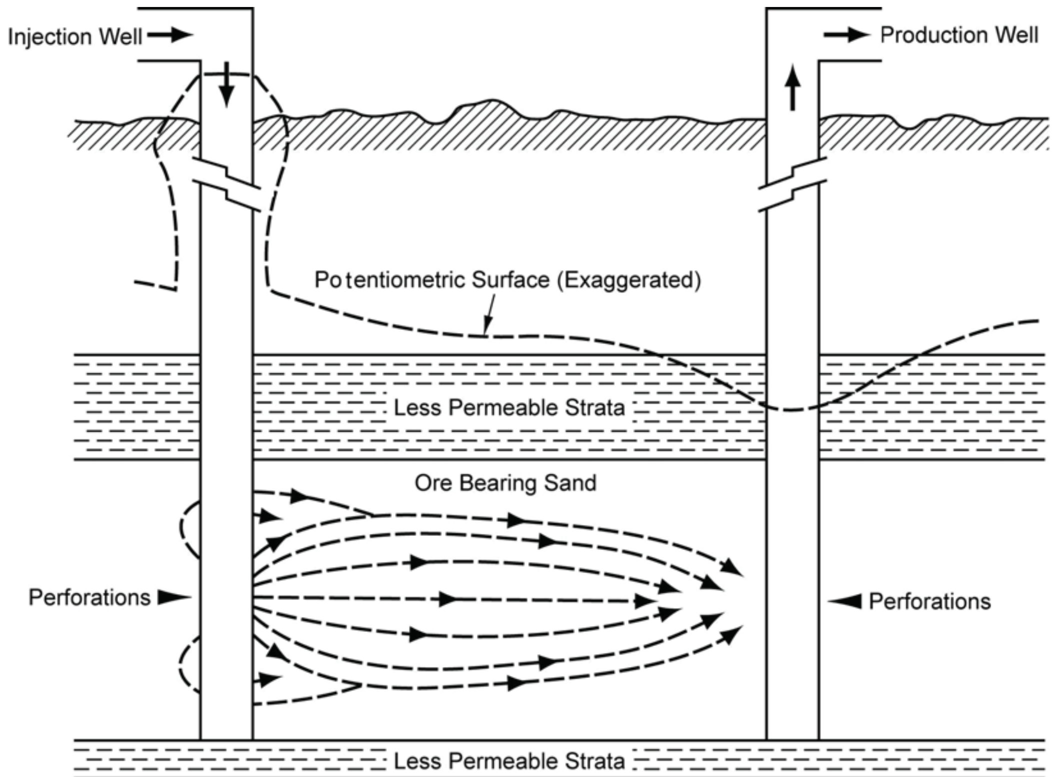

Figure 2.4-1. Idealized Schematic Cross Section To Illustrate Ore-Zone Geology and Lixiviant Migration From an Injection Well to a Production Well (From NRC, 1997a)

Pregnant lixiviant is pumped from the well fields by submersible pumps located in each production well. In some cases, booster pumps are installed in the lines to the processing plants or satellite facilities. Given the seasonal temperature variation in the four regions considered in this GEIS, the main injection and production lines to and from the processing plants may be buried up to several meters [feet] to prevent freezing. These lines are usually 10.2- to 35.6-cm [4- to 14-in]-diameter high-density polyethylene or PVC pipes. The pregnant lixiviant is enriched in uranium relative to groundwater {typically about 60 mg/L [0.0005 lb/gal]} and is also likely to contain the trace elements and contaminants as discussed previously. The pipeline pressures are monitored continuously for spills and leaks.

2.4.1.3 Excursions

ISL operations may affect the groundwater quality near the well fields when lixiviant moves from the production zone and beyond the boundaries of the well field. This unintended spread, either horizontally or vertically, of recovery solutions beyond the production zone is known as an excursion. An excursion can be caused by

- Improper water balance between injection and recovery rates
- Undetected high permeability strata or geologic faults
- Improperly abandoned exploration drill holes

- Discontinuity within the confining layers
- Poor well integrity, such as a cracked well casing or leaking joints between casing sections
- Hydrofracturing of the ore zone or surrounding units

NRC license and underground injection control (UIC) permit conditions require that licensees conduct periodic tests to protect against excursions. These include but are not limited to

- Conducting pump tests for each well field prior to operations within the well field to evaluate the confinement of the production horizon
- Continued well field characterization to identify geologic features (e.g., thinning confining layers, fractures, high flow zones) that might result in excursions
- Mechanical integrity testing of each well to check for leaks or cracks in the casing

An excursion that moves laterally from the production zone is a horizontal excursion. Vertical excursions occur where barren or pregnant lixiviant migrates into other aquifers above or below the production zone.

2.4.1.4 Excursion Monitoring

Licensees must maintain groundwater monitoring programs (see Chapter 8) to detect both vertical and horizontal excursions and must have operating procedures to analyze an excursion and determine how to remediate it. Monitoring wells are sampled at least every 2 weeks during well field operations to verify that ISL solutions are contained within the operating well field (NRC, 2003a). Geochemical excursion indicators are identified based on well field preoperational baseline water quality (see text box "Identifying Excursion Indicators and UCLs").

Identifying Excursion Indicators and UCLs

The applicant or licensee proposes excursion indicators and upper control limits (UCLs) based on lixiviant content and baseline groundwater quality (see Section 2.2.7). The licensee's safety evaluation and review panel (SERP) approve the excursion indicators and proposed UCLs. The SERP-approved UCLs are subject to the NRC staff review and oversight. UCLs are set on a well field basis and are concentrations for excursion indicators that provide early warning if leaching solutions are moving away from the well fields. As described in NRC (2003a, Section 5.7.8.3), the best excursion indicators are easily measurable parameters that are found in higher concentrations during ISL operations than in the natural waters. For example, at most ISL uranium recovery operations, chloride is selected because it does not interact strongly with minerals in the subsurface, it is easily measured, and chloride concentrations are significantly increased during ISL operations. Conductivity, which is correlated to total dissolved solids, is also considered a good excursion indicator because of the high concentrations of dissolved constituents in the lixiviant as compared to the surrounding aquifers (Staub, et al., 1986; Deutsch, et al., 1985). Total alkalinity (carbonate plus bicarbonate plus hydroxide) is used as an indicator in well fields where sodium bicarbonate or carbon dioxide is used in the lixiviant.

A minimum of three excursion indicators is selected, and the UCLs are determined using statistical analyses of the preoperational baseline water quality in the well field. The NRC staff has identified several statistical methods that can be used to establish UCLs. For example, in areas with good water quality (total dissolved solids less than 500 mg/L), the UCL may be set at a value of 5 standard deviations above the mean of the measured concentrations. Conversely, if the chemistry or a particular excursion indicator is very consistent, a concentration may be specified as the UCL. If baseline data indicate that the groundwater is homogeneous across the well field, the same UCLs may be used for all monitoring wells. Alternatively, if the water chemistry in the well field is highly variable, UCLs may be set for individual wells. An excursion is defined to occur when two or more excursion indicators in a monitoring well exceed their UCLs (NRC, 2003a). Alternate excursion detection procedures (e.g., one excursion indicator exceeded in a monitor well by a specified percentage) may also be used if approved by NRC.

The spacing of horizontal excursion monitoring wells is based on site-specific conditions, but typically they are spaced about 90–150 m [300–500 ft] apart and screened in the production zone (NRC, 2003a, 1997a; Mackin, et al., 2001a; Energy Information Administration, 1995). The distance between monitoring wells and the distance of monitoring wells from the well field are typically similar (NRC, 2006, 1997a). The specific location and spacing of the monitoring wells is established on a site-by-site basis by license condition. It is often modified according to site-specific hydrogeologic characteristics, such as the extent of the confining layer, hydraulic gradient, and aquifer transmissivity. Well placement may also be modified as the licensee gains experience detecting, recovering, and remediating these excursions.

NRC licenses also include requirements to establish monitoring wells in overlying and, as appropriate, in underlying aquifers to detect vertical excursions. Although uranium deposits are typically located in hydrogeologic units bounded above and below by adequately confining units, the possibility of vertical contaminant transport must be considered. Historically, these monitoring wells are more widely spaced than those within the host aquifer, although underlying aquifer monitoring wells may not be required under some circumstances (Mackin, et al., 2001a).

Historically, frequency of vertical monitoring wells at licensed ISL facilities has been (1) one monitoring well per 1.6 ha [4 acres] of well field in the first overlying aquifer, (2) one monitoring well per 3.2 ha [8 acres] in each higher aquifer, and (3) one monitoring well per 1.6 to 3.2 ha [4 to 8 acres] in the underlying aquifer (Mackin, et al., 2001a). These monitoring wells are typically sampled every 2 weeks during operations.

An excursion is defined to occur when two or more excursion indicators in a monitoring well exceed their UCLs (NRC, 2003a). Alternatively, since the advent of performance-based licensing, procedures to identify excursions can be imposed through site-specific license conditions. For example, an excursion may be defined to occur when one excursion indicator is exceeded in a monitoring well by a certain percentage. If an excursion is detected, the licensee takes several steps to notify NRC and confirm the excursion through additional and more frequent sampling (NRC, 2003a) (see Chapter 8). As described in NRC guidance (NRC, 2003a, Section 5.7.8.3), licensees typically retrieve horizontal excursions by adjusting the flow rates of the nearby injection and production wells to increase process bleed in the area of the excursion. To address vertical excursions, licensees may adjust injection and production flow rates in the area of the excursion and pump directly from the affected monitoring wells or from other wells drilled for that purpose. Vertical excursions are more difficult to retrieve, persisting for years in some cases (see Section 2.11.4). If an excursion cannot be recovered, the licensee may be required to stop injection of lixiviant into a well field (NRC, 2003a, Section 5.7.8.3).

2.4.2 Uranium Processing

Uranium is recovered from the pregnant lixiviant and processed into yellowcake in a multistep process (Figure 2.4-2). The following sections briefly describe key aspects of the uranium process circuit.

2.4.2.1 Ion Exchange

As pregnant lixiviant from the production wells enters the ion-exchange circuit, it may either be stored in a surge tank or sent directly to the ion-exchange columns (Figure 2.4-3). The ion-exchange columns contain ion-exchange resin composed of small, negatively charged

disposed in the licensed Class I UIC deep disposal well and about 14,370,000 L [3,800,000 gal] was discharged to the evaporation pond system (Cameco Resources, 2008).

Table 2.11-3. Onsite Quantities of Process Chemicals at *In-Situ* Leach Facilities*

Chemical	Typical Onsite Quantity	Use in Uranium ISL Process
Ammonia (NH_3)	40,820 kg [90,000 lb]	pH adjustment
Sulfuric acid (H_2SO_4)	37,850 L [10,000 gal]	pH control during lixiviant processing, and splitting uranyl carbonate complex into CO_2 gas and uranyl ions in preparation for their precipitation
Liquid and gaseous oxygen	No specific typical quantities available	Oxidant in lixiviant, and precipitation of uranium as an insoluble uranyl peroxide compound
Hydrogen peroxide (H_2O_2)	26,500 L [7,000 gal]	Uranium precipitation and oxidant in lixiviant
Sodium hydroxide (NaOH)	Typically stored in 208-L [55-gal] drums	pH adjustment
Barium chloride ($BaCl_2$)	No specific typical quantities available	Precipitation of radium during groundwater restoration, and wastewater treatment
Carbon dioxide (CO_2)	No specific typical quantities available	Carbonate complexing
Hydrochloric acid (HCl)	37,850 L [10,000 gal]	pH adjustment
Sodium carbonate (Na_2CO_3)	64,350 L [17,000 gal]	Carbonate complexing and resin regeneration
Sodium chloride (NaCl)	127,000 kg [280,000 lb]	Resin regeneration
Hydrogen sulfide (H_2S)	No specific typical quantities available	Groundwater restoration
Sodium sulfide (Na_2S)	No specific typical quantities available	Groundwater restoration

*Mackin, P.C., D. Daruwalla, J. Winterle, M. Smith, and D.A. Pickett. NUREG/CR–6733, "A Baseline Risk-Informed Performance-Based Approach for *In-Situ* Leach Uranium Extraction Licensees." Washington, DC: NRC. September 2001.

2.11.4 Excursions

As discussed in Section 2.4, ISL operations may affect the groundwater quality near the well fields or in overlying or underlying aquifers if lixiviant travels from the production zone and beyond the well field boundaries. Monitoring wells are designed and placed to detect any lixiviant that moves out of the production zone. A monitoring well is placed on excursion status when two or more excursion indicators exceed their respective upper control limits (UCLs)

(NRC, 2003a). Alternate excursion detection procedures (e.g., one excursion indicator exceeded in a monitoring well by a specified percentage) may also be used if approved by NRC. NRC licensees are required by license conditions to identify reporting, monitoring, and response measures to be taken to determine the extent and cause of the excursion, as well as measures to recover the excursion and remove the well from excursion status.

Historical information for several facilities indicates that excursions occur at ISL operations (NRC, 2006, 1998a,b, 1995; Crow Butte Resources, Inc., 2007; Cameco Resources, 2008; Arbogast, 2008). For example, from 1987 to 1998, 49 wells were placed on excursion status at the Irigary and Christensen Ranch uranium recovery facility in Campbell and Johnson Counties in the Wyoming East Uranium Milling Region (NRC, 1998a). Most of these excursions were recovered within a period of weeks to months, but six vertical excursions proved more difficult to return to baseline, with two wells remaining on excursion status for at least 8 years. These excursions were believed to be due to improperly abandoned wells from earlier exploratory programs prior to regulation by a UIC program. In 2007, three wells were on excursion status at the Christensen Ranch project, with only one, originally identified in 2004, remaining on excursion status at the end of 2007 (Arbogast, 2008a). None of the earlier excursions that affected monitoring wells identified in NRC (1998a) were on excursion status in 2007 (Arbogast, 2008b). An additional well at the Christensen Ranch project was placed on excursion status in 2008 (Arbogast, 2008b).

From 1988 through 1995, 22 monitoring wells (11 vertical and 11 horizontal) were placed on excursion status for the Highland Uranium Project located in Converse County in the Wyoming East Uranium Milling Region (NRC, 1995). Most of the excursions were recovered within less than 1 year, but four horizontal excursions lasted up to at least five years. In two of these wells, the excursions were due to a thinning of the confining layer that separated two production zones. Groundwater pumping during restoration of the underlying production zone resulted in a hydraulic gradient that brought excursion fluids down from the overlying aquifer. One of the other excursions was believed to be the result of fluids migrating from an upgradient abandoned uranium mine (NRC, 1995). No cause was identified for the other long-term excursion at the Highland Uranium Project. Only one horizontal excursion was reported between 2001 and 2005 at the Smith Ranch-Highland uranium recovery facility, and corrective action brought the well back below the UCLs within less than one month (NRC, 2006).

At the Crow Butte ISL facility located in Dawes County, Nebraska (Nebraska-South Dakota-Wyoming Uranium Milling Region), the operator reported five vertical excursions into the overlying aquifer from the start of commercial operations in 1989 through the license renewal in 1998 (NRC, 1998b). In two cases, these excursions resulted from well integrity problems (borehole cement contamination and a failed casing coupling). One excursion resulted from a leak in a plugged and abandoned injection well, and the remaining two were believed to result from natural fluctuations in the groundwater quality (NRC, 1998b). Between 1999 and 2006, 17 wells at the Crow Butte facility were placed on excursion status (7 vertical and 10 horizontal) Most of these wells were restored below the UCLs within 1 to 6 months, although one vertical well took almost four years to restore (Crow Butte Resources, Inc., 2007). In the second half of 2007, three horizontal monitoring wells were on excursion status (Cameco Resources, 2008). These excursions were first identified in April 2000, December 2003, and September 2006 (Crow Butte Resources, Inc., 2007). The licensee believes that these longer term excursions resulted from well field geometry and well field flare as a result of ongoing groundwater transfer and well field restoration activities.

Operational experience at these facilities indicates that lixiviant excursions can result from

- Thinning or discontinuous confinement
- Improperly abandoned wells that may provide vertical flow pathways
- Casing failure or other well leaks
- Natural fluctuations in groundwater quality
- Improper balance of well field hydrologic gradients

Most horizontal excursions were recovered quickly (weeks to months) by repairing and reconditioning wells and adjusting pumping rates in the well field, consistent with the findings of Mackin, et al. (2001a). Vertical excursions tended to be more difficult to recover than horizontal excursions, and in a few cases, a well remained on excursion status for as long as 8 years.

2.11.5 Aquifer Restoration

Operational history at NRC-licensed ISL facilities is available to examine aquifer restoration at the well-field scale. Table 2.11-4 shows a summary of restoration data for a 12-ha [30-acre] area covered by Production Units 1–9 at the commercial-scale Cogema Irigaray ISL facility (Cogema, 2006a,b). A comparison of the baseline and postrestoration stability monitoring groundwater analytical data determined that for the water quality in the production zone, the individual restoration and stabilization data fell within the baseline ranges for all constituents except for calcium, magnesium, sodium, carbonate, chlorine, ammonium, total dissolved solids, conductivity, alkalinity, lead, barium, manganese, and radium-226. These data showed that, when comparing premining baseline ranges to postmining stabilization ranges, several constituents did not meet the premining baseline concentration levels. Additionally, postmining mean concentrations for nearly half of the constituents exceeded the premining baseline mean concentrations for the same constituents in Production Units 1–9 (Cogema, 2006a,b).

Catchpole, et al. (1992a,b) provide an early discussion of small-scale restoration efforts for research and development of ISL uranium recovery facilities in Wyoming. These include the Bison Basin facility in Fremont County (described in NRC, 1981), the Reno Creek project in Campbell County, and the Leuenberger Project in Converse County. Restoration activities required treatment of water from nine pore volumes at Bison Basin and five pore volumes at Reno Creek. In all cases, most water quality parameters were returned to within a statistical range of baseline values with the exception of uranium (Bison Basin and Reno Creek) and radium-226 (Leuenberger). For these parameters, Catchpole, et al. (1992a,b) report that water in the well field was returned to the same class of use.

Davis and Curtis (2007) detailed available information on aquifer restoration at ISL uranium recovery facilities. These include a pilot scale study by Rio Algom for the Smith Ranch facility in Converse County, Wyoming (Rio Algom Mining Corporation, 2001); the proposed Crownpoint ISL facility near Crownpoint, New Mexico (NRC, 1997); the commercial-scale A-Well Field at the Highland Uranium Project in Converse County, Wyoming (Power Resources, Inc., 2004a); and the commercial-scale Crow Butte Mine Unit No. 1 in Dawes County, Nebraska (NRC, 2002, 2003c). Rock core laboratory studies that Hydro Resources Inc. conducted for the Crownpoint facility (NRC, 1997a) also provide useful insights to water quality parameters that may present challenges for aquifer restorations.

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Crook County, Wyoming

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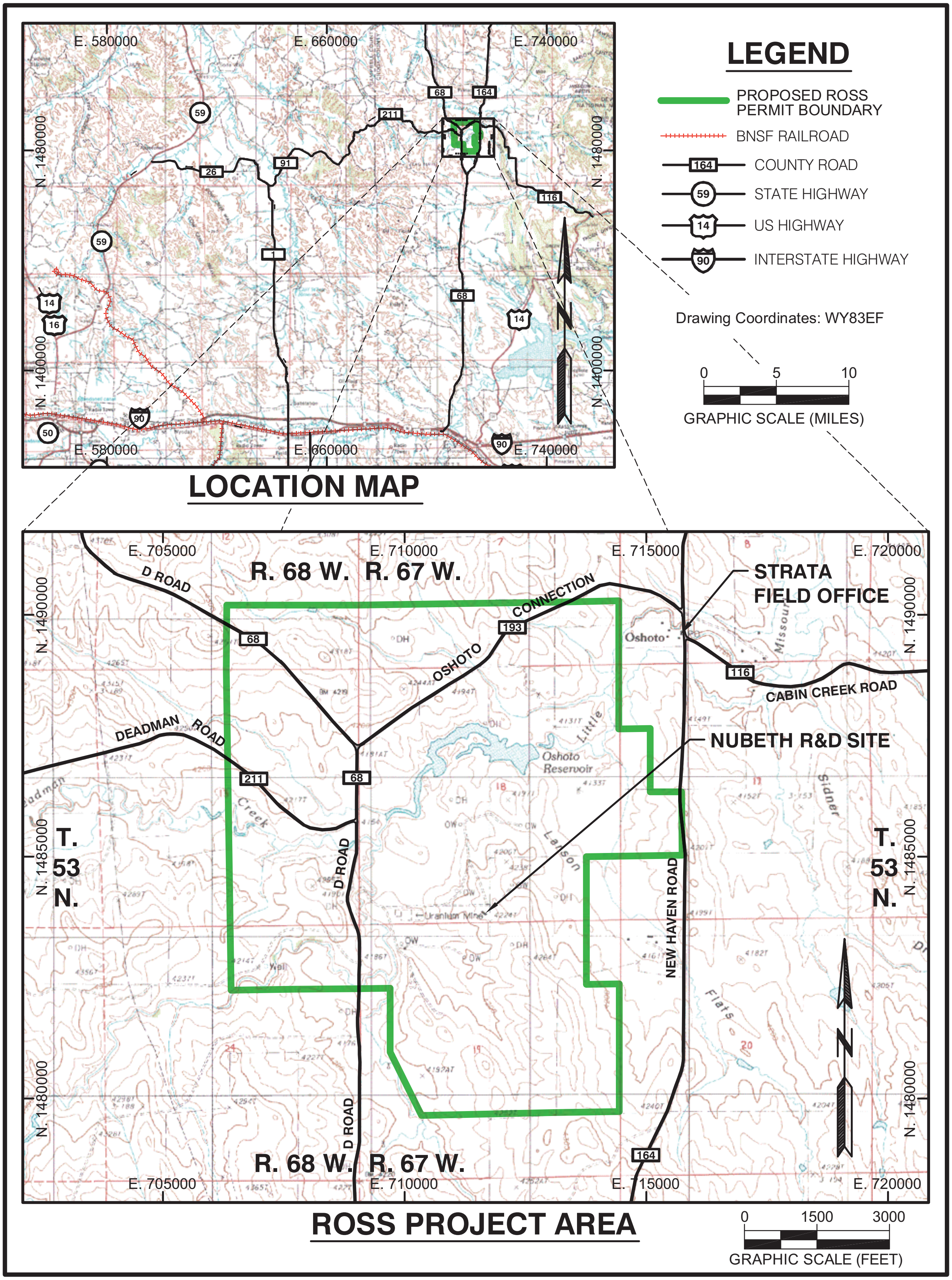

Figure 3.2-1. Existing Transportation Network

3.3 Geology and Soils

The regional geology and seismology related to the Lance District in general, and the local geology and seismology specifically related to the Ross ISR Project area are described in this section. Detailed information regarding the structure, stratigraphy, and ore mineralogy of the proposed project area are discussed to the extent that 10 CFR Part 40.32(e) allows Strata to obtain sufficient subsurface information by exploration drilling. Also included in this section is a detailed description of the soils characteristics of the proposed project area.

3.3.1 Regional Setting

3.3.1.1 Structural Geology

The Lance District is geographically located along the west side of Crook County in northeastern Wyoming. It is structurally situated between two major tectonic features: the Black Hills uplift to the east and the Powder River Basin to the west. Both of these structural features are related to the Laramide Orogeny (uplifts of the Rocky Mountain region). The Black Hills of South Dakota and Wyoming are commonly referred to as a classic example of doming of the basement (Lisenbee 1978). The Black Hills uplift is the easternmost and least deformed of the Laramide uplifts of the Rocky Mountain region (Lisenbee 1978). Figure 3.3-1 depicts the regional tectonic setting. The structural relief of this uplift is of a moderate nature compared to other uplifts of the Wyoming province (Lisenbee 1978).

Structural deformation that developed the Black Hills uplift and Powder River Basin was initiated in the Late Cretaceous and Early Tertiary (Paleocene) as Laramide crustal stresses. Erosion accompanied uplifting, and sediments stripped off from the growing uplift filled the structural basin that was synchronously developed to the west during the Laramide Orogeny. The depositional environments at that time consisted of near sea level low-relief streams, flood plains, sloughs, and swamps that were inland of the open sea that lay to the northeast. Through the Paleocene and into the Eocene, the Powder River Basin subsided intermittently, followed by periods of stability resulting in the accumulation of several thousand feet of interbedded sands, silts, clays and coal deposited in a near sea level environment. Deposition of the Paleocene Fort Union Formation and Eocene Wasatch Formation was

followed by the deposition of the Oligocene White River Group, which covered the Powder River Basin (Lisenbee 1988). The White River Group sediments were deposited with angular unconformity across most of the eroded roots of the uplift as well. During the Oligocene and Miocene Epochs, extensive volcanism to the west provided a source of thick accumulations of tuffaceous sediments that extended over much of the Powder River Basin and covered all but the highest mountain ranges (Mears 1993).

The age of the major regional uplift that resulted in the removal of most of the White River Group and formed the present-day Black Hills has been established as late Oligocene, or possibly as late as Pliocene (Whitcomb and Morris 1964 and Lisenbee 1988). Several erosional cycles in the stream valleys suggest that uplifting and exhumation has continued throughout the Tertiary Period. Uplifting may even prevail at the present time as streams in the Black Hills region apparently are downcutting (Whitcomb and Morris 1964). The north-northeast trending drainages in the Powder River Basin have continued their downcutting through recent time resulting in the present topography of the area (Mears 1993).

The Black Hills uplift is a broad north-trending domal structure approximately 180 miles long and 75 miles wide with its core comprised of Precambrian basement rocks. The intrusion of several large igneous masses into the rocks underlying the area accompanied the uplifting. The tectonic map of the Black Hills uplift and eastern Powder River Basin is depicted in Figure 3.3-2. In detail, the uplift is not a simple fold, but rather consists of two primary, north-trending en-echelon structural blocks, the western block and the eastern block. The flanks of the uplift display different characteristics, with a sharp monoclinal break on the west side of the western block and a broad arch on the east side of the eastern block (Lisenbee 1988). The structurally highest part of the uplift is on the eastern block centered on the exposed Precambrian core. The western block is bounded on the west by the Black Hills monocline. The north-trending monocline separates the gently west-dipping strata of the Powder River Basin from the uplift for a strike length of approximately 150 miles. The maximum values of westerly dips in the rotated limb range from 15 degrees west to vertical along strike (Lisenbee 1988).

The Powder River Basin, which borders the western flank of the Black Hills uplift, is a structurally asymmetric Tertiary intermontane basin having primarily Tertiary-age rocks exposed at the surface. The synclinal axis of the

basin is located along and near its western margin. Along the basin's eastern margin the structural dip of the sedimentary units is 1-2 degrees basinward. As described by Lisenbee (1988), the resistant Paleozoic strata are dramatically exposed in the monoclines along the western margin of the Powder River Basin and form an impressive topographic front at the eastern flank of the Big Horn Mountains approximately coincident with the uplift margin. In contrast, the eastern basin margin is undistinguished topographically. The Cretaceous units are only rarely reflected in topography at the Black Hills monocline, so the uplift and basin are at roughly the same elevation for much of their shared length.

3.3.1.2 Stratigraphy

The regional stratigraphy of the Black Hills uplift and adjacent Powder River Basin includes Precambrian crystalline basement rocks, Paleozoic, Mesozoic and Cenozoic sediments, along with some localized occurrences of igneous intrusive rocks. The regional stratigraphic column is depicted in Figure 3.3-3. The rocks of western Crook County are predominantly clastic and range from claystone to fine-grained sandstone. Some coarse and conglomeratic sandstone and massive limestone occur near the base of the stratigraphic sequence at great depth below land surface. This sedimentary series is underlain by igneous and metamorphic rocks of Precambrian age (Whitcomb and Morris 1964). Figure 3.3-4 depicts the regional bedrock geologic map. Sedimentary rocks of Mississippian age and older are not exposed on the surface along the northern and western flanks of the Black Hills uplift, nor are the Precambrian age crystalline basement rocks (Robinson et al. 1964). Sediments exposed in the Lance District are primarily limited to Lower (or Early) and Upper (or Late) Cretaceous and Quaternary age with the vast majority of the Tertiary age sediments being eroded away.

The Lower Cretaceous sedimentary units include the Lakota and Fall River Formations of the Inyan Kara Group. These sediments represent a transitional environment with terrestrial fluvial sequences grading into marginal marine sediments as the Cretaceous Interior Seaway inundated a stable land surface. Sandstone deposits of the Fall River Formation are known to be uraniferous both locally and regionally (Robinson et al. 1964). Uranium occurrences in the Carlile, Hulett Creek, and Elkhorn Creek areas were mined by a number of companies during the 1950s and 1960s from sandstones of the Fall River Formation.

unit at monitoring sites located in the lowland areas appear to correlate with water levels in Oshoto Reservoir. Piezometer SA43-18-3 is located near Oshoto Reservoir, where the surficial aquifer appears to be influenced and routinely flushed by infiltrating surface water. SA43-18-1 and SA43-18-2 are located upgradient and significantly further from Oshoto Reservoir and the Little Missouri River. The water in these wells is likely relatively stagnant, contributing to the higher dissolved solids.

3.4.3.5.2.3 Existing Water Supply Wells

As part of the baseline groundwater inventory, Strata identified all of the currently operable water supply wells within the proposed project area and surrounding 2 km (1.2 mi) area. The wells, depicted in Figure 3.4-33 and summarized in Table 3.4-44, were identified through the groundwater rights search, landowner interviews and field investigations.

A total of 29 existing water supply wells were identified and sampled including 2 industrial wells, 15 stock wells and 12 wells used for domestic use. No domestic wells are located within the proposed project area; all sampled domestic wells were in the surrounding area. The industrial wells were permitted in the early 1980s and completed at depths of 536 and 750 feet. The majority of the stock wells were permitted through the WSEO with permit dates ranging from 1953 to 2010. According to the WSEO (2010), completion depths of permitted stock wells range from 40 to 304 feet. According to WSEO records, the completion depths for the domestic wells range from 150 to 600 feet.

The wells were sampled on a quarterly basis with sample commencement between 3rd quarter 2009 and 1st quarter 2010. Samples were collected in bottles provided by the contract laboratory and analyzed for constituents listed in Table 3.4-11. Sample results are summarized below.

<u>Industrial Wells</u>

Two industrial wells, 19XX18 and 22X-19, were sampled as part of the existing water supply well baseline groundwater monitoring. A third industrial well (789V) could not be accessed. These three wells provide water for enhanced oil recovery within the proposed project area. The 19XX18 and 789V wells are permitted as two separate wells; however, water from well 19XX18 is piped to well 789V and comingled for injection. All samples were collected from a water spigot on the line from the 19XX18 well, while water from well 789V

could not be accessed. As previously stated, the 19XX18 well was utilized as the recovery well at the Nubeth R&D site prior to being converted to a water supply well for oil and gas operations in the 1980s. A discussion of the 19XX18 water quality while under ownership of Nuclear Dynamics is presented in Section 3.4.3.5.2.4.

The 19XX18 and 22X-19 wells, located within the proposed project area, have water chemistry similar to the OZ wells of the regional baseline monitoring network. This similarity in water quality would be expected since these two wells are completed in the OZ unit, although the 22X-19 is also completed in the DM zone as described in Section 3.4.3.3.1. The water in the industrial wells is dominated by sodium and sulfate ions and has moderate concentrations of TDS, as presented in Table 3.4-45.

Radiological constituents were detected in both wells, with the highest concentrations measured in the 19XX18 well. Overall, the results were consistent with the OZ wells in the regional baseline monitoring network.

Water quality in the industrial wells was compared to WDEQ class of use standards. The results indicate that the water is likely suitable for industrial use only (Class IV), due to high concentrations of radium-226, radium-228, and gross alpha. Similarly, the combined radium-226 and radium-228 and gross alpha concentrations exceed the EPA MCLs. The WDEQ and EPA standards for combined radium-226 and radium-228 and gross alpha are 5 and 15 pCi/L, respectively.

Stock Wells

Fifteen stock wells were sampled within and surrounding the proposed project area. The analytical results indicate variation in water chemistry similar to that found in the SA unit characterized in the regional baseline monitoring network.

The piper diagram presented in Figure 3.4-34 illustrates the major ion chemistry of the stock wells. The piper diagram shows that 10 of the wells are dominated by sodium, 1 is calcium dominant, and the remaining 4 have incomplete cation dominance, with a blend of sodium, calcium, and magnesium. Additionally, the figure shows that most of the wells are bicarbonate dominant, while four contain at least 30% sulfate and one is sulfate dominant. The variability in water chemistry is reflective of the variability in stock well depth, which ranges from about 40 to 300 feet.

Stock well water quality results are provided in Table 3.4-46. The sample results indicate relatively higher concentrations of selenium, uranium and/or radiological constituents in about half of the wells. Two wells measured higher uranium and selenium levels than the regional baseline OZ wells. All of the wells measured near or below detection limits for lead-210, polonium-210, radium-228, and thorium-230. Increased concentrations of radium-226 were measured in several wells as were relatively high levels of gross alpha.

The groundwater quality of the stock wells was compared to WDEQ and EPA standards. A comparison with WDEQ class of use standards is presented in Table 3.4-47. The table illustrates the broad range of stock well water quality. About half of the stock wells do not meet the Class I, II, or III suitability criteria for gross alpha. In contrast, one well met Class I class of use standards. The remaining wells appear to meet all agricultural (Class II) or livestock (Class III) class of use standards.

The groundwater quality of the stock wells was also compared to the EPA drinking water standards. The results, presented in Table 3.4-48, indicate that the water produced by half of the wells exceeds at least one primary standard (most often uranium and gross alpha), while all but one well yielded water samples that exceed one or more secondary standards (TDS, sulfate, and/or manganese). This table is presented for comparison with other wells only, since these wells are not used as a domestic drinking water supply.

Domestic Wells

Strata sampled 12 domestic wells near the proposed project area. As shown on Figure 3.4-33, the closest domestic well (DWWELL01) is about 0.12 mile outside the proposed project area. The monitoring results are presented in Table 3.4-49.

The piper diagram of the average water quality in domestic wells, Figure 3.4-35, shows that the water in all domestic wells is sodium dominant, while four wells had calcium plus magnesium levels of about 15% to 40%. Anion dominance was divided between bicarbonate and sulfate. TDS concentrations ranged from about 500 to 2,000 mg/L.

All of the domestic wells measured near or below the detection limit for selenium, while several wells had measurable concentrations of uranium and radiological constituents, including radium-226 and 228 and gross alpha.

The groundwater quality in nearby domestic wells was compared to WDEQ class of use standards. The results, presented in Table 3.4-50, indicate the water generally meets class of use standards for livestock and industrial uses. In the majority of domestic wells, TDS and sulfate exceed Class I (domestic) and II (agriculture) class of use standards. Four of the wells measured gross alpha in excess of the WDEQ standard (15 pCi/L) in at least one sample.

The monitoring results for the domestic wells were also compared to EPA drinking water standards, as presented in Table 3.4-51. One well exceeded MCLs for uranium and gross alpha, and another exceeded the MCL for arsenic. Three more exceeded the MCL for gross alpha in at least one sample, although the average concentrations were less than the MCL. Based on the very limited construction information available for the nearby domestic wells and the limited availability of geologic information near the Fox Hills Formation outcrop where most of the wells are completed, it was generally not possible to assign the domestic wells to a particular completion interval.

3.4.3.5.2.4 Nubeth R&D Groundwater Quality

As part of the Nubeth R&D site, Nuclear Dynamics monitored groundwater quality during all phases of the ISR uranium recovery process, including baseline, uranium recovery, and aquifer restoration. Prior to initiating uranium recovery operations, Nuclear Dynamics developed a “five spot” wellfield including recovery, injection, buffer, sampling and monitor wells. Records for the Nubeth R&D site indicate that groundwater samples were collected from nine wells, as summarized in Table 3.4-52.

Records indicate that Nuclear Dynamics began uranium recovery operations in August 1978. Groundwater monitoring results from April 4, 1978 were used to assess baseline monitoring water quality. Key constituent concentrations for each well are summarized in Table 3.4-53.

The major ion chemistry of the wells indicates that groundwater was dominated by sodium, sulfate and bicarbonate. The majority of the wells yielded significant concentrations of gross alpha, radium-226 and uranium. The highest radionuclide concentrations were measured in well 19X, which was utilized by Nuclear Dynamics as the recovery well for the ISR pilot project. This well is completed in the ore zone and remains in use today, as discussed in

project area would generate horizontal accelerations of approximately 0.15g, which is a Level VI earthquake. The 2,500-year probabilistic map presented in Section 3.3.7 shows that the peak ground acceleration with a 2% probability of exceedance in 50-years is 0.06 to 0.08g, which equates to a Level V earthquake. Level V or VI earthquakes are felt by almost everyone around but do not cause significant damage. Since structures at the Ross ISR Project will be designed according to the 2,500-year probabilistic map, the risk of significant earthquake damage to the proposed facilities is small, as the total anticipated project life is approximately 8 to 12 years.

4.3.1.2 Potential Operation Impacts to Geology and Soil

During operation and aquifer restoration, there will be a very low risk of hydraulic fracturing during operation of injection wells, including Class III injection wells in the ore zone and Class I deep disposal wells. Potential impacts will be avoided by maintaining the injection pressure at a level that does not exceed the fracture gradient of the receiving formation (OZ aquifer for Class III wells and Deadwood/Flathead Formations for Class I wells).

During operation, potential soil impacts could occur from compaction, especially vehicles driving on wellfield access roads; from salinity, if land application is used for permeate disposal; and from spills or leaks. Soil compaction could occur on all access roads, but potential impacts would be most noticeable on tertiary access roads, which will typically be unconstructed, 2-track roads without gravel surfacing. These roads will be used throughout operation for monitor well sampling and MITs. Compaction will be mitigated by ripping tertiary roads during reclamation and importing topsoil if needed during decommissioning.

There is a small potential for soil salinity impacts to occur if land application is used for permeate disposal. However, the highly treated permeate would not likely contain sufficient levels of dissolved constituents to increase soil salinity, as long as adequate leaching is available in irrigated areas. Soil salinity impacts and baseline soil salinity at the surface and root zone would be addressed in a site-specific land application plan submitted for regulatory approval prior to land application.

During operation, there will be additional soil contamination risks that require specific mitigation measures. These include potential spills from pipelines, module buildings, and process vessels. A pipeline leak could

potentially result in topsoil or subsoil contamination depending on the type of fluid, quantity of spilled fluid, and location of the leak. In the wellfield, potential pipeline leaks include ruptures of injection or recovery well feeder lines, lixiviant or recovery solution trunk lines, or deep disposal well pipelines. Small leaks could also occur at pipe joints and fittings at the well heads. Until remedied, these leaks may drip injection, recovery, or deep disposal well solutions onto the surrounding soil. To minimize the potential for pipeline leaks, Strata will hydrostatically test all pipelines during construction and institute leak detection monitoring as described in TR Section 3.1.7. Wellfield leak detection monitoring and control will include continuous measurement of flows and pressures for injection and recovery trunklines and feeder lines, inclusion of leak detection sensors in valve manholes, and inclusion of leak detection sensors in well head sumps.

A leaking pipeline within a module building could potentially impact the surrounding soil. This risk will be minimized by providing secondary containment for module buildings in the form of concrete sumps and by providing leak detection equipment.

Engineering controls will ensure that there is minimal potential impact to soil from the unintended release of process fluids or chemicals within the central plant area. Within the central plant area, potential releases of process fluids or chemicals to the environment include leaking pipelines, leaking chemical storage tanks or process vessels, major damage (i.e., rupture) of a process vessel, transportation accidents, or leaking ponds. The first level of protection is primary containment within pipelines, vessels, ponds, etc., all of which will be leakage tested during construction. The second level of protection is secondary containment. Secondary containment will be provided in the form of curbs, berms, and sumps for all chemical storage tanks, process vessels, and all piping and equipment inside the CPP building. A double liner and leak detection system will also be provided for lined retention ponds within the central plant area.

No potential impacts to geology have been identified during operation. The primary geologic hazard to the facility is that from earthquakes, which could potentially damage a process vessel, chemical storage tank, pipeline, or lined retention pond, and cause a contaminant release. As described previously, a Level V earthquake is predicted to occur in the proposed project area once every 2,500 years. The probability of occurring during the 4 to 8 year

operational life of the CPP and wellfield is therefore less than 0.3%. Since the CPP building will be designed according to the 2,500-year probabilistic map, the risk of contaminant release from an earthquake is very small.

4.3.1.3 Potential Aquifer Restoration Impacts

During aquifer restoration, the potential soil impacts include compaction, salinity (if land application is used), and contamination from spills and leaks. The risks will generally be lower than those occurring during operation, since there will be less wellfield traffic compacting soils, little if any excess permeate will be available for land application, and there will be less fluids transported in wellfield pipelines (e.g., there will be no lixiviant or recovery solutions from producing wellfield modules).

No potential impacts to geology have been identified during aquifer restoration.

4.3.1.4 Potential Decommissioning Impacts

During decommissioning, potential soil impacts will be similar to those occurring during construction. The risk of compacting soil will temporarily increase due to increased heavy equipment operation. Local impacts will also potentially occur as contaminated soils are removed and disposed. Heavy equipment operation also increases the risk of soil contamination from fuel or oil leaks. These will be mitigated by ripping compacted soils prior to topsoil replacement and re-seeding and by immediately cleaning up any oil or fuel-contaminated soil.

The only recognized potential geologic impact from decommissioning is physical impacts to the surficial aquifer within the central plant area. For example, if the containment barrier wall (CBW) were allowed to persist after decommissioning, hydrogeologic impacts could occur within the surficial aquifer. This will be mitigated by reclaiming the CBW as described in Section 6.2.6 in the TR. Reclamation of the CBW will be accomplished by creating a series of breaches, also known as finger drains, along the upgradient and downgradient reaches and filling these breaches with gravel.

evapotranspiration could impact the surficial aquifer water quality, the likelihood of this occurring can be minimized by agronomic water application rates, surface runoff controls, and contingencies for reducing or stopping the irrigation system in the event of surface runoff. These mitigation measures would be addressed in a site-specific land application plan submitted to NRC and WDEQ/LQD for regulatory approval prior to constructing a land application system.

4.4.2.3.2 Potential Operation Impacts to Surficial Aquifer Water Quantity

Potential impacts to surficial aquifer quantity would be small. Potential impacts from the CBW during operations would be similar to the construction phase and thus limited. Continued utilization of the Oshoto Reservoir for drilling water would have a small impact on the surficial system as these uses are minor. Beneficial use of permeate via enhanced crop production through land application or subsurface drip irrigation systems would result in small potential impacts with application rates at or slightly above agronomic rates. In general, during operation the amount of water in the surficial aquifer is not expected to deviate from baseline conditions.

4.4.2.3.3 Potential Operation Impacts to the Water Quality of the SM, OZ and DM Aquifers

Prior to injection, Strata will pursue a Class III Injection Permit through the WDEQ/LQD and EPA based on data collected during wellfield package development. Based on water quality samples collected during baseline data collection, the OZ aquifer groundwater is assumed to be Class IV (industrial use only) based on WDEQ/WQD Chapter 8, Table 1 criteria. Exceedances of the class of use standards were measured for TDS, sulfate, ammonia, radium-226 & 228 and gross alpha. Exceedances of EPA primary drinking water standards were measured for uranium, radium-226 & 228 and gross alpha. Given these exceedances, water from this aquifer is not suitable for human or livestock/wildlife consumption. While the OZ aquifer was never requested for exemption as a source of drinking water at the R&D site, the presence of commercially producible uranium/vanadium mineralization, confinement of the OZ and apparent poor water quality should allow WDEQ/LQD to support exempting portions of the aquifer within the perimeter monitor well ring(s) as either Class IV or V groundwater. Following a decision

by WDEQ/LQD on the exemption status, WDEQ/LQD will request an aquifer exemption from EPA. Strata will not inject water into a non-exempted aquifer.

During operations, the groundwater quality in the exempted aquifer will be impacted as part of the ISR uranium recovery process. The uranium and vanadium in the ore zone will be oxidized and mobilized by introducing lixiviant (native groundwater and reagents) into the OZ aquifer through the Class III injection wells. In addition to the uranium and vanadium, other constituents will be mobilized, including anions, cations, and trace metals (Section 6.1.6.2 of the TR indicates the estimated water quality of the OZ aquifer at the end of uranium recovery operations). Impacts to the exempted aquifer water quality will be short term, since aquifer restoration will take place in a phased manner with uranium recovery.

There is potential to impact the quality of the non-exempted OZ aquifer outside of the perimeter monitor well rings via a lateral excursion resulting from a local wellfield imbalance. A wellfield imbalance occurs when the rate of injected solution exceeds what is being extracted by the recovery wells resulting in migration of lixiviant laterally away from the wellfield area. Natural conditions within the Lance/Fox Hills OZ aquifer limit the potential for this type of impact. These natural conditions, governed by the sedimentary environment during deposition (discussed in detail in Sections 3.3 and 3.4), resulted in highly heterogeneous sandstones with similarly varied permeabilities, both vertically and laterally. To quote Buswell (1982), "The heterogeneous permeability and transmissivity of the host sediments modifies the migration of groundwater … the alteration projections [roll fronts] formed in response to increased flow through the more permeable channel sandstones." The limits of mineralization also define the limits of the higher permeability sediments. Otherwise, uranium mineralization would be more ubiquitous, and not concentrated in the various roll front deposits underlying the proposed project area. Therefore the conditions that led to the mineralization also work to limit the potential for migration of injected lixiviant beyond the wellfield areas.

Beyond natural limiting factors, Strata proposes to minimize the potential for lixiviant migration through a variety of operational methods. First, wellfield integrity will be demonstrated as a requirement of the Class III Injection Permit application. Second, groundwater modeling conducted in support of the NRC and WDEQ/LQD applications for uranium recovery and

permit to mine demonstrates that groundwater movement through these complex sedimentary systems can be accurately modeled and, more importantly, predicted. The predictive capability of Strata's groundwater model (see TR Addendum 2.7-H) was used to develop monitor well layouts protective of the non-exempt portions of the OZ aquifer. In addition to the water quality testing of the DM, SM and OZ aquifers (both inside and outside the proposed wellfield area), hydrologic testing through pumping of recovery wells in the wellfield area and measuring response in surrounding perimeter monitor wells is a significant component of the Class III Injection Permit application. Wellfield pumping and measured response in the perimeter monitor wells not only demonstrates wellfield integrity through similarity of completions but also allows accurate estimation of the horizontal hydraulic conductivity between the wellfield area and perimeter monitor well ring. By updating the groundwater model with wellfield-specific hydraulic conductivity estimates, a foundation for strong operational monitoring and control will be achieved as operational modeling platforms will utilize the same data during uranium recovery activities. Moreover, these data will support development of optimized injection and recovery well networks that account for natural heterogeneity and allow efficient targeting of the mineralized portions of the exempt aquifer.

The same principles apply to limiting the water quality impacts to underlying and overlying adjacent aquifers of the DM and SM monitoring units. The fine-grained clays and silts that envelop the ore zone not only limited uranium mineralization but further work to limit the potential for vertical migration of the lixiviant-fortified groundwater during operations. Geologic evaluation and hydrologic testing conducted in support of the Class III Injection Permit application will also be utilized to demonstrate the integrity of these confining units, through monitoring the DM and SM monitor wells while pumping the recovery wells. Previous aquifer testing both by Nubeth and Strata has recorded no response in vertically adjacent aquifers; moreover, the amount of confining head and contrasting water qualities observed in these aquifers further demonstrate ore zone isolation. With proper well construction and wellfield operation, ISR activities can safely take place at the Ross ISR Project. In addition, prior to ISR uranium recovery, all exploration drill holes that can be located within the perimeter monitor well ring and beneath the central plant area will be plugged and abandoned as described in TR Addendum 2.6-B.

In addition to the limiting factors such as natural conditions and an enhanced understanding of the groundwater flow regime developed to support the Class III Injection Permit application, significant operational instrumentation and control networks are proposed by Strata to further minimize the potential for water quality impacts to adjacent non-exempted aquifers. By utilizing three primary tools, the operational groundwater model, instrumentation in the wellfields and monitoring networks, and a strong control infrastructure to adjust injection and recovery activities, wellfields can be operated to prevent adjacent aquifer impacts. Instrumentation in the wells may include dedicated pressure transducers with dataloggers in the perimeter, deep and shallow monitor wells. In addition to water quality sampling of the monitor wells every 10 to 14 days, water levels will be captured by the operational groundwater model or reservoir engineering platform and used to continuously update operations. This data capture, particularly from the perimeter wells, will allow for continuous adjustments to injection and recovery rates in order to keep the wellfield balanced while simultaneously limiting the amount of production bleed necessary to maintain an inward hydraulic gradient. A properly balanced wellfield ensures complete recovery of lixiviant. The instrumentation and control system would also provide an early warning (prior to geochemical change) of a potential migration of uranium recovery fluids. Simulations of excursions (addressed in detail in TR Addendum 2.7-H) demonstrate that an increase in head due to a local wellfield imbalance would be quickly observed in adjacent perimeter monitor wells. The increase in hydraulic head would be a reversal from longer term, downward trends due to production bleed and a readily apparent indicator of a wellfield imbalance.

Instrumentation and control networks, through the use of PLCs, would also help to prevent local wellfield imbalances and a subsequent impact to a non-exempt adjacent aquifer. Monitoring of recovery well rates both in the module buildings and plant control room combined with measuring injection pressure, would ensure that wellfield balance is maintained. Additionally, in the event of an operational upset, the operational groundwater model, integrated with the injection and recovery well instruments, would allow for a rapid determination of potential migration paths, thereby allowing the operator to quickly mitigate any conditions that might lead to a water quality change in an adjacent aquifer.

Water quality impacts to the vertically adjacent SM and DM aquifers, though isolated from the ore zone by natural conditions, could potentially occur through a compromise of the confining intervals. The geologic modeling and hydrologic testing conducted to date indicate that no natural conduits are available for vertical migration of uranium recovery fluids. However, an improperly abandoned borehole or an improperly sealed well could introduce injected lixiviant into a vertically adjacent non-exempt aquifer. While not evaluated by the regional groundwater model developed in support of initial licensing, given the hydraulic pressures present in the DM and SM aquifers, instrumentation such as pressure transducers and dataloggers would provide similar early warning of a vertical migration. In addition, monitor wells targeting the DM and SM aquifers would be sampled for excursion indicator parameters similar to the perimeter monitor wells to ensure that the confining units have not been compromised.

Four primary methods limit the potential for a confining shale to be compromised through anthropogenic activities. First, penetration into the DM aquifer during wellfield installation would be limited to the necessary wells required to monitor the interval. Second, exploration and delineation boreholes would be plugged from the bottom of the hole to the surface with low hydraulic conductivity materials such as cement or heavily mixed bentonite grout. Third, methods approved by WDEQ/LQD and in compliance with WDEQ/LQD Chapter 11, Section 6 construction requirements for well locations, casing types and, most importantly, annular sealing techniques would be followed. Proper annular sealing methods ensure that vertical migration pathways are not created outside of the casing and inside of the borehole walls. Key characteristics of the well installation programs would include a sufficiently sized borehole diameter to provide adequate annular space for sealing materials, selection of appropriate annular seal materials such as cement with a weight of 15 pounds per gallon, displacement of the cement slurry sufficient to fill the entire annular volume from the bottom of the casing to ground surface, allowing sufficient curing time so that additional well construction work does not jeopardize the annular integrity, and selection of casing type with sufficient strength and diameter to prevent collapse and to accommodate the necessary injection pressures. Fourth, Strata will implement an approved MIT program for all Class III wells to ensure casing integrity. Key characteristics of the proposed MIT program include using a pressure-based testing method, a proactive testing program that targets wells displaying

anomalous pressures or characteristics, retesting every 5 years and any time a well is re-entered by a drill bit or underreaming tool, maintenance of records and quarterly reporting of all wells tested along with any subsequent actions (repair or abandonment). In the unlikely event that a well fails MIT, it would either be repaired or abandoned using permit approved procedures. Through the use of hydraulic isolation techniques during all phases of wellfield development, potential impacts to adjacent non-exempt aquifers would be minimized.

In summary, between natural processes, advanced instrumentation and control technologies, and implementation of approved drilling and well installation programs, the potential to impact groundwater quality beyond the exempted aquifer is small. In addition, strong economic factors drive Strata to ensure isolation of the uranium/vanadium recovery activities to select portions of the mineralized, exempt aquifer. Beyond the immediate costs to investigate, mitigate and monitor an excursion, reagents utilized to facilitate production are costly and are wasted when used outside of the mineralized areas. These economic factors provide an additional, significant incentive for Strata to ensure that the lixiviant injected into the OZ system is confined to the portions of the aquifer containing mineralization. Moreover, water treatment has tangible costs, and measures taken to prevent excursions also enhance Strata's ability to limit how much water requires treatment during aquifer restoration. This factor is most pronounced in terms of maintaining sufficient production bleed to sustain a cone of depression in the exempted aquifer while simultaneously limiting the amount of fresh water brought into the wellfield area. Strata will have every incentive to limit conditions that could result in an impact outside of the exempted aquifer area, and operation impacts to the water quality in the deeper aquifers are expected to be small.

4.4.2.3.4 Potential Operation Impacts to Water Quantity of the SM, OZ and DM Aquifers

The potential for impacts to the amount of water available in the SM and DM aquifers resulting from the proposed action is small given the natural confinement and measures discussed in Section 4.4.2.3.3. However, in the unlikely event of a vertical excursion of lixiviant-fortified groundwater to the SM or DM aquifers, mitigation measures may require withdrawal and treatment of impacted groundwater. These withdrawals would be minimal given that in all likelihood the excursion conduit would be due to anthropogenic

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Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming

Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities

Final Report

Office of Federal and State Materials and
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EXECUTIVE SUMMARY

BACKGROUND

By a letter dated January 4, 2011, Strata Energy Inc. (Strata) (also referred herein as the "Applicant") submitted an application to the United States (U.S.) Nuclear Regulatory Commission (NRC) for a new source and byproduct materials license for the proposed Ross Project, an in situ uranium-recovery (ISR) project to be located in Crook County, Wyoming. The proposed Ross Project includes a Central Processing Plant (CPP), injection and recovery wells, deep-disposal wells for liquid effluents, monitoring wells throughout the Ross Project area, as well as other various infrastructure (e.g., pipelines, roads, and lighting).

The *Atomic Energy Act of 1954* (AEA), as amended by the *Uranium Mill Tailings Radiation Control Act of 1978* (UMTRCA), authorizes the NRC to issue licenses for the possession and use of source material and byproduct materials. The NRC must license facilities, including ISR operations, in accordance with NRC regulatory requirements. These requirements were developed to protect public health and safety from radiological hazards and to protect common defense and security. The NRC's environmental-protection regulations are found at Title 10 of the *Code of Federal Regulations* (CFR), Part 51 (10 CFR Part 51); these regulations implement the *National Environmental Policy Act of 1969* (NEPA). 10 CFR Part 51 requires that the NRC prepare an environmental impact statement (EIS) or a generic EIS (GEIS), or a supplement to a GEIS (SEIS) for its issuance of a license to possess and use source and/or byproduct materials for uranium milling (see 10 CFR Part 51.20[b][8]).

In May 2009, the NRC issued NUREG–1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*. In this GEIS, the NRC assessed the potential environmental impacts of the construction, operation, aquifer restoration, and decommissioning of ISR facilities located in four specified geographic regions of the western U.S. The proposed Ross Project is located within the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR) identified in the GEIS. The GEIS provides a starting point for the NRC's NEPA analyses for site-specific license applications for new ISR facilities. This Final *Supplemental Environmental Impact Statement* (SEIS) incorporates by reference information from the GEIS. This document also uses information from the Applicant's license application and subsequent environmental report and its responses to the NRC's requests for additional information as well as other publicly available sources of information.

This Final SEIS includes the NRC staff's analysis of the environmental impacts from the Proposed Action (i.e., for the NRC to license the Ross Project), the environmental impacts of two Alternatives to the Proposed Action (i.e., the "No-Action" Alternative and the "North Ross Project" Alternative), and the mitigation measures that are intended to either minimize or avoid adverse impacts. It also includes the NRC staff's final recommendation regarding the Proposed Action.

PURPOSE AND NEED OF THE PROPOSED ACTION

The NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." The Applicant is seeking an NRC source and byproduct materials license to authorize commercial-scale in situ uranium recovery at the Ross Project area. The purpose of and need for this Proposed Action is to provide an option that allows the Applicant to recover uranium and to produce yellowcake at the Ross Project. Yellowcake is the uranium-oxide product of the uranium-recovery and uranium-milling processes that are the initial steps of the commercial nuclear fuel cycle. Yellowcake would be sent from the Ross Project area to a gaseous-conversion plant, which would produce uranium hexafluoride (UF_6) gas as the next step in the nuclear fuel cycle.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the AEA, as amended, or findings in the associated environmental analysis conducted under 10 CFR Part 51 that would lead NRC to reject a license application, NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

THE PROJECT AREA AND FACILITY

Strata's Proposed Action, the Ross Project, would occupy 696 ha [1,721 ac] in the north half of the approximately 90-km^2 [56-mi^2] Lance District, where the Applicant is actively exploring for additional uranium reserves. Strata has identified four uranium-bearing areas that would extend the area of uranium recovery in the Lance District: to the north (the Ross Amendment Area 1) and to the south (the Kendrick, Richards, and Barber areas). These areas are not components of the Proposed Action in this Final SEIS.

The Lance District is located on the western edge in the northwest corner of the NSDWUMR. It is situated between the Black Hills uplift to the east and the Powder River Basin to the west. Both of these regional features are described in the GEIS. The environment of the Proposed Action is described in Section 3 of this SEIS.

The Proposed Action includes the ISR facility itself and its wellfields. The ISR facility consists of the following:

- A CPP that houses the uranium- and vanadium-processing equipment, drying and packaging equipment, and water-treatment equipment;
- A chemical storage area as well as other storage, warehouse, maintenance, and administration buildings; and
- Two double-lined surface impoundments, a sediment impoundment, and up to five Class I deep-injection wells.

The Proposed Action includes the option of the Applicant operating the Ross Project facility beyond the life of the Project's wellfields. The facility could be used to process uranium-loaded resin from satellite areas within the Lance District operated by the Applicant, or from other offsite uranium-recovery projects not operated by the Applicant (i.e., "toll milling"), or from offsite water-treatment operations. With that option, the life of the facility would be extended to 14 years or more.

The Ross Project would also host 15 – 25 wellfields and would consist of a total of 1,400 – 2,200 injection and recovery wells. The wellfields would be surrounded by a perimeter ring of monitoring wells.

THE IN SITU URANIUM RECOVERY PROCESS

During the in situ uranium-recovery process, an oxidant-charged solution, called a lixiviant, is injected into an ore-zone aquifer (or uranium "ore body") through injection wells. For lixiviant injection to take place, the ore zone must lie within that portion of the aquifer that has been permanently exempted by the U.S. Environmental Protection Agency (EPA) as an underground source of drinking water per the *Safe Drinking Water Act*. Typically, a lixiviant uses native ground water (from the ore-zone aquifer itself), carbon dioxide, and sodium carbonate/bicarbonate, with an oxygen or hydrogen peroxide oxidant. As this solution circulates though the ore zone, the lixiviant oxidizes and dissolves the mineralized uranium, which is present in a reduced chemical state. The resulting uranium-rich solution, the "pregnant" lixiviant, is drawn to recovery wells by a pump, and then transferred to the CPP via a network of pipes buried below the frost line to prevent freezing. At the CPP, the uranium is extracted from the solution using an ion-exchange (IX) process. The resulting "barren" solution (i.e., uranium-depleted) is then recharged with complexing and oxidizing agents before being re-injected to recover additional uranium from the particular wellfield.

During production, the uranium-recovery solutions continually move through the aquifer from outlying injection wells to internal recovery wells. These wells can be arranged in a variety of geometric patterns depending upon the ore-body's configuration, the aquifer's permeability, and the operator's selection based upon operational considerations. Wellfields are often designed in a five-spot or seven-spot pattern, with each recovery (i.e., production) well located inside a ring of injection wells. Monitoring wells tapping into the ore-zone aquifer would surround the wellfield. In addition, monitoring wells would tap in both the overlying and underlying aquifers. These monitoring wells would be screened in appropriate stratigraphic horizons to detect lixiviant, should it migrate out of the ore zone (i.e., production zone). Uranium that is recovered would be conveyed and processed in the CPP into dry yellowcake. The yellowcake would be packaged into NRC- and U.S. Department of Transportation (USDOT)-approved 208-L [55-gal] steel drums and trucked offsite to a licensed uranium-conversion facility.

Once uranium recovery is completed and aquifer restoration has been performed, the Applicant would seek ground-water-restoration approval from the NRC. NRC approval would be given when the ground-water quality at the point of compliance within the exempted aquifer does not exceed the ground-water protection standards as required by 10 CFR Part 40, Appendix A, Criterion 5B(5). These standards require that the concentration of a given hazardous constituent must not exceed: 1) the Commission-approved concentration of that constituent in the ground water; 2) the respective value given in the table included in Paragraph 5C of Appendix A, if the constituent is listed in the table and if the level of the constituent is below the value listed; or 3) an Alternate Concentration Limit (ACL) established by the Commission for the constituent. The point of compliance is defined in 10 CFR Part 40, Appendix A, as the site specific location in the uppermost aquifer where the ground-water protection standard must be met. Historically, the NRC staff has assigned the point of compliance as defined in Appendix A as the boundary of the EPA-defined exempted aquifer. Per 10 CFR Part 40, Appendix A, Criterion 5B(6), ACLs that are established by the NRC must be as low as reasonably achievable (ALARA) and not pose a substantial present or potential hazard to human health or the

environment as long as the ACL is not exceeded. Following NRC approval of the ground-water restoration, the facility and wellfields would be decontaminated and decommissioned in accordance with NRC-approved rules as well as in accordance with an NRC-approved decommissioning plan and/or restoration action plan. Once all of the Applicant's decommissioning efforts have been completed, the NRC would affirm the decommissioning, and the site could then be released for unrestricted public use.

THE ALTERNATIVES

The NRC environmental review regulations in 10 CFR Part 51, which implement NEPA, require the NRC to consider reasonable alternatives, including the no-action alternative, to a Proposed Action. The NRC staff considered a range of alternatives to the Ross Project that would fulfill the underlying purpose and need for the Proposed Action as described in this SEIS. From this analysis, a set of reasonable alternatives was developed, and the impacts of the Proposed Action were compared to the impacts that would result if a given alternative were implemented. This SEIS evaluates the potential environmental impacts of the Proposed Action (Alternative 1) and two Alternatives, including the No-Action Alternative (Alternative 2) and the North Ross Project (Alternative 3). Under the No-Action Alternative, the Applicant would neither construct nor operate a uranium recovery facility or wellfields at the proposed Ross Project. In Alternative 3, the proposed Ross Project facility (i.e., the CPP, surface impoundments, and auxiliary structures) would be constructed at a site north of where it is proposed to be located in the Proposed Action, but the wellfields would remain in the same locations as in the Proposed Action. This alternative facility location would require additional, substantial earth-moving to construct the surface impoundments, but a containment barrier wall (CBW) (described later in this SEIS) would not be required. Alternatives considered and eliminated from detailed analysis include conventional mining and milling, conventional mining and heap leach processing, and alternate lixiviants. These alternatives were eliminated from detailed study because they either do not meet the purpose and need of the proposed Ross Project or would cause greater environmental impacts than the Proposed Action.

SUMMARY OF THE ENVIRONMENTAL IMPACTS

This Final SEIS includes the NRC staff's analysis, which considers and weighs the environmental impacts resulting from the construction, operation, aquifer restoration, and decommissioning of an in situ uranium recovery facility at the proposed Ross Project area and the two Alternatives. This SEIS also describes mitigation measures for the reduction or avoidance of potential adverse impacts that either: 1) the Applicant has committed to in its NRC license application, 2) would be required under other State or Federal permits or processes, or 3) are additional measures that the NRC staff identified as having the potential to reduce environmental impacts, but the Applicant did not commit to in its license application. The SEIS uses the assessments and conclusions reached in the GEIS in combination with site-specific information to assess and categorize impacts.

As discussed in the GEIS and consistent with NUREG–1748 (NRC, 2003b), the significance of potential environmental impacts is categorized as follows:

SMALL: The environmental impacts are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental impacts are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

LARGE: The environmental impacts are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

Table ExS.1 provides a summary of the NRC's evaluation of the potential environmental impacts of the construction, operation, aquifer restoration, and decommissioning of the Ross Project, followed by a brief summary of impacts by environmental resource area and lifecycle phase. These potential impacts are more fully described in Section 4 of this Final SEIS, where the magnitude of impacts by phase of the Ross Project is provided for each resource area.

1 INTRODUCTION

1.1 Background

The United States (U.S.) Nuclear Regulatory Commission (NRC) has prepared this *Final Supplemental Environmental Impact Statement* (SEIS, or FSEIS if the respective section, figure, or table did not appear in the Draft SEIS [DSEIS]) in response to an application Strata Energy, Inc. (Strata) (also referred to herein as the "Applicant") submitted on January 4, 2011, to develop and operate the proposed Ross In Situ Uranium Recovery (ISR) Project (herein referred to as the "Ross Project"), located in Crook County, Wyoming (Strata, 2011a; Strata, 2011b). The Applicant is a wholly owned subsidiary of Peninsula Energy, Ltd. Figure 1.1 depicts the geographic location of the proposed Ross Project.

This site-specific SEIS supplements the *Final Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (herein referred to as the "GEIS") and was prepared in accordance with the process described in GEIS Section 1.8 (NRC, 2009b) and as detailed in Section 1.4.1 of this SEIS. The NRC's Office of Federal and State Materials and Environmental Management Programs prepared this SEIS as required by Title 10, "Energy," of the *U.S. Code of Federal Regulations* (CFR) Part 51 (10 CFR Part 51). These regulations implement the requirements of the *National Environmental Policy Act of 1969* (NEPA), as amended (Public Law 91-190), which requires the Federal government to assess the potential environmental impacts of major Federal actions that may significantly affect the human environment.

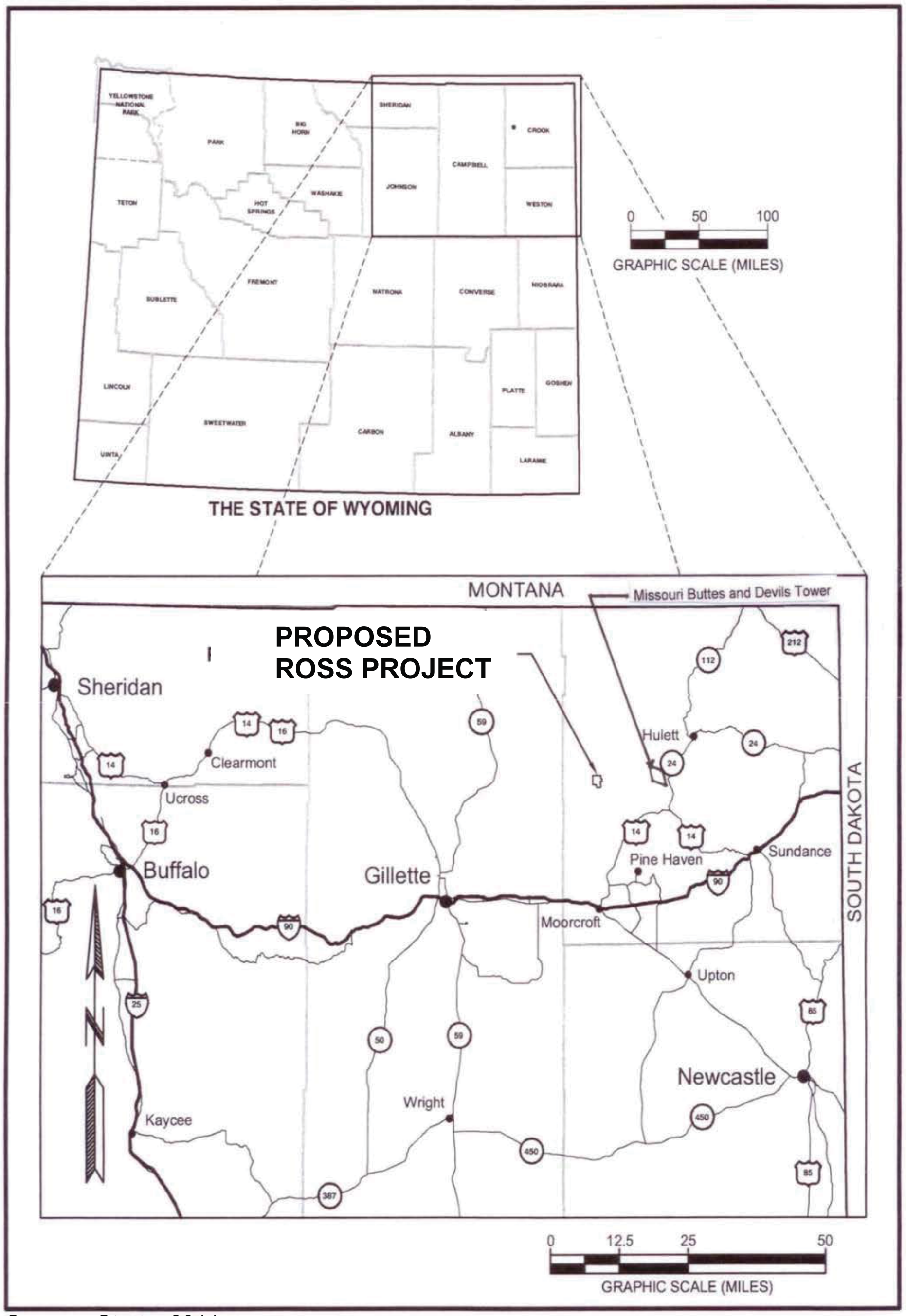
The GEIS uses the terms "*in-situ* leach (ISL) process" and "11e.(2) byproduct material" to describe this uranium-milling technology and the primary waste stream generated by this process. For the purposes of this SEIS, ISR is synonymous with ISL. This SEIS also uses the term "byproduct material" instead of "11e.(2) byproduct material" to describe the largest-by-volume waste stream generated by this uranium-milling process to be consistent with the definition in 10 CFR Part 40.4.

1.2 Proposed Action

On January 4, 2011, Strata submitted an application for an NRC source and byproduct materials license to construct and operate an ISR facility and wellfields at the proposed Ross Project area and to conduct aquifer restoration, facility decommissioning, and site reclamation. Based upon Strata's application, the NRC's Federal action is the decision to either grant or deny a license. The Applicant's proposal is described in detail in SEIS Section 2.1.1.

1.3 Purpose and Need of the Proposed Action

The NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." The Applicant is seeking an NRC source and byproduct materials license to authorize commercial-scale ISR at the proposed Ross Project area. The purpose and need for the Proposed Action is to provide an option that allows the Applicant to recover uranium and to produce yellowcake at the Ross Project. Yellowcake is the semi-solid, uranium-oxides product of the uranium-milling process. Yellowcake is subsequently processed and later made into fuel for commercially operated nuclear power reactors.



Source: Strata, 2011a.

Figure 1.1
Ross Project Location

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in its safety review required by the *Atomic Energy Act of 1954* (AEA), as amended, or findings in the NEPA environmental analysis that would lead the NRC to reject a license application, NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

1.3.1 BLM's Purpose and Need

The U.S. Bureau of Land Management's (BLM's) Federal action is either to approve the Applicant's *Plan of Operations* (POO), subject to mitigation as included in the license application and this SEIS, or deny approval of the POO. The BLM's responsibility to respond to the Applicant's POO establishes the need for the action. The purpose and need for the BLM is to provide for orderly, efficient, and environmentally responsible recovery of uranium resources. Uranium resources are needed to fulfill market demands for this product for power generation and other needs. The proposed Ross Project area contains 16 ha [40 ac] of BLM-administered public lands open to mineral entry, and the Applicant has filed mining claims on them. The mining claimant (i.e., Strata) has the right to mine and to develop the claims as long as such activities can be accomplished without causing unnecessary or undue degradation of the environment and as such activities are in accordance with pertinent laws and regulations under 43 CFR Part 3800.

1.4 Scope of the SEIS

The NRC staff has prepared this SEIS to analyze the potential environmental impacts (i.e., direct, indirect, and cumulative impacts) of the proposed undertaking (i.e., to grant an NRC license) and of reasonable alternatives to the Proposed Action. The scope of this SEIS considers both radiological and nonradiological (including chemical) impacts associated with the Proposed Action and its Alternatives. This SEIS also considers unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and long-term productivity, and the irreversible and irretrievable commitments of resources.

1.4.1 Relationship to the GEIS

As described in Section 1.1, this SEIS supplements the GEIS, which was published as a final report in May 2009 (NRC, 2009b). The GEIS serves as the starting point for environmental reviews of site-specific ISR license applications. The final GEIS assessed the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISR facility that could be located in four specific geographic regions of the western U.S. The NRC "tiers" an SEIS from the GEIS by incorporating applicable GEIS discussions by reference and by adopting relevant GEIS environmental impact conclusions.

This SEIS was prepared to fulfill the requirement at 10 CFR Part 51.20(b)(8) to prepare either an environmental impact statement (EIS) or supplement to an EIS (SEIS) for the issuance of a source and/or byproduct material(s) license for an ISR facility (NRC, 2009b). The GEIS provides a starting point for the NRC's NEPA analyses for site-specific license applications for new ISR facilities as well as for applications to amend or to renew existing ISR licenses. The GEIS provides criteria for each environmental resource area to be used in the assessment of levels of impact significance (i.e., SMALL, MODERATE, or LARGE). The NRC staff applied these criteria to the site-specific conditions at the proposed Ross Project. This SEIS tiers from, and incorporates by reference, the GEIS's relevant information, findings, and conclusions concerning environmental impacts. The extent to which the NRC staff incorporated the GEIS's

Table 1.1
Range of Expected Impacts in the GEIS's
Nebraska-South Dakota-Wyoming Uranium Milling Region

Resource Area	Construction	Operation	Aquifer Restoration	Decommissioning
Land Use	S	S	S	S to M
Transportation	S to M	S to M	S to M	S
Geology and Soils	S	S	S	S
Surface Water	S to M	S to M	S to M	S to M
Ground Water	S	S to L	S to M	S
Terrestrial Ecology	S to M	S	S	S
Aquatic Ecology	S	S	S	S
Threatened and Endangered Species	S to L	S	S	S
Air Quality	S	S	S	S
Noise	S to M	S to M	S to M	S
Historical and Cultural	S to L	S	S	S
Visual and Scenic	S	S	S	S
Socioeconomics	S to M	S to M	S	S to M
Public and Occupational Health and Safety	S	S to M	S	S
Waste Management	S	S	S	S

Source: NRC, 2009b.

Notes:
S: SMALL Impact
M: MODERATE Impact
L: LARGE Impact

impact conclusions depend upon the consistency between: 1) the Applicant's proposed facilities and activities as well as the conditions at the Ross Project area, and 2) the reference facility description, activities, and information in the GEIS. The NRC staff determinations regarding potential environmental impacts and the extent to which the GEIS's impact conclusions were incorporated by reference are described in Section 4 of this SEIS. GEIS Section 1.8.3 described the relationship between the GEIS and a site-specific SEIS (NRC, 2009b).

1.4.2 Public Participation Activities

The NRC staff conducted scoping activities to define the scope of the GEIS and any future supplements to the GEIS. The staff accepted public comments on the scope of the GEIS from July 24, 2007, to November 30, 2007, and held three public scoping meetings, one of which was in the State of Wyoming (Wyoming). Additionally, the NRC staff held eight public meetings to receive comments on the Draft GEIS, published in July 2008. Three of these meetings were held in Wyoming and one in nearby Spearfish, South Dakota. Comments on the Draft GEIS were accepted between July 28, 2008, and November 8, 2008. Comments received during the scoping meetings as well as the comments received on the Draft GEIS were made available on the NRC website (http://www.nrc.gov/reading-rm/adams.html). Transcripts of the scoping meetings and Draft GEIS-comment meetings are available at http://www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html. A scoping summary report was provided in Final GEIS Appendix A, and Final GEIS Appendix G provided responses to the public comments on the Draft GEIS (NRC, 2009b).

The NRC is not required to conduct a scoping process when a supplement to an EIS is prepared. Nevertheless, the NRC staff has the discretion to decide whether to conduct scoping when preparing a SEIS. For the Ross Project SEIS, in addition to the scoping activities conducted by NRC during preparation of the GEIS, NRC published ads, soliciting scoping comments on the Ross Project SEIS, in four local newspapers (Moorcroft Leader, Casper Star Tribune, Gillette News Record, and Sundance Times). The newspaper advertisements were published on December 2, 2011, in the *Casper Star Tribune* and December 1, 2011, in the other three newspapers. Scoping comments were received until December 30, 2011. In total, 19 scoping-comment letters were received containing a total of 53 individual comments.

As part of the preparation of this SEIS, the NRC staff also met with Federal, State, and local agencies and authorities as well as public-interest groups during a visit to the proposed Ross Project area and surrounding vicinity in August 2011 (NRC, 2011a). The purpose of these meetings was to gather additional site-specific information to assist the NRC's environmental review.

The NRC staff published a "Notice of Opportunity for Hearing" on the proposed Ross Project license application in the *Federal Register* (FR) on July 13, 2011 (76 FR 41308). A hearing request from Natural Resources Defense Council (NRDC) and Powder River Basin Resource Council (PRBRC) (herein collectively referred to as the "Petitioners") was received on October 27, 2011. The NRC staff published a "Notice of Intent" (NOI) to prepare both a DSEIS and then this FSEIS on November 16, 2011 (76 FR 71082).

On March 29, 2013, the NRC staff published a "Notice of Availability" (NOA) for the DSEIS in 78 FR 19330. This NOA stated that public comments on the DSEIS should be submitted by May 13, 2013. Members of the public were invited and encouraged to submit related comments electronically, by mail, or by facsimile. The 45-day period for public comments (i.e., from March 29, 2013, to May 13, 2013) met the minimum 45-day comment period required under NRC regulations.

The NRC staff identified 1,120 comments from the 43 documents commenting on the Ross Project DSEIS. This FSEIS's Appendix B details how the NRC staff systematically identified and responded to each comment. A response has been provided in Appendix B for each comment or group of comments, and each response indicates whether the SEIS was modified in response to the respective comment.

In addition to the opportunities provided through the NEPA process, the NRC provided multiple opportunities for public involvement during the NRC staff's safety review. Specifically, the NRC staff held 10 publicly noticed meetings and teleconferences with the Applicant from 2010 through 2012, including 3 meetings prior to Strata's submittal of the license application. For those meetings and teleconferences, the NRC staff provided opportunities for public participation.

1.4.3 Issues Studied in Detail

To meet its NEPA obligations related to its review of the Ross Project license application, the NRC staff conducted an independent, detailed, comprehensive evaluation of the environmental impacts that would result from the construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed Ross Project area and from reasonable alternatives. As described in Section 1.8.3, the GEIS: 1) evaluated the types of environmental impacts that may occur from ISR uranium-milling facilities; 2) identified and assessed generic impacts (i.e., the same or similar) at all ISR facilities (or those with specified facility or site characteristics); and 3) determined the scope of environmental impacts that needed to be addressed in site-specific environmental reviews. Therefore, although all of the environmental resource areas identified in the GEIS would be addressed in site-specific reviews, certain resource areas would require a more detailed site-specific analysis because the GEIS determined that a range in the significance of impacts (e.g., SMALL to MODERATE, SMALL to LARGE) could result depending upon site-specific conditions (see Table 1.1).

Based upon the GEIS analyses, this SEIS provides site-specific analyses of the following resource areas:

- Land Use
- Transportation
- Geology and Soils
- Water
  - Surface Water
  - Ground Water
- Ecology
  - Vegetation
  - Wildlife
  - Threatened, Endangered, and Sensitive Species
- Air Quality
- Noise
- Visual and Scenic Resources
- Historic, Cultural, and Paleontological Resources
- Socioeconomics
- Environmental Justice
- Public and Occupational Health and Safety
- Waste Management

Furthermore, certain site-specific analyses not conducted in the GEIS, such as an assessment of cumulative impacts, are considered in this SEIS. The NRC staff has also considered the potential effects of the Applicant's implementing the Proposed Action on global climate change

by estimating the Project's greenhouse gas emissions; conversely, this SEIS also describes the potential effects of global climate change on the Proposed Action.

1.4.4 Issues Outside the Scope of the SEIS

Some issues and concerns raised during the scoping process for the GEIS were determined to be outside the scope of the GEIS (NRC, 2009b). These issues and concerns include comments indicating general support or opposition for uranium milling, comments regarding the impacts associated with conventional uranium milling, specific comments regarding alternative sources of uranium-feed material, comments regarding alternative energy sources, requests for compensation for past mining impacts, and comments regarding the credibility of the NRC are all outside of the scope of this SEIS.

1.4.5 Related NEPA Reviews and Other Related Documents

A number of NEPA documents (environmental assessments [EAs] and EISs) and other documents were reviewed and used in the development of this SEIS. These related documents are described below:

- **NUREG–1910, Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Final Report (NRC, 2009b).** As described previously, this GEIS was prepared to assess the potential environmental impacts of the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in one of four different geographic regions of the western U.S., including the NSDWUMR where the proposed Ross Project would be located. The environmental analyses in this Ross Project SEIS both tier from this GEIS and incorporate it by reference. NUREG–1910 has four published Supplements at this time; this SEIS is Supplement 5. The four earlier Supplements concern the Moore Ranch Project, the Nichols Ranch Project, the Lost Creek Project, and the Dewey-Burdock Project. (This GEIS herein referred to as "the GEIS" without any additional identifiers.)

- **NUREG–0706, Final Generic Environmental Impact Statement on Uranium Milling (NRC, 1980).** This GEIS provided a detailed evaluation of the impacts and effects of anticipated conventional uranium-milling operations in the U.S. through the year 2000, including an analysis of mill-tailings-disposal programs. NUREG–0706 concluded the environmental impacts from underground mining and conventional milling would be more severe than from the ISR process. As SEIS Section 2.2.1 describes, conventional mining and milling were considered, but eliminated from detailed analysis, in this SEIS. (This GEIS, when discussed in this SEIS, is always modified as "Uranium-Milling GEIS.")

- **NUREG–1508, Final Environmental Impact Statement To Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico (NRC, 1997).** This EIS evaluated the use of the ISR process at the Church Rock and Crownpoint sites at Crownpoint, New Mexico. Alternative uranium-mining methods were not evaluated because the uranium ore located at the proposed sites was too deep to be extracted (i.e., mined) economically, and the Final EIS concluded underground uranium mining would result in more significant environmental impacts than ISR uranium recovery.

- **Safety Evaluation Report for the Strata Energy, Inc. ISR Project, Crook County, Wyoming, Materials License No. SUA-1601 (NRC, 2014a)**. The NRC staff has prepared a *Safety Evaluation Report* (SER) for the proposed Ross Project that assesses the Applicant's

proposed facility design, operational procedures, and radiation-protection programs and evaluates whether the Applicant's Proposed Action can be accomplished in accordance with the applicable provisions in 10 CFR Part 20, 10 CFR Part 40, and 10 CFR Part 40, Appendix A. The SER also provides the NRC staff's analysis of the Applicant's initial funding estimate to complete Ross Project facility decommissioning and site reclamation.

- **Final Environmental Impact Statement for the Newcastle Resource Management Plan (BLM, 2000).** The BLM's *Newcastle Resource Management Plan EIS* (the "BLM EIS" in this SEIS) included comprehensive analyses of alternatives for the planning and management of public land and resources administered by the BLM in Crook, Weston, and Niobrara Counties, Wyoming. The BLM EIS identified activities occurring in the region surrounding the Ross Project area that could either affect or be affected by the proposed Ross Project.

1.5 Applicable Regulatory Requirements

NEPA established national environmental policy and goals to protect, maintain, and enhance the environment and provided a process for implementing these specific goals for those Federal agencies responsible for an action. This SEIS was prepared in accordance with the NRC's NEPA-implementing regulations at 10 CFR Part 51 and other applicable regulations that were in effect at the time the SEIS was being written. The GEIS's Appendix B summarized other Federal statutes, implementing regulations, and Executive Orders that are potentially applicable to environmental reviews for the construction, operation, aquifer restoration, and decommissioning of an ISR facility. GEIS Sections 1.6.3.1 and 1.7.5.1 summarized Wyoming's statutory authority pursuant to the ISR process, relevant State agencies that would be involved in the permitting of an ISR facility, and the range of State permits that would be required (NRC, 2009b).

1.6 Licensing and Permitting

The NRC has statutory authority through the AEA and the *Uranium Mill Tailings Radiation Control Act of 1978* to regulate uranium-recovery facilities. In addition to obtaining an NRC license, uranium-recovery facilities must obtain the necessary permits from the appropriate Federal, State, local, and Tribal governmental agencies. The NRC licensing process for ISR facilities is described in GEIS Section 1.7.1. GEIS Sections 1.7.2 through 1.7.5 describe the role of the other Federal, State, local, and Tribal agencies in the ISR permitting process (NRC, 2009b). The information below in this section of the SEIS describes the NRC license-application review process and summarizes the status of the NRC licensing process at the proposed Ross Project and the status of the Applicant's permitting with respect to other applicable Federal, State, local, and Tribal requirements.

1.6.1 NRC Licensing Process for the Ross Project

With a letter dated January 4, 2011, the Applicant submitted a license application to the NRC for the proposed Ross Project (Strata, 2011a; Strata, 2011b). As described in GEIS Section 1.7.1, the NRC initially conducts an acceptance review of all of the license applications it receives in order to determine whether the respective application is complete enough to support a detailed technical review. The NRC accepted Strata's license application for the Ross Project by a letter dated June 28, 2011; the application was then subjected to a very detailed technical review and evaluation (NRC, 2011b).

The NRC staff's detailed technical review of Strata's license application was composed of both a safety review and an environmental review. These two reviews were conducted in parallel (see GEIS Figure 1.7-1). The focus of the safety review was to assess compliance with the applicable regulatory requirements at 10 CFR Part 20 and 10 CFR Part 40, Appendix A. The environmental review has been conducted in accordance with the regulations at 10 CFR Part 51.

The NRC's hearing process (10 CFR Part 2) applies to licensing actions and offers stakeholders a separate opportunity to raise concerns associated with proposed licensing actions. The NRC published a "Notice of Opportunity for Hearing" related to Strata's license application for the Ross Project on July 13, 2011 (76 FR 41308). The NRC later received a combined request for a hearing from the NRDC and the PRBRC on October 27, 2011 (NRDC and PRBRC, 2011).

Regulations in 10 CFR Part 2 specify that a petition for review and a request for hearing must include a showing that the petitioner(s) has(ve) standing and that the Atomic Safety and Licensing Board (ASLB) would rule on a petitioner's standing by considering: 1) the nature of the petitioner's right under the AEA or NEPA to be made a party to the proceeding; 2) the nature and extent of the petitioner's property, financial, or other interest in the proceeding; and 3) the possible effect of any decision or order that may be issued in the proceeding on the petitioner's interest. The two Petitioners based their claim of standing on the possibility that the Ross Project would jeopardize the economic and environmental interests of at least one of their members (NRDC and PRBRC, 2011).

On February 10, 2012, the ASLB ruled that the NRDC and the PRBRC had demonstrated standing to be parties to the Ross Project licensing proceeding. The ASLB granted the Petitioners' request for a hearing and admitted four contentions (ASLB, 2012).

1.6.2 Status of Permitting With Other Federal, State, Local, and Tribal Agencies

In addition to Strata's obtaining a source and byproduct materials license from the NRC prior to conducting uranium-recovery operations at the proposed Ross Project area, the Applicant is also required to obtain all necessary permits and approvals from other Federal and State agencies to address: 1) the underground injection of solutions and liquid effluents from the ISR process; 2) the specific exemption of all or a portion of the ore-zone aquifer from regulation under the *Safe Drinking Water Act*; and 3) the surface discharge of storm water during the construction and operation of the Ross Project facility and wellfields. SEIS Table 1.2 lists the status of the permits and approvals required for Strata to conduct uranium recovery at the Ross Project.

1.7 Consultations

As a Federal agency, the NRC is required to comply with the consultation requirements in Section 7 of the *Endangered Species Act of 1973* (ESA), as amended, and Section 106 of the *National Historic Preservation Act of 1966* (NHPA), as amended. As noted above, the GEIS programmatically reviewed the environmental impacts of ISR uranium milling within four distinct geographic regions and acknowledged that each site-specific review would need to include its own consultation process with relevant agencies. Section 7 (ESA) and Section 106 (NHPA) consultations that have been conducted for the proposed Ross Project are summarized in SEIS Sections 1.7.1 and 1.7.2, below. A list of related consultation correspondence is provided in Appendix A of this SEIS. Finally, SEIS Section 1.7.3 describes the NRC's coordination with other Federal, State, local, and Tribal agencies conducted during the development of this SEIS.

2 IN SITU URANIUM RECOVERY AND ALTERNATIVES

This section describes the Proposed Action, which is to issue a United States (U.S.) Nuclear Regulatory Commission (NRC) source and byproduct materials license to Strata Energy, Inc. (Strata or the "Applicant"), for the proposed Ross Project in northeastern Wyoming. Strata would use its license in connection with the construction, operation, aquifer restoration, and decommissioning of the proposed Ross Project. This section also discusses alternatives to the Proposed Action, including the No-Action alternative as required under the *National Environmental Policy Act of 1969* (NEPA).

What is source material?

"Source material" means either the element thorium or the element uranium, provided that the uranium has not been enriched with the radioisotope uranium-235.

What is byproduct material?

"Byproduct materials" are tailings or wastes generated by extraction or concentration of uranium or thorium processed ores, as defined under Section 11e.(2) of the Atomic Energy Act (AEA).

Figure 2.1 indicates the proposed location of the Ross Project. Section 2.1 of this Final Supplemental Environmental Impact Statement (SEIS, or FSEIS if the respective section, figure, or table did not appear in the Draft SEIS [DSEIS]) describes the Alternatives that are included for detailed analysis, including the Proposed Action; Section 2.2 describes those alternatives that were considered but eliminated from detailed analysis; Section 2.3 summarizes the potential environmental impacts of the Proposed Action and the two Alternatives; and Section 2.4 discusses the NRC staff's final recommendation that the NRC issue a source and byproduct materials license for the Proposed Action unless safety issues mandate otherwise.

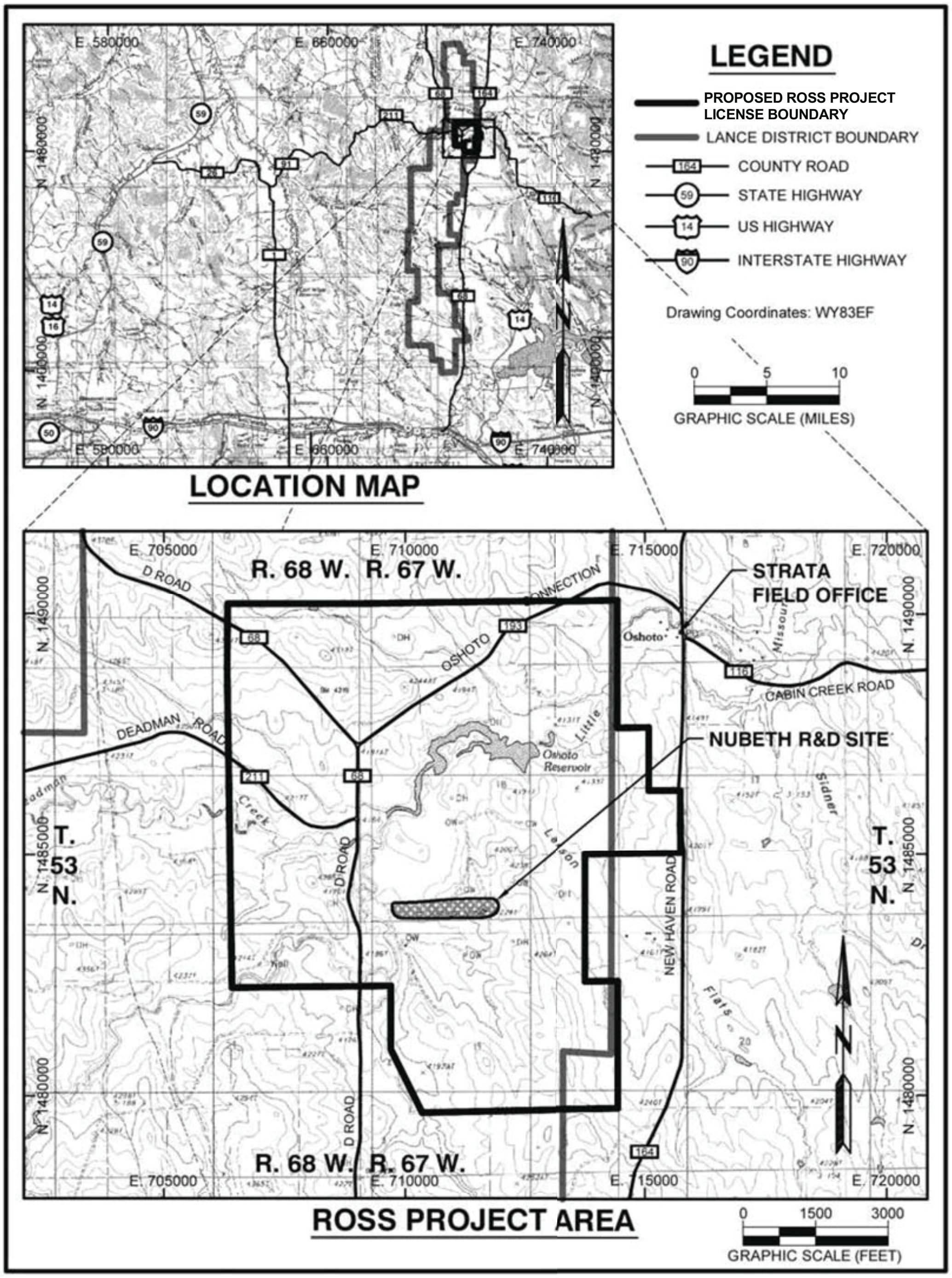
2.1 Alternatives Considered for Detailed Analysis

In addition to the Proposed Action, two alternatives to the Ross Project are also considered in this SEIS. All alternatives are evaluated with regard to the four phases of a uranium-recovery operation: construction, operation, aquifer restoration, and decommissioning. The range of alternatives has been established based on the purpose and need statement as described in Section 1.3 of this SEIS. In addition, this SEIS adopts many of the conclusions reached in the GEIS that was prepared for in situ recovery (ISR) projects (NRC, 2009b).

Alternatives examined in this SEIS are:

- Alternative 1 is the Proposed Action, as described in the Applicant's license application. The Proposed Action is described in SEIS Section 2.1.1.
- Alternative 2 is the No-Action Alternative, as required by NEPA, where the Applicant would not construct, operate, restore the aquifer, or decommission the Ross Project. Alternative 2 is described in SEIS Section 2.1.2.
- Alternative 3 is the same as the Proposed Action, except that the Ross Project facility (i.e., the central processing plant [CPP], auxiliary and support buildings and structures, and the surface impoundments) would be situated at a different location to the north of the Proposed Action (i.e., at the "north site"). Alternative 3 is identified in this SEIS as the "North Ross Project" and is described in SEIS Section 2.1.3.

The sources of information used in the development of this SEIS include the following: the Applicant's license application, including its *Environmental Report* (ER) (Strata, 2011a) and its *Technical Report* (TR) (Strata, 2011b) as well as its Responses to Requests for Additional



Source: Strata, 2011a.

Figure 2.1
Ross Project within the Lance District

Information (RAIs) (Strata, 2012a; Strata, 2012b); the information and scoping comments gathered during the NRC staff's and NRC consultants' site visit in August 2011 (NRC, 2011); information independently researched by the NRC staff from publicly available sources; multidisciplinary discussions held among NRC staff and various stakeholders; and the *Generic Environmental Impact Statement* (GEIS) itself (NRC, 2009b).

2.1.1 Alternative 1: Proposed Action

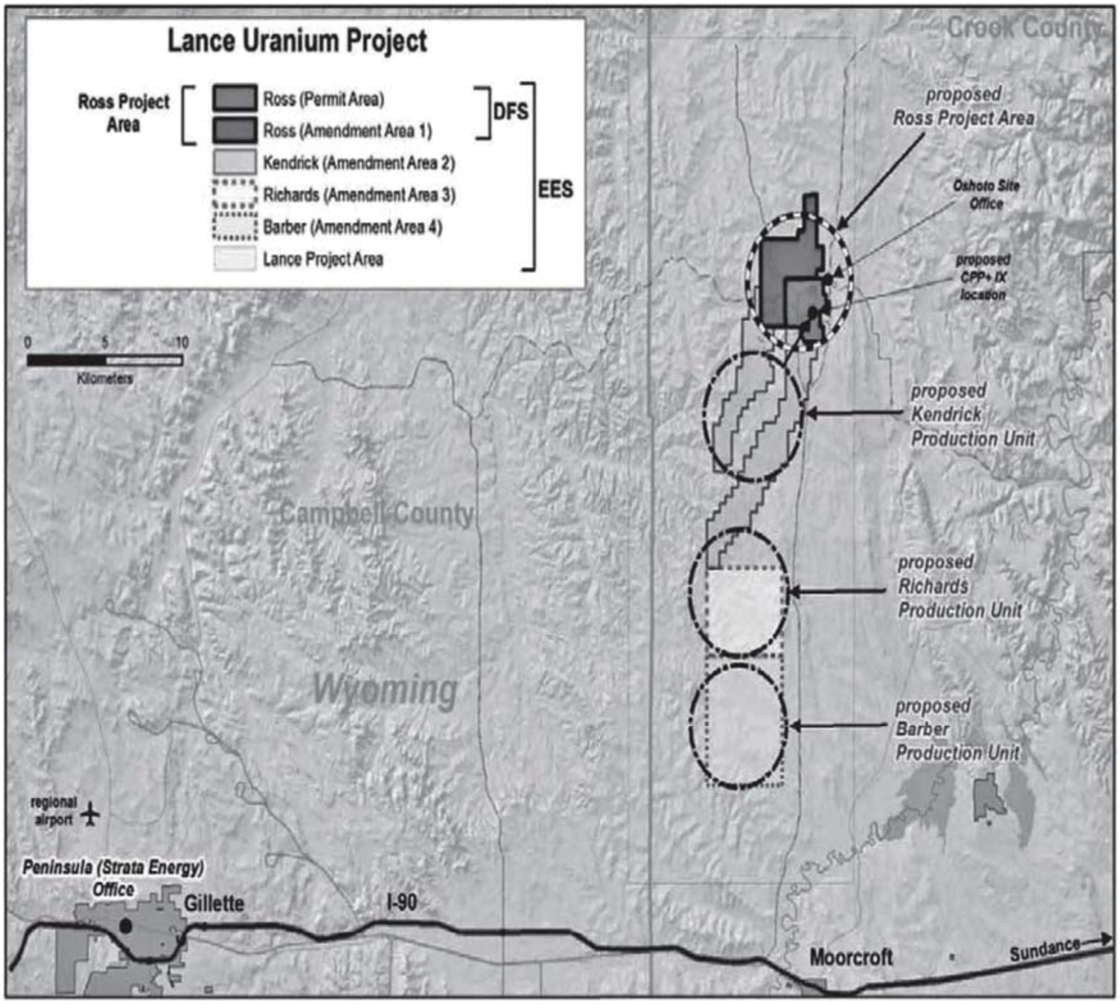
Under the Proposed Action, the NRC would issue the Applicant a source and byproduct materials license. The Applicant would use its license to construct, operate, restore the respective aquifers, and decommission the Ross Project facility and wellfields as described in its license application (Strata, 2011a; Strata, 2011b). Also, under the Proposed Action, the U.S. Bureau of Land Management (BLM) would approve the Applicant's Plan of Operations (POO). The Ross Project would occupy 696 ha [1,721 ac] in the north half of the approximately 90-km^2 [56-mi^2] Lance District, an area where the Applicant is actively exploring to determine whether there are additional uranium deposits. As Figure 2.2 shows, Strata has identified four other uranium-bearing areas that would potentially extend the area of uranium recovery in the Lance District itself to the north (the potential Ross Amendment Area 1) and to the south (the potential Kendrick, Richards, and Barber areas) (Strata, 2012a).

The Lance District is located on the western edge in the northwest corner of the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR) (see Figure 2.3). It is situated between the Black Hills uplift to the east and the Powder River Basin to the west (Strata, 2011a). Both of these regional features are described in the GEIS (NRC, 2009b). However, the Powder River Basin has been described as part of the Wyoming East Uranium Milling Region (WEUMR) and the Black Hills uplift as part of the NSDWUMR. The uranium ore zone at the Ross Project is situated in the Upper Cretaceous Fox Hills and Lance Formations. Although these stratigraphic units are not specifically described in the GEIS, they share key attributes that are important for ISR with the uranium-hosting Wasatch Formation in the Powder River Basin described for the WEUMR and the Inyan Kara Group described for the NSDWUMR (NRC, 2009b). These key attributes include alternating layers of permeable sandstone, which allow hydraulic connection within an ore zone, and shale layers, which prevent fluid migration outside of an ore zone. The present-day environment of the Proposed Action is described in SEIS Section 3, Affected Environment.

The Proposed Action includes the uranium-recovery facility itself and its wellfields (see Figures 2.4 and 2.5). The ISR facility consists of the following:

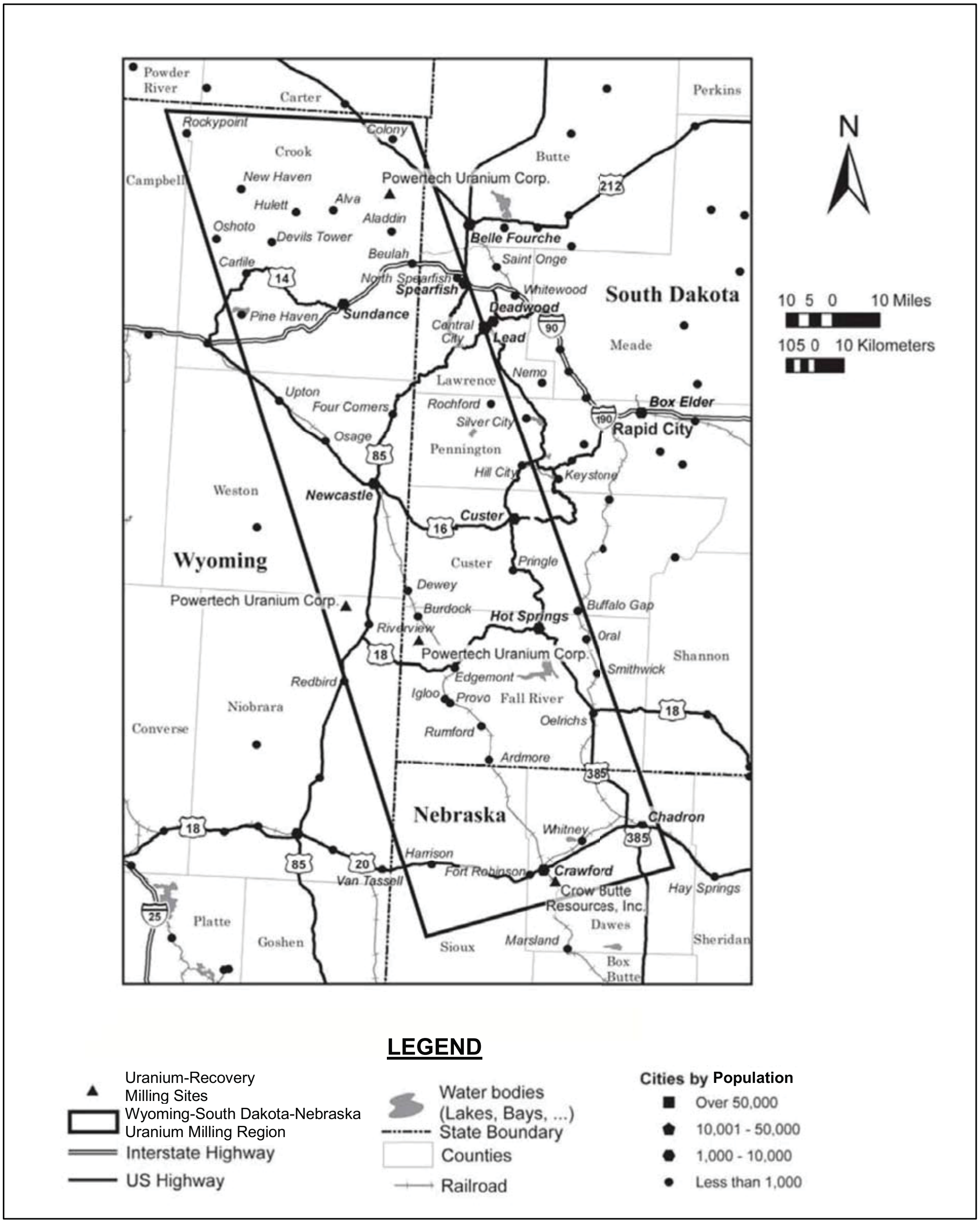
- A CPP that houses the uranium- and vanadium-processing equipment, drying and packaging equipment, and water-treatment equipment.
- A chemical storage area as well as other storage, warehouse, maintenance, and administration buildings.
- Two double-lined surface impoundments, a sediment impoundment, and up to five Class I deep-injection wells.

The schedule for the Proposed Action is shown in Figure 2.6. The Proposed Action includes the option of the Applicant's operating the Ross Project facility beyond the life of the Project's wellfields.



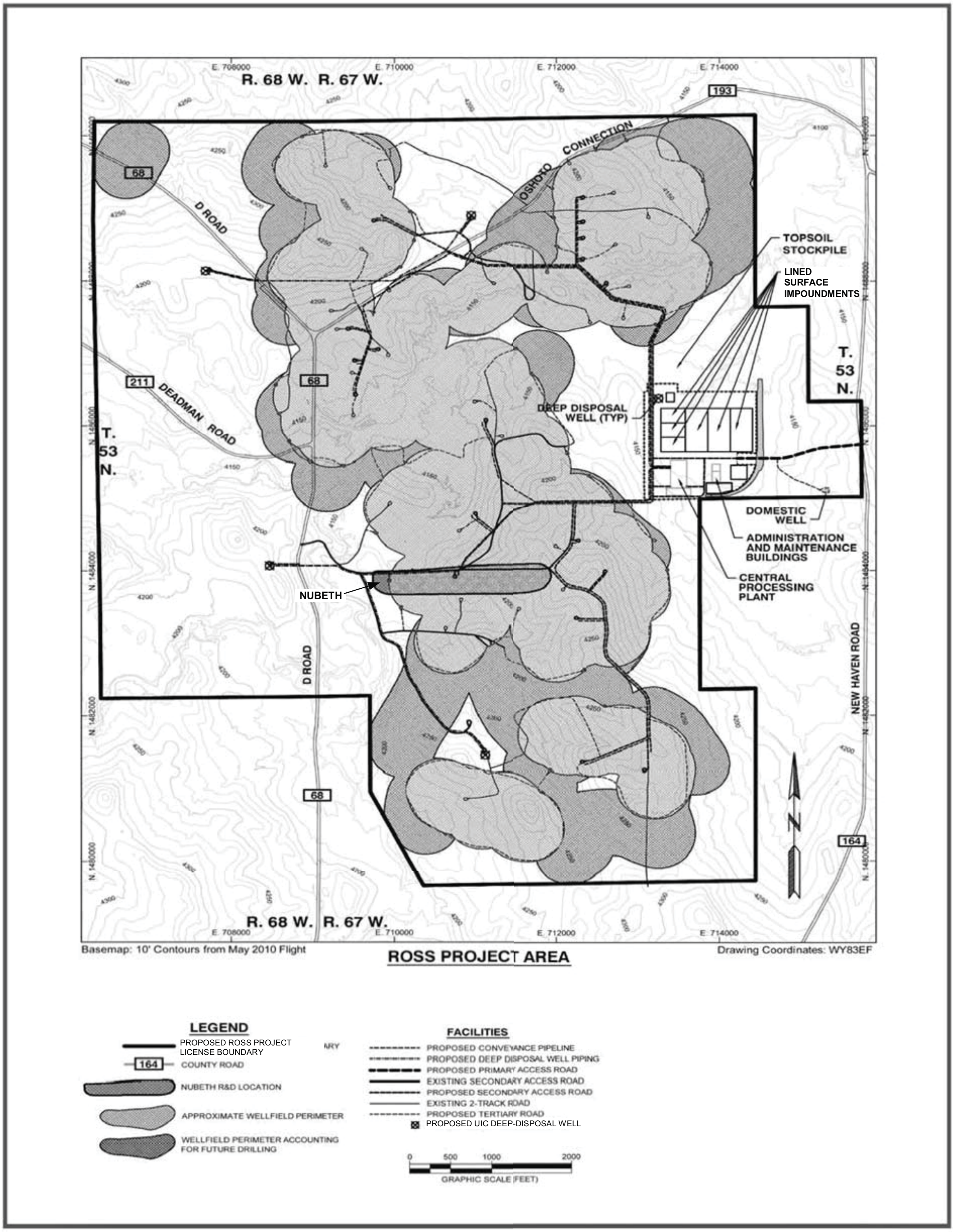
Source: Strata, 2012a.

Figure 2.2
Potential Satellite Areas in the Lance District



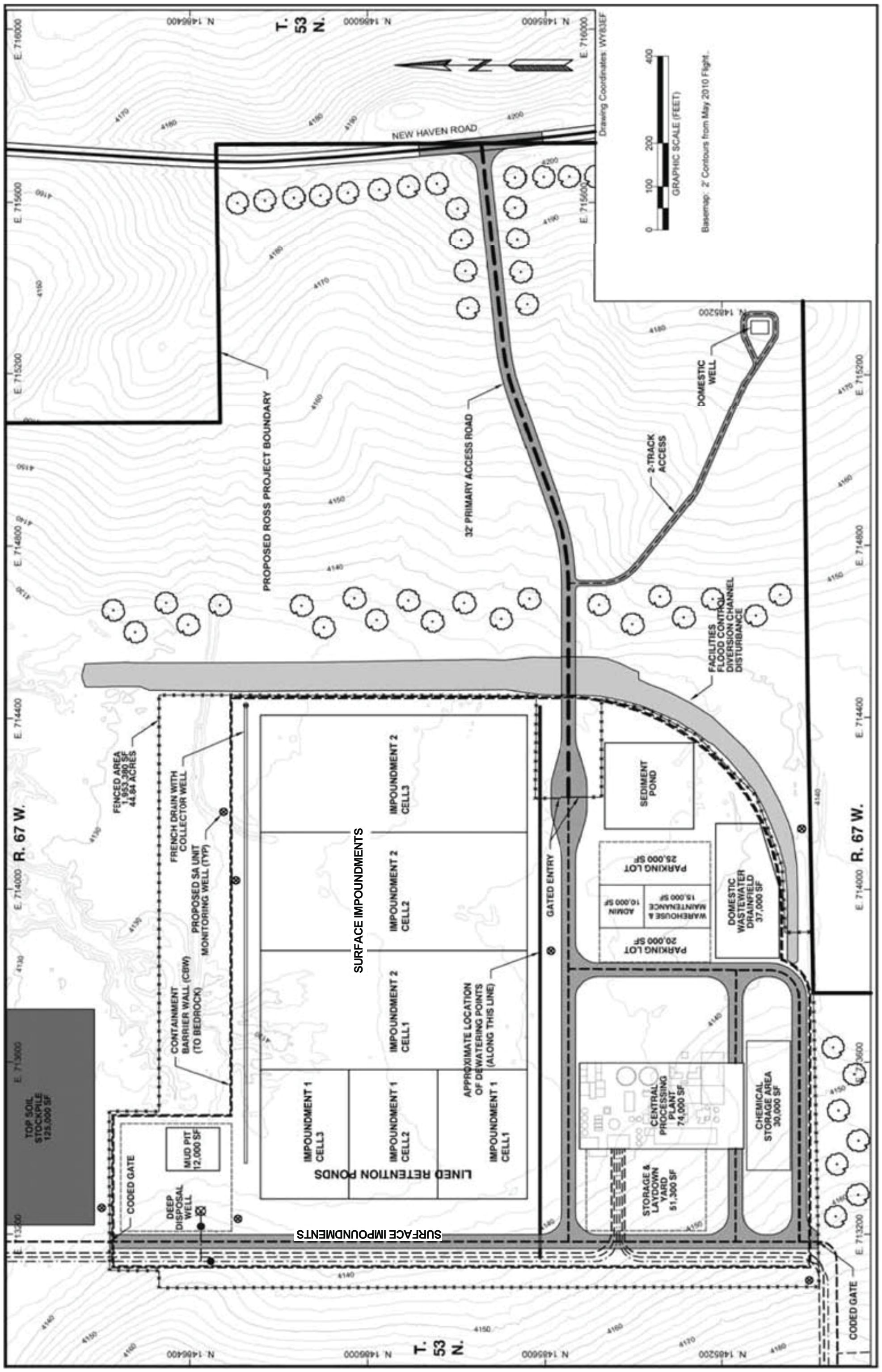
Source: NRC, 2009b.

Figure 2.3
Nebraska-South Dakota-Wyoming Uranium Milling Region



Source: Strata, 2011b.

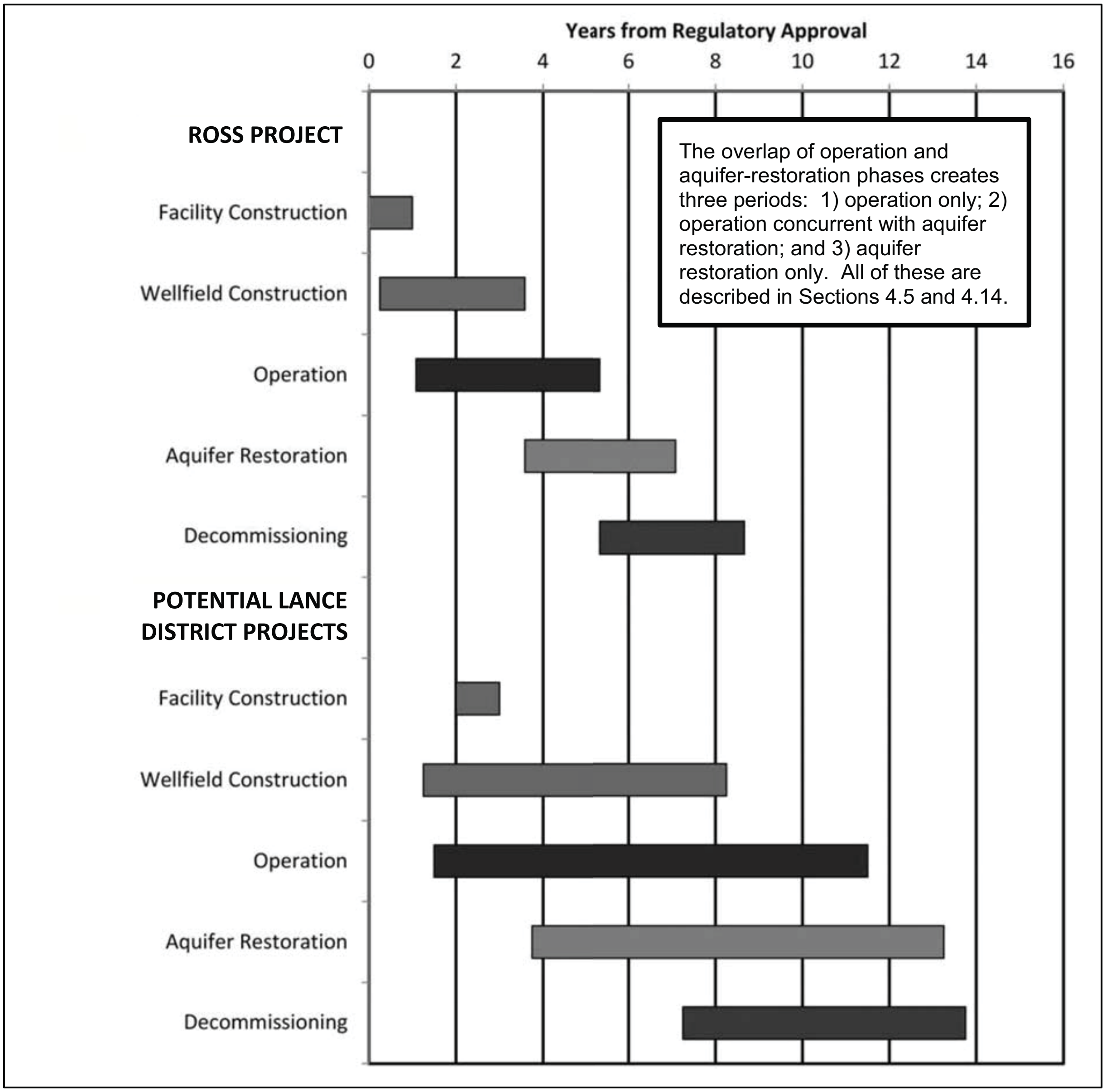
Figure 2.4
Proposed Ross Project Facility and Wellfields



Source: Strata, 2011b.

Note: Strata has proposed a modification of the facility design. The configuration would be revised to construct the CBW only along the south boundary of the facility itself (Strata, 2013b).

Figure 2.5
General Layout of Proposed Ross Project Facility



Source: Strata, 2012a.

Note: Decommissioning of the Ross Project's CPP would be completed after the last of the uranium from the Ross Project wellfields and satellites that may be developed within the Lance District are processed or after approximately 14 years from the time that all regulatory approvals are in place. Although Strata considers this schedule to be a "reasonably foreseeable development scenario," the actual development plans would depend upon a number of factors, including the results of ongoing exploration drilling, surface- and mineral-acquisition efforts, environmental pre-licensing, site-characterization studies for potential license-amendment areas, and the time required to acquire the necessary permits and licenses (Strata, 2012a).

Figure 2.6
Schedule for Potential Lance District Development

The facility could be used to process uranium-loaded resin from satellite projects within the Lance District operated by the Applicant, or from other offsite uranium-recovery projects not operated by the Applicant, or from offsite water-treatment operations. In this case, the life of the facility would be extended to 14 years or more (Strata, 2012a).

The Ross Project would host 15 – 25 wellfield modules and would consist of a total of 1,400 – 2,200 recovery and injection wells (Strata, 2011a). Groups of specific wells within a wellfield are called "wellfield modules." The wellfield modules would be connected with piping to a central collection facility called a "module building," or a "header house." The wellfields would be surrounded by a perimeter ring of monitoring wells.

This type of uranium extraction, in situ uranium recovery, consists of native ground water to which chemicals have been added, referred to as "lixiviant," that is injected into the aquifer bearing the uranium ore (the "ore zone" or "ore body") (see Section 2.1.1.2). The chemicals in the lixiviant dissolve the uranium from the rock within the aquifer. Ground water containing dissolved uranium is then pumped from the ore-zone aquifer, processed through ion-exchange (IX) columns to remove the uranium from the lixiviant, and then the uranium is precipitated into a solid material called "yellowcake" (U_3O_8). Most of the water is then reused for uranium recovery.

What is lixiviant?

A solution composed of native ground water and chemicals added during the ISR operations. Lixiviant is then pumped underground to mobilize (dissolve) uranium from a uranium-bearing ore zone, or the ore body.

ISR is not hydraulic fracturing or "hydrofracking." Hydrofracking is a technique that is used by oil companies to increase the production of petroleum and natural gas by creating cracks in tight rocks containing oil and gas. A hydraulic fracture is formed by a fracturing fluid that is pumped into a well at a rate sufficient to increase pressure in the well, so that it exceeds the in situ pressure of the rock. The fracturing fluid is a slurry of water, chemicals to aid in cracking, and a proppant, a material such as sand grains or ceramic particulates that keep the fractures open when the injection is stopped and oil recovery occurs. In contrast, ISR operates at much lower pressure in an injection well. In-situ pressures in ISR injection wells are maintained at less than the fracture pressures of the formations in which uranium-recovery is occurring. In addition, ISR is only used in aquifers with sufficient porosity and permeability to allow water flow from an injection well with a slightly positive pressure to the recovery well with a slightly negative pressure. This difference in pressure causes the ground water to move toward the recovery well. Finally, the chemicals in the water injected in ISR are for the purpose of dissolving the uranium, not to affect the porosity or permeability of the rock as are those during hydrofracking.

The Ross Project would be located in Crook County, Wyoming, 35 km [22 mi] north of the town of Moorcroft and Interstate-90 (see Figure 2.1). Other nearby towns and approximate direct distances to the Ross Project area include Pine Haven (27 km [17 mi] southeast), Gillette (53 km [33 mi] southwest), and Sundance (48 km [30 mi] southeast). The Ross Project area is adjacent to the unincorporated ranching community of Oshoto. The Oshoto community includes 11 residences within 3 km [2 mi] of the Proposed Action's boundary. Access to the Ross Project area is by either County Road (CR) 68 (D Road) or CR 164 (New Haven Road), both of which proceed north.

The Ross Project encompasses approximately 696 ha [1,721 ac] in portions of Sections 7, 17, 18, and 19, Township 53N, Range 67W, and portions of Sections 12, 13, and 24, Township 53N, Range 68W.

Table 2.1
Surface Ownership at Ross Project Area

Surface Ownership	Total Acres within Ross Project Area	Acres Disturbed During Year Preceding Operation	Acres Disturbed Over Life of Proposed Action
U.S. Bureau of Land Management	40.0	1.3	1.3
State of Wyoming	314.1	40	80
Private	1,367.2	69	199
TOTAL	**1,721.3**	**110.3**	**280.3**

Source: Table 1.2-1 in Strata, 2011a.

Surface ownership within the Ross Project area is primarily private, with small tracts of land owned by the State of Wyoming (Wyoming) and the BLM (Strata, 2011a). Approximately 16 ha [40 ac] are BLM land. The Wyoming Office of State Lands and Investments (WOSLI) administers 127 ha [314 ac]. In addition to the surface ownership, the BLM manages the subsurface mineral rights under 65 ha [160 ac] of privately owned land. Table 2.1 indicates the respective landowners of the Ross Project area. Current land uses are discussed in Section 3.2.

The Ross Project area is located in the upper reaches of the Little Missouri River, which flows northeasterly into southeastern Montana, through northwest South Dakota, and into North Dakota where it empties into the Missouri River at Lake Sakakawea. The area is characteristic of northeastern Wyoming: It is sparsely populated rangeland used primarily for grazing and some dryland agricultural production. Oil development from the Minnelusa Formation in western Crook County began in the 1970s. There are three oil-recovery wells within the Ross Project area; oil production from these wells peaked in 1985 – 1986, but production has generally declined since then (Strata, 2011a). The current status of oil and gas production is fully described in SEIS Section 5.2.1.2.

As noted earlier, uranium targeted for production within the Ross Project is located in permeable sandstones of the Upper Cretaceous Lance and Fox Hills Formations. The uranium in the Oshoto area resides in roll-front deposits typical of those across the Powder River Basin as described in the WEUMR (NRC, 2009b). Roll fronts are formed in sandstone formations when uranium-bearing ground water, moving down-gradient, encounters changing conditions. As the aquifer changes from oxygenated to oxygen-deficient, uranium precipitates as a coating on sand grains. The precise geometry of the uranium-ore deposits is controlled by the site-specific characteristics of the host sandstones. At the Ross Project area, the ore zones are generally thicker and more massive in the deeper Fox Hills compared to the deposits in the Lance Formation (Strata, 2011a). The top of the ore zone is approximately 76 m [250 ft] deep at the eastern edge of the Project area and 200 m [650 ft] deep at the Project's western edge (Strata, 2011a). The thickness of the ore zone ranges from 30 m [100 ft] to 55 m [180 ft].

Exploration of uranium deposits in the Lance Formation began in late 1970 (Strata, 2011a). The Nubeth Joint Venture (Nubeth), a joint venture between Nuclear Dynamics (later named ND Resources, Inc.) and Bethlehem Steel, received a License to Explore (No. 19) from the Wyoming Department of Environmental Quality's (WDEQ's) Land Quality Division (LQD) in August 1976, with subsequent modifications to accommodate research and development activities in 1978 (Strata, 2011a). ND Resources, Inc. filed for an NRC source material license in November 1977, and that license was approved in April 1978. Nubeth constructed a research and development operation in Section 18 of Township 53 North, Range 67 West, which is located within the Ross Project area (see Figure 2.1).

The research and development operation consisted of a single five-spot well pattern, with four injection wells and one recovery well, and a small facility with an IX column, elution, and precipitation circuit capable of producing yellowcake slurry (Nubeth, 1977). The research and development facility could process 340 L/min [90 gal/min] of uranium-bearing lixiviant. Hydraulic control during the operation was accomplished with "buffer" wells, which were meant to form a hydraulic barrier to keep the lixiviant within the well pattern. Nubeth operated from August 1978 through April 1979 and recovered small amounts of uranium. No precipitation of a uranium product took place, and all of the recovered uranium was stored as a solution. The operation was shutdown prematurely because of difficulties in operation's not being able to achieve desired injection rates (Strata, 2011a). The limitations on injection rates were attributed to the build-up of fines and organic material in the wellfield.

After uranium-recovery tests were completed, the single five-spot used in the test was restored. Restoration was completed in February 1983 and Nubeth was notified by the WDEQ on April 25, 1983 that the restoration was satisfactory. Final approval for the research and development operation's final decommissioning was granted by the NRC and WDEQ/LQD during the time period from 1983 through 1986 (Strata, 2011b; ND Resources, 1985a; ND Resources, 1985b).

A summary report on production feasibility estimated that uranium production could average about 360 kg/d [800 lb/d] in a facility sized to process 11,000 – 15,000 L/min [3,000 – 4,000 gal/min] (Strata, 2011a). However, due to the declining price of uranium at the time, commercial-scale licensing, construction, and operation did not occur. Two of Nubeth's wells (Well 789V and 19XX) have been used by oil companies since 1980 as water-supply wells (Strata, 2011b); currently, the Merit Oil Company (Merit) is operating these two wells in addition to one more on the Ross Project area to withdraw approximately 169 L/min [44.6 gal/min] from the aquifer in the Fox Hills Formation for enhanced oil recovery (Strata, 2012c).

The Applicant notes that information obtained from the Nubeth research and development operation was used in its decision to develop the Ross Project at the location described in this SEIS (Strata, 2011a). Nubeth's operation contributed the following information:

- Demonstration of the probability of an aquifer exemption of the mineralized zone.
- Determination of strong geologic confinement above and below the identified ore body(ies).
- Confirmation of fundamental hydrogeologic hypotheses regarding ground-water flow and behavior.
- Validation of information on potential regulatory and operational technical issues.
- Determination of site geology, hydrology, soils, ecology, climate, and Project area radiological conditions.

- Decrease of disturbance to both the surface and subsurface based upon data collected in the past.
- Demonstration of successful ground-water restoration and site reclamation.

Peninsula Energy, Ltd. (formerly Peninsula Minerals, Ltd.) initiated acquisition of mineral rights in the Lance District in 2007 and 2008 (Peninsula, 2011). Exploration drilling programs, which were conducted in 2008 and 2009, confirmed significant uranium resources in the Ross Project area. Strata was then incorporated in 2009, and by a letter dated January 2011, Strata then submitted a two-volume license application for a source and byproduct materials license to the NRC. It also submitted an application for a Permit to Mine to the WDEQ/LQD and a POO to the BLM. The WDEQ/LQD approved Strata's Permit to Mine application in November 2012, and the BLM is currently reviewing Strata's POO. The BLM is also participating as a cooperating agency to the NRC under a Memorandum of Understanding (MOU) for the Ross Project.

The Underground Injection Control (UIC) Program administered by the WDEQ/LQD regulates the design, construction, testing, and operation of all injection and recovery wells (WDEQ/LQD, 2005a). The WDEQ has primary regulatory authority for such actions as delegated by the U.S. Environmental Protection Agency (EPA). Wells for uranium extraction (i.e., uranium recovery) are classified under the WDEQ's UIC program as Class III wells. As part of its Permit to Mine issued by the WDEQ/LQD, the Applicant also acquired a UIC Permit to use Class III injection wells. The Permit to Mine would include maximum and average injection volumes and/or pressures necessary to ensure that fractures are not initiated in the confining zones; injected fluids do not migrate into any unauthorized zone; and formation fluids are not displaced into any unauthorized zone. Operating requirements of the WDEQ Permit-to-Mine would, at a minimum, specify that fluid and fracture pressures in the production zone be calculated to ensure that the pressure in the production zone during injection would not initiate new fractures or propagate existing fractures. In no case, would injection pressure initiate fractures in the confining zone, if confinement is present, or cause the migration of injection or formation fluids into an unauthorized zone. In addition, License Condition No. 10.14 would require that, during wellfield operations, injection pressures would not exceed the maximum operating pressures as specified in the Applicant's license application (Strata, 2011b; NRC, 2014b).

Before uranium-recovery operation can begin at any wellfield, however, the Applicant will also be required by license condition to provide the NRC with documents clearly delineating the approved aquifer-exemption areas (NRC, 2014b), as the portions of an aquifer designated for uranium recovery must be exempted as an underground source of drinking water (USDW) by the EPA and reclassified by the WDEQ/Water Quality Division (WQD) in accordance with the *Safe Drinking Water Act* (SDWA). Outside of the aquifer-exemption boundary, the aquifer is still protected as a source of drinking water because the governing regulations regarding underground injection found at 40 CFR Part 144.12 prohibit the movement of any contaminant into the underground source of drinking water which is located outside the aquifer-exemption boundary. In these regulations, a "contaminant" is defined broadly to include "any physical, chemical, biological, or radiological substance or matter in water." Therefore, groundwater at the aquifer-exemption boundary must meet 10 CFR Part 40, Appendix A, Criterion 5B(5) water-quality requirements. Wyoming's rules for "in situ mining" require that the exempted aquifer be restored to its premining class of use after operations are complete (WDEQ/LQD, 2005). The requirement by the WDEQ at "Noncoal In Situ Mining," *Rules and Regulations*, Chapter 11 for restoration of the area within the boundary of the exempted aquifer is more stringent than the EPA's regulations (at 40 CFR Part 144.12) that require that ground-water protection standards be met only at the aquifer-exemption boundary.

In Section 2 of the GEIS, the four stages in the life of an ISR facility are described: 1) construction, 2) operation, 3) aquifer restoration, and 4) decommissioning (NRC, 2009b). The decommissioning phase would include facility decontamination, dismantling, demolition, and disposal as well as site reclamation and restoration. Although the NRC recognizes that these four phases could be performed concurrently, and in practice early wellfields would undergo aquifer restoration while other wellfields are being installed, the GEIS determined that describing the ISR process in terms of these stages aids in the discussion of the ISR process and in the evaluation of potential environmental impacts from an ISR facility.

2.1.1.1 Ross Project Construction

Construction of the Ross Project would be consistent with the general construction activities described in Section 2.3 of the GEIS (NRC, 2009b). The Applicant discusses certain preconstruction activities that could be performed prior to its receiving its source and byproduct materials license from the NRC (Strata, 2011a; NRC, 2014b); however, for the purposes of this evaluation of environmental and other impacts, this SEIS assumes that these preconstruction activities would occur at the same time as the Proposed Action such that the impacts of the preconstruction activities are considered as part of Alternative 1: Proposed Action. These preconstruction activities could include site excavation and preparation, such as clearing, grading, and constructing design components intended to control drainage and erosion as well as other mitigation measures; erection of fences and other access control measures that are not related to the safe use of, or security of, radiological materials; support-building construction; infrastructure construction, such as paved roads and parking lots, exterior utility and lighting systems, domestic waste-water facilities, and transmission lines; and other activities which have no measurable relationship to radiological health and safety nor common defense and security. In addition, the Applicant has indicated its intent to construct one Class I deep-injection well to better characterize the hydrologic and geochemical properties of the targeted geologic formation (i.e., Deadwood and Flathead Formations) (Strata, 2011a; NRC 2011b). No radioactive material would be present at the Ross Project during preconstruction activities. As described in SEIS Section 3.13.1, drilling fluids and muds as well as soil cuttings from drilling during preconstruction activities are defined and regulated by the EPA as technologically enhanced naturally occurring radioactive materials (TENORM).

After some or all of these activities, actual construction of the Proposed Action would begin and include: 1) the ISR facility that would consist of the CPP as well as administration, warehouse, and maintenance buildings, including storage and other structures, and lined surface impoundments; 2) wellfields including piping and module buildings; and 3) deep-disposal wells (see Figure 2.5) (Strata, 2011b; Strata, 2012b).

The Applicant anticipates construction of the facility and initial wells within one year of receiving its Source and Byproduct Materials License (see Figure 2.6). Main access roads would be constructed at the same time as the facility (Strata, 2011a). Secondary wellfield access roads would be constructed as necessary, as each wellfield is developed. It is estimated that the facility would encompass 21 ha [51 ac] (Strata, 2011b). A total of 45 ha [110 ac] would be disturbed by construction activities during the year preceding ISR facility operation and 114 ha [282 ac] over the life of the Proposed Action (see Table 2.1) (Strata, 2011a).

The Ross Project would employ approximately 200 people during construction. The Applicant anticipates that most employees would be from Crook and Campbell Counties (Strata, 2011a). Further information on employment and other socioeconomic issues are described in Section 3.11.

What are underground injection control permits?

The U.S. Environmental Protection Agency (EPA) has delegated authority to the State of Wyoming (the Wyoming Department of Environmental Quality [WDEQ]) to administer its own Underground Injection Control (UIC) Permits. State's with delegated authority from EPA have regulations that meet or are more stringent than those of the EPA. Class I and III wells under the UIC program are most applicable to in situ uranium recovery.

- **Aquifer Exemption:** UIC criteria for the exemption of an aquifer that might otherwise be defined as an underground source of drinking water are found at 40 CFR Part 146.4. These criteria include whether the aquifer is currently a underground source of drinking water (USDW), whether the water quality is such that it would be economically or technologically impractical to use the water to supply a public water system, and whether the aquifer contains minerals that are expected to be commercially producible. An aquifer exemption is granted by the WDEQ and requires EPA approval. Wyoming's rules for In-Situ Mining require that the exempted aquifer be restorated to its pre-mining class of use after the operations are complete (WDEQ/LQD, 2005). This requirement is more stringent than EPA's rules which only require that ground-water protection standards be met at the aquifer-exemption boundary (i.e. contaminants cannot migrate from an exepted aquifer to the surrounding USDW).
- Industrial and Municipal Waste Disposal Wells (UIC Class I): Wells in this Class are used for the deep disposal of industrial, commercial, or municipal waste below the deepest USDW. This type of well uses injection and requires applied pressure. For in situ uranium recovery, this type of UIC permit is necessary to use deep-well injection for disposal of non-hazardous liquid wasteswaste. The WDEQ is responsible for Wyoming's UIC Program and, therefore, it is the agency that approves Class I permits for UIC wells.
- Mining Wells (UIC Class III): This type of UIC permit governs the injection wells used in the recovery of minerals. They include experimental-technology wells; underground coal-gasification wells; and wells for the in situ recovery of materials such as copper, trona, and uranium. For in situ uranium recovery, this type of UIC permit applies to wells that inject lixiviant into a uranium-bearing aquifer. The corresponding monitoring and recovery wells are regulated through the WDEQ by both its Water Quality Division (WQD) and Land Quality Division (LQD), which cooperate through a Memorandum of Understanding (MOU) which facilitates in situ uranium-recovery oversight by the WDEQ/LQD.

Under the terms of the UIC Class I Permit, the Applicant is allowed to inject into the Class I deep-disposal wells the following: operation bleed streams, yellowcake wash water, sand-filter and IX-resin wash water, onsite laboratory waste water, RO brine, aquifer-restoration ground water, facility wash-down water, wash waters used in cleaning or servicing waste-disposal-system equipment, and storm water—all generated during uranium-recovery activities—as well as fluids produced during the drilling, completion, testing, or stimulation of wells or test drillholes related to uranium-recovery operations, or during the work-over or abandonment of any such well, and drilling-equipment wash water. Under the terms of the UIC Permit, the Applicant is also prohibited from injecting certain materials into these wells. For example, hazardous wastes as defined by EPA or WDEQ cannot be injected into these wells (WDEQ/WQD, 2011b). Well construction, operation, MIT inspection, and proper well abandonment techniques and requirements, are defined in this Permit as well. The Applicant would need to obtain written acceptance of financial-assurance methods from WDEQ prior to construction of each of the proposed wells.

The Applicant proposes that each well location would consist of a 76 m x 76 m [250 ft x 250 ft] pad with a storage tank (Strata, 2011b; Strata, 2012b). Surface equipment for the deep-disposal wells would include storage tanks, pumps, filtration systems, instrumentation and control systems, and equipment for injection of process chemicals (Strata, 2011b). Pads would either be asphalt pavement or gravel and would be retained through the life of the disposal well in order to conduct maintenance. Access

3.5.3 Ground Water

3.5.3.1 Regional Ground-Water Resources

The Applicant presented a description of the regional hydrogeology within which the Ross Project area resides, based upon published literature, in its license application (Strata, 2011a; Strata, 2011b). The site-specific hydrogeology of the Lance Formation and the associated stratigraphy underlying the Ross Project area is not specifically described in the GEIS; thus, detailed information is included here. Water-bearing bedrock intervals in the eastern Powder River Basin range in age from Precambrian to Paleocene (see Figure 3.7). Regionally, recharge occurs in the outcrop areas, with ground water moving away from the outcrop into the Basin. Due to the geologic dip of the units, stratigraphic horizons that are accessible near the Black Hills uplift are deeply buried in the Basin's center about 125 km [75 mi] west from the Ross Project area (Hinaman, 2005).

Within the northeast corner of Wyoming there are a number of water-bearing intervals tapped by municipalities and industrial users (Strata, 2011a; Langford, 1964). Below the Fox Hills aquifer, the Minnelusa Formation (210 – 270-m [700 – 900-ft] thick), and the underlying Madison Formation (90 – 270-m [300 – 900-ft] thick) are the most significant aquifers (Whitcomb and Morris, 1964). The Minnelusa and Madison aquifers are recharged at the outcrop in the area of the Black Hills uplift. Ground-water flow in all aquifers is from the recharge areas along the outcrop, westward towards the center of the Powder River Basin. Flow directions are locally modified by pumping wells. The Minnelusa Formation has received aquifer exemptions in portions of Campbell County which allow it to be used for waste-water disposal (EPA, 1997).

The Minnelusa Formation is also an important hydrocarbon reservoir interval in the areas of the Powder River Basin that are west of the Ross Project (De Bruin, 2007). At the Ross Project area, the Minnelusa Formation is approximately 1,860 m [6,100 ft] bgs (Strata, 2011a). It is separated from the Ross Project's proposed ore zone by 1,680 m [5,500 ft] of sandstone, claystone, and shale, most notably the Pierre Shale which is over 600-m [2,000-ft] thick under the Ross Project area (see SEIS Section 3.4) (Whitcomb and Morris, 1964).

Water-supply wells in the Madison Formation have reported yields of up to 60 L/s [1,000 gal/min]; the Formation is an important source of drinking water for the communities of Gillette and Moorcroft. The city of Gillette operates a wellfield consisting of ten wells north of the town of Moorcroft, yielding 590 L/s [9,300 gal/min] from a depth of approximately 760 m [2,500 ft]. The water is piped approximately 53 km [33 mi] to Gillette and blended with locally-produced ground water from the Fort Union Formation and to a lesser degree from wells completed in the Lance and Fox Hills Formations. Other towns in the vicinity (e.g., Moorcroft, Sundance, Upton, Newcastle, and Hulett) also use the Madison Formation for municipal water supply (Strata, 2011a). In the vicinity of Gillette, the Fox Hills and Lance Formations are typically targeted by industrial users, while smaller municipalities, subdivisions, and improvement districts west of Ross Project area use wells completed within the shallower Fort Union Formation.

3.5.3.2 Local Ground-Water Resources

The detailed geologic stratigraphy and its relationship to the corresponding hydrology are illustrated in Figure 3.7. The detailed stratigraphic sequence from the land surface to the confining unit below the ore zone is, in descending order: recent, unconsolidated, surficial

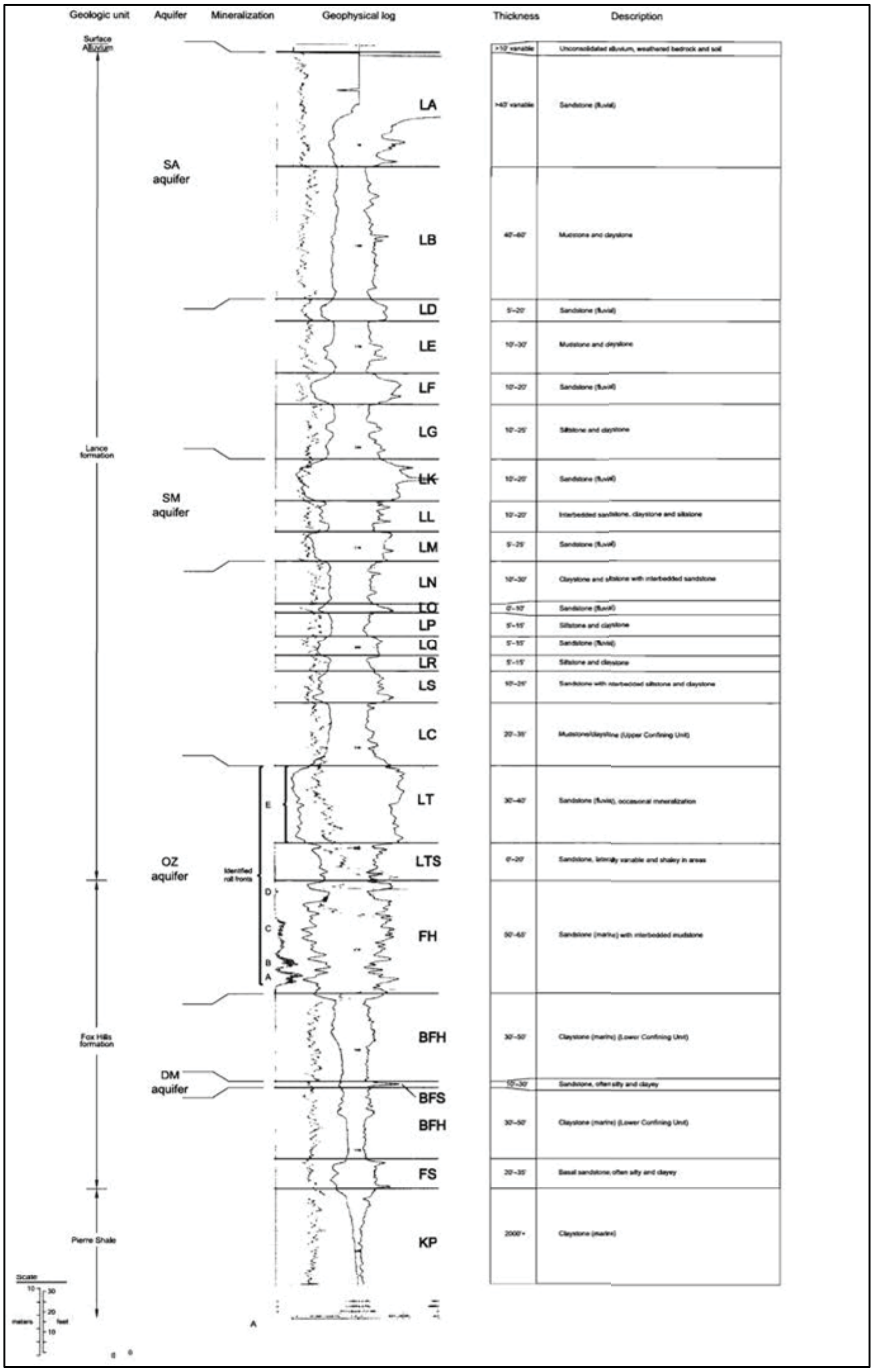
deposits including residual soils, colluvium, and alluvium; Lance Formation; Fox Hills Formation; and Pierre Shale (see SEIS Section 3.4). Figure 3.14 illustrates the geophysical log and corresponding lithology obtained from Exploration Drillhole No. RMR008, the location of which is shown in Figure 3.6 in SEIS Section 3.4.1. This particular drillhole was chosen as the "type log" by the Applicant for the Ross Project because of the clarity of the geophysical logs and the associated stratigraphic descriptions from land surface to the top of the Pierre Shale (Strata, 2011a).

Within the Ross Project area, there are four named aquifers existing between the land surface and the Pierre Shale. The correspondence between stratigraphic horizons and hydrologic units, and the related nomenclature, are summarized in Table 3.4.

Table 3.4
Geologic Units, Stratigraphic Horizons, and Hydrologic Intervals of Ross Project Area

Geologic Unit	Stratigraphic Horizon	Hydrologic Interval
Lance Formation and/or Recent Alluvium/Colluvium	Qal/LA/LB	SA (Surficial Aquifer)
Lance Formation	LD-LG	Lance Units (Aquitard)
	LK-LM	SM (Shallow-Monitoring Aquifer)
	LN-LS	Sandstone within Confining Unit
	LC	Upper Confining Unit
	LT-LTS	OZ (Ore-Zone Aquifer)
Fox Hills Formation	FH	
	BFH	Lower Confining Unit (Aquitard)
	BFS	DM (Deep-Monitoring Aquifer)
	BFH/FS	Sandstone within Confining Unit
Pierre Shale	KP	Regional Confining Unit (Aquitard)

Source: Strata, 2012b.



Source: Strata, 2011a.

Note:

Nomenclature used to describe stratigraphic horizons and hydrogeologic units or intervals at the Ross Project Area (developed by Strata from the geophysical log and corresponding lithology obtained from Exploration Drillhole No. RMR0008. The respective location is shown in Figure 3.8.)

Figure 3.14
Stratigraphic Horizons and Hydrogeologic Units at Ross Project Area

The surficial aquifer, or the SA interval, is the “water-table” aquifer within the Ross Project area. It consists of the uppermost water-bearing unit within the Upper Lance Formation and the alluvium of the Little Missouri River and Deadman Creek. Ground-water levels range from near-surface in the river valleys to over 15 m [50 ft] bgs in topographically higher areas.

The sandstones of the Lower Lance Formation (LT intervals) make up the upper portion of the ore zone (i.e., ore-zone [OZ] aquifer) (see Figure 3.14). The LT sands range in thickness from 9 – 12 m [30 – 40 ft] and show hydraulic continuity beneath the Ross Project area. Above the LT sands is a shale layer varying in thickness from 6 – 24 m [20 ft – 80 ft], locally called the LC interval aquitard. The Applicant designates the LC aquitard as the “upper confining unit.” The LC aquitard serves as a confining unit that separates the uranium-mineralized sandstones of the FH and LT horizons and the OZ aquifer, from the water-bearing unit above (see Figure 3.14).

The water-bearing sands above the upper confining unit are referred to as the “shallow-monitoring (SM) unit,” or the SM aquifer, and is composed of the LM- through LK-horizon sandstones. Above the SM aquifer is a sequence of thin sands, shales, and silts. Many of the thin sandstones contain water; however, these sandstones are generally discontinuous and, while they may be used locally for stock and domestic wells, they are not regionally extensive.

The Lance Formation is recharged at the outcrop and at the subcrop beneath the alluvium in the valley of the Little Missouri River and its tributaries. Natural ground-water flow would be expected to be westward from the outcrop toward the Basin.

At the Ross Project area, the thickness of the Fox Hills Formation is approximately 46 m [150 ft], with local variations of up to 15 m [50 ft] or more. The Fox Hills Formation consists of an upper sandstone unit (i.e., FH horizon) and a lower sandstone unit (i.e., FS horizon) which are separated by an intervening shale, claystone, and mudstone interval (i.e., BFH horizon) containing the BFS sandstone unit (see Figure 3.14). Uranium mineralization primarily occurs within the Fox Hills Formation’s sands, although in localized areas mineralization occurs within the overlying Lance Formation’s (i.e., LT horizon) sandstone.

The FS and BFS sandstones represent the only water-bearing units within the Lower Fox Hills Formation (see Table 3.4). Both sand units are believed to be continuous throughout the Ross Project area, although in places they are relatively thin. The BFS horizon is the nearest aquifer below the uranium-bearing sandstone (the FH horizon and also known as the ore zone) in the Upper Fox Hills Formation, and in terms of uranium-recovery activities, it is referred to as the “deep-monitoring (DM) unit,” or the DM aquifer. It is separated from the FH sand (i.e., the ore zone) above and the FS (basal sandstone) below by a shale, claystone, and mudstone (BFH horizon). The Applicant provides potentiometric contours for the DM interval in its ER (Strata, 2011a).

The Pierre Shale yields very little water; it is considered regionally as a confining unit (NRC, 2009b; Whitehead, 1996). No wells are known to be completed within the Pierre Shale at the Ross Project area. Exploratory drilling in the upper 30 m [100 ft] of the Pierre Shale by Nuclear Dynamics showed that the shale was composed of silts and clay, with some calcareous cement.

The FH horizon sandstones within the Upper Fox Hills Formation contain uranium and are the primary uranium-recovery target units for the Proposed Action. The Applicant has designated

What terms are used to describe hydrologic characteristics?

Transmissivity: This term is used to define the flow rate of water through a vertical section of an aquifer, considering a unit width and extending the full saturated height of the aquifer under unit hydraulic gradient. Transmissivity is a function of an aquifer's saturated thickness and hydraulic conductivity.

Hydraulic Conductivity: This term represents a measure of the capacity of a porous medium to transmit water. It is used to define the flow rate per unit cross-sectional area of an aquifer under unit hydraulic gradient.

Storativity: This term is used to characterize the capacity of an aquifer to release ground water from storage in response to a decline in water levels.

the OZ aquifer as consisting of the FH sandstones with the overlying Lower Lance Formation sandstones (LT horizon). The lithologies of the ore zone range from thick-bedded, blocky sandstones to thin, interbedded sandstones, siltstones, and shales. The OZ aquifer is underlain by claystone of the Fox Hills Formation (i.e., BFH interval). Within the Ross Project area, this ore-zone interval ranges from 27 – 55-m [90 – 180-ft] thick (see Figure 3.14). Thin, silty, and clayey sandstone comprises the DM aquifer. The Applicant designates the BFH aquitard above the DM aquifer and below the ore zone as the "lower confining unit." Isopachs of the lower confining unit (BFH) show that it ranges in thickness from less than 3 m [10 ft] to more than 15 m [50 ft] (Strata, 2011a). Above the ore zone, the mudstone and claystone of the Lance Formation form the upper confining unit, as noted above, ranging in thickness from less than 6 m [20 ft] to more than 15 m [50 ft] (see Figure 3.14).

The FH sandstones, shales, and silts have been studied extensively through both core analysis and aquifer tests. Seven pumping tests targeting the ore zone were performed by the Applicant at six separate well clusters. Applicable methodology and testing were used and those results are shown in Table 3.5 (additional details can be found in Strata, 2011b).

Table 3.5
Ore-Zone Aquifer Hydrogeologic Characteristics

	Transmissivity m^2/day [ft^2/day]	Hydraulic Conductivity cm/s [ft/day]	Storativity (Unitless)
Minimum	0.353 [3.80]	4.59E-05 [0.13]	4.00E-06
Maximum	34.2 [368]	2.69E-03 [7.62]	1.50E-04
Median	8.20 [88.3]	1.25E-03 [3.55]	6.10E-05
Geometric Mean	6.10 [65.6]	6.74E-04 [1.91]	4.50E-05
Average	8.15 [87.8]	1.15E-03 [3.26]	6.70E-05

Source: Addendum 2.7-F, Table 3, in Strata, 2011b.

The aquifer properties determined by the 2010 tests are comparable to results reported for previous pumping tests within the Ross Project area (Strata, 2011b).

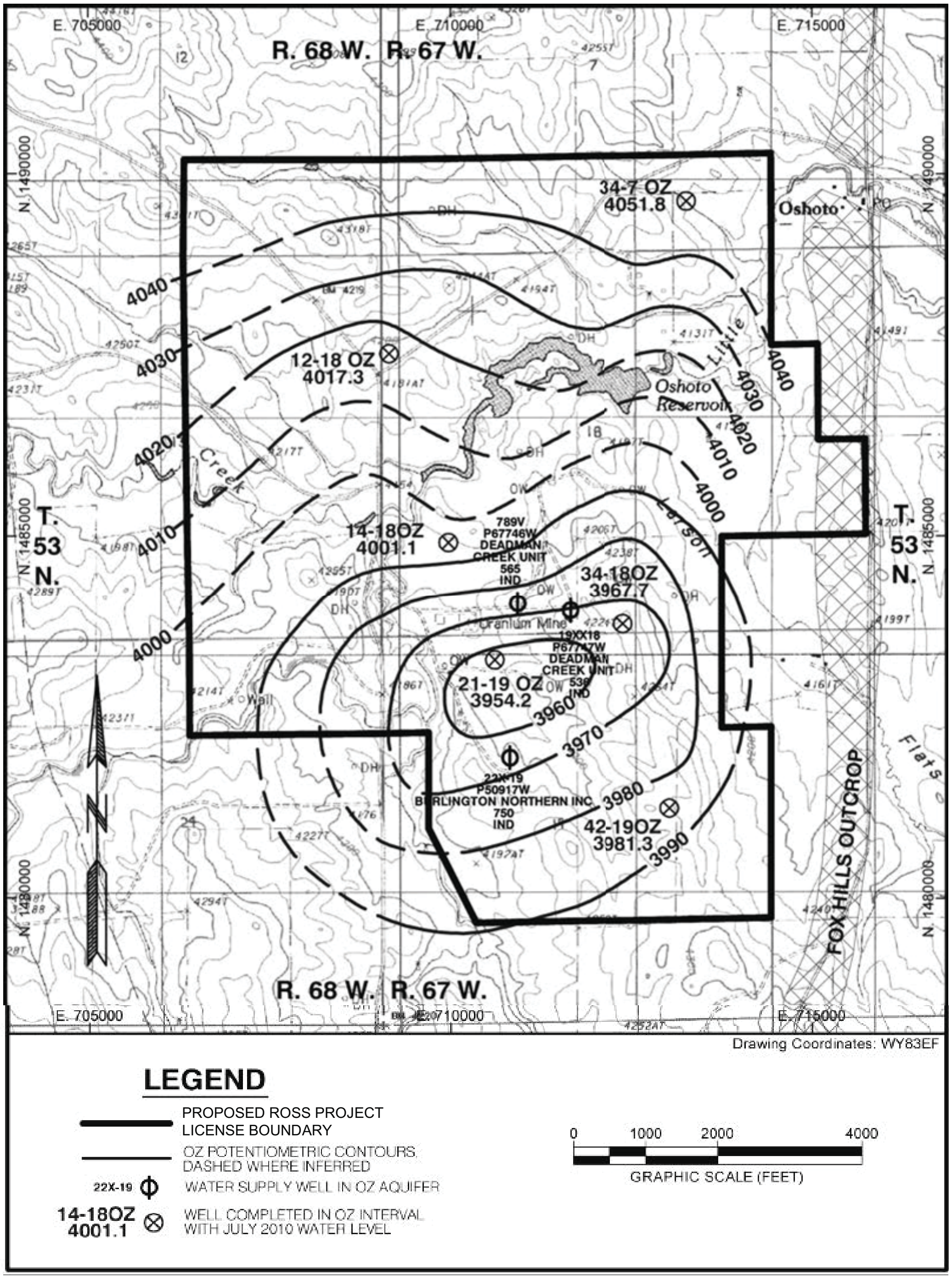
The Applicant developed a static piezometric surface (i.e., a map showing the static water levels expressed as feet above sea level) for the ore-zone aquifer (see Figure 3.15). The ore zone's potentiometric surface shows a distinct cone of depression near the No. 21-19 well cluster that has resulted from 30 years of ground-water withdrawals by oil-field water-supply wells completed in the OZ aquifer. This pumping has changed the hydraulic gradient and the direction of ground-water flow throughout most of the Ross Project area. The potentiometric surface near the No. 34-7 well cluster, which is farthest from the oil-field water-supply wells that have been pumping for 30 years, has been least affected by such pumping. Based upon the Applicant's estimates, approximately 46 m [150 ft] of drawdown (i.e., the decline in water level) in the ore-zone aquifer has occurred in the vicinity of the No. 21-19 well cluster since pumping began in 1980 for local oil-field water-flood operations (Strata, 2011b). An updated map of the ore zone's piezometric surface prepared by the Applicant using a ground-water model provides additional detail of the drawdown associated with the withdrawals from the Merit Oil Company's (Merit's) three water-supply wells (Strata, 2012b).

The Applicant also calculated horizontal gradients and vertical-head differences between the OZ, SM, and DM aquifers (Strata, 2011a). Horizontal gradients in the OZ aquifer are toward the oil-field water-supply wells, and they range from 0.009 – 0.025, with the steeper gradients being in the vicinity of the oil-field water-supply wells. Vertical-head differences between the OZ and the DM aquifers range from 6 m [20 ft] downwards in the northwestern portion of the Ross Project area to 3 m [10 ft] upwards in the area of the oil-field water-supply wells. Vertical gradients are downwards from the SM to the OZ aquifers, with head differences ranging from 15 – 46 m [50 – 150 ft].

The OZ aquifer remains a confined aquifer across the Ross Project area, with potentiometric heads ranging from approximately 46 m [150 ft] to more than 122 m [400 ft] above the top of the ore zone (Strata, 2011a). Recharge to the Fox Hills Formation and, hence, the OZ aquifer, is from precipitation along the outcrop, ground water from the subcrop beneath alluvium in the valley of the Little Missouri River and its tributaries, and from leakage from the overlying Lance Formation. Under current conditions, discharge is to the oil-field water-supply wells.

Continuous measurement of water levels for the period April to October 2010 were recorded by the Applicant in six monitoring wells completed in the OZ aquifer and are presented graphically by the Applicant in its TR (Strata, 2011b). The hydrograph for Well 34-7OZ, which is located farthest from the oil-field water-supply wells, displays the least variation. The variability in the ore-zone-well hydrographs is a function of the well locations relative to the oil-field water-supply wells in Sections 18 and 19. The wells located closest to this area (Wells 21-19OZ, 34-18OZ, 14-18OZ, and 42-19OZ) display water-level fluctuations that are related to pumping of the water-supply wells. Pumping starts and stops that occurred in late June though early July 2010 are apparent on hydrographs from these wells. A rapid water-level rise (over 4.6 m [15 ft] in Well 21-19OZ) in late September 2010 was attributed to a temporary cessation of pumping. This was followed by a rapid decline in the water level, which was interpreted as an indication of resumption of pumping.

Other than the aquifer testing that took place over the period above, other recorded perturbations are related to sampling events and barometric fluctuations. The barometric fluctuations are less than 0.2 m [0.5 ft]. During January through October 2010, the hydrograph



Source: Strata, 2011a.

Figure 3.15
Potentiometric Contours of Ground Water in Ore-Zone Aquifer

for Well 34-7OZ showed a steady increase of approximately 0.6 m [2 ft]. The cause of this increase has not been identified; similar patterns have not been seen in other ore-zone well hydrographs. The hydrograph for Well 12-18OZ varies within a range of approximately 0.76 m [2.5 ft]. Most of the water-level changes are interpreted as responses to barometric pressure changes. However, fluctuations in the late June though early July time period coincide with pumping-related water-level changes observed in the group of four wells discussed above.

The shale, claystone, and mudstone unit, the BFH horizon and lower confining unit, separates the DM aquifer from the FH horizon. This low-permeability unit ranges in thickness from less than 3 m [10 ft] to 24 m [80 ft]. Vertical hydraulic conductivities for this interval are expected to be comparable to that of the Pierre Shale (i.e., 2×10^{-7} cm/s [5×10^{-4} ft/d] or less), based upon their similar lithologies.

Aquifer pumping tests were performed on six well clusters, where the Applicant pumped from the OZ aquifer and monitored the SA, SM, and DM aquifers (Strata, 2011a). No effects from the Applicant's pumping were measured in any of wells completed in the overlying SA or SM horizon, which indicates that the shale layer between the SM and OZ aquifers prevents hydrologic communication between the aquifers. The intact confining layer between the overlying (i.e., SM) aquifer and the OZ aquifer was also demonstrated during Nubeth's research and development.

Water levels in two of the six underlying DM wells (Nos. 14-18DM and 34-18DM) declined slightly during Applicant's pumping (Strata, 2011a). The lower confining unit is 9 – 15-m [30 – 50-ft] thick in the portions of the Ross Project area where these wells are located. The NRC staff has determined that these responses were correctly interpreted by the Applicant as communication between the OZ and DM aquifers due to improperly abandoned drillholes, which were installed during previous resource-exploration efforts, that had not yet been located and properly abandoned by the Applicant (NRC, 2014a). The water levels in the other four wells in the DM aquifer were not affected by the pumping in the OZ aquifer, which confirmed the integrity of the confining layer between those two aquifers. Prior to the Applicant's conducting the aquifer pumping test at Well 12-18, all exploration drillholes in the vicinity of that well cluster had been located and properly abandoned, and no response of the DM-aquifer well was observed during that pumping test.

The communication between the OZ and DM aquifers in locations where the lower-confining unit has been breached has been demonstrated by: 1) the responses observed in the DM zone during the two aquifer pumping tests, where old exploration drillholes had not been properly abandoned, and 2) the similarities in the potentiometric heads in the DM, OZ, and SM aquifers in the vicinity of the oil-field water-supply wells, which are completed in both the OZ and DM intervals. To prevent communication between aquifers during uranium-recovery operations, as indicated in Condition No. 10.12 of the Draft Source and Byproduct Materials License, the Applicant will attempt to locate and properly abandon all historical drillholes located within the ring of perimeter-monitoring wells in each wellfield prior to conducting tests for the respective "hydrologic-test data package" required by the NRC for the Applicant to begin wellfield operations (see SEIS Section 2.1.1.1 and the Draft License currently available as NRC, 2014b).

3.5.3.3 Ground-Water Quality

The Applicant has compiled regional water-quality data listed in the USGS's National Water Information System (NWIS) from 16 wells located in Crook and Campbell Counties that were

completed in the Lance and Fox Hills aquifers (Strata, 2011a; USGS, 2012b). Data from these wells indicated that the water quality of the Lance and Fox Hills Formations' aquifers is slightly alkaline (i.e., median pH of 8.4) with a median TDS of 1,130 mg/L, with sodium and bicarbonate as the dominant dissolved species.

The water quality of the shallow ground water from alluvial deposits in the Lance Formation is dominated by sodium, sulfate, and bicarbonate with moderate levels of TDS of approximately 1,200 – 1,400 mg/L (Langford, 1964). Rankl and Lowry (1990) noted that the water quality in the aquifer sequence through the Lance and Fox Hills Formations depends upon the stratigraphy and varies according to well depth. As well depths increase from 30.5 – 152 m [100 – 500 ft], TDS in the waters decrease sharply due to declining concentrations of calcium, magnesium, and sulfate. Water from wells at depths of 152 m [500 ft] or greater are dominated by bicarbonate and sodium.

The deep-injection-well UIC Class I permit application for the Ross Project contains estimates of water quality in deeper formations, from the Minnelusa through the Cambrian Formations (WDEQ/WQD, 2011b). The Minnelusa, Deadwood, and Flathead Formations are expected to have TDS concentrations greater than 10,000 mg/L, while the Madison Formation likely has a TDS concentration of approximately 1,000 mg/L in the vicinity of the Ross Project area.

To comply with the requirements of 10 CFR Part 40, Appendix A, Criterion 7, the Applicant has collected pre-licensing, site-characterization ground-water-quality data from the Ross Project area. These data originate from three sources: 1) data from the Applicant's own pre-licensing, site-characterization monitoring-well network at the Ross Project and the respective analytical data; 2) data from the sampling and analysis of existing water-supply wells; and 3) historical data from the former Nubeth operation (Nuclear Dynamics, 1978). The first source of ground-water-quality data is the Applicant's own ground-water monitoring network which it constructed in 2009 and 2012 and which consists of six monitoring-well clusters and four piezometers (Strata, 2011a). The locations of the monitoring-well clusters are shown in Figure 3.14. Each well cluster would include four monitoring wells targeting the OZ aquifer and the aquifer units above the ore zone (SA and SM) and below the ore zone (DM) (see Figure 3.14). The Applicant provided construction details of the wells and methods used for ground-water sampling in its ER (Strata, 2011a). The four piezometers in the SA were installed in the portion of the Ross Project area proposed for the Central Processing Plant (CPP) and surface impoundments (Strata, 2011a).

Analytical data and field measurements of selected parameters obtained during the 2009 and 2010 quarterly sampling efforts are provided in the Applicant's ER and TR (Strata, 2011a; Strata, 2011b). Water-quality data from samples collected in 2011 and submitted to WDEQ/LQD are provided in information the NRC subsequently received from the Applicant (Strata, 2012a). All of the ground-water-quality data are presented in Appendix C of this SEIS. The Applicant adhered to both the WDEQ/LQD's *Hydrology*, "Coal and Noncoal," Guideline No. 8, and the NRC's Regulatory Guide 4.14, Revision 1, during its sampling and analysis efforts, generating the data in Appendix C (WDEQ/LQD, 2005b; NRC, 1980). The data from 2011 are generally consistent with the 2009 and 2010 data; this consistency indicates a representative characterization of ground-water quality. Appendix C data are summarized in the following paragraphs.

The maximum, average, and minimum values of the chemical constituents measured in ground water from wells installed in each aquifer (SA, SM, OZ, and DM) are presented in Table 3.6. TDS in the ground water at the Ross Project area are predominately bicarbonate-sulfate-sodium; this differs from the typical ground water described in GEIS Section 3.2.4.3.3, which is the bicarbonate-sulfate-calcium type. The pH conditions of greater than 8.0 in the Ross Project area's aquifers are consistent with bicarbonate water, and the dissolved oxygen levels of less than 5 mg/L as measured in the field by the Applicant suggest low-oxygen conditions (Strata, 2011a). The measured values of these two parameters are typical of uranium-bearing aquifers (NRC, 2009b).

The water-quality data included in Table 3.6 indicate distinctive water quality in each aquifer unit (i.e., the SA, SM, OZ, and DM). The distinctive water qualities suggest that vertical movement of water between the aquifers is prevented by the stratigraphic layers between the aquifer units. Average values of TDS in Strata's pre-licensing, site-characterization ground-water monitoring network range from 730 mg/L in the SA unit to 1,574 mg/L in the OZ unit. Ground-water from piezometers in the SA also show that TDS increases sharply with increasing distance from the Little Missouri River (Strata, 2011a).

Table 3.7 summarizes the water-quality data collected by Nubeth in 1976 and 1978, before the operation's research and development activities began. The operation's single-well, push-pull, in situ test conducted in 1976 was located approximately 300 m [1,000 ft] north of Oshoto Reservoir, whereas the 1978 samples were collected approximately 900 m [3,000 ft] south of Oshoto Reservoir (Nubeth, 1977). The distance between the two sampling locations, and the westerly flow of the underlying ground water, would prevent mixing of the ground water in the two locations. TDS and sulfate measured in 1976 and 1978 are within the range of total concentrations of TDS and sulfate in the OZ aquifer, as reported by the Applicant and shown in Table 3.6. Maximum concentrations of dissolved iron and dissolved manganese measured in the OZ aquifer by the Applicant are greater, however, than the concentrations measured in 1978; this suggests that current oxygen levels in the OZ aquifer are lower than they were in the 1970s. In addition, the maximum concentrations of ammonia, most trace metals, radium, gross alpha, and gross beta measured in 1978 are greater than the maximum values in the OZ aquifer than those reported by the Applicant and shown in Table 3.6.

The Table 3.8 presents the WDEQ's and the U.S. Environmental Protection Agency's (EPA's) water-quality standards for constituents that were found to exceed the standards in the Applicant's pre-licensing, site-characterization data (WDEQ/WQD, 2005b; 40 CFR Part 41). Constituent concentrations that exceed the standards are indicated by shading in Tables 3.6 and Table 3.7.

Typical of uranium-bearing aquifers described in GEIS Section 3.3.4.3.3 (NRC, 2009b), the average TDS of each aquifer unit associated with the Ross Project area exceed the EPA's Secondary Maximum Contaminant Levels (MCLs) for drinking water of 500 mg/L, but they were within all the upper limits set by the WDEQ for Class II Agriculture Use (see Tables 3.6, 3.7, and 3.8) (WDEQ/WQD, 2005b). The two upper aquifers, the SA and the SM, contained lower TDS than the lower units, and the OZ aquifer contained the highest average TDS.

Comparison of the metals, radionuclides, ammonia, and fluoride to the EPA's MCLs for drinking water and WDEQ standards are provided in Tables 3.6, 3.7, and 3.8. Ammonia was measured in all four aquifer units at concentrations greater than the WDEQ's Domestic Use standard,

Table 3.6
Ground-Water Quality from the Ore-Zone (OZ) Aquifer and Aquifers Above (SM and SA) and Below (DM) the Ore Zone

			Ross Project Monitoring-Well Data Collected (2009 – 2011†)											
			SA			SM			OZ			DM		
Constituent	††	Units	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
Bicarbonate	T	mg/L	<5	*	572	<5	*	752	478	583	662	<5	*	448
Calcium	T	mg/L	2	21	54	<1	*	3	3	6	11	1	3	8
Carbonate	T	mg/L	<5	*	218	25	98	250	8	26	52	22	103	324
Chloride	T	mg/L	2	29	86	2	4	8	3	7	11	139	491	818
Magnesium	T	mg/L	<1	*	35	<1	*	2	1	2	3	<1	*	2
Potassium	T	mg/L	7	12	22	4	15	47	3	6	17	8	19	48
Sodium	T	mg/L	78	224	416	275	417	542	368	545	718	302	520	807
Sulfate	T	mg/L	84	172	347	179	318	574	294	602	937	<1	*	234
TDS	T	mg/L	370	730	1230	830	1145	1350	1050	1574	2070	870	1321	2130
pH (Lab)	T	s.u.	8.1	9.0	11	8.7	9.5	11.6	8.4	8.7	9	8.7	10	11.7
Ammonia	T	mg/L	<0.1**	*	0.6	<0.1	*	2.8	<0.1	*	0.8	<0.1	*	3.9
Arsenic	D	mg/L	<0.005	*	<0.005	<0.005	*	0.023	<0.005	*	<0.005	<0.005	*	0.014
Barium	D	mg/L	<0.5	*	<0.5	<0.5	*	<0.5	<0.5	*	<0.5	<0.5	*	<0.5
Boron	D	mg/L	<0.1	*	0.3	0.2	0.5	0.8	0.3	0.4	0.6	0.3	0.8	1
Cadmium	D	mg/L	<0.002	*	<0.002	<0.002	*	<0.002	<0.002	*	<0.002	<0.002	*	<0.002
Chromium	D	mg/L	<0.01	*	<0.01	<0.01	*	<0.01	<0.01	*	<0.01	<0.01	*	<0.01
Copper	D	mg/L	<0.01	*	<0.01	<0.01	*	0.02	<0.01	*	<0.01	<0.01	*	<0.01
Fluoride	T	mg/L	0.1	0.3	0.8	0.8	1.3	2.1	0.2	0.5	1.3	0.8	1.1	1.6
Iron	D	mg/L	<0.05	*	0.66	<0.05	*	0.21	<0.05	*	0.69	<0.05	*	0.4
Lead	D	mg/L	<0.02	*	<0.02	<0.02	*	<0.02	<0.02	*	<0.02	<0.02	*	<0.02
Mercury	D	mg/L	<0.001	*	<0.001	<0.001	*	<0.001	<0.001	*	<0.001	<0.001	*	<0.001
Manganese	D	mg/L	<0.02	*	0.36	<0.02	*	0.88	<0.02	*	0.06	<0.02	*	0.37
Molybdenum	D	mg/L	<0.02	*	0.07	<0.02	*	0.05	<0.02	*	<0.02	<0.02	*	0.06
Nickel	D	mg/L	<0.01	*	<0.01	<0.01	*	<0.01	<0.01	*	<0.01	<0.01	*	<0.01
Selenium	D	mg/L	<0.005	*	0.008	<0.005	*	0.017	<0.005	*	0.009	<0.005	*	0.03
Silver	D	mg/L	<0.003	*	0.006	<0.003	*	0.011	<0.003	*	<0.003	<0.003	*	0.005
Uranium	D	mg/L	<0.001	*	0.007	<0.001	*	0.004	0.005	*	0.109	<0.001	*	0.003
Vanadium	D	mg/L	<0.02	*	<0.02	<0.02	*	0.02	<0.02	*	<0.02	<0.02	*	<0.02
Zinc	D	mg/L	<0.01	*	1.32	<0.01	*	0.03	<0.01	*	0.02	<0.01	*	0.09
Radium-226	D	pCi/L	<0.2	*	0.5	<0.2	*	3.7	0.6	3.8	12.1	<0.2	*	0.7
Radium-228	D	pCi/L	<1	*	1.8	<1	*	12.27	<1	*	1.6	<1	*	2.2
Gross Alpha	T	pCi/L	<6	*	13.8	<3	*	12.2	<5	*	222	<2	*	28.3
Gross Beta	T	pCi/L	<7	*	17.6	<3	*	319**	<7	*	46.8	<7	*	41

Sources: Strata, 2011a; Strata, 2012a. The complete data set is presented in Appendix C.

† = Shading indicates a value greater than WDEQ and EPA Water-Quality Standards (see Table 3.8).

†† = "D" indicates dissolved concentrations (i.e., the sample was filtered before analysis) and "T" means total concentrations (i.e., the sample was not filtered before analysis).

* = Indicates that one or more values are less than the detection limit; thus an average was not calculated.

** = Indicates that "319" appears to be an anomalous value; the next lowest value is 42.5 (see text).

< = Less than, where the value following the "<" value is the detection limit.

N/A = Datum not available.

2011b). The potential impacts of the Proposed Action's construction on the ground-water quantity available from the confined aquifers, therefore, would be SMALL.

Drilling for mineral delineation and well installation would potentially impact the SM aquifer, the OZ aquifer laterally adjacent to the ore zone, and the DM aquifer. Improperly abandoned drillholes, overly penetrating drillholes, or lack of well integrity could result in the mixing of industrial-use ground water from the OZ aquifer with the chloride-dominated ground water of the DM aquifer or the stock-water quality of the overlying SM aquifer. This mixing would be localized and any significant changes in water quality would be detected by monitoring wells.

To mitigate potential impacts to the confined aquifers from drilling, the Applicant proposes to continue to comply with WDEQ/LQD rules for well completion and drillhole abandonment (WDEQ/LQD, 2005). The Applicant would rely upon the geological model developed to determine total depths for drillholes, thus preventing over-penetration into underlying aquifers. Onsite geological and engineering supervision would continue throughout the construction phase. Wells installed for further hydrologic studies, during post-licensing and pre-operational monitoring, and production infrastructure would pass MIT prior to use (see SEIS Section 2.1.1.1). Consequently, the potential impacts from the Proposed Action's construction on the ground-water quality within the confined aquifers would be SMALL.

Deep Aquifers

Construction of the Ross Project would not impact the aquifers below the DM aquifer. The Flathead and Deadwood Formations would be tapped by the construction of the Class I injection well(s) discussed in SEIS Section 2.1.1.1, where that well(s) would be used for the disposal of brine and other byproduct liquid wastes during the Ross Project's operation, aquifer restoration, and decommissioning phases. The potential impacts of construction of the Proposed Action on the quantity and quality of ground water present within the deep aquifers would be SMALL.

4.5.1.2 Ross Project Operation

This section describes potential impacts and mitigation measures to surface and ground waters associated with operation of the Proposed Action.

Surface Water

As described in GEIS Sections 4.2.4.1.2 and 4.4.4.1.2, surface waters could be impacted by accidental spills during ISR operations. Spills from the CPP or wellfields as well as spills during transportation could impact storm-water runoff or contaminate shallow aquifers that are hydraulically connected to surface waters. The GEIS determined that surface-water monitoring and rapid spill response would limit the impacts of potential surface spills to SMALL; however, impacts of spills to surface waters that are connected to shallow aquifers would be SMALL to MODERATE, depending upon the specifics of an incident. Activities posing potential impacts to surface waters from uranium-recovery operation would be regulated by Federal agencies. According to the GEIS, the Applicant's use of BMPs, and implementation of required mitigation measures would moderate the impacts of the Proposed Action's operation from MODERATE to SMALL, depending upon local conditions.

The Applicant estimates that approximately 0.76 L/s [12 gal/min] of surface water from either the Oshoto Reservoir or the Little Missouri River would be used during the Proposed Action's operation for continuing construction activities in the wellfields and for dust control (see Table 4.3). The estimated annual use of 2.4 ha-m [19 ac-ft/yr] would be significantly less than the existing, permitted annual appropriation for Oshoto Reservoir of 21 ha-m [173 ac-ft/yr]. Ground water produced from developing, and testing wells that have not been affected by ISR activities would be discharged according to a temporary WYPDES Permit as described in SEIS Section 2.1.1.5. This water would either infiltrate into the ground or add to the surface water in the Little Missouri River. The Permit does not allow degradation of habitat for aquatic life, plant life, and wildlife nor does it allow discharges to adversely affect public water supplies or supplies intended for agricultural or industrial uses (WDEQ/WQD, 2011a). The mitigation measures proposed by the Applicant would ensure habitat and water-supply degradation do not occur.

Flow in the Little Missouri River could potentially be affected during operation. Water from the Little Missouri River infiltrates into the OZ aquifer where the river crosses the area of Fox Hills and Lance Formations exposure at the ground surface east of the Ross Project area (Strata, 2011a). The Applicant's ground-water model shows that infiltration would increase by approximately 0.095 L/s [1.5 gal/min], decreasing the average annual discharge of the Little Missouri River by less than 0.005 percent just downstream of the Wyoming-Montana border (Strata, 2011a). Thus, no mitigation measures would be warranted for this very small volume and the potential impacts of the Proposed Action's operation on surface-water quantity would be SMALL.

Storm-water runoff from impervious surfaces, including buildings, roads, and parking areas, could result in higher water flows, channel erosion, and increased sediment concentrations in surface waters. The Applicant predicts a peak flow of 1.4 m^3/s [50 ft^3/s] during a 100-year, 24-hour storm (Strata, 2011a). This peak flow represents an increase of less than 1 percent of the peak flow in the Little Missouri River of 170 m^3/s [6,000 ft^3/s].

Water quality impacts from surface-water runoff would be mitigated by the Proposed Action's storm-water-control system that would route all storm water to a sediment surface impoundment sized to hold runoff from the 100-year, 24-hour runoff event. A flood-control diversion channel around the CPP and surface impoundments (i.e., the facility itself) would prevent storm water originating in the ephemeral stream channel upstream of the facility from encountering process solutions or chemicals. In addition, BMPs would be implemented by the Applicant to reduce erosion and the likelihood of increased sediment loads. Mitigation measures employed by the Applicant to reduce soil erosion would also mitigate storm-water runoff across the Ross Project. Protection of wellheads and module buildings from large runoff events would typically be accomplished by placement on high ground out of the flood plain. When wells or other facility components must be placed within the 100-year-flood inundation area, appropriate engineering controls would be used to ensure safety and environmental protection. The injection, recovery, and monitoring wells would be protected from flooding by the installation of cement seals around the well casings and the use of watertight well caps.

Measures designed to mitigate the impacts of suspended sediment would be contained in a storm-water discharge Permit required by the WDEQ/WQD prior to uranium-recovery operation. The permit would include a requirement for a SWPPP that describes erosion and sediment controls as well as operational controls that would be used to ensure that storm-water discharges from the Ross Project facility do not cause a violation of Wyoming's surface-water

quality standards (WDEQ/WQD, 2007). Storm-water BMPs would be inspected semiannually or as required by the WYPDES Storm Water Permit. The SWPPP would be updated as needed, such as when potential problems are identified during inspections or when there are changes in uranium-recovery operation (e.g., transition from operation to aquifer restoration).

Release of process solutions from uranium-recovery wellheads, pipelines, module buildings, or process vessels; accidental discharge from surface impoundments; or release of yellowcake or IX resin during a transportation accident could result in surface-water contamination if the release(s) reach a surface-water body. Potential impacts from accidental spills and releases will be mitigated by SOPs for operational and emergency procedures for managing radioactive and non-radioactive materials (NRC, 2014b, License Condition 10.4). Impacts from releases that do reach surface water(s) would be short-term, elevated concentrations of radionuclides and associated chemical constituents at levels above pre-licensing, site-characterization. Cleanup of contaminated sediments associated with a spill would follow the same requirements as those for soil cleanup efforts (see SEIS Section 4.4.1.2). Any impacts to surface waters remaining after cleanup would decline over time as the contaminated fluids are dispersed in the surface-water body.

The potential for release of process solutions will be mitigated by daily measurement of injection manifold pressure and flow rates as described in Section 2.1.1.1 of this SEIS (NRC, 2014b, License Condition 10.14). Accidental discharge from surface impoundments would be mitigated by the size and design of the impoundments and by regular inspections (NRC, 2014b, License Condition 10.8). Because roads would cross surface-water drainages in only a few, isolated locations, it is unlikely that a transportation accident would result in a release to any surface water. Further mitigation of impacts would be accomplished by the Applicant's personnel containing and cleaning up any release before the solution could migrate to a surface-water body. Therefore, given these mitigation measures, the potential impacts of the operation of the Proposed Action on surface-water quality would be SMALL.

The potential impacts of the Proposed Action's operation to the Ross Project area's wetlands would be the same as described for the Ross Project's construction-phase impacts and the impacts would be SMALL.

Ground Water

The GEIS concluded in GEIS Sections 4.2.4.2.1 and 4.4.4.2.1 that the amounts of ground water from shallow aquifers used in routine activities during operations such as dust suppression, cement mixing, and well drilling are small and would have a SMALL and temporary impact.

At an ISR facility, a network of buried pipelines would be used during in situ uranium recovery for transporting lixiviant between module buildings and the CPP as well as connecting injection and recovery wells to manifolds inside the module buildings. The failure of pipeline fittings or valves, or well mechanical-integrity failures, in shallow aquifers could result in spills or leaks of lixiviant, which could impact water quality in the shallow aquifers. Potential environmental impacts due to spills and leaks from pipelines could be MODERATE to LARGE depending upon site-specific conditions, including whether 1) the ground water in the shallow aquifers is close to the ground surface; 2) the shallow aquifers are important sources for local domestic or agricultural water supplies; or 3) the shallow aquifers are hydraulically connected to other locally or regionally important aquifers; or 4) the shallow aquifers have either poor water quality or

yields that are not economically suitable for production (NRC, 2009b). The use of surface impoundments to manage process solutions generated during ISR activities could also impact shallow aquifers by failure of impoundment embankments or their liners. Thus, the GEIS concluded that impacts of the use of surface impoundments on ground water would be SMALL (NRC, 2009b).

As discussed in GEIS Sections 4.2.4.2.2.2 and 4.4.4.2.2.2, potential environmental impacts to ground-water resources in the OZ and surrounding aquifers include consumptive water use and changes to water quality (NRC, 2009b). Consumptive use arises from the fact that ISR operations withdraw on average 1.25 percent more water than is injected into the wellfields, which is referred to as “production bleed.” Ground-water bleed ensures a net inflow of ground water into the wellfield to minimize the potential movement of lixiviant and its associated contaminants out of the wellfield. Bleed water is generally disposed of through a waste-water control system, and it is not re-injected into the ISR wellfields. The GEIS determined that the short-term impacts of consumptive use could be MODERATE, but temporary, if the OZ aquifer outside the exempted portion of ore zone is used locally. (Uranium-recovery requires exemption of the uranium-bearing aquifer as an underground source of drinking water (USDW) and is exempted through Wyoming’s UIC Program administered by the WDEQ.) Therefore, the long-term consumptive-use impacts would be expected to be SMALL in most cases, depending upon site-specific conditions.

The GEIS noted that water quality in the OZ aquifer would be degraded during ISR operations (NRC, 2009b). A licensee would be required, by its WDEQ Permit to Mine and by its source and byproduct materials license, to conduct aquifer-restoration activities to restore the OZ aquifer to pre-operational conditions, if possible. If the aquifer cannot be returned to post-licensing, pre-operational conditions described in SEIS Section 2.1.1.1, the NRC would require that the aquifer meet the U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs) provided in 10 CFR Part 40, Appendix A, Table 5C or Alternate Concentration Limits (ACLs), as approved by NRC (10 CFR Part 40; NRC, 2009b). For these reasons, the NRC determined in the GEIS that potential impacts to water quality of the exempted aquifer (i.e., ore zone, production zone or unit, or mineralized zone) as a result of ISR operations would be expected to be SMALL and temporary (NRC, 2009b).

GEIS Section 4.2.4.2.2.2 discussed the potential for vertical and horizontal excursions of degraded ground water outside of the uranium-production zone (i.e., the ore zone). The impact of horizontal excursions could be MODERATE to LARGE, if a large volume of contaminated water leaves the ore zone and moves down-gradient and impacts an area outside the ore zone which is being used for consumption (NRC, 2009b). As discussed in GEIS Section 2.11.3, the historical record for several licensed ISR facilities indicates that excursions occur at ISR operations (NRC, 2009b). Most of the excursions are horizontal and were recovered within months after detection. Vertical excursions tend to be more difficult to recover than horizontal excursions, and in a few cases, remained on excursion status for as long as eight years. The vertical excursions were traced to thinning of the confining geologic unit below the ore zone and improperly abandoned drillholes from earlier exploration activities (NRC, 2009b).

To reduce the likelihood and consequences of potential excursions, the NRC requires licensees to identify preventive measures before starting ISR operations. In general, the potential impacts of vertical excursions to ground-water quality in surrounding aquifers would be SMALL if the vertical hydraulic-head gradients between the OZ aquifer and the adjacent aquifer are small; if the vertical hydraulic conductivities of the confining geologic units are low; and if the confining geologic units are sufficiently thick (NRC, 2009b). Environmental impacts, however, would be expected to be MODERATE to LARGE if the confining units are discontinuous, thin, or fractured (NRC, 2009b). The NRC requires assurance of the integrity of the confining units to minimize the potential impacts from vertical excursions into overlying and underlying aquifers.

As indicated in GEIS Sections 4.2.4.2.2.3 and 4.4.4.2.2.3, the potential environmental impacts from disposal of liquid effluents into deep aquifers below ore-bearing aquifers would be SMALL, if water production from the deep aquifers is not economically feasible; if the ground-water quality from these aquifers is not suitable for domestic or agricultural uses (e.g., high salinity); and if they are confined above by sufficiently thick and continuous low-permeability layers (NRC, 2009b). Under different environmental laws such as the CWA, the *Safe Drinking Water Act*, and the *Clean Air Act of 1970* (CAA), the EPA has statutory authority to regulate activities that could affect the environment. Underground injection of liquids requires a permit from the EPA or from an authorized State UIC program. As noted in SEIS Section 2.1, the WDEQ has been authorized to administer the UIC program in Wyoming.

In the following sections, the potential impacts and mitigation measures related to the Proposed Action's operation are considered for the three types of aquifers: 1) the unconfined shallow (i.e., near-surface) aquifers; 2) the confined aquifers hosting the ore zone as well as those above and below the ore zone (the SM and the DM aquifers); and 3) the deep aquifers below the DM aquifer. Conditions of the Source and Byproduct Materials License will mitigate potential impacts to surface water and ground water. The following Conditions of the Draft Source and Byproduct Materials License would require compliance with: Condition 10.5, mechanical integrity tests; Condition 10.6, ground-water restoration; Condition 10.7, a net inward hydraulic gradient; Condition 10.12, an attempt to locate and abandon all historic drillholes located within the perimeter-monitoring-well ring of a wellfield; Condition 10.13, a "hydrologic-test data package" for each wellfield; Condition 10.19, wellfields south of the Little Missouri River until the use of the Merit wells have ceased or diminished to an acceptable level; and Condition 10.20, a ground-water monitoring program for the surface impoundments. Conditions 11.1, 11.3, 11.4, and 11.5 of the Draft License would require excursion-monitoring and aquifer-restoration goals, and Condition 12.3 would require that protection of ground-water uses occur within 2 km [1.2 mi] outside of the all wellfields.

Shallow Aquifers

Potential impacts from operation to ground-water quantity in the shallow aquifers would be similar to those described for the Proposed Action's construction phase and would be SMALL.

During ISR operation, the water quality throughout the Ross Project has the potential to be impacted by accidental spills or leaks from chemical-storage areas, process-solution vessels, or the surface impoundments as well as by spills and leaks of lixiviant from failure of a pipeline or a shallow break in the casing of an injection or recovery well. To reduce the risk of pipeline failure, the Applicant would hydrostatically test all pipelines prior to use and install leak-detection devices in manholes along the pipelines as described in Section 2.1.1.1. The Applicant's

implementation of BMPs during Ross Project operation would reduce the likelihood and magnitude of spills or leaks and facilitate expeditious cleanup.

Further, the Applicant would monitor recovery and injection pipelines and immediately shut-down affected pumps if a spill or leak were detected (Strata, 2011b). The CPP would include a control room where a master control-system would allow remote monitoring and control of ISR, wellfield, and deep-well-disposal operations (Strata, 2011b). Operators would be located in the CPP's control room 24 hours a day and would use a computer-based station to command the control system.

MIT would be conducted on all Class III injection wells, recovery wells, and monitoring wells (see SEIS Section 2.1.1.1). Construction of all wells and their respective MIT would comply with the pertinent WDEQ/LQD regulations (WDEQ/LQD, 2005).

The Applicant would also implement spill control, containment, and cleanup measures in the CPP and surface-impoundment areas (i.e., the facility). These measures would include secondary containment for process-solution vessels and chemical storage tanks, a geosynthetic liner beneath the CPP's foundation, dual liners with a leak-detection system for the surface impoundments, and a sediment impoundment to capture storm-water runoff. In the event of a surface-impoundment leak, sufficient capacity would be reserved in the other impoundments' cells to allow the contents of the leaking cell to be rapidly transferred, minimizing the volume of the release. In addition, the ground-water levels downgradient of the CBW would be maintained below the ground-water levels in the shallow aquifer outside the CBW. This would impose inward and upward hydraulic gradients and therefore minimize the potential for contaminated ground water to migrate into the regional system. The Applicant has committed that it would install and monitor additional wells in the SA-unit aquifer, and this commitment would be codified in the Source and Byproduct Materials License. Thus, the potential impacts of the Proposed Action's operation to ground-water quality in the shallow aquifers would be SMALL.

Ore-Zone and Surrounding Aquifers

Potential impacts from the consumptive use of ground water from the ore-zone and surrounding aquifers were evaluated by the Applicant using a regional numerical model (Strata, 2011b). The conditions simulated by the Applicant were for two ISR "mine units" operating simultaneously, as described in SEIS Section 2.1.1. Details of the ISR simulations and results of the modeling are provided in Addendum 2.7-H of the Applicant's TR (Strata, 2011b).

The simulations assumed no changes in flow rates within the stock and domestic wells within the model area. Estimated flow rates for the oil-field water-supply wells were developed based upon average historical flow rates for the last two years of recorded flow (i.e., 2008 and 2009). Three of the oil-field water-supply wells (Wells 22X-19, 19XX18, and 789V) are located immediately adjacent to Modules 2-6 and 2-7. The Applicant simulated two uranium-recovery scenarios. Scenario 1 assumed that an alternative water supply could be found, which would allow the Merit wells to be taken out of operation two years prior to uranium recovery at the Ross Project; the wells would be kept out of operation until uranium-recovery operation ceases. Scenario 2 assumed that an alternative water-supply source could not be located and that, during uranium-recovery operation, the Merit oil-field water-supply wells continued to operate at their assumed 2008 – 2009 average flow rates. The Applicant will not be able to develop wellfields south of the Little Missouri River until the use of oil-field water-supply wells has

ceased or has diminished to an acceptable level (NRC, 2014b, License Condition 10.19). This acceptable level will be reviewed and verified by the NRC staff. Given this Draft License Condition, the ground-water-modeling results under Scenario 1 were the most applicable to the Proposed Action.

The most significant drawdown predicted by the ground-water model occurs in the Wesley No. TW02 well located in the SWSW Section 8, Township 53 North, Range 67 West. This well gets limited use, as it only supplies water to a structure that is currently used by the Applicant as its Field Office for the Ross Project and to provide water to livestock. At the end of the aquifer-restoration phase under Scenario 1, the model predicts 9.17 m [30.1 ft] of drawdown, or 42.4 percent of the available head in that well. This magnitude of drawdown is the worst case based upon conservative assumptions in the model.

Potential impacts to the SM-aquifer water quantity, because of drawdown during uranium recovery and aquifer restoration in the ore zone, were also evaluated by the regional ground-water model (Strata, 2011b). Under the two recovery scenarios evaluated, the estimated maximum amounts of drawdown ranged from 1.5 – 5 m [5 – 15 ft] within the Ross Project area following the Proposed Action's operation and aquifer-restoration phases.

Impacts from consumptive use of ground water from the ore zone would be minimized by cessation of water withdrawals by the Merit oil-field water-supply wells as would be required by the Source and Byproduct Materials License (NRC, 2014b, License Condition 10.19). The ground-water model simulated a single operational sequence of wellfield development, recovery, and aquifer restoration. Different operational approaches could be more effective in reducing impacts, and the Applicant proposes to investigate these as wellfield installation and testing progresses.

In the event that uranium recovery at the Proposed Action prevents the full use of a well which provides water under a valid water right, the Applicant would commit to providing an alternative source of water of equal or better quality and quantity, subject to Wyoming water statute requirements.

In the regional numerical model, the model's lower boundary was the base of the ore zone/top of the lower confining unit. As a result, potential impacts to the DM aquifer were not evaluated by the model. The DM aquifer supports only one well (Merit Well No. 22X-19), and it has only limited hydraulic conductivity and yield. Thus, as the model demonstrates, the potential impacts from the Proposed Action's operation to ground-water quantity in the confined aquifers would be SMALL.

During the Proposed Action's operation, the ground-water quality of the ore-zone aquifer within the wellfields would be impacted from uranium-recovery activities. The Applicant has received approval from EPA and WDEQ/LQD to exempt the ore-zone aquifer within the area of the wellfields from the requirements of a USDW, as described in SEIS Section 2.1.1.1. The uranium and vanadium in the ore-zone aquifer would be oxidized and mobilized by the introduction of lixiviant into the ore-zone aquifer through injection wells. In addition to the uranium and vanadium, other constituents would also be mobilized, including anions, cations, and trace metals (Strata, 2011b). These impacts to the water quality of the ore-zone aquifer within the wellfields would be short term because aquifer restoration that would be required by the Source and Byproduct Materials License would return these constituent concentrations to

each wellfield's respective NRC-approved post-licensing, pre-operational concentrations, numeric water-quality criteria, or specific ACLs as approved by the NRC (NRC, 2014b License Condition 10.6; 10 CFR 40).

The quality of the non-exempted ore-zone aquifer (i.e., that which is outside the perimeter-monitoring-well ring in the wellfields) could be impacted by a horizontal excursion resulting from a local wellfield imbalance. A wellfield imbalance can occur when the rate of injected lixiviant exceeds the rate of extraction from the recovery wells, resulting in a potential migration of lixiviant laterally, away from the respective wellfield. There would also be the potential for water-quality impacts (i.e., vertical excursions) to the SM and DM aquifers from the lixiviant-fortified ground water during injection and withdrawal from the OZ aquifer. Condition No. 11.5 of the Draft Source and Byproduct Materials License would prescribe the excursion-monitoring program and the procedures for confirmation in the event that the monitoring signals an excursion as well as corrective actions that would be required to recover an excursion (NRC, 2014b).

Typical lixiviant circulating through the ore zone would contain concentrations of TDS up to 12,000 mg/L that consist primarily of sodium, bicarbonate, chloride, and sulfate and concentrations of uranium, vanadium, and radium greater than 100 mg/L (NRC, 2009b; Strata, 2011a; WDEQ/WQD, 2011b). As described in SEIS Section 3.5, the surrounding aquifers have lower TDS, averaging 1,145 mg/L, 1,574 mg/L, and 1,321 mg/L in the SM, OZ, and DM aquifers, respectively. These values are approximately 10 percent of the TDS contained in the proposed lixiviant. As described in Section 2.1.1.2 of this SEIS, chloride, conductivity, and total alkalinity would be measured twice monthly in the monitoring wells to detect excursions. These constituents move through the aquifer faster than other water-quality parameters, and therefore levels above these would indicate excursions before radionuclides and other elements move outside the production (i.e., uranium-recovery) zone.

Temporary increases in concentrations of TDS outside the production zone would occur in the event of an excursion. Levels of radionuclides and elements such as arsenic, selenium, and vanadium that are mobilized with the uranium may increase in aquifers outside the production zone if excursions were to occur, but corrective actions in response to increased TDS would likely prevent increases of these elements.

Measures proposed by the Applicant to mitigate the potential for horizontal excursions include a computer-based control system, which is staffed 24 hours a day at the CPP, to monitor injection pressures and recovery-well flow rates so that wellfield balance would be maintained. In addition, water level and water quality would be monitored in wells installed around the perimeter of each wellfield (Strata, 2011a).

In the event of an operational upset that could allow horizontal excursions, the ground-water model (discussed above in this section of the SEIS), integrated with injection- and recovery-well data, would allow the Applicant's staff to make a determination of potential migration paths as well as assisting the system operator's decision making with respect to the proper mitigating actions. The Applicant noted that the heterogeneous lithology of the sandstones produces lateral and vertical variations in permeability, with uranium mineralization concentrated in the higher-permeability sediments (Strata, 2011a). Lateral migration of lixiviant would therefore be limited by the less-permeable and un-mineralized zones within the ore-zone sandstones.

The potential for vertical excursions would be mitigated by the naturally confining units of fine-grained mudstones, siltstones, and claystones above and below the ore-zone aquifer (see SEIS Section 3.5). In addition, the Applicant's testing program would ensure the integrity of well casings in injection and recovery wells as well as in monitoring wells installed in the SA and DM aquifers.

The Applicant tested the integrity of the lower confining unit separating the OZ aquifer from the DM aquifer with six pump tests; in two of the six tests, pumping of the OZ aquifer showed a possible response in the DM aquifer (Strata, 2011a). NRC staff has determined that these responses were correctly interpreted by the Applicant as communication between the OZ and DM through improperly plugged drillholes from previous exploration programs that have not yet been properly abandoned (NRC, 2014a). Other aquifer tests by the Applicant as well as those conducted by Nubeth in 1978, recorded no response in the aquifers vertically adjacent to the ore zone. The different water qualities observed in the OZ and DM aquifers also support the premise of hydraulic separation. Stratigraphic sections created by the Applicant from the geologic logs of the drillholes have provided further support for the continuity and integrity of the shale confining units (Strata, 2011b). The thickness of the shale unit between the OZ and the DM aquifers is generally greater than 6 m [20 ft], except for an area along the southern edge of the Ross Project area where the unit thins to about 1.5 m [5 ft]. The Applicant would continue geologic evaluation and hydrologic testing to characterize the integrity of the lower confining unit, through observations of piezometric levels in the SM and DM aquifers. The upper confining unit would also continue to be monitored by the Applicant.

To ensure the integrity of confining layers, Condition No. 10.13 of the Draft License would require the Applicant to submit a hydrologic-test data package to the NRC staff for review and verification prior to conducting operations in a wellfield (NRC, 2014b). The hydrologic-test data package must adequately define ground-water-flow paths, demonstrate the lateral continuity of the OZ aquifer, provide an evaluation of the heterogeneities within the ore zone, and confirm the hydraulic isolation of the OZ aquifer (NRC, 2014b).

Breaches to the integrity of the confining unit from historical exploration and delineation drillholes will be minimized by the Applicant's locating and abandoning the drillholes within the wellfields (NRC, 2014b, License Condition 10.12). Hole plugging would be done with low-hydraulic-conductivity materials such as cement or heavily mixed bentonite grout according to methods approved by the WDEQ as described in SEIS Section 2.1 (Strata, 2011b). As of October 2010, the Applicant had located 759 of the estimated 1,682 holes from Nubeth exploration activities and had plugged 55 of them (Strata, 2011b). The number of historical drillholes located and plugged would increase as wellfields are developed. The Applicant would also implement a WDEQ-approved MIT program for all injection and recovery wells to ensure well-casing integrity (WDEQ/LQD, 2005).

As noted above, Condition No. 11.3 of the Draft License would require the Applicant to install monitoring wells around each wellfield at approved maximum spacing (NRC, 2014b). The perimeter-monitoring wells would allow the Applicant to monitor the OZ aquifer, while the monitoring wells in the overlying and underlying aquifers would allow monitoring of the SM and DM aquifers, respectively. The Applicant has committed to a maximum spacing of 120 m [400 ft] between the uranium-recovery wellfields and perimeter-monitoring-well ring as well as

between monitoring wells in the perimeter ring itself (Strata, 2011b). Condition No. 11.5 of the Draft License would establish the requirements for the excursion-monitoring program (NRC, 2014b).

In addition to sampling the monitoring wells for water-quality parameters, the Applicant would measure water levels during the semi-monthly sampling to detect anomalous hydrostatic-pressure increases which may signal an operational upset. Condition No. 11.5 of the Draft License would require the Applicant to cease injecting lixiviant into the uranium production area surrounded by the perimeter-monitoring-well ring if a vertical excursion is detected during operation (NRC, 2014b). Operation would cease until the Applicant demonstrates that the vertical excursion cannot be attributed to leakage through any abandoned drillhole. Mitigation in the event of an excursion of lixiviant-containing ground water could require withdrawal and treatment of contaminated ground water from the adjoining aquifers.

The potential impacts of the operation of the Proposed Action to ground-water quality in the confined aquifers above and below the ore zone would, therefore, be SMALL. The short-term potential impacts of lixiviant excursions from uranium-recovery operation to the OZ aquifer outside the exempted area would be SMALL to MODERATE. Detection of excursions through the network of monitoring wells, followed by the Applicant's pumping of ground water to "recover" the excursion would reduce long-term potential impacts to the OZ aquifer outside the exempted portion to SMALL.

Deep Aquifers

The Applicant plans to dispose of brine and other liquid byproduct wastes into up to five UIC Class I deep-disposal wells that discharge to the Flathead and Deadwood Formations, which are defined as the Formations that occur beneath the base of the Icebox Shale member of the Winnipeg Group and above the top of the Precambrian basement. There are no porous and permeable zones below the Deadwood and Flathead Formations that would make suitable injection zones. Because of the depth, approximately 2,500 m [8,200 ft], at which these Formations occur and the apparent lack of oil or other hydrocarbons, there has been little exploration of these intervals, and few data are available for the Ross Project area. To improve its understanding of the targeted Formations, the Applicant plans to drill one deep well for hydraulic testing as a preconstruction activity (Strata, 2011a). If the capacity in the targeted Formation for injected solutions is less than anticipated by the Applicant, more wells than five may be needed.

The UIC Class I Permit issued by the WDEQ identified the confining unit immediately above the discharge zone as consisting of approximately 16 m [52 ft] of Icebox Shale. An additional confining unit immediately above the Icebox Shale is the Red River Formation, which consists of 96.9 – 140 m [318 – 460 ft] of cryptocrystalline to microcrystalline impermeable dolomite. The top of the injection zone occurs about 2,488 m [8,163 ft] below the ground surface, and the total thickness of the injection zone for the wells is estimated to be 180 m [592 ft]. In issuing the UIC Permit, the WDEQ/WQD determined that, at the depths and locations of the injection zones specified in the Permit, the use of ground water from the Flathead and Deadwood Formations is economically and technologically impractical (WDEQ/WQD, 2011b).

The data that are available for the Formations targeted for deep-well injection suggest that the ground water contains greater than 10,000 mg/L TDS. The estimated water quality of the brine,

and liquid effluent that would be injected in the UIC Class I deep-injection wells, comprises the following constituent concentrations: 4,000 – 40,000 mg/L TDS; 5 – 25 mg/L uranium as U_3O_8; and 15 – 93 Bq/L [400 – 2,500 pCi/L] Ra-226 (WDEQ/WQD, 2011b). Its pH would be between 6 and 9. WDEQ concluded that the liquid effluents could be suitably isolated in the deep aquifers, and they would not affect any overlying underground sources of drinking water. The deep-injection wells would be installed and tested in accordance with WDEQ/WQD Class I disposal-well standards and the UIC Class I Permit. The Permit requires the Applicant to control effluent pressures at the wellhead to ensure that the fracture pressure of the Formation is not exceeded. Regular monitoring of the water quality of the injected brine is required by the Permit, and pH would have to be within the range of 2 – 11 established by the Permit to meet the respective upper control limits (UCLs) to be injected (WDEQ/WQD, 2011b). In addition, daily measurements of injection rates and pressures are required by the Permit as well as records of the monthly volume of fluid injected. The daily monitoring required by the UIC Class I Permit would allow detection of loss of integrity of a well's casing. In response to a loss of integrity, injection into that deep-disposal well would be suspended for well repair, thus preventing impacts to the aquifers above the Deadwood/Flathead Formations. The Permit also prohibits injection of hazardous waste as defined by the EPA and the WDEQ. Thus, the potential impacts of the Proposed Action's operation to ground-water quantity and quality in the deep aquifers would be SMALL. The conditions of the UIC Permit would mitigate potential impacts, including those described above.

4.5.1.3 Ross Project Aquifer Restoration

As described in Section 2.1.1.3 of this SEIS, the Proposed Action's aquifer-restoration methodology would use a combination and sequence of: 1) ground-water transfer; 2) ground-water sweep; 3) RO treatment with permeate injection; 4) ground-water recirculation; and 5) stabilization monitoring. The Applicant proposes to use ground-water sweep selectively (i.e., around the perimeter of the wellfield) rather than throughout the entire wellfield to minimize the consumptive use of ground water (Strata, 2011a). After uranium recovery in the first wellfield is completed, the Applicant would conduct aquifer restoration concurrently with operation of subsequent wellfields.

<u>Surface Water</u>

As described in GEIS Sections 4.2.4.1.3 and 4.4.4.1.3, the activities occurring during aquifer restoration that could impact surface waters include management of waste water, permeate reinjection, storm-water runoff, and accidental spills and leaks (NRC, 2009b). The GEIS concluded that the potential impacts to surface water due to the management of ground water extracted during aquifer restoration would be SMALL. An ISR operator's compliance with permit conditions, use of BMPs, and execution of mitigation measures would reduce impacts from storm-water runoff as well as accidental spills and leaks such that they would be SMALL to MODERATE, depending upon site-specific conditions.

At the Ross Project, the Applicant intends to use approximately 0.26 L/s [3.6 gal/min] of water obtained from either the Oshoto Reservoir or the Little Missouri River for dust control during aquifer restoration (see Table 4.3). Because of the lower surface water usage during restoration compared to construction and operations, the potential impacts would thus be comparable to those during the Proposed Action's construction and operation phases.

Potential increases in sediment concentrations during the Proposed Action's aquifer-restoration phase would also be comparable to its operation phase. Potential risk of surface-water contamination associated with releases of process solutions and/or waste liquids as well as spills of other materials during aquifer restoration would be comparable to the operation phase of the Proposed Action, although the concentration of uranium-bearing solutions would decline. Thus, the potential impacts of aquifer restoration to surface-water quantity and quality would be SMALL.

The potential impacts of aquifer restoration during the Proposed Action to the wetlands on the Ross Project area would be the same as discussed under the Ross Project's construction.

Ground Water

As the GEIS states in Sections 4.3.4.2.3 and 4.4.4.2.3, the potential environmental impacts on ground-water resources during aquifer restoration are related to ground-water consumptive use and waste-management practices, including liquid-effluent discharges to the surface impoundments and deep disposal of brine resulting from the RO process. As noted in the GEIS, potential impacts are affected by the respective aquifer-restoration methodology(ies) chosen, the water quality at the end of operation, and the current and future uses of the ore-zone and surrounding aquifers in the vicinity of an ISR facility. Consequently, the GEIS concluded that the potential impacts of ground-water consumption during aquifer restoration could range from SMALL to MODERATE, depending upon site-specific conditions. In addition, aquifer restoration also directly affects ground-water quality in the vicinity of the wellfield being restored (NRC, 2009b). Rather than negatively impacting the ground-water quality during aquifer restoration, the water quality would improve as restoration continues.

The purpose of aquifer restoration is to return the ground-water quality at a specified point of compliance, generally defined as the boundary of the exempted aquifer, to the ground-water protection standards specified at 10 CFR Part 40, Appendix A. The restoration of an exempted aquifer to meet the standards in Criterion 5B(5)(a) would ensure that a present or potential future USDW outside of the exempted aquifer would be protected (NRC, 2003b). Criterion 5B(5) of Appendix A requires that the concentration of a given hazardous constituent at the point of compliance must not exceed: 1) the NRC-approved concentration of that constituent in ground water (5B(5)(a)); 2) the respective numeric value in the table included in Paragraph 5C of Criterion 5B(6), if the specific constituent is listed in the table and if the level of the constituent is below the value listed (5B(5)(b)); or 3) an ACL the NRC establishes for the constituent (5B(5)(c)). To achieve this requirement, Criterion 5B(6) states, conceptually, that concentrations pose no incremental hazard and the numeric limits in paragraph 5C pose acceptable hazards, but these two options might not be practical at a specific project, in which case the NRC can establish an ACL, if the project's licensee demonstrates that an ACL does not present a significant hazard. Prior to 2009 (i.e., prior to the Regulatory Issue Summary (NRC, 2009c)), the NRC used the "pre-operational class of use" established by a State as a secondary standard for ground-water protection for the evaluation of aquifer-restoration approval requests submitted by licensees. Subsequent to the 2009 Regulatory Issue Summary, the NRC has used the factors listed in Criterion 5B(6) for evaluating proposed ACLs.

Aquifer-restoration success would be assessed when the Applicant monitors the wells, most of which would be installed during the time between Project licensing and wellfield operation and used to determine the post-licensing, pre-operational concentrations required per Criterion

5B(5)(a) as well as the wellfield perimeter wells monitored throughout operation, to detect excursions (NRC, 2003b). The compliance period for which NRC would require this ground-water monitoring program is from the time the ground-water protection standards are established per Criterion 5B(5) of Appendix A, until its Source and Byproduct Materials License is terminated. Therefore ground water would be monitored throughout the operation and aquifer-restoration phases. The NRC could also require that monitoring would be continued through a post-reclamation period (NRC, 2003b).

Recent approvals of aquifer restoration by the NRC provide examples of the improvement in water quality within the exempted aquifer as a result of aquifer-restoration activities. NRC has approved aquifer restoration in Crow Butte Wellfield 1 (NRC, 2003c), Smith Ranch-Highland A-Wellfield (NRC, 2004a), and Irigaray Mine Units 1-9 (NRC, 2006). Cogema Mining Company has also conducted restoration at its Christensen Ranch Mine Units 2 – 6 and improved water quality to the point that it has requested approval of restoration from the NRC. The NRC has requested additional information from Cogema Mining Company before approving the restoration (NRC, 2012a; NRC 2012b).

At the time the NRC approved the restoration of Wellfield 1 at the Crow Butte facility, the wellfield averages for 30 of the 37 water-quality parameters were returned to either post-licensing, pre-operational levels concentrations or Wyoming's Class I Domestic Use standards and the EPA's Drinking Water MCLs. Concentrations of calcium, carbonate, potassium, magnesium, and molybdenum, for which there are no EPA MCLs or Wyoming Class I, II, or III standards, exceeded post-licensing, pre-operational concentrations by 6 – 60 percent. The NRC determined that the radium-226 and uranium concentrations at 31 percent and 18 percent above post-licensing, pre-operational concentrations were protective of human health and the environment (Crow Butte Resources, 2001). The applicable condition in Crow Butte's NRC license was changed to require stability monitoring beyond the six-month period, as necessary to ensure no increasing concentration trends were exhibited.

At the time NRC approved restoration of A-wellfield at the Smith Ranch-Highland facility, 31 of the 35 water-quality parameters were returned to post-licensing, pre-operational concentrations or Wyoming's Class I Domestic Use standards (PRI, 2004). Wellfield average concentrations of iron and selenium were returned to Wyoming's Class II Agriculture Use and Class III Livestock Use standards, respectively. The wellfield average concentration of manganese exceeded the Class II Agriculture Use standard, but Wyoming does not have a Class III Livestock Use standard for manganese. The wellfield's average for radium-226 is within the range of radium-226 measured in the post-licensing, pre-operational monitoring wells.

At the time the NRC approved restoration of Irigaray Mine Units 1 – 9, 27 of the 35 water-quality parameters were returned to post-licensing, pre-operational concentrations or Wyoming's Class I Domestic Use standards (Cogema, 2006a; Cogema, 2006b). Concentrations of calcium, magnesium, sodium, bicarbonate, and alkalinity as well as the measure for conductivity, for which there are no EPA MCLs or Wyoming Class I, II, or III standards, exceeded post-licensing, pre-operational concentrations 48 – 680 percent. Both the post-licensing, pre-operational and the post-restoration average levels of ammonium, TDS, and radium-226 exceeded the Class I Domestic Use standard. The average post-restoration concentration of manganese exceeded the limit for the Wyoming Class II Agriculture Use by 10 percent. The NRC determined that the concentrations in excess of post-licensing, pre-operational levels would not exceed EPA MCLs for ground water outside the aquifer-exemption boundary.

Shallow Aquifers

Potential impacts to the water quantity of the shallow aquifers at the Ross Project area during aquifer-restoration would be reduced, compared to the construction and operation phases of the Proposed Action. The impact to the aquifers' water levels from consumptive use of water from the Oshoto Reservoir and the Little Missouri River would also be moderated, because of the lower-volume withdrawals from the surface-water bodies.

In addition, potential impacts to water quality would again be reduced when compared to the Proposed Action's operation because no lixiviant would be used in the injection stream and the concentration of chemicals in the recovered ground water would be significantly less than during ISR operations. The Applicant's implementation of BMPs during uranium-recovery operation would also reduce the likelihood and magnitude of spills and leaks, and thorough cleanup would be facilitated. The ground-water mitigation measures during aquifer restoration would be the same as those described for the operation of the Proposed Action. Thus, the potential impacts of aquifer restoration to ground-water quantity and quality of the shallow aquifers would be SMALL.

Ore-Zone and Surrounding Aquifers

The potential impacts to water quantity of the ore-zone aquifer (i.e., the exempt aquifer) and the surrounding aquifers during the aquifer-restoration phase of the Proposed Action would be greater than from its operation because of the greater consumptive use of ground water (Strata, 2011a). Ground-water modeling results indicate that the drawdown in the SM aquifer during both Ross Project operation and aquifer restoration would be less than 5 m [15 ft]. The exempted ore-zone aquifer was predicted to experience significant drawdowns in three wells on the Ross Project area, with minor drawdowns in wells within 3 km [2 mi] of the Project. The conservative regional impact analysis conducted by the ground-water modeling predicts a small reduction in the available head in wells used for stock, domestic, and industrial use. Although these effects would be localized and short-lived, the Applicant would commit to provide an alternative source of water of equal or better quantity and quality, subject to Wyoming water-statute requirements, in the event that aquifer-restoration operations prevent the full use of a well under a valid water right (Strata, 2011a; Strata, 2012a). Consequently, the potential impacts of the Proposed Action's aquifer-restoration phase to ground-water quantity of the confined aquifers would be SMALL to MODERATE.

The potential impacts to water quality of the ore-zone aquifer outside the exempt aquifer as well as the aquifers above and below the exempt aquifer (i.e., SM and DM aquifers) during the aquifer-restoration phase of the Proposed Action would be less than from its operation because no lixiviant would be used during aquifer restoration. The potential for vertical and horizontal excursions during aquifer restoration would be similar to those described for the Proposed Action's operation. However, the magnitude of impacts would be less because the injection and recovery flow rates would be lower during aquifer restoration than during active uranium-recovery operation, the addition of lixiviant would have ceased, and the ore-zone water quality would improve throughout active aquifer-restoration activities. The concentrations of radiological parameters and other chemical constituents in the permeate that would be injected as "clean" water to restore the exempted ore-zone aquifer, would be lower than the pre-licensing, site-characterization ore-zone water quality reported by the Applicant, except for radium-226 (Strata, 2011a). As presented in Table 3.6 of this SEIS, dissolved radium-226

measured in the ore-zone aquifer has ranged from 0.02 Bq/L [0.6 pCi/L] to 0.4444 Bq/L [12.01 pCi/L], and the typical radium-226 concentration anticipated in the permeate is 1 Bq/L [30 pCi/L] (Strata, 2011a).

As described earlier in this section, most of the ground-water-quality parameters in wellfields for which the NRC has approved restoration were either returned to post-licensing, pre-operational concentrations or Class I Domestic Use standards. For the few parameters that exceeded post-licensing, pre-operational concentrations or Class I Domestic Use standards, the concentrations in the ground-water did not change the class of use and did not represent a potential impact to the ground water outside the aquifer-exemption boundary. The potential impacts of aquifer restoration to ground-water quality of the exempted aquifer and the confined aquifers surrounding the exempted aquifer would be SMALL.

Deep Aquifers

The Applicant estimates that less than 14.3 L/s [227 gal/min] of brine and other byproduct wastes would be disposed in the Class I injection wells during aquifer restoration concurrent with operation at the Proposed Action (see Table 4.10 for specific production rates of brine for disposal). Although the volume of waste injected would be greater during the aquifer-restoration phase than during the first 2.5 years of Ross Project's operation before aquifer restoration of the first wellfield begins, the potential impacts would be similar because the injection pressures would not increase beyond the limit established by WDEQ's UIC Class I Permit. These pressure limits would ensure that the capacity of the Class I receiving aquifer is not exceeded. The potential impacts of aquifer restoration to ground-water quantity and quality of the deep aquifers would, therefore, be SMALL.

4.5.1.4 Ross Project Decommissioning

The decommissioning activities of the Proposed Action that might impact surface water and/or ground water include the Applicant dismantling the CPP, auxiliary structures, and the surface impoundments; removing buried pipelines; excavating and removing any contaminated soil; plugging and abandoning wells using accepted practices; breaching the CBW; and restoring and revegetating all disturbed areas. Figure 4.1 indicates the components of the Proposed Action that would be in place by the end of its decommissioning.

Surface Water

As described in GEIS Sections 4.2.4.1.4 and 4.4.4.1.4, during the decommissioning phase, temporary impacts to water quality would be anticipated due to sediment loading during the excavation and removal of pipelines, drainage crossings, and other infrastructure (NRC, 2009b). As the GEIS noted, an Applicant's compliance with permit conditions, its use of BMPs, and its observance of required mitigation measures would reduce decommissioning impacts to SMALL to MODERATE, depending upon site-specific conditions.

For the Proposed Action, the Applicant intends to use surface water from either the Oshoto Reservoir or the Little Missouri River for dust control and any demolition activities during the Project's decommissioning. As shown in Table 4.3, the Applicant estimates that approximately 0.69 L/s [11 gal/min] of surface water would be used during facility and wellfield

5 CUMULATIVE IMPACTS

5.1 Introduction

The Council on Environmental Quality's (CEQ's) *National Environmental Policy Act of 1969* (NEPA) regulations, as amended (Title 40 *Code of Federal Regulations* [CFR] Parts 1500 – 1508), define cumulative impacts as "the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1500 – 1508). Cumulative impacts can result from individually minor, but collectively significant, actions that take place over a period of time. (For the purposes of this *FinalSupplemental Environmental Impact Statement* (SEIS, or FSEIS if the respective section, figure, or table did not appear in the Draft SEIS [DSEIS]) analysis, the phrase "cumulative impacts" is synonymous with the phrase "cumulative effects.") A proposed project could contribute to incremental cumulative impacts when its environmental impacts overlap with those of other past, present, or reasonably foreseeable future actions (RFFAs) in a given area. For this SEIS, other past, present, and future actions near the Ross Project include (but are not limited to) cattle and sheep grazing, agricultural production, other uranium-recovery activities, coal mining, oil and gas production, and wind-farm operation.

This analysis of the cumulative impacts of the Proposed Action is based upon publicly available information on existing and proposed projects, information in the *Generic Environmental Impact Statement* (GEIS), NUREG–1910 (NRC, 2009b), and general knowledge of the conditions in Wyoming and in the nearby communities. The current primary activities taking place in the area of the Ross Project are mineral recovery and mining as well as oil and gas development. The Power River Basin contains the largest deposits of coal in the United States (U.S.) as well as significant reserves of other natural resources including uranium, oil, and gas (NRC, 2010). There has been a resurgence in interest in these mining and recovery activities.

This section evaluates the potential for cumulative impacts associated with the Ross Project and other RFFAs as described below in Section 5.2. The GEIS provides an example methodology for conducting a cumulative-impacts assessment (NRC, 2009b). This methodology, which has been used by U.S. Nuclear Regulatory Commission (NRC) staff in its cumulative-impact analysis in this SEIS, is discussed in Section 5.3.

5.2 Other Past, Present, and Reasonably Foreseeable Future Actions

The Ross Project area, where the Proposed Action would be sited, is located just within the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR) as defined in the GEIS (NRC, 2009b). The Ross Project encompasses approximately 696 ha [1,721 ac] of land, all of which is located in Crook County, Wyoming. It is located within the Lance District (see Figure 2.1), so-called due to its location above the uranium-rich Late Cretaceous Lance Formation as discussed earlier in Section 3.4. The surface landowners of the Ross Project area include private parties (553 ha [1,367 ac]), the State of Wyoming (Wyoming) (127 ha [314 ac]), and the U.S. Bureau of Land Management (BLM) (16 ha [40 ac]). The subsurface-mineral owners include the same parties, except that of 553 ha [1,367 ac] of privately owned land, 65 ha [160 ac] of subsurface mineral rights are administered by BLM. The surface water at the Ross Project predominantly flows in a northeasterly direction to the Little Missouri River, while the ground water, which is part of the Powder River Basin regime, flows mostly westerly. This

bifurcation is important to note as cumulative impacts are identified and evaluated. The Ross Project area, at approximately 7 km^2 [somewhat less than 3 mi^2] in size, represents approximately 0.03 percent of the 25,900 km^2 [10,000 mi^2] of the entire Powder River Basin.

5.2.1 Actions

The historical and current actions (i.e., historical and current land uses) on and near the Ross Project area include livestock grazing, crop cultivation and agriculture, wildlife habitats, oil production, and, to the northeast, bentonite mining (Strata, 2011a). The historical Nubeth Joint Venture (Nubeth) was also operated on some of the land which comprises the proposed Ross Project area. SEIS Section 3.2 discusses these historical and present land uses in more detail; these land uses are expected to continue into the future, albeit to a lesser extent, while the Ross Project is operating in the area. It should be noted that no long-term, permanent changes to the environment are anticipated as a result of the Ross Project within about 8 km [5 mi] of the Ross Project area, except for the potential installation of additional roads. The extensive aquifer-restoration and site-reclamation activities that Strata Energy, Inc. (Strata) (herein also referred to as the “Applicant”) would perform during the Ross Project’s aquifer-restoration and decommissioning phases would ensure that no permanent land-use changes occur on the Ross Project area itself.

Several industries presently conduct activities in and near Crook County, activities which could have environmental impacts that, when combined with those of the Ross Project, could be greater than the individual impacts of the Ross Project. In addition, some of these activities, such as uranium recovery as well as oil and gas production, could be actively expanded within Crook County and into its neighboring counties. These activities are described below.

5.2.1.1 Uranium Recovery

Uranium was discovered in 1918, near Lusk, Wyoming, and then first mined in 1920. Greater uranium reserves were discovered in both the Powder River Basin and the Wind River Basin during the 1950s, and continued exploration for uranium resulted in the delineation of additional sedimentary uranium deposits in the major basins of central and south Wyoming, including the Powder River Basin. Uranium production in Wyoming declined in the mid-1960s, but increased again in the late 1960s and 1970s. Conventional uranium-mine production peaked in 1980 and then decreased in the early 1980s through the early 1990s when in situ uranium-recovery (ISR) facilities were established. The total uranium-mine production in the U.S. in 2007 was 2.1 million kg [4.5 million lb], almost half of which was produced in the southernmost Powder River Basin. ISR replaced conventional uranium mining and milling as the preferred means for extracting uranium in the U.S. Currently, only ISR facilities are extracting uranium in Wyoming.

Interest in uranium-recovery has translated into several ISR projects in Wyoming (see Table 5.1). The Ross Project is one. In addition, the Applicant indicates that it might develop at least four additional satellite uranium-recovery areas within the larger Lance District over the next few years (each of which would be subject to its own license-amendment actions by the NRC). Several other ISR projects are currently licensed in Wyoming as well, with two facilities operating and two ready for construction in the Powder River Basin (see Figure 5.1).

None of these operating and/or licensed ISR projects is located in Crook County (i.e., the location of the proposed Ross Project) nor have any other Crook County ISR facilities been

officially proposed to the NRC. However, four ISR projects are reportedly in the very early stages of development in Crook County (Strata, 2012a). In addition, two licensed ISR facilities

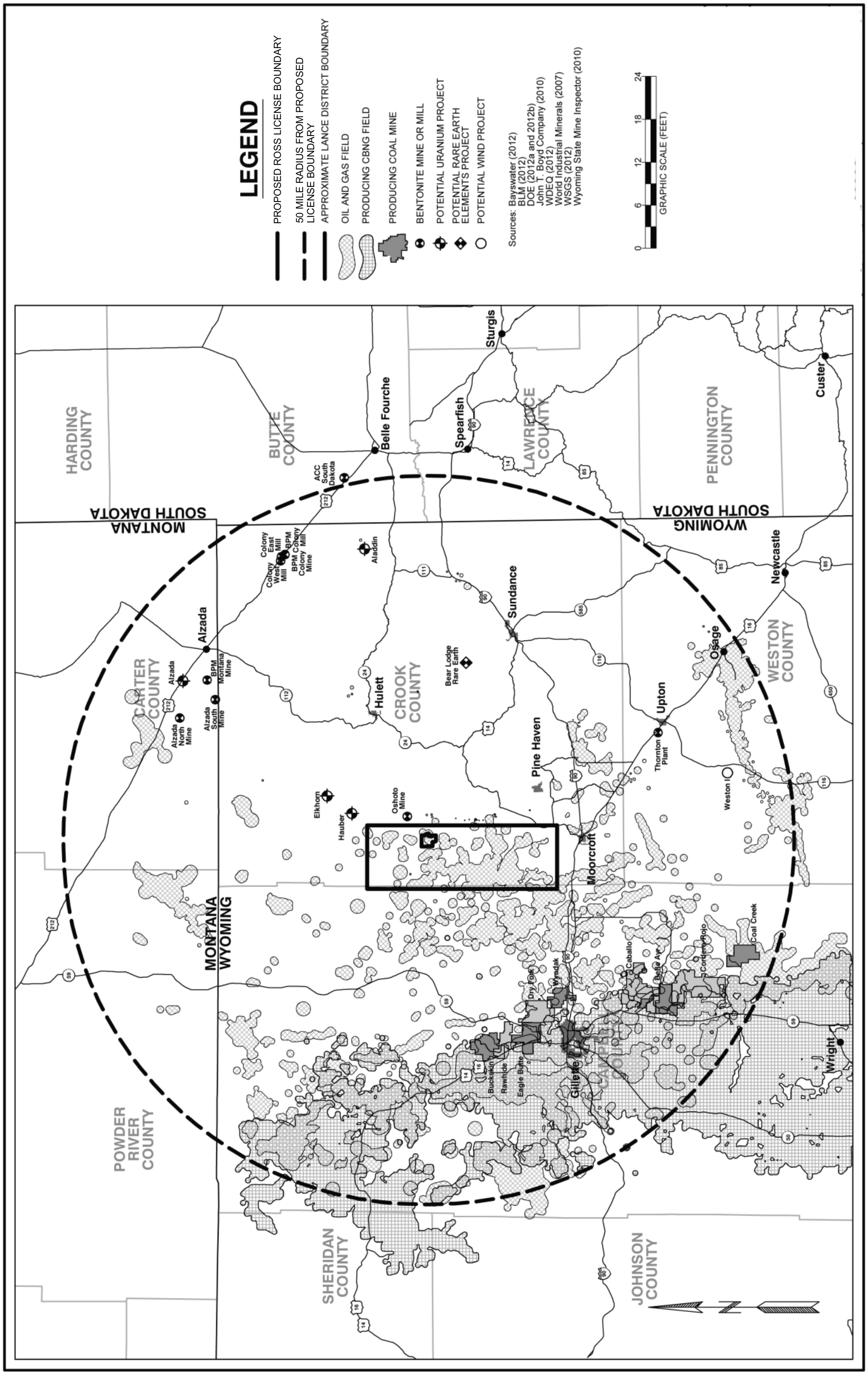
**Table 5.1
Uranium-Recovery Projects
within Eighty Kilometers [Fifty Miles] of Ross Project Area**

Project	Owner	County	Direction and Distance[a] (km [mi])	Status
Smith Ranch License SUA-1548 North Butte Ruby Ranch	Cameco Resources Inc./ Power Resources Inc.	Converse Campbell Campbell	SSW 180 km [110 mi]	Operating. Renewal and expansion (additional satellite areas) license application in technical review. Construction activities are occurring at the North Butte site. Ruby Ranch expansion license application not yet submitted.
Willow Creek (Formerly Irigaray/ Christensen Ranch) License SUA-1341 Ludeman Allemand-Ross	Uranium One	Johnson and Campbell Converse Converse	WSW 120 km [75 mi]	Operating. Renewal license issued March 2013. Amendments to include Ludeman (license application has been submitted) and, later, Allemand-Ross (license application has not been submitted) satellite areas.
Nichols Ranch License SUA-1597	Uranerz Energy Corporation	Johnson and Campbell	SW 120 km [75 mi]	Licensed and under construction.
Moore Ranch License SUA-1596	Energy Metals Corporation/ Uranium One	Campbell	SW 150 km [90 mi]	Licensed, but not yet under construction.
Reno Creek	AUC LLC	Campbell	SW 105 km [65 mi]	License application submitted.

Sources: Strata, 2012a; NRC, 2013a.

Note:

[a] Approximate distance from the Ross Project area to the respective ISR project in "as the crow flies" (i.e., a straight line) in kilometers [miles].



Source: Strata, 2012a.

Figure 5.1
Circular Area of an Eighty-Kilometer [Fifty-Mile] Radius around Ross Project Area

are located in adjacent Campbell County (satellite areas of the Smith Ranch ISR Project, which is currently operating, and the Moore Ranch, which is still to be constructed). Two other ISR facilities overlap both Campbell and Johnson Counties (Willow Creek, which is currently operating, and Nichols Ranch, which is licensed and under construction).

The Applicant describes in its license application the types and sequence of its planned development of the Lance District. The Applicant has identified significant uranium resources within the District, and it intends for the Ross Project to be the first of several "satellite" areas. These potential satellite areas could consist of those shown in Figure 2.2 in SEIS Section 2.1.1, including, within the northern portion of the Lance District, Ross Amendment Area 1 and, to the south within the Lance District, the potential Kendrick, Richards, and Barber satellite areas (Strata, 2012a). If additional wellfields were to be developed by the Applicant and licensed by the NRC, the Ross Project's Central Processing Plant (CPP) would be used to process pregnant solutions from these satellite areas into yellowcake. In addition, the Applicant also proposes that ion-exchange (IX) resin loaded with uranium ("uranium-bearing" or "pregnant") would be accepted at the Ross Project's CPP from other offsite ISR facilities (this activity is referred to as "toll milling") or companies and/or from water-treatment plants (Strata, 2011a). This additional potential use of the CPP at the Ross Project is the reason that the Plant is designed for four times the capacity needed for only the Ross Project.

Lance District

The four satellite areas within the Lance District that the NRC staff has identified as reasonably foreseeable are as follows:

Ross Amendment Area 1

This area would be an extension of the proposed Ross Project to the north and west. This area would not increase the overall production rate of yellowcake, but rather it would increase the operating life of the Ross Project. As uranium production from the early wellfields within the Ross Project area begins to diminish and the wellfields begin to enter the aquifer-restoration phase of the proposed Project, additional wellfields in the Ross Amendment Area 1 could be begin uranium recovery. The Ross Amendment Area 1 could extend the lifetime of the Ross Project by several years as shown in Figure 2.6 (Strata, 2012a).

Kendrick Satellite Area

The Kendrick satellite area would be contiguous to the Ross Project area as shown in Figure 2.2 in SEIS Section 2.1.1. However, unlike the Ross Amendment Area 1, the Kendrick satellite area would allow the Applicant to increase its production of yellowcake to approximately 680,000 kg/yr [1.5 million lb/yr] (Strata, 2012a).

Richards Satellite Area

The Richards satellite area would be contiguous to the Kendrick satellite area. The uranium-rich solutions extracted from this satellite area would be piped to the Ross Project's CPP for uranium recovery or, potentially, piped to the Barber satellite area as described below (Strata, 2012a). The relative schedule for this satellite would be identified by the Applicant in the future.

Barber Satellite Area

Although the Applicant's plans for development of the Lance District are not yet complete, Strata anticipates that a remote IX-only plant would be constructed at the Barber satellite area. This would mean that the pregnant, uranium-rich solutions brought to the surface at the Barber satellite area would be treated by IX to yield uranium-loaded resin, which would then be trucked to the Ross Project's CPP for further processing (e.g., resin elution) (Strata, 2012a). This additional uranium would increase the CPP's output to approximately 993,000 kg/yr [2.19 million lb/yr]. In addition, the Applicant would investigate the possibility of transferring pregnant solutions from wellfields in the Richards satellite area to the remote IX facility at the Barber satellite area before transfer to the CPP at the Ross Project area.

Other Potential ISR Facilities within 80 Kilometers [50 Miles] of the Ross Project

There are no other uranium-recovery or nuclear-fuel-cycle projects currently located within 80 km [50 mi] of the Ross Project area nor have any Letters of Intent or license applications been submitted to the NRC for any ISR projects within 80 km [50 mi] (see Figure 5.1) (Strata, 2011a). There are, however, four other uranium-recovery operations in various very early planning stages located within 80 km [50 mi] of the Ross Project, including the following:

Potential Aladdin Project

The potential Aladdin ISR Project would be located in Crook County, approximately 66 km [41 mi] east-northeast of the Ross Project, although the driving distance to this Project would be approximately 113 km [70 mi]. The Aladdin Project is being considered by Powertech Inc. and comprises approximately 7,099.8 ha [17,554 ac].

Potential Elkhorn Project

The potential Elkhorn ISR Project is currently being evaluated by NCA Nuclear, Inc. (a wholly owned subsidiary of Bayswater Uranium Corporation). This Project would also be located in Crook County, approximately 26 km [16 mi] from the Ross Project (driving distance would be approximately 30 km [20 mi]). It is currently estimated that this Project's area of 2,110 ha [5,215 ac] may ultimately yield approximately 544,000 kg [1.2 million lb] of uranium. The Project is located near the former, and decommissioned, Homestake Hauber Uranium Mine (see below).

Potential Hauber Project

The potential Hauber ISR Project would also be owned by NCA Nuclear, Inc., in a joint venture with Ur-Energy Inc. This Project would be located approximately 23 km [14 mi] from the Ross Project area, or 30 km [20 mi] if driven, and would comprise approximately 2,090 ha [5,160 ac]. The total uranium production from this Project is estimated at 680,000 kg [1.5 million lb] (Strata, 2012a). This Project would be located near the now-closed Hauber Uranium Mine, which was operated between 1958 and 1966 and which is discussed below (Strata, 2011a).

Potential Alzada Project

The potential Alzada ISR Project would be owned and operated by NCA Nuclear, Inc. and would comprise approximately 10,000 ha [25,000 ac]. It would be located approximately 62 km

[39 mi] north-northeast of the Ross Project area (driving distance would be approximately 129 km [80 mi]) (Strata, 2012a).

Other ISR Facilities within the Powder River Basin

There are four other ISR Projects in various stages of the NRC's licensing process and/or currently operating or being constructed within the Powder River Basin, all of which are located in Wyoming, although none of these Projects are within a 80-km [50-mi] radius of the Ross Project. However, the 80-km [50-mi] cumulative-impacts area does not include the entire Powder River Basin; thus, none of these four Projects is located within that cumulative-impacts area. Two of these facilities are currently operating; two have been licensed, one of which has begun construction. The owner of a fifth ISR Project has submitted a license application to the NRC in October 2012. These ISR projects include the following:

Smith Ranch ISR Project

The Smith Ranch ISR Project conducts uranium recovery and is currently being operated by Power Resources Inc. (dba Cameco Resources Inc. [Cameco]). The Smith Ranch Project is primarily located in Converse County, Wyoming, but this Project also includes several remote satellite areas in other Wyoming counties—one of which is not located in the Powder River Basin (i.e., in the Wind River Basin). A license application to renew and to expand Source Materials License SUA-1548 for the Smith Ranch Project was received by the NRC in February 2012 (see Docket No. 40-8964). If the NRC grants a license amended and renewed as proposed, the Smith Ranch License would allow Cameco to continue conducting ISR activities at its Smith Ranch Project as well as to initiate and/or expand ISR activities at its associated and remote ISR satellite areas: 1) the Highlands and the Reynolds Ranch satellite areas, both also located in Converse County, Wyoming; 2) the Gas Hills remote satellite area in Fremont and Natrona Counties, Wyoming; 3) the North Butte remote satellite area in Campbell County, Wyoming; and 4) the Ruth remote satellite area in Johnson County, Wyoming (NRC, 2013a).

Willow Creek ISR Project

The Willow Creek ISR Project is located in Johnson and Campbell Counties, Wyoming; the Project is owned by Uranium One (see Docket No. 40-8502). The NRC license was renewed for this Project in March 2013. A license application for the Ludeman ISR Project was originally submitted to the NRC in January 2010, but it was subsequently withdrawn in May 2010. A license application was resubmitted by the owner of the Project, Uranium One, in December 2011, where three specific subdivisions of the Ludeman area, which is located in Converse County, would be satellites of the Willow Creek ISR Project (NRC, 2013a). Both of these Projects are situated in the Powder River Basin. The Ludeman Project consists of approximately 8,000 ha [20,000 ac]; the Willow Creek Project is approximately 5,500 ha [13,600 ac].

Nichols Ranch ISR Project

The Nichols Ranch ISR Project is located in Johnson and Campbell Counties of Wyoming. It is owned by the Uranerz Corporation (Uranerz) and is comprised of 1,251 ha [3,091 ac]. Its NRC license has been granted, and the facility is currently under construction (see Docket No. 40-9067) (NRC, 2013a). Uranerz has received an Underground Injection Control (UIC) Permit from

the Wyoming Department of Environmental Quality (WDEQ). The company has also signed a toll-milling agreement with the owner of the Smith Ranch Project, Cameco, to transfer uranium-loaded IX resin from the Nichols Ranch ISR Project to the Smith Ranch Project for final processing to yellowcake.

Moore Ranch ISR Project

The Moore Ranch ISR Project is located in Campbell County, Wyoming; it is owned by Energy Metals Corporation, a wholly owned subsidiary of Uranium One. It is comprised of approximately 2,879 ha [7,110 ac]. It is currently licensed by the NRC to operate through September 2020 (see Docket No. 40-9073) (NRC, 2013a); construction on this ISR facility has not yet begun.

Reno Creek ISR Project

AUC LLC, submitted a license application in October 2012 to site, design, license, construct, and operate an ISR facility in Campbell County, Wyoming (NRC, 2012c).

Past ISR Facilities within 80 Kilometers [50 Miles] of the Ross Project

In addition to the present and reasonably foreseeable uranium-recovery facilities described above, it should be noted that, historically, two uranium-recovery facilities were located in the 80-km [50-mi] area surrounding the Ross Project area. The first was a historic uranium mine near Hulett, and the second, Nubeth, is identified above; Nubeth has been included in this SEIS's analysis of pre-licensing, site-characterization data as well as cumulative impacts in this section.

The historic Homestake Hauber Uranium Mine was operated by the Homestake Mining Company between 1958 – 1966; the mine closed in 1966. It is also located in Crook County, approximately 19 km [12 mi] to the northeast of the Ross Project. This mine is no longer a contributor to cumulative impacts in the area because it is not operating and, thus, no longer producing impacts related to traffic, water resources, ecology, air quality, noise, and so forth. However, it is now a part of the area currently being explored for additional potential uranium recovery by NCA Nuclear, Inc., in a joint venture with Ur-Energy Inc. The potential Hauber ISR Project is described above; the Project is currently in the planning stages. This Project would be the nearest uranium-recovery project to the proposed Ross Project.

Nubeth was described more extensively in SEIS Sections 2.1.1 and 3.5.3. This research and development ISR operation operated between 1978 – 1979. Nubeth was decommissioned according to NRC and WDEQ requirements, and final approval for its decommissioning was issued between 1983 – 1986. Additional information regarding potential impacts from this historical operation is included in this SEIS Section's assessment of cumulative impacts.

5.2.1.2 Mining

Coal as well as other natural resources are mined in and around Crook, Weston, and Campbell Counties. Indeed, Powder River Basin coal mines supply almost 97 percent of the coal produced in Wyoming each year (BLM, 2005a; BLM, 2005b; BLM, 2005c), and Wyoming produces the greatest quantity of coal in the U.S. Thus, substantial mining activities occur

Wind-Power Development

While there is potential in the Powder River Basin for wind-power generation to contribute to region's meeting forecasted electric-power demands, it depends upon 1) the location of sage-grouse core breeding areas and 2) the available transmission capacity to send power to users. Both the location of Greater sage-grouse core breeding areas and transmission capability may be constraining factors (BLM, 2008).

There are currently no wind-power projects within the 80-km [50-mi] vicinity of the Ross Project area, and only one has been proposed (see Figure 5.1) (Strata, 2012a). This wind-power project, as proposed, would have a 250-MW capacity with 166 turbines generating approximately 600 million kWh annually (Strata, 2012a). It would be constructed and operated by Wind Energy America. The turbines would be located approximately 42 miles south-southeast of the Ross Project area, although it would be approximately 97 km [60 mi] to drive between the two operations. The project would be south of Interstate (I)-90, where the Ross Project area would be north of I-90.

5.3 Cumulative-Impacts Analysis

5.3.1 EISs as Indicators of Past, Present, and Reasonably Foreseeable Future Actions

One indicator of RFFAs in a particular region of interest is the number of recent draft and final environmental impact statements (EISs) and environmental assessments (EAs) that have been prepared by Federal agencies. The NRC used information presented in GEIS Section 5.1.1 as well as publicly available information, several site-specific EISs and Supplemental EISs (SEISs) for projects in the Powder River Basin, and draft and final programmatic EISs for large-scale actions related to several states, including Wyoming, to accomplish its cumulative-impacts analyses (NRC, 2009b).

5.3.2 Methodology

For the determination of potential cumulative impacts, the NRC staff reviewed Appendix F of the GEIS and determined that a Level 2 cumulative-impacts analysis was appropriate for this Ross Project SEIS due to the fact that concerns were identified during the site-specific analysis (SEIS Section 4) with respect to the sustainability or quality of some of the resource areas within the uranium-milling region (NRC, 2009b). Therefore, the following methodology was developed, based upon CEQ guidance for a Level 2 cumulative-impacts analysis as described in the GEIS (CEQ, 1997; NRC, 2009b):

- Identify for each resource area potential environmental impacts that would be of concern from a cumulative-impacts perspective. The impacts of the Proposed Action and the two Alternatives are described and analyzed by resource area in SEIS Section 4, "Environmental Impacts and Mitigation Measures."
- Identify the geographic scope for the analysis of each resource area. This scope would be expected to vary from resource area to resource area, depending upon the geographic extent of the potential impacts.
- Identify the timeframe over which cumulative impacts would be assessed. The cumulative-impacts analysis timeframe selected for the proposed Ross Project was

selected as 2013 in 2011, the estimated earliest year in which the when the Applicant could receive its Source and Byproduct Materials License from the NRC and could begin major construction. While there have been some preconstruction activities conducted by the Applicant since 2009, those activities have been determined to be minor with respect to cumulative impacts, because most of the actions have been simply ground-water monitoring-well installation, surface-water- and meteorological-station installation, data collection (i.e., ground-water and surface-water monitoring in addition to meteorological monitoring and a variety of pre-licensing, site-characterization field surveys); minor road construction; and renovation of a ranch house into Strata's Field Office).

After the NRC approves the Applicant's development of its post-licensing, pre-operational ground-water constituent-concentration values (i.e., after the first wellfield is fully installed and all required wellfield data have been collected and reported) that would be used for lixiviant-excursion detection and aquifer-restoration success, the Applicant could begin uranium recovery. In general, the cumulative-impacts analysis timeframes terminate in 2027, which represents the projected license-termination date at the end of the decommissioning period (see Figure 2.6 in SEIS Section 2.1.1). In some resource areas, however, the NRC's analysis considers impacts beyond 2027 to the extent that some resources, such as ground-water resources, could require additional time to equilibrate after the complete decommissioning of the Ross Project.

- Identify past, existing, and anticipated future projects and activities in and surrounding the Project area. These projects and activities are identified in this section.
- Assess the cumulative impacts for each resource area as a result of the Proposed Action and the reasonable Alternatives and other past, present, and reasonably foreseeable future actions. This analysis should take into account the environmental impacts of concern identified in Step 1 and the resource area-specific geographic scope identified in Step 2.

The following terminology was used to define the level of cumulative impact:

SMALL: The environmental impacts are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental impacts are sufficient to alter noticeably, but not destabilize important attributes of the resource considered.

LARGE: The environmental impacts are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

In conducting this assessment, the NRC staff recognized that for many aspects of the activities associated with the proposed Ross Project, there would be SMALL impacts on affected resources. It is possible, however, that an impact that may be SMALL by itself, but could result in a MODERATE or LARGE cumulative impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a small individual impact could be important if it contributes to or accelerates the overall resource decline. The NRC staff determined an appropriate level of analysis that was merited for each resource area potentially affected by the Proposed Action and alternatives. The level of detailed analysis was determined by considering the impact level to

that resource, as described in SEIS Section 4, as well as the likelihood that the quality, quantity, or stability of the given resource could be affected.

The subsequent sections document the NRC's cumulative-impact analysis in the following areas:

- Land Use
- Transportation
- Geology and Soils
- Water Resources
- Ecology
- Air Quality
- Global Climate Change and Greenhouse-Gas (GHG) Emissions
- Noise
- Historical, Cultural, and Paleontological Resources
- Visual and Scenic Resources
- Socioeconomics
- Environmental Justice
- Public and Occupational Health and Safety
- Waste Management

5.4 Land Use

The geographic area within which cumulative impacts to land use were evaluated were Crook and Weston Counties, which are within the BLM's Newcastle Field Office planning area, and Campbell County, which is within the planning area administered by the BLM's Buffalo Field Office (see Figure 2.1 in SEIS Section 2.1). These three counties include over 26,000 km^2 [10,000 mi^2] and incorporate the approximately 96 km^2 [56 mi^2] of the Lance District area. These three Counties serve as the geographic area where socioeconomic factors that could relate to land use (i.e., reasonable commuting, shopping, and/or lodging or new-home distances) would occur. This area is referred to in this section as the "land-use cumulative-impacts study area." Given the size of the three Counties and the size of the Ross Project, the Project would be approximately 0.03 percent of the entire land-use cumulative-impacts study area. The timeframe for this cumulative-impacts analysis is from 2013, when it was estimated the Applicant could be issued a Source and Byproduct Materials License by the NRC, through 2027, when the Ross Project and the satellites in the Lance District would be completely decommissioned and the aquifers would have been restored.

Land use within the Powder River Basin is diversified and cooperative, with CBM as well as oil- and gas-extraction activities sharing the land with livestock. Although Federal grasslands and forests cover approximately 21 percent of the Powder River Basin area, most rangeland is privately owned (68 percent) and is used primarily for grazing cattle and sheep. In Crook County, land ownership is also primarily private. Within Campbell County, however, land ownership is primarily Federal and is allocated by the BLM for use as pastureland (see Figure 3.1 in SEIS Section 3.2).

As noted in SEIS Section 4.2, the land-use impacts of the Ross Project would result primarily in the interruption, reduction, or impedance of livestock grazing and wildlife habitat; there is not public access to the Project area generally (e.g., for hunting or fishing) nor is there significant agriculture occurring currently at the Ross Project area (see Table 3.1 in SEIS Section 3.2). There are no longer any impacts from historical operations at the Ross Project area (i.e., Nubeth). In addition, the area that would be disturbed by the Ross Project encompasses a total

of 114 ha [282 ac] of land, which represents 16 percent of the Ross Project area. The permanent impacts of the Ross Project would be limited, because the Applicant would be required to return the land to the pre-licensing conditions described in SEIS Sections 2.1.1.2 and 3.2, unless the respective landowners wish to have certain roads, for example, remain. Thus, the potential land-use impacts from the Ross Project would be temporary and SMALL through all of its phases, as discussed in SEIS Section 4.2.

Mining in the form of coal, mineral, oil, and gas extraction are all important land uses of the cumulative-impacts study area. As noted Section 5.2, both conventional and CBM oil and gas production are expected to continue in upcoming years. As of 2010, there were over 2,600 conventional oil- and gas-well permits in the land-use cumulative-impacts study area (USGS, 2011), with 889 producing wells (or less than 1 producing well per 26 km^2 [10 mi^2]). A typical drilling location, including a well pad and any access roads, disturbs approximately 1.11 ha [2.75 ac] of land (BLM, 2009e); at a density of 1 well per 26 km^2 [10 mi^2], this would represent up to 0.04 percent of the land affected by these wells. In addition, over 1,570 of the permitted wells have been abandoned and are no longer being used. Through 2008, 547 CBM wells had been drilled within the three-County study area (or approximately one producing well per 52 km^2 [20 mi^2], affecting approximately 0.02 percent of the total land area) (USGS, 2011). Because of the small area of impact for each well and the moderate number of wells currently being operated, the cumulative impacts by the use of land for oil and gas production is SMALL.

As noted in Section 5.2, coal production in the Wyoming portion of the Powder River Basin is expected to grow at an annual rate of 2 – 3 percent per year. It is predicted that from 2010 – 2020, the land area impacted by coal development in the Powder River Basin will increase from 39,927 ha – 55,621 ha [98,662 ac – 137,443 ac]. By 2020, these impacts would represent 1.3 percent of the land in the Powder River Basin. However, most of this coal-mining growth would be in the central area of Campbell County and in an area where the nearest coal mine is over 45 km [28 mi] from the Ross Project area. In the 80-km [50-mi] area shown in Figure 5.1, there are 9 operating coal mines (Strata, 2012a). This land use dedicated to coal mining has and would continue to have a MODERATE impact in the land-use cumulative-impacts study area.

There are no operating nor licensed ISR uranium-recovery facilities within 80 km [50 mi] of the Ross Project area, although there are four uranium-recovery projects in the very early stages of development as described in SEIS Section 5.2 (i.e., Aladdin, Elkhorn, Hauber and Altzada). There is also a potential for development of other uranium facilities to the north, east, and south of the Ross Project as part of the entire Lance District as described earlier. Thus, some land-use changes as a result of these reasonably foreseeable future developments could occur. To assess the projected land area that would be affected by the development of these present and foreseeable future actions, the NRC staff assumed that approximately the same area affected by the Ross Project and its disturbance of 114 ha [282 ac] would also be approximately the same as by these other ISR projects. Using this assumption, the NRC staff estimated that the four other non-Strata projects and the four other Strata Lance-District projects would impact an additional 904 ha [2,240 ac], for a total area disturbed by potential ISR projects in the land-use cumulative-impacts study area of 1,017 ha [2,520 ac]. This acreage accounts for only approximately 0.04 percent of the total study area. Therefore, these ISR projects would have a SMALL impact on land use.

The NRC staff has concluded that the cumulative impacts on land use in the study area resulting from past, present, and reasonably foreseeable future actions is MODERATE. The

Ross Project would have a SMALL incremental effect on land use when added to the MODERATE cumulative land-use impacts.

5.5 Transportation

An area with an 80-km [50-mi] radius was used as the geographic boundary in the evaluation of the cumulative impacts of transportation for this SEIS (referred to in this section as the "transportation cumulative-impacts study area"). This study area was selected because it incorporates the area that would likely be travelled by the majority of the workers at the Ross Project and includes the distance to the nearest Interstate highway (i.e., I-90). The analysis of transportation-related cumulative impacts uses the timeframe of 2013 – 2027, which would be the entire lifecycle of Ross Project from licensing to final decommissioning. The analysis assumes that, within this timeframe, the four potential satellite areas within the Lance District would be developed sufficiently by the Applicant to construct and begin operation.

The environmental impacts identified in SEIS Section 4.3.1 for the Ross Project would result from the transport of chemical supplies, building materials, yellowcake product, vanadium product, solid byproduct wastes, other hazardous and nonhazardous wastes, and the commuting workforce, all of which increase traffic volumes to and from the Ross Project area. During the phases of the Ross Project examined in SEIS Section 4.3, traffic volume was estimated to increase up to 400 percent. This traffic would predominantly be present on the local Crook County roads. As a result, the wear and tear of the county roads would be significantly increased, and the potential for wildlife mortality and vehicular accidents would increase as well. Therefore, the transportation impacts were found to be SMALL to MODERATE to LARGE on local and county roads, depending upon the Project phase, and SMALL to the Interstate-highway system, as discussed in Section 4.3. With the mitigation measures discussed in Section 4.3, the overall transportation impacts would be reduced to SMALL to MODERATE. Once the Ross Project is decommissioned, most wellfield roads constructed as part of the Ross Project would be removed, and the traffic volume would subside to possibly a little more than the 2010 volume.

Direct impacts to the roads and highways within the transportation cumulative-impacts study area include increased vehicular-traffic volumes and increased risk of vehicular accidents during daily commutes by workers and the trips their families take, especially on roads such as New Haven and D Roads. Ross Project workers would use these local and county roads as would workers from the Lance District satellite areas and two of the five potential ISR projects currently being planned. If the same workforce is assumed for the two other potential ISR projects; if they are assumed to be under construction at the same time; and if it is assumed that the workers at both the Elkhorn and Hauber Projects were to use D or New Haven Roads to commute to and from work, these assumptions would increase the traffic on D and New Haven Roads to approximately and conservatively 920 additional automobiles on these roads alone per day (it was assumed here that the Ross Project would be already in its operation phase and its workforce would have been reduced to 60 workers). In addition, all of the supply and materials deliveries during their respective construction phases and uranium-product shipments would need to be added to this traffic volume. The volume that results, if the same number of deliveries and shipments by the other potential ISR projects is assumed, would increase to almost 1,000 vehicles per day. (Also, D Road is already being used by the Oshoto bentonite mine northeast of the Ross Project area, although there are only a reported eight workers currently commuting to that facility; consequently, this traffic was already considered under the

Ross Project's transportation impacts in SEIS Section 4.3.) This would be a LARGE cumulative impact for both D and New Haven Roads. Traffic on I-90 would be similarly increased during this period. However, the Interstate highway has been designed to provide sufficient capacity to accomodate this increase (as discussed in SEIS Section 4.3). Thus, the transportation impacts on the Interstate-highway system of the U.S. would be SMALL.

All of the indirect impacts identified for the proposed Ross Project, including increased wear and tear on existing roads, additional air emissions and fugitive dusts, greater noise, and an increased risk of vehicle collisions with livestock, wildlife, and other vehicles, would occur as a result of this increased traffic volume on the local county roads. This increased local traffic would yield MODERATE to LARGE impacts for the local roads, depending upon the sequencing of project development.

The NRC staff has concluded that the cumulative impacts within the overall transportation study area resulting from past, present, and reasonably foreseeable future actions, such as energy-related projects (e.g., CBM, oil, and gas projects as well as uranium recovery and coal mining) would be MODERATE. The proposed Ross Project would have a SMALL to MODERATE incremental effect on transportation when added to the MODERATE cumulative transportation impacts due primarily to significantly increased traffic.

5.6 Geology and Soils

The geographic area for the evaluation of geology and soils cumulative impacts ("geology and soils cumulative-impacts study area") is defined as the approximately 9,000-ha [22,200-ac] Lance District shown on Figure 2.2 in SEIS Section 2.1.1. This limitation of the cumulative-impacts assessment for soils to this area is appropriate since geology and soil impacts are constrained to the area in which they occur (i.e., they don't spread). The Ross Project itself would result in the disturbance of 114 ha [282 ac] of surface soil, a very small fraction of the total study area (i.e., approximately 0.013 percent).

Previous ISR activities at the Ross Project site include research and development activities conducted by Nubeth in the late 1970s. These activities included construction and operation of a small 5-spot wellfield for one year that likely resulted in some soil disturbance to a small area of land (Strata, 2011a). Regulatory approval of Nubeth's decommissioning was granted by 1986. The Nubeth area was approved as restored and reclaimed; thus, this past action is consequently no longer relevant for the geology and soils cumulative-impacts analysis.

As noted in SEIS Section 5.3.2, the proposed schedule for the construction, operation, and decommissioning phases as well as the restoration of the aquifer(s) at the Ross Project has these activities taking place over an approximate nine-year period from the time the Project would be licensed by the NRC (Strata, 2012a). Other Lance District wellfield-development activities (i.e., satellite areas) could extend the processing of uranium-bearing IX resin at the Ross Project's CPP by another five years or more, to 2027 (see Figure 2.6 in Section 2.1.1) (Strata, 2012a). However, the geology and soils impacts within the Ross Project area, where the soils would have been disturbed, would need time after the cessation of uranium recovery to recover. These impacts would dissipate once site restoration is complete, within five years or less according to the professional judgment of soils scientists; therefore, the time period for this

geology and soils cumulative-impacts evaluation is a conservative 19 years from the licensing of the Ross Project, or the year 2032.

During the lifecycle of the Ross Project, as discussed in SEIS Section 4.4, potential impacts to Ross Project area geology would be predominantly associated with drillholes, wells, and wellfields. At the conclusion of the Ross Project, an average density of approximately 4.3 wells/ha [1.7 wells/ac], each properly plugged and abandoned, would remain. The Applicant's proper plugging and abandoning of these holes would mitigate their impact to the local geology. Also, the records required by the Applicant's permits for well plugging and abandonment would allow a final assessment of any impacts on the geology after the Ross Project has been decommissioned, if necessary.

The most significant impacts for soils would be soil loss and compaction, soil-productivity loss, and potential soil contamination. There would also be soil disturbance associated with the construction of the CPP, surface impoundments, and access roads as well as pipeline and wellfield installation. Accidental spills or other releases of drilling fluids and muds, process solutions, and other liquids could cause soil contamination throughout the Project's lifecycle. As noted in SEIS Section 4.4, facility- and wellfield-design features, best management practices (BMPs), and permit requirements, such as the requirements of the Applicant's Permit to Mine, UIC Permit, and Wyoming Pollutant Discharge Elimination System (WYPDES) Permit would minimize these potential impacts during the Ross Project's construction, operation, aquifer restoration, and decommissioning. The Project's decommissioning would include reclamation of soils and the restoration of the area to current conditions. Current conditions have been documented by soils and vegetation pre-licensing, site-characterization surveys of the Ross Project area as described in SEIS Section 3.4.. These surveys have established the conditions against which soils impacts at the Ross Project could be measured (see Figure 3.10). Thus, the geology and soil impacts of the Ross Project would be SMALL in the geology and soils cumulative-impact study area.

To assess cumulative impacts to soils, the area of soil disturbances needs to be quantified. The Applicant has identified four potential satellite areas within the Lance District (see Figure 2.2 in SEIS Section 2.1.1) (Strata, 2012a). The NRC assumed that each of these satellite areas would require the same area of soil disturbance as the Ross Project; consequently, their development would result in 450 ha [1,120 ac] of soil disturbance. The density of wells at the satellite facilities is also assumed to be similar to the well density at the Ross Project area. In addition, the impacts to geology and soils would be mitigated as those at the Ross Project would, including complete site reclamation at the end of the Project's lifecycle. If the density of drillholes and wells at these areas would be the same as the Ross Project, and the requirements for the plugging and abandonment of the drillholes and wells would be the same, then the potential impacts to geology and soils at each satellite facility would be generally equivalent to those of the Ross Project; thus, they would be SMALL.

As shown on Figure 5.1, there are numerous oil and gas fields that are located within the area of the Lance District, as noted earlier in this section. However, there are no publicly announced plans for further oil and gas development in the Lance District itself. The impacts to local geology would then be the depletion of the oil and gas mineral resources and the remaining, plugged wells after gas and oil extraction. For soils, the current wells and any future wells would cause soil impacts due to the drilling of the wells, the construction of new access roads, and the conduct of other operating activities. These soil impacts would also be required to be

mitigated with site-specific BMPs as well as site-restoration and site-reclamation permit requirements.

The NRC staff has determined that the cumulative impacts to geology and soils in the geology and soils cumulative-impacts study area would be SMALL. The soil disturbance associated with the Ross Project area and the other satellite projects in the Lance District would be limited to approximately 5 percent of the approximately 9,000-ha [22,200-ac] Lance District with 95 percent of the area remaining undisturbed. This disturbance to geology and soils would be dispersed throughout the Lance District and site restoration and reclamation would be required of the Applicant. The proposed Ross Project would have a SMALL incremental impact on the SMALL cumulative impacts to geology and soils in the geology and soils cumulative-impacts study area.

5.7 Water Resources

The analysis of the cumulative impacts to both surface and ground waters are described below.

5.7.1 Surface Water

The geographic area for the evaluation of surface-water cumulative impacts has been defined by the NRC staff as Little Missouri River Basin, from the Ross Project downstream to the Wyoming/Montana border (see Figure 3.10 in SEIS Section 3.4.2). Within this stretch of the Little Missouri River, which begins in the Ross Project area, the mean flow increases from an average of less than 0.05 m^3/s [1.7 ft^3/s] at SW-1, near the downstream Ross Project boundary, to an average of 2 m^3/s [77 ft^3/s] just downstream of the Wyoming/Montana border. The 45-fold increase in flow within 80 km [50 mi] indicates that cumulative impacts associated with the Ross Project could only be measured in the upper reaches of the Little Missouri River Basin, which is why this geographic area was selected for cumulative-impacts analysis. As the River's flow substantially increases downstream of the Ross Project, any cumulative impacts would be greatly diminished by the additional volume of water.

As discussed in SEIS Section 5.3.2, the timeframe defined for the cumulative-impact analysis is 14 years after license issuance. The schedule shown in Figure 2.6 in SEIS Section 2.1.1 indicates that the construction, operation, aquifer restoration, and decommissioning of the Ross Project facility and wellfields as well as other potential Lance District satellite areas would take place during this time period. Since the impacts of the Ross Project on surface-water flows and surface-water quality would dissipate quickly upon completion of the decommissioning phase, this cumulative-impact analysis for surface water ends at 2027 after final Ross Project decommissioning is complete.

As described in the SEIS Section 3.5, the Ross Project would use surface water from the Oshoto Reservoir for dust control and construction-related activities at rates far less than the permitted water right. The Applicant has already obtained a WYPDES Permit (No. WYR104738) to manage storm-water runoff into the Little Missouri River (see SEIS Section 1.7). In addition, a temporary WYPDES Permit would continue to be required for the Applicant's discharge to the ground surface of all waters pumped from each new well during Strata's development of all injection, recovery, and montitoring wells (currently WYPDES Permit No. WYG720229). Water from the development of UIC Class I wells would also discharged according to a WYPDES permit. As described in SEIS Section 4.5.1, the impacts to surface-

water quantity would be minimal, and the potential water-quality impacts would be mitigated by standard operating procedures (SOPs), BMPs, and permit requirements. The potential impacts of erosion in the small area of temporary land disturbance as well as from accidental process-solution and other liquid spills, leaks, and other releases would be localized and short-term because of the SOPs and BMPs the Applicant would adopt. The potential impacts to the surface-water quantity and quality from the Ross Project would be SMALL.

With respect to wetlands, the Ross Project's construction would have the potential to impact up to 0.8 ha [2 ac] of wetlands. A USACE-required permit would oblige the Applicant to provide a site-specific mitigation plan for all Project-related disturbance of jurisdictional wetlands. This plan would ensure that appropriate mitigation measures would be in place so that there is no net loss of wetlands. As described in SEIS Section 4.5.1, the Ross Project's potential impacts to wetlands would be SMALL.

Measurements of pre-licensing, site-characterization surface-water flows and water-quality parameters provide the basis for an assessment of the cumulative impacts to surface-water quantity and quality (Strata, 2011a). The monitoring program that the Applicant would implement during all phases of the Ross Project would ensure that the Applicant meets all Conditions of its Source and Byproduct Materials License as well as WDEQ/Land Quality Division's (LQD's) Permit to Mine requirements (NRC, 2014b; WDEQ/LQD, 2011). This monitoring program is discussed in SEIS Section 6.

The cumulative impacts for surface water would be related to water quantity and water quality. All streams within the upper reaches of the Little Missouri River and for 67 km [40 mi] downstream of the Ross Project are classified by WDEQ/Water Quality Division (WQD) as 3B streams (i.e., intermittent or ephemeral streams incapable of supporting fish populations or providing drinking water). At the confluence with Government Canyon Creek (approximately 67 km [40 mi] downstream of the Ross Project area), the River's flow increases to the point that the stream classification changes to 2ABWW (i.e., it is protected as a drinking-water source and can support warm-water fisheries). Surface-water quality in the upper reaches of the Little Missouri River currently meet Wyoming's surface-water criteria for a Class 3B stream (Strata, 2011a). Current surface-water flows would define the conditions against which impacts to Project surface-water can be measured over time. Data on surface-water flows are available from three monitoring stations within the Ross Project area for 2010 and 2011 (see SEIS Figure 3.12) (Strata, 2012a). These data, combined with flow data from the Wyoming/Montana border, would provide a data set against which changes in surface-water flow could be evaluated.

Surface-Water Quantity

Strata's potential uranium-recovery satellite areas in the Lance District, as described in SEIS Section 5.2, could impact the Little Missouri River (Strata, 2012a). Of the four identified potential satellite areas, only the Ross Amendment Area 1 lies within the Little Missouri River Basin, however. The others are located within the drainage basin of the Belle Fourche River. Because process-solution blending would continue to occur at the Ross Project's CPP as well as yellowcake production, all of these areas were considered in the NRC staff's evaluation of surface-water-quality cumulative impacts.

Crop irrigation and stock watering are the primary uses of surface water in the Wyoming portion of the Little Missouri River Basin (WWDC, 2002a). Irrigation use is estimated to range from

1,200 ha-m [9,700 ac-ft] to 1,400 ha-m/yr [11,600 ac-ft/yr] and evaporative loss from stock reservoirs is less than approximately 120 ha-m/yr [1,000 ac-ft/yr] (WWDC, 2002a). There are no other significant uses of surface water in the Wyoming portion of the Little Missouri River. The high estimate of current surface-water use is approximately 22 percent of the mean annual flow in the Little Missouri River at the Wyoming/Montana border (6,900 ha-m/yr [55,800 ac-ft/yr]). Agricultural uses of surface water in the northeastern portion of Wyoming are estimated to grow between 0 – 9 percent, or an increase up to 140 ha-m/yr [1,130 ac-ft/yr], over the next 30 years (WWDC, 2002a). The predicted future increase to 140 ha-m/yr [1,130 ac-ft/yr] would represent approximately 24 percent of the mean annual flow in the Little Missouri River at the Wyoming/Montana border.

During the lifecycle of the Ross Project, the annual surface-water use for construction and dust control is estimated to range from 0.71 – 4.6 ha-m/yr [5.8 – 37 ac-ft/yr]. If the Ross Amendment Area 1 were to be permitted and developed concurrently with the Ross Project, and if it were to use a similar quantity of water for construction and dust control, surface-water use would double. However, the potential for increasing water-quantity impacts would continue to be mitigated by SOPs, BMPs, and permit requirements. The remaining Lance District potential satelllite areas are expected to rely upon surface water from outside the Little Missouri River Basin.

Other projects that could potentially affect surface-water use within the surface-water cumulative-impacts study area (i.e., the Little Missouri Basin within Wyoming) are described as follows.

- ***Oshoto Mine***: Bentonite mining typically does not use surface water. Water quality could be impacted by increased sediment due to erosion and runoff (see Surface-Water Quality below) (BLM, 2011).

The two uranium-recovery projects that have been identified for potential development within the Little Missouri River Basin are the Hauber and Elkhorn Projects. Because there are no concrete plans available for these Projects, the amount of surface-water use is unknown. However, the quantity of uranium targeted by each Project has been used to scale and calculate the approximate water use by each, based upon the quantity of uranium reported to occur at each site.

- ***Hauber Uranium Project***: This Project targets approximately 1.5 million pounds of U_3O_8, approximately 12 – 25 percent of the 3 – 6 million pounds targeted by the Ross Project. Thus, this Project could use between 12 – 25 percent of the surface water that the Ross Project would use.
- ***Elkhorn Uranium Project***: This Project targets approximately 1.2 million pounds of U_3O_8, approximately 10 – 20 percent of the 3 – 6 million pounds targeted by the Ross Project. Thus, this Project could use between 10 – 20 percent of the surface water that the Ross Project would use.

The numerous oil- and gas-extraction operations identified in Figure 5.1 have been assumed to rely upon ground water for water supply and are not expected to impact surface-water quantity. As discussed in SEIS Section 4.5.1, if water from the Oshoto Resorvoir were to be used to replace ground water pumped by the Merit Oil Company (Merit) from wells within the Project area and used for EOR, the requirement for surface water would be far less than the permitted

water right from the Oshoto Reservoir. In addition, the projected changes in agricultural and industrial uses of surface water over the next 14 years are predicted to increase surface-water use of the Little Missouri River from 22 – 24 percent of the total flow in the Little Missouri River.

Agriculture would account for about 1.8 percentage-point increase. The two areas that the Applicant could develop (i.e., the Ross Project and the Ross Amendment Area 1) and the two other planned uranium-recovery projects, the Hauber and Elkhorn Projects, all in the Little Missouri Basin, would account for a 0.2 percentage-point increase over the current use. Thus, the cumulative impact, a two-percent decline in the flow of the Little Missouri at the Wyoming/Montana border, due primarily to an increase of agricultural withdrawals over the next 14 years, is SMALL. In addition, the reduction in flow due to uranium-recovery projects would be short-term and minor compared to agricultural use. Thus, surface-water cumulative-impacts related to water quantity would be SMALL.

Surface-Water Quality

Water-quality impacts at the Ross Amendment Area 1 and the Hauber and Elkhorn Projects described above would also be mitigated by SOPs, BMPs, and permit requirements. Increases in sediment and other water-quality parameters from uranium-recovery projects and other mining (e.g., bentonite) activities would be mitigated by the owner's/operator's implementing SOPs and BMPs as well as complying with respective WYPDES permits, WDEQ/LQD permits to mine, and the NRC's conditions in amended or new licenses. Increases in the impacts to water quality from agriculture would be mitigated through compliance with Wyoming's Watershed Protection Program. Thus, the cumulative impacts to surface-water quality in the Little Missouri River Basin would be SMALL. Also, the proposed Ross Project would contribute SMALL incremental impacts to the SMALL cumulative impacts.

5.7.2 Ground Water

The geographic area for the cumulative-impact analysis of ground-water impacts was based upon the hydrogeology of the Lance and Fox Hills Formations within the Powder River Basin, the practical maximum depth for water-supply wells, and the availability of ground-water sources as alternatives to the Lance and Fox Hills Formations. As described in SEIS Section 3.5.3, the ore zone at the Ross Project area is within the lower interval of the Lance Formation and upper interval of the Fox Hills Formation, which are separated from the aquifers above and below by confining units. The NRC's evaluation of cumulative impacts is therefore limited to only the stratigraphic horizon targeted by the Ross Project, because the ore-zone aquifer is not in contact with aquifers above and below it.

The Black Hills Monocline east of the Ross Project area brings the Lance and Fox Hills Formations to outcrop. Recharge occurs primarily in the area of outcrop and where the Formations are directly below alluvium-filled drainages. The geographic extent for the "ground-water cumulative-impacts analysis study area" is therefore delimited by the outside edge of the outcrop of the Fox Hills Formation, which is less than 300 m [1,000 ft] east of the Ross Project area, and by the 0 m [0 ft] elevation contour of the top of the Fox Hills Formation, which is located approximately 60 km [40 mi] west of the Project area. At this point, the Fox Hills aquifer is approximately 1,200 – 1,500 m [4,000 – 5,000 ft] deep. Along the other Ross Project

boundaries, the geographic extent is defined by the 80-km [50-mi] radius of a circle whose center is the Ross Project boundaries.

As described in SEIS Section 3.5, the ground-water flow within the Ross Project area is to the west northwest, into the Powder River Basin. The top of the Fox Hills Formation is at an elevation of approximately 1,100 m [3,600 ft] in the area of the Ross Project. A review of ground-water resources in the Powder River Basin indicated that ground-water quality and drilling economics generally limit the maximum depth of drinking-water wells to less than 300 m [1,000 ft] (WWDC, 2002b). However, wells operated by the City of Gillette are approximately 1,050 – 1,350 m [3,500 – 4,500 ft] deep; these tap the Fox Hills Formation, where the top of the Fox Hills Formation is at an elevation of 150 m [500 feet]. The quality of the ground water taken from these wells is poor (WSGS, 2012). The high total dissolved solids (TDS) found in this ground water requires it to be mixed with waters from other, deeper wells, which are located near Moorcroft; these wells are drilled into the Madison Formation, where lower TDS concentrations are present. Because both the depth to the Fox Hills Formation and the fact that TDS concentrations increase as one travels farther into the Powder River Basin, the municipal water-supply wells for Gillette mark the practical westernmost limit for extraction of potable water from the Ross Project's ore-zone aquifer. Therefore, the western edge of the ground-water area defined for cumulative-impact analysis is the 0 m [0 ft] structural contour, on the top of the Fox Hills Formation.

The schedule for construction, operation, aquifer restoration, and decommissioning at the Ross Project indicates a period of 14 years, from the licensing of the Ross Project to its complete decommissioning if Strata's potential satellite areas within the Lance District are developed (see Figure 2.6 in SEIS Section 2.1.1) (Strata, 2012a). Site-specific ground-water modeling demonstrates that ten years after aquifer restoration is complete, ground-water levels would have nearly recovered to a pre-uranium-recovery state (Strata, 2011b). Thus, the time period of 24 years from the start of the Ross Project was defined for this cumulative-impacts evaluation of ground water (i.e., the year 2037).

Data on ground-water levels and water-quality data are available for a number of wells within the Ross Project area from early 2010 (Strata, 2011a; Strata, 2011b; Strata, 2012a). These data, together with individual wellfield post-licensing, pre-operational hydrologic and water-quality data that would be required by the Source and Byproduct Materials License, would provide a data set against which changes in ground-water quality and quantity could be evaluated. Long-term observations of ground-water levels and ground-water monitoring within the hydrostratigraphic ore-zone unit would provide a metric for the assessment of the cumulative ground-water impacts. The aquifer-monitoring program proposed by the Applicant to meet NRC requirements as well as those requirements in its WDEQ/LQD Permit to Mine are discussed in SEIS Section 6.3.2.

Cumulative impacts to ground-water resources could be related to both water quantity and water quality, and these are evaluated below.

Ground-Water Quantity

During uranium-recovery operations at the Ross Project, there would be a net withdrawal of water from the ore-zone aquifer. This withdrawal would produce decreases in ground-water levels in Ross Project wellfields. Other ground-water users that operate wells completed in the

same hydrostratigraphic unit would also affect water levels in the vicinity of their wells. Extraction of ground water in excess of the rate of recharge to the aquifer in the same hydrostratigraphic unit would result in the decline in ground-water levels with time. Upon termination of ground-water extraction, however, recharge of the ore-zone aquifer would then begin to increase ground-water levels. The Applicant estimates that recharge to the Lance Formation would be between 0.03 – 0.09 cm/yr [0.07 – 0.22 in/yr] (Strata, 2011b). Because of the limited Lance and Fox Hills Formations' recharge areas and the low recharge rates, small residual drawdowns in the vicinity of the Lance District would likely be present for tens of years after cessation of uranium-recovery activities. However, this small residual drawdown would not affect the water available for use in the aquifer because the projected drawdown would be a minor reduction of the total thickness of water in the ore-zone aquifer. As described in SEIS Section 4.5.1, the potential impacts to the ground-water quantity outside the Ross Project would be SMALL and mitigated by alternative water supplies as necessary.

The schedule for the potential development of the Ross Project and the Lance District, which is shown in Figure 2.6 of SEIS Section 2.1.1, suggests that other uranium-recovery satellite areas in the Lance District could overlap temporally with the Ross Project. Extrapolation of the ground-water model constructed for the Ross Project indicates the potential for overlap of ground-water drawdowns from wellfield development (Strata, 2011b).

During the operation and aquifer-restoration phases of the Ross Project, the weighted average ground-water consumption has been estimated to be 7.7 L/s [122 gal/min] over a period of 6 years (Strata, 2011a). The Ross Project area has a predicted U_3O_8 production of 340,000 kg/yr [750,000 lb/yr] over 4 – 8 years, and the Ross Amendment Area 1 would extend this rate of production for several years (Strata, 2012a). Production would rise to 993,000 kg/yr [2.2 million lb/yr] U_3O_8 (i.e., yellowcake) with the Kendrick, Richards, and Barber satellite areas. If consumptive water use is assumed to be proportional to U_3O_8 production, then ground-water consumption would increase to an average of 22.5 L/s [356 gal/min] spread across the Lance District for the period of maximum yellowcake production within the Lance District.

The NRC recognizes that it would be in the Applicant's operating interest to minimize overlap of ground-water drawdowns produced by future potential satellite operations. Thus, Strata would minimize the overlap to prevent interference between wellfields during operations as well as wellfields undergoing aquifer restoration in order to effectively recover uranium and to restore ground-water resources.

As noted earlier, the Wyoming State Engineer's Office (SEO) maintains a database of ground-water rights, including water use, well yield, well location, and well depth; however, the geologic interval from which the ground water is extracted is not recorded. Furthermore, data on the yield might not be representative of the actual volumes pumped. Thus, the current rate of ground-water withdrawal from the Lance and Fox Hills Formations, and in particular the ore-zone aquifer, cannot be estimated. The Applicant reviewed the Wyoming SEO's database and concluded that most of the permitted stock and domestic wells within the region of the Ross Project were completed within the Lance Formation's sandstones—above the ore zone—and are not in hydrologic communication with the ore-zone aquifer (see SEIS Section 3.5 3). The depth of the ore zone, typically greater than 120 m [400 feet], and the fact that there are other

aquifers above the ore-zone aquifer, would make the ore-zone aquifer unattractive as a ground-water source (Strata, 2011b). In addition, any future ground-water development of the Lance and Fox Hills aquifers would be localized and limited, due to poor water quality (WWDC, 2002a).

In addition to the potential for future ISR development in the Lance District, there are a number of existing or potential resource-extraction projects within the ground-water cumulative-impacts study area that have water demands. These are:

- ***Uranium Recovery***: Other existing or planned uranium-recovery projects are outside the specific geographic area selected for ground-water-related cumulative-impact analysis, and would utilize a different stratigraphic horizon than the Ross Project would (Strata, 2012a). The planned uranium-recovery Aladdin, Elkhorn, Hauber, and Alzada Projects, if they come to fruition, would target uranium in the Fall River and Lakota Formations. These Formations are of Lower Cretaceous age, located several thousand feet below the Lance and Fox Hills Formations, and are separated by the thick Pierre Shale. Thus, uranium-recovery activities in those Formations would not impact the same ground water at the Ross Project.

- ***Oil Extraction:*** In the mature oil fields of northeast Wyoming, water is used for EOR and is described as "water flooding" (De Bruin, 2007). A planning report prepared for the Wyoming Water Development Commission (WWDC) concluded that traditional oil and gas production in northeast Wyoming is in decline. Ground-water use by the oil-and-gas industry might cause localized aquifer depression, but it would be generally spread over a large geographic area and would not typically impact other ground-water resources (WWDC, 2002a). At the Ross Project area, the Lance and Fox Hills aquifers show approximately 46 m [150 ft] of drawdown due to withdrawals from the three industrial water-supply wells that have been used since 1980 for oil extraction (see SEIS Section 4.5.1) (Strata, 2011b). The Applicant could not develop wellfields south of the Little Missouri River until the three water-supply wells cease operation or the water volume removed through the three wells diminishes to an acceptable level (NRC, 2014b, License Condition 10.19). Only a portion of the water requirements for EOR is provided by the Lance and Fox Hills Formations, as stratigraphically higher aquifers are available in the western portion of the Project area.

- ***Coal Mining and CBM Extraction:*** The mining of coal and extraction of CBM occur within the western portion of the ground-water cumulative-impacts geographic study area (see Figure 5.1). The principal coal seams are in Tongue River Member of the Fort Union Formation, which is above the Lance and Fox Hills Formations and which is separated by several thousand feet of the Upper Hell Creek (Upper Lance Formation) and Lebo (Lower Fort Union Formation) confining units (Hinaman, 2005). Ground-water pumping associated with CBM production, coal mining and processing, and mine-mouth power generation would therefore not impact ground water within the Lance and Fox Hills Formations.

- ***Bentonite Mining:*** Bentonite-mining operations take place in the shale horizons stratigraphically below the Lance and Fox Hills Formations and are, therefore, outside the geographic area for the analysis of ground-water cumulative impacts.

- ***Other Mining:*** Other potential mining projects, for example, the Bear Lodge Rare Earth Project, are also outside the geographic area defined for ground-water cumulative impacts.

- ***Domestic Use:*** Ground water extracted for domestic use within northwest Wyoming, which includes the ground-water cumulative-impacts study area, is expected to increase approximately 24 percent between 2002 – 2030 which includes the underlying assumption that population growth will be moderate (WWDC, 2002a). The water satisfying this increased need will be meet by pumping the Wasatch and Fort Union aquifers, Lance and Fox Hills aquifers, and other, deeper aquifers, all of which possess better water quality.

The NRC staff has determined that the cumulative impacts to ground-water quantity in the ground-water cumulative-impacts study area would be SMALL. There would be no expected increases in water consumption as a result of continued oil and gas extraction and/or agriculture, although the possibility of small increases from the Lance and Fox Hills Formations as a result of domestic-use requirements exists. The impacts on ground-water quantity from uranium recovery in the Lance District would be essentially recovered within 24 years after the issuance of the Source and Byproduct Materials License to the Applicant. As described in Section 4.5.1.2, the impacts from drawdown during the operation and aquifer-restoration phases, and the time it takes for the aquifer to recover to pre-licensing, site-characerization conditions, would be SMALL because the drawdown would be only be a small portion of the total water in wells. Similar levels and durations of drawdowns would be expected in localized areas around wellfields throughout the Lance District if the potential satellite areas were to be developed by the Applicant. Therefore, cumulative impacts to ground-water quantity in the Lance and Fox Hills Formations would be SMALL.

Ground-Water Quality

Impacts from previous uranium-recovery activities at Nubeth are part of the cumulative impacts to the Ross Project area. Past impacts can be evaluated by comparing Nubeth's pre-operational water-quality data to Nubeth's post-aquifer-restoration data, as summarized in Table 5.4 (Nuclear Dynamics, 1980; ND Resources, 1982) and to Strata's pre-licensing, site-characterization data as described in SEIS Section 3.5.1.2. The data in Table 5.4 show that aquifer-restoration efforts by Nubeth returned TDS to levels below pre-operational conditions, except for the Injection Well 20X, which also contained levels of radiological parameters above pre-operational values obtained at the completion of Nubeth's aquifer-restoration efforts. Of the six buffer and monitoring wells in the ore zone, pre-operational mean values for gross alpha, radium-226 (Ra-226), and total uranium were achieved by aquifer restoration in three, four, and two wells, respectively. In the other wells, concentrations of radiological constituents exceeded the average pre-operational levels by 5 – 243 percent at the close of aquifer restoration; the concentrations of radiological constituents in the Recovery Well 19X and Injection Well 20X exceeded the average pre-operational levels at the close of aquifer restoration. The monitoring well in the shallow-monitoring (SM) zone (Well 7X) did not show excursions of TDS and

Table 5.4
Comparison of Pre-Operational† and Post-Restoration†† Water Quality at Nubeth Joint Venture

Well in Zone	Well Use	Sample Date	TDS (mg/L)	Gross Alpha (pCi/L)	Ra-226 (pCi/L)	Uranium (mg/L)
3X in OZ	Buffer	Mean Baseline 1978	1674	209	76	0.07
		Restoration 10/1981	1500	130	22	0.24
4X in OZ	Buffer	Mean Baseline 1978	1660	145	16	0.09
		Restoration 10/1981	1510	180	26	0.22
5X in OZ	Monitoring	Mean Baseline 1978	1562	88	0.3	0.08
		Restoration 4/1980	1550	37	0.5	0.04
6X in OZ	Monitoring	Mean Baseline 1978	1746	98	0.4	0.09
		Restoration 4/1980	1650	66	0.1	0.095
7X in SM	Observation	Mean Baseline 1978	1498	1.4	0.3	0.004
		Restoration 4/1980	1400	180	0.6	< 0.001
11X in OZ	Monitoring	Mean Baseline 1978	1764	78	1.3	0.08
		Restoration 4/1980	1730	116	1	0.08
12X in OZ	Monitoring	Mean Baseline 1978	1596	67	2.2	0.06
		Restoration 4/1980	1520	111	1.6	0.08
19X in OZ	Recovery	Mean Baseline 1978	1672	178	85	0.12
		Restoration 10/1981	1510	300	31	0.48
	Industrial Supply	2009 – 2011†††	1703	234	39	0.08
20X in OZ	Injection	Mean Baseline 1978	1284	4.4	1.5	0.003
		Restoration 10/1981	1520	85	20	0.07

Sources: Nuclear Dynamics, 1980; ND Resources, 1982.

Notes:

† "Pre-operational" values calculated as the average of five samples collected from April – June 1978 before Nubeth operations began (Nuclear Dynamics, 1978). These values were identified as "baseline," though that term is not used in this document.

†† Restoration data from Nuclear Dynamics, 1980, and ND Resources, 1982.

††† The reported values for Well 19XX18 during 2009 – 2011 are average concentrations from Strata's pre-licensing, site-characterization environmental monitoring (Strata, 2011a; Strata, 2012a). Well 19XX18 is Nubeth's Recovery Well 19X that was converted to a water-supply for oil- and gas-extraction operations in the 1980s.

*"<" = "Less than," where the value following the "<" is the detection limit.

uranium. The measurements of Ra-226 in Well 7X before and after Nubeth activities were equivalent (i.e., within the analytical error of the measurement). The gross-alpha measurement of 180 pCi/L [6.7 Bq/L] in Well 7X in April 1980 indicated an excursion of radioactivity into the aquifer above the ore zone (see Table 5.4). However, gross-alpha measurements in Well 7X during the 1979 aquifer-restoration period were much lower than 180 pCi/L [6.7 Bq/L], ranging from 1.4 – 4.7 pCi/L [0.1 – 0.2 Bq/L] which suggests that the measurement in April 1980 may be an outlier (Nuclear Dynamics, 1980).

Evaluation of the restoration conditions in Nubeth's wells provides a short-term assessment of past impacts. The longer-term impacts from Nubeth can be determined by a comparison of Nubeth's pre-operational water-quality data with Strata's pre-licensing, site-characterization water-quality data, as described in SEIS Section 3.5.3. The data presented in Tables 3.6 and 3.7 in SEIS Section 3.5.3 suggest that the current water quality in the ore zone and the SM aquifers are the same as each were at the time of Nubeth's pre-operational sampling.

For example, the maximum values of TDS, total uranium, Ra-226, and gross alpha determined by Strata (see Table 3.6) are less than the maximum values of those parameters measured in 1978 (see Table 3.7). Specifically, Strata's pre-licensing, site-characterization water quality in Well19X (Strata's sample location = 19XX18) can be compared with Nubeth's pre-operational data to evaluate longer-term impacts from that past action. The average values as a result of the monitoring efforts in 2009, 2010, and 2011 (0.08 mg/L uranium and 1.4 Bq/L [39 pCi/L] Ra-226) are less than the values measured in Well 19X in 1978. The current TDS concentrations range from 1,650 – 1,790 mg/L, which includes the average concentration of 1,672 mg/L measured in 1978. The current gross-alpha measurements range from 6.2 – 12 Bq/L [168 – 324 pCi/L]; this range encompasses the average concentration of 6.6 Bq/L [180 pCi/L] measured in 1978. Thus, these two aquifers (i.e., ore zone and SM zone) are not currently impacted by the past uranium-recovery activities by Nubeth.

As described in SEIS Section 4.5.1, water quality at the Ross Project could be impacted during operations by excursions of lixiviant (i.e., process solutions) from the ore-zone aquifer into surrounding aquifers. The lixiviant injected into the ore zone causes metals such as uranium, vanadium, arsenic, selenium, and molybdenum, as well as other constituents such as radium, to dissolve into the ground water. Despite the design of the wellfields and the pumping methods, which would contain the uranium-recovery process within the exempted aquifer (see SEIS Section 2.1.1), short-term impacts from excursions do occur. As described in SEIS Sections 2.1.1 and 4.5.1, a network of monitoring wells around the perimeter of each wellfield would provide the capability for early detection, control, and reversal of such excursions. As Draft Source and Byproduct Materials License Condition No. 11.5 indicates, the Applicant would recover any excursions into aquifers surrounding the ore-zone aquifer (NRC, 2014b). Ground-water restoration would return the exempted aquifer to the ground-water protection standards that would be established in accordance with the License. As described in SEIS Section 4.5.1, therefore, the potential impacts to the ground-water quality from the Ross Project would be SMALL. The same set of potential impacts to short-term ground-water quality, mitigating actions, and license requirements would be incorporated into any license that the Applicant would be required to obtain for the potential Lance District satellite areas; these would ensure that the potential impacts of each satellite area would be SMALL.

Because the water quality of the exempted aquifer for each potential uranium-recovery project would be returned to the ground-water protection standards of 10 CFR Part 40, Appendix A, and

every NRC license would require all excursions to be recovered, the cumulative impacts of the all potential uranium-recovery projects would also be SMALL. In the unlikely event that increased concentrations of metals mobilized by the lixiviant at the Ross Project or other satellite areas in the Lance District migrate downgradient, outside the area affected by lixiviant, the geochemical conditions of the ore-zone aquifer in that area would promote lower dissolved metal concentrations (i.e., would cause the dissolved metals to precipitate) (NRC, 2007). That is, as the dissolved metals enter portions of the aquifer that had not been subjected to the oxidizing lixiviant, the naturally occurring, oxygen-deficient conditions would cause chemical reactions that would precipitate the dissolved metals into minerals on the rock of the impacted aquifer. Thus, cumulative impacts to ground-water quality would be SMALL. Therefore, the incremental impacts of the proposed Ross Project in terms of both ground-water quantity and quality would be SMALL when added to the SMALL ground-water quantity and quality cumulative impacts in the ground-water cumulative-impacts study area.

5.8 Ecology

The geographic area employed by the NRC staff in the analysis of cumulative impacts to ecological resources is the entire Powder River Basin (i.e., the “ecology cumulative-impacts study area”) because grassland and sagebrush-shrubland habitats are important features of the Basin’s entire landscape, and these habitats occur on the Ross Project area as well. The Powder River Basin includes approximately 1,801,401 ha [4,451,360 ac] of land (BLM, 2009e). Approximately 222,568 acres, or 5 percent, of the Powder River Basin land area has been disturbed by past development activities. Of this amount, approximately one-half of the disturbed area has been reclaimed (BLM, 2009e).

The timeframe for the ecology cumulative-impacts analysis is 2013 – 2032. This timeframe was chosen to allow impacts to the ecology of the Ross Project area and its vicinity to mature. It would take some time for the flora and fauna to fully recover after site restoration; the NRC has assumed five years in this cumulative-impacts analysis.

5.8.1 Terrestrial Ecology

Activities occurring in the vicinity of the Ross Project include livestock and wildlife grazing, agricultural production, and mineral extraction. These activities take place over a larger area of the Powder River Basin as well. As discussed in SEIS Section 4.6, potential impacts to ecological resources, both flora and fauna, include reduction in wildlife habitat and forage productivity, modification of existing vegetative communities, and potential spread of invasive-species and noxious-weed populations. Impacts to wildlife could involve loss, alteration, and incremental habitat fragmentation; displacement of and stresses on wildlife; and direct and indirect mortalities.

5.8.1.1 Vegetation

Vegetation at the Ross Project area is primarily sagebrush shrubland and upland grasslands, which are typical of the Powder River Basin. As discussed in Section 4.6, the Ross Project’s impacts to vegetation at Project area would be SMALL.

There are no licensed or operating uranium-recovery projects within 80 km [50 mi] of the Ross Project area, although there is a potential for development of satellite areas as part of the

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Prepared by:	Office of Federal and State Materials and Environmental Management Programs U.S. Nuclear Regulatory Commission Washington, D.C. 20555-0001
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Instructions:	Please append the enclosed table of corrections to the text of NUREG-1910, Supplement 5.

On March 11, 2014, the U.S. Nuclear Regulatory Commission's (NRC) notice of availability of NUREG-1910, Supplement 5, *Final Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming, Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (FSEIS) was published in the Federal Register (79 FR 13683). Following publication of NUREG-1910, Supplement 5, the NRC staff was informed of and identified certain errors in the FSEIS.

In a motion filed on March 31, 2014, the Joint Intervenors for the hearing on the licensing action that is the subject of the FSEIS identified an error in Section 4.5.1.3 of the FSEIS related to the ground-water restoration concentrations of Wellfield 1 at the Crow Butte facility near Crawford, Nebraska. Section 4.5.1.3 of the FSEIS includes a discussion of historic approvals of aquifer restoration activities by the NRC. The FSEIS describes three facilities that received NRC's approval for aquifer restoration activities and the ground-water-quality parameters in those wellfields for which the NRC approved restoration. In the FSEIS's description of one of those facilities, Crow Butte Wellfield 1, the NRC states that "[t]he NRC determined that the radium-226 and uranium concentrations at 31 percent and 18 percent above post-licensing, pre- operational concentrations were protective of human health and the environment (Crow Butte Resources, 2001)." Based upon the information in the source document, the relevant portion of that statement should instead describe the concentration for uranium as 18 *times* the post-licensing, pre-operational uranium concentration. The use in error of the term "18 percent" in the FSEIS was a drafting mistake that does not affect the NRC staff's analysis of the potential impacts of the proposed action on restored ground-water quality of the ore-zone and surrounding aquifers, or the staff's conclusion that such potential impacts would be SMALL.

In reviewing the statements in the FSEIS regarding restoration of Crow Butte Wellfield 1, the NRC staff identified additional errors regarding the number of parameters sampled. These errors in the description of ground-water quality in Crow Butte Resource's Wellfield 1 at the time of restoration approval do not affect the FSEIS's characterization of NRC-approved historic restoration values or its conclusion that the potential impacts of aquifer restoration to ground-water quality of the ore-zone and surrounding aquifers would be SMALL. It remains the case that most of the ground-water-quality parameters in wellfields for which the NRC has approved restoration, as described in the FSEIS, were either returned to post-licensing, pre-operational concentrations or Class I Domestic Use standards. For the few parameters that exceeded these standards, the concentrations in the ground water did not change the class of use and did not represent a potential impact to the ground water outside the aquifer-exemption boundary.

Additionally, by letter dated April 4, 2014, the U.S. Environmental Protection Agency (EPA) requested that the NRC clarify information provided in Table 1.2 of the FSEIS regarding the role of the EPA for the Underground Injection Control Program.

To address these matters, the NRC staff has prepared this errata to the FSEIS.

ERRATA

FSEIS SECTION	Page	Correction
1.6.2 Status of Permitting With Other Federal, State, Local, and Tribal Agencies	1-10	Table 1.2 - Environmental Approvals for the Proposed Ross Project, Row 3 (Issuing Agency - U.S. Environmental Protection Agency), Column 2 (Description): • Insert "for Class III injection wells" after "(USDW)"
1.6.2 Status of Permitting With Other Federal, State, Local, and Tribal Agencies	1-11	Table 1.2 - Environmental Approvals for the Proposed Ross Project (*Continued*), Row 5 (Issuing Agency - U.S. Environmental Protection Agency), Column 2 (Description): • Change "Aquifer Exemption Permit for Class I Injection Wells" to "Aquifer exemption approval required for Class I injection wells if receiving aquifer is a USDW" • Delete entire cell with "Aquifer Reclassification for Class III Injection Wells (WDEQ, Title 35-11)"
1.6.2 Status of Permitting With Other Federal, State, Local, and Tribal Agencies	1-11	Table 1.2 - Environmental Approvals for the Proposed Ross Project (*Continued*), Row 5 (Issuing Agency - U.S. Environmental Protection Agency), Column 3 (Status): • Insert a cell next to "Aquifer Exemption Permit for Class I Injection Wells (40 CFR Parts 144 & 146)" with the following text: "Pending water quality data acquisition during well installations and EPA review"
4.5.1.3 Ross Project Aquifer Restoration	4-46	Second full paragraph, replace first and second sentence with the following: "Crow Butte's NRC license initially required the analysis of 35 ground-water constituents to determine pre-operational ground-water quality (Crow Butte Resources, 2000). The NRC amended Crow Butte's license in 2001 to modify the constituent list in License Condition 10.3B to duplicate the constituents contained in the Restoration Table in Crow Butte's Class III UIC permit issued by the Nebraska Department of Environmental Quality. Because of this amendment, several constituents that were originally discussed in Crow Butte's first restoration report were no longer considered restoration parameters by the NRC. The 27 constituents listed in Tables 2 and 3 in Crow

		Butte Resources (2001) are those in the modified parameter list contained in that license amendment (NRC, 2001). The average concentrations of 34 constituents (the initially required 35 constituents minus temperature) at the end of restoration compared to baseline concentrations are reported by the NRC in Table 5 of NUREG/CR-6870, which discusses the geochemical issues in ground -water restoration at ISR facilities (NRC, 2007). Of the 34 constituents, 23 were returned to post-licensing, pre-operational concentrations. The average concentrations of two constituents, arsenic and iron, were returned to levels lower than Wyoming's Class I Domestic Use standards, which, for these two constituents, are identical to the EPA's Drinking Water MCLs and Standards in the UIC Permit from the Nebraska Department of Environmental Quality held by Crow Butte (Crow Butte Resources, 2001). The average concentration of one constituent, vanadium, was returned to the Wyoming Class II standard for agricultural use, which is lower than the UIC Permit Standard. Concentrations of six constituents – alkalinity, bicarbonate, calcium, potassium, magnesium, and molybdenum – for which there are no EPA MCLs or Wyoming Class I, II, or III standards, exceeded post-licensing, pre-operational concentrations by 6 – 65 percent."
4.5.1.3 Ross Project Aquifer Restoration	4-46	Second full paragraph, line 7, replace "18 percent" with "18 times"
4.5.1.3 Ross Project Aquifer Restoration	4-46	Last paragraph, line 7, delete "average"
4.15 References	4-122	Insert the following new reference (NRC, 2001) before the second-to-last reference entry on this page (NRC, 2003a): (US)NRC. "License Amendment 11/Crow Butte Resources In Situ Leach Facility/License No. SUA-1534." Washington, DC: USNRC. 2001. ADAMS Accession No. ML011830343.
4.15 References	4-123	Insert the following new reference (NRC, 2007) after the fourth reference entry on this page (NRC, 2006): (US)NRC. "Consideration of Geochemical Issues in Groundwater Restoration at Uranium In-Situ Leach Mining Facilities." NUREG/CR-6870. Washington, DC: USNRC. 2007. ADAMS Accession No. ML070600405.

U.S. NUCLEAR REGULATORY COMMISSION RECORD OF DECISION FOR THE ROSS URANIUM IN-SITU RECOVERY PROJECT IN CROOK COUNTY, WYOMING

Introduction:
The U.S. Nuclear Regulatory Commission (NRC) staff prepared this record of decision (ROD) for the proposed Ross Uranium In-Situ Recovery (ISR) Project in Crook County, Wyoming (Ross Project). This ROD satisfies Section 51.102(a) of Title 10 of the *Code of Federal Regulations* (10 CFR), which states that "a Commission decision on any action for which a final environmental impact statement has been prepared shall be accompanied by or include a concise public record of decision."

In February 2014, the NRC staff issued a Final Supplemental Environmental Impact Statement (Final SEIS) (NRC, 2014a) in support of the NRC's review of the Strata Energy, Inc. (Strata or "Applicant") license application. Strata's application, which was submitted in 2011, is for a new source and byproduct materials license for the Ross Project (Strata, 2011a-b). The Ross Project Final SEIS is Supplement 5 to the NRC staff's *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (NUREG-1910) (known as the GEIS) (NRC, 2009).

This ROD has been prepared pursuant to NRC regulations at 10 CFR § 51.102(b) and § 51.103(a)(1)-(4). Additionally, pursuant to 10 CFR § 51.103(c), this ROD incorporates by reference materials contained in the Final SEIS.

On July 13, 2011, the NRC staff notified the public of the NRC's acceptance of Strata's application for a materials license for a detailed technical and environmental review. By *Federal Register* notice, the NRC staff also informed members of the public that they could request a hearing in connection with Strata's application. *Strata Energy, Inc. Ross In Situ Recovery Uranium Project, Crook County, WY; Notice of Materials License Application, Opportunity to Request a Hearing and To Petition for Leave To Intervene*, 76 Fed. Reg. 41308. The NRC's Atomic Safety and Licensing Board (ASLB), an independent, trial-level adjudicatory body, granted a hearing request from joint intervenors, the National Resources Defense Council and the Powder River Basin Resource Council (ASLB, 2012). The ASLB has scheduled a hearing for late September/early October 2014, and the hearing may involve environmental issues. This ROD may be revised in accordance with any ASLB decision on those issues.

The Decision:
This ROD documents the NRC staff's decision to issue a materials license to Strata for its proposed Ross Project in Crook County, Wyoming (Materials License SUA-1601; NRC, 2014b). The license will authorize Strata to possess uranium source and byproduct materials at the Ross Project facility. Under its license, Strata will be able to construct and operate its facility as proposed in its license application and under the conditions in its NRC license.

The proposed Ross Project will occupy 696 hectares (1,721 acres) in the north half of the approximately 90-square-kilometer (56-square-mile) Lance District. The Lance District is located on the western edge in the northwest corner of the Nebraska-South Dakota-Wyoming Uranium Milling Region identified in the GEIS (NRC, 2009). It is situated between the Black Hills uplift to the east and the Powder River Basin to the west.

Strata intends to recover uranium and produce yellowcake at the Ross Project site. The proposed Ross Project includes a Central Processing Plant (CPP), injection and recovery wells

(in wellfields), surface impoundments, deep disposal wells for liquid effluents, monitoring wells throughout the Ross Project area, and other various infrastructure (e.g., additional buildings, pipelines, roads, and lighting). Strata's proposed activities include construction, operation, aquifer restoration, and decommissioning of its Ross Project. Together, these actions represent the "Proposed Action" evaluated in the Final SEIS. In addition, the Proposed Action includes the option of the Applicant to operate the Ross Project facility beyond the life of the Project's wellfields. The facility could be used to process uranium-loaded resin from potential satellite areas within the Lance District operated by the Applicant, or from other offsite uranium recovery projects not operated by the Applicant (i.e., "toll milling"), or from offsite water treatment operations.

During the ISR process, an oxidant-charged solution, called a lixiviant, will be injected into the ore-zone aquifer (or uranium "ore body") through injection wells. The lixiviant will use native groundwater (from the ore-zone aquifer), carbon dioxide, sodium carbonate and/or sodium bicarbonate, with a hydrogen peroxide or oxygen oxidant. As this solution circulates though the ore zone, the lixiviant oxidizes and dissolves the mineralized uranium, which is present in a reduced chemical state. The resulting uranium-rich solution, the "pregnant" lixiviant, will be drawn to recovery wells by pumping, and then transferred to the CPP via a network of underground pipes. At the CPP, the uranium will be extracted from the solution using an ion exchange process. The resulting "barren" (i.e., uranium-depleted) solution will then be recharged with the oxidant and re-injected to recover additional uranium. The uranium collected in the ion exchange process is subject to another circuit within the CPP to produce yellowcake. The yellowcake is packaged and shipped off-site to a uranium conversion facility, the next step in the fuel cycle process for developing fuel for commercial nuclear power plants.

Alternatives Considered in Reaching the Decision:
The NRC staff analyzed three alternatives in detail before deciding to issue Strata a license. These alternatives included: (i) the Proposed Action in the license application (described above), (ii) the No-Action Alternative, and (iii) the North Ross Project. Under the No-Action Alternative, the NRC staff would not approve Strata's license application, which would result in Strata not constructing or operating the proposed Ross Project. The No-Action Alternative was included to provide a benchmark for the NRC staff to compare and evaluate the potential impacts of the other two alternatives. In the North Ross Project alternative, the proposed Ross Project facility (i.e., the CPP, surface impoundments, and auxiliary structures) would be constructed at a site north of where it is proposed to be located in the Proposed Action, but the wellfields would remain in the same locations as in the Proposed Action. In the Final SEIS (NRC, 2014a), the NRC staff describes the three alternatives (Section 2.1) and compares their potential environmental impacts (Section 2.3 and Table ExS.1 in the Executive Summary).

The NRC staff considered a number of other alternatives when evaluating the Proposed Action. The staff eliminated these alternatives from detailed analysis, however, for reasons discussed in Section 2.2 of the Final SEIS (NRC, 2014a). These alternatives included recovery of uranium by conventional uranium mining and milling (Section 2.2.1), the use of a lixiviant with different chemistry (Section 2.2.2), and alternative methods of waste management (Section 2.2.3).

Preferences Among Alternatives Based on Relevant Factors:
In Chapter 4 of the Final SEIS (NRC, 2014a), the NRC staff assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of the proposed Ross Project. The staff also assessed the potential impacts of the No-Action Alternative and the North Ross Project alternative. The NRC staff assessed the impacts of these three alternatives on the following resource areas: land use,

transportation, geology and soils, water resources, ecology, air quality, noise, historical, cultural and paleontological resources, visual and scenic resources, socioeconomics, environmental justice, public and occupational health and safety, and waste management. The staff compared the potential environmental impacts of the three alternatives in Section 2.3 and Table ExS.1 in the Executive Summary of the Final SEIS (NRC, 2014a). In Chapter 5 of the Final SEIS, the NRC staff evaluated the potential for cumulative impacts associated with the Proposed Action and other past, present, or reasonably foreseeable future actions. Additionally, in Chapter 7 of the Final SEIS, the staff summarized the costs and benefits associated with the Proposed Action and the two alternatives. In preparing the Final SEIS, the NRC staff also considered, evaluated, and addressed the public comments received on the Draft SEIS published on March 29, 2013 (78 Fed. Reg. 19330).

After weighing the impacts of the Proposed Action and comparing the alternatives, and evaluating safety issues associated with the Proposed Action, the NRC staff determined that the NRC should issue a source materials license for the proposed Ross Project. The NRC staff based its decision on: (i) the license application, including the Applicant's environmental report (Strata, 2011a-b), and the Applicant's supplemental submissions and responses to the NRC staff requests for additional information (Strata 2011c; Strata and Crook County, 2011d; Strata, 2012a-b); (ii) the NRC staff's consultations with Federal, State, and local agencies and with Native American Tribes; (iii) independent NRC staff review; (iv) the NRC staff's consideration of comments received on the Draft SEIS (see Appendix B in the Final SEIS (NRC, 2014a)); (v) the assessments in the NRC staff's Final SEIS (NRC, 2014a) and in the GEIS (NRC, 2009); and (vi) the assessments in the NRC staff's Safety Evaluation Report (NRC, 2014c-d) for the Ross Project.

Measures to Avoid or Minimize Environmental Harm from the Alternative Selected:
As described below, the NRC has taken all practicable measures within its jurisdiction to avoid or minimize environmental harm from the alternative selected. In its license application (Strata, 2011a-b) and in its supplemental submissions and responses to NRC staff requests for additional information (Strata 2011c; Strata and Crook County, 2011d; Strata, 2012a-b), the Applicant identified mitigation measures that are intended to either minimize or avoid potential adverse environmental impacts from construction, operation, aquifer restoration, and decommissioning of the Ross Project. The Applicant also identified environmental measurements and monitoring programs to verify compliance with the applicable standards and requirements for the protection of worker health and safety in active uranium recovery areas (i.e., both the facility and the wellfields) and for the protection of the public and the environment beyond the licensed facility's boundary. As discussed below, the Applicant's mitigation measures and monitoring programs are conditions in the materials license.

The mitigation measures identified by the Applicant are described for each resource area in Chapter 4 of the Final SEIS (NRC, 2014a). The Applicant's environmental measurements and monitoring programs for the Ross Project are described in detail in Chapter 6 of the Final SEIS (NRC, 2014a), organized as follows: Radiological Monitoring (Section 6.2), Physicochemical Monitoring (Section 6.3), Meteorological Monitoring (Section 6.4), and Ecological Monitoring (Section 6.5). These monitoring programs will provide data on operating and environmental conditions so that prompt corrective actions can be implemented when adverse conditions are detected.

Administrative Condition 9.2 of Materials License SUA-1601 (NRC, 2014b) requires Strata to conduct operations in accordance with the commitments, representations, and statements contained in the license application and supplementary submissions. License Condition 9.2

incorporates by reference Strata's approved application and the supplements to its application. Strata's commitments, representations, and statements include the mitigation measures and monitoring programs described above. An additional license condition relevant to mitigation measures is Administrative Condition 9.8, which requires mitigation of impacts to cultural resources and adherence to the April 24, 2014 Programmatic Agreement (NRC, 2014e). Additional license conditions relevant to monitoring include License Conditions 9.10, 10.9, 10.15, 10.16,10.20, 11.1A, 11.1D, 11.2, 11.3, 11.5, 12.6, 12.7, 12.8, 12.9, , 12.10, 12.11A, 12.11C, and 12.12.

References:

76 Fed. Reg. 41308. *Federal Register*, Vol. 76, No. 134, p. 41308-41312. "Strata Energy, Inc. Ross In Situ Recovery Uranium Project, Crook County, WY; Notice of Materials License Application, Opportunity to Request a Hearing and To Petition for Leave To Intervene, and Commission Order Imposing Procedures for Document Access to Sensitive Unclassified Non Safeguards Information for Contention Preparation." July 13, 2011.

78 Fed. Reg. 19330. *Federal Register*, Vol. 78, No. 61, p. 19330-19332. "Supplemental Environmental Impact Statement for the Ross In-Situ Uranium Recovery Project in Crook County, Wyoming." March 29, 2013.

ASLB (Atomic Safety and Licensing Board). "Memorandum and Order (Ruling on Standing and Contention Admissibility)." In the Matter of Strata Energy, Inc. (Ross In Situ Recovery Uranium Project). Docket No. 40-9091-MLA. ASLB Proceeding No. 12–915–01–MLA–BD01. February 10, 2012. Agencywide Documents Access and Management System (ADAMS) Accession No. ML12041A295.

(US)NRC (U.S. Nuclear Regulatory Commission). NUREG–1910, "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009. ADAMS Accession Nos. ML091480244 (Volume 1) and ML091480188 (Volume 2).

(US)NRC. NUREG-1910, "Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming." Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities. Final Report. Supplement 5. Washington, DC: NRC, Office of Federal and State Materials and Environmental Management Programs. February 2014a. ADAMS Accession No. ML14056A096.

(US)NRC. "Materials License SUA-1601, Ross Project in Crook County, Wyoming." ADAMS Accession No. ML14069A335. Washington, DC: NRC, Office of Federal and State Materials and Environmental Management Programs. 2014b.

(US)NRC. Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming, Materials License No. SUA-1601." Washington, DC: NRC, Office of Federal and State Materials and Environmental Management Programs. January 2014c. ADAMS Accession No. ML14002A107.

(US)NRC. Supplemental Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming, Materials License No. SUA-1601." Washington, DC: NRC, Office of Federal and State Materials and Environmental Management Programs. April 2014d. ADAMS Accession No. ML14083A240.

(US)NRC. Programmatic Agreement Among the U.S. Nuclear Regulatory Commission, the Advisory Council on Historic Preservation, the Wyoming State Historic Preservation Office, the Bureau of Land Management–Newcastle Field Office, and Strata Energy, Inc., Regarding the Ross In Situ Uranium Recovery Project in Crook County, Wyoming. April 24, 2014e. ADAMS Accession No. ML14111A346.

Strata (Strata Energy, Inc.). Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices. Docket No. 40-09091. Gillette, WY: Strata. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

Strata. Air Quality Permit Application for Ross In-Situ Uranium Recovery Project. Prepared for Strata Energy, Inc. Sheridan, WY: Inter-Mountain Laboratories, IML Air Science. 2011c. ADAMS Accession No. ML11222A060.

Strata and Crook County. Memorandum of Understanding for Improvement and Maintenance of Crook County Roads Providing Access to the Ross ISR Project. Sundance, WY: Crook County. April 6, 2011d. ADAMS Accession No. ML111170303.

Strata. Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices. Docket No. 40-09091. Gillette, WY: Strata. 2012a. ADAMS Accession No. ML121030465.

Strata. Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Technical Report, Volumes 1 and 2 with Appendices. Docket No. 40-09091. Gillette, WY: Strata. 2012b. ADAMS Accession Nos. ML121020357 and ML121020361.

Docket No.: 040-09091
License No.: SUA-1601

FOR THE NUCLEAR REGULATORY COMMISSION

Date: 4/24/14

/RA/
Andrew Persinko, Deputy Director
Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

SEI015

NRC FORM 374

U.S. NUCLEAR REGULATORY COMMISSION

MATERIALS LICENSE

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93-438), and the applicable parts of Title 10, Code of Federal Regulations, Chapter I, Parts 19, 20, 30, 31, 32, 33, 34, 35, 36, 39, 40, 51, 70, and 71, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations, and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

Licensee	
1. Strata Energy, Inc.	3. License Number SUA-1601
2. 1900 W. Warlow Dr., Bldg A, P.O. Box 2318 Gillette, WY 82716	4. Expiration Date: 5. Docket No. 040-09091 Reference No.

6. Byproduct Source, and/or Special Nuclear Material	7. Chemical and/or Physical Form	8. Maximum amount that Licensee May Possess at Any One Time Under This License
a. Natural Uranium	a. Any	a. Unlimited
b. Byproduct material as defined in 10 CFR 40.4	b. Unspecified	b. Quantity generated under operations authorized by this license

SECTION 9: Administrative Conditions

9.1 The authorized place of use shall be the licensee's Ross Project in Crook County, Wyoming. The licensee shall conduct operations within the license area boundaries shown in Figure 1.4-2 of the approved license application.

9.2 The licensee shall conduct operations in accordance with the commitments, representations, and statements contained in the license application dated January 4, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML110120063), which is supplemented by submittals dated February 28, 2011 (ML110800187), March 30, 2012 (ML121030404), April 6, 2012 (ML121020343), August 10, 2012 (ML12227A369), January 18, 2013 (ML130370654), October 14, 2013 (ML13295A230), October 17, 2013 (ML13296A026) and February 28, 2014 (ML14091A036). The approved application and supplements, hereby, are incorporated by reference, except where superseded by specific conditions in this license. The licensee must maintain the approved, updated, license application on site.

Whenever the word "will" or "shall" is used in the above referenced documents, it shall denote a requirement. The use of "the Wellfield" in this license is synonymous with the use of mine unit as defined in the approved license application. The use of "verification" in this license with respect to a document submitted for NRC staff review means a written acknowledgement by U.S. Nuclear Regulatory Commission (NRC) staff that the specified submitted material is consistent with commitments in the approved license application, or requirements in a license condition or regulation. A verification will not require a license amendment.

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9.3 All written notices and reports sent to the NRC as required under this license and by regulation shall be addressed as follows: ATTN: Document Control Desk, Director, Office of Federal and State Materials and Environmental Management Programs, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001. An additional copy shall be submitted to: Deputy Director, Decommissioning and Uranium Recovery Licensing Directorate, Division of Waste Management and Environmental Protection, Office of Federal and State Materials and Environmental Management Programs, U.S. Nuclear Regulatory Commission, Mail Stop T-8F5, 11545 Rockville Pike, Rockville, MD 20852-2738. Incidents and events that require telephone notification shall be made to the NRC Operations Center at (301) 816-5100 (collect calls accepted).

9.4 Change, Test, and Experiment License Condition

A) The licensee may, without obtaining a license amendment pursuant to 10 CFR 40.44, and subject to conditions specified in (B) of this condition:

i Make changes in the facility as described in the license application (as updated);

ii Make changes in the procedures as described in the license application (as updated); and

iii Conduct tests or experiments not described in the license application (as updated).

B) The licensee shall obtain a license amendment pursuant to 10 CFR 40.44 prior to implementing a proposed change, test, or experiment if the change, test, or experiment would:

i Result in more than a minimal increase in the frequency of occurrence of an accident previously evaluated in the license application (as updated);

ii Result in more than a minimal increase in the likelihood of occurrence of a malfunction of a facility structure, equipment, or monitoring system (SEMS) important to safety previously evaluated in the license application (as updated);

iii Result in more than a minimal increase in the consequences of an accident previously evaluated in the license application (as updated);

iv Result in more than a minimal increase in the consequences of a malfunction of an SEMS important to safety previously evaluated in the license application (as updated);

v Create a possibility for an accident of a different type than any previously evaluated in the license application (as updated);

vi Create a possibility for a malfunction of an SEMS important to safety with a different result than previously evaluated in the license application (as updated); or

vii Result in a departure from the method of evaluation described in the license application (as updated) used by the NRC in establishing the final safety evaluation report (FSER), environmental impact statement (EIS), environmental assessment (EA), technical evaluation reports (TERs), or other analyses and evaluations for license amendments.

For purposes of this paragraph as applied to this license, SEMS important to safety means any SEMS that has been referenced in a staff SER, TER, EA, or EIS, and supplements and

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amendments thereof.

C) Additionally, the licensee must obtain a license amendment unless the change, test, or experiment is consistent with NRC's previous conclusions, or the basis of, or analysis leading to, the conclusions of actions, designs, or design configurations analyzed and selected in the site or facility SER, TER, and EIS or EA. This would include all supplements and amendments, and SERs, TERs, EAs, and EISs issued with amendments to this license.

D) The licensee's determinations concerning (B) and (C) of this condition, shall be made by a Safety and Environmental Review Panel (SERP). The SERP shall consist of a minimum of three individuals. One member of the SERP shall have expertise in management (e.g., Plant Manager) and shall be responsible for financial approval for changes; one member shall have expertise in operations and/or construction and shall have responsibility for implementing any operational changes; and one member shall be the radiation safety officer (RSO) or equivalent meeting recommendations in paragraph 2.4 of regulatory Guide 8.31 with the responsibility of assuring changes conform to radiation safety and environmental requirements. Additional members may be included in the SERP, as appropriate, to address technical aspects such as ground water or surface water hydrology, specific earth sciences, and other technical disciplines. Temporary members or permanent members, other than the three above-specified individuals, may be consultants.

E) The licensee shall maintain records of any changes made pursuant to this condition until license termination. These records shall include written safety and environmental evaluations made by the SERP that provide the basis for determining changes are in compliance with (B) of this condition. The licensee shall furnish, in an annual report to the NRC, a description of such changes, tests, or experiments, including a summary of the safety and environmental evaluation of each. In addition, the licensee shall annually submit to the NRC page changes, which shall include both a change indicator for the area changed, e.g., a bold line vertically drawn in the margin adjacent to the portion actually changed, and a page change identification (date of change or change number or both), to the operations plan and reclamation plan of the approved license application (as updated) to reflect changes made under this condition.

9.5 Financial Assurance. The licensee shall maintain an NRC-approved financial surety arrangement, consistent with 10 CFR 40, Appendix A, Criterion 9, adequate to cover the estimated costs, if accomplished by a third party, for decommissioning and decontamination, which includes offsite disposal of radioactive solid process or evaporation pond residues, and ground water restoration. The surety shall also include the costs associated with all soil and water sampling analyses necessary to confirm the completion of decontamination.

Proposed annual updates to the financial assurance amount, consistent with 10 CFR Part 40, Appendix A, Criterion 9, shall be provided to the NRC 90 days prior to the anniversary date (e.g. renewal date of the financial assurance instrument/vehicle). The financial assurance update renewal date for the Ross Project will be determined following consultation with the licensee and the State of Wyoming. If the NRC has not approved a proposed revision 30 days prior to the expiration date of the existing financial assurance arrangement, the licensee shall extend the existing arrangement, prior to expiration, for one year. Along with each proposed revision or annual update of the financial assurance estimate, the licensee shall submit supporting documentation, showing a breakdown of the costs and the basis for the cost estimates with adjustments for inflation,

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maintenance of a minimum 15-percent contingency, changes in engineering plans, activities performed, and any other conditions affecting the estimated costs for site closure. Within 90 days of NRC approval of a revised closure (decommissioning) plan and its cost estimate, the licensee shall submit, for NRC staff review and approval, a proposed revision to the financial assurance arrangement if estimated costs exceed the amount covered in the existing arrangement. The revised financial assurance instrument shall then be in effect within 30 days of written NRC approval of the documents.

At least 90 days prior to beginning construction associated with any approved, planned expansion or operational change that was not included in the annual financial assurance update, the licensee shall provide, for NRC approval, an updated estimate to cover the expansion or change. The licensee shall also provide the NRC with copies of financial assurance-related correspondence submitted to the State of Wyoming, a copy of the State's financial assurance review, and the final approved financial assurance arrangement. The licensee also must ensure that the financial assurance instrument, where authorized to be held by the State, identifies the NRC-related portion of the instrument and covers the aboveground decommissioning and decontamination, the cost of offsite disposal of solid byproduct material, soil, and water sample analyses, and ground water restoration associated with the site. The basis for the cost estimate is the NRC-approved site closure plan or the NRC-approved revisions to the plan. Reclamation or decommissioning plan cost estimates and annual updates should follow the outline in Appendix C to NUREG-1569 entitled "Recommended Outline for Site-Specific In Situ Leach Facility Reclamation and Stabilization Cost Estimates."

The licensee shall continuously maintain an approved surety instrument for the Ross Project, in favor of the State of Wyoming. The initial surety estimate shall be submitted for NRC review and approval within 90 days of license issuance, and the surety instrument shall be submitted for NRC staff review and approval 90 days prior to commencing operations.

9.6 Release of surficially contaminated equipment, materials, or packages for unrestricted use shall be in accordance with the NRC guidance document "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," (the Guidelines) dated April 1993 (ADAMS Accession No. ML003745526) or suitable alternative procedures approved by NRC prior to any such release.

Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides shall apply independently.

Personnel performing contamination surveys for items released for unrestricted use shall meet the qualifications as health physics technician or radiation safety officer as defined in Regulatory Guide 8.31 (as revised). Personal effects (e.g., notebooks and flash lights) which are hand carried need not be subjected to the qualified individual survey or evaluation, but these items should be subjected to the same survey requirements as the individual possessing the items.

Regulatory Guide 8.30 (as revised), Table 2 shall apply to the removal to unrestricted areas, of equipment, materials, or packages that have potential accessible surface contamination levels above background radiation levels. The contamination control program shall provide sufficient detail to demonstrate how the licensee will maintain radiological controls over the equipment,

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materials, or packages that have the potential for accessible surface contamination levels above background, until they have been released for unrestricted use as specified in the Guidelines, and what methods will be used to limit the spread of contamination to unrestricted areas. The contamination control program shall demonstrate how the licensee will limit the spread of contamination when moving or transporting potentially contaminated equipment, materials, or packages (i.e. pumps, valves, piping, filters, etc.) from restricted areas through unrestricted areas. Prior to its implementation, the licensee shall receive written NRC verification of the licensee's contamination control program if recommendations in RG 8.30 are not followed.

The licensee may identify a qualified designee(s) to perform surveys, as needed, associated with the licensee's contamination control program when moving or transporting potentially contaminated equipment, materials, or packages from restricted or controlled areas through uncontrolled areas and back into controlled or restricted areas. The qualified designee(s) shall have completed education, training, and experience, in addition to general radiation worker training, as specified by the licensee. The education, training, and experience required by the licensee for qualified designees shall be submitted to the NRC for review and written verification. The licensee shall receive written verification of the licensee's qualified designee(s) training program prior to its implementation.

9.7 The licensee shall follow the guidance set forth in NRC Regulatory Guides 8.22, "Bioassay at Uranium Recovery Facilities" (as revised), 8.30, "Health Physics Surveys in Uranium Recovery Facilities" (as revised) and 8.31, "Information Relevant to Ensuring that Occupational Radiation Exposure at Uranium Recovery Facilities will be As Low As Is Reasonably Achievable (ALARA)," (as revised) or NRC-approved equivalent with the following exception:

The licensee may identify qualified designee(s) to perform daily inspections in the occasional absence of the RSO and radiation safety technician(s) (RST). The qualified designee(s) will have health physics training, and the licensee will specify the training program to qualify a designee and submit it to the NRC staff for review and written verification. A qualified designee may perform daily inspections on weekends, holidays, or times when both the RSO and RST(s) must both be absent (e.g., illness or offsite training). A designee shall not perform daily inspections for more than two consecutive days except in the event of a Federal or company holiday, whereby the designee will not exceed more than three consecutive days. Reports generated by the designee will be reviewed by the RSO or RST as soon as practical, but no later than 3 hours from the beginning of the next work day following an absence, weekend, or holiday. The licensee will also have the RSO or RST available by telephone while the qualified designee is performing the daily inspections.

Notwithstanding the License Condition (LC) 9.4 change process, no additional exceptions to the guidance will be implemented without written NRC verification that the criteria in LC 9.4 do not require a license amendment.

9.8 <u>Cultural Resources.</u> Before engaging in any developmental activity not previously assessed by the NRC, the licensee shall administer a cultural resource inventory. All disturbances associated with the proposed development will be completed in compliance with the National Historic Preservation Act (as amended) and its implementing regulations (36 CFR Part 800), and the Archaeological Resources Protection Act (as amended) and its implementing regulations (43 CFR Part 7).

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In order to ensure that no unapproved disturbance of cultural resources occurs, any work resulting in the discovery of previously unknown cultural artifacts shall cease. The artifacts shall be inventoried and evaluated in accordance with 36 CFR Part 800, and no disturbance of the area shall occur until the licensee has received authorization to proceed from the NRC, Wyoming State Historic Preservation Officer or the Bureau of Land Management, as appropriate.

The licensee shall comply with the terms and conditions included in the Programmatic Agreement (PA) executed on April 24, 2014 (ADAMS Accession No. ML14111A346) that was developed to protect cultural resources within the Ross ISR project boundary. If the PA is terminated, the licensee shall comply with Stipulation L of the PA. Therefore, in the event the PA is terminated, the licensee is required to follow the terms and conditions provided in the PA for on-going ground-disturbing activities, and is not permitted to begin ground-disturbing activities in new areas, until the NRC completes consultation and a new PA or Memorandum of Agreement (MOA), as appropriate, is executed, or the NRC has requested, taken into account, and responded to the comments of the ACHP under 36 CFR § 800.7(c)(4).

9.9 The licensee shall dispose of solid byproduct material from the Ross Project at a site that is authorized by NRC or an NRC-Agreement State to receive such byproduct material. The licensee's approved solid byproduct material disposal agreement shall be maintained on site during any time the facility is in operation. In the event that the agreement expires or is terminated, the licensee shall notify the NRC within seven working days after the date of expiration or termination. A new agreement shall be submitted for NRC review within 90 days after expiration or termination, or the licensee will be prohibited from further lixiviant injection.

9.10 The results of the following activities, operations, or actions shall be documented: sampling; analyses; surveys or monitoring; survey/ monitoring equipment calibrations; audits and inspections; all meetings and training courses; and any subsequent reviews, investigations, or corrective actions required by NRC regulation or this license. Unless otherwise specified in a license condition or applicable NRC regulation, all documentation required by this license shall be maintained until license termination, and is subject to NRC review and inspection.

9.11 The licensee is hereby exempted from the requirements of 10 CFR 20.1902(e) for areas within the facility, provided that all entrances to the facility are conspicuously posted with the words, "CAUTION: ANY AREA WITHIN THIS FACILITY MAY CONTAIN RADIOACTIVE MATERIAL."

SECTION 10: **Operations, Controls, Limits, and Restrictions**

Standard Conditions

10.1 The licensee shall use a lixiviant composed of native ground water; carbon dioxide, sodium carbonate and/or sodium bicarbonate; and hydrogen peroxide and/or oxygen, as specified in Section 3.1.3.1 of the licensee's approved license application.

10.2 <u>Facility Throughput.</u> The Ross Project processing facility throughput shall not exceed a maximum instantaneous flow rate of 7,500 gallons per minute, excluding restoration flow. The annual production of dried yellowcake shall not exceed 3 million pounds.

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10.3 At least 12 months prior to initiation of any planned final site decommissioning, the licensee shall submit a detailed decommissioning plan for NRC staff review and approval. The plan shall represent as-built conditions at the Ross Project.

10.4 The licensee shall develop and implement written standard operating procedures (SOPs) prior to operation for:

A) All routine operational activities involving radioactive and non-radioactive materials associated with licensed activities that are handled, processed, stored, or transported by employees;

B) All routine non-operational activities involving radioactive materials including in-plant radiation protection and environmental monitoring; and

C) Emergency procedures for potential accident/unusual occurrences including significant equipment or facility damage, pipe breaks and spills, loss or theft of yellowcake or sealed sources, significant fires, and other natural disasters.

The SOPs shall include appropriate radiation safety practices to be followed in accordance with 10 CFR Part 20. SOPs for operational activities shall enumerate pertinent radiation safety practices to be followed. A copy of the current written procedures shall be kept in the area(s) of the production facility where they are utilized. Should an activity be deemed 'non-routine', its procedures will be documented in a specific Radiation Work Permit for that non-routine activity.

10.5 <u>Mechanical Integrity Tests.</u> The licensee shall construct all wells in accordance with methods described in Section 3.1.2 of the approved license application. Mechanical integrity tests shall be performed on all wells (injection, extraction, and monitoring wells) before the well is utilized and on wells that have been serviced with equipment or procedures that could damage the well casing. Each well shall be retested at least once every five (5) years it is in use. Integrity tests shall be performed in accordance with Section 3.1.2.3 of the licensee's approved license application. Any failed well casing that cannot be repaired to pass the integrity test shall be appropriately plugged and abandoned in accordance with Addendum 2.6-E of the approved license application.

10.6 <u>Ground water Restoration.</u> The licensee shall conduct ground water restoration activities in accordance with Section 6.1.5 of the approved license application. Permanent cessation of lixiviant injection in a production area would signify the licensee's intent to shift from the principal activity of uranium recovery to the initiation of ground water restoration and decommissioning for any particular production area. If the licensee determines that these activities are expected to exceed 24 months for any particular production area, then the licensee shall submit for approval an alternate schedule request to the NRC that meets the requirements of 10 CFR 40.42.

<u>Restoration Standards.</u> Hazardous constituents in the ground water shall be restored to the numerical ground water protection standards as required by 10 CFR Part 40, Appendix A, Criterion 5B(5). In submitting any license amendment application requesting review and approval of proposed alternate concentration limits (ACLs) pursuant to Criterion 5B(6), the licensee must also show that it has first made practicable effort to restore the specified hazardous constituents to the background or maximum contaminant levels (whichever is greater).

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Restoration Stability Monitoring. The licensee shall conduct sampling of the parameters included in the baseline sampling under LC 11.3 during the restoration stability period in accordance with Section 6.1.2.5 of the approved application. The sampling consists of eight samples during a 12 month period. The sampling shall include the specified production zone aquifer wells used to define the baseline levels. The applicant shall continue the stability monitoring until the data show, for all parameters monitored, no statistically significant increasing trend, which would lead to an exceedence of the relevant standard in 10 CFR Part 40, Appendix A, Criterion 5B(5).

10.7 The licensee shall maintain a net inward hydraulic gradient at a wellfield as measured from the surrounding perimeter monitoring well ring starting when lixiviant is first injected into the production zone and continuing until initiation of the stabilization period.

10.8 The licensee is permitted to construct and operate lined retention pond(s) as described in Section 4.2.2 and Addendum 3.1-A of the approved license application subject to requirements of LC 10.11. The ponds will be used for retention of liquid byproduct material prior to disposal in a deep disposal well as described in Section 4.2.3 of the approved license application. Routine pond inspections will be conducted in accordance with procedures defined in Section 5.3.2 of the approved license application. The inspections include:

A) Daily Inspection. The licensee will perform daily inspections in accordance with Section 5.3.2.1 of the approved license application. The inspections will include visual inspections of the piping, berms, diversion ditches, freeboard and leak detection systems. The minimum freeboard is 3 feet. If during the daily inspections a fluid height in any of the standpipes for the pond leak detection system is found to be in excess of six (6) vertical inches, then the licensee will collect a sample of the fluid for analysis of specific conductance. If the specific conductance of the fluid in the leak detection system is in excess of 50 percent of the specific conductance of fluids in the pond, then it is concluded that a leak has occurred in the pond primary liner and the licensee will perform mitigative and corrective actions. The corrective actions include notifying the NRC Project Manager by telephone or email within 48 hours and lowering the water level in the pond sufficiently to eliminate the leak. If corrective actions are not completed within 60 days, the pond will not be used to store any byproduct material until the liner is inspected by qualified personnel as required by Subsection E (Annual Technical Inspection). The licensee will submit a report to NRC upon completion of the corrective actions including documentation of all pond repairs. Routine daily inspections reports will be maintained on-site for NRC staff to review during routine inspections.

B) Weekly Inspection. The licensee will conduct weekly inspections in accordance with Section 5.3.1.2 of the approved license application. The inspections will include visual inspection of the entire area including perimeter fencing. The inspection report will be reviewed by the RSO, Manager of Health, Safety and Environmental Affairs, and the Facility Manager. The weekly inspection reports will be maintained on-site for NRC staff to review during inspections.

C) Monthly Inspection. The licensee will conduct inspections monthly in accordance with Section 5.3.2.2 of the approved license application or following a major storm event (precipitation greater than 1-inch of water during a 24-hour period) of the condition of structures associated with the diversion of the stream around the Central Processing Plant area in accordance with

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Section 5.3.4 of the approved license application. The reports will be maintained on-site for NRC staff to review during inspections.

D) Quarterly Inspection. The licensee will conduct quarterly inspections in accordance with Section 5.3.2.3 of the approved license application. Results of the quarterly inspections will be included in the semi-annual report submitted to NRC as required by LC 11.2. If ground-water quality in the monitoring wells indicates a release of fluids from the pond, then the licensee will immediately perform corrective actions to eliminate the leak and any appropriate remedial actions including characterization of impacts to shallow soils and water in the uppermost aquifer. Results of the quarterly inspections will be submitted to NRC for review.

E) Annual Technical Inspection. The licensee will conduct annual inspections in accordance with Section 5.3.2.4 of the approved license application. The annual inspection will include a review of the previous year's daily, weekly, and quarterly inspections, assessment of the hydraulic and hydrologic capacities, and a survey of the embankment by qualified personnel. A copy of the report will be submitted to NRC for review.

10.9 The licensee shall establish and conduct an effluent and environmental monitoring program in accordance with programs described in Section 5.7.8.2 (Operational Monitoring-Surface Water and Operational Monitoring-Private Wells) and Section 5.7.7.1 (radon, air particulate, direct radiation, and soil) of the approved license application. The licensee will conduct a monitoring program in accordance with Section 5.7.8.2 (Operational Monitoring-CPP Area) unless those elements are included in the ground water detection monitoring program required by LC 10.20.

Facility Specific Conditions

10.10 The licensee shall submit to NRC staff for review and approval, plans for equipment and procedures prior to the use, storage, handling and transport of biological or chemical materials for reductant injections during restoration.

10.11 The licensee is prohibited from using Pond 2 for the retention of byproduct material until NRC review and verification that the field operations of the CPP dewatering system is consistent with its design as described in Technical Report Addendum 3.1-A of the approved license application and the October 14, 2013 supplemental data.

10.12 Prior to conducting tests for a wellfield data package, the licensee will attempt to locate and abandon all historic drill holes located within the perimeter well ring for the Wellfield. The licensee will document such efforts to identify and properly abandon all drill holes in the wellfield data package.

10.13 Wellfield Package. Prior to conducting principal activities in a new wellfield, the licensee shall submit a hydrologic test data package (wellfield package) to the NRC. The initial wellfield package will be submitted for NRC staff review and verification. Each wellfield package shall be submitted at least 60 days prior to the planned start date of lixiviant injection. In each wellfield data package, the licensee will document that: (1) all perimeter monitoring wells are screened in the appropriate horizon in order to provide timely detection of an excursion; and (2), the baseline values to establish ground water protection standards and Upper Control Limits (UCLs) for the Wellfield in accordance with LC 11.3. The wellfield package will adequately define heterogeneities that may affect the

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chemical signature and ground-water flow paths within the ore zone as described in Sections 2.7.3.2.3, 3.1.1 and 5.7.8.1 of the approved license application.

10.14 Facility and Wellfield Inspection. Injection manifold pressures and flow rates shall be measured and recorded daily by the in-line computer system and/or Wellfield Operator. During wellfield operations, injection pressures shall not exceed the maximum operating pressure as specified in Section 3.1.4 of the approved license application. To the extent possible, the weekly inspections shall include visual inspections and document leaks or other abnormalities in the wellfield piping, wellheads, or module buildings in accordance with Section 5.3.3 of the approved license application. The licensee shall conduct the weekly in-plant inspection and audit programs described in Section 5.3.1 of the approved license application. In addition, as described in Section 5.7 of the approved license application and supplements, the RSO shall document that radiation control practices are being implemented appropriately. Requirements for inspections of the on-site retention ponds are listed in LC 10.8.

10.15 The licensee will use calibrated radiation instruments that can measure the full range of radiation exposure rates or dose rates for radiological parameters that are reasonably expected at an ISR facility to ensure the magnitude and extent of radiation levels are measured in accordance with 10 CFR 20.1501(a)(2)(i). The instruments used to measure airborne concentrations of radioactive materials will allow for a lower limit of detection (LLD), as described in Regulatory Guide 8.30 (as revised), to provide a 95 percent confidence that measurements are in conformance with 10 CFR 20.1201, 20.1204, 20.1301, 20.1501, and 20.1502.

10.16 The licensee shall conduct radiological characterization of airborne samples for natural U, Th-230, Ra-226, Po-210, and Pb-210 for each restricted area air particulate sampling location at a frequency of once every 6 months for the first two years, and annually thereafter to ensure compliance with 10 CFR 20.1204(g). The licensee shall also evaluate changes to plant operations to determine if more frequent radionuclide analyses are required for compliance with 10 CFR 20.1204(g).

10.17 Any area with exposure rates that exceed 2 millirem in any one hour must be immediately treated as a restricted area in accordance with 10 CFR 20.1301(a)(2).

10.18 The licensee shall ensure radiation safety training is consistent with Regulatory Guides 8.13, "Instruction Concerning Prenatal Radiation Exposure," (as revised) and 8.29, “Instruction Concerning Risks from Occupational Radiation Exposure," (as revised) in addition to the requirements in Section 2.5 of Regulatory Guide 8.31 (as revised), and as described in Section 5.5 of the approved application, or NRC-approved equivalent.

10.19 The licensee shall confine its operations to wellfields located north of Little Missouri River within the area delineated as “Mine Unit 1” on Figure 3.1-1 of the approved license application until use of the three industrial wells, designated as “19XX18”, “22x-19” and “789V” in the approved license application, as water supply sources for the oil field flooding operations have ceased or diminished to an acceptable level, which has been reviewed and verified by NRC staff. For wellfields south of the Little Missouri River, the licensee must demonstrate in the wellfield package that the proposed operations are outside of the area of influence of the industrial wells. The location of a wellfield or a portion of a wellfield shall not include any of the industrial wells if the well has not been properly abandoned. If the licensee’s principal activities are being conducted at a wellfield on the Ross

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Project and operations of the onsite industrial water supply wells have not been discontinued, the effluent monitoring program will include monthly sampling of water pumped from the industrial wells.

10.20 The licensee shall conduct a ground water detection monitoring program for the retention ponds that meets requirements of Criteria 5 and 7A of 10 CFR Part 40, Appendix A. The elements in this program will be documented in the licensee's SOPs.

10.21 Emission Controls (Dryer). The licensee shall maintain effluent control systems as specified in Sections 3.3.1, 4.1, and 5.7.1 of the approved license application, with the following exception:

If any of the yellowcake emission control equipment fails to operate within specifications set forth in the SOPs, the drying and packaging room shall immediately be closed-in as an airborne radiation area and heating operations shall be switched to cooldown, or packaging operations shall be temporarily suspended. Packaging operations shall not be resumed until the vacuum system is operational to draw air into the system.

All these cessations, corrective actions, and restarts must be reported to NRC Region IV Office, as indicated in Criterion 8A, in writing, within ten days of the subsequent restart.

SECTION 11: Monitoring, Recording, and Bookkeeping Requirements

Standard Conditions

11.1 In addition to reports required to be submitted to NRC staff or maintained on-site by the applicable parts of Title 10 of the Code of Federal Regulations, the licensee shall prepare the following reports related to operations at the facility:

A) A quarterly report that includes a summary of the excursion indicator parameter concentrations, corrective actions taken, and the results obtained for all wells that were on excursion status during that quarter. This report shall be submitted to NRC within 60 days following completion of the reporting period.

B) A quarterly report summarizing daily flow rates and pressures for each injection manifold within the operating system. This report shall be made available for inspection upon request.

C) A semi-annual report that discusses: status of wellfields (or wellfield modules if appropriate) in operation (including last date of lixiviant injection), progress of wellfields (wellfield modules) in restoration, status of any long term excursions and a summary of the mechanical integrity tests (MITs) during the reporting period. This report shall be submitted to NRC within 60 days following completion of the reporting period.

D) Consistent with Regulatory Position 2 of Regulatory Guide 4.14 (as revised), a semiannual report that summarizes the results of the operational effluent and environmental monitoring program. For this program, the nearby water supply wells are those within 2 km of the perimeter ring monitoring wells for all wellfields undergoing recovery operations or restoration. This report shall be submitted to NRC within 60 days following completion of the reporting period.

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E) An annual report pursuant to LC 9.4(E).

F) An annual report that summarizes modifications to the inventory of nearby water supply wells and land-use survey within 2 km of any production area. This report shall be submitted to NRC within 90 days following completion of the reporting period.

11.2 The licensee shall submit the results of at least an annual review of the radiation protection program performed in accordance with 10 CFR 20.1101(c). This review shall include the content and implementation of the radiation protection program. Results shall include an analysis of dose to individual members of the public consistent with 10 CFR 20.1301 and 10 CFR 20.1302. This report shall be submitted to NRC within 90 days following completion of the reporting period.

11.3 Establishment of Background Water Quality. Prior to injection of lixiviant in a wellfield, the licensee shall establish background water quality data for the ore zone, overlying and underlying aquifers. The background water quality sampling shall provide representative baseline data and establish ground water protection standards and excursion monitoring upper control limits, as described in Section 5.7.8 of the approved license application and this license condition.

The data for each mine unit shall consist, at a minimum, of the following sampling and analyses:

A) Ore Zone. To establish a Commission-approved background concentration pursuant to Criterion 5B(5)(a) of 10 CFR Part 40 Appendix A, samples shall be collected from production and injection wells at a minimum density of one production or injection well per two acres of wellfield production area, or, if a wellfield production area is sufficiently isolated from the other wellfield production areas in the Wellfield, a minimum of two wells. Wells selected for the baseline data will be the same ones used to measure restoration success and stabilization.

B) Perimeter Monitoring Wells. Samples shall be collected from all perimeter monitoring wells that will be used for the excursion monitoring program. The perimeter wells will be installed for a wellfield in accordance with information presented in Section 3.1.6 of the approved license application. In no case will the perimeter monitoring wells be installed outside of the exempted aquifer as defined by the Class III UIC permit issued by the Wyoming Department of Environmental Quality.

C) Overlying and Underlying Aquifers. Samples shall be collected from all monitoring wells in the first overlying and first underlying aquifer at a minimum density of one well per 4 acres of wellfield.

D) Sampling and Analyses. Four samples shall be collected from each well to establish background levels. The sampling events shall be at least 14 days apart. The samples shall be analyzed for parameters listed in Table 5.7-2 of the approved license application. The third and fourth sample events can be analyzed for a reduced list of parameters; the parameters that can be deleted from analysis are those below the minimum analytical detection limits (MDL) during the first and second sampling events provided the MDLs meet the data quality objectives for the sampling.

E) Background Water Quality. For the perimeter ring monitoring wells (Section B) and monitoring

wells in the overlying and underlying aquifers (Section C), the background levels shall be the mean values on a parameter-by-parameter, well-by-well, wellfield or sub-set of the wellfield basis, as deemed appropriate, in accordance with Section 5.7.8.1 of the approved license application. The UCLs for monitoring wells in the perimeter ring and overlying and underlying aquifers are established per LC 11.4. For the ore zone monitoring wells, the background levels shall be established on a parameter-by-parameter basis using either the wellfield, sub-set of the wellfield or well-specific mean value. The established background value for each parameter shall be based on the mean value plus a statistically valid factor to account for spatial variability in the data, in accordance with Section 6.1.1.1 of the approved license application.

11.4 Establishment of UCLs. Prior to injection of lixiviant into a wellfield, the licensee shall establish excursion control parameters and their respective upper control limits (UCLs) in the designated overlying aquifer, underlying aquifer and perimeter monitoring wells in accordance with Section 5.7.8.2 of the approved license application. The default excursion parameters for wells in the ore zone and overlying aquifer are chloride, conductivity, and total alkalinity. The default excursion parameters for wells in the underlying aquifer are sulfate, conductivity, and total alkalinity. The UCLs shall be established for each excursion control parameter and for each well, wellfield or subset of the wellfield, as appropriate, based on the mean plus five standard deviations of data collected for LC 11.3. The UCL for chloride can be set at the background mean concentration plus either five standard deviations or 15 mg/l, whichever is higher.

11.5 Excursion Monitoring. Monitoring for the excursion monitoring program shall be conducted twice monthly (semi-monthly) and at least 10 days apart for wells installed under LC 11.3 (B and C). If, at any well during a semi-monthly sampling event, the concentrations of any two excursion indicator parameters exceed their respective UCL or any one excursion indicator parameter exceeds its UCL by 20 percent, then the excursion criterion is exceeded and a verification sample shall be taken from that well within 48 hours after results of the first analysis are received. If the verification sample confirms that the excursion criterion is exceeded, then the well is placed on excursion status. If the verification sample does not confirm that the excursion criterion is exceeded, a third sample shall be taken within 48 hours after results of the first verification sampling are received. If the third sample shows that the excursion criterion is exceeded, the well shall be placed on excursion status. If the third sample does not show that the excursion criterion is exceeded, the first sample shall be considered to be an error and routine excursion monitoring is resumed (the well is not placed on excursion status).

Upon confirmation of an excursion, the licensee shall notify NRC as stated below, implement corrective action, and increase the sampling frequency for the excursion indicator parameters at the well on excursion status to at least once every seven days. Corrective actions for confirmed excursions may be, but are not limited to, those described in Section 5.7.8.2 of the approved license application. An excursion is considered corrected when concentrations of all indicator parameters defining the excursion status are at or below the UCLs defined in LC 11.4 for three consecutive weekly samples.

For wellfields located in an area in which the uppermost aquifer, the "SA Aquifer", is comprised of saturated unconsolidated alluvium, the licensee will include monitoring wells in the SA Aquifer in that area of the wellfield as part of the excursion monitoring program as described above. The wellfield data package must include sufficient justification on the locations, baseline sampling if the frequency

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is less than quarterly and operational sampling if the frequency is less than semi-monthly for wells in the uppermost aquifer. The justification must demonstrate that the wells provide early detection of a release (including a surficial release).

If a vertical excursion is detected during operations, then injection of lixiviant into the production area surrounding the monitoring well will cease until the licensee demonstrates to the satisfaction of NRC that the vertical excursion is not attributed to leakage through any abandoned drill hole.

If an excursion is not corrected within 60 days of the initial confirmation, the licensee shall either: (a) terminate injection of lixiviant within the wellfield, or a portion of the wellfield provided the licensee demonstrates to NRC that only a portion of the wellfield is within the area of influence for the excursion) until the excursion is corrected; or (b) increase the financial surety in an amount to cover the full third-party cost for correcting and cleaning up impacts that may be attributed to the excursion. The surety increase shall remain in force until the NRC has verified that the excursion has been corrected and appropriate remedial actions have been undertaken. The written 60-day excursion report shall identify which course of action the licensee is taking if the excursion has not been corrected. Under no circumstances does this condition eliminate the requirement that the licensee remediate the excursion to meet ground water protection standards as required by LC 11.3.

The licensee shall notify the NRC Project Manager (PM) by telephone or email within 24 hours of confirming a lixiviant excursion, and by letter within 7 days from the time the excursion is confirmed, pursuant to this license condition and LC 9.3. A written report describing the excursion event, corrective actions taken, and the corrective action results shall be submitted to the NRC within 60 days of the excursion confirmation. For all wells that remain on excursion status after 60 days, the licensee shall submit a report as discussed in LC 11.1(A).

11.6 Until license termination, the licensee shall maintain documentation on spills of source or byproduct materials (including process solutions) and process chemicals. Documented information shall include, but not be limited to: date, spill volume, total activity of each radionuclide released, radiological survey results, soil sample results (if taken), corrective actions, results of post remediation surveys (if taken), a map showing the spill location and the impacted area, and an evaluation of NRC reporting criteria.

The licensee shall have procedures used to evaluate the consequences of the spill or incident/event against 10 CFR Part 20 Subpart M and 10 CFR 40.60 reporting criteria. If the criteria are met, then the licensee will report the spill or incident/event to the NRC Operations Center, as required.

If the licensee is required to report to a State or other Federal agency incidents/events that may have an impact on the environment, including wellfield excursions or spills of source, byproduct material, and/or process chemicals, the licensee shall submit a report to the NRC Headquarters PM by telephone or electronic mail (e-mail) within 24 hours. This notification shall be followed, within 30 days of the notification, by submittal of a written report to NRC Headquarters in accordance with LC 9.3, detailing conditions leading to the spill or incident/event, corrective actions taken, and results achieved.

SECTION 12.0: Preoperational Conditions

License Number SUA-1601

MATERIALS LICENSE
SUPPLEMENTARY SHEET

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Standard Conditions

12.1 Prior to commencement of operations, the licensee shall obtain all necessary permits, licenses and approvals from the appropriate regulatory authorities. The licensee shall submit a copy of the permits it has obtained from other regulatory agencies for any effluent or waste disposal that includes treated or non-treated byproduct material, as well as documents clearly delineating the approved aquifer exemption areas and boundaries for the Class III UIC wells to the NRC.

12.2 Prior to commencement of operations, the licensee shall coordinate critical emergency response requirements with local authorities, fire department, medical facilities, and other emergency services. The licensee shall document these coordination activities and maintain such documentation on-site.

12.3 Prior to commencement of operations, the licensee shall identify the location, screen depth, and estimated pumping rate of any new water supply well or new use for an existing well within 2 km of a proposed wellfield area, as measured from the perimeter monitoring well ring, since the application was submitted to the NRC. The licensee shall evaluate the impact of ISR operations and recommend any additional monitoring or other measures to protect ground-water users. The evaluation shall be submitted to the NRC staff for review and verification at least 30 days prior to the expected commencement of operations.

12.4 Prior to commencement of operations, the licensee shall submit the qualifications of radiation safety staff members, including the qualifications and responsibilities of a designee, and the policy on the work situations for a declared pregnant worker, for NRC review and verification.

12.5 Prior to commencement of operations, the licensee shall submit a copy of the solid byproduct material disposal agreement to the NRC.

12.6 The licensee shall not commence operations until the NRC performs a preoperational inspection to confirm, in part, that operating procedures and approved radiation safety and environmental monitoring programs are in place, and that preoperational testing is complete.

The licensee should inform the NRC, at least 90 days prior to the expected commencement of operations, to allow for sufficient time for NRC to plan and perform the preoperational inspection.

Facility Specific Conditions

12.7 No later than 30 days before the preoperational inspection, the licensee shall provide to the NRC staff, for review and written verification, written procedures for its airborne effluent and environmental monitoring program that:

A) Discuss how, in accordance with 10 CFR 40.65, the quantity of the principal radionuclides from all point and diffuse sources will be accounted for, and verified by, surveys and/or monitoring.

B) Discuss and identify how radon (radon-222) progeny will be factored into analyzing potential public dose from operations consistent with 10 CFR Part 20, Appendix B, Table 2.

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C) Discuss how, in accordance with 10 CFR 20.1501, the occupational dose (gaseous and particulate) received throughout the entire License Area from licensed operations will be accounted for, and verified by, surveys and/or monitoring.

12.8 Prior to the preoperational inspection, the licensee shall develop a survey program that will meet the requirements of 10 CFR Part 20, Subpart F to detect beta-gamma contamination on personnel exiting restricted areas and to detect beta-gamma contamination in unrestricted and restricted areas. The licensee shall provide, for NRC staff review and approval, the surface contamination detection capability (scan MDC) of the radiation survey meters used in surveys for releasing equipment and materials to unrestricted use or personnel contamination. In the scanning mode, the detection capability for any expected alpha and beta radiation shall be provided in terms of dpm per 100 cm^2.

12.9 Prior to the preoperational inspection, the licensee shall submit to the NRC staff, for review and verification, procedures by which it will ensure that unmonitored employees will not exceed 10 percent of the dose limits in 10 CFR Part 20, Subpart C.

12.10 At least 60 days prior to the preoperational inspection, the licensee will submit a completed Quality Assurance Plan (QAP) for NRC staff review and verification. The QAP will include the requirements in 10 CFR 20.1703(c)(4)(vii), and be consistent with guidance for a Quality Assurance Project Plan in Regulatory Guide 4.15 (as revised). The portion of the QAP fulfilling requirements of 10 CFR 20.1703(c)(4)(vii) may be included as a section or attachment in the applicable SOP(s).

12.11 Prior to the preoperational inspection, the licensee will provide to the NRC written SOPs required for LC 10.4, which will include information to meet the following specific-site conditions:

A) Development and sampling of low-yielding monitoring wells.

B) Inspection procedures for the CPP dewatering system.

C) A CPP effluent and environmental monitoring program (if not incorporated into the ground water detection monitoring program required by LC 10.20).

D) An emergency response program that includes hazard assessment of all chemicals used at the facility including an accident analysis for those chemicals.

E) Transportation of licensed material outside of the License area.

12.12 Prior to construction of the retention ponds, the licensee shall submit, for NRC review and verification, a ground water detection monitoring program plan for the retention ponds that meets requirements of Criteria 5 and 7A of 10 CFR Part 40, Appendix A. The plan will include specificity of elements discussed in Section 5.7.8.2 (Operational Monitoring-CPP Area) of the approved license application (e.g., monitoring dewatering effluent quality and water level, and water quality monitoring of monitoring wells along the containment barrier wall).

12.13 At least 90 days prior to the preoperational inspection, the licensee shall submit its analysis of the meteorological data collected to demonstrate long-term meteorological conditions at the Ross ISR Project. The licensee shall continue to collect meteorological data on a continuous basis at a data

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recovery rate of at least 90 percent and may not commence operations until the data collected are verified in writing by NRC headquarters staff to be representative of long-term meteorological conditions at the Ross ISR Project. The data collected on-site shall include, at a minimum, wind speed, wind direction, an annual wind rose and a summary of the stability classification.

To support the verification by NRC headquarters staff, the licensee must submit to the NRC a written justification of the similarity or validity of the data. This justification must include an analysis of the statistical data presented to illustrate confidence in the representativeness of the data.

FOR THE NUCLEAR REGULATORY COMMISSION

Dated: April 24, 2014

/RA/
Andrew Persinko, Deputy Director
Decommissioning and Uranium Recovery
Licensing Directorate
Division of Waste Management
and Environmental Protection
Office of Federal and State Materials
and Environmental Management Programs

April 25, 2014

G. Paul Bollwerk, III, Chair
Administrative Judge
Atomic Safety and Licensing Board Panel
Mail Stop T-3 F23
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Dr. Craig M. White
Administrative Judge
Atomic Safety and Licensing Board Panel
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Dr. Richard F. Cole
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Atomic Safety and Licensing Board Panel
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Washington, DC 20555-0001

In the Matter of
Strata Energy, Inc.
(Ross In Situ Recovery Uranium Project)
Docket No. 40-9091-MLA; ASLBP No. 12-915-01-MLA-BD01

NRC STAFF'S NOTICE OF LICENSE ISSUANCE

Dear Administrative Judges and Parties:

Today the Nuclear Regulatory Commission (NRC) Staff issued Strata Energy, Inc. (Strata) NRC Source Materials License No. SUA-1601. The license allows Strata to possess and use source and byproduct material in connection with its Ross Project in Crook County, Wyoming. The license is available in the NRC's Agencywide Documents Access Management System (ADAMS) under Accession Number ML14069A335.[1]

When the Staff issues a license while there is a hearing pending under Subpart L of 10 C.F.R. Part 2, as is the case here, its notice to the Board and parties "must include the NRC staff's explanation why the public health and safety is protected and why the action is in accord with the common defense and security despite the pendency of the contested matter before the presiding officer." 10 C.F.R. § 2.1202(a).

As documented in the Staff's Safety Evaluation Report for Strata's application, the Staff finds that the application complies with the Atomic Energy Act and the NRC's regulations. More specifically, the Staff finds that Strata's application meets all applicable requirements in 10

[1] ADAMS Accession Package No. ML14069A315 includes the license transmittal letter and the license. The NRC staff also issued its Record of Decision for the Ross Project today and it, along with the Staff's final Environmental Impact Statement (FSEIS) for the Ross Project and an errata to the FSEIS, may be found at ADAMS Accession Package No. ML14112A447. The Final Safety Evaluation Report for the Ross Project may be found in ADAMS Accession Package No. ML14108A088. The Final Programmatic Agreement for the Ross Project was executed April 24, 2014 and is available in ADAMS Accession Package No. ML14111A346.

C.F.R. Parts 20 and 40. In particular, under 10 C.F.R. § 40.32(b), the Staff finds that Strata is qualified by reason of training and experience to use source material for its requested purpose. Under § 40.32(c), the Staff finds that the equipment and procedures Strata proposes to use at the Ross Project are adequate to protect public health and minimize danger to life or property.

Based on these findings and the specific analysis in its Safety Evaluation Report, pursuant to § 40.32(b), the Staff finds that issuing a license to Strata is not inimical to either public health and safety or common defense and security. The pending hearing before the Board does not affect these conclusions. The Staff has considered the arguments raised by the Intervenors in the hearing, but those arguments do not affect the conclusions in the Safety Evaluation Report.

Sincerely,

/Signed (electronically) by/

Christopher C. Hair
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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

August 14, 2014
Errata No. 2

Report Number:	**NUREG-1910, Supplement 5**
Report Title:	Final Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming, Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities
Prepared by:	Office of Federal and State Materials and Environmental Management Programs U.S. Nuclear Regulatory Commission Washington, D.C. 20555-0001
Date Published:	February 2014
Instructions:	Please append the enclosed table of corrections to the text of NUREG-1910, Supplement 5.

On March 11, 2014, the U.S. Nuclear Regulatory Commission's (NRC) notice of availability of NUREG-1910, Supplement 5, *Final Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming, Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (FSEIS) was published in the Federal Register (79 FR 13683). Following publication of NUREG-1910, Supplement 5, the NRC staff was informed of and identified certain errors in the FSEIS regarding figures in Section 3.5.3.3 and Appendix B and regarding a reference to NUREG-1910 in Section 4.5.1.2. To address these matters, the NRC staff has prepared this second errata to the FSEIS.

SECOND ERRATA

FSEIS SECTION	Page	Correction
3.5.3.3 Ground-Water Quality	3-38	Third full paragraph, lines 9 and 11, replace "Figure 3.14" with "Figure 3.15."
3.5.3.3 Ground-Water Quality	3-43	Figure 3.16, "Locations of 29 Water-Supply Wells within a 3-Kilometer [2-Mile] Radius of Ross Project Area," is the incorrect graphic. The graphic should be Environmental Report (ER) Figure 3.4-33, "Sampled Water Supply Wells," which can be found on ER Page 3-231 (ADAMS Accession No. ML110130342).
4.5.1.2 Ross Project Operation	4-37	Last paragraph, line 5, replace "GEIS Section 2.11.3" with "GEIS Section 2.11.4."
B.5.9.5 Monitoring	B-44	NRC response to "Comments: RP032-071; RP032-077; RP035-035," last line of the response, replace "*Figure 3.15*" with "*Figure 3.16*."
B.5.15.1 Concerns about ISR and Ground-Water Contamination	B-82	NRC response to "Comment: RP035-034," line 6 of the response, replace "*Other maps indicating the locations*" with "*The locations*."

U.S. NUCLEAR REGULATORY COMMISSION
RECORD OF DECISION
FOR THE ROSS URANIUM IN-SITU RECOVERY PROJECT
IN CROOK COUNTY, WYOMING

Introduction:
The U.S. Nuclear Regulatory Commission (NRC) staff prepared this updated record of decision (ROD) for the proposed Ross Uranium In-Situ Recovery (ISR) Project in Crook County, Wyoming (Ross Project). This ROD satisfies Section 51.102(a) of Title 10 of the *Code of Federal Regulations* (10 CFR), which states that "a Commission decision on any action for which a final environmental impact statement has been prepared shall be accompanied by or include a concise public record of decision."

In February 2014, the NRC staff issued a Final Supplemental Environmental Impact Statement (Final SEIS) (NRC, 2014a) in support of the NRC's review of the Strata Energy, Inc. (Strata or "Applicant") license application. The Final SEIS was appended in April 2014 (NRC, 2014b) and in August 2014 (NRC, 2014c). Strata's application, which was submitted in 2011, is for a new source and byproduct materials license for the Ross Project (Strata, 2011a-b). The Ross Project Final SEIS is Supplement 5 to the NRC staff's *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (NUREG-1910) (known as the GEIS) (NRC, 2009).

This ROD has been prepared pursuant to NRC regulations at 10 CFR § 51.102(b) and § 51.103(a)(1)-(4). Additionally, pursuant to 10 CFR § 51.103(c), this ROD incorporates by reference materials contained in the Final SEIS.

On July 13, 2011, the NRC staff notified the public of the NRC's acceptance of Strata's application for a materials license for a detailed technical and environmental review. By *Federal Register* notice, the NRC staff also informed members of the public that they could request a hearing in connection with Strata's application. *Strata Energy, Inc. Ross In Situ Recovery Uranium Project, Crook County, WY; Notice of Materials License Application, Opportunity to Request a Hearing and To Petition for Leave To Intervene*, 76 Fed. Reg. 41308. The NRC's Atomic Safety and Licensing Board (ASLB), an independent, trial-level adjudicatory body, granted a hearing request from joint intervenors, the Natural Resources Defense Council and the Powder River Basin Resource Council (ASLB, 2012). The ASLB held an evidentiary hearing from September 30, 2014 through October 1, 2014, for three admitted contentions on environmental matters related to the licensing of the Ross project. In its initial decision following the hearing, the ASLB ruled in favor of Strata and the NRC staff on all three contentions (ASLB, 2015). In doing so, the ASLB supplemented the ROD to include a revised license condition (10.12) and additional analyses that were placed on the record by various parties. In June 2016, the Commission denied a petition for review of the ASLB's decision (NRC, 2016a). The NRC staff's initial ROD was published on April 24, 2014 (NRC, 2014d). This updated ROD accounts for the ASLB's decision and the Commission's ruling.

The Decision:
This ROD documents the NRC staff's decision to issue a materials license to Strata for its proposed Ross Project in Crook County, Wyoming (Materials License SUA-1601; NRC, 2016b). The license will authorize Strata to possess uranium source and byproduct materials at the Ross Project facility. Under its license, Strata will be able to construct and operate its facility as proposed in its license application and under the conditions in its NRC license.

The proposed Ross Project will occupy 696 hectares (1,721 acres) in the north half of the approximately 90-square-kilometer (56-square-mile) Lance District. The Lance District is located on the western edge in the northwest corner of the Nebraska-South Dakota-Wyoming Uranium Milling Region identified in the GEIS (NRC, 2009). It is situated between the Black Hills uplift to the east and the Powder River Basin to the west.

Strata intends to recover uranium and produce yellowcake at the Ross Project site. The proposed Ross Project includes a Central Processing Plant (CPP), injection and recovery wells (in wellfields), surface impoundments, deep disposal wells for liquid effluents, monitoring wells throughout the Ross Project area, and other various infrastructure (e.g., additional buildings, pipelines, roads, and lighting). Strata's proposed activities include construction, operation, aquifer restoration, and decommissioning of its Ross Project. Together, these actions represent the "Proposed Action" evaluated in the Final SEIS. In addition, the Proposed Action includes the option of the Applicant to operate the Ross Project facility beyond the life of the Project's wellfields. The facility could be used to process uranium-loaded resin from potential satellite areas within the Lance District operated by the Applicant, or from other offsite uranium recovery projects not operated by the Applicant (i.e., "toll milling"), or from offsite water treatment operations.

During the ISR process, an oxidant-charged solution, called a lixiviant, will be injected into the ore-zone aquifer (or uranium "ore body") through injection wells. The lixiviant will use native groundwater (from the ore-zone aquifer), carbon dioxide, sodium carbonate and/or sodium bicarbonate, with a hydrogen peroxide or oxygen oxidant. As this solution circulates though the ore zone, the lixiviant oxidizes and dissolves the mineralized uranium, which is present in a reduced chemical state. The resulting uranium-rich solution, the "pregnant" lixiviant, will be drawn to recovery wells by pumping, and then transferred to the CPP via a network of underground pipes. At the CPP, the uranium will be extracted from the solution using an ion exchange process. The resulting "barren" (i.e., uranium-depleted) solution will then be recharged with the oxidant and re-injected to recover additional uranium. The uranium collected in the ion exchange process is subject to another circuit within the CPP to produce yellowcake. The yellowcake is packaged and shipped off-site to a uranium conversion facility, the next step in the fuel cycle process for developing fuel for commercial nuclear power plants.

Alternatives Considered in Reaching the Decision:
The NRC staff analyzed three alternatives in detail before deciding to issue Strata a license. These alternatives included: (i) the Proposed Action in the license application (described above), (ii) the No-Action Alternative, and (iii) the North Ross Project. Under the No-Action Alternative, the NRC staff would not approve Strata's license application, which would result in Strata not constructing or operating the proposed Ross Project. The No-Action Alternative was included to provide a benchmark for the NRC staff to compare and evaluate the potential impacts of the other two alternatives. In the North Ross Project alternative, the proposed Ross Project facility (i.e., the CPP, surface impoundments, and auxiliary structures) would be constructed at a site north of where it is proposed to be located in the Proposed Action, but the wellfields would remain in the same locations as in the Proposed Action. In the Final SEIS (NRC, 2014a), the NRC staff describes the three alternatives (Section 2.1) and compares their potential environmental impacts (Section 2.3 and Table ExS.1 in the Executive Summary).

The NRC staff considered a number of other alternatives when evaluating the Proposed Action. The staff eliminated these alternatives from detailed analysis, however, for reasons discussed in Section 2.2 of the Final SEIS (NRC, 2014a). These alternatives included recovery of uranium by conventional uranium mining and milling (Section 2.2.1), the use of a lixiviant with different chemistry (Section 2.2.2), and alternative methods of waste management (Section 2.2.3).

Preferences Among Alternatives Based on Relevant Factors:
In Chapter 4 of the Final SEIS (NRC, 2014a), the NRC staff assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of the proposed Ross Project. The staff also assessed the potential impacts of the No-Action Alternative and the North Ross Project alternative. The NRC staff assessed the impacts of these three alternatives on the following resource areas: land use, transportation, geology and soils, water resources, ecology, air quality, noise, historical, cultural and paleontological resources, visual and scenic resources, socioeconomics, environmental justice, public and occupational health and safety, and waste management. The staff compared the potential environmental impacts of the three alternatives in Section 2.3 and Table ExS.1 in the Executive Summary of the Final SEIS (NRC, 2014a). In Chapter 5 of the Final SEIS, the NRC staff evaluated the potential for cumulative impacts associated with the Proposed Action and other past, present, or reasonably foreseeable future actions. Additionally, in Chapter 7 of the Final SEIS, the staff summarized the costs and benefits associated with the Proposed Action and the two alternatives. In preparing the Final SEIS, the NRC staff also considered, evaluated, and addressed the public comments received on the Draft SEIS published on March 29, 2013 (78 Fed. Reg. 19330).

After weighing the impacts of the Proposed Action and comparing the alternatives, and evaluating safety issues associated with the Proposed Action, the NRC staff determined that the NRC should issue a source materials license for the proposed Ross Project. The NRC staff based its decision on: (i) the license application, including the Applicant's environmental report (Strata, 2011a-b), and the Applicant's supplemental submissions and responses to the NRC staff requests for additional information (Strata 2011c; Strata and Crook County, 2011d; Strata, 2012a-b); (ii) the NRC staff's consultations with Federal, State, and local agencies and with Native American Tribes; (iii) independent NRC staff review; (iv) the NRC staff's consideration of comments received on the Draft SEIS (see Appendix B in the Final SEIS (NRC, 2014a)); (v) the assessments in the NRC staff's Final SEIS (NRC, 2014a) and in the GEIS (NRC, 2009); and (vi) the assessments in the NRC staff's Safety Evaluation Report (NRC, 2014e-f) for the Ross Project.

Measures to Avoid or Minimize Environmental Harm from the Alternative Selected:
As described below, the NRC has taken all practicable measures within its jurisdiction to avoid or minimize environmental harm from the alternative selected. In its license application (Strata, 2011a-b) and in its supplemental submissions and responses to NRC staff requests for additional information (Strata 2011c; Strata and Crook County, 2011d; Strata, 2012a-b), the Applicant identified mitigation measures that are intended to either minimize or avoid potential adverse environmental impacts from construction, operation, aquifer restoration, and decommissioning of the Ross Project. The Applicant also identified environmental measurements and monitoring programs to verify compliance with the applicable standards and requirements for the protection of worker health and safety in active uranium recovery areas

(i.e., both the facility and the wellfields) and for the protection of the public and the environment beyond the licensed facility's boundary. As discussed below, the Applicant's mitigation measures and monitoring programs are conditions in the materials license.

The mitigation measures identified by the Applicant are described for each resource area in Chapter 4 of the Final SEIS (NRC, 2014a). The Applicant's environmental measurements and monitoring programs for the Ross Project are described in detail in Chapter 6 of the Final SEIS (NRC, 2014a), organized as follows: Radiological Monitoring (Section 6.2), Physicochemical Monitoring (Section 6.3), Meteorological Monitoring (Section 6.4), and Ecological Monitoring (Section 6.5). These monitoring programs will provide data on operating and environmental conditions so that prompt corrective actions can be implemented when adverse conditions are detected.

Administrative Condition 9.2 of Materials License SUA-1601 (NRC, 2016b) requires Strata to conduct operations in accordance with the commitments, representations, and statements contained in the license application and supplementary submissions. License Condition 9.2 incorporates by reference Strata's approved application and the supplements to its application. Strata's commitments, representations, and statements include the mitigation measures and monitoring programs described above. An additional license condition relevant to mitigation measures is Administrative Condition 9.8, which requires mitigation of impacts to cultural resources and adherence to the April 24, 2014 Programmatic Agreement (NRC, 2014g). Additional license conditions relevant to monitoring include License Conditions 9.10, 10.9, 10.15, 10.16,10.20, 11.1A, 11.1D, 11.2, 11.3, 11.5, 12.6, 12.7, 12.8, 12.9, , 12.10, 12.11A, 12.11C, and 12.12.

References:

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Docket No. 040-09091
License No. SUA-1601

FOR THE NUCLEAR REGULATORY COMMISSION

Date: 9/28/16

Signature: Craig G Erlanger

Craig G. Erlanger, Director
Division of Fuel Cycle Safety, Safeguards,
and Environmental Reviews
Office of Nuclear Material Safety and Safeguards

CERTIFICATE OF SERVICE

I hereby certify that on February 15, 2017, undersigned counsel for Petitioners filed the foregoing Joint Appendix with the U.S. Court of Appeals for the District of Columbia Circuit by filing the same with the Court's CM/ECF filing system. The following counsel will be served through this filing:

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*/s/ Howard M. Crystal*_
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