

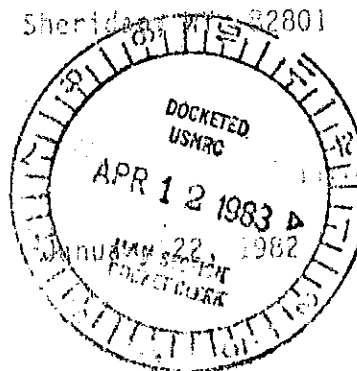
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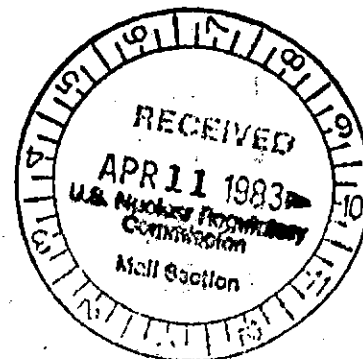


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ASSESSMENT RESTORATION ACTIVITIES

SUNDANCE PROJECT



Prepared for

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ERMIT NO. LE #19

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## BACKGROUND

### INTRODUCTION

On September 19, 1979, ND Resources, Inc. shut down restoration operations on Test Site No. 1 at their Sundance Project in situ solution mining test site. LE #19

Nuclear Dynamics, Inc., as operator for Nubeth Joint Venture, has requested permission from the Wyoming Department of Environmental Quality, Land Quality Division to plug and seal all wells in the Phase I field of their In Situ Solution Mining Test Site at the Sundance Project in Brook County, Wyoming.

At the request of Mr. Al Stoick of ND Resources, Inc. (formerly Nuclear Dynamics), Mr. Doyl Fritz of Western Water Consultants, Inc., Sheridan, Wyoming has examined the restoration water quality at the test site to provide an independent opinion as to whether the restoration activities have met the requirements of the Wyoming Environmental Quality Act and accompanying rules and regulations. This report presents the findings of Western Water Consultants, Inc. The report has been reviewed by a second independent contractor, Margery A. Hulburt, Consulting Hydrogeologist of Cheyenne, Wyoming. Ms. Hulburt's comments have been incorporated into the text of this report.

## BACKGROUND

On September 19, 1979, ND Resources, Inc. shut down restoration operations on Test Site No. 1 at their Sundance Project in situ solution mining test site. LE #19

on these four wells at the request of LQD since these are the four "pattern wells" for which baseline had been established.

On April 23, 1980 check sampling of other water quality in pattern wells commenced. results with established restoration criteria. On September 26, 1980, ND Resources, Inc. submitted to the Wyoming Department of Environmental Quality (DEQ) Land Quality Division (LQD) a report entitled "1980 Activity and Restoration Report" describing the results of restoration monitoring at the site. Accompanying this submittal to LQD was a request for permission to plug and seal off all the wells in the Phase I well field and then reclaim the well sites.

On March 31, 1981 LQD responded to that request by stating that certain parameters remained above the "pre-mining use category" in certain wells. Permission to plug and seal off the Phase I wells was not given by LQD.

Since that time additional sampling has been done by ND Resources. Several wells have been included in this sampling program, with emphasis placed on wells 19X (adjacent to the recovery well), injection well 20X (also called I-2), and buffer wells 3X (B-1) and 4X (B-3). Emphasis was placed on these four wells at the request of LQD since these are the four "pattern wells" for which baseline had been established.

This report presents the results of this additional sampling and compares the results with established restoration criteria.

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standards (pH, TDS, Cd, Pb, SO<sub>4</sub>, NH<sub>3</sub>-N, Ra226, and gross alpha), five Class II standards (pH, Cd, SO<sub>4</sub>, Ra226, and gross alpha), and four Class III standards (pH, Cd, Ra226, and gross alpha). RESTORATION CRITERIA

The ground water in the B zone aquifer would probably be classed as a Class IV (A) ground water according to Water Quality Division Rules and Regulations, Chapter VIII. Class (one-zone sand) were established during licensing as the highest average concentration for any given parameter at any well in the baseline study plus 10 percent of that average (averages were based on five samples). Exceptions were pH, which was established as the highest average pH at any well plus 0.2 standard pH units, and uranium, which was established as the highest average concentration of uranium at any well plus 0.1 milligram per liter (mg/l).

The restoration criteria established for wells in the B aquifer are presented in Table 1. Table 1 also shows, for purposes of comparison, Wyoming's water quality standards for Class I (domestic), Class II (irrigation) and Class III (livestock) ground waters. It is important to note that assuming all restoration criteria were met the water would still not meet established standards as a Class I, II, or III water. The restoration criteria exceed eight Class I standards (pH, TDS, Cd, Pb, SO<sub>4</sub>, NH<sub>3</sub>-N, Ra226, and gross alpha), five Class II standards (pH, Cd, SO<sub>4</sub>, Ra226, and gross alpha), and four Class III standards (pH, Cd, Ra226, and gross alpha).

The ground water in the B zone aquifer would probably be classed as a Class IV (A) ground water according to Water Quality Division Rules and Regulations, Chapter VIII. Class

Ra226 (pCi/l) 15.0  
 Gross α (pCi/l) 230.0  
 Gross β (pCi/l) 267.0

Table 1. Established Restoration Criteria for B Aquifer  
in Comparison to Wyoming Ground Water Standards

(All units in mg/l unless otherwise noted.)

Parameter	Restoration Value	Class I Standard	Class II Standard	Class III Standard
		6.5 - 9.0	4.5 - 9.0	6.5 - 8.5
pH (s.u.)	9.32	---	---	---
Cond. (μmhos/cm)	2898.0	---	---	---
Na	733.0	---	---	---
TDS	1940.0	500.0	2000.0	5000.0
As	0.015	0.05	0.1	0.2
Se	0.008	0.01	0.02	0.05
NO <sub>3</sub> /NO <sub>2</sub> -N	0.088	---	---	100.0
Ba	0.01	1.0	---	---
B	0.638	0.75	0.75	5.0
Cd	0.061	0.01	0.01	0.05
Cr	0.026	0.05	0.1	0.05
Cu	0.01	1.0	0.2	0.5
Fe	0.146	0.3	5.0	---
Pb	0.053	0.05	5.0	0.1
Mn	0.017	0.05	0.2	---
Hg	0.00005	0.002	---	0.00005
Ni	0.024	---	0.2	---
Zn	0.024	5.0	2.0	25.0
Mo	0.005	---	---	---
Ca	8.91	---	---	---
Mg	3.41	---	---	---
Cl	14.3	250.0	100.0	2000.0
K	8.69	---	---	---
SO <sub>4</sub>	891.0	250.0	200.0	3000.0
CO <sub>3</sub>	33.0	---	---	---
HCO <sub>3</sub>	660.0	---	---	---
NH <sub>3</sub> -N	1.089	0.5	---	---
Y	0.01	---	0.1	0.1
Ag	0.005	0.05	---	---
U	0.219	5.0	5.0	5.0
Ra226 (pCi/l)	93.5	5.0	5.0	5.0
Gross α (pCi/l)	230.0	15.0	15.0	15.0
Gross β (pCi/l)	267.0	---	---	---

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columns in Table 2 through 5 present comparisons of post-restoration assay values to the established restoration criteria (item 2 above) and to Wyoming Class II criteria (item 3 above). Class II criteria were used for comparison since that is the highest use to which the water could conceivably be put, even though the natural water does not meet all Class II criteria. TDS alone would prohibit use of water from the B aquifer for domestic uses. LE #19

#### RESTORATION ASSAYS

Tables 2 through 5 present restoration assay summaries for wells 3X, 4X, 19X and 20X, the four Pattern I wells for which extensive baseline and restoration data are available. The tables present for purposes of comparison (1) the individual well baseline values, (2) restoration criteria established for this project during the processing of License to Explore No. 19, (3) Class II water quality criteria, and (4) the post-restoration assay values as determined by CDM Laboratories of Wheat Ridge, Colorado and by Chemical and Geological Laboratories of Casper, Wyoming. The last two columns in Table 2 through 5 present comparisons of the post-restoration assay values to the established restoration criteria (item 2 above) and to Wyoming Class II criteria (item 3 above). Class II criteria were used for comparison since that is the highest use to which the water could conceivably be put, even though the natural water does not meet all Class II criteria. TDS alone would prohibit use of water from the B aquifer for domestic uses. LE #19

Table 2 - RESTORATION SUMMARY WELL NO. 28 (B-1)  
(All values in  $\mu\text{g/l}$  unless otherwise noted.)

Parameter	Mean Baseline	Restoration Criteria	Class II Criteria	Assay Values and Dates						Meets Restoration Criteria?	Meets Class II Criteria?
				CCL Lab							
				3-11-81	3-31-81	5-12-81	7-22-81	10-14-81	10-14-81		
pH (s.u.)	8.73	9.32	4.5 - 9.0	8.2	8.1	8.1	8.2	8.3	8.3	YES	YES
Cond. ( $\mu$ mho/cm)	2511	2899	---	550	570	563	563	580	568	YES	YES
TDS	1624	1940	2000.0	1850	1620	1520	-0.005	-0.005	-0.01	YES	YES
As	0.011	0.015	0.1	0.013	-0.035	0.005	-0.005	-0.005	-0.01	YES	YES
Se	0.003	0.038	0.02	-0.005	0.36	0.05	-0.05	0.42	0.01	NO	---
NO <sub>3</sub> /NO <sub>2</sub> -N	0.06	0.089	---	---	-0.2	-0.2	-0.01	-0.2	0.01	YES	---
Ba	-0.01	0.01	---	---	0.6	0.5	---	0.5	0.005	YES	YES
B	0.55	0.638	0.75	---	-2.01	-0.01	---	-0.005	0.011	YES	YES
Cd	0.053	0.026	0.01	---	-0.02	-0.02	---	-0.005	0.005	YES	YES
Cr	-0.01	0.026	0.1	---	-0.05	-0.05	---	0.14	0.03	YES	YES
Cu	-0.01	0.61	0.2	4.4	0.15	-0.05	---	-0.005	0.014	YES	YES
Fe	0.079	0.145	5.0	---	-0.005	-0.005	---	0.006	0.017	YES	YES
Pb	0.033	0.053	5.0	---	-0.05	-0.05	---	0.001	0.002	YES	YES
Mn	0.012	0.017	0.2	---	-0.001	-0.001	---	0.02	0.003	YES	YES
Hg	0.006	0.006	---	---	-0.05	-0.05	---	0.017	-0.1	YES	---
Ni	0.021	0.024	0.2	---	-0.05	-0.05	---	0.017	0.01	YES	---
Zn	0.013	0.024	2.0	0.021	0.058	0.010	0.006	5.4	67.7	YES	YES
Mo	-0.005	0.005	---	---	4.4	5.9	---	2.6	640	YES	---
Ca	7.7	8.91	---	---	2.9	2.5	---	13	640	YES	---
Mg	2.8	3.41	---	---	16	11	---	3.3	640	YES	---
Cl	13	14.3	100.0	---	3.5	4.3	---	725	640	YES	---
K	4.3	8.69	---	---	726	752	---	0	640	YES	---
SO <sub>4</sub>	727	891	200.0	---	0	0	---	0	640	YES	---
CO <sub>3</sub>	15	33	---	557	551	594	---	505	640	YES	---
HCO <sub>3</sub>	576	660	---	---	-0.2	0.2	---	-0.2	640	YES	---
NH <sub>4</sub> -N	0.73	1.089	---	0.03	0.006	0.008	-0.005	0.077	-0.05	YES	YES
V	-0.005	0.01	0.1	---	-0.02	-0.02	---	-0.005	0.24	NO	YES
Ag	-0.005	0.005	---	0.12	0.18	0.64	0.51	0.24	0.25	YES	NO
U	0.071	0.219	5.0	---	22	9.5	---	22	16	YES	NO
Ra226	77	93.5	5 pCi/l	---	180	400	310	130	68	YES	---
Gross $\alpha$ (pCi/l)	209	230	15 pCi/l	---	56	220	190	68	68	YES	---
Gross $\beta$ (pCi/l)	218	267	---	---	---	---	---	---	---	YES	---

\*Blank space indicates no assay for given date. \*--- indicates no Wyoming Standard. \* - indicates less than value shown.

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Table 3 - RESTORATION SUMMARY WELL NO. 4X (B-3)  
(all values in  $\mu\text{g/l}$  unless otherwise noted.)

Parameter	Mean Baseline	Restoration Criteria	Class II Criteria	C & G Lab						Peets Restoration Criteria?	Peets Class II Criteria?
				C & G Lab							
				3-10-81	3-31-81	5-12-81	7-23-81	10-14-81	10-14-81		
pH (S.U.)	8.92	9.32	4.5 - 9.0	8.9	8.1	8.2	8.4	8.3	8.3	YES	YES
Cond. (µmho/cm)	2496	2898	---	550	580	569	---	2700	570	YES	YES
Na	631	733	---	1630	1630	1640	---	1510	---	YES	YES
TDS	1660	1910	2000-2	-0.005	0.035	-0.005	-0.005	-0.005	-0.01	YES	YES
As	0.012	0.015	0.1	-0.005	0.013	-0.005	-0.005	-0.005	-0.01	YES	YES
Se	0.003	0.035	0.02	-0.005	0.50	0.34	0.07	-0.05	-0.01	YES	---
NO <sub>3</sub> /NO <sub>2</sub> -N	0.05	0.686	---	-0.2	-0.2	-0.2	---	-0.2	-0.2	YES	---
Ba	-0.01	0.01	---	0.6	0.6	0.4	---	0.6	0.6	YES	YES
R	0.55	0.638	0.75	-0.01	-0.01	-0.01	---	-0.005	-0.005	YES	YES
Cd	0.0055	0.026	0.01	-0.02	-0.02	-0.02	---	0.016	0.016	YES	YES
Cr	-0.01	0.026	0.1	-0.05	-0.05	-0.05	---	-0.005	-0.005	YES	YES
Cu	-0.01	0.01	0.2	0.18	0.18	-0.05	---	0.13	0.13	YES	YES
Fe	0.073	0.16	5.0	0.005	-0.005	-0.005	---	-0.005	-0.005	YES	YES
Pb	0.043	0.053	5.0	-0.05	-0.05	-0.05	---	0.028	0.028	YES	YES
Mn	0.010	0.017	0.2	-0.0001	-0.0001	-0.0001	---	-0.0001	-0.0001	YES	---
Hg	-0.0001	0.0001	---	-0.05	-0.05	-0.05	---	0.02	0.02	YES	YES
Ni	0.022	0.024	0.2	0.02	0.02	-0.05	0.01	0.011	0.011	YES	YES
Zn	0.008	0.024	2.0	0.007	0.007	0.006	0.008	0.010	0.010	YES	---
Mo	-0.005	0.005	---	4.7	6.2	6.2	---	5.5	5.5	YES	---
Ca	8.1	8.91	---	2.9	2.4	2.4	---	2.6	2.6	YES	YES
Mg	2.7	3.41	---	13	11	11	---	12	12	YES	YES
Cl	10	14.3	100.0	3.6	4.5	4.5	---	3.9	3.9	YES	YES
K	7.1	8.69	---	739	750	750	---	715	715	YES	YES
SO <sub>4</sub>	753	891	---	51	0	0	12	0	0	YES	---
CO <sub>3</sub>	27	33	---	638	568	619	542	588	588	YES	---
HCO <sub>3</sub>	570	660	---	-0.2	0.3	0.3	---	0.4	0.4	YES	---
NH <sub>3</sub> -N	0.85	1.039	---	-0.005	-0.005	0.014	-0.005	0.094	0.094	YES	YES
V	-0.005	0.01	0.1	-0.02	-0.02	-0.02	---	-0.005	-0.005	YES	---
Ag	-0.005	0.005	---	0.12	0.16	0.16	0.16	0.22	0.22	YES	YES
U	0.089	0.219	5.0	16	14	14	---	26	26	YES	YES
Ra226	16	93.5	5 pCi/l	118	160	160	130	180	180	YES	YES
Gross α(pCi/l)	145	230	15 pCi/l	67	35	35	60	49	49	YES	YES
Gross β(pCi/l)	95	267	---	---	---	---	---	---	---	YES	YES

\*Blank space indicates no assay for given date. --- indicates no Myring Standard. - indicates less than value shown.

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Table 4 - RESTORATION SUMMARY WELL NO. 20A (1-2)  
(all values in mg/l unless otherwise noted.)

Parameter	Mean Baseline	Restoration Criteria	Class II Criteria	Assay Values and Dates						C & G Lab 10-14-81	Meets Restoration Criteria?	Meets Class II Criteria?
				3-12-81	4-1-81	5-12-81	7-22-81	10-14-81	10-14-81			
pH (s.u.)	8.77	9.22	5.5 - 9.0	8.5	8.4	8.1	8.7	8.5			YES	YES
Cond. (umho/cm)	2036	2593	---	590	2570	2323		2700	580		YES	---
Ca	516	733	---	1690	580	509		1520			YES	YES
TDS	1254	1940	2000.0	1690	1690	1770	0.010	0.005	-0.01		YES	YES
As	0.038	0.015	0.1	0.019	0.016	-0.005	-0.005	-0.005	-0.01		YES	---
Se	0.001	0.039	0.02	-0.005	0.010	-0.005	0.24	-0.05			YES	---
NO <sub>2</sub> /NO <sub>3</sub> -N	0.06	0.083	---		-0.05	0.52		-0.2			YES	---
Ba	-0.01	0.01	---		-0.2	-0.2		0.6			YES	YES
F	0.58	0.638	0.75		0.7	0.4		-0.005			YES	YES
Cd	0.025	0.026	0.01		-0.01	-0.01		0.012			YES	YES
Cr	-0.01	0.026	0.1		-0.02	-0.02		-0.005			YES	YES
Cr	-0.01	0.01	0.2		-0.05	-0.05		0.07	0.03		YES	YES
Cu	0.109	0.146	5.0	0.44	0.12	-0.005		-0.005			YES	YES
Fe	0.035	0.053	5.0		-0.005	-0.005		0.015			YES	YES
Pb	0.011	0.017	0.2		-0.05	-0.05		-0.0001			YES	YES
Mn	-0.0001	0.011	---		-0.0001	-0.0001		-0.02			YES	YES
Hg	0.012	0.024	0.2		-0.05	-0.05		0.095	0.01		YES	YES
Ni	0.002	0.024	2.0		-0.03	-0.05	-0.01	0.010	-0.1		YES	---
Zn	-0.005	0.035	---	0.016	-0.032	0.005	-0.005	3.9			YES	---
Mo	4.9	8.91	---		3.4	6.3		2.2			YES	---
Ca	2.7	3.41	---		2.2	2.5		11	16		YES	---
Mg	6	14.3	100.0		12	12		3.7			YES	---
Cl	4.7	8.69	---		652	755		722	725		YES	---
K	401	891	200.0		4	0	62	11			YES	---
SO <sub>4</sub>	30	33	---		580	591	444	520			YES	---
CO <sub>3</sub>	707	660	---		0.6	-0.2		0.6			YES	YES
HCO <sub>3</sub>	0.37	1.099	---		0.029	0.005	-0.005	0.101	-0.05		YES	---
NH <sub>3</sub> -N	-0.005	0.01	0.1		-0.02	-0.02		-0.005			YES	---
V	-0.005	0.025	---		0.081	0.088	0.065	0.068	0.055		YES	YES
Ag	0.032	0.219	5.0	0.094	0.081	0.088		20	8.6		YES	NO
U	1.5	93.5	15 pCi/l		17	21	---	85			YES	NO
Ra226	4	230	15 pCi/l		160	88	35	36			YES	---
Gross a(pCi/l)	5	267	---		39	28	6				YES	---

\*Blank space indicates no assay for given date. \*--- indicates no Wyming Standard. \* - indicates less than value shown.

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Table 5 - RESTORATION SUMMARY WELL NO. 19X  
(All values in mg/l unless otherwise noted.)

Parameter	Mean Baseline	Restoration Criteria	Class II Criteria	Assay Values and Dates						C & G Lab	Meets Restoration Criteria?	Meets Class II Criteria?
				3-12-81	4-1-81	5-12-81	7-22-81	10-14-81	12-14-81			
pH (s.u.)	8.51	9.32	8.5 - 9.0	8.6	8.5	8.1	8.2	8.3	8.3	10-14-81	YES	YES
Cond. (µmho/cm)	2513	2898	---	620	7240	2460	---	2600	2600	---	YES	---
Na	619	733	---	1750	630	516	---	805	805	569	YES	---
TDS	1672	1930	2000.0	0.084	1690	1630	0.011	-0.005	-0.005	-0.01	YES	YES
As	0.011	0.015	0.1	0.009	0.054	-0.005	-0.005	-0.005	-0.005	-0.01	YES	YES
Se	0.002	0.038	0.02	0.009	0.055	0.52	0.26	0.54	0.54	---	NO	---
NH <sub>4</sub> /NO <sub>2</sub> -N	0.05	0.053	---	---	-0.05	-0.2	---	-0.2	-0.2	---	---	---
Ba	-0.01	0.01	---	---	-0.2	-0.2	---	---	---	---	---	---
B	0.45	0.638	0.75	---	0.6	0.5	---	0.7	0.7	---	YES	YES
Cd	0.0053	0.026	0.01	---	-0.01	-0.01	---	-0.005	-0.005	---	YES	YES
Cr	-0.01	0.026	0.1	---	-0.02	-0.02	---	0.01	0.01	---	YES	YES
Cu	-0.01	0.01	0.2	0.33	-0.05	-0.05	---	0.17	0.17	0.03	YES	YES
Fe	0.108	0.146	5.0	---	-0.035	-0.005	---	-0.005	-0.005	---	YES	YES
Pb	0.038	0.053	5.0	---	-0.05	-0.05	---	0.026	0.026	---	NO	---
Mn	0.013	0.017	0.2	---	-0.05	-0.05	---	0.02	0.02	---	YES	YES
Hg	-0.0101	0.031	---	---	-0.0001	-0.0001	---	0.019	0.019	0.03	YES	YES
Ni	0.018	0.024	0.2	---	-0.05	-0.05	---	0.01	0.01	-0.1	YES	YES
Zn	0.008	0.025	2.0	0.072	0.03	0.01	0.027	0.011	0.011	---	YES	YES
Mo	-0.005	0.035	---	---	0.075	0.06	---	5.5	5.5	---	YES	---
Ca	6.9	8.91	---	---	2.8	6.6	---	2.8	2.8	16	YES	YES
Mg	2.9	3.41	---	---	2.3	2.5	---	13	13	---	YES	---
Cl	12	14.3	100.0	---	13	12	---	3.1	3.1	700	YES	---
K	3.8	8.69	---	---	3.6	4.2	---	722	722	---	YES	---
SO <sub>4</sub>	761	891	200.0	---	652	764	---	0	0	---	YES	---
CO <sub>3</sub>	10	33	---	19	13	0	---	531	531	---	YES	---
HCO <sub>3</sub>	581	660	---	726	676	595	---	0.4	0.4	---	YES	---
NH <sub>4</sub> -N	0.59	1.099	---	---	0.5	0.4	0.057	-0.2	-0.2	-0.05	NO	YES
V	-0.005	0.01	0.1	0.560	0.457	0.049	---	0.005	0.005	---	YES	---
Ag	-0.005	0.035	---	---	-0.02	-0.02	---	0.84	0.84	0.485	NO	YES
U	0.119	0.219	5.0	8.0	1.1	1.4	---	31	31	20	YES	NO
Ra226	85	93.5	5 pCi/l	---	37	30	---	360	360	---	NO	---
Gross α(pCi/l)	123	230	15 pCi/l	---	850	830	270	91	91	---	YES	---
Gross β(pCi/l)	243	267	---	---	770	500	---	---	---	---	---	---

\*Blank space indicates no assay for given date.

\*\*\* indicates no monitoring Standard.

\* - indicates less than value shown.

\*Blank space indicates no assay

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restored water meets a  
with the exceptions of sulfate, radium 226 and  
gross alpha, which were above Class II criteria in the natural  
water. From Table 2 it may be seen that well 3X (or B-1) is  
fully restored to established criteria for all parameters  
with the exceptions of nitrate/nitrite nitrogen, molybdenum,  
vanadium and uranium. However, the restored water meets  
all Wyoming Class II standards which were met by the natural  
water.

From Table 3 it may be seen that well 4X (or B-3) is  
fully restored to established restoration criteria with the  
exceptions of manganese, molybdenum, vanadium and uranium.  
Again, the restored water meets all Wyoming Class II criteria  
which were met by the natural water.

Wells 3X and 4X were used as buffer wells, meaning that  
they received only formation water and not solution mining  
chemicals. Thus, it is probable that the restoration values  
which are exceeded are the result of analytical errors or  
natural water quality fluctuations.

From Table 4 it may be seen that well 20X (or injection  
well I-2) has been fully restored to established restoration  
criteria with the single exception of vanadium. Again, the  
restored water meets all Class II criteria, including  
vanadium, with the exceptions of sulfate, radium 226 and  
gross alpha, which were above Class II criteria in the natural  
water.

Table 5 shows that well 19X (within the production zone)  
has been fully restored to established restoration criteria  
with the exceptions of nitrate/nitrite nitrogen, boron,  
manganese, molybdenum, vanadium, uranium and gross alpha.

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practical limits, met established restoration criteria. Further, it is clearly demonstrated that the restored water does in fact exhibit a quality of use equal to and consistent with uses for which the water was suitable prior to However, it meets all Class II criteria (and even Class I criteria, see Table 1) which were met by the natural water with Class II water quality criteria. The restoration values meet all Class II criteria. CONCLUSIONS were met by the natural

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Pattern wells exhibit minor variations from established restoration criteria. However, the restoration meets criteria which would be established under modern regulations. The 1981 LQD rules and regulations (Chapter XXI, Section 3.d) require that "... through the employment of the best practicable technology (WS 35-11-103(f) (i))..." the "... condition and quality of all affected ground water will be returned to background or better, or if not possible, then ... to a quality of use, equal to and consistent with uses for which the water was suitable prior to commencement of the operation..."

Data presented in this report demonstrate that the restoration procedures employed by ND Resources have, within practical limits, met established restoration criteria. Further, it is clearly demonstrated that the restored water does in fact exhibit a quality of use equal to and consistent with uses for which the water was suitable prior to commencement of the operation. This was demonstrated by comparing assays of water from the restored well pattern with Class II water quality criteria. The restoration values meet all Class II criteria which were met by the natural

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Therefore, the conclusion that the water is restored is confirmed.

Water quality trends during the stabilization period water. The natural water does not meet quality standards for domestic, irrigation or livestock waters, and comparison of restoration values with Class II criteria were done merely for illustrative purposes. LE #19

Another method of evaluating restoration success, rather than comparing the restored water to an entire use category, is to compare restored water quality with parameter-by-parameter use categories. That is, the restoration is considered a success if each individual parameter in the restoration assay is within the baseline use category for that particular parameter. Thus, if arsenic meets Class I standards in the baseline sample, it would have to meet Class I standards in the restoration assay even though the water itself is not a Class I water. This method of examining restoration success can be readily applied using data presented in this report by comparing information contained in Tables 1 through 5. Each individual parameter in the final restoration assays meets the same use category suitability that is met by that parameter in the baseline sample. Therefore, the conclusion that the water is restored is confirmed.

Water quality trends during the stabilization period may be determined by examining the various restoration assays presented in Tables 2 through 5. These trends indicate that the restoration assays demonstrate stability over the long term. LE #19

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Therefore, it is concluded that restoration has been achieved and has evidenced stability over a substantial period of time. This restoration meets the requirements of the Wyoming Environmental Quality Act and the 1981 LQD Rules and Regulations. LE #19

13  
It is therefore our opinion that ND Resources, Inc. is justified in requesting permission from DEQ/LQD to plug and seal off all Phase I wells. ND Resources, Inc. has been achieved and has evidenced stability over a substantial period of time. This restoration meets the requirements of the Wyoming Environmental Quality Act and the 1981 LQD Rules and Regulations.

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