SWEC Project No. 05996.02

SUPPLEMENTAL GEOTECHNICAL LABORATORY TESTING NOVEMBER 1999

Prepared for:
Private Fuel Storage, LLC
Private Fuel Storage Facility
Skull Valley, Utah

Prepared by:	Alan C. Smith	12/10/99 Date
Reviewed by:	Thomas Y. Chang	12/10/99 Date
Independently Reviewed by:	Thomas Y. Chang	12/10/99 Date
Approved by:	J. L. Cooper	12/10/99 Date

QUALITY ASSURANCE CATEGORY I
STONE & WEBSTER ENGINEERING CORPORATION
BOSTON, MASSACHUSETTS

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INTRODUCTION

The primary objective of the laboratory testing program was to determine the apparent cohesion and friction angle (total strength parameters) of the soils at the base of the mat foundations for use in the sliding stability analyses and bearing capacity. The direct shear and the consolidated-undrained compression test specimens were obtained from preserved tube sections of thin-walled tube samples obtained from prior testing programs. Testing began on November 8, 1999 and ended on November 12, 1999.

The tests performed included classification, water content, Atterberg limits, direct shear, and consolidated-undrained triaxial compression. They were conducted in accordance with the following American Society for Testing and Materials standards.

D-2216	1992	Test Method for Laboratory Determination of Water (Moisture) Content of Soil, Rock, and Soil-Aggregate Mixtures
D-3080	1998	Test Methods for Direct Shear Test of Soils Under Consolidated Drained Conditions
D-4318	1995a	Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
D-4767	1995	Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils

All laboratory equipment and materials used to conduct this testing program were calibrated and maintained in accordance with the requirements of the Stone & Webster Standard Nuclear Quality Assurance Program.

TEST RESULTS

A total of one additional direct shear test was performed on thin-walled tube sample U-1 from Boring CTB-S and two additional consolidated-undrained triaxial compression tests were performed on thin-walled tube sample U-2 from Boring B-1. The test results are shown in Table 1, along with the results from previous direct shear tests (from Attachment 7) and consolidated-undrained triaxial tests (Attachment 5). A plot of the normal stress vs peak shear stress for each

tube sample is shown after Table 1. The plot of horizontal displacement vs shear stress and data for the direct shear test are presented in Appendix A. The axial strain vs shear stress plots and data from the triaxial compression tests are presented in Appendix B.

For direct shear tests, the samples were trimmed into a nominal 2.5-inch diameter ring and placed in the direct shear apparatus. The samples were not inundated because the soils at the site are not expected to be saturated during the life of the facility. A normal load was applied and the deformation measured. Primary consolidation occurred prior to 1 minute. After at minimum of 90 minutes, the sample was sheared at a displacement rate of 18 mm/hr. The test continued until the shear load peaked and remained constant or started decreasing after 0.25 inches of displacement. The sample was removed and oven dried.

For consolidated-undrained triaxial compression tests, the samples were setup in a triaxial cell and consolidated using a confining pressure of 0 and 1 ksf. They were sheared undrained after consolidating for at least 1 hour. Since the *in situ* soils are not expected to be saturated throughout the life of the proposed facility, these samples were not saturated prior to shearing.

The trimmings from each test were retained and used to prepare an Atterberg limits test sample. For the previous direct shear tests, the trimmings from the same tube were combined for one Atterberg limits test. The results are shown in Table 1.

LABORATORY TESTING PROGRAM
GENERAL INFORMATION

STONE & WEBSTER
ENGINEERING CORPORATION

SHEET 1 OF 3

CLIENT	J.O. NUMBER	REVISION	1	2	3	4	PREPARED BY	DATE PREPARED
Private Fuel Storage, LLC	05996.02 WP 3450	DATE					Alan C Smith	11/8/99
SITE: PFSF Skull Valley, UT		REVISED BY					APPROVED BY: JL COOPER	RECEIVED BY: ACS
FEATURE OR PHASE OF PROJECT: Mat Foundations		NEAREST CITY OR TOWN					NEAREST AIRPORT HANDLING FREIGHT	

PROJECT MANAGER	LEAD GEOTECHNICAL ENGINEER	SUPERVISOR OF FIELD WORK	SUPERVISOR OF OFFICE WORK	CONTACT FOR LABORATORY WORK
J.L. Donnell	PJ Trudeau	RP Gillespie	GR Doton	PJT / TY Chang
DATE PROGRAM ASSIGNED 11/8/99	DATE TESTING TO START 11/8/99	DATE BORING LOG DATA NEEDED	DATE ALL TEST DATA AVAILABLE	DATE ALL FINAL PLOTS FORWARDED

TYPES OF STRUCTURES INVOLVED:
Mat Supported Storage Pads and Canister Transfer Building

PARTICULAR CRITICAL FEATURES OF STRUCTURES:
Soils at Base of Mat Foundations

TYPES OF BEHAVIOR TO BE ANALYZED:
Sliding Stability and Bearing Capacity

TYPICAL ANTICIPATED LOADING STRESSES:
~2 ksf at base of pads

PRIMARY OBJECTIVES OF LABORATORY TESTS:
Determine c & ϕ at Base of Mat in soils supporting mat

GENERAL MAGNITUDE OF TESTING PROGRAM:
Small

NUMBER OF DISTURBED SAMPLES:

NUMBER OF UNDISTURBED SAMPLES:

TYPE OF REPORT TO CONTAIN RESULTS:
Supplemental Geotechnical Laboratory Testing November 1999

UNITS FOR REPORTING STRESSES:
ksf

ADDITIONAL:
All Laboratory Equipment and Testing Procedures shall be carried out under a QA Category I program that meets the applicable requirements of 10CFR50, Appendix B, and 10CFR72.

LABORATORY TESTING PROGRAM
SPECIFIC TEST REQUIREMENTS

STONE & WEBSTER
ENGINEERING CORPORATION

SHEET 2 of 3

CLIENT	J.O. NUMBER	REVISION	1	2	3	4	PREPARED BY	DATE PREPARED
Private Fuel Storage, LLC	05996.02 WP 345W	DATE					A C Smith	11/8/99
SITE: PFSF Skull Valley, UT		REVISED BY					APPROVED BY: JL Cooper	RECEIVED BY: ACS

NOTE	COL. NO.	TYPE OF TEST	REQUIREMENTS OF TYPE OF TEST AND PROCEDURES TO BE USED (SIZE OF SPECIMENS, RATES OF STRAIN, CONFINING PRESSURES, CYCLES OF RECOMPRESSION ETC.)
A	ALL	ALL TESTS	SELECTION OF NECESSARY AND APPROPRIATE DETERMINATIONS AND/OR TEST PROCEDURES TO BE MADE BY LABORATORY PERSONNEL.
B	1	CLASSIFICATION	VISUAL-MANUAL CLASSIFICATION ONLY; NO INDEX PROPERTIES TO BE DETERMINED.
C	1	CLASSIFICATION	VISUAL-MANUAL CLASSIFICATION TO BE SUPPLEMENTED BY DETERMINATIONS OF SPECIFIC INDEX DETERMINATIONS INDICATED IN SUBSEQUENT COLUMNS.
D	3	ATTERBERG LIMITS	FOR CLASSIFICATION PURPOSES ONLY; ONE-POINT LIQUID LIMIT DETERMINATION ACCEPTABLE.
E	5	GRADATION ANALYSES	SIEVE ANALYSIS ONLY; NO HYDROMETER ANALYSIS REGARDLESS OF PERCENT FINES.
F	10	DIRECT SHEAR	$\sigma_N = 0.25$ ksf
G	9	CU	Consolidation Pressure = 0 and 1.0 ksf

LABORATORY TESTING PROGRAM
UTILIZATION OF SAMPLE

STONE & WEBSTER
ENGINEERING CORPORATION

CLIENT	J.O. NUMBER	REVISION	1	2	3	4	PREPARED BY	DATE PREPARED
Private Fuel Storage, LLC	05996.02 WA 345W	DATE					AC Smith	11/8/99
SITE: PFSF Skull Valley, UT		REVISED BY					APPROVED BY: JLCooper	RECEIVED BY: ACS

LETTERS BELOW SPECIFIC TYPES OF TESTS CORRESPOND TO SIMILARLY LETTERED NOTES GIVEN ON SHEET 2

BORING NO.	SAMPLE TYPE	SAMPLE NO.	DEPTH (FT.)	1 CLASSIFICATION	2 WATER CONTENT	3 ATTERBERG LIMITS	4 PERCENT FINES	5 GRADATION ANALYSES	6 SPECIFIC GRAVITY	7 UNIT WEIGHT	8 UNDRAINED COMPRESSION	9 CONSOLIDATED TRIAXIAL	10 DRAINED DIRECT SHEAR	11 CONSOLIDATION	12 COMPACTION	13 RELATIVE DENSITY	14 PERMEABILITY	15	16	17	REMARKS OR REQUIREMENTS FOR TESTING OF SPECIFIC SAMPLES (REFER TO COL. NO. FOR TYPE OF TEST)
CTB-5	U	1				☒							☒								σ_N = 0.25 ksf
B-2	U	2				☒						☒									σ_c = 0 & 1 ksf

☐ TEST TO BE PERFORMED ☐ TEST IN PROGRESS ☒ TEST COMPLETED & CHECKED ☐ TEST CANCELLED

TABLE 1

Direct Shear Test Results

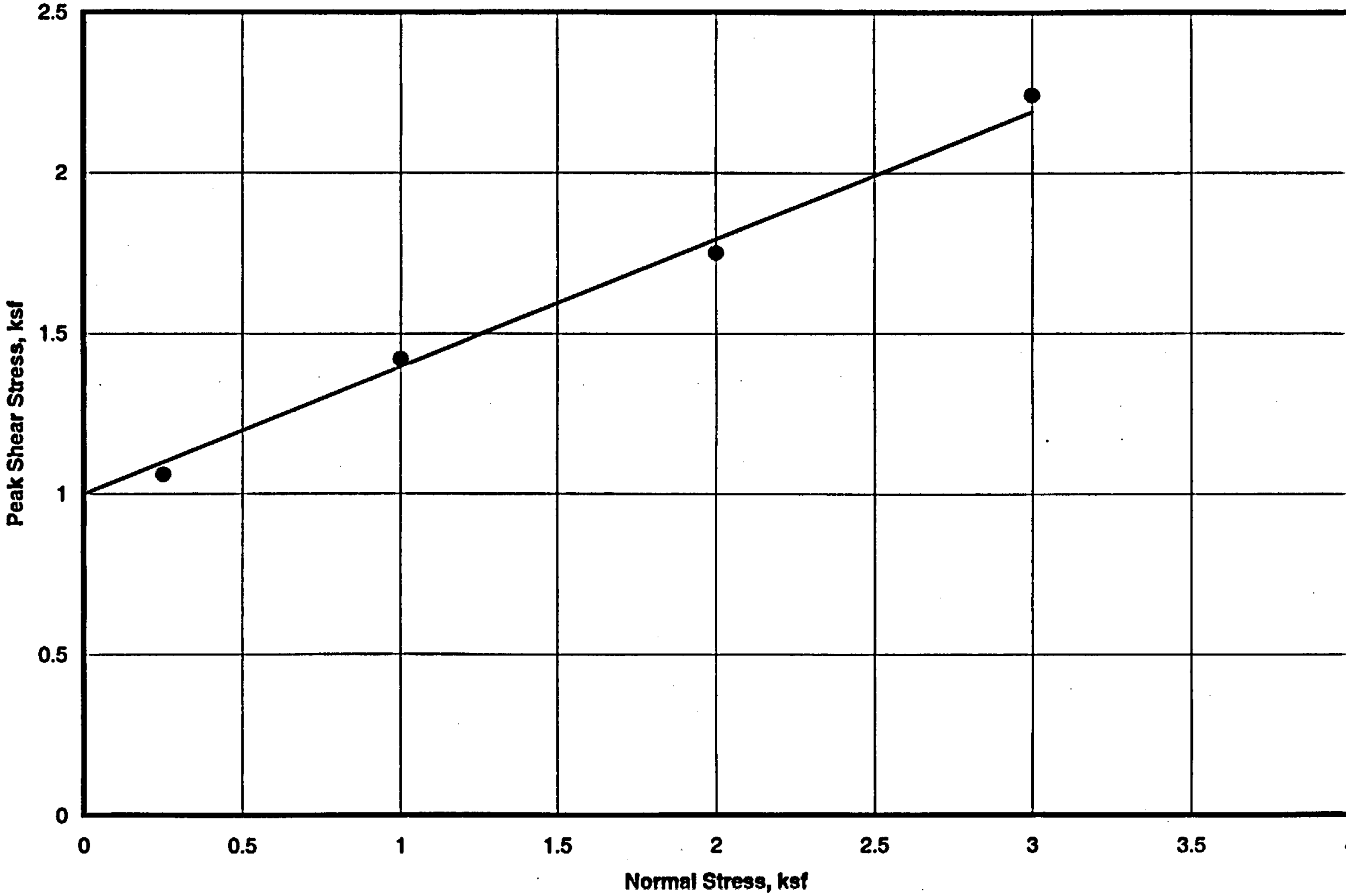
Boring	Sample	Depth (ft)	Elevation (ft)	Atterberg Limits LL	PL	PI	USC Code	Water Content (%)	Initial γ_m (pcf)	γ_d (pcf)	Void Ratio	After Consolid. γ_d (pcf)	Void Ratio	Normal Stress (ksf)	Peak Shear (ksf)	Cohesion (ksf)	Tan ϕ	ϕ (deg)
CTB-S	U-1AA3	5.1	4469.4					80.9	75.7	41.8	3.06	42.6	2.98	3.0	2.24			
CTB-S	U-1AA2	5.3	4469.2	82.7	44.8	37.9	MH	84.6	73.1	39.6	3.29	39.9	3.25	2.0	1.75	1.00	0.397	21.6
CTB-S	U-1AA1	5.4	4469.1					86.8	70.9	37.9	3.48	38.1	3.45	1.0	1.42			
CTB-S	U-1C	6.1	4468.4	79.0	44.8	34.2	MH	69.2	78.8	46.5	2.65	46.6	2.64	0.25	1.05			

Consolidated-Undrained Triaxial Compression Test Results

Boring	Sample	Depth (ft)	Elevation (ft)	Atterberg Limits LL	PL	PI	USC Code	Water Content (%)	Initial γ_m (pcf)	γ_d (pcf)	Void Ratio	After Consolid. γ_d (pcf)	Void Ratio	Confin'g Stress (ksf)	Peak Shear (ksf)	Cohesion (ksf)	Tan ϕ	ϕ (deg)
B-1	U-2B	5.3	4459.5	80.6	40.9	39.7	MH	52.9	70.8	46.3	2.67	46.3	2.67	1.0	2.21	1.4	0.390	21.3
B-1	U-2C	5.9	4458.9	66.1	33.4	32.7	MH	47.1	79.3	53.9	2.15	53.9	2.15	0.0	2.03	1.15	0.390	21.3
B-1	U-2D	6.5	4458.3	59.8	34.7	25.1	MH	45.2	76.7	52.8	2.22	52.8	2.22	2.10	3.26	1.4	0.390	21.3

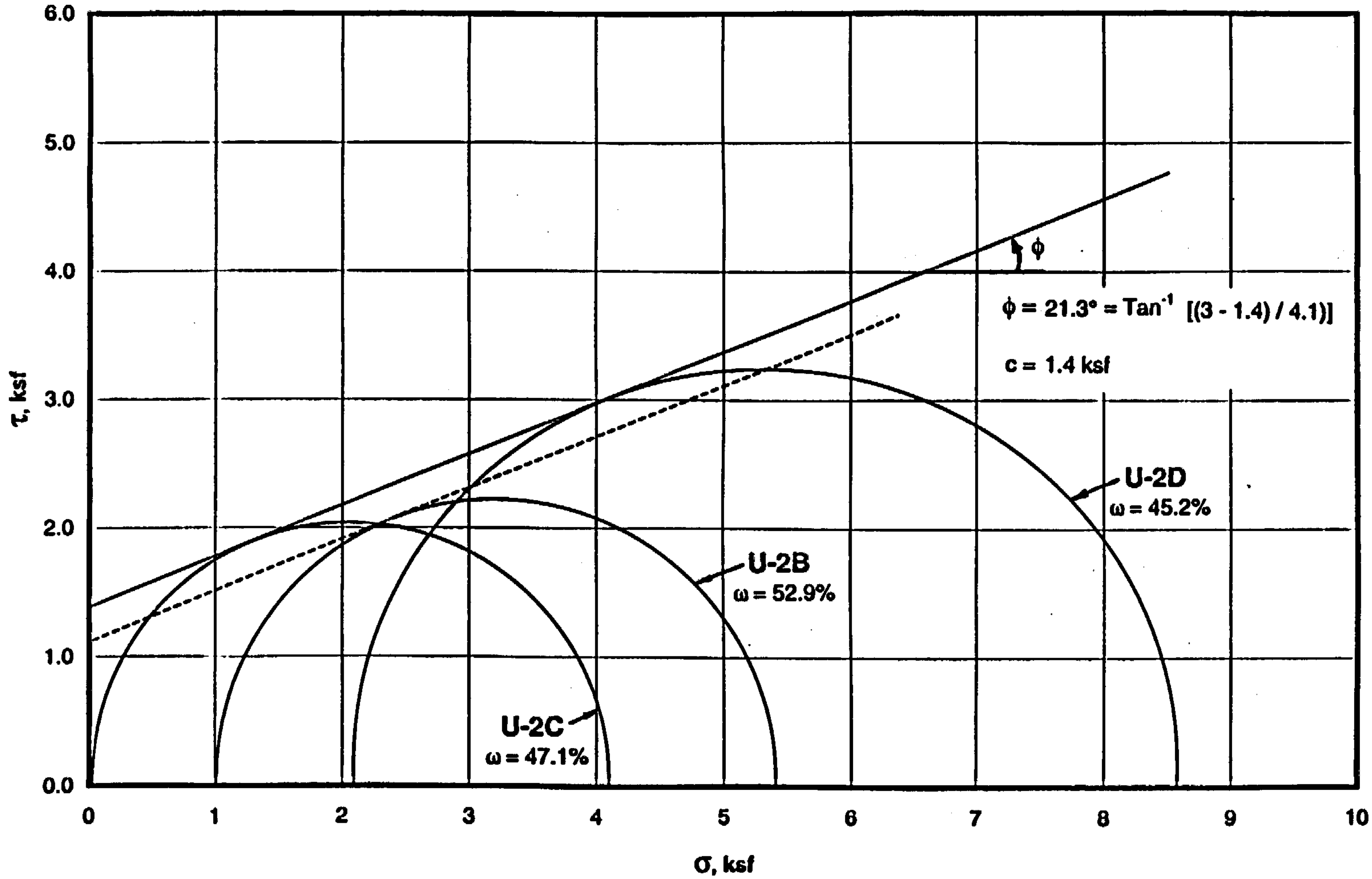
STONE & WEBSTER ENGINEERING CORPORATION

DIRECT SHEAR TEST
Boring CTB-S, Sample U-1AA&C



Total Stress Mohr's Circles

Boring B-1, Sample U-2

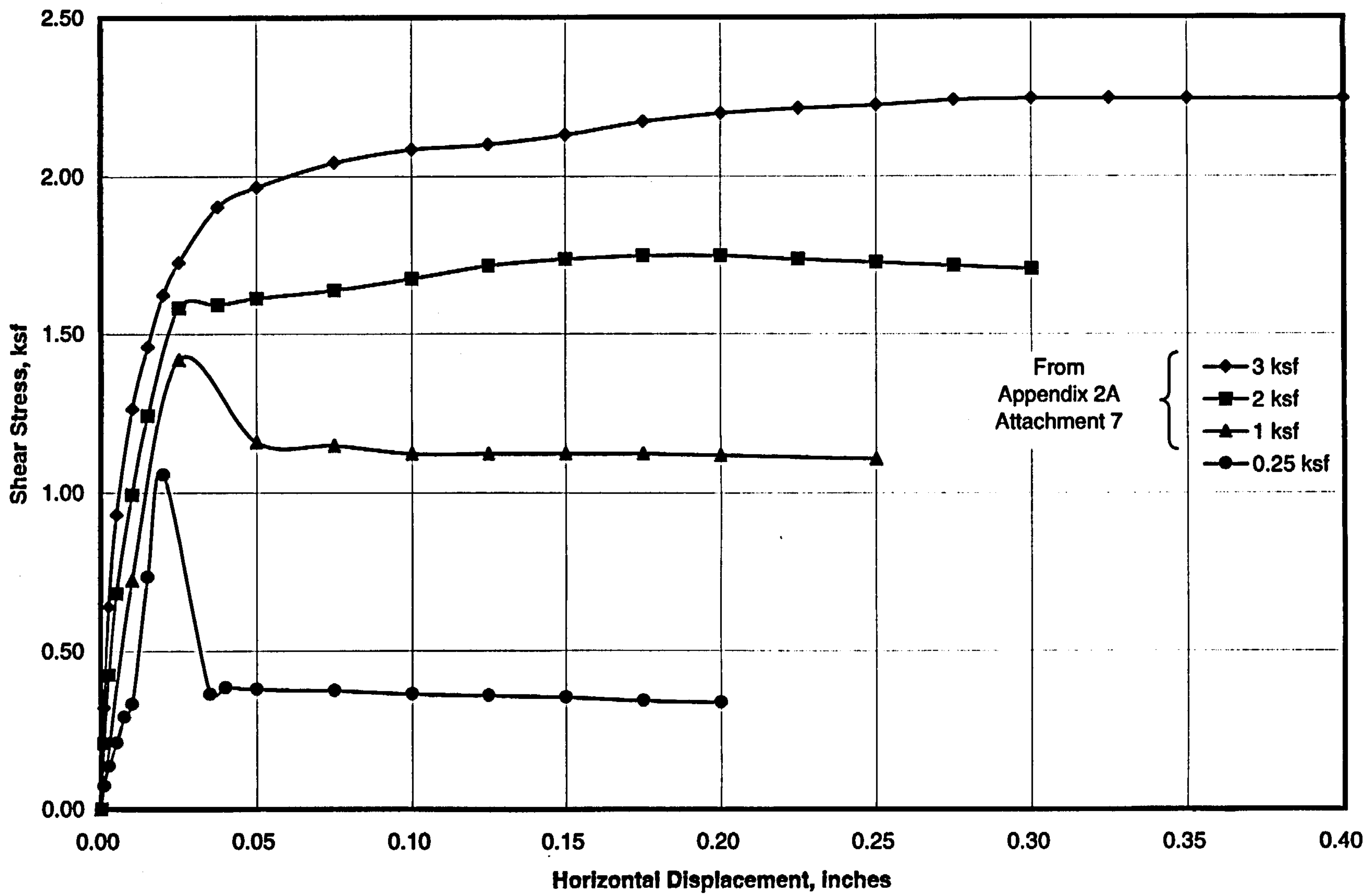


APPENDIX A

Direct Shear Test Plots and Data

STONE & WEBSTER ENGINEERING CORPORATION

DIRECT SHEAR TEST
Boring CTB-S, Sample U-1AA&C



DIRECT SHEAR TEST DATA

SAMPLE INFORMATION:

BORING:	CTB-S	DATE:	11/11/99
SAMPLE:	U-1C	TESTED BY:	ACS
DEPTH:	6.1 ft	CHECKED:	TGC
DESCRIPTION:	Clayey SILT (MH)		
HEIGHT:	0.99 inches	WATER CONTENT:	69.2 %
DIAMETER:	2.50 inches	DRY WEIGHT SOIL:	59.32 g
AREA:	4.90 sq. in.	SPECIFIC GRAVITY:	2.72

	INITIAL	AFTER CONSOLIDATION
MOIST UNIT WEIGHT:	78.8 pcf	
DRY UNIT WEIGHT:	46.5 pcf	46.8 pcf
VOID RATIO:	2.65	2.64

TEST DATA:

NORMAL STRESS:	1.0 ksf
STRAIN RATE:	0.012 in/min
PEAK SHEAR STRESS:	1.42 ksf

ELAPSED TIME min.	HORIZONTAL DISPLACEMENT in.	VERTICAL DEFORMATION mm	SHEAR FORCE div.	SHEAR FORCE lb.	SHEAR STRESS ksf	STRESS RATIO
0.00	0.000	1.00	0.0	0.0	0.00	0.00
0.23	0.001	1.00	7.0	2.5	0.07	0.07
0.55	0.0025	1.00	13.0	4.6	0.13	0.13
0.85	0.005	1.01	20.0	7.0	0.21	0.21
1.14	0.0075	1.025	28.0	9.9	0.29	0.29
1.42	0.010	1.03	32.0	11.3	0.33	0.33
2.27	0.015	1.10	71.0	25.0	0.73	0.73
3.12	0.020	1.21	102.0	35.9	1.05	1.05
3.90	0.035	1.20	35.0	12.3	0.36	0.36
4.30	0.040	1.20	37.0	13.0	0.38	0.38
5.15	0.050	1.24	36.5	12.8	0.38	0.38
7.35	0.075	1.31	36.0	12.7	0.37	0.37
9.46	0.100	1.38	35.0	12.3	0.36	0.36
11.60	0.125	1.46	34.5	12.1	0.36	0.36
13.73	0.150	1.50	34.0	12.0	0.35	0.35
15.87	0.175	1.55	33.0	11.6	0.34	0.34
18.02	0.200	1.58	32.5	11.4	0.34	0.34

APPENDIX B

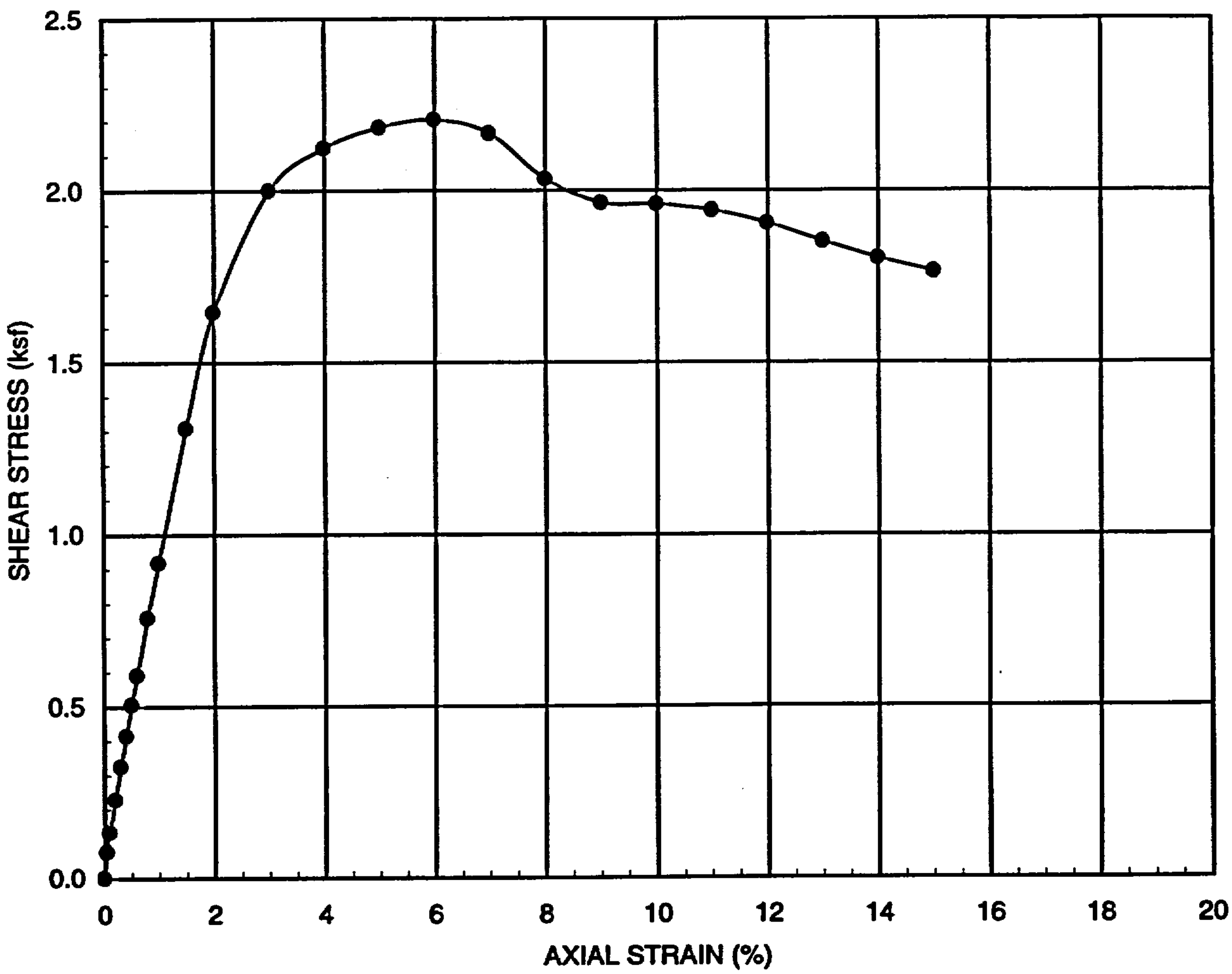
Consolidated Undrained Triaxial Test Plots and Data

STONE & WEBSTER ENGINEERING CORPORATION

Private Fuel Storage, LLC.
PFSF, Skull Valley, UT

JO: 05996.02
November 1999

CONSOLIDATED UNDRAINED TRIAXIAL



SAMPLE INFORMATION:

BORING:	B-1	DATE:	11/11/99
SAMPLE:	U-2B	TESTED BY:	ACS
DEPTH:	5.3 ft	CHECKED:	TEC
DESCRIPTION:	Clayey SILT		
HEIGHT:	0.555 ft	WATER CONTENT:	52.9 %
DIAMETER:	0.237 ft	INITIAL DRY UNIT WEIGHT:	46.3 pcf
AREA:	0.0440 ft^2	INITIAL VOID RATIO:	2.67

TEST DATA:

LOADING:	Axial Compression	STRAIN RATE:	0.8 %/min
CELL PRESSURE:	1.0 ksf		

UNDRAINED SHEAR STRENGTH:	2.21 ksf
COMPRESSIVE STRENGTH:	4.41 ksf
FAILURE STRAIN:	6.0 %

CONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST DATA

SAMPLE INFORMATION:

BORING: B-1
SAMPLE: U-2B
DEPTH: 5.3 ft
DESCRIPTION: Clayey SILT

DATE: 11/11/99
TESTED BY: ACS
CHECKED: TYC

HEIGHT: 0.555 ft
DIAMETER: 0.237 ft
AREA: 0.0440 ft²

WATER CONTENT: 52.9 %
INITIAL DRY UNIT WEIGHT 46.3 pcf
INITIAL VOID RATIO: 2.67

TEST DATA:

LOADING: Axial Compression
CELL PRESSURE: 1.0 ksf
STRAIN RATE: 0.8 %/min

UNDRAINED SHEAR STRENGTH: 2.21 ksf
COMPRESSIVE STRENGTH: 4.41 ksf
FAILURE STRAIN: 6.0 %

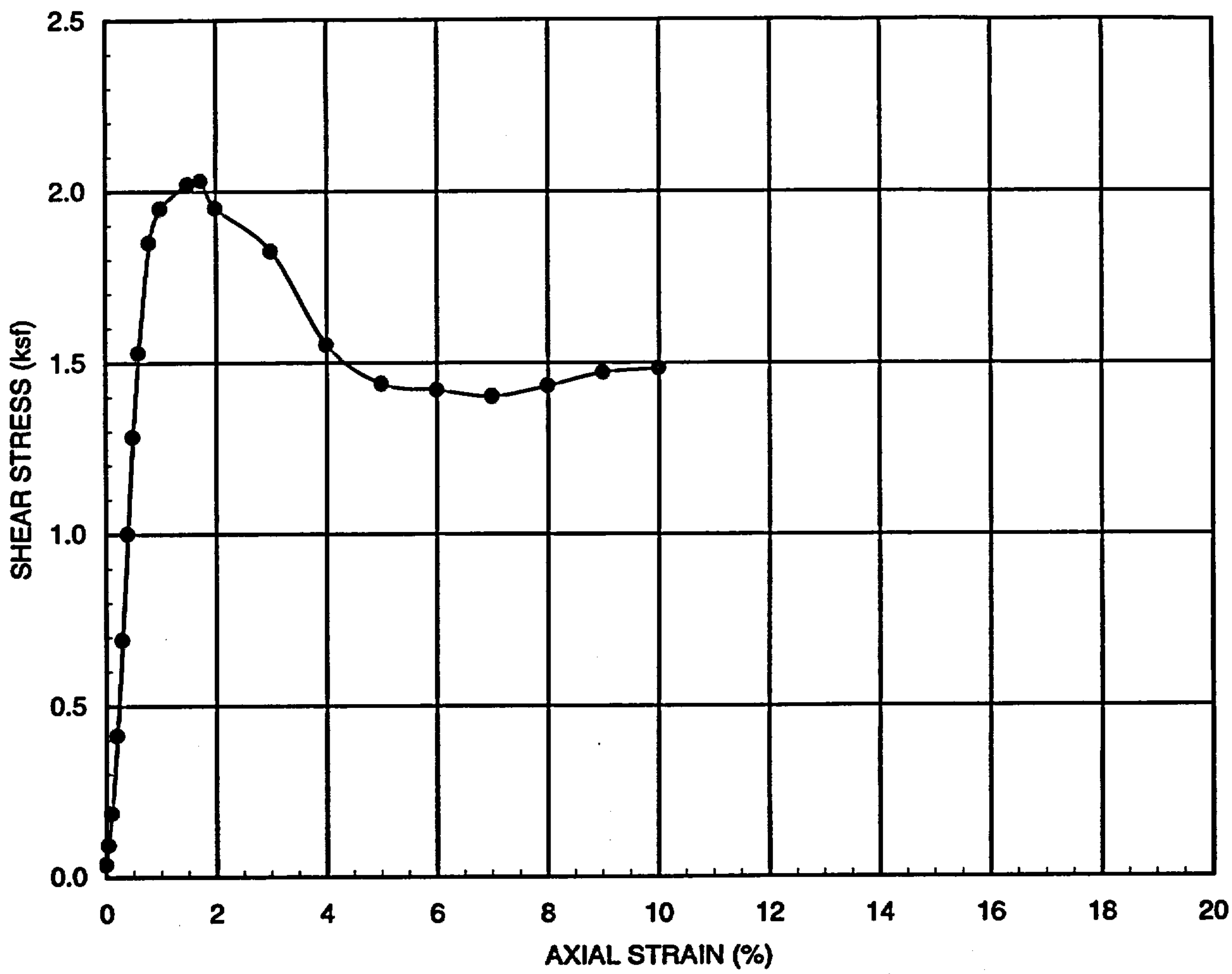
DIAL READING mm	LOAD CELL mV	AXIAL STRAIN %	FORCE kip	AREA sq ft.	AXIAL STRESS ksf	SHEAR STRESS ksf
0.49	0.34	0.00	0.000	0.0440	0.00	0.00
0.57	2.50	0.05	0.007	0.0440	0.15	0.08
0.66	4.15	0.10	0.012	0.0440	0.27	0.13
0.83	6.83	0.20	0.020	0.0441	0.46	0.23
1.00	9.58	0.30	0.029	0.0441	0.65	0.33
1.17	12.12	0.40	0.037	0.0442	0.83	0.41
1.34	14.71	0.50	0.045	0.0442	1.01	0.51
1.51	17.16	0.60	0.052	0.0443	1.18	0.59
1.84	21.96	0.80	0.067	0.0443	1.52	0.76
2.18	26.58	1.00	0.082	0.0444	1.84	0.92
3.03	37.89	1.50	0.117	0.0447	2.62	1.31
3.87	47.87	2.00	0.148	0.0449	3.29	1.65
5.57	58.67	3.00	0.181	0.0453	4.00	2.00
7.26	62.90	4.00	0.195	0.0458	4.25	2.12
8.95	65.33	5.00	0.202	0.0463	4.37	2.18
10.64	66.71	6.00	0.206	0.0468	4.41	2.21
12.33	66.20	7.00	0.205	0.0473	4.33	2.17
14.03	62.85	8.00	0.194	0.0478	4.07	2.03
15.72	61.42	9.00	0.190	0.0483	3.93	1.97
17.41	61.94	10.00	0.192	0.0489	3.92	1.96
19.10	62.07	11.00	0.192	0.0494	3.88	1.94
20.79	61.55	12.00	0.190	0.0500	3.81	1.90
22.49	60.55	13.00	0.187	0.0506	3.70	1.85
24.18	59.66	14.00	0.184	0.0511	3.61	1.80
25.87	59.04	15.00	0.183	0.0517	3.53	1.76

STONE & WEBSTER ENGINEERING CORPORATION

Private Fuel Storage, LLC.
PFSF, Skull Valley, UT

JO: 05996.02
November 1999

UNCONSOLIDATED UNDRAINED TRIAXIAL



SAMPLE INFORMATION:

BORING:	B-1	DATE:	11/11/99
SAMPLE:	U-2C	TESTED BY:	ACS
DEPTH:	5.9 ft	CHECKED:	TLC
DESCRIPTION:	Clayey SILT		
HEIGHT:	0.550 ft	WATER CONTENT:	47.1 %
DIAMETER:	0.237 ft	INITIAL DRY UNIT WEIGHT:	53.9 pcf
AREA:	0.0442 ft^2	INITIAL VOID RATIO:	2.15

TEST DATA:

LOADING:	Axial Compression	STRAIN RATE:	0.8 %/min
CELL PRESSURE:	0.0 ksf		

UNDRAINED SHEAR STRENGTH:	2.03 ksf
COMPRESSIVE STRENGTH:	4.06 ksf
FAILURE STRAIN:	1.7 %

UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TEST DATA

SAMPLE INFORMATION:

BORING:	B-1	DATE:	11/11/99
SAMPLE:	U-2C	TESTED BY:	ACS
DEPTH:	5.9 ft	CHECKED:	TWC
DESCRIPTION:	Clayey SILT		
HEIGHT:	0.550 ft	WATER CONTENT:	47.1 %
DIAMETER:	0.237 ft	INITIAL DRY UNIT WEIGHT	53.9 pcf
AREA:	0.0442 ft^2	INITIAL VOID RATIO:	2.15

TEST DATA:

LOADING:	Axial Compression	STRAIN RATE:	0.8 %/min
CELL PRESSURE:	0.0 ksf		

UNDRAINED SHEAR STRENGTH: 2.03 ksf
COMPRESSIVE STRENGTH: 4.06 ksf
FAILURE STRAIN: 1.7 %

DIAL READING mm	LOAD CELL mV	AXIAL STRAIN %	FORCE kip	AREA sq ft.	AXIAL STRESS ksf	SHEAR STRESS ksf
0.00	-0.23	0.00	0.003	0.0442	0.07	0.04
0.08	1.38	0.05	0.008	0.0442	0.18	0.09
0.17	4.03	0.10	0.016	0.0442	0.37	0.18
0.34	10.53	0.20	0.037	0.0443	0.83	0.41
0.50	18.49	0.30	0.061	0.0443	1.38	0.69
0.67	27.30	0.40	0.089	0.0444	2.00	1.00
0.84	35.42	0.50	0.114	0.0444	2.57	1.28
1.01	42.44	0.60	0.136	0.0444	3.06	1.53
1.34	51.72	0.80	0.165	0.0445	3.70	1.85
1.68	54.70	1.00	0.174	0.0446	3.90	1.95
2.51	57.00	1.50	0.181	0.0449	4.04	2.02
2.90	57.44	1.73	0.182	0.0450	4.06	2.03
3.35	55.31	2.00	0.176	0.0451	3.90	1.95
5.03	52.21	3.00	0.166	0.0455	3.65	1.82
6.70	44.70	4.00	0.143	0.0460	3.10	1.55
8.38	41.80	5.00	0.134	0.0465	2.88	1.44
10.06	41.70	6.00	0.134	0.0470	2.84	1.42
11.73	41.60	7.00	0.133	0.0475	2.80	1.40
13.41	43.00	8.00	0.138	0.0480	2.86	1.43
15.08	44.70	9.00	0.143	0.0485	2.94	1.47
16.76	45.60	10.00	0.146	0.0491	2.97	1.48

tractor/trailer unit shall also be limited by the size of the fuel tank to minimize a potential fire duration in the Canister Transfer Building load/unload bay. The design for the SSCs shall encompass any temperature gradients resulting from a fire from these scenarios. For rail delivery/retrieval of shipping casks, the train locomotives are required by administrative procedure to stay out of the Canister Transfer Building to prevent the possibility of a fire in the building fueled by the large quantity of fuel in the locomotive. The design of the building and its surroundings will assure that any diesel fuel spilled outside the building will not flow into the building, which could also create a fire hazard inside the building.

Determination of overpressure conditions due to explosions at the PFSF shall be in accordance with Regulatory Guide 1.91 (Reference 22). Per Regulatory Guide 1.91, a 1 psi overpressure would be produced by a detonation of the following quantities of explosives at the approximate distances shown:

Mode of Transport	Amount of Hazardous Cargo	At a Distance of
Highway Truck	50,000 lb	1660 ft
Railroad Car	132,000 lb	2290 ft
River Vessel	10,000,000 lb	10,000 ft

Since the distances from the PFSF to the nearest highway, railroad, and river exceeds the distances shown above for a 1 psi overpressure, the SSCs are not required to be designed for explosives.

3.3.7 Materials Handling and Storage

This section of the principal design criteria establishes requirements that satisfy 10 CFR 72.128(a) and (b), which identify general design criteria that requires spent fuel storage

and handling equipment be designed to ensure adequate safety under normal and accident conditions and that radioactive waste treatment facilities be provided.

This section also establishes requirements that satisfy 10 CFR 72.122(l), which identifies general design criteria that requires the storage system be designed to allow ready retrieval of the spent fuel for shipping offsite.

3.3.7.1 Spent Fuel Handling and Storage

All spent fuel handling and storage at the PFSF shall be performed with the spent fuel contained in the sealed metal canister. The design for handling and storage components shall ensure that the spent fuel canister confinement integrity is maintained.

The design shall ensure that handling components can safely be used to retrieve canisters from the storage casks and load them into shipping casks for shipment offsite throughout the life of the PFSF.

3.3.7.2 Radioactive Waste Treatment

Since the spent fuel is contained in the sealed metal canister, there is expected to be negligible radioactive contamination at the PFSF. The PFSF shall include provisions to package and store health physics survey material and dry wipes used to remove contamination in the event some minor radioactive contamination is found.

3.3.7.3 Waste Storage Facilities

A low level waste (LLW) holding cell shall be provided to store health physics survey material and dry wipes used to check casks for radioactive

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4.2.1.5.3 Shielding Design

Shielding design and performance for the HI-STORM storage system is addressed in HI-STORM SAR Chapter 5. The HI-STORM storage system is designed to maintain radiation exposure as low as is reasonably achievable (ALARA) in accordance with 10 CFR 72.126(a). The concrete storage cask is designed to limit the average external contact dose rates (gamma and neutron) to 40 mrem/hr on the sides, 10 mrem/hr on top, and 60 mrem/hr at the air inlets and outlets based on HI-STORM design basis fuel.

The storage cask is a massive structure designed to provide gamma and neutron shielding of the spent fuel assemblies stored within the canister. Radiation shielding is provided by the 2 inch thick steel inner liner and shield plate, the 26.75 inch thick concrete shell, and the 0.75 inch thick steel outer shell. Axial shielding at the top is provided by the steel canister lid and the storage cask lid. The storage cask lid consists of an approximately 10 inches of concrete sandwiched in a steel shell, with a 4 inch thick steel top plate. The configuration of the inlet and outlet ducts prevents a direct radiation streaming path from the canister to outside the cask.

The design dose rates allow limited personnel access during canister closure operations. HI-STORM SAR Section 5.1.1 provides calculated dose rates on contact and at 1 meter for the top and side surfaces of the HI-STORM storage cask for design PWR and BWR fuel, which shows that the above design criteria are met by the HI-STORM storage system. Maximum dose rates on contact from a storage cask, calculated for design basis zircaloy clad fuels for normal conditions, are shown to be approximately 35 mrem/hr on the side, 5 mrem/hr on top, 9 mrem/hr at the top vents, and 15 mrem/hr at the bottom vents.

Section 3.3.5 presents the radiological requirements for the PFSF. The requirements originate from 10 CFR 72.104, which requires that the annual dose equivalent to any

real individual located beyond the OCA boundary not exceed 25 mrem to the whole body, and from 10 CFR 20.1301, which requires that the hourly dose to any member of the public in any unrestricted area not exceed 2 mrem as a result of exposure to radiation from the PFSF. As discussed in Chapter 7, the HI-STORM storage system shielding design achieves compliance with these requirements for the PFSF array, assumed to consist of 4,000 HI-STORM storage casks, configured as shown in the detail on Figure 1.2-1.

4.2.1.5.4 Criticality Design

Criticality of the HI-STORM storage system is addressed in HI-STORM SAR Chapter 6. The HI-STORM storage system is designed to maintain the spent fuel subcritical in accordance with 10 CFR 72.124(a) and (b), with canister materials and geometry. The primary criteria for the prevention of criticality is that k_{eff} remain below 0.95 for all normal, off-normal, and accident conditions.
Criticality safety of the HI-STORM system depends on the following three principal design parameters:

- An administrative limit on the maximum average enrichment acceptable for storage in the canister,

- The inherent geometry of the fuel basket designs within the canister, including the flux-traps (water gaps for loading fuel into submerged canisters), where present, and

- The incorporation of fixed neutron absorbing panels (Boral) in the fuel basket structure to assist in control of reactivity (applicable only while the canister is submerged in a nuclear plant spent fuel pool or for shipping requirements).

Therefore, the thermal design of the TranStor storage system bounds the site specific design requirements.

4.2.2.5.3 Shielding Design

Shielding for the TranStor storage system is addressed in TranStor SAR Chapter 5. The TranStor storage system is designed to maintain ALARA radiation exposure in accordance with 10 CFR 72.126(a). The concrete storage cask is designed to limit the average external dose rate (gamma and neutron) one meter from the cask to less than 50 mrem/hr on the sides and 250 mrem/hr on top at the cover lid centerline based on TranStor design basis fuel. The design dose rates allow limited personnel access during canister closure operations.

Radiation shielding of the TranStor storage system is provided by the 0.75 inch thick steel canister shell, the 2 inch thick steel storage cask liner, and the 29 inch thick reinforced concrete cask wall. Axial shielding at the top is provided primarily by the steel canister shield and structural lids, which have a combined thickness of 11 inches. The 0.75 inch thick steel storage cask lid also provides axial shielding. The inlet and outlet ducts are configured to prevent direct radiation streaming from the spent fuel assemblies to the outside of the cask.

TranStor SAR Section 5.1 provides calculated dose rates on contact and at 1 meter for the top and side surfaces of the TranStor storage cask for design PWR and BWR fuel, which show that the above criteria are met by the TranStor Storage System. Maximum dose rates for TranStor design basis fuels are shown to be approximately 72 mrem/hr on contact with the side and 43 mrem/hr at 1 meter from the side of the TranStor storage cask; 278 mrem/hr on contact with the center of the lid and 237 mrem/hr at 1 meter from the top of the cask; and 10 mrem/hr on contact with the top vent and 17 mrem/hr on contact with the bottom vent.

Section 3.3.5 presents the radiological requirements for the PFSF. The requirements originate from 10 CFR 72.104, which requires that the annual dose equivalent to any real individual located beyond the OCA boundary not exceed 25 mrem to the whole body, and from 10 CFR 20.1301, which requires that the hourly dose to any member of the public in any unrestricted area not exceed 2 mrem as a result of exposure to radiation from the PFSF. As discussed in Chapter 7, the TranStor storage system shielding design achieves compliance with this requirement for the PFSF array, assumed to consist of 4,000 TranStor storage casks, configured as shown in the detail on Figure 1.2-1.

4.3 AUXILIARY SYSTEMS

4.3.1 Ventilation and Offgas Systems

The canister-based storage technologies use a sealed (welded) canister design that precludes the need for ventilation or off-gas systems. No canisters will be opened at the site, therefore no ventilation system is required.

4.3.2 Electrical Systems

4.3.2.1 Major Components and Operating Characteristics

Normal electrical power will be provided to the PFSF via an existing 12.5 kV offsite distribution power line, which runs parallel to Skull Valley Road. A new electrical line will be constructed parallel to the site access road to furnish 12.5 kV to a 480 volt site transformer located at the site. The line will be run on new wooden power poles that will be installed by Utah Power & Light. Electrical power onsite downstream of the utility meter will be run underground and installed by contractors. The lines will either be underground service cable laid and buried in trenches or run in plastic conduit that is installed in underground concrete ductbanks.

Step down transformers will be used to provide 480 and 120/240 volt services as required. No switching stations will be necessary. The normal power will be provided for lighting, general utilities, security system, HVAC loads, crane loads, and miscellaneous equipment.

Emergency backup power is provided at the PFSF by a 480 volt diesel-generator. The emergency power supply is limited to the security system, emergency lighting loads, storage cask temperature monitoring system, and the site communications system.

The diesel generator fuel supply is sized to provide continuous operation for a minimum 24 hour period. The diesel generator is located in the Security and Health Physics Building. A battery charger is provided with automatic and manual charge control to maintain fully charged diesel generator starting batteries when the unit is stopped.

An Uninterruptible Power Source (UPS) is utilized to support the security loads until the diesel starts and comes up to speed. The UPS system is a 120 volt, single phase system with integral batteries and battery charger. The UPS system is designed for aminimum of 1 hour operation without replacing or recharging batteries. The UPS system is located in the Security and Health Physics Building.

4.3.2.2 Safety Considerations and Controls

In the event of a loss of offsite power, the UPS system is designed to automatically switch over to the battery source without loss of output voltage. When the diesel generator comes up to speed, the UPS automatically switches back to its normal source (which is then from the diesel generator) without loss of output voltage or battery recharge.

The diesel generator is provided with starting batteries maintained to supply sufficient capacity to consecutively crank the engine a minimum of five times. When the diesel generator starts, an automatic transfer switch transfers the security, emergency, and temperature monitoring loads to the generator when the diesel comes up to speed. Transfer back to normal offsite power takes place after the normal power is restored for a minimum of 30 minutes.

Electrical power is not classified as Important to Safety since the storage systems do not require electrical power for operation. In addition the cranes and operating

equipment have been designed to maintain adequate safety provisions for handling spent fuel canisters in the event of a loss of power as discussed in Section 8.1.1.

In the event of a lightning strike, the most probable target is the 130 foot tall light poles that provide the lighting for the storage area. The light poles are metal and therefore act as a conductor. The poles are grounded to ensure that the current from a lightning strike is properly conducted to ground.

4.3.2.3 Restricted Area Lighting

The lighting system will be designed to maintain a minimum lighting distribution of 0.2 foot-candles throughout the Restricted Area (RA) such that sufficient lighting is provided to meet the following design objectives:

- Security of the site
- Safety of personnel and canisters
- CCTV to distinguish shapes, objects, and movement
- Human eye observation
- Lighting coverage of entire site per 10 CFR 73.51 requirements
- Minimize shadows around and under canisters
- Lighting of perimeter, double security fences, and the area immediately outside of this fence. These areas are the most critical for CCTV observation.

Note: Poles for site lighting cannot be located in close proximity to security fences thus eliminating a means to breach the security of the site. This results in the lighting for the perimeter, double security fences and the area immediately outside of this fence being more visible since they are aimed out to and past the Restricted Area perimeter fence. This is minimized as much as possible during final, fine-tuning of the lighting installation.

The facility lighting system will consist of 130' mast lighting with 1000W HPS symmetrical patterned fixtures. These fixtures were chosen for efficiency and economy (they provide the greatest light distribution with the least number of fixtures).

Additional perimeter fence lighting is provided by 1000W and 400W HPS floodlights (with asymmetrical patterns) mounted at 130' for the 1000W fixtures and 40' for the 400W fixtures.

In three locations, 40' poles with a single luminare will be placed to provide lighting for roadway and parking facilities. These are 400W HPS fixtures and are aimed low in an effort to eliminate, horizontal glare (brightness) from the fixture.

4.3.3 Air Supply Systems

An air supply system is provided at the PFSF in the Canister Transfer Building and Operation and Maintenance Building for maintenance purposes. There are no SSCs classified as being Important to Safety that require compressed air for operation.

4.3.4 Steam Supply and Distribution System

A steam supply system is not provided at the PFSF. There are no SSCs classified as being Important to Safety that require steam for operation.

4.3.5 Water Supply System

A water supply system is provided at the PFSF for normal facility services and operation and maintenance functions. Water will be supplied using surface storage tanks fed from one or more wells drilled on-site. In the event that onsite water quantity

or quality are inadequate, potable water will be obtained directly from the Reservation's existing supply or an additional well or wells will be drilled east of the site and outside of the OCA, where water supplies are likely to be more satisfactory. The water distribution piping and plumbing within the buildings will be provided in accordance with the Uniform Plumbing Code. There are no safety related SSCs classified as being Important to Safety that require water for operation.

4.3.6 Sewage Treatment System

A sanitary drainage system will be provided at the PFSF in accordance with the Uniform Plumbing Code to transmit waste from the buildings to a septic system. The drainage lines will be installed underground and sloped to facilitate drainage.

Two septic tank and drain field systems will be provided to collect and process sanitary waste water from the facility. The systems will be located near the Security and Health Physics Building for the storage facility and near the Administration Building for the Balance of Facility. The systems will be sized for the maximum number of personnel expected on site during normal operating periods. The septic system is expected to process less than 5,000 gallons per day.

4.3.7 Communications and Alarm Systems

The communication systems consist of normal telephone service in all the buildings, a site public address system, and a short-wave radio system for security. The main telephone panel will be located in the administration building and will provide for 25 telephone lines. The service will be provided from the existing underground service located along the Skull Valley Road and will be routed underground parallel to the site access road. The telephone service will be used to provide normal communication to and from the site, emergency communications with local authorities, and on-site voice

paging. The communication systems provide a means to contact the local law enforcement authorities for security purposes and for emergency responses on site in the event of an "ALERT", with notifications and follow-up communications.

In the event of an emergency, facility personnel and visitors on site are notified by an announcement over the onsite communications system (intercom). Offsite emergency response personnel are notified by means of personal pagers and/or using the notification list of telephone numbers located in the Emergency Plan implementing procedures. Alarms at the PFSF are only used on area radiation monitors to notify nearby personnel of doses that exceed the alarm setpoint.

Portable two-way radios are used by security personnel to maintain continuous communications with the Security and Health Physics Building while on patrol. The communication system is in accordance with proposed rule 10 CFR 73.51 (Reference 23).

4.3.8 Fire Protection System

4.3.8.1 Design Basis

Fires that could affect SSCs classified as Important to Safety are postulated to result from diesel fuel sources originating from the cask transporter or shipping cask transport vehicles (heavy haul tractor/trailer or railroad locomotive). SSCs affected include the storage casks in the yard and the shipping and storage system components and cranes in the Canister Transfer Building. Scenarios for a fire in both locations considering fire location, intensity, and duration have been analyzed in Section 8.2.5. The analysis determined that the fires will not compromise the safety provisions of the SSCs.

No other major fire fuel sources are located in areas near SSCs classified as Important to Safety. The Canister Transfer Building is constructed of noncombustible materials and is designed to limit the potential effects from a diesel fuel fire with curbs, raised thresholds, and sloped floors located to contain spilled diesel fuel away from SSCs.

The Canister Transfer Building is designed with a fire detection system and a fire suppression system to aid in the mitigation of fires. Portable fire extinguishers are located in the building and yard areas to facilitate fire suppression. The fire detection system is designed in accordance with NFPA 72E (Reference 24). The fire suppression system consists of a sprinkler system designed, installed, and tested in accordance with the Uniform Building Code (Reference 25) and NFPA 13 (Reference 26) and 13A (Reference 27). The fire pumps and water supply tanks are provided in accordance with NFPA 20 (Reference 28) and NFPA 22 (Reference 29) respectively. The portable fire extinguishers are provided in accordance with NFPA 10 (Reference 30).

4.3.8.2 System Description

A sprinkler type fire suppression system is provided in the Canister Transfer Building to mitigate potential fires. The sprinkler system is supplied water by fire pumps located outside of the RA. Water for the pumps is supplied by a primary and a backup water tank. One pump is powered by an electric motor, the other by a diesel engine in the event of a loss of electrical power.

Fire hydrants are located near the buildings to support fire suppression of the buildings. The PFSF is served by at least one fire truck located at the site and one truck located at the Goshute Village 3.5 miles from the site to suppress fires that may occur around the site such as brush fires.

The fire detection system consists of photo-sensitive smoke detectors located in all the facility buildings. The smoke detectors are interconnected within each building and are connected to a central alarm panel located in the Security and Health Physics Building. Annunciation of the smoke alarms occurs within both the building where the detector is located and the central alarm panel. A trip of the fire detection system in the Canister Transfer Building will automatically set off the building's fire sprinkler system.

Smoke from a fire in the Canister Transfer Building will be removed by the building's ventilation exhaust fans.

4.3.8.3 System Evaluation

An evaluation of potential fires affecting SSCs classified as Important to Safety is shown in Section 8.2.5. The analysis concludes that these fires will not produce an unsafe condition or preclude the ability of SSCs from performing their safety related function. The sprinkler system further ensures that fires that could occur in the Canister Transfer Building will be extinguished within minutes.

4.3.8.4 Inspection and Testing Requirements

Preoperational and periodic operational testing and inspection of the fire detection and fire suppression systems will be performed in accordance with requirements of Section 9.2.

4.3.8.5 Personnel Qualification and Training

Training and qualification requirements associated with the testing, inspection, and operation of the fire systems will be in accordance with the requirements of Section 9.3.

4.3.9 Maintenance System

4.3.9.1 Major Components and Operating Characteristics

The PFSF has relatively few maintenance requirements because of the passive nature of the storage system's design. Major components at the PFSF that require routine periodic maintenance include the overhead bridge crane, semi-gantry crane, transfer equipment, and fire suppression system located in the Canister Transfer Building, the rail cars or heavy haul tractor/trailer units, the cask transporters, the backup diesel generator located in the Security and Health Physics Building, and the temperature monitoring equipment, fire pumps, and fire engine.

Periodic inspection and maintenance is also required to ensure the storage cask air ducts are not blocked from snow, dirt, debris, or small animal nesting per the operation controls and limits given in Chapter 10.

4.3.9.2 Safety Considerations and Controls

Routine maintenance procedures ensure that timely maintenance is performed according to equipment manufacturer's standards. The Operations and Maintenance Building is designed to facilitate activities performed on equipment and provide a safe environment. Ladders and platforms mounted on the walls and cranes in the Canister Transfer Building are used to access the cranes for maintenance and inspection activities. PFSF procedures prevent maintenance of the cranes or transfer equipment near casks loaded with spent fuel to minimize personnel radiation doses. Maintenance and inspection of the temperature monitoring system at the storage casks or the storage cask air vents are controlled by PFSF procedures to ensure that the work is performed ALARA.

4.3.10 Cold Chemical Systems

There are no chemical systems required or provided at the PFSF.

4.3.11 Air Sampling Systems

Since the spent fuel is totally contained within the canisters, there is no need for air sampling systems or airborne monitors except for the hand held monitor use to analyze the air sample taken from the shipping cask prior to being opened.

4.3.12 Gas Utilities

Propane will be used to provide fuel to all gas heating units located in the PFSF buildings rather than natural gas due to the remote location of the site. Propane for heating the Canister Transfer Building and the Security and Health Physics Building will be stored in two 1,000 gallon propane fuel storage tanks, located outside of the RA, approximately 400 ft east of the Canister Transfer Building and 1,030 ft from the nearest storage casks. The storage tanks will be above-ground, designed in accordance with the requirements of NFPA 58. The effects of a postulated explosion involving 1,000 gallons of propane assumed to leak from a tank are analyzed in Section 8.2.4. Propane for heating the Operations and Maintenance Building and the Administration Building will be similarly stored, in propane tanks located near these structures. NFPA 58 requires that propane tanks between 50 and 2,000 gallon capacity be located at least 25 ft away from any building, adjacent container, or adjacent property. Since the amount of propane stored will be less than 10,000 lbs., no threshold levels that would invoke compliance with hazardous and toxic chemical regulations will be exceeded. The propane heating system will be installed in accordance with NFPA requirements. Outdoor piping between the tanks and the buildings will be located below ground and coated or wrapped.

4.5.3 Shipping Cask Repair and Maintenance

If shipping cask repair or maintenance activities are necessary, they will be conducted at the Operation and Maintenance Building or at a vendor designated location. No special contamination control measures are anticipated for repair or maintenance activities since the spent fuel is contained within a sealed canister and the shipping casks used for the PFSF do not enter any nuclear plant spent fuel pools and therefore, remain free of radioactive contamination.

Health physics surveys will be taken on all incoming canisters as normal receiving operations at the PFSF. In the event contamination above acceptance levels is discovered, the canister will be shipped back to the originating nuclear power plant for canister decontamination and/or spent fuel repackaging.

4.5.4 Skull Valley Road / Intermodal Transfer Point

4.5.4.1 Intermodal Transfer Point

Shipments that utilize the Skull Valley Road / intermodal transfer point are moved by the use of roads from the rail mainline to the PFSF using heavy-haul tractor/trailers. The intermodal transfer point is located 1.8 miles West of Timpie, approximately 24 miles north of the PFSF. The intermodal transfer point equipment is designed to accommodate transfer of the shipping casks from the rail car to the heavy haul tractor/trailer unit for highway shipping. The intermodal transfer point consists of rail sidings off the Union Pacific Railroad mainline, a 150 ton gantry crane, and a tractor/trailer yard area. The gantry crane is a single-failure-proof crane to preclude the accidental drop of a shipping cask even though the cask is designed to withstand such drops in accordance with 10 CFR 71. The crane is housed in a weather enclosure, which provides a clean, dry environment for transfer of the shipping cask.

The intermodal transfer point is shown on Figure 4.5-3.

4.5.4.2 Shipping Cask Heavy Haul Tractor/Trailer

Heavy haul transport tractor/trailers are used to transport the shipping cask from the intermodal transfer point to the PFSF by highway. The maximum weight of a loaded shipping cask with impact limiters and shipping cradle is approximately 142 tons, which requires the use of overweight trailers. The heavy haul tractor/trailers are designed to accommodate road conditions at the intermodal transfer point, frontage road, Skull Valley Road, and PFSF. A minimum of 2 heavy haul tractor/trailer units would be used if the casks were transported by highway from the ITP to the PFSF. The units are designed to travel at low speeds and are 12 ft wide with multiple wheel sets to provide stable transport of the shipping cask. Based on vendor information from three of the largest trailer manufacturers for this type of trailer, the heavy haul trailers range from 150 ft to 180 ft in length. The trailers use up to 100 tires to distribute the weight within typical highway limits. However, use of these trailers usually requires permitting due to the overall weight and length. The trailers are articulated, that is they can pivot in several places and include steerable axles to accommodate tight radius turning. The turning radius ranges 75 ft to 150 ft, depending on whether steerable dollies are used. The tractor/trailers will usually be stored in either the Canister Transfer Building truck bay or in the intermodal transfer point enclosure in preparation for their next assigned task. Both buildings are designed to fully enclose the tractor/trailer unit. Maintenance activities will be conducted at the Operation and Maintenance Building, except such maintenance duties that are complex enough in nature that they require off-site contracted major maintenance. It is anticipated that contract facilities within the area would be used for such items as engine overhaul, etc.

The unit is classified as not Important to Safety since safety of the spent fuel canister is maintained by the shipping cask. A typical heavy haul transport tractor/trailer unit is shown on Figure 4.5-4.

4.5.5 Low Corridor Rail Line

4.5.5.1 Rail Line

Shipments that utilize the railroad line continue on from the rail mainline to the PFSF by rail car. A rail line will be built from the Union Pacific mainline located at Low Junction to the PFSF. The rail line is designed to standard railroad load, grade, and clearance requirements per the Union Pacific Railroad and industry standards to facilitate use of Union Pacific and standard railroad equipment.

The Low Corridor rail line is shown on Figure 4.5-6

4.5.5.2 Shipping Cask Rail Car

The rail cars will either be heavy duty 145 ton flatbed cars with 3 axle-trucks or depressed center flatbed cars with double bolsters (two sets of 2-axle trucks) similar to those used by the Department of Defense for their spent fuel shipments. The maximum weight of the shipping cask with impact limiters and shipping cradle on the rail car is approximately 142 tons as discussed in Section 4.5.4.2, which is within the allowable load for a 145 ton flatbed rail car. The Canister Transfer Building cask load/unload bays are designed with railroad tracks to facilitate rail car shipments where the shipping casks would be unloaded or loaded.

The radius of the track for rail cars is dependent on various factors such as car length. The final design is not complete on the rail car, so the turning radius of the cask car has

not been determined. However, the car would be somewhat short (probably not exceeding 50' in length) and the turning radius would be fairly tight. However, direct rail transportation to the PFSF has been designed using mostly 3 degree curves (1909 ft radius) with the tightest curve being a 10 degree curve (573 ft radius). The rail cars, which typically will be in transit to pickup more spent fuel, will be stored on the railroad storage siding at the PFSF when not in use (See SAR Figure 1.2-1). If the intermodal transfer point is utilized, parking for the cars when not in use would either be provided at the intermodal transfer point or at leased space somewhere in the vicinity. Routine maintenance will be performed at the PFSF or the intermodal transfer point, depending on the case. Major overhauls and maintenance would have to be in a privately operated railroad equipment servicing shop approved for such activities and inspections.

The flat bed rail cars are classified as not Important to Safety since spent fuel safety functions are maintained by the shipping cask. A typical 145 ton flat bed rail car is shown on Figure 4.5-5.

4.8 REFERENCES

1. Topical Safety Analysis Report for the Holtec International Storage and Transfer Operation Reinforced Module Cask System (HI-STORM 100 Cask System), Holtec Report HI-951312, Docket 72-1014, Revision 7, June 1999.

2. Safety Analysis Report for the TranStor Storage Cask System, SNC-96-72SAR, Sierra Nuclear Corporation, Docket 72-1023, Revision C, November 1998.

3. Topical Safety Analysis Report for the Holtec International Storage, Transport, and Repository Cask System (HI-STAR 100 Cask System), Holtec Report HI-951251, Docket 71-9261, Revision 4, September 1996.

4. Regulatory Guide 1.76, Design Basis Tornado for Nuclear Power Plants, U.S. Nuclear Regulatory Commission, April 1974.

5. NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, U.S. Nuclear Regulatory Commission, June 1987.

6. Regulatory Guide 1.60, Design Response Spectra for Seismic Design of Nuclear Power Plants, U.S. Nuclear Regulatory Commission, Revision 1, December 1973.

7. Multi-Cask Seismic Response at the PFS ISFSI, Holtec International, Holtec Report HI-971631, Revision 1.

8. Scoping Seismic Analyses of HI-STORM on a Western Area ISFSI, Holtec International, Holtec Report HI-961574, Revision 0.

9. Regulatory Guide 1.91, Evaluations of Explosions Postulated to Occur on Transportation Routes near Nuclear Power Plants, U.S. Nuclear Regulatory Commission, February 1978.

10. ANSYS Revision 4.48, Swanson Analysis Systems, Inc.

11. ASME Boiler and Pressure Vessel Code, Section III, Rules for Construction of Nuclear Power Plant Components, American Society of Mechanical Engineers, 1992.

12. EPRI NP-7551, Structural Design of Concrete Storage Pads of Spent Fuel Casks, Electric Power Research Institute, 1991.

13. Safety Analysis Report for the TranStor Shipping Cask System, SNC-95-71SAR, Sierra Nuclear Corporation, Docket 71-9268, Revision 1, September 1996.

14. ANSI/ANS 57.9, Design Criteria For An Independent Spent Fuel Storage Installation (Dry Storage Type), American Nuclear Society, 1984.

15. ACI-349, Code Requirements for Nuclear Safety Related Concrete Structures, American Concrete Institute, 1990.

16. International Civil Engineering Consultants, Inc., Pad Analysis and Design, Calculation No. SC (PO 17) - 1, Revision 0.

TABLE 4.2-2

PHYSICAL CHARACTERISTICS OF THE HI-STORM STORAGE CASK

PARAMETER	VALUE
Height	231.25 inches
Outside Diameter	132.5 inches
Capacity	1 loaded canister
Max. Radiation Dose[1]	
1 meter from surface:	
Side	17 mrem/hr
Top	2 mrem/hr
On contact with surface:	
Side	35 mrem/hr
Top	5 mrem/hr
Top vents	9 mrem/hr
Bottom vents	15 mrem/hr
Material of Construction	Concrete (core and lid) Steel (liner and shell)
Weight, maximum	268,334 lb (empty) 348,321 lb (with loaded MPC-24) 355,575 lb (with loaded MPC-68)
Service Life	>100 years

1. Dose rate is based on HI-STORM design basis zircaloy clad fuel for normal conditions.

TABLE 4.2-3

HI-STORM STORAGE SYSTEM STEADY STATE TEMPERATURE EVALUATION UNDER NORMAL CONDITIONS OF STORAGE

COMPONENT	MPC-24 TEMPERATURE (°F)	MPC-68 TEMPERATURE (°F)	NORMAL CONDITION TEMPERATURE LIMITS (°F)
Ambient Air	80	80	N.A.
Storage Cask Outer Shell	131	131	350
Air Outlet	179	185	N.A.
Storage Cask Inner Liner	166	171	200 *
Canister Shell	295	301	450
Basket	657	722	725
Fuel Cladding	692	742	**

* 200°F is Holtec's normal condition temperature limit on the concrete. The storage cask steel structure has a normal condition limit of 350°F (HI-STORM SAR Table 2.2.3).

** The temperature limits in accordance with DCCG (gross rupture) criteria are 787°F (PWR) and 824°F (BWR). Permissible cladding temperatures for the HI-STORM system are in accordance with PNL criteria (i.e. 692°F PWR and 742°F BWR).

TABLE 4.2-4

PHYSICAL CHARACTERISTICS OF THE TRANSTOR CANISTER

PARAMETER	VALUE
Outside Diameter	66 inches
Length	192.25 inches maximum
Capacity	24 PWR assemblies 61 BWR assemblies
Maximum Heat Load	26 kW
Material of Construction	Stainless steel (shell), Carbon steel (internals)
Weight, maximum (loaded with spent fuel)	77,760 lb (PWR) 84,020 lb (BWR)
Internal Atmosphere	Helium

TABLE 4.2-5

PHYSICAL CHARACTERISTICS OF THE TRANSTOR STORAGE CASK

PARAMETER	VALUE
Height	222.5 inches maximum (depending on fuel length)
Outside Diameter	136 inches
Capacity	1 loaded canister
Maximum Radiation Dose[1]	
1 Meter from surface:	
Side	43 mrem/hr
Top	237 mrem/hr
On contact with surface:	
Side	72 mrem/hr
Top	278 mrem/hr
Top vent	10 mrem/hr
Bottom vent	17 mrem/hr
Material of Construction	Reinforced concrete Steel (inner liner)
Weight, maximum	222,200 lb (empty) 297,200 lb (loaded with PWR canister) 307,600 lb (loaded with BWR canister)
Service Life	>50 years

1. Dose rate is based on TranStor design basis fuel

TABLE 4.2-8

DYNAMIC PAD ANALYSIS MAXIMUM RESPONSE VALUES

(based on PFSF deterministic design earthquake – See Section 8.2.1.1)

PFSF DETERMINISTIC DESIGN EARTHQUAKE LOADING	MAXIMUM MOMENT (k-ft/ft)	MAX. SHEAR FORCE (k/ft)	MAXIMUM SOIL PRESSURE (k/ft^2)	MAX. HORIZONTAL TOTAL SOIL REACTION (kips)	
				Longitudinal	Transverse
2 Casks	344.3	76.3	3.34	670	730
4 Casks	132.6	25.2	2.10	1,195	910
8 Casks	114.0	27.7	2.80	1,330	2,030

TABLE 4.7-1

PHYSICAL CHARACTERISTICS OF THE HI-TRAC TRANSFER CASK

PARAMETER	VALUE
Inside Diameter	68.75 inches
Outside Diameter	94.625 inches
Height	203.50 inches
Materials of Construction	Steel (inner and outer shell) Lead (gamma shield) Water (neutron absorber)
Weight (empty)	152,636 lb
Maximum Working Dose Rate[1] (1 meter from surface) Side	 42 mrem/hr

1. Dose rates are based on HI-TRAC design basis zircaloy clad fuel for normal conditions.

Table 4.7-2

HI-TRAC TRANSFER CASK STEADY STATE TEMPERATURE EVALUATION

COMPONENT	TEMPERATURE (°F)	SHORT-TERM TEMPERATURE LIMITS (°F)
Ambient Air	100	N/A
Transfer Cask Outer Shell	223	700
Top Neutron Shield	175	300
Bulk Average Water Jacket	269	307
Transfer Cask Inner Surface	323	600
Canister Shell	459	775
Basket	884	950
Fuel Cladding	902	1058

TABLE 4.7-3

PHYSICAL CHARACTERISTICS OF THE TRANSTOR TRANSFER CASK

PARAMETER	VALUE
Inside Diameter	67 inches
Outside Diameter	86 inches
Height	204 inches maximum (depends on fuel length)
Materials of Construction	Steel (inner and outer shell) Lead (gamma shield) Polymer (neutron absorber)
Weight (empty)	126,230 lb max.
Maximum Working Dose Rate[1] (1 meter from surface) Side	 94 mrem/hr

1. Dose rates are based on TranStor design basis fuel.

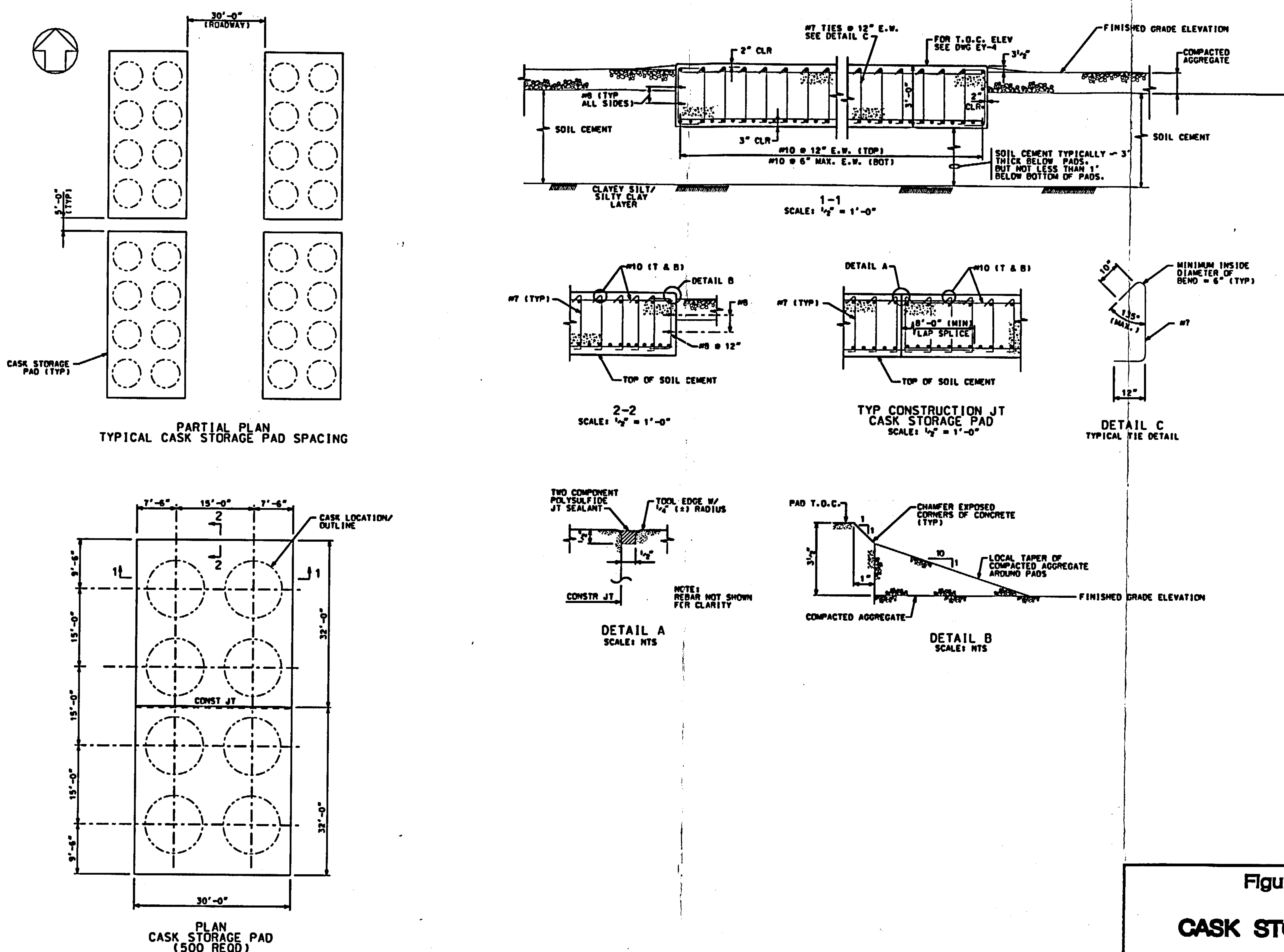

Figure 4.2-7

CASK STORAGE PADS

PRIVATE FUEL STORAGE FACILITY
SAFETY ANALYSIS REPORT

sources of gamma, neutron, beta, and alpha radiation, including the capability to measure the range of dose rates and radioactivity concentrations expected. Radiation protection procedures will govern instrument calibration, instrument inventory and control, and instrument operation.

Portable survey and personnel monitoring instrumentation will include, but not be limited to, the following:

- Low-level contamination meters
- Beta/gamma portable survey meters
- Alarming beta/gamma personnel friskers
- Portable air samplers

Radiological instrument storage, calibration and maintenance facilities will also be located in the Security and Health Physics Building, along with a low-radiation background counting room containing laboratory equipment for measuring radioactivity.

Area radiation monitors are utilized in the Canister Transfer Building since the operations performed in this building (shipping cask receipt, inspection, and canister transfer operations) pose the greatest risk to the operating staff for radiation exposure. These monitors have audible alarms to warn operating personnel of abnormal radiation levels. Area radiation monitors are not utilized outside the Canister Transfer Building since these areas have relatively low area radiation levels and there are no operations performed in these areas which could result in a rapid change in radiation level and pose a risk for over-exposure of personnel.

The RA is approximately 99 acres and is surrounded by a chain link security fence and an outer chain link nuisance fence with an isolation zone and intrusion detection system

between the two fences. Access to the RA is controlled through a single access point in the Security and Health Physics Building (see Figure 1.2-1, the PFSF General Arrangement). Personal dosimetry is issued and controlled in this building to individuals entering the RA. External radiation dose monitoring will be accomplished through the use of thermoluminescent dosimeters (TLDs) and self reading dosimeters (SRDs) or digital alarming dosimeters (DADs). All operating personnel inside an active canister transfer cell will be required to utilize alarming dosimeters during the canister transfer process to warn of excessively high direct radiation to maintain exposures ALARA, thereby providing additional assurance that occupation exposures will not exceed the limits of 10 CFR Part 20. The official record of external dose to beta and gamma radiations will normally be obtained from the TLDs, with SRDs or DADs used as a means for tracking dose between TLD processing periods and as a backup to TLDs. Self-reading dosimeters will be administered in accordance with the guidance in Regulatory Guide 8.4 (Reference 15).

Provisions exist in the Security and Health Physics Building for donning and removing personal protective equipment, such as anti-contamination clothing and/or respirators, which could be necessary in the event of contamination in the Canister Transfer Building due to off-normal or accident conditions. The respiratory protection program will be established in accordance with 10 CFR 20 and consistent with the guidance of NUREG-0041 (Reference 16). Radiation protection procedures will include the conduct of bioassays including criteria for the performance of bioassay, dose tracking and methods for data analysis and interpretation. The bioassay program will be based on NRC Regulatory Guide 8.26 (Reference 17) and Regulatory Guide 8.9 (Reference 18).

Provisions for personnel decontamination are contained in the Security and Health Physics Building. Contamination of equipment or personnel is not expected to occur under normal conditions of operation. In accordance with the PFSLLC's policy of preventing generation of liquid radioactive waste, any necessary decontamination of

equipment and personnel will be conducted using methods that produce only solid radioactive waste. Decontamination methods would typically include wiping the contaminated item with rags or paper wipes. Drain sumps are provided in the cask load/unload bay of the Canister Transfer Building which catch and collect water that drips from shipping casks (e.g. from melting snow) onto the floor. Water collected in the cask load/unload bay drain sumps is sampled and analyzed to verify it is not contaminated prior to its release. In the event contaminated water is detected, it will be collected in a suitable container, solidified by the addition of an agent such as cement or "Aquaset" so that it qualifies as solid waste, staged in the LLW holding cell while awaiting shipment offsite, and transported to a LLW disposal facility, in accordance with Radiation Protection procedures.

No process or effluent monitors are necessary because of the design of the PFSF storage system, in which spent fuel assemblies are stored in welded canisters. During routine storage operations at the PFSF, the only radiological instrumentation in use in the storage area will be the TLDs, as described in Section 7.3.5. Routine radiological surveys will use instruments that are controlled by the Radiation Protection Program and governed by existing procedures. Calibration procedures for radiological instrumentation will be established and applied to instruments used at the PFSF.

7.5.3 Procedures

Radiation protection requirements for all radiological work at the PFSF will be governed by radiation protection procedures. Radiation protection practices for cask loading and unloading operations, canister transfer, canister storage, and monitoring will also be based on these procedures, as well as on anticipated conditions when the task is to be performed. These procedures include, but are not limited to, the following:

- Procedure for performing badging functions for access authorization to the RA.
- Procedure for issuing personnel dosimetry, and monitoring, recording, and tracking individual exposures.
- Procedure for performing radiological safety training and refresher training.
- Procedure for performing ALARA reviews of plant procedures and monitoring of operations.
- Procedure for determining radiation doses on a periodic basis at RA and OCA boundaries using TLDs.
- Procedure for issuing, revising, and terminating radiation work permits and standing radiation work permits.
- Procedure for roping off, barricading, and posting radiation control zones.
- Procedure for decontaminating personnel, equipment, and areas.
- Procedure for performing radiation surveys.
- Procedure for smear swab sampling, counting, and calculation.
- Procedure for calibrating detection, monitoring, and dosimetry instruments.
- Procedure for quantifying airborne radioactivity.

- Procedure for maintaining records of the radiation protection program, including audits and other reviews of program content and implementation; radiation surveys; instrument calibrations; individual monitoring results; and records required for decommissioning.

Implementation of the Radiation Protection Program procedures ensures that occupational doses are below the limits required by 10 CFR 20.1201 and are ALARA both in the Canister Transfer Building as well as other parts of the facility. Area radiation montitors in the Canister Transfer Building have audible alarms and warn operating personnel of abnormal radiation levels. While area radiation monitors are not installed in the RA, measures are in place to ensure that personnel in the RA do not exceed dose limits. As discussed in Section 7.5.2, access to the RA is controlled through a single access point in the Security and Health Physics Building where personal dosimetry is issued to individuals entering the RA. Periodic radiation surveys will be conducted of areas inside the RA and maps will be generated showing the radiation levels in all areas. Radiation work permits (RWPs) will be completed by qualified radiation protection personnel prior to any entry and will identify normal and unusual radiation readings. Workers will be required to read, understand and sign that they are aware of the conditions or unknowns. Personnel will be trained to use the appropriate radiation detection instruments or will be required to have a qualified radiation protection technician with them at all time while in the areas. Training will include responses to unusual readings and off-scale conditions. The Radiation Protection program will provide for the immediate reading of any individual's TLD if an unusual reading or off-scale condition occurs.

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1.2 NEED FOR THE FACILITY

As a result of the status of DOE's program and DOE's interpretation of its authority, utilities have had to plan on continuing to provide interim storage for their spent fuel beyond 1998. Even those utilities who would have been entitled to make spent fuel deliveries to DOE in the first years following the 1998 deadline now have to assume that it will be a decade or more before any deliveries will occur.

In the past, utilities have generally been able to provide adequate at-reactor storage for their spent fuel. Some reactors, particularly those that were constructed after reprocessing of spent fuel was no longer an option, may have significantly greater spent fuel pool storage capacity than reactors that were built prior to the mid-1970's. Most reactors have been able to add additional capacity to their spent fuel pools by reracking. Other utilities have constructed dry spent fuel storage capacity at their reactor sites. But some utilities are running out of options or are running the risk that those options will not be available to them. Some reactors have reached their maximum spent fuel pool capacity because of structural or other physical limitations. Some utilities are subject to state or local restrictions or regulatory processes that could restrict or prohibit storage expansions. In some cases, state legislation or state regulatory decisions have imposed very costly and burdensome restrictions or limitations on storage expansions, raising the risk that future expansions my be restricted, delayed, limited, or prohibited. The unavailability of added storage has become a significant risk that utilities must consider. Inability of an operating reactor to provide sufficient spent fuel storage capacity will cause the shutdown of that reactor.

In addition to the need for spent fuel storage capacity for operating reactors, reactors that have reached the end of their operating life must also provide spent fuel storage until the spent fuel can be shipped off-site. Until such off-site shipment takes place, the reactor site cannot be completely decommissioned. Particularly in those situations

where all reactors at a site have been permanently shut down, the absence of an off-site option for spent fuel storage will result in significant added costs of maintaining a licensed site. It will also result in increased decommissioning costs. Delayed decommissioning would leave the utility with a large ongoing operations and maintenance cost at a non-revenue producing facility. Uncertainties in the cost and availability of low-level radioactive waste disposal facilities caused by delayed decommissioning will also cause greater decommissioning costs.

PFS members have and are pursuing at-reactor spent fuel storage technologies to provide spent fuel storage capacity until the PFS ISFSI is available, as described in the letter from J. Parkyn, PFS to Director, Office of Nuclear Material Safety and Safeguards, NRC, dated May 18, 1998.

PFS members have reracked spent fuel storage pools and some have implemented dry storage or have plans to implement dry storage at reactor sites if needed, as discussed in the above letter. However, at least three of the PFS member reactors have limited spent fuel storage capacity that cannot be expanded due to state political constraints (Prairie Island 1 and 2) or may not be able to be expanded using existing dry storage technologies due to site constraints (Indian Point 2). Other facilities that have not added dry storage and have exhausted in-pool storage expansion alternatives may experience either political or site constraints that could prohibit dry storage and thus require shutdown of the nuclear power plants prior to the end of their useful lives.In addition, PFS members own three shutdown nuclear power plants (Indian Point 1, LaCrosse, and San Onofre 1) which will have to store spent fuel at the reactor sites for an estimated 30 to 40 years if spent fuel cannot be shipped off-site until 2015 or later.

The amount of storage capacity available is as follows (Data published by the Nuclear Regulatory Commission current as of November 4, 1998).

Utility	Reactor	Spaces Remaining
Consolidated Edison	Indian Point #1	Shut-down, fuel on-site
Consolidated Edison	Indian Point #2	457
Southern California Edison	San Onofre Unit #1	Shut-down, fuel on-site[1]
Southern California Edison	San Onofre Unit #2	672
Southern California Edison	San Onofre Unit #3	624
Genoa FuelTech (Dairyland Power Cooperative)	La Crosse Boiling Water Reactor	Shut-down, fuel on-site
American Electric Power	D. C. Cook Unit #1	1598 (shared)
American Electric Power	D. C. Cook Unit #2	
Illinois Power	Clinton	1381
GPU Nuclear	Oyster Creek	180
GPU Nuclear	TMI	583
Northern States Power	Monticello	1115
Northern States Power	Prairie Island Unit #1	125 (shared)
Northern States Power	Prairie Island Unit #2	
Southern Nuclear	Farley Unit #1	527
Southern Nuclear	Farley Unit #2	641
Utility	**Reactor**	**Spaces Remaining**
Southern Nuclear	Hatch Unit #1	1062 (shared)
Southern Nuclear	Hatch Unit #2	
Southern Nuclear	Vogel Unit #1	2392 (shared)
Southern Nuclear	Vogel Unit #2	

[1] Pool full; additional unit #1 assemblies being stored on an interim basis in Unit #2 and Unit #3 fuel pools and in space leased at the General Electric Morris Facility through 2002.

The storage capacity projected full-core off-load states for each unit are:

D. C. Cook Unit #1 - 2010
D. C. Cook Unit #2 - 2010
Indian Point Unit #2 - 2005
Oyster Creek - full core off-load lost 1996
TMI - 2009
Clinton - 2005
Monticello - 2006
Prairie Island Unit #1 - 2007
Prairie Island Unit #2 - 2007
San Onofre Unit #2 - 2006
San Onofre Unit #3 - 2006
Hatch Unit #1 - 2000
Hatch Unit #2 - 2000
Vogel Unit #1 - 2015
Vogel Unit #2 - 2015
Farley - Unit #1 - 2006
Farley Unit #2 – 2010

The need for the PFSF facility can be summarized under the four headings of economics, decommissioning capability, assurance of continued operations, and state restrictions. Following is a summary of how these needs relate to the PFSLLC member utilities.

Economics - Each of the PFSLLC member utilities made a conscientious decision to proceed with PFS based on the economics issue since it provides a lower cost alternative than the other options that are available. Most of the utilities have no capability remaining to re-rack within their existing pools. On-site dry storage is the only other option readily available. Due to economies of scale, spent fuel storage at a centralized storage facility is projected to be more cost effective than long-term storage of spent fuel at nuclear power plant sites until a DOE repository is available

Decommissioning Capability - Each of the PFS members that have fuel on-site (20 units) will reach the end of their operating license prior to the capability of the DOE's

facility to remove all accumulated fuel from the individual sites. The time required for the DOE removal causes an impediment to decommissioning in each of these cases. The existing three reactors that are shutdown need to remove fuel from site to complete decommissioning. As closure at the end of an operating period through decommissioning is an established principle of the NRC license, the clear existence of this need is a strong motivator to construct and operate a single site that would be dedicated solely to spent fuel oversight.

Assurance of Continued Operations - Several utilities expressed a need for the PFSF to continue to operate for the time specified in their operating license. Consolidated Edison at Indian Point #2 pointed out the potential of being unable to make appropriate arrangements for on-site storage of its' spent nuclear fuel, which would curtail the operation of Indian Point #2. California Edison indicated a need at San Onofre Units #2 and #3 to have the PFSF available to ensure full-core reserve and continued operation throughout its' license. American Electric Power indicated a need for its' Cook Nuclear Plants (Units #1 and #2) to use the PFSF to ensure full-core off-load and operation capability until the end of its license. Illinois Power indicated a need to have PFSF available in order to continue operation and avoid the costs of either additional wet spent fuel storage rack capacity or the construction of on-site dry storage. GPU Nuclear indicated that they need to have PFSF available for the continuing operation of Oyster Creek, whose spent fuel pool has reached full status and whose dry storage facility is not available, or shut the plant down. In the event that the plant is shut down for other reasons, they indicated a need to have PFSF available to promptly comply with the decommissioning needs. Northern States Power indicated a need to have the PFSF available to be capable of operating Prairie Island Units #1 and #2 beyond a date in which fuel storage is lost. Due to current state law, Northern States Power is limited to the use of a set number of casks or other equivalent for on-site storage. Southern Nuclear, which operates six reactors, indicated a need to have the PFSF to operate any of its' units to the end of their license. Failing to provide the PFSF would require

multiple expansions of on-site capability.

State or Local Restrictions - Minnesota has already imposed restrictions on further expansion of expended fuel storage capability at Northern States Power's Prairie Island facility.

With all of these considerations in mind, several utilities have formed the Private Fuel Storage L.L.C. (PFSLLC) to construct a privately-owned independent spent fuel storage installation (ISFSI) that will store spent fuel from several nuclear plants at a central site. This ISFSI, called the Private Fuel Storage Facility (PFSF), will be located on the Skull Valley Indian Reservation in northwestern Utah. The PFSLLC has entered into a lease agreement with the Skull Valley Band of Goshute Indians for the site.

The PFSF would allow reactors that are permanently shutdown to remove all the spent fuel from the site, thus permitting the complete decommissioning of the site. The availability of the PFSF would provide assurance of continued operation for those reactors which may be unable to increase at-reactor spent fuel storage due to physical or other limitations or restrictions. It would also provide insurance for situations where increased on-site storage might be physically possible but economically disadvantageous. In these latter situations, the availability of the PFSF may be the only alternative to the premature shutdown of a nuclear power reactor with its attendant costs, loss of generating capacity, and negative environmental impact.

The construction and operation of the PFSF is therefore the substitute for building dozens of individual on-site ISFSIs throughout the country. The canister-based transportable storage cask system to be used at the PFSF also will make subsequent transportation to a permanent repository or other location more efficient by use of a consistent packaging design and the use of the PFSF as a staging facility allowing for more efficient transportation campaigns.

The PFSF would utilize the dry cask storage technology which is currently in use at several operating nuclear power plants in the United States and abroad. Dry cask storage safely stores spent nuclear fuel inside of sealed canisters rather than in a spent fuel pool. The canister-based system confines the radioactive waste and therefore minimizes the potential for contamination of the environment. The casks are licensed by the Nuclear Regulatory Commission (NRC) in accordance with 10 CFR 72, which establishes requirements for the independent storage of spent nuclear fuel. The storage system technology is compatible with the long-term plans of the DOE interim storage facility and permanent repository (DOE/RW 1994). The PFSF is designed to store spent fuel for up to 40 years, by which time it is anticipated that all of the spent fuel will be transferred offsite and the facility ready for decommissioning. The initial request for a license is for a term of 20 years. Prior to the end of the initial license term an application for license renewal will be submitted.

The PFSF is designed to store up to 40,000 Metric Tons of Uranium [1](MTU) of spent fuel from U.S. commercial power reactors in sealed metal canisters (approximately 4,000 storage casks). The canister-based spent fuel storage system selected for use at the PFSF utilizes sealed metal canisters to store multiple spent fuel assemblies. Each canister is placed inside a concrete cask. The storage system is passive and relies on natural convection for cooling. The system is an integral part of the facility "Start Clean/ Stay Clean" philosophy which precludes handling individual fuel assemblies at the site. The system assures there is negligible contamination or radioactive waste generated at the site and facilitates the ease of decommissioning at the end of the life of the facility.

[1] Metric Tons of Uranium (initial uranium). This includes the small amount of mixed oxide fuels that are anticipated to require storage.

It is planned that four mixed-oxide fuel assemblies will be stored at the PFS facility. These assemblies are owned by the Southern California Edison and the San Diego Gas & Electric companies. The four assemblies were loaded into San Onofre Nuclear Generating Station Unit 1 for cycles 2 and 3 (operation 1970-1973) as part of the Edison Electric Institute's plutonium recycle demonstration program. They have been stored in the SONGS Unit 1 spent fuel pool since they were removed from the reactor.

The total spent nuclear fuel estimated to be generated by PFS member nuclear power plants that may be shipped to the PFS Independent Spent Fuel Storage Installation (ISFSI) is approximately 13,000 MTU of spent nuclear fuel. While all of the remaining capacity may not be used, a 40,000 MTU facility would make additional spent fuel storage capacity available for other nuclear power plants that are projected to require additional storage capacity while operating and for acceptance of spent fuel from shutdown nuclear power plants. While additional nuclear power plants have not joined PFS to date, the larger facility capacity could accommodate utilization of PFS's cost effective storage by additional nuclear power plants instead of building additional at-reactor storage capacity or continuing to store spent fuel at shutdown nuclear power plant sites.

A total of 86,000 MTU of spent fuel is projected to be discharged from U.S. nuclear power plants through the end of their 40-year operating licenses. PFS assumes that a DOE repository would be available by 2015 to begin spent fuel acceptance from commercial nuclear power plants. If DOE does not begin spent fuel acceptance until 2015, it is projected that approximately 21,500 MTU of additional storage capacity in excess of current pool capacity would be required at operating nuclear power plants nationwide. In addition, by 2015 there would be an estimated 27,000 MTU of spent fuel in storage at shutdown nuclear power plants nationwide. In a scenario in which DOE does not begin spent fuel acceptance until 2015, nuclear power plants would have to store spent fuel at nuclear power plant sites for an average of 23 years after shutdown

for decommissioning. For older shutdown nuclear power plants this number would be as high as 41 years of at-reactor spent fuel storage unless there is an interim storage facility to which spent fuel can be shipped.

Although PFS assumes that a DOE repository would be available by 2015 to begin spent fuel acceptance from commercial nuclear power plants, PFS also assessed additional storage requirements assuming that DOE begins SNF acceptance in 2010. If DOE begins spent fuel acceptance in 2010, it is projected that approximately 18,000 MTU of additional storage capacity in excess of current pool capacity would be required at 89 currently operating nuclear power plants (58 reactor sites) nationwide. In addition, by 2010 there would be an estimated 6,800 MTU of spent fuel in storage at shutdown nuclear power plants nationwide. In a scenario in which DOE does not begin spent fuel acceptance until 2010, nuclear power plants would have to store spent fuel at nuclear power plant sites for an average of 18 years after shutdown for decommissioning. For older shutdown nuclear power plants this number would be as high as 36 years of at-reactor spent fuel storage unless there is an interim storage facility to which spent fuel can be shipped.

Due to economies of scale, spent fuel storage at a centralized storage facility is projected to be more cost effective than long-term storage of spent fuel at nuclear power plant sites until a DOE repository is available.

Assuming a 40,000 MTU storage facility begins operation in 2002 and is utilized by all commercial nuclear power plants prior to spent fuel being accepted by DOE in 2015, approximately 6,300 MTU of additional storage capacity would be required at operating nuclear power plants nationwide. Under a 2002 PFS ISFSI scenario, spent fuel would be stored at nuclear power plants nationwide for an average of 11 years following plant shutdown for decommissioning.

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1.4 REFERENCES

10 CFR 72, Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High Level Radioactive Waste.

DOE/RW 1994, Multi-Purpose Canister System Evaluation, U.S. Department of Energy Civilian Radioactive Waste Management, DOE/RW-0445, September 1994.

PFS Letter, J. Parkyn to Director, Office of Nuclear Material Safety and Safeguards, U.S. NRC, dated May 18, 1998.

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CHAPTER 2

THE SITE AND ENVIRONMENTAL INTERFACES

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Land use within the Skull Valley Indian Reservation boundary consists of residential uses (approximately 30 persons living on the Reservation), and the Tekoi Rocket Engine Test Facility operated by Alliant Techsystems on leased Reservation lands. This facility, located approximately 2.5 miles south-southeast of the PFSF on the south side of Hickman Knolls, has been operated at this location since 1975. Based on phone conversations with Alliant Techsystems Inc. in September 1999, Alliant currently has no rocket engine tests scheduled at the Tekoi test facility, and no plans to conduct rocket motor testing at the Tekoi test facility in the foreseeable future. According to Alliant, five rocket engine tests were conducted at the Tekoi test facility over the past two years, with each test lasting approximately 1.5 to 2 minutes. Noise produced by rocket motor testing is discussed in Section 2.8. In order for this facility to be used by Alliant Techsystems Inc. in the future, the lease agreement between Alliant and the Goshute Band would need to be renegotiated. Skull Valley Road (designated as Federal Aid Secondary Road (FAS) 108) is located to the east of the PFSF and traverses Skull Valley from Interstate 80 south to the intersection with State Route 199.

2.1.2 Transportation Corridors

Two modes of transporting the shipping casks to the PFSF are presented. The preferred approach is by direct rail from the Union Pacific mainline to PFSF via a new rail line that originates at Low Junction, Utah. Alternatively, the shipping casks will be transferred from the rail mainline at an intermodal transfer point and transported by heavy haul tractor/trailer to the PFSF along Skull Valley Road.

For the direct rail approach, the portion of the Skull Valley that would be affected, due to the construction of the new rail line, is approximately 32 miles of undeveloped public rangeland administered by the BLM. The new line will be approximately 40-ft wide and will originate from the mainline on the south side of Interstate 80 at Low Junction and

will proceed southeast, parallel to Interstate 80, for approximately 3 miles, turn south for approximately 26 miles, and then east for about 3 miles to the PFSF.

For the intermodal transfer point, a portion of the frontage road on the north side of Interstate 80 (from the intersection of Interstate highway 80 and the Skull Valley Road to a point 1.8 miles west) would be affected by the transportation of shipping casks to and from the PFSF. The frontage road is a 20-foot wide asphalt roadway with 0 to 3-foot wide aggregate shoulders. The portion of the Skull Valley Road that would be affected is approximately 24 miles long, beginning at Timpie and continuing south to the PFSF access road. The existing road is a 22 to 24-foot wide asphalt roadway with 0 to 3-foot wide aggregate shoulders.

years. Cattle graze following a 3-year cycle: in year one they graze from November 1 to April 30th; in year two they graze from November 1 to February 28th; and in three they graze from November 1 to February 28, and April 1 to April 30th (BLM, 1985).[2] Portions of two pastures in the South Skull Valley allotment are within the 5mile radius: the east end of the Cochrane Pasture and the northern edge of the Post Hollow Pasture. The permit holder for these pastures is authorized to graze a maximum of 700 cattle and 3,800 sheep from November 1 to April 30th in alternating years (BLM, 1986).[3]

Land ownership in Skull Valley is split between private landowners along the Skull Valley Road and the Federal Government for the expansive general areas of the valley. The BLM has long-standing grazing allotments with the Castlerock Land and Livestock, L.C., the significant private landowner in Skull Valley for their cattle ranching enterprise from the north end of the valley to south of the Skull Valley Band of Goshute Reservation. Water use in the valley is therefore limited to servicing human consumptive needs, limited irrigation for cattle feedstock along Skull Valley Road, and drinking water for the livestock itself over the grazing areas. The opportunity for expansion of existing uses in the valley is limited due to the lack of accessible private land in the valley or for the same reason along the Skull Valley Road corridor. According to the Tooele County General Plan (November 1995), little growth is anticipated for Skull Valley and the residents also indicated a desire of no growth. Consultations with BLM on existing land use have indicated their concern of possible overgrazing in the valley at the present time. All of these factors indicate that current water use is likely to stand for the foreseeable future with little if any increase.

[2] 5,000 sheep and 2,300 cattle are the maximum authorized for the three pastures in the 271,000-acre Skull Valley allotment.
[3] The permit holder is allowed to graze livestock at two other pastures within the South Skull Valley allotment outside the 5-mile radius, so we would expect considerably fewer sheep or cattle grazing within the 5-mile radius.

In addition to grazing, recreation use is also allowed on some BLM land within the PERA. Off-highway vehicle (OHV) use, dispersed camping, and hunting are principal uses of BLM property within the PERA (BLM, 1988). There are no designated camping areas or OHV trails or roads within the 5-mile radius, though the BLM land within the radius is given an OHV designation category "A," meaning that it is open to all types of motor vehicle use (BLM, 1992).

The estimated recreational use in Skull Valley does not exceed 3,000 visitor days per year. The Bureau of Land Management's (BLM's) estimate for total recreation use in the entire Pony Express Resource Area (PERA) is 218,870 visitors per year. A majority of the area encompassed by the PERA, however, extends well beyond Skull Valley and includes land beyond the 50-mile radius of the PFSF site. There are no major recreation areas within Skull Valley. The largest designated recreation use in the Skull Valley portion of the PERA is off-highway vehicle (OHV) use. The BLM does not have a specific estimate of the amount of OHV vehicle use in Skull Valley but includes it in the overall dispersed recreation use for the entire PERA. One of the most popular OHV use areas is the Knolls, which is not in Skull Valley. BLM reported recreational use of 17,577 visitor days at the Knolls in 1997; use in 1998 was estimated at 9-12,000 visitor days. OHV use in Skull Valley would be significantly less than in the Knolls because, unlike the Knolls area, there is a large percentage of private land in Skull Valley that inhibits OHV use. Use in Skull Valley is also seasonally limited to designated routes from December 1st to April 15th and to existing roads and trails from April 16th to November 30th (Personal communication between S. Conant, SWEC, and L. Kirkman, BLM, May 22, 1997 and S. Conant, SWEC, and Britta Nelson, BLM, January 19, 1999).

The closest developed BLM recreation facility is Horseshoe Springs, which is located 15 miles north on the Skull Valley Road. Horseshoe Springs is accessed via a short (~1,100 ft) gravel road. The site consists of a 10 to 20 space parking area, an

information kiosk, and a short, unmarked hiking trail that winds around the two ponds that are the central feature of the area. There is a wooden boardwalk and footbridge on the trail. Recreation activity in the area consists of OHV use, nature study, bird watching, fishing, and waterfowl hunting. BLM reports visitor use of the area at 500 to 1,000 visits per year (Personal communication between S. Conant, SWEC and L. Kirkman, BLM, May 22, 1997).

Although area is posted as "No Swimming", BLM reports that some limited unauthorized swimming does occur (BLM, 1992).

Horseshoe Knolls is located across Skull Valley Road from the Horseshoe Springs. It is described by the BLM as an undeveloped camping area. There are no restrooms, running water, designated campsites, or other amenities provided by the BLM at the site. The area is one of an estimated 7 to 9 similar areas located throughout the Pony Express Resource Area to which the BLM directs groups and other casual users in order to confine recreation user impacts to specific areas. It is typically used by community organizations, such as the Boy Scouts, or by other groups such as motorcyclists or target shooters. Because it is an undeveloped camping area, the BLM does not maintain site specific visitor use figures. The number of visitors estimated for the area is included in recreation use figures for Horseshoe Springs.

Mount Deseret, approximately 9 miles northeast of the PFSF, is the central feature of the 25,000-acre Deseret Peak Wilderness located within the Stansbury Mountain unit of the Wasatch-Cache National Forest. The Forest Service manages the area for primitive recreational use at dispersed locations. Developed recreational facilities and motorized vehicle use is prohibited in wilderness areas. Recreational activity in the Deseret Peak Wilderness includes hiking, hunting and horseback riding. Overnight camping by groups of more than 10 persons, and camping in one location for a period of more than three days is

prohibited. The number of annual recreational visits to the Deseret Peak Wilderness is estimated at 18,000.

Six campgrounds are located along South Willow Canyon Road in the Stansbury Mountain unit of the Wasatch-Cache National Forest to the east of the boundary to the Deseret Peak Wilderness. South Willow Canyon Road and the campgrounds are located approximately 10 miles northeast of the PFSF, in line with Mount Deseret Peak. The campgrounds contain a total of 32 campsites and are open from May to October. According to the National Forest Service, there are approximately 17,000 visits annually within the six campgrounds. Also within the Stansbury Mountains, two trail heads (Medina Flat and O.P. Miller) attract an estimated 9,500 visits per year. (Telephone conversation between S. Conant, S&W, and Jack Vanderberg, Acting Recreation Manager, Wasatch-Cache National Forest, January 21, 1999).

Land use outside the boundaries of the Skull Valley Indian Reservation is regulated by the BLM or Tooele County zoning. All of the property that is required for the Low corridor rail line or intermodal transfer point is situated within land owned by BLM except for land adjacent to the mainline, which is owned by Union Pacific Railroad. Based on a review of applicable laws for the state of Utah, the Tooele County Zoning Ordinance does not apply to federal lands such as the land administered by the BLM and therefore does not apply. The Union Pacific right-of-way is currently zoned for industrial uses. The addition of rail sidings at Low for the rail line or at the intermodal transfer point that are within the UP right-of-way are allowed by the zone designation.

BLM property and most of the privately owned property is zoned as a Multiple Use District. The minimum lot size in a Multiple Use District is 40 acres. Multiple Use Districts are established in open, generally undeveloped areas where human habitation would be limited in order to protect land and open space resources. The remainder of

the privately owned land is zoned Agricultural, which has a minimum lot size of 20 acres. The purpose of an Agricultural District is "to promote and preserve in appropriate areas conditions favorable to agricultural uses and to maintain greenbelt open spaces" (Tooele County 1996). Permitted uses in Multiple Use and Agricultural Districts include grazing of livestock, agricultural uses, construction of single and two-family homes, development of public park and recreation facilities, and the storage and disposal of agricultural equipment (Tooele County, 1995 and 1996).

2.2.3 Demographics

2.2.3.1 Population Distribution and Trends

Populations in this section are discussed from four viewpoints: (1) "regional population" consisting of a three-county area comprised of Tooele, Salt Lake, and Utah counties, which contain nearly 60 percent of the total state population, (2) a 50-mile circle centered on the PFSF to show population densities relative to the site location, and (3) the population within a 5-mile radius of the PFSF, for the purpose of identifying whether disproportionately high and adverse impacts might exist to minority or low income populations (see Section 2.7.3, Environmental Justice).

2.2.3.2 Regional Population

Utah had a population of 1,980,000 persons in 1994. Among the 50 states and the District of Columbia, the State ranked as 34th most populous (BEA, 1996). From 1970 to 1990, the Tooele County regional population approximated State-wide growth levels. During this period, the Tooele County region's population increased at an average annual rate of approximately 2.55 percent, while the growth rate for the State was 2.8 percent. Between 1980 and 1990, Tooele County regional population growth slowed to

an average annual growth rate of 1.3 percent, compared to 3.8 percent during the previous decade. Utah is expected to remain the 34th most populous state, with 2.2 million people expected for the year 2000 and 2.9 million people expected for the year 2025 (Campbell, 1996).

The 1990 population for the three county area around the PFSF (Tooele, Salt Lake, and Utah Counties) was 1,016,147, which comprised nearly 60 percent of the state's total 1990 population of 1,722,850. The most populous county was Salt Lake, which contained over 71 percent of the three county total. Tooele was the least populous county in the region (Census, 1983, 1988, and 1993). Population in this three county area is projected to reach 1,804,519 persons by 2020, based on a projected annual average population growth of 2.0 percent.

2.2.3.3 Population Within 50 Miles

Skull Valley is a remote region with populations found in the unincorporated residential community of Terra, the Town of Dugway, the Skull Valley Band of Goshute Village, and ranches located in the valley along Skull Valley Road. According to county utility records, there are approximately 30 households in Terra and 11 others scattered in Skull Valley. Utilizing the persons per household value of 3.06 (Census, 1993), we estimate that an additional 119 persons live in Skull Valley (excluding the two ranches accounted for in the 5-mile radius). In addition, the nearest sizable population area to the PFSF is the Town of Dugway, with a population of about 1,761 (Census, 1993), located approximately 12 miles to the southwest of the PFSF. Therefore, the total population estimate for Skull Valley is 1,916. Using an area of 600 square miles for Skull Valley, the population density equals approximately 3.2 persons per square mile.

Figures 2.2-2 and 2.2-3 show estimated population figures, based on the 1990 Census, for the years 1990 through 2020 for the 50-mile radius around the PFSF. Also shown are the relative locations of the major towns. The population between 5 and 50 miles of the PFSF is about 276,577 (Figure 2.2-2). The two largest population centers within the 50-mile radius include Tooele City and a portion of western Salt Lake City, with 1990 populations of approximately 13,887 and 246,981, respectively. Expected population growth by the year 2020 (based on state-wide growth levels) is depicted in Figure 2.2-3. The age distribution within this area, from the 1990 Census, is shown in Table 2.2-1.

2.2.3.4 Population Within 5 Miles

The population within a 5-mile radius of the PFSF has been characterized for the purposes of identifying whether any disproportionately high and adverse impacts might exist to minority or low-income populations. The definitions of minority and low-income and the analysis approach are presented in Section 2.7 on Environmental Justice (Census, 1993).

Population within a 5-mile radius of the PFSF consists of approximately 30 residents of the Skull Valley Indian Reservation and two private ranches (each assumed to have 3 residents) on Skull Valley Road, approximately 2.75 and 4.0 miles northeast of the PFSF. The closest residences to the PFSF are two homes on the Skull Valley Indian Reservation, located approximately 2 miles southeast of the PFSF. There are no cities, towns or census designated places (CDP) located within a 5-mile radius of the PFSF (see Figure 2.2-4). There are no residences located near the Low Corridor.

The estimated population within a 5-mile radius of the PFSF is about 36 persons. Because of the remoteness of the Skull Valley location, it is unlikely that the permanent

population within a 5-mile radius of the PFSF would change significantly during the license period.

2.2.3.5 Transient and Institutional Population

No transient or institutional populations are present within 5 miles of the PFSF. The Skull Valley Road passes through the Reservation approximately 1.5 miles from the PFSF. Traffic on this roadway is primarily related to local resident travel and travel between Interstate 80 and the Dugway Proving Ground. During October 1996, a survey was conducted to identify existing and planned public facilities and institutions, within a 5-mile radius of the facility. Due to the remoteness and extreme low population density of the area (36 persons within 5-mile radius), no public facilities such as hospitals, prisons, parks or recreational areas are located or planned within 5-miles of the PFSF.

2.3 ECOLOGY

Within a 5-mile radius around the PFSF, there are approximately 28,000 acres of public land administered by the BLM, 9,000 acres of privately owned land and 13,000 acres of land which is part of the Skull Valley Indian Reservation. The area is nearly flat, sloping gently downward to the north with small, local elevation changes of about 1 foot per 100 ft.

The heavy-haul of transportation casks will begin at the intermodal transfer point, 1.8 miles west of the intersection of I-80 and Skull Valley Road at Timpie, and continue south approximately 24 miles along Skull Valley Road to the access road for the PFSF. The Low Corridor rail line will cross BLM land beginning at Low Junction on the south side of I-80, Section 18, Township 1 North, Range 9 West, and proceed southeast along I-80 about 3 miles, turning south for about 26 miles, and finally east for 3 miles to the west side of the PFSF (about 32 miles total). Assuming a 200 foot construction right-of-way for the rail line, about 776 total acres would be disturbed. Resources were evaluated and are described in this section for a 0.5-mile zone along both sides of the existing Skull Valley Road and 0.5-mile zone along both sides of the Low Corridor rail line. Transportation of casks on Skull Valley Road would occur by heavy haul tractor/trailer; a rail line would be used to transport casks along the Low Corridor.

Skull Valley is within the area identified by Bailey (1978) as the Bonneville Saltbush-Greasewood section of the Intermountain Sagebrush Province. This is a high desert environment with desert shrub species dominating the valley floors and a coniferous forest (pinyon/juniper) creeping down the adjacent mountain slopes. In addition to sagebrush (*Artemisia tridentata*), other important plants found in this community include shadscale (*Atriplex confertifolia*), fourwing saltbush (*Atriplex canescens*), rubber rabbitbrush (*Chrysothamnus nauseosus*) , spiny hopsage (*Grayia spinosa*), and

horsebrush (*Tetradymia sp.*) (Bailey, 1978). This vegetative community results from the low precipitation and highly alkaline soils. Soils which encompass the PFSF site and transportation corridors are poor in terms of supporting vegetation that would provide diverse wildlife habitats (USDA-SCS, undated).

The BLM identifies seven vegetation zones within the Pony Express Resource Area (PERA), which includes most of Tooele and some of Utah Counties. They are as follows: desert shrub/saltbush, greasewood, sagebrush, mountain shrub, juniper/pinyon woodland, riparian /wetland habitats and conifer/aspen. Additional vegetation types found in the area include barren/rock outcrops, perennial grass, and annuals. Cheatgrass (*Bromus tactorum*), an introduced annual grass, has invaded disturbed areas within the desert shrub/saltbush zone (BLM, 1988).

A study of the ecological history of Tooele and Rush Valleys (located to the east of Skull Valley) indicates that the original vegetation over the more accessible parts of the area may have been destroyed by overgrazing and fires prior to 1880 (Christensen and Hutchinson, 1965, as cited in BLM, 1990). Range conditions continued to decline until 1929 when parts of the valleys became a major "dust bowl." These areas are relatively stable today; however, fire has played a major part in the diversity of vegetation (Christensen and Hutchinson, 1965, as cited in BLM, 1990). The abundance of invasive annuals and conspicuous absence of native plant species in Skull Valley reflects the past history and repeated cycles of overgrazing, drought, and fire (Cottom 1976, Rogers 1982, Billings 1990, Christensen and Hutchinson as cited in BLM 1990).

Sparks et al (1990) conducted a study of changes in vegetation in Skull Valley and how those changes relate to land use and native vegetation types. The study concluded that unrestricted livestock grazing, coupled with wildfires, triggered the conversion to dominance by annuals. It further noted that the greatest changes occurred in former

sagebrush and shadscale dominated vegetation on bench, foothill, and baja sites where livestock grazing and fires have been most concentrated. Areas at higher elevations, and rugged topography where there has been less grazing and fires, have had less conversion to cheatgrass. When fires occurred at higher elevations where there was no grazing, native vegetation recovered with little invasion. In addition, Greasewood, saltgrass, and playa sites saw little change in plant species composition over the historical period studied. The results of the study suggest that a combination of both livestock overgrazing and wildfires are probably required for the conversion from native species to invasive annuals.

Table 2.3-1 classifies the major vegetation types found within the project area including those areas within a 5-mile radius of the PFSF and the proposed transportation corridors, along with common plants, and elevations and locations where the vegetation types are normally found.

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ground squirrels (*Spermophilus sp.*), jackrabbits (*Lepus sp.*), kangaroo mice (*Dipodomys sp.*), wood rats (*Neotoma sp.*), and kit fox (*Vulpes macrotis*). Some species, such as the Belding and Townsend ground squirrels (*Spermophilus townsendii* and *Spermophilus beldingi*), become dormant during the hot, dry summer. In the northern portion of Skull Valley, waterbirds, shorebirds, and wading birds are present, in association with water and wetlands adjacent to and south of the Great Salt Lake and the Horseshoe Springs Wildlife Management Area (WMA), about 26 miles and 15 miles from the PFSF, respectively.

Appendix 2B provides life history information including habitat, diet, predator/pray relationships and limiting factors for twenty "important" wildlife species found in Skull Valley. Appendix 2C of this report ranks the relative biological importance of each land cover type shown on Figure 2.3-1 for each vertebrate species as either critical, high-priority, substantial, or limited value.

Big game species that use the area are limited to mule deer and pronghorn antelope. The PFSF and the access road are within mule deer West Desert North Herd Unit 62A and the eastern portions of the 5-mile radius are in the Stansbury Herd Unit 12. There are an estimated 850 mule deer in the West Desert North Herd and 13,400 in the Stansbury Herd. The West Desert Herd range conditions are reported to be in fair condition with a stable trend; the Stansbury Herd range conditions are reported to have good summer habitat and fair-poor winter habitat, with a stable trend for the summer habitat conditions and a downward trend for winter habitat.

According to BLM maps, there is no crucial deer wintering, fawning, or summering habitat within 5-miles of the PFSF; however, crucial deer wintering habitat occurs approximately 6 miles east of the PFSF, along the west side of the Stansbury Mountains (BLM, 1988). Most of the project area is considered as having only limited value for mule deer;

however, small segments along the east side of a 5-mile radius from the facility overlap winter mule deer use areas that are ranked as high-priority and of critical value (see Figure 2.3-3) (UDWR, 1997a).

Land within the 5-mile radius of the PFSF site, access road, and both transportation corridors are all located within the pronghorn antelope West Desert Herd Unit 2, Riverbed (A) portion. This herd unit consists of 231,252 acres of suitable habitat that supports approximately 130 antelope. No crucial summer habitats have been identified for this area (BLM, 1988). Pronghorn antelope occur mainly in the southern portions of Skull Valley and are uncommon in the vicinity of the PFSF (BLM, 1990 and personal communication with K. Gardner, Wildlife Biologist, Salt Lake City District Office, BLM, February 25, 1997). Only two pronghorn were observed during wildlife surveys conducted in 1998.

Pronghorn antelope (*Antilocapra americana*), mule deer, mourning dove (*Zenaidura macroura*), ravens, desert woodrat (*Neotoma lepida*) (nests and food cache among rocks of Hickman Knoll), coyote (scat observed), turkey vulture (*Carthartes aura*), an unidentified hawk (large pellet observed), a number of unidentified sparrows, vesper sparrow (*Pooecetes gramineus*), western meadowlark (*Sturnella neglecta*), and unidentified small lizards were observed in the PFSF site area during initial site visits in June and October 1996 and February 1997.

The only upland game birds that typically occur in the vicinity of the PFSF are mourning doves and less frequently chukar (*Alectoris graeca*), sage grouse (*Centrocercus urophasianus*), Hungarian partridge (*Perdix perdix*), and ring-necked pheasant (*Phasianus colchicus*). These are all protected game birds. If chukar, sage grouse, Hungarian partridge, or ring-necked pheasant nests are found, UDWR recommends (UDWR, 1997a) that they should be protected from disturbance and disturbed sites

should be revegetated with species having value to the birds. It is unlikely that these birds will occur in areas of disturbance.

Mourning doves are common during the late spring, summer and early fall. Chukars are plentiful along the slopes of the Stansbury Mountains and can be found in sagebrush/grass, greasewood/shadscale, and juniper vegetation types near steep, rocky slopes. Although the PFSF site and access road are not in chukar range, the easternmost portion of the 5-mile radius is (BLM, 1990). Chukars are an exotic game species that occur in the easternmost portion of a 5-mile radius from the PFSF (see Figure 2.3-4) (UDWR, 1997a).

Sage grouse are an endemic game species that the UDWR identified as potentially occurring within a 5-mile radius of the PFSF and the transportation corridors. Local sage grouse habitat is generally associated with the benches and upper valley floors of the Stansbury Mountains. Figure 2.3-5 shows the mapped sage grouse habitat in Skull Valley where their general range extends to the northern part of Skull Valley Road, just south of I-80 (BLM, 1990). UDWR has not identified any leks or strutting grounds (courtship areas where male sage grouse congregate to attract mates) within the PFSF project's 5-mile radius. Leks are usually associated with wet meadows (UDWR, 1997a), and these mesic areas are concentrated on the northern end of Skull Valley. No crucial winter range or nesting habitat type has been located within the project's 5-mile radius.

The ring-necked pheasant and the Hungarian partridge are exotic game species that could be found within a 5-mile radius of the PFSF and within 0.5 miles of the Skull Valley Road Corridor. No pheasants or partridges are expected nor have any been observed within 0.5 miles of the Low Corridor rail line. Agricultural areas that produce small grain crops are critically valued areas to both species (UDWR, 1997a). There are no agricultural areas within any areas that will be disturbed by the project. Figure 2.3-6

shows the locations of ring-necked pheasant use within the project area. Hungarian partridge once existed within the project area but are not known to exist there today (UDWR, 1997a).

According to the UDWR (1997a), all raptor species in the area are endemic, and are classified as state protected wildlife in Utah. There are no identified nests within a 5-mile radius of the PFSF, as shown in Figure 2.3-7, however UDWR expects many nests are unidentified throughout Skull Valley. Raptors that inhabit the area include golden eagle (*Aquila chrysaetos*), prairie falcon (*Falco mexicanus*), burrowing owl (*Speoyoto cunicularia*) short-eared owl (*Asio flammeus*), northern harrier (*Circus cyanneus*), rough-legged hawk (*Buteo lagopus*), Swainson's hawk (*Buteo swainsoni*), ferruginous hawk (*Buteo regalis*), and red-tailed hawk (*Buteo jamaicensis*). There is extremely limited nesting habitat available within the 5-mile radius of the PFSF because most of these species require trees or cliffs to nest. However, there is some potential nesting habitat available at Hickman Knolls about 1.5 miles south-southwest of the PFSF and within 1 to 2 miles west of the Low Corridor. Observations made during the 1998 wildlife survey indicate that suitable raptor nesting habitat is used and available within 0.5 mile of the Skull Valley Road transportation corridor. In addition, short-eared owls and the northern harrier (marsh hawk) (*Circus cyaneus*) nest on the ground or in short bushes. Ferruginous hawks may also select rock outcrops low to the ground for nesting. State and BLM requirements place a 0.5-mile buffer zone around active raptor nests where disturbing activities are not permitted during specified nesting periods.

The location of the large mudflat at the base of the Stansbury Mountains is shown on the Regional Location map, Figure 2.1-1. Mudflat areas provide habitat for a variety of shorebirds and amphibians. In Skull Valley, the areas that remain wet the longest, thereby providing the best and most enduring habitat, are at the northern areas closest to the Salt Lake along the center of Skull Valley. In many cases, wildlife, such as

amphibians, that utilize mudflats remain within these areas. However, some shorebirds, such as the long billed curlew, will nest in upland areas adjacent to the mudflats.

The PFSF site is located greater than 10 miles away from the nearest mudflat area and is not likely to be used by wildlife found in the mudflats. At its closest, the railroad corridor is about a mile to the west of mudflats. It is possible that wildlife, primarily shorebirds, could use these upland areas as well. However, most of the railroad line is removed from the mudflats to preclude the presence of mudflat species.

2.3.1.3 Aquatic Resources

There are no aquatic resources within Section 6 and there are no wetlands or ponds within a 5-mile radius of the PFSF. However, there are approximately 20 stream channels identified on the U.S. Geological Survey (USGS) quadrangles within a 5-mile radius of the PFSF. These stream channels are ephemeral or, at best, intermittent and have no features that can be considered aquatic. They are essentially dry washes that probably have short-term flow following local storm events or perhaps during a period of snowmelt. The infrequency and small magnitude of these flows precludes the development of wetlands and prevents the streams from providing aquatic or riparian habitat.

2.3.1.4 Threatened, Endangered, and Sensitive Species

Table 2.3-2 lists the plant and animal species identified as threatened, endangered, or sensitive by each agency's classification criteria along with the associated habitat of each species. If an agency commented on a species, the species' status was entered into the table, however if no agency commented on a species, no status was entered in

that agency's column even if that agency lists that species as threatened, endangered, or sensitive.

According to the State of Utah, Sensitive Species List (February 1998), "species of special concern" are defined as any wildlife species or subspecies that has experienced a substantial decrease in population, distribution and/or habitat availability, or occurs in limited areas and/or numbers due to a restricted or specialized habitat, or has both a declining population and a limited range;

2.3.1.4.1 Plants

Based on the most recent U.S. Fish and Wildlife Service (USFWS) review for federally threatened and endangered species (letter from Field Supervisor, Utah Field Office, USFWS, Salt Lake City, Utah, July 31, 1998), there is only one federally listed plant species that could occur within the project area i.e., Ute Ladies-tresses.

Ute Lady's-tresses (*Spiranthes diluvialis*) is a rare orchid listed as federally threatened. This orchid is generally found in several small populations at relatively low elevations in mesic or wet meadows along permanent streams, and around springs and major desert lakes of Nevada, Utah, and Colorado. These sites are commonly subject to intermittent and unpredictable inundation, and the plants often emerge from shallow water (Sheviak 1984). The USFWS stated that this plant species is found in Tooele County and may occur in the project area. However, there are no known springs or permanent water bodies within the PFSF area that support the habitat for Ute Lady's tresses and none have been observed during project surveys.

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According to the UDWR (1997a), there are three "high interest" plant species which potentially occur within a 5-mile radius of the PFSF. The Pohl's milkvetch (*Astragalus lentiginosus var. pohlii*), small spring parsley (*Cymopterus acaulis var. parvus*), and big saltbush (*Atriplex lentiformis*) are classified as non-protected endemic plants. "High interest" species are defined as all game species, any economically important species, and any species of special aesthetic, scientific, or educational significance including those deemed as being sensitive, which would include all federally listed, threatened, and endangered species (UDWR 1997a).

The Pohl's milkvetch is also described as "rare" and has a Natural Heritage Program Global Rank of G5T1 (meaning the species is widespread and abundant, but the variation is rare, and vulnerable to extinction), and a State Rank of S1 (describes species with five or fewer occurrences or very few individuals, which makes the species vulnerable to extirpation) (UDWR, 1997a). It is currently listed as a species special concern by the BLM and could potentially occur in Skull Valley growing on exposed clays and fine sands in sagebrush, salt desert shrub, and greasewood communities at approximately 4,362-5,412 feet elevation. The species is endemic to Rush and Skull Valleys, although previously it has never been recorded (letter from A. Stephenson, Environmental Specialist, Salt Lake Field Office, BLM to S. Davis, SWEC, February 20, 1997).

No Pohl's milkvetch were identified within the PFSF site or along the access road during surveys conducted in June 1998 (Kass 1998b). The nearest known population of Pohl's milkvetch to the project area is located south of the PFSF site on an abandoned road to Hickman Knolls in SE 4, SW4, Section 9, Township 5 South, Range 8 West (Kass 1998b). The next known location is in Township 4 South, Range 8 West, Section 6, approximately 6 miles east of the PFSF (UDWR, 1997a).

Springs. Many species of waterfowl and shorebirds (discussed in Section 2.3.5.5) occur at Horseshoe Springs and Timpie Springs.

Big game species are limited to mule deer and pronghorn antelope which are in the same herds as those that occur near the PFSF. Pronghorn antelope usage of transportation corridor lands is infrequent . As discussed in Section 2.3.2, pronghorn antelope occur mainly in the southern portions of Skull Valley (BLM, 1990 and communication with Salt Lake City District Office, BLM, February 25, 1997).

According to UDWR (1997a) most of the project area is considered as having only limited value for mule deer. According to BLM (1988) maps, there is no crucial deer wintering, fawning, or summering habitat within the transportation corridor. Winter use areas, as mapped by UDWR (1997a), occur along the eastern edge of the mile wide area evaluated as the transportation corridor with very little of this crucial habitat actually existing within the 0.5 mile zone on either side of Skull Valley Road (see Figure 2.3-3).

Mink (*Mustela vison*), a state-protected furbearer species, exists in association with wetlands occurring in the transportation corridor (UDWR, 1997a). Figure 2.3-10 shows the usage area for the mink in Skull Valley. The only other aquatic furbearer existing in the transportation corridor is the muskrat (*Ondatra zibethicus*) (BLM, 1988). The PFSF site visit (Stone & Webster site visits, 1996) shows that there are plentiful muskrat holes found at Horseshoe Springs.

Upland game birds that typically occur in the vicinity of Skull Valley Road (as at the PFSF) are mourning doves and less frequently chukar, sage grouse, Hungarian partridge, and ring-necked pheasant. The range of yearlong chukar usage does not extend into the mile wide area evaluated as the transportation corridor, but does occur along the eastern edge of the corridor, in association with the Stansbury Mountains (see Figure 2.3-4). The

typical range of the sage grouse includes the northern part of the transportation corridor and extends south along the eastern edge of the corridor towards the PFSF (UDWR, 1997a) (see Figure 2.3-5). However, crucial winter range and strutting and nesting habitat does not occur within the transportation corridor (BLM, 1988).

According to UDWR (1997a), the ring-necked pheasant and the Hungarian partridge are state protected exotic game species which could be found within the transportation corridor. Ring-necked pheasant nest between mid-March and May and can be found in agricultural areas that produce alfalfa and small grain crops, which occur in patches along Skull Valley Road (see Figure 2.3-6). Hungarian partridge also use agricultural areas with small grain crops grown in proximity to shrublands. The Hungarian partridge historically occurred in Skull Valley, but may not be present today. Figure 2.3-11 shows the locations in Skull Valley with suitable habitat conditions to support Hungarian partridge.

If chukar, sage grouse, Hungarian partridge, or ring-necked pheasant nests are found, UDWR recommends (UDWR, 1997a) that they should be protected from disturbance and disturbed sites should be revegetated with species having value to the birds. However, as discussed above, It is unlikely that construction will affect any upland game bird nest locations.

The only upland game birds observed in the vicinity of the ITP area were mourning doves. The lack of suitable habitat and proximity to traffic along I-80 likely deters upland game birds from breeding in the area.

Raptors that are in the area include golden eagle; prairie falcon; short-eared owl; great-horned owl, northern harrier, Swainson's, rough-legged (mostly wintering), and red-tailed hawks. Peregrine falcons, nesting at Timpie Springs, hunt within 10-miles of their nest, including at Horseshoe Springs (BLM, 1992). Migratory peregrines may also utilize the area during the early spring and fall. Riparian areas are considered to be crucial to raptors because these areas usually contain trees for nesting and roosting and small

mammals, birds, and reptiles (important prey sources) concentrate in riparian areas (BLM, 1988). Although there are no trees at Horseshoe Springs, there are potential nest sites at other areas along the transportation corridor, near houses and other springs. Active raptor nests were identified along the Skull Valley Road in large trees at private residences. Figure 2.3-7 shows the location of known raptor nests, including six (five Swainson's and one red-tailed hawk) identified within the mile wide Skull Valley Road evaluation area. Table 2.3-3 lists the locations of all raptors located during the 1998 wildlife survey.

Wildlife species found in the ITP area are associated with the Great Salt Lake north of the site and saline ponds west of the site. During the 1998 wildlife survey, a variety of shorebirds were observed at the adjacent ponds including Wilson's phalarope (*Phalaropus tricolor*), American avocet (*Recurvirostra americana*), killdeer (*Charadrius vociferus*), willet (*Catoptrophorus semipalmatus*), solitary sandpiper (*Tringa solitaria*), and several gull species. Many other unidentified sandpiper species were observed along the shores of the Great Salt Lake which were likely in migration to northern breeding grounds. Many of these species likely utilize the ponds adjacent to the ITP.

It is unlikely that mule deer and pronghorn use the area because of it provides only low quality very marginal habitat. The site is also in close proximity to I-80 which likely deters its use by big game species. There was some evidence of badger and ground squirrel activity in the ITP area, although the condition of burrows were poor, and most appeared abandoned. No badgers, ground squirrels, pocket gophers, or jackrabbits were observed during two site visits made in May and June 1998.

2.3.2.3 Aquatic Resources

There are many intermittent or ephemeral stream channels along the transportation corridor that only contain water during periods of heavy precipitation. None of these channels contain aquatic resources. There are, however, a few springs located along the

corridor that could support aquatic resources. Big Spring (at Timpie), Burnt Spring, Muskrat Spring, Horseshoe Spring, Salt Mountain Springs, and Kanaka Lake are all located within the transportation corridor. According to BLM (1988, 1990, and 1992) only Horseshoe Springs supports fish. Carp and largemouth bass are known to be present with the possibility that Horseshoe Springs supports other fish species. However, aquatic habitat is limited by the high salinity (BLM, 1992). UDWR (1997a), identifies the speckled dace (*Rhinichthys osculus*), a state-protected indigenous fish species known to inhabit the wetlands of cold desert and sub-montane ecological associations, as occurring within the Salt Mountain Springs (see Figure 2.3-12). The speckled dace is not a high interest species, is found in a variety of aquatic habitats, and it is more often found in waters less than three ft deep.

Palustrine wetlands occur within the transportation corridor near Timpie Springs, Horseshoe Springs, and Salt Mountain Springs. Riparian wetlands occur along limited drainages that exist in the corridor (UDWR, 1997a). Figure 2.3-8 and 2.3-9 show the location of these wetlands. Both palustrine and riparian wetlands are ranked as being of critical value to local wildlife and are limited in size due to the low level of precipitation in the region (UDWR, 1997a).

No aquatic resources, wetlands, or ponds are located on the immediate ITP area. The entire proposed ITP is located within an elevated area that shows no signs of periodic flooding. There are lower elevation areas to both sides of the proposed site, however, they will not be impacted. The ITP would be built within the upland area and connect immediately to the frontage road without affecting the nearby mudflat areas. However, the Great Salt Lake and adjacent ponds, approximately 3 miles NE of the ITP, support a diversity of wildlife species.

2.3.2.4 Threatened and Endangered Species

This section provides a discussion of threatened, endangered, sensitive, special concern, and high interest species that could be found within the Skull Valley Road transportation corridor. Table 2.3-2 lists the plant and animal species identified as threatened, endangered, or sensitive by each agency along with their appropriate habitats. UDWR (1997a), identifies the swamp lymnaea (*Lymnaea stagnalis*) and Great Basin spadefoot (*Spea intermontana*) as high interest species that could occur in wetlands along the transportation corridor. The swamp lymnaea is a non-protected endemic aquatic snail which has been documented south of the project facilities in Township 5 South, Range 8 West. This species has not yet been ranked by the state. It has a Natural Heritage Program Global rank of G5 and a tentative State Rank of S1S2.

No Pohl's milkvetch, small spring parsley, or big saltbush were identified within the ITP area during surveys conducted in May 1998 (Kass 1998a). No suitable habitats were located nor have any previous locations been documented (Kass 1998a).

The Great Basin spadefoot is a state-protected indigenous toad which has been documented in wetlands south of the project area in Township 5 South, Range 8 West. It has a Natural Heritage Program Global Rank of G5 and a State Rank of S4 (usually more than 100 occurrences; widespread, abundant, and apparently secure, though it may be quite rare in parts of its range) (UDWR, 1997a).

There are four BLM-listed sensitive species that might occur in riparian/wetland habitats along the Skull Valley Road (mainly at Horseshoe Springs). The peregrine falcon, snowy plover (*Charadrius alexandrinus*), long-billed curlew, and white-faced ibis (*Plegadis chihi*) are known to occur in Skull Valley. During the June 1998 survey, long-billed curlews were observed in uplands south of Horseshoe Springs. No falcons, plovers or ibis were observed during the wildlife surveys occurring in May and June 1998.

Raptors in the ITP area include golden eagle; peregrine and prairie falcon; short-eared owl; burrowing owl; northern harrier, Swainson's, ferruginous, rough-legged (mostly wintering), and red-tailed hawks. Wet areas and shorelines located near the area likely support other raptors. Utility poles crossing on the northern edge of the site could provide nest sites for red-tailed and Swainson's hawks. No raptor nests were observed on the utility poles located within 0.5 mile of the ITP area. No trees are present that could provide potential nest or roosting sites for tree-dwelling birds. Rock outcrops are non-existent; therefore, nesting ferruginous hawks and golden eagles are very unlikely. Patches of greasewood could provide protective nesting cover for ground-nesting northern harriers and burrowing owls; however, given the level of human disturbance in the area, they are unlikely to select such a marginal site for nesting. As mentioned previously, the federally endangered and BLM sensitive peregrine falcon nests at Timpie Springs Waterfowl Management Area, and the hunting area of these falcons includes the ITP area.

No evidence or observations of kit fox or the Skull Valley pocket gopher occurred during the 1998 wildlife survey of the ITP area. The only raptor observed during the June 1998 survey included a prairie falcon. No evidence of wild horses occurred during the surveys of the Skull Valley Road and ITP areas.

The long-billed curlew (*Numenius americana*) is a BLM sensitive species and a western bird that ranges from southern portions of the western Canadian provinces south to Texas. In migration, the curlews utilize the shores of lakes, rivers, and salt marshes to catch small fish, crabs, snails, and toads. In summer, curlews nest in open prairie and upland areas where its diet consists of invertebrates. A pair of curlews was observed south of Horseshoe Springs during the 1998 wildlife survey. The behavior of this pair indicated that a nest site was present in an open, upland area surrounded by greasewood and rabbitbrush.

facilities have been installed. A boardwalk and bridge extending from the parking area to the springs has been installed to provide better access to the area.

The ITP area is highly disturbed and does not support any unique ecological communities. However, the Great Salt Lake and adjacent ponds, approximately 3 miles NE of the ITP area, provide significant high quality wildlife habitat for many associated wildlife species.

2.3.3 Ecological Resources at the Low Railhead and Along The Low Corridor

Generally, the ecological resources found along the Low Corridor (which includes the Low railhead) are very similar to those found at the PFSF and the Skull Valley Road transportation corridor, as described in Sections 2.3.1 and 2.3.2, respectfully. BLM has studied the general ecology of this area and the vegetation has been mapped and presented in the Habitat HMP for the Horseshoe Springs WHA.

2.3.3.1 Vegetation

The Low Corridor is within the BLM's Skull Valley Grazing Allotment (see section 2.3.1.1) and is dominated by the greasewood community. Some limited interspersion of the desert shrub /saltbush, perennial grass and annual grass communities also occurs. The annual grass community dominates in the extreme northern end of the transportation corridor. Vegetation within the transportation corridor is similar to that in a 5-mile radius of the PFSF. The major vegetation types located within a one mile zone of the proposed Low Corridor are included in Table 2.3-1. Land cover types for the Low Corridor are shown in Figures 2.3-13 and 2.3-14.

Greasewood is dominant in the mostly saline bottom of the Low Corridor while native salt desert shrubs such as shadscale, budsage (Artemisia spinescens), horsebrush (Tetrodymia glabrata), winterfat (Ceratoides lanata), and native grasses such as galleta grass (Hilaria jamesii). Indian ricegrass (Stipa hymenoides), sand dropseed (Sporobolus cytandrus), and alkali sacaton (Sporobolus airoides) are sparse to virtually absent from the corridor. The most commonly occurring species are invasive annuals such as cheatgrass, bur buttercup (Ranunculus testiculatus), and tansy mustardseed (Descurainia sophia). The abundance of invasive annuals and conspicuous absence of native plant communities reflects the past history and repeated cycles of overgrazing, drought, and fire (Cottam, 1976, Rogers 1982, Billings 1990, and Kass 1998a).

The entire Low railhead area is grassland. It is located between the Interstate 80 and the old Route 40 road, which still receives some usage by four wheel drive vehicles to access jeep trails in the valley. The vegetation at the Low railhead site is dominated by invasive annuals such as cheatgrass. As stated in the Rare Plant Inventory (Intermountain Ecosystems, May 1998), which was conducted along the proposed Low transportation corridor, the abundance of invasive annuals and absence of natural plant communities reflects the past history and repeated cycles of overgrazing, drought, and fire. It is likely that the cheatgrass invasion at the Low railhead area is also partially due to disturbance from Route 40, Route 80, and the railroad through the years.

2.3.3.2 Wildlife

Wildlife species found in the Low Corridor are similar to those discussed in Sections 2.3.1.2 and 2.3.2.2 for the PFSF site and the Skull Valley Road transportation corridor respectively.

BLM and UDWR provided general information for wildlife and their habitats within Skull Valley. A wildlife survey was conducted of the transportation corridors in May and June 1998 and recorded all species observed. Although numerous ground squirrel burrows and colony complexes were located along the Low Corridor, no ground squirrel activity was observed. Encroachment of vegetation in and around burrow entrances and the collapsed condition of most entrances indicated that most burrows have been abandoned for about 3-5 years. Only a few jackrabbits, badgers and badger dens were observed within a 0.5 mile wide area on both sides of the Low Corridor.

Big game species that use the transportation corridor are limited to mule deer and pronghorn antelope which are in the same herds as those that occur near the PFSF. Only two mule deer were observed during the 1998 survey and these animals occurred in heavily vegetated draws 2 miles west of the Low Corridor in the Redlam Spring area at the foothills of the Cedar Mountains. Pronghorn antelope utilize the transportation corridor lands less frequently. Two pronghorn (1 adult male, 1 yearling female) were also observed during the 1998 survey west of the Low Corridor. As discussed in Section 2.3.2, pronghorn antelope occur mainly in the southern portions of Skull Valley (BLM, 1990 and personal communication with Salt Lake City District Office, BLM, February 25, 1997).

The UDWR considers most of the PFSF site and the Skull Valley as having only limited value for mule deer (UDWR, 1997a). Thus it is expected that the Low Corridor also does not provide any crucial deer wintering, fawning, or summering habitat.

The Skull Valley pocket gopher is a non-protected endemic species, which could occur along the Low Corridor. No evidence of the pocket gopher was observed within the Low Corridor during the 1998 wildlife survey.

Upland game birds that typically occur in the vicinity of the transportation corridor are mourning doves and less frequently sage grouse. Ring-necked pheasant, chukar, and the Hungarian partridge are state protected exotic game species (UDWR 1997a). Ring-necked pheasant, chukar, and the Hungarian partridge are not likely to be found within the transportation corridor due to the lack of suitable habitat to meet their respective life history requirements. With the exception of mourning doves, no upland game birds were observed during the 1998 survey of the Low Corridor nor are any expected due to the general lack of suitable habitat. If chukar, sage grouse, Hungarian partridge, or ring-necked pheasant nests are found, UDWR recommends (UDWR, 1997a) that they should be protected from disturbance and disturbed sites should be revegetated with species having value to the birds.

2.3.3.3 Aquatic Resources

There are no aquatic resources, wetlands, or ponds along the Low Corridor.

2.3.3.4 Threatened and Endangered Species

2.3.3.4.1 Plants

The BLM and the UDWR indicate that Pohl's milkvetch, small spring parsley, and big saltbush could occur along the Low Corridor. No suitable habitats were identified along the corridor during the survey conducted in May 1998 nor have any previous locations been documented (Kass 1998a).

2.3.3.4.2 Animals

This section provides a discussion of threatened, endangered, sensitive, special concern, and high interest species that could be found within the Low transportation corridor (refer to Table 2.3-2).

As mentioned previously, the federally endangered peregrine falcon nests at Timpie Springs Waterfowl Management Area, and the hunting area of these falcons includes the length of the Low Corridor.

The Great Basin spadefoot is a state-protected indigenous toad which has been documented in wetlands south of the project area in Township 5 South, Range 8 West. It has a Natural Heritage Program Global Rank of G5 and a State Rank of S4 (usually more than 100 occurrences; widespread, abundant, and apparently secure, though it may be quite rare in parts of its range) (UDWR, 1997a).

While the peregrine falcon, snowy plover (*Charadrius alexandrinus*), long-billed curlew, and white-faced ibis (*Plegadis chihi*) are known to occur in Skull Valley, only long-billed curlews were observed during the June 1998 wildlife survey. No falcons, plovers or ibis were observed during the wildlife surveys occurring in May and June 1998 or during site visits conducted in 1997. No evidence or observations of kit fox or the Skull Valley pocket gopher occurred during the 1998 wildlife survey of the Low Corridor.

Raptors in the area include golden eagle; peregrine and prairie falcons; short-eared and burrowing owls; northern harrier, swainson's, ferruginous, rough-legged (mostly wintering), and red-tailed hawks. Peregrine falcons, nesting at Timpie Springs, hunt within 10-miles of their nest, including at Horseshoe Springs (BLM, 1992). The Skull Valley, including the Low Corridor area, is recognized by BLM as an important raptor wintering area. The species most likely to utilize the area during winter include bald and golden eagles, rough-legged, red-tailed, and perhaps some ferruginous hawks.

No trees are present along the corridor that could provide potential nest or roosting sites for tree-dwelling birds. Rock outcrops are also limited which could provide nest sites for ferruginous hawks and golden eagles. An abandoned ferruginous hawk nest was located

about 2 miles west of the Low Corridor. Four burrowing owl nests were also located along the Low Corridor. Numerous areas with relatively dense stands of greasewood could provide protective nesting cover for ground-nesting northern harriers, short-eared and burrowing owls. The presence of a few pair of northern harriers observed along the Low Corridor during the 1998 field survey indicates that the greasewood habitat likely provides desirable nesting sites for a small, local population of harriers. A pair of curlews was observed at the midpoint of the Low Corridor during the 1998 wildlife survey. The behavior of this pair indicated that a nest site was present in an open, upland area surrounded by greasewood and rabbitbrush. Table 2.3-3 lists the locations of all raptors located during the 1998 wildlife survey.

The only raptors observed along the Low Corridor during the May and June 1998 surveys included three pairs of northern harriers, four burrowing owls, and a single short-eared owl. Four burrowing owl nest sites in abandoned burrows were located along the edge of the transportation corridor. The accumulation of owl pellets and skeletal remains of prey indicates that these burrowing owls return to these same sites annually. Although nest sites were not observed, it is expected, given the density of greasewood along the Low Corridor, that northern harriers and the short-eared owl nest in the area. Swainson's, ferruginous, and red-tailed hawks would be expected to hunt in the vicinity of the Low Corridor, but the lack of suitable nesting sites (trees and rock outcrops) make it unlikely that these species would nest within the one-mile wide corridor. Figure 2.3-15 shows the locations of raptor nests and sightings within the Low Corridor as identified by UDWR (1999) and Stone & Webster field surveys.

In its January 6, 1999 letter, UDWR provided information on high interest wildlife species including two federally listed species known to occur near the Low corridor. State listed sensitive species that are known to occur in the Skull Valley are the bobolink (Dolichonyx oryzivorus), burrowing owl (*Athene cunicularia*), caspian tern

(*Sterna caspia*), common yellowthroat (*Geothlyis trichas*), ferruginous hawk (*Buteo regalis*), long-billed curlew (*Numenius americanus*), short-eared owl (*Asio flammeus*), and Swainson's hawk (*Buteo swaisoni*).

Species that occur in Skull Valley and are of conservation concern by UDWR's Utah Natural Heritage Program or resource management agencies such as BLM or the US Forest Service, but are not federally or state listed are: Skull Valley pocket gopher (*Thomomys bottae robustus*) and sandhill crane (*Grus canadensis*).

Additional high interest species identified by the state as occurring in Skull Valley include: the great horned owl (*Bubo virginianus*), golden eagle (*Aquila chrysaetos*), mourning dove (*Zenaida macroura*), northern harrier (*Circus cyaneus*), prairie falcon (*Falco mexicanus*), ring necked pheasant (*Phasianus colchicus*), red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and chukar (*Alectoris chukar*).

In addition to the above species, UDWR states that there are additional species that are not known to occur near the Low Corridor, but could possibly occur. They are the least chub (*Iotichthys phlegethontis*), Columbia spotted frog (*Rana luteiventris*), milk snake (*Lampropeltis triangulum*), Townsend's big-eared bat (*Plecotus townsendii*), Brazilian free-tailed bat (*Tadarida brasiliensis*), ringtail (*Bassariscus astutus*), sage grouse (*Centrocercus urophasianus*), and Lewis' woodpecker (*Melanerpes lewis*).

2.3.3.5 Notable Ecological Communities

The Low Corridor does not support any unique ecological communities either identified and managed by BLM or identified during the 1998 field survey.

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2.4.2.6 Air Quality

The air quality in the PFSF area is generally very good. The U.S. Environmental Protection Agency (EPA) has adopted National Ambient Air Quality Standards (NAAQS) for six criteria pollutants. The primary NAAQS are designed to protect public health while the secondary standards are designed to protect public welfare (includes protection of economic interests, vegetation, and visibility). The Utah Department of Environmental Quality (DEQ) has adopted the federal NAAQS as the state ambient air quality standards; Table 2.4-9 shows these standards.

Ambient air monitoring data collected by the DEQ at several monitoring stations throughout the state are used to determine whether or not these NAAQS are being met. Areas where the standards are attained are referred to as "attainment" areas and those areas not attaining the standards are called "nonattainment" areas. This project is located in the Wasatch Front Intrastate Air Quality Control Region (AQCR) which is in attainment for nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter with aerodynamic diameter less than 10 microns (PM-10), lead (Pb), and ozone (O_3) based on monitoring data collected in the AQCR. A portion of eastern Tooele County is currently non-attainment for the primary and secondary sulfur dioxide (SO_2) standard.

The attainment status of the Wasatch Front Intrastate AQCR is supported by the three most recent years (1995 - 1997) of available ambient air quality monitoring data collected by the DEQ in the AQCR. Table 2.4-10 summarizes these data showing the highest annual average and second highest short-term (1-, 3-, 8-, 24-hour) monitored values in the county for each pollutant and averaging time. These data demonstrate that ambient criteria pollutant concentrations are well below the NAAQS. Given that all of Tooele County, except for the highest elevation areas in the far eastern part of the county, is currently in attainment of the NAAQS for all criteria pollutants and the available monitoring

data indicate air pollutant concentrations generally well below the NAAQS, air quality is not expected to be a resource of concern for development of the PFSF.

The annual criteria air pollutant emissions from significant point sources located within 60 kilometers of the PFSF site and their locations relative to the PFSF site are summarized in Table 2.4-11. This table is based on the 1998 database for Tooele County provided by the Utah Department of Environmental Quality (DEQ), Division of Air Quality and is provided as a means of identifying the more significant point source contributors to the air quality of the site area. The available stack parameter data for these point sources, as supplied by the DEQ, are provided in Table 2.4-12. The parameters included in the table consist of UTM coordinates, stack height, stack inner diameter, stack exit temperature, and stack flow rate (ft^3/sec). Stack elevations above mean sea level were not provided in the DEQ database but have been added to the table using U.S.G.S. topographic maps as available. It should be noted that the DEQ database does not contain stack parameters for every source listed in Table 2.4-11 and this data is therefore not available.

rapidly eroded. The lake dropped more than 300 ft in a matter of a few weeks, and resulted in the Bonneville flood. The outlet stabilized at about elevation 4,740 ft, and the Provo level developed (Malde, 1968). Sack (1993) has also mapped this shoreline east of the PFSF on the alluvial fan (Figure 2.6-4).

Climatic change beginning about 14,000 years B.P. caused the gradual shrinkage of Lake Bonneville to at least the lowest level of the present Great Salt Lake by about 12,000 years B.P. (Currey, 1990). A brief transgression of the lake occurred between about 10,900 and 10,300 years B.P. to about elevation 4,250 ft (Currey, 1990). This level is known as the Gilbert level of the Great Salt Lake and has been mapped about 11 miles north of the PFSF (Sack, 1993). Since that time the lake has receded and fluctuates within about 20 ft elevation of its historic average (Lund et al., 1990). Only once in the past 10,000 years has the level of the lake been as high as 4,220 ft (Atwood and Mabey, 1995). The PFSF is at approximate elevation of 4,465 ft, well above any recorded maximum level of the Great Salt Lake.

2.6.4 Site Stratigraphy

The PFSF site geology was investigated in 1996 by a subsurface drilling program totaling 24 borings to a maximum depth of 100 ft, and a seismic refraction and reflection program. Logs of borings are included in the PFSF SAR, Appendix 2A, and the results of the seismic surveys are found in the PFSF SAR, Appendix 2B. Section 2.6.5 includes a description of the generalized subsurface profile and engineering characteristics of the subsurface materials.

Additional investigations were conducted in 1998 and included surficial and bedrock mapping, excavation and mapping of numerous test pits and trenches, drilling of more than 40 additional boreholes to a maximum depth of 225 ft, and completion of 6

kilometers of high-resolution seismic shear-wave reflection lines. A summary of these efforts is included below. Additional detail and discussion are found in the original reports of this work (Geomatrix Consultants, Inc., 1999a; Bay Geophysical Associates, 1999).

The PFSF site is situated near the center of Skull Valley where Quaternary lacustrine and geomorphic features dominate the topography. The stratigraphy beneath the site consists of approximately 500 to 800 ft of Quaternary and Tertiary basin fill overlying Paleozoic bedrock. The nature of the deepest Tertiary deposits is unknown at this time but is believed to include sediments of the Salt Lake Formation, mainly sand, silt, marl and tuff in varying states of consolidation. The Salt Lake Formation extends up to a depth of about 85 ft in the central part of the PFSF. A volcanic ash at that level has been correlated with the Walcott tuff, known to be late Miocene in age (approximately 6 m.y.; SAR Appendix 2E). This boundary was also identified as a prominent reflector the high-resolution shear wave profiles (Bay Geophysical Associates, 1999; Geomatrix Consultants, Inc., 1999a, Plate 4).

There is evidence for four major lake cycles in the Bonneville basin during the past 700,000 years (Machette and Scott, 1988; Oviatt et al., 1997). Evidence for the three oldest is not well preserved regionally and was found only sporadically in the PFSF vicinity. The most recent cycle, the Lake Bonneville cycle, occurred between about 30,000 and 12,000 years ago and is well documented in Skull Valley. Several transgressions and recessions of the lake occurred during this time, each leaving an identifiable characteristic in the geomorphology of the valley or in the stratigraphic record. This evidence is presented in detail in Geomatrix Consultants, Inc. (1999a, Section 3.2). Near-surface Pleistocene deposits at the PFSF consist mainly of fine sand, silt, clay and marl. In general, the finer grained materials, such as silt, clay and marl were deposited during the deeper water portions of the lake cycle and the sand represents shallower, near-shore beach or deltaic fan environments. The engineering properties of those

materials are discussed in Section 2.6.1.6. Locally, Holocene eolian and fluvial activities have reworked the surface soils to some extent (Sack, 1993). Eastward from the PFSF, along the proposed access road to Skull Valley Road, the influence of the proximity to the range-front alluvial fans is apparent as an increase in gravel content at shallow depths (SAR Appendix 2A).

Bedrock is not exposed at the PFSF but is found about 1.5 miles to the south at Hickman Knolls, and about 1.5 miles northeast in a series of unnamed low hills. Hickman Knolls has been mapped as Fish Haven Dolomite of Ordovician age (Moore and Sorensen, 1979; Geomatrix Consultants, Inc., 1999a). At this location the formation is a medium to dark gray dolomite and limestone breccia. Bedding is massive to indistinct, and breccia pebbles are angular to sub-round and appear to be the same composition as the enclosing matrix. Bedding strikes northerly to northeasterly and dips to the east at moderate to steep angles. Bedrock fracturing consists mainly of two sets of high angle fractures, one trends east-west and the other north-south. These fractures tend to coincide with more silicified zones that form prominent scarps on the Knolls that are strongly expressed in the morphology and are associated with many of the aerial-photo lineaments (See Plate 1, Geomatrix Consultants, Inc., 1999a).

Several faults and ductile shear zones were identified at Hickman Knolls during the recent investigations. Geomatrix Consultants, Inc. (1999a) presents evidence that indicates the faults developed prior to the dolomitization process and the shear zones are likely penecontemporaneous with the process of brecciation. No large, through-going faults are believed to exist on Hickman Knolls.

There has been some enlargement of a few joints from dissolution, and a few small caves or openings (1 to 4 ft deep) can be seen on some of the steeper rock faces. Karst conditions do not exist at Hickman Knolls nor are they likely to develop because of the

near-desert environment and the depth to ground water (~125 ft). The outcrop mapped northeast of the PFSF has been identified as Deseret Limestone of Mississippian age (Moore and Sorensen, 1979).

Areas of bedrock outcrop are indicated on Figure 2.6-4, in addition to the surficial deposits. Scarps in soil near the PFSF identified on the map have been investigated by Dr. Donald Currey for this project (see PFSF SAR, Appendix 2C). Currey concluded the features were related to lacustrine processes of Lake Bonneville and are not of tectonic origin.

2.6.5 Engineering Characteristics of Site Materials

Figure 2.6-2 is a plot plan showing the locations of the major structures of the PFSF, the locations of the 1996 geotechnical borings and geophysical survey lines, and the location of Foundation Profile A-A'. Plate 1 of Geomatrix Consultants, Inc. (1999a), indicates the locations of both the 1996 and 1998 investigations, exclusive of the geotechnical borings for the Canister Transfer Building.

Geotechnical boring programs were conducted in 1996 and 1998. The borings drilled in October 1996 were located in the pad emplacement area and along the access road corridor. The borings drilled in October and December of 1998 were located in the Canister Transfer Building area, as shown in Figure 2.6-11. The soil samples obtained from these borings were sent to the Stone & Webster Geotechnical Laboratory in Boston for testing. The results of the boring programs and laboratory testing are found in Appendix 2A of the SAR.

In April 1999, ConeTec, Inc performed cone penetration tests (CPT) and dilatometer tests (DMT) in the pad emplacement area and the Canister Transfer Building area. The

locations of these CPTs and DMTs are presented in Figure 2.6-12. The results from this investigation are presented in ConeTec (1999). The primary goal of this investigation was to develop profiles of the relative strength and compressibility of the soils within the depth interval of 10 ft to ~25 ft in the pad emplacement area. As stated in ConeTec (1999), the other interpretations are presented only as a guide for geotechnical use and should be carefully scrutinized for consideration in any geotechnical design.

This program included performing cone penetration tests (CPT) to develop continuous profiles of the strength of the soils in the upper layer (from the surface down to ~25 ft) within the pad emplacement area. It also included performing dilatometer tests (DMT) to develop profiles of the compressibility of the in situ soils. These were located, primarily, in areas where the preliminary tip resistance profiles from the CPT tests indicated that the in situ soils had the lowest strengths and the highest compressibilities.

Based on these borings and laboratory test data, the generalized subsurface profile consists of three layers, as shown in Figure 2.6-5. The uppermost layer extends to a depth of between 25 and 35 ft below existing grade and is mainly interlayered silt, silty clay, and clayey silt. SPT N-values for this layer are mostly between 8 and 20 blows per ft, with an average value of 16 blows per ft and a median value of 14 blows per ft, indicating that these are "stiff" or "medium dense" materials. The upper layer was subdivided based on the results of the cone penetration tests. More detailed stratigraphy is presented in the foundation profiles included in the SAR as Figure 2.6-5, Sheets 1 through 14. SAR Figure 2.6-19 identifies the locations of these foundation profiles in plan view.

There are some differences between the results of the borings and the CPTs in regard to describing the types of soils encountered, mostly in the 10 to 20 ft depth range. The

cone penetration testing program indicated that the soils between approximately 10 ft and 20 ft below existing grade at the site behave as though they are silty sands and sands. This finding was not corroborated by the descriptions of the soils obtained from that zone in the borings, many of which are supported by laboratory test results. As discussed in Section 2.6.1.6 of the SAR, to more accurately reflect the actual soil classification at the site, the SBT values reported by ConeTec (1999) were adjusted downward by 1 zone for those whose SBT values were greater than 5. Based on the results of this recalibration, the soil behavior type data from ConeTec (1999) are replotted, as shown in SAR Figure 2.6-5, Sheets 2 through 14, along with the data from the soil borings, to generate the foundation profiles at the pad emplacement area.

This layer is underlain by 25 to 30 ft of very dense, dry, fine sand with occasional thin layers of fine gravel and coarse sand. SPT N-values often are greater than 100 blows per 6 inches. A few clayey zones were encountered, but they had no apparent effect on the blow counts. The borings that were drilled to depths greater that 100 ft (Borings A-1, D-4, CTB-1, and CTB-5) indicate that this second layer of dense, dry, fine sand is underlain by very dense silt, silty sand, and sandy silt with occasional layers of clayey silt.

The groundwater table was encountered in Boring CTB-5(OW) at a depth of 125 ft in the area of the Canister Transfer Building. Seismic refraction results indicate the compression wave (P-wave) velocity (PFSF SAR, Appendix 2B) changes from approximately 2,800 fps to approximately 5,525 fps at about 100 to 130 ft depth, which corroborates the depth to the water table measured in Boring CTB-5(OW).

Borings AR-1 through AR-5 were drilled along the corridor for the access road, which extends easterly from the PFSF in the vicinity of the Administration Building to Skull Valley Road. These borings indicate that the near-surface soils are similar to the

uppermost layer described above; i.e., silt, silty clay, and clayey silt, although the layer is somewhat thinner. Sands were encountered at depths of 5 and 10 ft in Boring AR-1 and from a depth of 5 ft to 20 ft in Boring AR-2. Silty or sandy gravels were encountered at depths of 30 ft in Boring AR-3, 20 ft in Boring AR-4, and 6 ft in Boring AR-5.

None of these borings encountered bedrock. Interpretation of the seismic reflection survey data indicates that the depth to bedrock is between 520 ft and 820 ft below the surface in the vicinity of the PFSF and that it drops off towards the east, dipping from an estimated depth of 740 ft at Station 700 on Seismic Line 3 to approximately 1,020 ft at the eastern end of this seismic line.

Geotechnical laboratory tests were performed on samples obtained from the boring programs. The results of these tests, which are included in PFSF SAR, Appendix 2A, are summarized below.

For the soils in the pad emplacement area above the sand layer at a depth of about 25 to 30 ft, consisting of silt, clayey silt, and silty clay, as shown in Figure 2.6-5:

	Maximum	Minimum	Average
Water Content, %	58	8	32
Liquid Limit	77	25	44
Plastic Limit	46	20	30
Plasticity Index	38	0.5	14
Moist Unit Weight, pcf	91	64	78
Dry Unit Weight, pcf	71	40	56
Void Ratio	3.2	1.4	2.1
Saturation, %	64	28	53

Specific Gravity =2.72

Consolidation parameters:	Low	High	Average
Maximum past pressure, ksf:	5.6	7.2	6.2
Virgin compression ratio, CR:	0.25	0.34	0.29
Recompression ratio, RR:	0.008	0.017	0.012

Rate of secondary compression, as shown by the dashed curve in Figure 2.6-6.

Total-stress strength parameters for undrained analyses are ϕ= 24.9° and c = 1.22 ksf, based on direct shear tests.

For the silt, clayey silt, and silty clays in the Canister Transfer Building area, above the sand layer located at a depth of about 25 to 30 ft:

	Maximum	Minimum	Average
Water Content, %	86	7	40
Liquid Limit	83	28	51
Plastic Limit	48	18	30
Plasticity Index	38	4	20
Moist Unit Weight, pcf	118	73	92
Dry Unit Weight, pcf	98	40	65
Void Ratio	3.3	0.7	1.8
Saturation, %	88	40	71
Specific Gravity	2.73	2.71	2.72

Consolidation parameters:	Low	High	Average
Maximum past pressure, ksf:	6	26	13
Virgin compression ratio, CR:	0.13	0.37	0.31
Recompression ratio, RR:	0.014	0.020	0.018

Total-stress strength parameters for undrained analyses are ϕ = 21.1° and c = 1.13 ksf, based on direct shear tests.

For the sand or sandy soils layer in the Canister Transfer Building area found in some of the borings located at a depth of 8 to 20 ft.

	Maximum	Minimum	Average
Water Content, %	15	3	6
Moist Unit Weight, pcf	105	85	98
Dry Unit Weight, pcf	102	77	93
Void Ratio	1.2	0.64	0.83
Saturation, %	32	11	19
% Fines	38	9	23

Specific Gravity = 2.69

Effective-stress strength parameters for drained analyses are estimated to be ϕ = 30° and c = 0, based on the plasticity index of the silts and clays. These values are very conservative for the sandy soils, which are characterized as dense based on their SPT N-values and the CPT Q_t data. Note, Appendix D of ConeTec (1999) indicates that ϕ based on the CPTs generally exceeds 35 to 40°.

The recommended coefficients of earth pressure for the silts and clays are as follows:

- At-rest, K_o, is 0.5
- Active, K_a, is 0.33
- Passive, K_p, is 3.0.

The recommended coefficient of friction between concrete placed on the in situ soils is

0.58 for long-term loadings, and the total-stress strength parameters should be used to resist sliding for short-term (e.g., earthquake) loadings.

The recommended value of the coefficient of vertical subgrade reaction of the silt, silty clay, clayey silt for a 1 ft x 1 ft square is 100 kips/ft^3 for the clayey soils. Where the near-surface soils are cohesionless silts, this value should be 120 kips/ft^3. This value should be reduced for footing widths greater than 1 ft by applying a reduction factor, RF, calculated as follows:

For clayey soils: $RF = 1/B$

For cohesionless soils, $RF = [(B+1) / 2B]^2$

where B is the effective width of the footing.

This value should also be reduced for rectangular footings by (1 + 0.5 x B / L) / 1.5, where L is the effective length of the footing.

The recommended value of the coefficient of vertical subgrade reaction of the in situ clayey soils for use in design of the storage pads is 2.75 kips/ft^3, and for the cohesionless soils is 26 kips/ft^3.

The recommended value of the coefficient of horizontal subgrade reaction of the in situ clayey soils for use in the design of drilled caissons is 67 / B kips/ft^3. For cohesionless soils, the recommended value of the coefficient of horizontal subgrade reaction is 20 • z / B kips/ft^3.

The dynamic foundation parameters in support of the soil-structure interaction analyses

2.7 SOCIOECONOMICS

This section provides a description of the local social, economic, and community characteristics of the area surrounding the PFSF and consists of those factors associated with the residents of the Skull Valley Band of Goshute Indians living on the Reservation and the residents of Tooele County.

2.7.1 Skull Valley Indian Reservation

There are approximately 30 members of the Skull Valley Band of Goshute Indians who live on the Skull Valley Indian Reservation. Of those members living on the Reservation, 5 adult members are employed, one is retired, and the balance are unemployed living on public assistance or no income (Slack, 1997).

The household income of the Band members living on the reservation is approximately $20,000 per year. About 17 individuals are noted as having incomes below the poverty level. (Includes individuals who live on the reservation but are non-Band members, eg, spouses of Band members).

It is noted that the above information conflicts with some government documents, eg, one document reports that a total of five households on the reservation have an income of between $40,000 and $74,999 with the median household income within the reservation at $61,359 (Income & Poverty Data for Skull Valley Reservation, UT, 1/8199). Also, the per capita income in 1990 was reported as $20,647 for residents on the reservation. These numbers are incorrect and grossly overstate the income on the reservation.

Approximately 10 % of the enrolled membership of the Band have two or four year degrees from post-secondary education. The Band has an ongoing tuition assistance program that has limited capability due to the lack of financial resources. The general health of the Band is not any different and would not be distinguishable from the general population.

The ancestral land routinely inhabited over the centuries by the Skull Valley Band of Goshute Indians is in Tooele Valley not Skull Valley. The Band was a nomadic tribe with family units traveling together rather than village units. The Tooele Valley was the area to where these nomadic families gravitated together. Their spiritual and other ceremonial events are traditionally individualistic in nature and occurred more often when two families met while traveling. Today, the Band's practicing of spiritual or other kinds of ceremonies remains individualistic.

Individual spiritual ceremonies are open to all native Americans who share the same personal spiritual beliefs as the person requesting the ceremony. The conduct of the ceremonies is not a scheduled activity. Word of mouth throughout the Band and other tribes is the typical mechanism for announcement. A great many of the ceremonies are conducted in individual homes, whether on or off the reservation.

Band governance activities in terms of a yearly general council meeting draw nearly full attendance of the enrolled members to Skull Valley.

Band members over the years have left the reservation due to the lack of jobs, adequate housing, and suitable conditions to raise a family. At the present time, 50 % of the enrolled members living off the reservation have expressed interest in returning to the reservation if jobs and housing were available.

The reservation is open to all enrolled Band members without exclusion. Non tribal members can only live on the reservation if married to an enrolled member of the Band.

Tribal enterprise opportunities are screened by the Band's Executive Committee for consistency with the Bands goals of economic independence through ventures that are similar to those throughout Tooele County. The General Council meetings that are attended by a majority of enrolled members of the Band determine the direction and focus that the Executive Committee uses in its assessment of business ventures. The General Council then approves further action by the Executive Committee for those ventures worthy of interest.

The Skull Valley Indian Reservation lands are completely lacking in mineral wealth; there are no oil and gas revenues or timber or mining resources to be developed. Therefore, the Band has pursued other economic strategies, including a lease to Alliant Techsystems for a $15 million static rocket engine test facility. This facility was originally developed by Hercules Aerospace and has been operating on the Reservation since 1975. The Band also operates a store, the Pony Express convenience store, located on the Skull Valley Road at the southern end of the Reservation (Quintana, 1995). This small retail venture provides convenience groceries and gasoline to Skull Valley Band members and passersby on the Skull Valley Road.

According to the U.S. Census Bureau, in 1990, of the 17 individuals (15 male, 2 female) living on the Skull Valley Reservation aged 16 years and over, 5 males were employed in the labor force. All five of the employed individuals lived within 10 minutes of their place of employment, and all 5 were employed in the "industrial, agriculture, forestry, and fisheries" business sector. Today, 4 males and 1 female have income producing employment. The balance of the potential work-force either are physically unable to

work, volunteer for unpaid tribal positions, or have not found suitable opportunities for employment.

The Pony Express Convenience Store is owned and operated by the Skull Valley Band of the Goshute Indians and sells convenience groceries and gasoline to Band members and passersby on Skull Valley Road. Three volunteer staff members operate the store. These members include one tribal resident from the reservation, one non-tribal member married to a tribal resident, and one nontribal member who lives in a nearby residence south of the reservation. The store is open seven days a week from nine to five. All operational and maintenance costs for the store are controlled through the tribal budgeting process. Income derived from the Pony Express operation is deposited into the tribal general account.

The Alliant Techsystems rocket testing facility employs 3 security personnel, 1 of which is a tribal member living in Grantsville, another tribal member living on the reservation, and 1 non-tribal member living in Skull Valley. Five non-tribal technicians work at the facility only during the infrequent testing operations. These individuals commute from the Salt Lake City area to the test facility. No Tribal members are directly employed for facility operations.

Statistics are not available to determine the extent to which residents of Skull Valley are employed in other communities. Census figures for Census Tract 1306, which includes Skull Valley as well as Dugway-Wendover Division, identified a total of 3668 residents, 1020 of whom "work in the place of residence" (1990 US Census). Assuming that most of these 1020 workers are family heads of household, the balance of workers employed outside of their communities would be very small.

There are seven owner-occupied homes and four trailers on the Reservation. Four of the homes are considered adequate, while the other three are in poor condition; all of the trailers are in poor condition. With the exception of a home built in 1995 and one currently under construction, all of the homes are in need of some minor repair. In addition, the Reservation contains a Community Building, storage shed, water shed, water tank, and a small reservoir. The types of utilities available on the Reservation include Skull Valley Band water, individual septic systems, electricity provided by Utah Power, and propane provided by Amerigas (Slack, 1997).

No public services are available on the Reservation; residents are responsible for fire control and the three school-age children attend classes at the school located in the Town of Dugway (Slack, 1997).

2.7.2 Tooele County

The economy of Tooele County consists of several "mini-economies". The more remote, rural areas are resource-based economies that rely on mineral extraction and ranching while the developed and populous Tooele Valley is more multi-dimensional with active roles played by the manufacturing, retail and wholesale trade, and government sectors.

The County's overall economic strategies for each of these areas vary from the promotion of a full-service economy in the northeastern portion of the county (Tooele and Rush Valleys) to less intensive development in the west desert area. The remote desert environment of much of the county (including Skull Valley) cannot support increased population or development. Natural resources, particularly the lack of water resources, will always serve as a limitation to potential growth in certain areas of the county (Tooele, 1995).

As of 1991, there were 10,219 jobs in Tooele County. Between 1970 and 1980, total non-agricultural employment in the county increased by 6.5 percent. Many of the job increases were in high-paying industries (mining, finance, insurance, and real estate). Between 1980 and 1990, total civilian employment in Tooele County decreased by 1.1 percent. The unemployment rate in 1990 was 5.3 percent, exceeding the statewide rate of 4.7 percent (Tooele, 1995). Current employment data for Tooele County (February 1997) indicates that the unemployment rate has dropped to 4.4 percent (personal communication between Diane Johnson, Tooele County Economic Development Corporation and J.H. Rumpp of Stone & Webster, May 15, 1997). The state-wide unemployment rate dropped to 2.9 percent in March, 1997 (UDES, 1997).

Government employment plays an important role in the Tooele economy. Even excluding military employment at the Dugway Proving Ground and the Tooele Army Depot, roughly 88 percent of all jobs in the county in 1970 were provided by the federal government. This reflects the significant civilian government employment related to the military installations in the county. Government's share dropped to roughly 55 percent in 1991. The next largest employment sector is wholesale and retail trade, which was almost 14 percent of the county's economy in 1991. Employment in both trade and service sectors has been steadily increasing since 1980. The historically high reliance on federal government installations, such as the Tooele Army Depot and Dugway Proving Grounds, subjects the county to employment fluctuations related to changes in defense funding levels (Tooele, 1995).

2.7.2.1 Income

Per capita personal income (PCI) is an area's annual total personal income divided by the total population as of July 1 of that year. Utah's 1995 per capita personal income of $18,226 ranked 46th among the 50 states. Because Utah's population has a large

number of children (the result of many years of high birth rates), these PCI comparisons portray Utah as a low income state. However, the 1990 adult per capita income figures indicate Utah is 88 percent of the national figure. Similarly, the total personal income per household for Utah in 1995 was $57,690, which is 92 percent of the national personal income per household of $62,830.

Twelve of Utah's 29 counties posted double digit growth total personal income (TPI) between 1994 and 1995, an improvement over 3 counties posting such growth between 1993 and 1994. At the same time, four counties, including Tooele County, suffered year-over losses of TPI as a result of slow growth in nonfarm jobs.

Tooele County's 1995 PCI was $14,800, a decrease of nearly 6 percent from the previous year. This PCI level is 81 percent of the 1995 state level and 64 percent of the 1995 U.S. level of $23,208 (Economic Report to the Governor, 1997).

2.7.2.2 Infrastructure

In the more populated portions of the county there is an established infrastructure that provides potable water, sanitary sewer, fire protection and other facilities. The entire county is served by electrical power and telephone service. Natural gas and cable television are only available in the Tooele Valley area where the population density is higher.

Almost all of the drinking water available in the county originates from well or spring sources. Most of the incorporated cities provide central water systems and operate well systems. These systems provide water for potable uses as well as fire protection. In the rural areas, individual wells provide potable water for homes and farm operations. The federal facilities also rely on groundwater resources as the principal source of

industrial and potable water. The entire system is regulated by the State of Utah, Division of Water Rights, which allocates use through water rights processes.

Centralized water systems are only available in the Tooele Valley and in Stockton, Vernon, Wendover, and at Tooele Army Depot and Dugway Proving Grounds military installations. Most of the systems are associated with an incorporated city, but are also found in Stansbury Park and Pine Canyon. Many of these systems have been developed to provide for higher density developed areas, fire protection systems or to provide adequate high quality water in areas where it is limited.

The only centralized wastewater systems serving the county are located in Tooele, Grantsville, Lake Point, Stansbury Park and at the military facilities located at Tooele Army Depot, North Area, and Dugway Proving Grounds. The rest of the county is served by individual septic tank systems. The septic tank systems have functioned relatively well in most areas of the county, but in areas of shallow groundwater some failures are becoming more common.

Electrical power is provided to virtually the entire county. Service is limited in the more rural areas and is generally located along public roads. Power lines also cross through the county to serve other areas. Telephone service is also available to most of the county. US West provides service to the eastern portion of the county, while smaller systems serve the more rural areas. Natural gas service is provided to the eastern portion of the county where population densities are highest. In other areas, service is not provided due to the economics required to extend service lines to customers.

In Tooele Valley and Rush Valley, the military has recently established a warning system to alert residents and businesses should an emergency which could endanger the population occur at the weapons disposal facilities located at Tooele Depot South

Area. The system consists of loud speakers and warning signals that sound in the event of an emergency. This system is tested every Monday throughout Rush and Tooele Valleys.

The management and disposal of solid waste has traditionally been a service provided by the county to all county residents. Historically, the county has operated a solid waste landfill where all collected wastes were deposited. With the recent changes in the laws governing such facilities, the county has closed their old facilities and has developed a new facility for recycling, composting and conditioning waste that complies with all current regulations.

2.7.2.3 Public Services

The Tooele County Fire District is a volunteer fire department whose response area extends from Stockton to the Great Salt Lake and from the eastern county line to I-80 mile marker 45. When necessary, the department does respond to emergencies throughout the rest of the county.

In most of Tooele County there are few health or emergency services available, so residents utilize the resources located in Tooele Valley. The Tooele Valley health care system includes the Tooele Regional Medical Center, Home Health and Nursing Home operations, and the Tooele Valley Ambulance Service, located in Grantsville, Tooele City and Vernon. The medical center offers surgery, emergency, laboratory, and special medical care and testing.

The Tooele County Sheriff's Department responds to accidents and crime throughout the county. City police departments serve the communities of Tooele, Grantsville, Stockton, and Wendover (Tooele 1995).

Tooele County is the second largest school district in Utah in terms of geographic size, covering approximately 7,000 square miles with an enrollment of 7,756. The district operates 13 schools in eight locations: Tooele City, Tooele Army Depot, Vernon, Dugway, Stansbury Park, Grantsville, Wendover, and Ibapah (Tooele School District, 1996).

2.7.3 Environmental Justice

On February 11, 1994 President Clinton issued Executive Order 12898," Federal Actions To Address Environmental Justice in Minority Populations and Low-income Populations," which directs each federal agency to consider environmental justice. Environmental justice is defined as identifying and addressing disproportionately high and adverse human health or environmental effects of an agency's programs, policies, and activities on minority populations and low income populations. The President's "Memorandum on Environmental Justice" accompanying the Executive Order directs each "federal agency [to] analyze the environmental effects, including human health, economic and social effects, of Federal actions, including effects on minority communities, when such analysis is required" by the National Environmental Policy Act NEPA.

On March 31, 1994, the Nuclear Regulatory Commission Chairman confirmed to the President that the NRC would "endeavor to carry out the measures set forth in Executive Order 12898 and the accompanying Memorandum." On April 21, 1995, the NRC Office of Nuclear Materials Safety and Safeguards (NMSS) issued guidance for addressing environmental justice issues in the context of NRC environmental assessments and environmental impact statements.

2.7.3.1 Environmental Justice Potential

In order to evaluate the environmental justice potential, demographic data consisting of minority and low-income level breakdowns are required for the state, county, and immediate site area. For the purpose of the evaluation, NMSS guidelines define minority as "individuals classified by the U.S. Bureau of the Census as either Negro/Black/African American, Hispanic, Asian and Pacific Islander, American Indian, Eskimo, Aleut, and or other non-White persons." Low-income is defined as being below the poverty level as defined by the U.S. Bureau of the Census. NMSS guidelines recommend the immediate site area for facilities located in rural areas should be a 4 mile radius or a "geographic scale ... commensurate with the potential impact area..." For this environmental evaluation, an immediate site area of 5-miles will be used since the data throughout this Environmental Report is based upon an area encompassed by a 5-mile radius of the facility.

The NMSS guidelines establish a threshold below which environmental justice potential is ruled out, and above which environmental justice potential exists. The approach screens for environmental justice potential by determining the percentage of minority and low-income populations. The threshold is based on a comparison of the percentage of minorities and low-income households in the immediate site area to those in the state or county where the project is located. If the site area's percentage of low-income population or percentage of minorities is 20 percentage points higher than the county or state's low-income percentage or percentage of minorities, then, according to the NMSS guidelines, the site has an environmental justice potential and additional analysis must be conducted. If the differential is less than 20 percentage points, there is no environmental justice potential and no further evaluation is necessary. Additionally, if either the minority or low-income population percentage exceeds 50 percent, environmental justice will need to be considered in greater detail.

The 1990 Federal census data and Skull Valley Band of Goshute Indians' statistics were used as the basis of this evaluation to identify minority and low-income populations in the 5-mile immediate site area. Table 2.7-1 presents the minority and low-income statistics for the State of Utah, Tooele County, and the area within 5-miles of the PFSF. Table 2.7-2 presents a comparison of the county and PFSF site area with state minority and low-income statistics. The population of the area within 5-miles of the PFSF (totaling 36 persons, including approximately 30 members of the Skull Valley Band of Goshute Indians living on the Reservation) exceeds the NMSS guideline for both minority populations and low-income levels, indicating that the PFSF may have an environmental justice potential. In addition the data presented shows that the minority and low-income population within 5-miles of the PFSF exceed 50 percent, which, according to the NMSS guidance, indicates the need to consider environmental justice in greater detail.

Figure 2.2-4 identifies 1 residence outside of the reservation but within 4 miles of the site. The population of 3 people assigned to that residence was derived by multiplying the people per household factor (3.35) for the Census tract in which this area is included by the number of houses counted in the area. It is difficult to determine the ethnic background or economic status of the small population residing within 4 miles of the site from published data. To protect confidentiality, the Census and state agencies that develop population projections don't provide data when the sample group is so small that one would be able to identify the individuals for whom the data apply. Given the sparse population of the region, the smallest area for which information is enumerated around the site is census tracts. The entire area within 4 miles of the Skull Valley PFSF is included within Tooele County Census Tract 1306, which encompasses 5,751 square miles and contained a total population of 3,592 people in 1990.

A total of 1,008 households were identified within Census Tract 1306 in the 1990

census with a median household income of $25,852.00. In 1989 about 12% of the families had incomes below the poverty level. Approximately 1,628 persons 16 and over were employed with 32% employed in service occupations, 15% in administrative support occupations (including clerical), 11% in sales occupations and 10% in executive, administrative and managerial occupations. The balance was distributed among a wide variety of business sectors.

No data is available that would allow determination of the specific health status of the Skull Valley population. The Utah Department of Health reports health statistics by Health District. While Health Districts can be as small as a zip code area in more densely populated urban areas, the health district in which Skull Valley is located consists of all of Tooele County and is the smallest area for which published information is available. The following table lists the prevalence of various chronic diseases within the Tooele Health District (including the Tribe) and the State of Utah in 1996. The review was not able to identify any unusual incidences of diseases or the income or ethnicity of the individuals with chronic diseases.

Disease	Percent of Population: Tooele County	Percent of Population: State of Utah	Tooele Residents With Disease As Percentage of State Total*
Asthma	5.5%	4.1%	1.8%
Arthritis	5.5%	5.1%	1.5%
Heart Disease	3.7%	2.7%	1.9%
Chronic Obstructive Pulmonary Disease	1.1%	1.0%	1.5%
Diabetes	3.7%	2.9%	1.7%
Stroke	0.9%	0.9%	1.1%

*Total Tooele County population is 1.4% of the State's total population.

Source: Utah Department of Health, Bureau of Surveillance and Analysis. Overview of 1996 Health Status Survey.

The Skull Valley Band of Goshute Indians is a federally recognized Indian Tribe. An Executive Committee, that is the governing body of the Band, and the General Council, which is the membership of the Band, handles tribal governance. The Executive Committee is comprised of three members, Chairman, Vice-Chair, and Tribal Secretary, who are nominated and elected by the adult membership of the General Council for four year terms.

Activities, ceremonies, and traditional practices other than governance are practiced by the individual in a home setting wherever that is located. Ancestral lands reside in Tooele Valley with the more well known historical and logged locations found on the Tooele Army Depot property.

A Site Selection Questionnaire was given to the Band by PFS. The Band received this questionnaire after PFS was notified by the Band of their interest in hosting the facility on the reservation in the area identified for industrial development. The Band had approached PFS for consideration and have, on record, a resolution of the General Council (consisting of all adult enrolled members of the Band) approving and supporting the development and operation of the facility, which clearly establishes the Band as a "willing jurisdiction." In addition, the reservation is located in an area that has been designated as a waste zone by the State of Utah. Numerous "waste" businesses have already been established everywhere in this zone but on the reservation. Therefore, the members of the Band believe that the Band represents the only "public" left to be considered for acceptability and as previously established and find the facility not only acceptable, but also highly desirable.

The consumption rates of locally harvested plants and animals by Skull Valley members that help to determine whether the proposed action in conjunction with traditional activities and /or food consumption patterns could lead to adverse health impacts to the

reservation are as follows: The lack of water in general on the reservation severely restricts the availability of all edible plants and therefore restricts the presence of animals with the exception of a few horses maintained by Band members. Tribal members consume food obtained from commercial stores no different than other members of the general population in Tooele County or Salt Lake City. The Band has identified an area (1/2 section) of potential agricultural development (limited cattle grazing) east of Skull Valley Road and west of the Tribal Village. This area has been identified for possible future development if sufficient water can be obtained to support the operation. No plants or animals are presently grown or grazed on the reservation for human consumption.

2.7.3.2 Determination of Disproportionately High and Adverse Impacts

Because the minority and low-income population percentages exceed the NMSS guidelines, it is necessary to determine if there is a ".. 'disproportionately high and adverse impact' (human health or environmental effect) to the minority or low-income population surrounding the site." Chapter 4 of this Environmental Report identifies the potential effects of site preparation, construction, and operation. These potential impacts are summarized in Table 2.7-3.

Since the PFSF is located 2 miles from the nearest residence, most of the impacts shown above have no effect on the population within the 5-mile immediate PFSF site area. Impacts that do affect the local population would affect most residents in the 5-mile PFSF site area. Since these impacts generally decline with distance, these impacts would "disproportionately" affect minorities or low-income population in the 5-mile PFSF site area. However, none of the impacts are significant, unacceptable, or above regulatory limits, and are therefore not high and adverse. Therefore, there is no environmental justice concern.

The 5-mile immediate site area was evaluated for "cumulative and indirect effects of impacts," which are defined as increased impacts when added to other past, present, or future impacts. There are no apparent major impacts from other sources in the area. Therefore, there are no major cumulative or indirect effects as a result of the impacts from this project coupled with the impacts from other area sources.

2.7.3.3 Mitigative Measures and Benefits

There are no significant impacts associated with the project requiring mitigative measures. The design of the facility already provides mitigative measures to reduce potential impacts. The facility will be located away from residences to prevent disruption to existing land uses and minimize the visual impact on the regional surroundings. Dust pollution will be minimized by dust control techniques. The facility is designed to use very little water and to provide radiation shielding to lower doses to residences greatly below the regulation limits.

The project benefits to the Skull Valley Band of Goshute Indians, Tooele County, and the State of Utah will include jobs and revenue sources that will reduce the low-income status of the area. The benefits far outweigh the minor impacts that the project will create.

The Skull Valley Band of Goshute Indians voluntarily initiated consideration of the Reservation as a site for spent fuel storage. Beginning in 1992, the Band closely examined the proposal by the United States government to store spent nuclear fuel, and conducted extensive research on storage facilities both in the United States and around the world. Following the conclusion of a Phase I study which included visits by the Band to nuclear generating stations, existing spent fuel storage facilities, and

conferences on the environment and nuclear waste, the Skull Valley Band Council concluded that a storage facility on the Reservation was safe, that additional employment opportunities would be created, and that this type of facility is compatible with the Band's commitment to protect the environment.

On October 15, 1993, a Preliminary Site Assessment of the Skull Valley Indian Reservation was prepared for the DOE Office of Civilian Radioactive Waste Management (OCRWM), which evaluated land areas within the Reservation as presented by the Skull Valley Band of Goshute Indians for potential development of a Monitored Retrievable Storage (MRS) facility[4]. The assessment evaluated the Reservation for siting requirements as defined in DOE/RW-0315P, "Preliminary Siting Requirements and Considerations for a Monitored Retrievable Storage Facility," which included considerations of geologic hazards, environmental and socioeconomic factors, transportation access, and cost and development time. The evaluation concluded that the siting areas within the Reservation as proffered by the Skull Valley Band met the site requirements of DOE/RW-0315P and were suitable for proceeding with the voluntary siting process.

Under a Phase II grant, members of the Skull Valley Band traveled to Japan, France, Great Britain, and Sweden to view existing spent fuel storage facilities. In February of 1994, the Band voted to approve the building of a storage facility for spent nuclear fuel on the Reservation. Following the end of DOE's siting program, the Band initiated contacts with the utilities who later formed the PFSLLC concerning utility interest to site an ISFSI on the Skull Valley Indian Reservation. After extensive negotiations with the PFSLLC, the Band entered into a lease agreement for development of a storage facility at this location. Under this agreement, the Band will receive significant lease payments

[4] MRS is the designated name for a DOE operated commercial spent fuel and high level radioactive waste storage facility.

for the use of Reservation lands during the life of the facility that will bring substantial economic benefit to Skull Valley Band members and residents of the Reservation. Further, potential employment opportunities will exist for Band members during both the construction and operational phases of the project. This discussion shows the beneficial nature of the project and the fact that the Band has had a full and extensive opportunity to participate with respect to this project.

2.7.3.4 Environmental Justice Evaluation Conclusion

Therefore, because no "disproportionately high and adverse" impact to the minority or low-income population surrounding the site has been identified, because the benefits will provide needed economic improvement for the area, and because the Skull Valley Band of Goshute Indians have actively and voluntarily pursued the issue of spent fuel storage and voted in favor of building a spent fuel storage facility on the Skull Valley Indian Reservation, environmental justice is not considered an issue for the proposed PFSF.

2.8 NOISE AND TRAFFIC

The nearest noise-sensitive residential receptor to the PFSF is 2 miles southeast of the center of the PFSF on Skull Valley Road. The nearest settlement is the Skull Valley Band of Goshute Indian village located approximately 3.5 miles east of the PFSF on the Skull Valley Indian Reservation. The primary existing sources of noise in the area are local traffic, insects, aircraft, and military testing at Dugway Proving Ground and Utah Test and Training Range.

As discussed in Section 2.1.1, the Tekoi Rocket Engine Test Facility, located approximately 2.5 miles south-southeast of the PFSF on the south side of Hickman Knolls, has been used very seldom over the past two years. Its use in the future would require the lease agreement between Alliant Techsystems Inc. and the Goshute Band to be renegotiated. No rocket motors were tested during the recent ambient sound level survey, and it was therefore not possible to directly measure rocket noise during the survey. The Tekoi Rocket Motor Test facility was therefore contacted to determine if they had any sound level data for motor testing. They reported that to their knowledge no sound level measurements have been taken in the last decade.

Other historical data, however, has been obtained. The sound levels of several rocket motors were summarized in "Environmental Impact Analysis, Rocket Motor Test Site, Skull Valley Band of Goshute Indians, Skull Valley Reservation, March 18, 1975. This data is given in the following table. Current rocket motors may be expected to be somewhat larger and louder.

Trident I C4 Rocket Motor Sound Level Test Data

Rocket Motor	Background Noise, dBA	Distance, ft.	Rocket Motor Noise dBA
C4 F/S[1]	45	7800	72-74
C4 F/S	52	7800	60-62
C4 S/S	55	7800	Audible, not measurable
C4 S/S	55	7800	Audible, not measurable
C4 F/S	58	7800	70
C4 F/S	58	1600	90
C4 T/S	25	1600	88

[1] F/S, First stage, S/S second stage, T/S third stage

The existing ambient sound level was quantified in two ways. The first was with an ambient sound level survey. The survey measured the existing ambient sound level at several locations along Skull Valley Road. The primary matrix measured was the residual or background sound level. This level is used to assess the non-traffic related noise from the construction and operation of the facility.

The second method quantified the existing sound level for traffic noise. In this analysis existing traffic counts were used to predict the existing traffic noise. The expected increases in traffic counts were then used to quantify the expected increases in traffic noise. This is more accurate than using the direct measure of the traffic noise which could not usually be collected far enough from the road to be representative.

2.8.1 Ambient Sound Level Survey

A sound level survey was conducted on June 9-10, 1998 in the vicinity of PFSF. The purpose of the survey was to document the existing ambient sound levels to be used in

identifying potential noise impacts of the non-traffic related construction and operation of the PFSF.

A precision, integrating, octave band, sound level meter was used to take sound level measurements at 4 locations. The meter collected 10 minute statistical sound level and octave band sound pressure level samples, and was calibrated before and after each survey. The meter and calibrator have calibrations traceable to the National Institute of Standards and Technology.

The meter measured the hourly L10, L50, and L90, which are the levels exceeded 10, 50, and 90 percent of the time. The Leq, or the energy average sound level, was also measured during the sample.

The L90 quantifies the quiet periods in the absence of intrusive noise such as passing vehicles or calling birds and is representative of the background sound level experienced by the residences along Skull Valley road. Any new noise source introduced into the area would be most audible during the quietest periods. The L90 was therefore selected as the primary matrix for assessing the audibility and impact of noise in this analysis.

The second unit of measure is the Leq, which is the energy average sound level. The Leq is dominated by passing vehicles, so the level was dependent on the distance of the measurement from the road, and the number of vehicle pass-byes. Measurements taken close to the road are necessarily higher than those experienced by residences set back from the road. Most of the measurements were taken within 25 ft. of the center of the road to avoid entrance to private land.

2.8.2 Measurement Locations

The noise measurements locations are described below.

Location #1. Horseshoe Springs parking lot.

Location #2. 8 Mile Springs Road and Skull Valley Road, 25 feet from center of road.

Location #3 Goshute Reservation north entrance cattle guard on Skull Valley Road, 20 ft. from center of road.

Location #4. Pony Express, south of building, 60 ft. from center of road.

Location #4 alt. Tekoi Test Range entrance on Skull Valley Road, 25 ft. from center of road.

2.8.3 Summary of Ambient Levels

The ambient sound level data are summarized in Table 2.8-1. The data illustrate the considerable spacial and temporal variability of the sound levels in the vicinity of Skull Valley Road. Additional survey information, including the times of data collection, the L10 levels, and the controlling noise sources are given in Table 2.8-1.

As indicated in Table 2.8-1, the residual (L90) sound levels are mostly controlled by insects, wildlife, and "singing" wires, rather than human activity. As such their spacial and temporal variability were somewhat irregular. For each measurement period, the first line of the "Controlling Noise Source" entry in the table describes what is controlling

the Leqs. The second line indicates what is controlling the L90, or minimum sound levels.

Locations 1 (Horseshoe Springs) and 4 (Pony Express) were the loudest locations with daytime L90 levels in the 40-48 dBA range, dropping to around 30 dBA at night. Both day and night levels were controlled by insect activity, or occasionally the vent fan at the Pony Express.

At Location #3, at the north entrance to the reservation, the L90s were 30-35 dBA the first 3 surveys, dropping to 25 dBA the second night. Location #2 (8 Mile Springs Road), the quietest location, was around 30 dBA the first day, and in the low 20s dBA thereafter.

In the presence of automobile/truck traffic the Leqs were controlled by distance from the road and the number of passing cars. The Leqs were generally in the 50 - 60 dBA range when several cars passed during the measurement period, except lower at Horseshoe Springs, which was further from the road. In the absence of cars, the Leqs were often in the 25-30 dBA range.

In summary the residual L90 sound levels along Skull Valley Road were controlled by insects, frogs and singing wires. They generally varied from the low 20s dBA to the low 40s dBA.

As indicated above, the existing traffic noise was estimated using existing traffic counts. Average daily traffic (ADT) counts on Skull Valley Road are reported by the State of Utah for the road sections north and south of Iosepa. The ADT is the total vehicle count (both directions) for a 24 hour period. The ADT north and south of Iosepa are 565 vehicles and 325 vehicles respectively (personal communication with R. Phillips, Utah DOT and Planning, February 18, 1997). Peak-hour and vehicle type data are not available for Skull Valley Road. Field observations (Stone & Webster site visits, 1996)

indicate usage by mixed vehicle types, including two-axle passenger vehicles, medium sized trucks, and three-axle semi-trailers.

Ambient levels of traffic generated noise on Skull Valley Road is a function of vehicle type, traffic volume, and traffic speed. In the absence of hourly data, we assumed that the maximum vehicle per hour (v/h) volume is one-sixth of the total ADT. This is equivalent to 1/3 of the ADT occurring during the morning 2-hour commute period, and 1/3 during the evening 2-hour commute. For traffic between Iosepa and I-80, this approach gives a maximum volume of 94 v/h. We assumed that 50 percent of the vehicles will be automobiles, 35 percent medium trucks, and 15 percent heavy. Based on these assumptions, we predict the noise from existing traffic traveling at 62 miles per hour to have an equivalent sound level of 68 dBA at a distance of 50 ft. The equivalent sound level, Leq, is the hourly energy level. For traffic between Iosepa and Route 199, we estimated a maximum volume of 54 v/h and assumed the same vehicle type distribution as that north of Iosepa. Based on these assumptions, we predict the noise from existing peak hour traffic traveling at 62 miles per hour to have an equivalent sound level of 67 dBA at a distance of 50 ft.

For non-peak traffic-generated noise, it is assumed that the remaining third of the non-peak traffic will be evenly distributed over a 12-hour, non-rush hour period (it is assumed that there is no traffic between the hours of 10 p.m. and 6 a.m.) resulting in a non-peak, average daytime traffic volume of 16 v/h north of Iosepa and 9 v/h south of Iosepa. The equivalent sound levels at 50 ft generated by this volume of traffic north and south of Iosepa will be 63 dBA and 62 dBA, respectively.

The traffic noise predictions will be used for assessing the impact of the construction and operation traffic noise. The ambient noise survey residual sound levels will be used to assess the noise impact (audibility) of the onsite facility operation and the rail line operation. Traffic counts for other roads in the area are shown in Table 2.8-2.

2.9 REGIONAL HISTORIC, SCENIC, CULTURAL, AND NATURAL FEATURES

2.9.1 Cultural Resources

Section 106 of the National Historic Preservation Act requires that projects receiving federal licenses and permits take into account how these undertakings could affect historic properties. Historic properties are defined as properties listed on or eligible for listing on the National Register of Historic Places (NRHP). For this review process, SWEC contacted the Utah State Historic Preservation Officer (SHPO) by letters dated January 3, 1997, and March 11, 1997, and contacted the Skull Valley Band of Goshute Indians to aid in the identification of historic properties in the project study area.

The Skull Valley Band of Goshute Indians has a traditional form of government under a General Council comprised of the eligible membership of the Band. A three person Executive Committee, elected by the General Council, comprised of a Chairman, Vice-Chairman, and Secretary, is the governing body of the Band and handles day to day matters. The Executive Committee represents the Band and all of it's enrolled members for Tribal affairs. PFS previously conferred with members of the Executive Committee for information to support the License Application to the Nuclear Regulatory Commission.

The PFSF is located within the Skull Valley Indian Reservation. The Skull Valley Band of Goshute Indians historically lived in the region around the Great Salt Lake in Northern Utah. The Skull Valley Reservation was established in 1917 and is home to approximately 30 members of the Skull Valley Band of Goshute Indians. The Band indicates that the portion of the Reservation designated as project area does not contain any cultural or historic resources, or areas of religious significance to the Band (letter dated October 28, 1996, from L. D. Bear, Band Chairman, to J. Donnell, SWEC).

The Skull Valley Band of Goshute Indians' ancestral land is in Tooele Valley rather than Skull Valley where the reservation and the leased site are located. There are no known Traditional Cultural Properties in Skull Valley. Although historically other Native American tribes have probably passed through the area, there are no known cultural properties from these migrations through Skull Valley. Members of the Confederated Tribes, a separate federally recognized tribe located in western Utah, continue to have family ties with members of the Skull Valley Band. The ancestral roots of the Confederated Tribes, like the Band, are in Tooele Valley and do not change the lack of cultural properties within Skull Valley.

The Band and its members have a cultural association with and respect for all "mother earth". However, traditional Band practices are individual in nature and are not associated with a specific location on the reservation property or other locations in Skull Valley. The Band believes that planned economic development, such as the proposed storage facility, which has been thoroughly studied by the Band, is compatible with their respect of "mother earth". An earlier example of economic development coexisting with the surrounding environment on the reservation is the Tekoi Rocket Motor Test Facility.

There is a lack of surface water on much of the reservation property and in the general area of the reservation. Traditional plants of value to the Band, such as sage and cedar, that grow, if any, are in an inferior condition to be used by the Band members. Acceptable plants are found in the Stansbury Mountains but not lower in the valley where the PFSF site area, the ITP, or the Low Corridor rail line are located. The availability and quality of such plants is far greater and more accessible in Tooele Valley than in Skull Valley. The availability and quality of traditional plants in Skull Valley would also directly apply to members of the Confederated Tribes in their visits to Skull Valley. There are no known uses of traditional plants by other Native American tribes within Skull Valley. As a result, the development of the PFSF, Low Corridor rail

line, or Intermodal Transfer Point in Skull Valley will have no significant effect on the traditional Band practices or ethnobiological resources. However, the Band requests that if any artifacts that may be of cultural value are discovered during construction on the Reservation, construction should stop and the Band contacted immediately to investigate the artifacts.

By letter dated January 14, 1997, the Utah SHPO concurs with the determination of the Band that there are no known historic or religious properties in the project area as defined by the National Historic Preservation Act or the American Religious Freedom Act. Skull Valley is sparsely settled. White explorers first traversed the area in the 1820's looking for routes across the Great Salt Lake Desert. An abandoned trail, through Skull Valley and extending beyond the Silver Mountains to the west, marks the route taken by the ill-fated Donner Party in 1846. The trail crosses Skull Valley Road just north of Iosepa.

The Iosepa Cemetery is listed in the National Register of Historic Places and is significant as surviving evidence of the settlement of Mormon converts from Hawaii in 1889. An outbreak of leprosy in 1896, combined with the poor climate for farming, led to the abandonment of the Iosepa settlement by 1917. The Iosepa Cemetery is situated well away from the PFSF and the transportation corridor.

Approximately 20 miles south of the Skull Valley Indian Reservation, remnants of the legendary Pony Express Trail, which operated from 1860-1861, survive and are maintained for public visitation by the BLM.

The Pony Express Trail is one of 5 "Scenic Backways" designated by the BLM in Tooele County. The 133-mile-long Pony Express Trail retains the ruins of 14 Pony Express Station sites (Tooele County Chamber of Commerce and Tourism, 3/21/97).

There are no National Natural Landmarks within a 5-mile or a 50-mile radius of the PFSF (U. S. Department of Interior, 1996).

The Class I cultural resource inventory for the ITP area and the Low Corridor rail line conducted in May 1998 included a study area of one-quarter mile radius around the ITP area, and a half mile wide corridor on either side of the proposed rail line. A Class I inventory is designed to locate previously inventoried areas and previously recorded sites in the area to help assess the effect of project development on cultural resources. Archeological surveys were conducted along Skull Valley Road in the early 1980'sBesides the two historic trails (Hastings and Donner-Reed) that cross the proposed Low Corridor, no other recorded archeological or historical sites were located within the study area. These trails are part of the California Historic Trail. While both trails are significant and eligible to be on the NRHP, given the proximity to Interstate 80, the Hastings Trail has already been severely impacted in the area of the proposed rail line corridor. The Donner-Reed Trail, however, may have been less impacted in the area where it crosses the proposed corridor. No sites were located in the intermodal transfer point study area. The Class I Survey concluded that there is only a low probability of encountering archeological or historical sites in the proposed rail line corridor or ITP area.

A Class III Cultural Resource Inventory has been completed for the Intermodal Transfer Point, the Low Transportation Corridor, and the PFSF site area on the Goshute Indian Reservation (P-III Associates, Inc., 1999a). The Class III inventory confirmed the location of the Hastings Cutoff (site 42T0709) along the Low Transportation Corridor, and resulted in the discovery of an additional site (42T01187) and eight isolated finds. None of the isolated finds are considered eligible for inclusion in the National Register of Historic Places (NRHP).

Site 42T01187 is a rock alignment and cairn. The rock alignment is located approximately 550-ft East of the rail line centerline and therefore will be avoided by construction activities and operation of the rail line. Site 42T0709 is the Hastings Cutoff Trail in the immediate vicinity of the Low Transportation Corridor. This portion of the trail cannot be avoided by the Low Corridor rail line and therefore a Treatment Plan to preserve the significant historical data of the Hastings Cutoff in Skull Valley has been prepared (P-III Associates, Inc., 1999b.)

2.9.2 Visual and Scenic Resources

The overall scenic character of Skull Valley is one of vast openness and isolation. There are long views across the flat desert valley toward the distant serrated peaks of the Stansbury Mountains to the east or the Cedar Mountains to the west. The scenic quality is marked by variations in landforms and color. There is dispersed evidence of human development, such as farmhouses, fences, overhead transmission lines, and roads. The two-lane Skull Valley Road is the most prominent manmade feature in the valley. A wooden-pole, single overhead power transmission line extends from Interstate 80 south to Dugway. Sections of the transmission line parallel the Skull Valley Road corridor, with slight variances through the open valley to provide service to area ranches.

The BLM has established visual resource management (VRM) classes for lands under its management control. Three VRM classifications are established for the Pony Express Resource Area (PERA) - Classes II, III, and IV. BLM land near the Intermodal Transfer Point, along the Low Corridor, and within the 5-mile radius of the PFSF is within VRM Class IV, which has a management objective that provides for activities that may result in major modifications to the existing character of the landscape. Class IV designated areas allow activities that may dominate the view and be a major focal point

for the viewer. The designation anticipates high levels of change in the visual character of the landscape, yet calls for efforts to control the impact of activities through repetition of visual elements, sensitive siting, and minimization of disturbances (BLM, 1988). The facility has been designed to minimize visual impacts by siting structures in a remote location approximately 1.5 miles west of Skull Valley Road where the natural topography provides some screening for viewers. The design of buildings, with the exception of the canister transfer building, is typical of other structures in the area.

Regional scenic features include the Stansbury Mountains that encompass the Stansbury Mountain unit of the Wasatch National Forest. Deseret Peak is located about 9.5 miles east-northeast of the facility and is the central feature of the 25,000-acre Deseret Peak Wilderness Area. The boundary of the wilderness area is about 6 miles east of the PFSF. The Cedar Mountains are located on the opposite side of Skull Valley, about 10 miles distant.

2.10 BACKGROUND RADIOLOGICAL CHARACTERISTICS

Background radiological characteristics for the PFSF site were determined from a survey of area gamma radiation levels and samples of the surface soil. The area gamma measurements are being performed using thermoluminescent dosimeters (TLDs). Two TLDs are located on the PFSF meteorological tower and one on the outside of the Pony Express convenience store. The meteorological tower and the convenience store are on Skull Valley Road about 3 miles southeast of the PFSF. During the 4 month period from December 1996 to April 1997, the average exposure rate measured by the TLDs was 0.28 mrem/day (102 mrem/yr).

Five samples of the surface soil were collected from the PFSF site in November 1996. The approximate locations of the samples were at the center and each of the four corners of the site. The radiological analysis consisted of gross alpha / beta and gamma spectrometry for radionuclide concentrations. Detectable alpha results ranged from 8.6 to 1.1E1 pCi/g and the beta from 2.2E1 to 3.7E1 pCi/g.

The gamma spectrometry analysis of the soil radionuclides employed a library of naturally occurring and manmade nuclides. The range of results above detectable limits are as follows:

- Potassium-40 1.0E1 to 1.6E1 pCi/g
- Cesium-137 7.1E-2 to 6.1E0 pCi/g
- Lead-210 5.8E-1 to 1.1E0 pCi/g
- Bismuth-212 9.7E-1 to 1.3E0 pCi/g
- Lead-212 5.0E-1 to 8.5E-1 pCi/g
- Bismuth-214 9.2E-1 to 1.4E0 pCi/g
- Lead-214 7.6E-1 to 1.1E0 pCi/g

- Radium-223 2.4E-1 to 5.2E-1 pCi/g
- Radium-224 3.0E0 to 9.6E0 pCi/g
- Radium-226 1.3E0 to 2.3E0 pCi/g
- Actinium-228 7.5E-1 to 1.2E0 pCi/g
- Protactinium-231 2.2E0 to 3.1E0 pCi/g
- Uranium-235 8.0E-2 to 1.4E-1 pCi/g
- Uranium-238 5.7E-1 to 1.4E0 pCi/g

The above radionuclide contributions are assumed to be from natural sources since there are no industrial or nuclear fuel cycle facilities in the area (except for Cs-137 which is from atmospheric weapons tests). These concentrations are in general agreement with a similar survey performed for the nearby Envirocare site at Clive, Utah, about 24 miles northwest of the PFSF (USNRC, 1993). The Envirocare facility is located approximately 13 miles west of the northern portion of the Low Rail Corridor, across the Cedar Mountains in the neighboring valley (Ripple Valley). Both Skull Valley and Ripple Valley are high desert environments with vegetation characterized by desert shrubs and grasses adapted to low precipitation and highly alkaline soils. Wildlife in Skull Valley is also similar to wildlife found in Ripple Valley where the Envirocare facility is located, characterized by species typical of the desert shrub/saltbush habitat type in the Intermountain Sagebrush Province (ER Section 2.3.1.2). Since the background radioactive nuclides and radioactivity concentrations in the soil are similar at the two nearby sites, and since vegetation and animal species found near the Envirocare facility are essentially the same as those that inhabit the PFSF site and the Low Rail Corridor, it is considered that background concentrations of radioactivity in vegetation and mammal flesh at the PFSF site and along the Low Rail Corridor will be similar to background levels measured at Envirocare.

There is no surface water in the PFSF site area, and consequently no water samples were taken. Also, no radiological samples of the vegetation were obtained. An indication of radiation levels in vegetation near the Envirocare facility is noted in USNRC, 1993, which reports the following average concentrations: 5.4 pCi/kg for uranium, 6.0 pCi/kg for Th-230, 3.1 pCi/kg for Ra-226, 198.0 pCi/kg for Pb-210, and 48.0 pCi/kg for Po-210. An indication of radioactivity levels in mammals near the Envirocare facility is also noted in USNRC, 1993, which identifies the following average background radioactivity concentrations in mammal (rabbit) flesh: 0.5 pCi/kg for U-238, 0.5 pCi/kg for Th-230, 0.6 pCi/kg for Ra-226, 4.0 pCi/kg for Pb-210, and 8.0 pCi/kg for Po-210.

Radioactivity levels in groundwater at the Envirocare facility are probably not representative of those at the PFSF site. As bedrock weathers, it releases radionuclides such as uranium, thorium and radon into the groundwater. The bedrock (granite or basalt) in Ripple Valley could have different radioactivity concentrations than bedrock in Skull Valley, and there could be a significant difference in groundwater radioactivity concentrations between the two sites. In order to characterize radioactivity concentrations in the groundwater near the PFSF site, water samples will be drawn from the groundwater monitoring well that is located at the site of the Canister Transfer Building and analyzed for radioactivity levels. Radioactivity levels in groundwater north-northwest of the PFSF site, representative of the Low Rail Corridor, will also be determined. This groundwater sampling and analysis will be included in the PFSF preoperational radiological environmental baseline, discussed in the following paragraph.

Although PFS considers that background radioactivity levels in vegetation and mammal flesh in the vicinity of the Envirocare facility near Clive Utah are representative of the background radioactivity levels near the PFSF site and along the Low Rail Corridor,

PFS will nonetheless establish a preoperational radiological environmental baseline at the PFSF site. As stated in Section 6.1.2, the baseline will sample for radioactivity levels in soil, groundwater, vegetation, and the flesh of non-migratory mammals. The background radioactivity levels at the PFSF site will therefore be established prior to the beginning of PFSF operation.

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Table 2.4-11 (sheet 1 of 2)

1998 Point Source Criteria Pollutant Emissions within 60 Kilometers of the PFSF Site

Point Source	Distance from PFSF (km)	Direction from PFSF (degrees)	Tons per Year PM-10	SO_2	NO_x	VOC	CO
A. P. Green Refractories, Inc. Silica Stone Quarry	26.399	76.2	3.49	0.01	0.12	0.01	0.03
Barrick Resources (USA), Inc., Mercur Mine	51.999	102.1	No inventory needed due to limited activity				
Cargill Inc., Salt Division (formerly AKZO Nobel Salt) Timpie Salt Processing Plant	39.437	17.7	28.1	3.34	48.2	3.15	10.8
Chemical Lime Company, Grantsville Plant	37.100	30.6	87.9	2.48	127.0	3.81	81.0
Deseret Chemical Depot, South Area	41.893	102.8	8.48	20.1	73.1	3.73	10.8
Detroit Diesel Remanufacturing (formerly Tooele Army Depot, North Area)	37.485	62.0	0.60	0.43	8.86	62.3	3.57
Dugway Proving Ground	28.712	206.9	687.9	14.1	16.5	20.5	3.93
Envirocare of Utah, Inc., Radioactive Material Disposal Site	41.313	310.3	41.2	8.93	88.4	6.07	34.6
Magnesium Corp. of America Rowley Plant	56.226	6.3	1313	40.9	780.5	251.4	124.6
Morton International, Morton Salt Division	38.000	36.9	No inventory reported				
Safety-Kleen (formerly Aptus, Inc.) Aragonite Hazardous Waste Storage/Incineration	39.002	338.7	2.64	2.40	101.6	2.31	19.1

Table 2.4-11 (sheet 2 of 2)

Point Source	Distance from PFSF (km)	Direction from PFSF (degrees)	Tons per Year PM10	SO_2	NO_x	VOC	CO
Safety-Kleen, Clive Hazardous Waste Incinerator	43.573	317.3	0.44	0.42	5.80	1.42	2.16
Staker Paving (formerly Bolinder Co.)							
Bauer Pit	36.924	80.3	2.14	1.10	6.85	1.50	3.52
Erda Pit	49.546	61.2	6.66	15.2	12.2	3.08	4.78
Rocky Ridge Pit	40.661	67.3	No inventory reported				
Tekoi Rocket Motor Test Facility	4.023	158.0	[Waiting for EPA Region 8 Input]				
USPCI - Grassy Mountain Landfill Facility	57.380	323.3	24.2	0.94	12.3	3.62	64.6

Stack Parameter Data of Significant Point Sources Located Within 60 Kilometers of the PFSF Site (All Locations Within Tooele County)

Company	Site	Cmpnt_Plant_ID	Unit ID	Description	Stack ID	Stack_Description	Stack-UTM North	Stack-UTM East	Stack Latitude	Stack Longitude	Stack Height (ft)	Stack In. Dia. (ft)	Stack Exit Temp (F)	Flow Rate (cu ft/sec)	Cmpnt. Year-Of-Record	Elevation AMSL
Cargill Inc.--Salt Division	Timpie Salt Processing Plant		2	Carrier Drier	6	3	0	0			40	2	439	51	1998	4215 ft
Cargill Inc.--Salt Division	Timpie Salt Processing Plant		2	Carrier Drier	6	3	0	0			40	2	439	51	1998	4215 ft
Cargill Inc.--Salt Division	Timpie Salt Processing Plant	Diesel Generator	19 and 20	Diesel Generator and Pump	4119		0	0			0	0	0	0	1998	4215 ft
Cargill Inc.--Salt Division	Timpie Salt Processing Plant	Rail & Truck Loading	11	Rail Car Loading	0	n/a	0	0			1	0	0	0	1998	4215 ft
Cargill Inc.--Salt Division	Timpie Salt Processing Plant	Timpie Plant	10	Harvester--salt 300 HP	0	n/a	0	0			1	0	0	0	1998	4215 ft
Cargill Inc.--Salt Division	Timpie Salt Processing Plant	Timpie Plant	12	Truck Loading	0	n/a	0	0			1	0	0	0	1998	4215 ft
Cargill Inc.--Salt Division	Timpie Salt Processing Plant	Timpie plant	3	Bepex System	3	3	0	0			25	2.6		7000	1998	4215 ft
Cargill Inc.--Salt Division	Timpie Salt Processing Plant	Timpie plant	4	central dust collection system	4	1	0	0			100	8	308	695	1998	4215 ft
Cargill Inc.--Salt Division	Timpie Salt Processing Plant	Timpie plant	9	Trace minerals system	5	2	0	0			100	4	244	296	1998	4215 ft
Chemical Lime Company	Grantsville Plant		DC-1QS	Quicklime Storage Bins	1665	4	4506547	366956	40 42 00	112 34 30	75	1.17	70	85	1998	5000 ft
Chemical Lime Company	Grantsville Plant		DC-2QP	Quicklime Process System	1660	5	4506522	366940	40 42 00	112 34 30	8	1.67	70	210	1998	5000 ft
Chemical Lime Company	Grantsville Plant		DC-3HB	Hydrate & Bagging	1663	2	4506569	366938	40 42 00	112 34 30	8	3.2	70	230	1998	5000 ft
Chemical Lime Company	Grantsville Plant		DC-4LO	Quicklime Loadout System	1668	7	4506544	366958	40 42 00	112 34 30	5	0.5	70	10	1998	5000 ft
Chemical Lime Company	Grantsville Plant		DC-5LO	Loadout Belt System	1667	6	4506565	366959	40 42 00	112 34 30	30	1.3	70	35	1998	5000 ft
Chemical Lime Company	Grantsville Plant		DC-6KD	Kiln Dust Bin	1669	8	4506533	366897	40 42 00	112 34 30	7.5	0.67	70	20	1998	5000 ft
Chemical Lime Company	Grantsville Plant		DS1RK	Rotary Kiln	1662	1	4506528	366895	40 42 00	112 34 30	60	5.4	350	270	1998	5000 ft
Chemical Lime Company	Grantsville Plant		HBH-1HY	Hydrator	1664	3	4506547	366932	40 42 00	112 34 30	30	1.9	220	50	1998	5000 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	5127	Generator	3905		4464	389			7	0.3	1085	495	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	1800	Heater	1552	1800	0	0	40 18 18	112 21 47	25	0.3	350	23	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	1800	Generator	3899		4462	384			0	0	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	1800	Heater	1551	1800	0	0	40 18 18	112 21 47	25	0.3	350	23	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	1850	Heater	1553	1850	0	0	40 18 24	112 21 58	15	0.6	350	28	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	1870	Heater	1555	1870	0	0	40 18 47	112 22 09	30	0.6	350	28	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	1870	Heater	1554	1870	0	0	40 18 47	112 22 09	30	0.6	350	28	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	4301	Heater	1564	4301	0	0	40 17 27	112 18 34	25	0.3	350	28	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	4541	Heater	1566	4541	0	0	40 18 25	112 19 26	25	0.3	350	169	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	4541	Generator	3901		4461	384			12	0.7	892	404	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	4544	Boiler	1568	4544	0	0	40 18 24	112 19 23	33	1.5	325	254	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	4553RRS	Generator	3902		4462	388			3.4	1.5	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	5005	Heater	3046	5005	0	0	40 19 23	112 18 44	0	0	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	5014	Generator	3903		4464	389			9	0.3	1085	495	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	5108	Generator	3904		4464	389			18	0.3	950	420	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	5125	Boiler	1573	5125	0	0	40 19 05	112 18 35	40	6	325	849	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	5165	Boiler	3047	5165	0	0	40 18 55	112 18 51	0	0	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	5165	Boiler	3048	5165	0	0	40 18 55	112 18 51	0	0	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	5451	Generator	3906		4465	388			8	0.7	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	6059	Generator	3907		4462	385			10	0.5			1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	DCD	7001	Generator	3908		4461	384			16	0.3	1110	168	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (CAMDS)	b16	Emergency Generator	1587	B17	4460	384			25	0.5	895	45	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (CAMDS)	b17	Emergency Generator	3050	B16	4460	384			25	0.5	895	45	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (CAMDS)	b18	Emergency Generator	1588	B18	4460	384			24	0.3	1060	3	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (CAMDS)	b5	Emergency Generator	1580	7037	4460	384			16	3.3	885	41	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (CAMDS)	b6	Emergency Generator	1579	7037 B6	0	0	40 17 24	112 22 06	16	3.3	885	41	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A01	LPG Flare	3737	A01	4462169	385202			14	0.33	0	143	1998	5400 ft

Stack Parameter Data of Significant Point Sources Located Within 60 Kilometers of the PFSF Site (All Locations Within Tooele County)

Company	Site	Cmpnt_Plant_ID	Unit ID	Description	Stack ID	Stack_Description	Stack-UTM North	Stack-UTM East	Stack Latitude	Stack Longitude	Stack Height (ft)	Stack In. Dia. (ft)	Stack Exit Temp (F)	Flow Rate (cu ft/sec)	Cmpnt. Year-Of-Record	Elevation AMSL
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A02	Emergency Generator-CAMDS	3082	CAL Lab	4461	384			15	0.5	900	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A03	CAL Ventil	3738	A03	4460636	383824			0	0	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A04	TCB Ventilation System	3739	A04	4462230	385186			0	0	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A07	Emergency Generator #1	3083	Emergency Gen #1	4462	385			15	1.25	920	27	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A08	Emergency Generator #2	1586	Emergency Gen #2	4462	385			15	1.3	925	27	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A13	DUN	3072	A13	4462512	385097			100	1.8	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A17	HW Boiler	3740	A17	4462210	385186			0	0	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A18	Medical Ventilation System	3741	A18	4462210	385186			0	0	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A23	RHA	3080	A23	4462210	385186			30	1	72	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A24	Steam Boiler #1	3073	A24	4462306	385254			43	1.5	500	9960	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A25	Steam Boiler #2	3074	A25	4462299	385246			43	1.5	500	9960	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A26	HW Boiler #1	3075	A26	4462275	385234			43	1.5	310	85	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A27	HW Boiler #2	3076	A27	4462275	385234			43	1.5	310	85	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A28	S1 Heater	28	2.2	0	0					180		1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A29	S1 Heater	29	2.3	0	0							1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A30	S2 Heater	3054	A30	4462573	385292			25	4.24	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A31	S3 Heater	3055	A31	4462482	385313			23	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A32	S3 Heater	3056	A32	4462489	385313			23	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A33	S4 Heater	3057	A33	4462336	385379			23	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A34	S4 Heater	3058	A34	4462386	385336			23	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A35	S4 Heater	3059	A35	4462394	385336			23	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A36	S4 Heater	3060	A36	4462401	385336			23	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A37	S4 Heater	3061	A37	4462408	385336			23	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A38	S5 Heater	3062	A38	4462308	385367			23	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A39	S5 Heater	3063	A39	4462315	3853673			28	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A40	S5 Heater	3064	A40	4462330	385367			28	0.67	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A41	S6 Heater	3065	A41	4462224	385411			23	1	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A42	S7 Heater	3066	A42	4462479	385411			2	2.91	0	0	1998	5400 ft
Deseret Chemical Depot	Deseret Chem. Depot (South Area)	South Area (TOCDF)	A43	MOB Ventilation System	3067	A43	4462330	385235			120	7.2	0	0	1998	5400 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		100	Overhead Natural Gas Heater	100	18	0	0			125	1	140	47	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		105	Overhead Natural Gas Heater	105	23	0	0			170	0.8	140	77	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		111	Natural Gas Water Heater	111	N2	4463129	437575	401930	1113700	34	1.5	95	197	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		145	Natural Gas Heater	145	63	111548	107500	40 55 00	112 44 50	250	9	160	2917	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		147	Natural Gas Boiler	147	65	111548	107500	40 55 00	112 44 50	254	5.5	120	1833	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		148	Natural Gas Boiler	148	66	111548	107500	40 55 00	112 44 50	254	3.5	120	935	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		16	Water Heater/Pressure Washer	16	2	4462765	437240			250	10.8	327	1563	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		17	Overhead Natural Gas Heater	17	CP5 1	4462815	437230			250	10.8	347	1625	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		18	Overhead Natural Gas Heater	18	CP6 4	4462970	437210			250	10.8	353	1568	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		26	Proceco Pass-thru Washer	26	1	4442000	643400			600	26	120	26667	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		27	Proceco Pass-thru Washer	27	2.1	0	0			6	2	80		1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		3	Overhead Natural Gas Heater	3	3	0	0			25	2.6		7000	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		32	Double Table Goff Steel Shot	32	was stack 4 in 1993	4514862	414678	40 46 55	112 00 40	34	1	390		1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		33	6 Glass Beaders	33	was stack 5 in 1993	4514862	414678	40 46 55	112 00 40	33	2.5	76	233	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		33	Tumbler Goff Steel Shot	33	was stack 5 in 1993	4514862	414678	40 46 55	112 00 40	33	2.5	76	233	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		34	2 Spinner Hanger Goff Steel Shot	34	was stack 6 in 1993	4514862	434678	40 46 55	112 00 40	31	0.83	408		1998	4500 ft

Stack Parameter Data of Significant Point Sources Located Within 60 Kilometers of the PFSF Site (All Locations Within Tooele County)

Company	Site	Cmpnt_PlantID	Unit ID	Description	Stack ID	Stack Description	Stack UTM North	Stack UTM East	Stack Latitude	Stack Longitude	Stack Height (ft)	Stack In. Dia. (ft)	Stack Exit Temp (F)	Flow Rate (cu ft/sec)	Cmpnt. Year-Of-Record	Elevation AMSL
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		35	Overhead Natural Gas Heater	18	CP6 4	4462970	437210			250	10.8	353	1568	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		39	Overhead Natural Gas Heater	39	12	0	0			31	1.5	347		1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		4	Overhead Natural Gas Heater	4	1	0	0			100	8	308	695	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		40	Overhead Natural Gas Heater	40	was stack 14 in 1993	4514862	414678	40 46 55	112 00 40	31	0.83	80	25	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		41	Overhead Natural Gas Heater	41		4492186	413605	40 34 40	112 01 03	24	2.82	70	20300	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		42	Overhead Natural Gas Heater	42		4492186	413605	40 34 40	112 01 03	24	1.4	70	20300	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		43	Overhead Natural Gas Heater	43		4492186	413605	40 34 40	112 01 03	23	2.82	70	20300	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		44	Mart Cyclone Washer Heater	44		4492186	413605	40 34 40	112 01 03	23	2.82	70	20300	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		45	Poceco Typhoon Washer Heater	45		4492186	413605	40 34 40	112 01 03	23	2.82	70	20300	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		46	pcp Oven	46		4492186	413605	40 34 40	112 01 03	23	2.82	70	20300	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		47	pcp Oven	47		4492186	413605	40 34 40	112 01 03	27	2.82	70	20300	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		48	pcp Oven	48		4492186	413605	40 34 40	112 01 03	27	2.82	70	20300	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		50	Overhead Natural Gas Heater	50		4492186	413605	40 34 40	112 01 03	26	2.82	70	20300	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		57	Overhead Natural Gas Heater	57	H-602	4521134	422642			32.5	1.7	900	54	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		59	Overhead Natural Gas Heater	59	H-621	4521074	422630			111.5	6.5	500	228	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		61	Reciprocating Driven IC Engine	61	BLR-2	4521038	422652			36.75	3.5	600	426	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Spray Booth	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Spray Booth	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Spray Booth	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Spray Booth	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Spray Booth	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Spray Booth	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Spray Booth	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Miscellaneous	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Miscellaneous	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		65	Spray Booth	65	BLR-6	4520779	422635			38	4	650	263	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		72	Overhead Natural Gas Heater	72		342200	4311500	38 56 38	112 49 31	100	5	350	1229	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		73	Natural Gas Boiler	73		342200	4311500	38 56 38	112 49 31	100	7	350	1408	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		74	Overhead Natural Gas Heater	74	HE-028	4570	397	41 17 00	112 13 45	60	3.2	138	184	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		75	Overhead Natural Gas Heater	75	AH-081	4570	397	411700	1121345	80	2.5	137	241	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		76	Engine Paint Booth Heater	76	AH-054	4570	397	41 17 00	112 13 45	90	6.5	74	458	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		77	Overhead Natural Gas Heater	77	BH-001	4570	397	41 17 00	112 13 45	98	4	94	444	1998	4500 ft
Detroit Diesel Remfmg.* Corp.	Consolidated Maintenance Facility		85	Overhead Natural Gas Heater	85	3	0	0			70	2.25	70	133	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		01	boiler, Reilly	174	1	0	0	40 55	112 44 55	30	2	300	20000	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		105	Pump engine P-0-W	117	105	111667	116310	40 55 14	112 41 40	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		106	Pump engine P-1-E	118	106	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		107	Pump engine P-2-N	119	107	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		108	Pump engine P-2-C	120	108	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		109	Pump engine P-2-S	121	109	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		11	furnace, #1	149	67	111548	107500	40 55 00	112 44 50	100	3.67	550	8	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		110	Pump engine P-3-E	122	110	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		111	Pump engine P-3-W	123	111	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		112	Pump engine P-5-E	124	112	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		113	Pump engine P-5-W	134	113	62182	147061	40 46 57	112 35 10	10	0.75	400	0	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		114	Pump engine P-6	135	114	62182	147061	40 46 57	112 35 10	10	0.75	400	0	1998	4500 ft

Stack Parameter Data of Significant Point Sources Located Within 60 Kilometers of the PFSF Site
(All Locations Within Tooele County)

Company	Site	Cmpnt Plant ID	Unit ID	Description	Stack ID	Stack Description	Stack-UTM North	Stack-UTM East	Stack Latitude	Stack Longitude	Stack Height (ft)	Stack In. Dia. (ft)	Stack Exit Temp (F)	Flow Rate (cu ft/sec)	Cmpnt. Year-Of-Record	Elevation AMSL
Magnesium Corp. of America	Rowley Plant		115	Pump engine P-7	136	115	62182	147061	40 46 57	112 35 10	10	0.75	400	0	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		116	Pump engine P-9	137	116	62164	134700	40 46 57	112 38 20	10	0.75	400	0	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		117	Pump engine P-10-E	138	117	70595	120595	40 48 32	112 41 20	10	0.75	400	0	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		118	Pump engine P-10-W	139	118	70595	120595	40 48 32	112 41 20	10	0.75	400	0	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		119	Pump engine P-11-C	140	119	104048	114405	40 53 50	112 42 20	10	0.75	400	0	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		12	furnace, #2	149	67	111548	107500	40 55 00	112 44 50	100	3.67	550	8	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		120	Pump engine P-11-W	141	120	104048	114405	40 53 50	122 42 20	10	0.75	400	0	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		121	—	142	121	62182	147061	40 46 57	112 35 10	10	0.75	400	0	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		126	anode oven, casthouse	152	70	111548	107500	40 55 00	112 44 50	59	2	160	1.6	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		127	crucible, furnace, #1	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		128	crucible, furnace, #2	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		129	crucible, furnace, #3	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		13	furnace, #3	149	67	111548	107500	40 55 00	112 44 50	100	3.67	550	8	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		130	crucible, furnace, #4	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		131	crucible, furnace, #5	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		132	crucible, furnace, #6	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		133	crucible, furnace, #7	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		134	crucible, furnace, #8	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		135	crucible, furnace, #9	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		136	crucible, furnace, #10	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		137	crucible, furnace, #11	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		139	stk, waste heat boiler 1	154	139	111548	107500	40 55 00	112 44 50	50	4	350	1210	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		14	furnace, #4	149	67	111548	107500	40 55 00	112 44 50	100	3.67	550	8	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		141	stk, waste heat boiler 3	156	141	111548	107500	40 55 00	112 44 50	50	4	250	307	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		142	stack, Riley boiler	157	142	111548	107500	40 55 50	112 44 50	50	4.25	400	849.3	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		143	stack, paint booth	158	143	111548	107500	40 55 00	112 44 50	25	3.5		267	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		149	stk, waste heat boiler 2	155	149	111548	107500	40 55 00	112 44 50	50	4	250	302	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		15	furnace, #5	149	67	111548	107500	40 55 00	112 44 50	100	3.67	550	8	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		16	furnace, #6	150	68	111548	107500	40 55 00	112 44 50	59	2	950	3.4	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		17	furnace, #7	150	68	111548	107500	40 55 00	112 44 50	59	2	950	3.4	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		18	furnace, #8	150	68	111548	107500	40 55 00	112 44 50	59	2	950	3.4	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		19	furnace, #9	151	69	111548	107500	40 55 00	112 44 50	60	2.92	1115	3	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		2	bin, O2, Magnesium Chloride	176	2	0	0	40 55	112 44 55	75	1	200	90000	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		20	furnace, #10	151	69	111548	107500	40 55 00	112 44 50	60	2.92	1115	3	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		21	furnace, #11	151	69	111548	107500	40 55 00	112 44 50	60	2.92	1115	3	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		22	pump engine 1-1	177	R13W T1S Sec 7 NW quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		23	Pump engine 1-2	178	R13W T1S Sec 7 NW quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		24	Pump engine 1-3	179	R13W T1S Sec7 NW quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		25	Pump engine 1-4	180	R13W T1S Sec7 NW quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		26	Pump engine 2-N	181	R13W T1S Sec7 NW quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		27	Pump engine 2-S	182	R13W T1S Sec14 SW quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		28	Pump engine 3	183	R13W T1S Sec 14 NW quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		29	Pump engine 4-N	184	R13W T1S Sec15 NE quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		3	bin, O3, Magnesium chloride	185	3	0	0	40 55	112 44 55	75	1	200	90000	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		30	Pump engine 4-S	186	R13W T1S Sec15 NE quad	0	0			10	0.75	400		1998	4500 ft

Stack Parameter Data of Significant Point Sources Located Within 60 Kilometers of the PFSF Site (All Locations Within Tooele County)

Company	Site	Cmpnt_Plant_ID	Unit ID	Description	Stack ID	Stack_Description	Stack-UTM North	Stack-UTM East	Stack Latitude	Stack Longitude	Stack Height (ft)	Stack In. Dia. (ft)	Stack Exit Temp (F)	Flow Rate (cu ft/sec)	Cmpnt_Year-Of-Record	Elevation AMSL
Magnesium Corp. of America	Rowley Plant		31	Pump engine 5-N	187	R13W T1S Sec 15 NEquad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		32	Pump engine 5-S	186	R13W T1S Sec15 NE quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		33	generator, #1	189	33	62182	147061	40 46 57	112 35 19	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		34	generator, #2	190	R13W T1S Sec14 SW quad	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		35	mixer/settler	191	35	0	0	40 55	112 44 55	13		40		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		36	mixer/settler	192	36	0	0	40 55	112 44 55	13		40		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		37	mixer/settler	117	105	111667	116310	40 55 14	112 41 40	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		38	mixer/settler	118	106	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		39	mixer/settler	119	107	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		40	mixer/settler	121	109	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		41	mixer/settler	122	110	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		42	mixer/settler	123	111	62182	147061	40 46 57	112 35 10	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		44	engine, fresh water	125	R13W T1s sec14 SW quad	0	0			5	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		45	generator, lister #1	126	45	62182	147061	40 46 57	112 35 19	5	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		46	generator, lister #2	127	46	62182	147061	40 46 57	112 35 19	5	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		47	air comp	128	47	0	0			10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		48	Pump engine P-0-E	129	48	111667	116310	40 55 14	112 41 48	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		49	Pump engine P-0-C	130	49	111667	116310	40 55 14	112 41 48	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		5	bin, O5/O6 , MgCl2	131	5	0	0	40 55	112 44 5	110	2.6	150	960000	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		50	Pump engine P-1-W	132	50	62182	147061	40 46 57	112 35 19	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		51	Pump engine P-11-E	133	51	104048	114405	40 53 50	112 42 25	10	0.75	400		1998	4500 ft
Magnesium Corp. of America	Rowley Plant		6	casting machine, O1	163	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		61	stack, 01 spray dryer	143	61	111548	107500	40 55 00	112 44 50	250	9	160	2433	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		62	stack, 02 spray dryer	144	62	111548	107500	40 55 00	112 44 50	250	9	160	3067	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		63	stack, 03 spray dryer	145	63	111548	107500	40 55 00	112 44 50	250	9	160	2917	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		64	stack, melt/reactor	146	64	111548	107500	40 55 00	112 44 50	254	3	150	317	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		65	stack, emergency offgas	147	65	111548	107500	40 55 00	112 44 50	254	5.5	120	1833	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		66	stack, cathode	148	66	111548	107500	40 55 00	112 44 50	254	3.5	120	935	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		67	stack, lg. casthouse	149	67	111548	107500	40 55 00	112 44 50	100	3.67	550	8	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		68	stack, sm. casthouse E.	150	68	111548	107500	40 55 00	112 44 50	59	2	950	3.4	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		69	stack, sm. casthouse, W.	151	69	111548	107500	40 55 00	112 44 50	60	2.92	1115	3	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		7	casting machine, O2	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		70	stack, anode oven	152	70	111548	107500	40 55 00	112 44 50	59	2	160	1.6	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		8	casting machine, O3	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		88	vent, bulk material building	167	88	0	0	40 55	112 44 5	20	0.5		30000	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		89	vent, casthouse building	168	89	111548	107500	40 55 00	112 44 50	75	5		6500	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		90	vent, elec. bldg.	169	90	111548	107500	40 55 00	112 44 50	75	5		1900000	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		91	vent, elec. bldg.	170	91	111548	107500	40 55 00	112 44 50	75	5		1900000	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		92	vent, elec. bldg.	171	92	111548	107500	40 55 00	112 44 50	75	5		1900000	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		93	vent, elec. bldg.	172	93	111548	107500	40 55 00	112 44 50	75	5		1900000	1998	4500 ft
Magnesium Corp. of America	Rowley Plant		94	vent, reactor bldg.	173	94	111548	107500	40 55 00	112 44 50	100	5		7500	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	1204	2479 609B	0	0			50	0.67	80	400	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	1205	2479 610	0	0			62	2.5	1150	3000	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	599	M 053 FH11	0	0			25	0.83		900	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	1	1	0	0			25	2.6		7000	1998	4500 ft

Stack Parameter Data of Significant Point Sources Located Within 60 Kilometers of the PFSF Site (All Locations Within Tooele County)

Company	Site	Cmpnt_Plant ID	Unit ID	Description	Stack ID	Stack_Description	Stack-UTM North	Stack-UTM East	Stack Latitude	Stack Longitude	Stack Height (ft)	Stack In. Dia. (ft)	Stack Exit Temp (F)	Flow Rate (cu ft/sec)	Cmpnt. Year-Of-Record	Elevation AMSL
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	8	5	0	0			175	6.5	334	1920	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	10	7	0	0			175	2		44.3	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	10	7	0	0			175	2		44.3	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	400	24	0	0			21	1.5	200	500	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	516	E 517 DC03	4619706	381279			45	1.67	80		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	516	E 517 DC03	4619706	381279			45	1.67	80		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	516	E 517 DC03	4619706	381279			45	1.67	80		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)				1376	1228	0	0	40 30 48	112 25 29	33	1.5	325	453	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	521	M 008 DC01	0	0			30	1.5	75		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	1203	2479 609A	0	0			50	0.67	80	400	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	1000	p-15	0	0			33	1.83		1030	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	1201	2479 608B	0	0			60	1	250	1000	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	1202	2479 608C	0	0			45	0.83	550	550	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)			Emergency Generator	7	4	0	0			198	9.5	686	1638	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)		576	Heater	576	M 009B FH01	0	0			18	1.17		900	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	001	boiler	1327	001	0	0	40 30 08	112 20 50	33	1.5	325	302	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	007	heater	1329	007	0	0	40 30 10	112 20 52	25	1	350	113	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	008	boiler	1330	008	0	0	40 30 10	112 20 46	33	1	325	302	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	009	heater	1331	009	0	0	40 30 14	112 20 48	15	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	010	heater	1332	010	0	0	40 30 15	112 20 52	25	1	350	141	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	017	heater	1333	017	0	0	40 30 30	112 20 52	25	0.3	350	65	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	017	heater	3010	017	0	0	40 30 30	112 20 52	10	0.3	350	65	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	017	heater	3012	017	0	0	40 30 30	112 20 52	10	0.3	350	65	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	017	heater	3011	017	0	0	40 30 30	112 20 52	10	0.3	350	65	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	025	boiler	1334	025	0	0	43 30 07	112 20 43	33	1.5	325	86	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	026	boiler	1335	026	0	0	40 30 06	112 20 42	33	1.5	325	86	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	027	boiler	1336	027	0	0	40 30 05	112 20 43	33	1.5	325	86	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	028	boiler	1337	028	0	0	40 30 05	112 20 45	33	1.5	325	86	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	029	boiler	1338	029	0	0	40 30 05	112 20 46	33	1.5	325	80	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	035	boiler	1340	035	0	0	40 30 05	112 20 51	33	1.5	325	302	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	100	heater	1342	100	0	0	40 30 03	112 20 07	5	0.3	350	28	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1000	Heater	1339	1000	0	0	40 30 00	112 20 06	25	0.5	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1000	Heater	1341	1000	0	0	40 30 00	112 20 06	25	0.5	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1000	Heater	1328	1000	0	0	40 31 00	112 20 06	25	0.5	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1001	Heater	1403	1001	0	0	40 29 57	112 20 36	10	0.3	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1002	Heater	3033	1002	0	0	40 29 56	112 20 08	25	0.3	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1002	Heater	1443	1002	0	0	40 29 56	112 20 08	33	1.5	325	310	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1002	boiler	3018	1002	0	0	40 29 56	112 20 08	15	1	350		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1004	heater	1419	1004	0	0	40 29 55	112 20 05	25	0.3	350	85	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1005	Heater	1359	1005	0	0	40 29 56	112 20 00	10	1	350	0	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1005	boiler	1437	1005	0	0	40 29 56	112 20 00	10	1	350		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1005	boiler	1352	1005	0	0	40 29 56	112 20 00	10	1	350	0	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1005	boiler	1353	1005	0	0	40 29 56	112 20 00	10	1	350	0	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	101	heater	1343	101	0	0	40 30 05	112 20 08	10	0.3	350	43	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1010	Heater	1356	1010	0	0	40 29 54	112 20 09	15	1	350	0	1998	4500 ft

Stack Parameter Data of Significant Point Sources Located Within 60 Kilometers of the PFSF Site (All Locations Within Tooele County)

Company	Site	Cmpnt_Plant_ID	Unit ID	Description	Stack ID	Stack Description	Stack-UTM North	Stack-UTM East	Stack Latitude	Stack Longitude	Stack Height (ft)	Stack In. Dia. (ft)	Stack Exit Temp (F)	Flow Rate (cu ft/sec)	Cmpnt. Year-Of-Record	Elevation AMSL
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1011	Heater	1344	1011	0	0	40 29 53	112 20 08	25	0.3	350	16	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1011	Heater	1357	1011	0	0	40 29 53	112 20 08	15	0.3	350	0	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1012	Heater	1360	1012	0	0	40 29 53	112 20 17	10	0.3	350	0	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1020	Heater	1361	1020	0	0	40 29 57	112 20 05	10	2	350	0	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	108	boiler	1346	108	0	0	40 30 12	112 20 12	5	1	325	177	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	109	heater	1347	109	0	0	40 30 13	112 20 15	5	0.6	350	39	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	112	Heater	1355	112	0	0	40 30 11	112 20 16	25	1	350	28	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	112	heater	1350	112	0	0	40 30 11	112 20 16	25	1	350	65	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	112	heater	1351	112	0	0	40 30 11	112 20 16	25	1	350	28	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	112	Heater	1354	112	0	0	40 30 11	112 20 16	25	1	350	28	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	114	Heater	1365	114	0	0	40 30 10	112 20 15	25	1	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	114	Heater	1367	114	0	0	40 30 10	112 20 15	25	1	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	114	Heater	1369	114	0	0	40 30 10	112 20 15	25	1	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	114	Heater	1368	114	0	0	40 30 10	112 20 15	25	1	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	116	Heater	1372	116	0	0	40 30 10	112 20 15	25	1	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	116	Heater	1373	116	0	0	40 30 10	112 20 15	25	1	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	116	Heater	1374	116	0	0	40 30 10	112 20 15	25	1	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	116	Heater	1375	116	0	0	40 30 10	112 20 15	25	1	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	118	Heater	1382	118	0	0	40 30 10	112 20 13	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	118	Heater	1383	118	0	0	40 30 10	112 20 13	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	120	Heater	1379	120	0	0	40 30 09	112 20 13	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	120	Heater	1386	120	0	0	40 30 09	112 20 13	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1201	Heater	1358	1201	0	0	40 30 18	112 25 09	25	0.3	350	141	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1202	Heater	1362	1202	0	0	40 30 22	112 25 16	25	0.3	350	141	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1203	Heater	1366	1203	0	0	40 30 25	112 25 24	25	0.3	350	141	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1204	Heater	1363	1204	0	0	40 30 27	112 25 30	25	0.3	350	141	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1205	Heater	1370	1205	0	0	40 30 31	112 25 37	25	0.3	350	141	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	122	Heater	1392	122	0	0	40 30 08	112 20 12	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	122	Heater	1389	122	0	0	40 30 08	112 20 12	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1222	boiler	3013	1222	0	0	40 31 00	112 25 50	33	1.5	325	90	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1227	boiler	1380	1227	0	0	40 30 46	112 25 19	33	1.5	325	453	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1228	boiler	1376	1228	0	0	40 30 48	112 25 29	33	1.5	325	453	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	124	heater	1396	124	0	0	40 30 09	112 20 11	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	124	heater	1395	124	0	0	40 30 09	112 20 11	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1250	heater	1377	1377	0	0	40 30 23	112 23 27	25	0.3	350	197	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1252	Heater	1387	1252	0	0	40 30 24	112 23 28	25	0.3	350	85	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	126	Heater	1397	126	0	0	43 30 09	112 20 10	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	126	Heater	1398	126	0	0	43 30 09	112 20 10	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1283	Heater	3015	1283	0	0	40 31 53	112 23 09	5	0.3	325	0	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1283	Heater	3014	1283	0	0	40 31 53	112 23 09	5	0.3	325	0	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1366	boiler	3017	1366	0	0	40 30 37	112 26 36	33	1.5	325	136	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1366	boiler	3016	1366	0	0	40 30 37	112 26 36	33	1.5	325	136	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1375	boiler	1423	1375	0	0	40 30 40	112 36 44	33	1.5	325	176	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	1376	boiler	1442	1376	0	0	40 30 24	112 27 35	33	1.5	325	164	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	139	heater	1402	AI0595B01	0	0	40 30 14	112 20 14	25	0.5	350	30	1998	4500 ft

Stack Parameter Data of Significant Point Sources Located Within 60 Kilometers of the PFSF Site (All Locations Within Tooele County)

Company	Site	Cmpnt_Plant_ID	Unit ID	Description	Stack ID	Stack_Description	Stack-UTM North	Stack-UTM East	Stack Latitude	Stack Longitude	Stack Height (ft)	Stack In. Dia. (ft)	Stack Exit Temp (F)	Flow Rate (cu ft/sec)	Cmpnt, Year-Of-Record	Elevation AMSL
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	139	heater	1401	139	0	0	40 30 14	112 20 14	25	0.5	350	30	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	141	Heater	1438	141	0	0	40 30 13	112 20 12	25	1	350	85	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	150	Heater	1409	150	0	0	40 30 14	112 20 07	25	1	350	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	152	Heater	1410	152	0	0	40 30 14	112 20 06	25	1	350	169	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	153	Boiler	1411	153	0	0	40 30 14	112 20 05	15	1.5	325	169	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	155	heater	1412	155	0	0	40 30 16	112 20 04	25	1.5	85	178	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	400	boiler	1390	400	0	0	40 30 14	112 20 36	10	1.5	325	259	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	503	Heater	1428	503	0	0	40 30 25	112 20 45	0.3	1	325		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	503	Heater	1426	503	0	0	40 30 25	112 20 45	0.3	1	325		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	503	Heater	1425	503	0	0	40 30 25	112 20 45	0.3	1	325		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	503	Heater	1422	503	0	0	40 30 25	112 20 45	0.3	1	325		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	503	Heater	1418	503	0	0	40 30 25	112 20 45	25	1	350	141	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	508	boiler	1430	508	0	0	40 30 22	112 20 51	20	1.5	325	1861	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	508	boiler	1429	508	0	0	40 30 22	112 20 51	20	1.5	325	1861	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	511	Heater	1452	511	0	0	40 30 22	112 20 55	20	2.5	70		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	516	Heater	3027		0	0	40 30 32	112 20 50	10	1	350	39	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	518	Heater	1518	518	0	0	40 30 27	112 20 49	10	1	350	39	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	519	Boiler	3031	519	0	0	40 30 36	112 20 45	33	1	325	302	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	520	Boiler	3034	520	0	0	40 30 40	112 20 42	15	1.5	325	423	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	520	Boiler	3037	520	0	0	40 30 40	112 20 42	33	3	325	818	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	522	Heater	1526	522	0	0	40 30 14	112 21 29	15	1	350	141	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	535	Heater	1527	535	0	0	40 30 14	112 21 29	5	0.3	350	28	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	539	Heater	1435	539	0	0	40 30 43	112 20 45	5	0.5	325		1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	594	boiler	3019	594	0	0	43 31 13	112 20 54	33	2.5	325	2283	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	622	Heater	1519	622	0	0	40 31 34	112 20 51	10	0.5	350	39	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	679	Heater	3039	679	0	0	40 31 58	112 20 19	25	0.3	350	17	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	687	Heater	3040	687	0	0	40 32 08	112 20 17	10	0.5	350	24	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	699	Heater	3041	699	0	0	40 32 10	112 20 10	25	0.3	350	8	1998	4500 ft
Tooele Army Depot	Tooele Army Depot (North Area)	North Area	GWTP	Ground Water Treatment Plant	3043		0	0			51	12	0	26860	1998	4500 ft
USPCI - Grassy Mtn. Facility	Grassy Mountain Landfill Facility		051-063	Lab Fume Hood	3240		4520600	313700			27	1	70	16.67	1998	4500 ft

*abbrev. for Remanufacturing

TABLE 2.8-2

TRAFFIC COUNTS FOR ROADS NEAR THE PRIVATE FUEL STORAGE FACILITY

Route	Location of Count	Average Daily Traffic (1997)
I-80	Rowley Interchange (at Skull Valley Road)	8,495
I-80	Delle Interchange (7 miles west of Skull Valley Road)	8,000
I-80	Stansbury Interchange (7 miles east of Skull Valley Road)	9,014
SR 199	Dugway Proving Ground East Gate	725
SR 199	Terra	915
SR 138	Junction with I-80 at Stansbury	1,260
SR 112	Junction with SR 138	6,245
SR 36	Junction with SR 199	1,715

Source: Ron Phillips, Utah Department of Transportation, Data Analysis Section

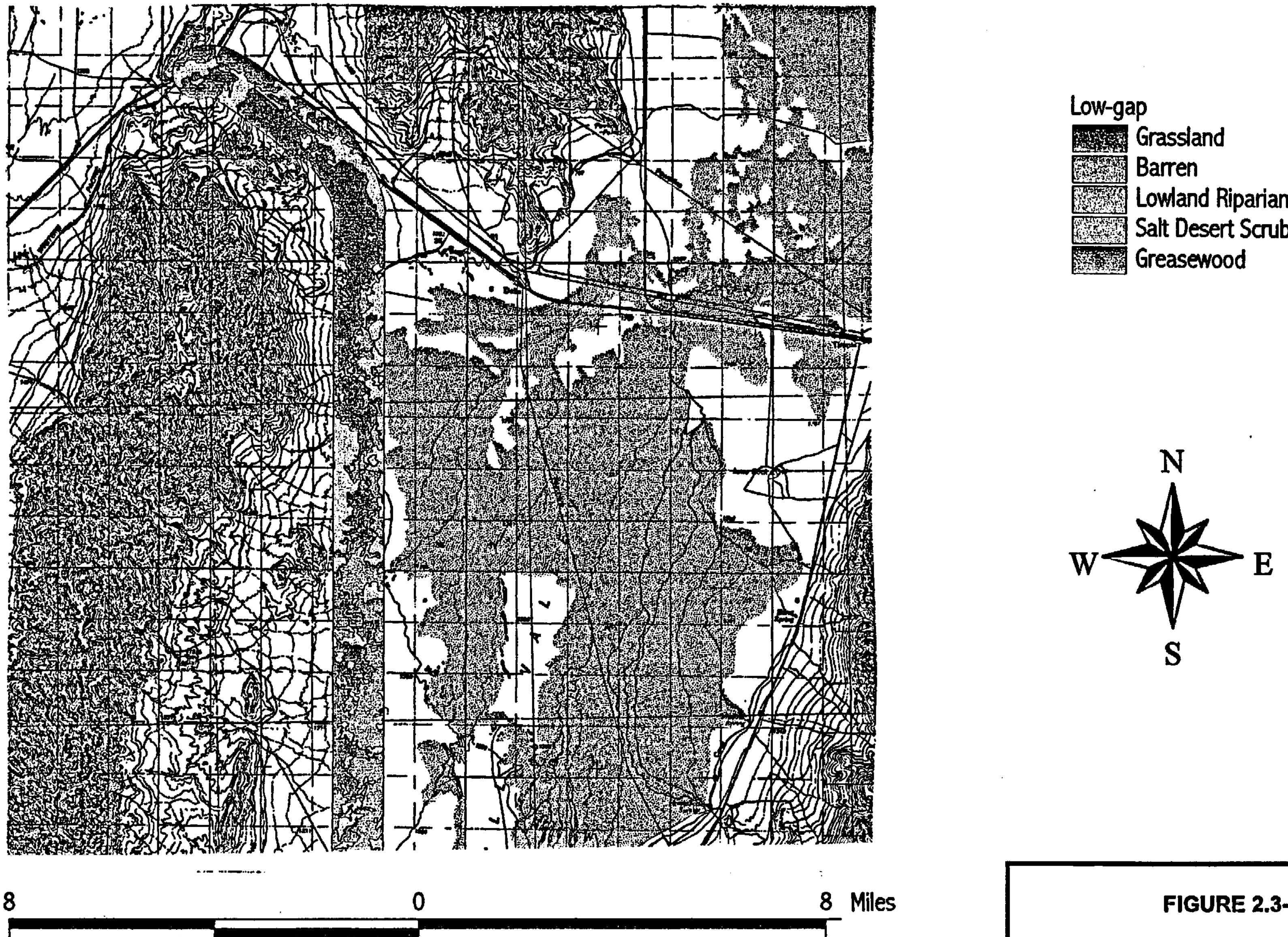

FIGURE 2.3-13

LAND COVER TYPES - LOW CORRIDOR

PRIVATE FUEL STORAGE FACILITY ENVIRONMENTAL REPORT

SOURCE: UDWR, 1999

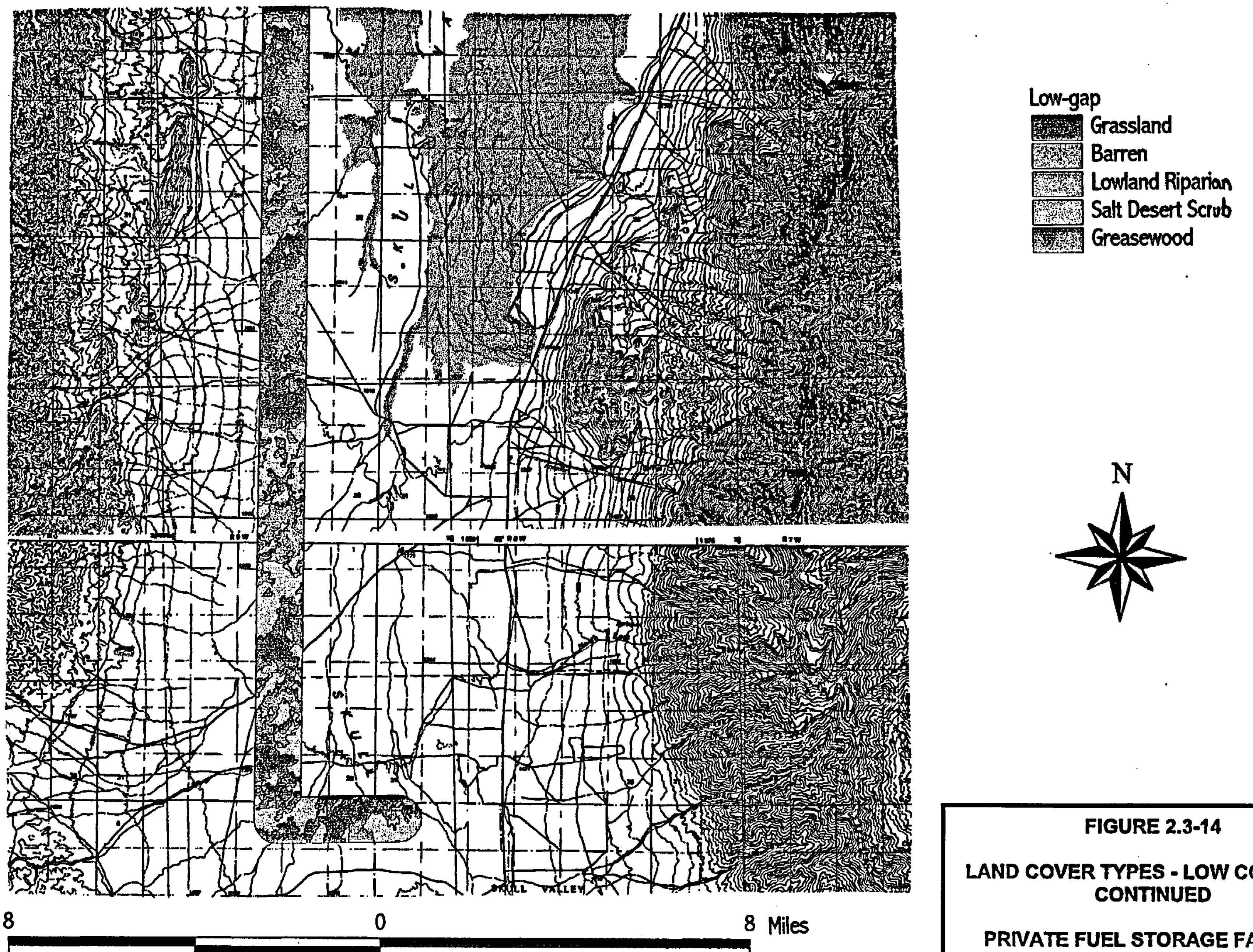

FIGURE 2.3-14

LAND COVER TYPES - LOW CORRIDOR CONTINUED

PRIVATE FUEL STORAGE FACILITY ENVIRONMENTAL REPORT

SOURCE: UDWR, 1999

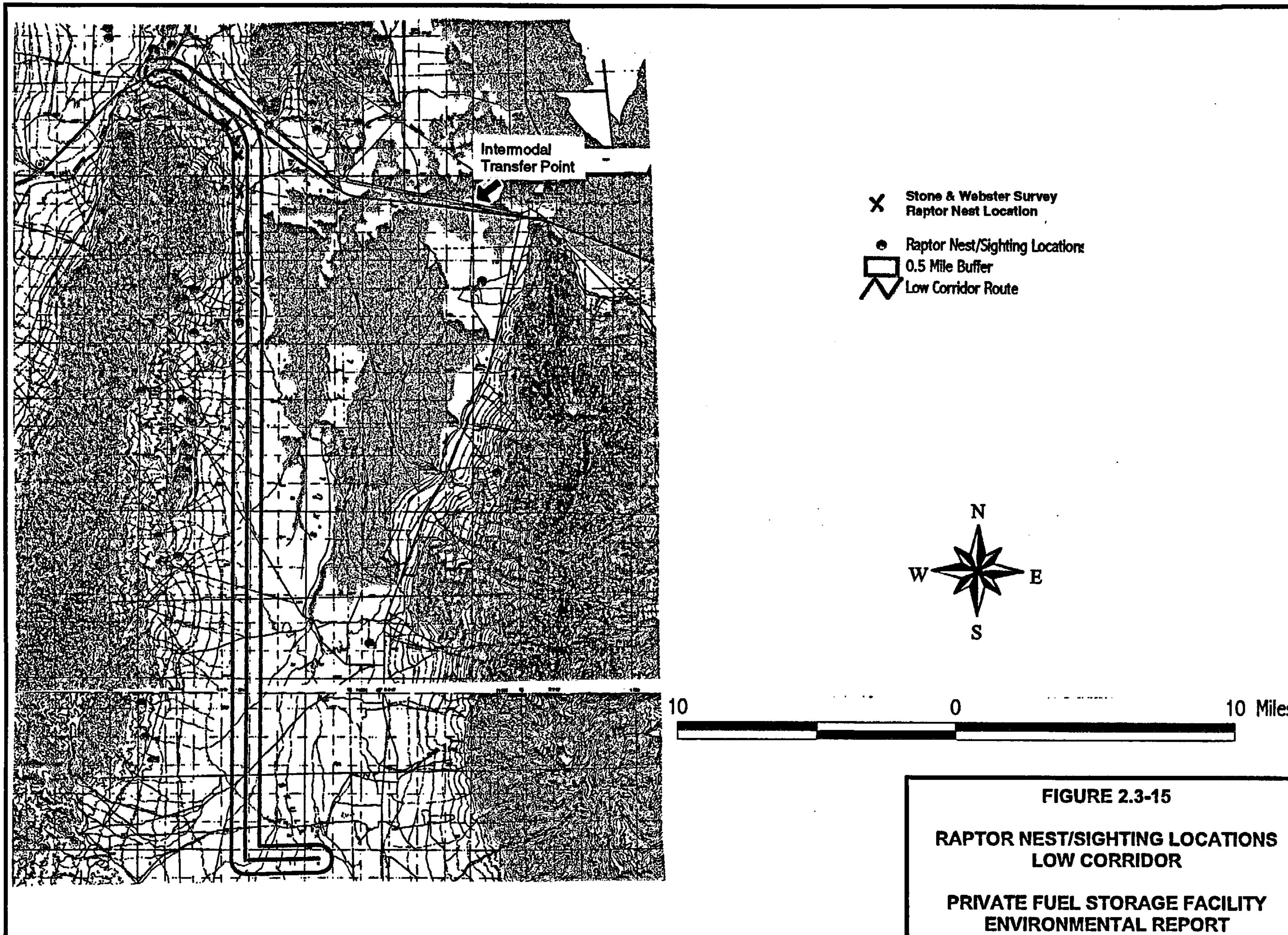

FIGURE 2.3-15

**RAPTOR NEST/SIGHTING LOCATIONS
LOW CORRIDOR**

**PRIVATE FUEL STORAGE FACILITY
ENVIRONMENTAL REPORT**

SOURCE: UDWR, 1999

CHAPTER 3

THE FACILITY

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CHAPTER 3

THE FACILITY

3.1 EXTERNAL APPEARANCE

The dominant external features of the Private Fuel Storage Facility (PFSF) are the access road and the storage facility itself. The noticeable features of the storage facility include the storage casks and pads, the Canister Transfer Building, the Administration Building, the Operations and Maintenance Building, the Security and Health Physics Building, light poles, security and access road fences, a storm water detention basin, and earthen berms for flood and storm water diversion. The overall site or owner controlled area (OCA) is approximately 820 acres with the actual storage area or Restricted Area (RA) occupying approximately 99 acres. Figure 2.1-2 shows the overall layout of the PFSF. The general arrangement of the proposed facility is shown in Figure 3.1-1.

The spent nuclear fuel will be stored in cylindrical shaped concrete casks which are approximately 11 ft in diameter and 19 ft tall. The casks will be stored on concrete storage pads which are arranged in a rectilinear grid pattern within the facility. Each storage pad is 30 feet wide and 64 feet long and can accommodate up to eight casks. At full capacity the facility will store 4000 casks. The surface of the concrete storage pads are 3.5 inches above grade elevation. The area around the storage pads is surfaced with compacted crushed rock with a gentle slope toward the north to facilitate drainage.

The Administration Building, located at the entrance to the OCA, is a single story steel frame building and is approximately 80 feet wide, 150 feet long, and 17 feet tall. The Operations and Maintenance Building located between the Administration Building and

the storage area is a single story steel frame building and is approximately 80 feet wide, 200 feet long and 26 feet tall. The Security and Health Physics Building located at the entrance to the RA, is a single story concrete masonry building and is approximately 76 feet wide, 120 feet long, and 18 feet tall. The Canister Transfer Building is located within the RA and is a reinforced concrete high bay structure and is approximately 200 feet wide, 260 feet long, and 92 feet tall. A general arrangement of the buildings is shown in Figures 3.1-2 through 3.1-5.

The RA is surrounded by an eight foot chain link security fence (w/ barbed wire), a 20 foot isolation zone and an eight foot chain link nuisance fence. A 20 foot wide compacted gravel perimeter road surrounds the RA. The boundary of the OCA is surrounded by a typical 4-strand wire range fence, which will serve to identify the limit of PFSF activities and to keep out any stray livestock. Specifications for the fence, such as wire type and spacing, and pole type and spacing will meet the requirements of the BLM Manual Handbook H-1741-1 for Fencing and/or other applicable requirements identified by the BLM and BIA. PFS will consult with the BLM and BIA prior to construction of the fence to make sure the fence meets the latest BLM/BIA requirements.

The site access road is approximately 2.5 miles long and connects the PFSF with the Skull Valley Road located 1.5 miles from the OCA boundary. The access road is provided with multiple culverts beneath the road to accommodate storm runoff under the road. The access road will be designed with two 15 foot paved lanes to facilitate the potential use of heavy haul tractor/trailer for shipment by highway of spent fuel from the intermodal transfer point to the PFSF. The preferred shipping method is by means of a new rail line. The new rail line will be constructed to connect the PFSF directly to the Union Pacific mainline to facilitate shipment by rail from the mainline railroad to the PFSF. These shipment routes are discussed in more detail in section 3.2.

An earthen berm is located on the west and south sides of the RA to divert runoff from the Hickman Knolls Probable Maximum Flood (PMF) event. The berm is five feet high, 50 feet wide and 4300 feet long. Another earthen berm is located perpendicular to the access road approximately 750 feet east of the OCA to divert runoff from the Stansbury Mountains PMF event. The berm is a maximum of nine feet high where it meets the access road and tapers down to meet the Hickman Knolls. The berm is a maximum of 64 feet wide at the base, and is 1900 feet long. The RA is provided with a gentle slope toward the north such that onsite storm runoff will flow into the storm water detention basin north of the RA.

As part of construction, the driveways and parking areas around the facility buildings will be paved with asphalt or concrete. Native vegetation will be provided at the main entrance to the Administration Building. The facility, located more than 1.5 miles from the nearest public road, will have the appearance of a light industrial park. The lighting luminaries are selected to shine downward to minimize nighttime glare.

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3.2.1.1 Access Road

The access road is approximately 2.5 miles long and connects the PFSF with the existing Skull Valley Road located 1.5 miles from the OCA boundary. The access road will be constructed early in the first year of construction to facilitate access to the site for construction equipment, materials, and personnel. Road grading will be performed, large concrete box culverts will be installed, and the PMF diversion berm will be constructed. To minimize damage from the heavy construction equipment required to perform the major site excavation and grading, the roadway will initially be constructed with a gravel surface. After completion of the major site earthwork, the access road will be paved with asphalt.

3.2.1.2 Restricted Area

The RA includes the Canister Transfer Building, the Security and Health Physics Building, and the cask storage pads. The Canister Transfer Building is a large, concrete structure and the Security and Health Physics Building is a one-story, concrete-block building. The RA occupies approximately 99 acres and provides for a total of 500 concrete cask storage pads which are capable of supporting a total of 4000 storage casks.

As described previously, construction of the RA will be performed in 3 phases. The phases are further described below:

The objective of Phase 1 is to provide an operational facility with a portion (25%) of the storage pads completed. Phase 1 construction will include completion of the Canister Transfer Building, the Security and Health Physics Building, one quarter of the storage pads (130 total) located in the southeast quadrant of the RA. Phase 1 construction also includes the Administration Building and the Operations and Maintenance (O&M)

Building. The southwest quadrant will be rough graded. The storm water detention basin and PMF diversion berm on the south and west sides of the RA will also be constructed. The site drainage from the southeast and southwest quadrants will be channeled to the detention basin by means of a rockfill ditch. Yard lighting, duct banks, grounding, security fences, perimeter intrusion detection system and perimeter road will be completed for the southeast quadrant. Phase 1 construction will be completed by December 31, 2001 with the exception of the Administration Building, and the O&M Building, which will be completed by March 1, 2002. (These buildings are not required to support the initial testing and startup of the storage facility).

The objective of Phase 2 is to provide additional storage capacity to the operating facility by adding the second 25 percent of the storage pads. Construction in the southwest quadrant (Phase 2) will be performed while the storage pads in the southeast quadrant are being loaded with casks, and will be completed before all of the Phase 1 casks are in-place. When all of the pads are constructed in the southwest quadrant, the Phase 1 security fence, perimeter road, and perimeter intrusion detection systems will be extended to include the Phase 2 area. Phase 2 construction is tentatively planned for completion by November 30, 2006.

The objective of Phase 3 is to provide additional storage capacity to the operating facility by completing the remaining 50 percent of the storage pads. Construction of the northern half of the RA (Phase 3) will be performed while the Phase 2 (southwest quadrant) pads are being loaded with casks, and will be completed before all of the Phase 2 casks are in-place. When all of the pads are constructed in the northern half of the RA, the security fence, perimeter road, and perimeter intrusion detection systems will be extended to include this area. Phase 3 construction is tentatively planned for completion by November 30, 2011.

required for the small operating staff. An underground sewage (septic) system with leach field is provided for normal facility services. Site soils appear to be suitable for septic tank and leach field development. A compressed air supply system is provided in the Canister Transfer Building and O&M Building for maintenance purposes. HVAC is provided for all buildings to provide personnel comfort as well as to provide the proper environment for equipment. Electrical power is provided for lighting, general utility, and the security system and is obtained from a new transformer and the existing 12.5-kV distribution line near the Skull Valley Road. A diesel-generator is used as a backup power supply for the security system, emergency lighting loads, and the site public address system. The communication system consists of normal telephone service in all the buildings, a site public address system, and a short wave radio system for security. The communication system provides a means to contact the local law enforcement authorities for security purposes and for emergency responses on site in the event of an "ALERT", with notifications and follow-up.

Other structures of the PFSF will include the Security and Health Physics Building, the Administration Building, and the O&M Building.

The Security and Health Physics Building will house the security work force and the security, communications, and electrical equipment. The Security and Health Physics Building will also provide office and work space for the health physics personnel.

The Administration Building will house administrative, engineering and licensing personnel. The building will also provide space for a records management center and an emergency response center.

The O&M Building will house maintenance shops, and spare parts and equipment storage areas to service the vehicles and equipment used at the facility.

3.3.1 Direct Rail Delivery of Shipping Casks to the PFSF

The preferred mode of "direct rail" utilizes a new 32-mile long rail-line originating at Low, Utah and terminating at the PFSF. At Low, adjacent to the mainline, multiple sidings are provided to facilitate the arrival of each single purpose train transporting SNF to the PFSF and for the cars "out-bound" from the PFSF for the start of another SNF delivery cycle. At the PFSF, rail sidings are also provided within the protected area. These sidings facilitate the receipt of single purpose SNF trains and the return of empty cask cars for the start of another spent fuel delivery cycle.

Regardless of the mode of transportation, the ultimate capacity of the PFS storage facility is based on 4000 casks received over 20 years. This translates to an average receipt rate of 200 loaded casks per year (4 casks per week). For the preferred mode of transportation, direct rail, PFS intends to procure and use two single purpose trains carrying a maximum of 6 casks per train. On average, PFS would receive one train a week carrying 4 loaded casks per train, which would result in PFS reaching its ultimate storage capacity in 20 years. If needed, a larger capacity single train could be assembled utilizing the necessary rail equipment from the two planned trains but the average weekly receipt rate would be maintained.

The operating scenario for an incoming train to PFS with SNF is as follows:

The single purpose train carrying the loaded cask cars will arrive at Low, Utah, at a coordinated time with PFS. The train, operated by Union Pacific personnel utilizing rail equipment provided by PFS, will then leave the mainline and stop at the Low siding area provided adjacent to the new rail-line. The mainline locomotives will then be disconnected from the balance of the train (containing the loaded cask cars, security car and buffer cars). A PFS provided short-line locomotive and crew will then pick-up the incoming train, excluding the mainline

locomotives, and complete the in-bound trip to the PFS storage facility. This delivery as stated before would occur on the average of once per week with an average of 4 loaded shipping casks per train. The loaded SNF train would only be located at the Low siding area for the duration of time necessary to transfer the incoming train from the mainline locomotives to the PFS short-line locomotives. A second option under consideration by PFS would be only to change the crew at Low, which would reduce the time that loaded casks would be at its Low siding. In this event, the entire single purpose train including the "mainline" locomotives would continue on directly to the PFSF for receipt with a crew provided by PFS. Since PFS will be capable of contacting the loaded single purpose train at all times, its arrival at Low, UT would be known in advance to plan, coordinate and facilitate the transfer. No significant time periods (measured in a few hours) are anticipated for this transfer and there are no known reasons for "holding" the casks at the Low siding area other than to complete the transfer or crew change as previously described. The mainline locomotives and empty cars awaiting return to the delivery cycle will be picked up by Union Pacific in "manifest service" (traditional mixed freight service rather than single purpose trains) at the Low siding area for the start of the next scheduled delivery cycle of SNF to the PFSF. Although it is difficult to predict the waiting time associated with "manifest service" for the return trip pickups by Union Pacific, it will be routine, scheduled, and must ultimately support the delivery rate schedule of a maximum of 200 cask cars per year.

3.3.2 Heavy Haul Vehicle Delivery of Shipping Casks to the PFSF

The alternate mode of transportation, "heavy haul", utilizes an over the road delivery of SNF from an Intermodal Transfer Point (ITP) 1.8 mile west of Timpie, Utah to the PFSF utilizing the existing I-80 frontage road and Skull Valley Road to and from the storage facility. The ITP has multiple sidings similar to those described for the direct rail

(preferred) mode of transportation at Low to receive SNF single purpose trains (in-bound) and to process the return of cars (out-bound) for another spent fuel delivery cycle.

As stated previously, the average receipt rate for the PFSF is 200 casks per year (4 casks per week) to achieve the ultimate capacity of 4000 casks over a 20 year loading cycle. The ITP can handle a maximum of 3 casks per single purpose train. To achieve the desired receipt rate of 4 casks per week (on the average), two equivalent incoming trains per week carrying 2 casks per train will be required.

The operating scenario at the ITP is as follows:

The transfer of SNF at the ITP requires only that the loaded shipping cask, shipping cradle, and impact limiter assembly be moved from the incoming rail car to a custom designed heavy haul trailer. This assembly is moved as one piece between the vehicles. The rail car and heavy haul trailer will share a common design for the attachment fixture utilized on both types of transport vehicles to lock the shipping cradle to the vehicle (rail or trailer). The ITP will utilize an overhead, single failure proof gantry crane to facilitate this transfer. The operations necessary for this to occur are limited in number. The shipping cradle attachment fixture is first released on the rail car. The necessary rigging is attached to the shipping cradle for the lift of the cask from the rail car. The shipping assembly (cask, cradle, and impact limiter assembly) is relocated over the heavy haul trailer and lowered in place. The shipping cradle attachment fixture is locked in placed and the shipping cask assembly on the heavy haul trailer is then delivered to the PFSF.

For the duration of time that the first shipping cask is being moved from rail car to heavy haul trailer and delivered to the PFSF, a maximum of two (more likely one) other

shipping cask rail cars would be parked on the adjacent rail sidings located at the ITP. These casks (or cask) would represent the remaining part of the single purpose train (which would also include the security car and associated buffer car). The mainline locomotives, associated buffer car, and empty cask cars awaiting return to the delivery cycle will be picked up by Union Pacific in "manifest service" for delivery to the start of the next scheduled cycle of SNF to the PFSF. As in the preferred mode of direct rail shipment, it is difficult to predict the "waiting time" associated with "manifest service" for the return trip pickups by Union Pacific. It will be routine, scheduled, and must ultimately support the delivery rate schedule of a maximum of 200 cask cars per year.

It is anticipated that for the maximum train size of 3 loaded cask cars, it would take approximately 28 work hours to complete the transfer of the last cask to the heavy haul trailer for delivery to the PFSF. This is based on the use of a single heavy haul trailer; the second heavy haul vehicle and truck is an available spare. The more typical receipt of 2 cask car trains would require approximately 16 work hours to complete the transfer of the last cask to the heavy haul trailer for delivery to the PFSF. Since PFS will be capable of contacting the loaded single purpose train at all times and controls the number of casks per single purpose train, the arrival to the ITP would be known in advance to plan, coordinate and facilitate the transfer. Extended workdays will likely be used for those infrequent times a 3-cask train is processed through the ITP.

3.3.3 Fueling of Vehicles Associated with the PFSF

In general, all fueling activities at the PFSF must comply with applicable regulations. The need for a 40 CFR 112 Spill Prevention Control and Countermeasures Plan (SPCC) will be evaluated, as discussed in Section 9.1.3. Operation and use of the stored fuel will be in accordance with 29 CFR 1910 (OSHA) regulations to ensure employee health and safety requirements are met. Prior to fueling, a management plan and procedures will be developed to ensure that personnel are properly trained and fuel

deliveries are carried out in accordance with the plan. Should a spill occur, spill control equipment will be readily available for immediate use by trained on-site personnel.

Fueling of on-site vehicles used at the proposed storage site

As stated in SAR Section 8.2.4.1, a diesel fuel oil storage tank will be located inside the restricted area (RA), and will supply diesel fuel oil for the cask transporter. This tank will be located near the RA fence, approximately 200 ft northeast of the northeast corner of the Canister Transfer Building and approximately 700 ft from the nearest storage casks. The outdoor tank will be above-ground, mounted on a concrete pad, with a double wall, having all necessary equipment for pumping and dispensing diesel fuel. The tank will have a capacity of approximately 1000 gallons and will store low grade sulfur No. 2-D diesel fuel. The tank includes a double wall for primary and secondary spill containment requirements, fill and venting requirements, and fire prevention requirements in accordance with NFPA 30, "Flammable and Combustible Liquids Code." The tank will be designed in accordance with the requirements of UL-142, "Above Ground Tanks for Flammable and Combustible Liquids." The tank will also be designed in accordance with UL-2085, "Insulated Secondary Containment for Aboveground Storage Tanks, Protected." This code requires that the tank meet 2-hour liquid-pool furnace fire tests, vehicle impact, and projectile resistance criteria. The station tank will be supplied with fuel from a regional bulk fueling service.

Fueling of locomotives used on the Low Corridor Rail Line

The PFSF will not include an on-site diesel fuel storage tank for the locomotives. Rather, the locomotives at the PFSF will be fueled outside the restricted area (RA) via a regional bulk fueling service that will deliver fuel to the PFSF approximately every two weeks with a tanker truck. Use of the fueling service will eliminate the need to store large quantities of fuel required for the locomotives near the PFSF as well as fuel station maintenance. The fueling service must comply with EPA and OSHA regulations and must provide containment and clean up for any spills in accordance with the

regulations.

Fueling of heavy-haul vehicles used for the Intermodal Transfer Point

The heavy-haul vehicles will be fueled via a self-contained diesel fuel filling tank located near the Operations/Maintenance Building. The tank will be the same as the tank described above for the transporter vehicles and will meet the same criteria per NFPA 30, UL-142, and UL-2085 except that it will have a capacity of approximately 1200 gallons. The station tank will be supplied with fuel from a regional bulk fueling service.

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CHAPTER 4

ENVIRONMENTAL EFFECTS OF SITE AND TRANSPORTATION CORRIDOR CONSTRUCTION AND OPERATION

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CHAPTER 4

ENVIRONMENTAL EFFECTS OF SITE AND TRANSPORTATION CORRIDOR CONSTRUCTION AND OPERATION

This chapter discusses impacts to the existing environmental baseline, described in Chapter 2, associated with the construction and operation of the Private Fuel Storage Facility (PFSF). It also discusses the impacts resulting from construction and operation of the Intermodal Transfer Point/Skull Valley Road and the Low Corridor rail line.

4.1 SITE PREPARATION AND FACILITY CONSTRUCTION

Impacts discussed in this section are based on the construction activities and scheduling described in Section 3.2, Facility Construction.

4.1.1 Effects on Geography, Land Use, and Demography

Development of the proposed PFSF on the Skull Valley Indian Reservation will not adversely affect any existing land uses, either on the Reservation or on adjacent properties. The proposed location for the PFSF, approximately 1.5 miles west of Skull Valley Road, is currently an undeveloped tract of land, inaccessible to the general public. The overall Owner Controlled Area (OCA) required for development of the facility is approximately 820 acres, with the actual cask transfer and storage area or Restricted Area (RA) occupying 99 acres.

Development of the proposed facility will not result in the displacement of any residences, commercial operations, or industrial facilities or impact the existing Tekoi Rocket Engine testing facility, located 2.5 miles S-SE of the site. Nor will the

construction of the PFSF preclude the future development of residential, commercial, or industrial facilities outside of the OCA.

Site preparation and facility construction will remove the OCA and access road corridor from potential rangeland use. However, the Skull Valley Band of Goshute Indians (Band) do not currently utilize this portion of the Reservation for grazing, or any other activity. Further, because the existing rangeland in Skull Valley is of fair to poor quality, the removal of 820 acres of potential rangeland (which also represents less than 0.5 percent of the 271,000 total acres of rangeland in Skull Valley) will not have a significant effect on grazing activity in the Skull Valley area.

During the initial construction phase, an estimated 130 workers will be required for various tasks related to project development. During later construction phases, an estimated work force of 43 persons will be required to continue activities associated with site earth work and concrete finishing as the remaining portions of the facility are developed. This construction work force is expected to be drawn from Tooele County and the Salt Lake City metropolitan area. It is anticipated that these workers will be current residents of these communities who will commute daily to the project site. Consequently, project construction will not induce the in-migration of families with school-age children, and there will be no impact on housing availability, levels of local government services, or other demographic variables.

Construction of the PFSF will result in an average of approximately 51 construction-related jobs per year during the extended 11-year construction period. This increase in employment will help to reduce the Tooele County unemployment rate of 4.4 percent (February 1997) (personal communication between D. Johnson, Tooele County Economic Development Corporation and J.H. Rumpp of SWEC, May 15, 1997).

4.1.2 Effects on Ecological Resources

Ecological resources potentially affected by construction of the facility and local access road include terrestrial vegetation and wildlife. Construction procedures for the proposed project facility will require the removal of vegetation for the site and access road. Overall, approximately 208 acres of desert shrub/saltbush vegetation community will need to be cleared for the life of the facility, unless the Band chooses to retain non-radiological portions of the facility after termination of the NRC license. This assumes approximately 99 acres for the RA, 5 acres for the area from the RA fence to the outer edge of the perimeter road, 22 acres for the access road, 6 acres for the PMF berms located near the access road and the site, 8 acres for a storm water detention basin located outside of the RA but within the OCA, and 68 acres for the crested wheat grass fire barrier. As discussed in SAR Section 8.2.5, the crested wheat grass fire barrier will extend 300 ft out from the outer edge of the perimeter road around the RA. Native vegetation will be cleared from this area and crested wheat grass planted over the area, including the portions of the PMF berms that are within this area. The site clearing includes the entire area within the RA. The access road clearing is 2.5 miles long and 80 feet wide.

Another 24 acres will be temporarily cleared of vegetation. This includes a 5-acre construction laydown area south of the site, a 2 acre area used for installation of the septic system and leach field, and an additional 17 acres of temporary vegetation disturbance. This 17 acres is contiguous and adjacent to the proposed access road location. Following construction, portions of these three areas outside of the crested wheat grass fire barrier will be actively revegetated, even though this small amount of vegetation removal is minor compared to the over 1 million acres of desert shrub/saltbush community within Tooele County alone. Any portions of these areas within 300 ft of the perimeter road around the RA will be planted with crested wheat grass. A detailed revegetation plan will be developed in consultation with the Tribe and BIA for the PFSF site. The plan will be developed during construction and will incorporate the latest requirements/recommendations for soil preparation, type of seed

mix, time of year to plant, watering frequency, etc. The revegetation plan will follow guidelines currently used by the BLM such as the Interagency Forage and Conservation, Planting Guide for Utah, EC 433, or later documents in effect at the time the plan is developed. There are no unique habitat features in areas proposed for permanent or temporary vegetation removal (BLM, 1988). Following decommissioning, the concrete pads will be removed or covered with topsoil and the site will be actively revegetated with appropriate naturally occurring species. The most commonly occurring species are invasive annuals such as cheatgrass (*Bromus tectorum*), which are not native to this area. These invasive species are likely to take advantage of disturbance to any areas of native vegetation within the project area, and could establish populations in these areas. Revegetating these areas with native vegetation will discourage non-native vegetation from expanding further into the project area.

No federal or state-listed threatened or endangered plant species are known to occur within the site or access road areas (letters from USFWS, Utah Field Office, dated February 10, 1997, February 27, 1997, and July 31, 1998 and UDWR, 1997). Construction of the proposed facility will not impact vegetation or habitats located outside of the site area and access road. Although Pohl's milkvetch is not protected, surveys for this species will be conducted again shortly before construction within the areas identified for earthwork to prevent impacts on any sensitive plant species.

Construction activities will temporarily disturb resident wildlife species. The proposed site and access road are located within a common desert shrub/saltbrush vegetation community with minimal wildlife habitat value. However, for resident wildlife species, these habitats provide meaningful area of cover for breeding, foraging, and avoidance of predators. Small, less mobile wildlife such as rodents and reptiles could be displaced or lost as a direct result of construction activity and/or destruction of suitable habitat. Impacts on local populations will be minimal because of the relatively small area of impact, the commonness of this habitat type in surrounding areas, and the high reproductive potential for many of these resident species. Larger mammals, birds, and some mobile reptiles will likely be disturbed by construction activities and will move to

other nearby suitable habitats. Prior to construction, a comprehensive wildlife survey should be conducted to assure that no sensitive or endangered species are nesting (or denning) within 0.5 mile of the PFSF site. If any animals are located, mitigation plans such as construction timing restrictions should be implemented and alternative nest (or den) site locations should be established in consultation with the BLM, UDWR, and FWS to offset the loss of these sites due to construction.

The proposed construction activities that will be likely to cause the most disturbance to wildlife (due to noise, land disturbance, and general human activity) will occur mostly in the first construction phase. These activities include grading the first portion of the RA, installing yard lighting, duct banks and grounding, and constructing all buildings, the access road, PMF berms, detention basin, perimeter road, security fence, all of the southeast quadrant storage pads, and clearing vegetation to a distance of 300 ft out from the perimeter road and planting crested wheat grass for the fire barrier. As a result, most of the construction impacts on wildlife discussed above will occur in the first construction phase. Subsequent construction activities in the second and third construction phases will consist of grading and constructing the remaining storage pads, along with the operation of the portable concrete batch plant. Construction lighting is also likely to contribute to wildlife disturbance. The impacts on wildlife will lessen as the level of construction related activities is reduced and wildlife should repopulate the area shortly thereafter.

Increased traffic on Skull Valley Road during construction and project operations could result in temporary minor impacts on wildlife that frequent the road area by altering individual behavioral patterns for some species (including mule deer, black-tailed jack rabbits, and pronghorn antelope) and increasing rates of carrion. Section 4.1.7 discusses the anticipated increases in traffic volumes. Increased traffic will be greatest during the first construction season (as shown in table 4.1-3) with an increase in the Average Daily Traffic (ADT) on Skull Valley Road south of Iosepa from 325 to 885 vehicles per day between September 1, 2000, and October 31, 2000; an increase from

325 to 671 vehicles per day between November 1, 2000, and May 31, 2001; and an increase from 325 to 623 vehicles per day between June 1, 2001, and March 1, 2002.

Traffic during the latter two construction phases (March 1, 2002 to November 30, 2006 and March 1, 2007 to November 30, 2011, excluding December, January, and February of each year), will decrease from peak construction levels to an ADT of 569 vehicles and 579 vehicles, respectively. These numbers include traffic from facility construction and operational staff as well as ongoing construction activities. Individual resident wildlife are likely to adjust to these changes and will resume more preconstruction activities and behaviors as construction traffic decreases. Although local population levels could potentially be reduced for some species in the first few years of construction, no long-term impacts on fecundity or population levels are expected. Some wildlife species may experience a temporary increase in population levels in the first few years of construction. Species such as coyotes or carrion-feeding raptors may be attracted to the Skull Valley Road due to the increased likelihood of carrion.

Consultation with the Utah Division of Wildlife Resources (UDWR) and the U.S. Fish and Wildlife Service (USFWS) indicates that, except for transient, infrequent occurrences, there are no state or federally-listed threatened or endangered wildlife species known to occur within the proposed site boundary or access road (letters from, USFWS, Utah Field Office, dated February 10, 1997, February 27, 1997, July 31, 1998 and UDWR, 1997). Threatened or endangered species that may occasionally occur in the area, including bald eagle or peregrine falcon, will not be affected by vegetation removal since only a small portion of available prey habitat is affected and these species do not perch or roost in the vicinity of the project facilities.

The U.S. Forest Service (USFS) stated that increased traffic along Skull Valley Road from construction and operation of the facility could have an effect on bald eagles feeding on carrion along the road (letter from K. Clapier, Kamas Field Office, USFS to S. Davis, SWEC, January 27, 1997). According to the Stansbury Mountains Habitat Management Plan (BLM, 1990), traditional bald eagle hunting and roosting areas occur in southern

Skull Valley. However, the nearest roost is approximately 10 miles south of the site, and the nearest high-use foraging area is almost 20 miles to the south. Construction of the project facility is, therefore, not likely to have an adverse impact on bald eagles during construction or operation. In fact, increased traffic could result in additional carrion on Skull Valley Road, thereby providing an additional source of food for eagles.

Peregrine falcons may travel more than 18 miles from the nest site to hunt for food, however, a 10-mile radius around the nest is an average hunting area, with 80 percent of foraging occurring within a mile of the nest (letter from K. Clapier, Kamas Field Office, USFS to S. Davis, SWEC, January 27, 1997). Since the only known peregrine falcon nest site is located in the Timpie Springs Waterfowl Management Area approximately 24 miles north of the site, any peregrine falcon occurrence around the site will, therefore, be unusual and infrequent. The 10-mile radius frequented by the peregrine falcons will include, however, the northern-most part of Skull Valley Road. There will be increased traffic on this road during construction and operation. The construction traffic will not travel near the nest location and the increased construction traffic will be temporary. Migratory peregrines are also not likely to be affected by increased construction traffic. Overall, the construction of the site is unlikely to have any impact on peregrine falcons.

The Skull Valley pocket gopher is not protected as a state or federally listed threatened or endangered species. However, this endemic gopher is a "high interest" species in the state and is a BLM sensitive species. It has been documented south of the project and could be found on the project area. UDWR (1997) requests that a survey of gopher mounds be conducted and surface disturbance within 100 feet of any burrow be avoided to protect this species. To accommodate the UDWR request, surveys will be conducted shortly before construction in consultation with UDWR. All appropriate protection and mitigation measures will be taken to mitigate construction effects on the pocket gopher.

The UDWR has requested (1997) that if project construction inadvertently unearths a snake den, a critical valued use area, UDWR's Central Region Habitat Manager should be contacted so that the animals can be relocated to an appropriate alternate habitat in

the region. Additionally, to avoid impacts on protected raptor nests, UDWR requests that a survey be conducted shortly prior to construction to identify any nesting locations. Surveys will be conducted in consultation with UDWR, and appropriate protection and mitigation measures will be developed to mitigate construction effects on raptor nests near the project facilities.

Erosion control methods during construction will consist of silt fencing and hay bales on the downstream side of drainage's. Construction dust will be controlled using methods that are in accordance with state, local, and federal laws.

4.1.3 Effects on Air Quality

Air quality related impacts associated with the construction of the PFSF will be comprised mainly of gaseous pollutant emissions from diesel-powered construction equipment and fugitive dust emissions from excavation activities and construction equipment travelling on paved and un-paved roads (dump trucks, cement trucks, watering trucks, bulldozers, graders, scrapers, front end loaders, and back hoes). A concrete batch plant will also be a source of fugitive dust emissions. There will also be pollutant emissions from private vehicles driven by the construction labor force estimated to be no more than 130 workers at any given time. These types of emissions will have only very localized impacts. Construction air quality impacts are usually mitigated to the extent that potential offsite nuisance conditions (or a condition of air pollution) are prevented.

The Utah Department of Environmental Quality (DEQ) regulations for fugitive dust generated by construction activities (R307-12.3) requires any person engaged in clearing or leveling land over 1/4 acre, earthmoving, excavation, or movement of trucks over cleared land greater than 1/4 acre in size or access haul roads to take steps to minimize dust emissions. The DEQ regulations have no specific provisions for quantifying construction impacts. Dust control techniques may include watering and/or chemical stabilization of potential dust sources. Other techniques that will be used to control fugitive dust emissions include covering materials being hauled from the site by truck and

by employing routine washing of trucks. Dust emissions from anticipated concrete batch plant operations will also be mitigated through the use of enclosures, hoods, shrouds, and water sprays. Gaseous emissions from construction equipment are mitigated typically by requiring regular maintenance of equipment.

Communications with local a supplier indicates that the estimated quantity of asphalt paving to be placed at the facility does not justify locating a batch plant onsite.

Construction related pollutant emissions cannot be well defined until such time as the construction process is broken down into its component operations and planned in some detail. However, preliminary estimates of air pollutant emissions due to construction activities are provided in Table 4.1-4 on the basis of estimated material usage (e.g., cubic yards of concrete) and reasonable assumptions regarding construction vehicle mileage and hours of operation during the construction phase. Emissions estimates are provided for fugitive dust emissions (PM10) from clearing and excavation activities as well as from the concrete batch plant. Gaseous criteria pollutant emissions (SO_2, NO_x, CO, VOC) from vehicular traffic (NO_x, CO, and VOC) are also provided. All of the construction activities are conservatively assumed to be occurring simultaneously during any given construction month for purposes of these emissions estimates. The emission factors used in the estimates for construction activities are taken from the 5th edition of EPA's AP-42 document (EPA 1995a) assuming reasonable levels of emissions control as needed to satisfy DEQ requirements. Vehicle emissions are derived from the latest version of EPA's MOBILE5b emissions estimating model (EPA 1996).

The plant wide controlled PM-10 emission factor (E) for concrete batching is taken from Section 11.12, Table 11.12-3 of AP-42 and is expressed as 0.12 pound per cubic yard of concrete produced. It is assumed that 125,300 cubic yards of concrete are produced in one year yielding 7.5 tons of PM-10 emissions per year or 0.6 ton per month.

The potential impact of these construction related pollutant emissions on ambient concentrations in public areas has also been preliminarily assessed using the EPA

SCREEN3 screening level dispersion model (EPA 1995b). This model calculates ground level concentrations of pollutants emitted from both point and area sources as a function of downwind distance utilizing either a standard matrix of meteorological conditions designed to produce worst case impacts or user input meteorological conditions. For fugitive dust impact estimates, the neutral atmospheric stability class (D stability) and a wind speed of 5 meters per second is assumed to be a representative combination of conditions causing dusting. General construction activities such as excavation and other fugitive dust sources are represented as area sources while emissions from the concrete batch plant are treated as a point source. Ambient pollutant concentrations are calculated at two locations where the general public could be impacted: the closest point from the facility to Skull Valley Road; and at the Goshute Village, located approximately 3.5 miles from the site.

Based on estimated quantities of required concrete and information from local concrete suppliers, the concrete batch plant would be sized for a maximum capacity of 75 yd^3 per hour. The batch plant and material storage for this capacity would require a footprint area of approximately 300-ft. x 300-ft., or approximately 2 acres. The specific location for the batch plant on the PFSF site would be determined during the construction planning phase of the project, but it will likely be sited North of the Canister Transfer Building on the Eastern side of the storage area. The batch plant location would be provided with controls, e.g., perimeter berm and drainage retention, to mitigate any environmental effects on the immediate area.

Emissions from the concrete batch plant are treated as point sources. One-hour concentrations calculated by SCREEN3 are adjusted to 3-, 8-, and 24-hour average concentrations using the factors 0.9, 0.7, and 0.4, respectively. The annual average adjustment factor used is 0.05.

The concrete batch plant PM-10 emissions are assumed to be released from a height of 20 feet above ground level. Annual pollutant emissions are based on an assumed 2,200 hours per year of operation of the concrete batch plant.

The results of the screening level impact analysis are presented in Table 4.1-5 and indicate that the estimated pollutant concentrations at Skull Valley Road and at the nearest residences are all below the ambient air quality standards. These impacts are preliminary in that more detailed construction practices information is needed to better characterize the pollutant emissions.

4.1.4 Effects on Hydrological Resources

There are no perennial streams at or near the PFSF and its access road. Several dry washes, which may flow for brief periods during spring snowmelt or local thunderstorms, will be crossed by the access road. Culverts will be provided through the access road embankment to carry the occasional runoff. Culverts will be sized to pass the 100-year flood for this area. Therefore, there will be no impact on area hydrology due to construction of the facility and its access road.

4.1.5 Effects on Mineral Resources

To assess the mineral potential of Skull Valley, PFS conducted a search of publications by the United States Geological Survey and publications and library holdings of the Utah Geological Survey regarding Skull Valley. PFS also consulted with two independent geologists regarding the potential for economic mineralization in the valley. That inquiry reflects that Skull Valley (including the Rail Corridor, ITP and PFSF) contains no known mineral or oil and gas deposits, except for sand and gravel and other commonly occurring deposits. None of these latter types of deposits are located within the Rail Corridor, ITP or PFSF. In addition, this inquiry indicates that Skull Valley has little mineral or oil and gas potential. In particular, the inquiry reveals that Skull Valley has very low potential for the discovery of economic metallic mineral deposits, and there is no reasonable possibility of an open pit metallic mine that would interfere with the proposed rail line operations during the projected life of the PFSF (USGS 1989). As a

result, there will be no impact from construction of the PFSF on known mineral resources.

The terminus of the Rail Corridor and the PFSF are located on the Skull Valley Reservation. Reservation lands are not subject to location of mining claims, and according to the BIA, there are no mineral leases on the Skull Valley Reservation.

There are no mining claims within the Rail Corridor or ITP site, and none has ever been filed on those lands. In addition, only one mining claim has ever been filed on any of the sections of land affected by the Rail Corridor and ITP site -- a 1982 claim located in Section 20, T. 1 N., R. 9 W., approximately one-half mile from the Rail Corridor. The claim was abandoned in 1983.

The only mineral leases ever issued on land affected by the Rail Corridor and ITP site were oil and gas leases, all but one of which have terminated. The one existing lease affects the Rail Corridor within Section 27, T. 3 S., R. 9 W. Under BLM's multiple use concepts, the existence of the oil and gas lease will not preclude construction and operation of the rail line.

The State of Utah owns the minerals underlying one section of land affected by the Rail Corridor, Section 2, T. 5 S., R. 9 W., with the BLM owning the surface of that section. State lands are not subject to location of mining claims. No mineral leases currently affect that section of land, and the only historic leases were oil and gas leases.

4.1.5.1 Imported Materials Required for Construction

The type and quantity of required imported materials necessary for construction of the alternative rail line, ITP, and the PFSF site are provided in Table 4.1-6. PFS does not intend to obtain any required imported construction materials from Federal or Tribal lands, but plans to obtain materials from private, commercial sources in and around the Skull Valley area.

PFS has performed a study to identify aggregate sources located in and near Skull Valley in Tooele County, Utah. The study identified sources of aggregate that could be used for construction of railroad beds, roads, bases for building foundations, and aggregate for concrete. The study concluded that there are sufficient sources of aggregates that are both economical and logistically reasonable for use to support the PFSF project. The types of material and quantities available from each of the most likely sources are presented in Table 4.1-7.

4.1.5.2 Excess Materials Resulting from Construction Activities

The construction of the PFSF site only generates material during stripping operations. The 86,000 cubic yards of material produced will be used to construct the PMF berm and used as slope dressing on the access roads and perimeter roads. Again, this will help stabilize the slopes by promoting the growth of vegetation and increase the stability of the slopes by flattening them. No material will be disposed of off site.

4.1.6 Effects on Socioeconomics

Local employment will increase during the extended construction phase of the proposed project. During the initial construction phase, an estimated 130 workers will be required for various tasks related to project development. Table 4.1-1 shows the anticipated breakdown by labor categories and the projected level of effort for each trade required for this project. During subsequent construction phases 2 and 3 an estimated work force of 43 persons will be required to continue activities associated with site earthwork and concrete finishing as the remaining portions of the facility are developed (Table 4.1-2).

As of 1991, there were 10,219 jobs in Tooele County (Tooele, 1995). The area supported some 780 construction jobs and another 2,804 manufacturing positions (Census 1993). Because of this abundant local labor force, the construction work force

is expected to be drawn from Tooele County and the Salt Lake City metropolitan area. It is anticipated that these workers will be current residents of these communities who will commute daily to the project site. Consequently, project construction will not induce the in-migration of families with school-age children, and there will be no impact on housing availability, schools, or levels of other government services.

The Salt Lake City region of Utah in which the PFSF site is located has had more than an adequate supply of skilled construction personnel to meet the area's needs in recent years and there is no indication that critical skill shortages will appear in the near future. Commercial construction has flourished recently which has, in turn, increased the number of construction workers in the area. According to the Utah Building and Construction Trades Council, the major venues for the 2002 Winter Olympics, hosted in Salt Lake City, have already been built with only the construction of private facilities to be completed before 2002. A continuation of this construction boom is anticipated for the next two years until the onset of the 2002 Winter Olympics. The construction trades work force has been rapidly growing to meet the upswing in demand, and the PFSF project will be positively impacted by this job market expansion.

In addition to construction activities for the Olympics, over $1 billion in highway construction projects are currently underway in the state. These projects are expected to peak in the year 2000. As the need for labor on the highway projects declines, there will be a surplus of construction workers skilled in the civil trades.

The earnings of local construction personnel and the spending of construction-related salaries at local retail and service establishments in the Tooele County area will benefit the local economy. In addition, it is expected that the project will purchase some equipment and much of the construction materials required for structural fill and concrete aggregate from local suppliers, thereby providing additional economic benefits during the extended 21-year construction period (11-12 years for phases 1, 2, and 3 facility construction, with storage cask construction continuing out to about 21 years).

Construction of the PFSF will also result in additional tax revenues to the State of Utah from the in-state purchase of equipment and materials. The State sales tax rate is 5 percent, with a local option sales tax of 1.25 percent. This increase in revenue will benefit local populations by reducing current tax rates, funding improvements to local infrastructure, or other initiatives identified by government agencies.

Construction of the PFSF may require that upgraded electrical service be brought to Skull Valley. This service upgrade could benefit residents of Skull Valley by providing reliable, higher-voltage electricity.

Although it is not possible to give a specific number of Native Americans that might be employed by the project, the area's Native American work force will be utilized to the greatest extent practicable on PFSF construction. Special efforts to train and employ Native-Americans in the construction trades will be undertaken on the project and Native-American owned contractors will be identified, and given every opportunity to bid on specified construction work packages.

Construction of the PFSF is not expected to have major impacts to any area schools from in-movers due to construction and operating labor force since the number of workers is not significant in comparison to the total employment of the area. The Tooele School District contains 18 public schools, 8 of which are located in Tooele, and 2 of which are located in Dugway as follows:

School Name	Grades	Town
Dugway High	07-12	Dugway
Dugway School	KG-06	Dugway
East School	KG-06	Tooele
Harris School	KG-06	Tooele
Northlake School	KG-06	Tooele
Oquirrh Hills School	UG	Tooele
Tooele High	09-12	Tooele
Tooele Jr. High	07-08	Tooele
Tooele Valley High	09-12	Tooele
West School	KG-06	Tooele

PFS is not aware of any Tooele County plans for future school expansion.

The U.S. census counted approximately 560 laborers employed in the construction trades in Tooele County in 1996. (U.S. Census, 1996 County Business Patterns for Tooele, UT). In Salt Lake County, almost 26,000 laborers were employed in the construction trades in the same year. (U.S. Census, 1996 County Business Patterns for Salt Lake, UT).

As presented in Section 4.1.1, the highest number of workers during peak construction activity is estimated at only 130 persons (the workforce is less during operation). This number of workers is very small compared with the available resources representing less than ½ percent of the total skilled construction labor pool that exists within Tooele County and the Salt Lake City metropolitan area. Therefore the existing area labor pool is expected to be able to meet the construction needs of the PFS construction work without requiring an influx of new workers specifically for this project. Consequently, no significant in-migration of families or project-induced growth that would cause the need for school expansion is anticipated.

4.1.7 Effects of Noise and Traffic

Construction of the PFSF will result in the need for construction materials to be brought to the site, the excavation and disposal of soil, delivery of equipment and supplies, and daily construction workers commuting to the sites in the morning and afternoon or evening on work days during an assumed shift length of 10 hours, at least five days per week. This section of the report details the major construction material usage and relative traffic volumes resulting from construction of the proposed PFSF. Material quantities in this section were estimated from the description of construction activities and requirements presented in Chapter 3. Although the material usage and construction traffic may not be precise estimates, they represent a reasonable approximation of the material usage and construction traffic that can be anticipated as a result of this project.

The determination of daily quantities of material traveling to or from the site was based on the estimated quantity for given tasks in the project schedule, divided by the number of work days included in the task, and the anticipated size of the trucks to be used (20 CY), to arrive at the average daily traffic volume. The material quantities were increased by a factor of 10 percent to reflect the fact that granular materials will expand in volume and a truck full of rock will have voids. It should be recognized that the numbers shown are averages, and that some days will have higher traffic volumes while others will have less depending on the actual timing of specific activities.

A concrete batch plant will be located onsite to provide concrete to the project and allow for a reduction in the number of concrete trucks that will have to use public roads. However, because the onsite materials are not suitable for concrete aggregate, these materials will be brought to the site from a quarrying operation located in Tooele County. The material volumes estimated below for traffic level purposes include both structural fill and concrete aggregate for a total constructed material volume.

4.1.7.1 Construction Phase 1

The initial construction period of this phase will include construction of the site access road, soil stabilization of the southeast quadrant of the cask storage pad area by mixing cement with the upper layer of soil, the access road flood diversion berm, and initial grading and excavation for the Administration Building and the Operation and Maintenance Building. These activities will begin about September 1, 2000, and be completed about October 31, 2000 (approximately 52 working days). These construction activities will require the transport of approximately 119,055 CY of solid material over the 52 day period. In addition, it is estimated that there would be 48 water truck trips per day (supply and return, assuming 7,500 gallon water truck capacity) for the first six weeks, and 6 water truck trips per day over the remainder of the period. Including a 10 percent expansion factor for the solid material to accommodate void space and assuming a 20 CY truck capacity, these activities will require an estimated average of 300 truck trips per day or 30 vehicles per hour to transport the required

volumes for construction of these project elements over the first six weeks, and 258 truck trips per day or 26 truck trips per hour for the remainder of the period.[1]

During the second period of this phase (November 1, 2000 to May 31, 2001), the storage facility will be leveled to final grade. Additional construction activities will include construction of the first half of the concrete storage pads in the south-east quadrant, the site flood diversion berm and storm detention basin, the Canister Transfer Building, and the Security and Health Physics Building. These activities will require the transport of approximately 130,497 CY of solid material over the 7 month period. In addition, it is estimated that there would be 6 water truck trips per day (supply and return) for the first five months, and 2 water truck trips per day over the remainder of the period. Including the solid material expansion factor, these activities will require an estimated average of 86 truck trips per day or 9 vehicles per hour over the first five months, and 82 truck trips per day or 8 truck trips per hour for the remainder of the 7 month period.

During the third period of this first construction phase (June 1, 2001 to March 1, 2002), the Administration Building and the Operation and Maintenance Building will be completed as well as the remaining concrete storage pads in the south-east quadrant. These activities will require the transport of approximately 67,631 CY of solid material over the 9 month period. In addition, it is estimated that there would be 6 water truck trips per day (supply and return) for the first two months, and 2 water truck trips per day over the remainder of the period. Including the solid material expansion factor, these activities will require an estimated average of 38 truck trips per day or 4 vehicles per hour over the first two months, and 34 truck trips per day or 3 truck trips per hour for the remainder of the 9 month period.

[1] A truck trip, or vehicle trip, is defined as a single or one direction vehicle movement. Therefore, a vehicle arriving and departing the site constitutes 2 vehicle trips.

Site preparation and facility construction will affect traffic and noise levels along Skull Valley Road. In addition to material and equipment deliveries, a peak construction labor force of 130 workers is projected. It is anticipated that workers will commute to and from the construction site on a daily basis utilizing individual passenger vehicles and light trucks. These workers will increase the ADT on Skull Valley Road south of the settlement of Iosepa from 325 to 585 trips. Trucks carrying fill material and water will add another 300 trips during the first period of Phase 1, increasing the ADT to 885 trips (Table 4.1-3). This anticipated additional traffic volume will lower the level of service (LOS) on Skull Valley Road from A to B.[2] This reduction in LOS results from delivery trucks moving at a slower rate of speed (estimated at 40 mph) than the posted limit of 55 miles per hour, requiring other traffic to reduce travel speed or make additional passing maneuvers. The LOS change is not significant and will not affect emergency response time for public safety vehicles. The second and third periods of the first construction phase will have less impact. The ADT resulting from construction activities during the second period of the first construction phase is estimated to be 671 for the first five months, and 667 for the remaining two months. The ADT resulting from construction activities during the third period of the first construction phase is estimated to be 623 for the first two months, and 619 for the remaining seven months (see Table 4.1-3).

Additional traffic volumes will also affect traffic generated noise levels. Noise levels are reported in units of Leq, which is the energy average sound level. During the first construction period of Phase 1 the average peak-hour traffic volume will increase to 149 trips and the traffic generated sound level (between Iosepa and Route 199) will increase by 5 dBA over the pre-construction levels to approximately 72 dBA at a distance of 50

[2] Level of service (LOS) is defined as a qualitative measure that represents the collective factors of speed, travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs provided by a highway facility under a particular volume condition. There are six levels of services, A through F. Level A is the highest quality of service. There is little or no restriction on maneuverability or speed caused by other traffic. Level F is the lowest. Level B is a zone of stable flow where operating speed is beginning to be affected by other traffic.

feet. During the latter two periods of this construction phase the average peak-hour volume will increase to 138 vehicle trips and 126 vehicle trips, respectively, and traffic-generated sound levels will increase during both periods from the existing sound level of 67 dBA to approximately 71 and 70 dBA respectively at a 50 ft distance.

In general, the land along the Skull Valley Road corridor is undeveloped and is therefore included within activity Category D under the Federal Highway Administration (FHWA) Design Noise Level guidelines. FHWA prescribes no upper level design noise limits for activities within Category D areas. There are, however, at least two residences along Skull Valley Road within 50 feet of the road. These two homes will experience a sound level of 72 dBA during the daytime working shifts. This level is 5 dBA higher than FHWA guidelines for category B (67 dBA exterior noise level for residences), but, because of the undeveloped nature of Skull Valley, only minor noise impacts are anticipated.[3]

4.1.7.2 Construction Phase 2

During this phase, the southwest quadrant of the storage facility will be constructed. These activities will begin about March 1, 2002, and be completed about November 30, 2006 (approximately 5 years). Construction activities (casks excluded) will require approximately 187,934 CY of solid material to be transported to the site over the 45 month construction period (no construction is assumed during the three winter months of Dec – Jan). In addition, it is estimated that there would be 48 water truck trips per day (supply and return) for the first six weeks of phase 2 construction, and no water truck trips over the remainder of the period (water obtained from on-site wells). During

[3] The FHWA has established four activity categories, A through D for recommended exterior, upper limits for acceptable highway traffic noise levels. The upper level for Category A, for lands on which serenity and quiet are of extraordinary significance and are to be preserved, is 57 dBA. The upper level for Category B, for lands including residences, picnic and recreation areas, schools, churches, hotels, libraries, and hospitals, is 67 dBA. The upper level for Category C, for developed lands and properties not covered by A and B, is 72 dBA. There is no upper level for Category D, undeveloped land.

phase 2 construction of the storage pads in the southwest quadrant, storage casks will be constructed for storage of fuel in the southeast (phase 1) storage area. Each cask requires approximately 47 CY of material to be supplied to the PFSF, by truck or rail. Assuming construction of 200 casks per year and truck delivery of cask materials, approximately 9,400 CY of material would be required annually, supplied by 517 trucks. Based on construction taking place 9 months per year, with 22 work days per month, about 6 truck trips per day would be required for storage cask construction.

Including the solid material expansion factor and accounting for materials for construction of storage casks, these activities will require an estimated average of 74 truck trips per day or about 7 vehicles per hour over the first six weeks, and 26 truck trips per day or about 3 truck trips per hour for the remainder of the 5 year construction period.

A construction labor force of 43 workers is estimated for this phase. An additional 84 vehicle trips will be generated by the operational labor force. The ADT resulting from construction activities during the second phase of construction is estimated to be 569 for the first six weeks, and 521 for the remainder of the 5 year construction phase (Table 4.1-3). The additional traffic will not affect the LOS on Skull Valley Road. The average peak-hour volume will increase to 111 vehicle trips for the first 6 weeks of phase 2 construction and result in an increased traffic generated equivalent sound level between Iosepa and Route 199 of 2 dBA to 69 dBA at 50 ft. This level is 2 dBA higher than FHWA guidelines for category B (67 dBA exterior noise level for residences), but, because of the undeveloped nature of Skull Valley (only 2 residences within 50 ft of the roadway) no significant noise impacts are anticipated from this minor increase in sound levels.

4.1.7.3 Construction Phase 3

During this phase, the remainder of the storage facility will be constructed, consisting of the two northern quadrants. These activities will begin about March 1, 2007, and be

completed about November 30, 2011 (approximately 5 years). Construction activities (casks excluded) will require approximately 271,882 CY of solid material to be transported to the site over the 45 month construction period (no construction is assumed during the three winter months of Dec – Jan). In addition, it is estimated that there would be 48 water truck trips per day (supply and return) for the first twelve weeks of phase 3 construction, and no water truck trips per day over the remainder of the period (water obtained from on-site wells). During phase 3 construction of the storage pads in the two northern quadrants, storage casks will be constructed for storage of fuel in the southwest (phase 2) storage area. As discussed for phase 2, about 6 truck trips per day would be required to supply materials for storage cask construction. Including the solid material expansion factor and accounting for materials for construction of storage casks, these activities will require an estimated average of 84 truck trips per day or about 8 vehicles per hour over the first twelve weeks, and 36 truck trips per day or about 4 truck trips per hour for the remainder of the 5 year construction period.

A construction labor force of 43 workers is estimated for this phase. An additional 84 vehicle trips will be generated by the operational labor force. The ADT resulting from construction activities during the third phase of construction is estimated to be 579 for the first twelve weeks, and 531 for the remainder of the 5 year construction phase (Table 4.1-3). The additional traffic will not affect the LOS on Skull Valley Road. The average peak-hour traffic volume will increase to 112 vehicle trips for the first 12 weeks of phase 3 construction and result in an increased traffic generated equivalent sound level between Iosepa and Route 199 of 2 dBA to 69 dBA at 50 ft. This level is 2 dBA higher than FHWA guidelines for category B (67 dBA exterior noise level for residences), but, because of the undeveloped nature of Skull Valley (only 2 residences within 50 ft of the roadway) no significant noise impacts are anticipated from this minor increase in sound levels.

Construction equipment used during the three construction phases will generate site construction noise. Equipment will consist of scrapers, bulldozers, dump trucks, compactors, graders, front-end loaders, cement trucks, water trucks, asphalt trucks,

backhoes, a crane, a concrete batch plant, an asphalt paver, a fence-post driver, and well drilling rig. Site-generated sound from this equipment will produce an equivalent sound level of 95 dBA at a distance of 50 feet. The nearest noise-sensitive residential receptor to the constructionsite is approximately 2 miles southeast. The equivalent sound level at this distance will be reduced by 63 dBA resulting in a sound level at the receptor of 32 dBA. This level is in the range of the lowest ambient sound levels measured along Skull Valley Road and will not result in a significant increase in sound levels at the nearest receptor. It is well below the estimated peak-hour traffic and average daytime equivalent sound level of 67 dBA and 62 dBA, respectively.

4.1.8 Effects on Regional Historical, Cultural, Scenic, and Natural Resources

4.1.8.1 Regional Historical and Cultural Resources

The Iosepa Cemetery is the only known site listed, or eligible for listing, on the National Register of Historic Places, located in the Skull Valley project area. This historic period site is located approximately 9 miles from the proposed PFSF site, and therefore will not be affected by construction or operation of the proposed facility.

Consultation with the Utah State Historic Preservation Officer (SHPO) and the Skull Valley Band of Goshute Indians indicates that the areas within the Skull Valley Reservation affected by project construction and operation contain no cultural or historic resources or areas of religious significance to the Skull Valley Band. Consultation with the Utah SHPO has been initiated to determine if additional archeological survey work by the PFSLLC is warranted prior to development of the proposed facility (letter to Max Evans, SHPO, dated March 11, 1997).

A Class III Cultural Resource Inventory for the Private Fuel Storage Facility was performed in May and June of 1999. The results are discussed in Section 2.9.1. No impacts on known historic, architectural, or cultural features will occur as a result of facility construction.

4.1.8.2 Scenic and Natural Resources

Construction equipment and land disturbances associated with construction will add new visual elements to Skull Valley. The presence of the construction equipment in an otherwise barren landscape will naturally draw a viewer's attention as a temporary focal point. Appearance of the facility will be minimized by the 1.5-mile distance of the site from Skull Valley Road, the point from which most viewers will observe the constructionsite, and by the area topography. Skull Valley Road, at the intersection with the site access road, is 130 ft higher than the grade elevation on the site. From this higher perspective and over a 1.5-mile distance, the construction activity will appear a mid-ground feature in the landscape and will not significantly interrupt views across the Skull Valley floor to the Cedar Mountains in the background. Furthermore, approaches to the site along Skull Valley Road are partially screened for viewers approaching from the south by topographic features such as Hickman Knolls, and for viewers approaching from the north by a low ridge.

4.2 EFFECTS OF FACILITY OPERATION

This section of the report discusses impacts on the existing environmental baseline, described in Chapter 2, associated with the operation of the PFSF. Details of PFSF operation are discussed in Section 3.3, Facility Operation.

4.2.1 Effects on Geography, Land Use, and Demography

Because of the PFSF's remote location on an unpopulated, undeveloped parcel of Reservation-controlled land, operation of the PFSF will have no impact on area land use or demographics. No impacts on the Tekoi Rocket Engine testing facility, located on the south side of Hickman Knolls, will result from operation at the PFSF site.

Operation of the facility will remove 820 acres from potential use as livestock grazing lands. This reduction in area will not result in a significant loss of valuable grazing land. It represents less than 0.5 percent of the 271,000 acres of rangeland in Skull Valley, the majority of which is characterized as of fair to poor quality.

4.2.2 Effects on Ecological Resources

Large mammals such as pronghorn antelope, mule deer, and coyote that may normally forage or travel through the site area will be excluded from the RA by the two 8-foot high chain link fences around the perimeter. These animals could continue to graze or inhabit the other areas within the OCA, although they might be discouraged by the barbed wire range fence installed around the OCA perimeter. Although these fences could alter some travel patterns for some species it is not likely to be a significant impact because the site is not located in a major wildlife travel corridor and there is an abundance of similar habitat in the areas surrounding the site that will not be impacted.

Runoff from precipitation will be collected in the detention basin. Surface runoff is uncontaminated and will not adversely affect vegetation or wildlife. A septic system with two leach fields will be installed near the buildings. In the immediate area of the detention basin and leach fields, the vegetative species composition could change to include species that occur in areas with greater root zone water availability. No adverse impacts to area vegetation would result from operation of the PFSF.

During operation, there could be a limited effect to wildlife near the project site because of the increase in night light levels. Individuals of some species might alter their behavioral patterns, including breeding and resting times and selection of breeding sites, to avoid the illuminated area. Any effect should be minimal and should only occur where the light is brightest. It is likely to affect only the 99 acre RA, since all lighting will be installed and oriented to minimize the amount of illumination that extends offsite.

Avian species are likely to be attracted to the casks, buildings, and light posts for perching and potential nesting because of the limited perching/nesting sites available in the valley. In addition, the exterior surfaces of the casks are at above-ambient temperatures, which will be attractive to birds, small mammals, and reptiles, during the winter.

However, the area within the nuisance fence will not provide attractive habitat since it will be devoid of vegetation and composed of compacted crushed rock and concrete. There will be no shelter available to prey species, such as small mammals and reptiles, to protect them from predators. Cask air inlet ducts located at the bottoms of the casks might provide some shelter; however both inlet and outlet ducts will be covered by screens with ¼" or finer mesh spacing to prohibit entry.

During the early stages of the project, construction activities would be likely to keep many species, especially raptors, away from the area. However, as casks are installed and activity moves to a different area, wildlife could move into the established areas.

Nevertheless, if left undeterred wildlife may exist inside the fenced areas of the PFSF and around the casks. Therefore to restrict habitation, PFS will monitor any wildlife activity on-site and will take measures to prevent habitation. Animal deterrent devices will be employed to keep all wildlife from being within the area for any length of time. A chain link fence, 8 ft high and embedded 1 ft into the ground, will be installed around the perimeter of the storage pads to prevent large wildlife such as deer antelope, coyotes, fox, rabbits, etc. from entering the area. If birds are found to be perching and/or nesting around or on the casks, deterrent devices such as cones or spikes will be installed to prevent this from happening. Small mammals and reptiles will also be kept from remaining in the cask area, using traps if necessary. Furthermore, the entire area will be surveyed frequently by facility workers. If any permanent signs of wildlife are found, actions will be taken immediately to remove the animals.

Operational noise resulting from the human activity/traffic and operation of the concrete batch plant and other equipment could also have a limited effect on wildlife. Some individuals that are particularly intolerant of human presence are likely to avoid the immediate area. Operational noise is likely to be minimal (see Section 4.2.7) with most of the additional noise occurring during the day when wildlife is more accustomed to human activity.

Increased traffic along Skull Valley Road and the access road from the daily workforce is not likely to have an impact on wildlife since the percent increase in traffic is small. Operation of the PFSF will require an estimated 42 persons per day. At night and on weekends the workforce will be reduced to security personnel only. This will result in a

maximum increase of 84 operational vehicle trips on Skull Valley Road, increasing the current ADT of 325 vehicle trips to 409 vehicle trips.

4.2.3 Effects on Air Quality

The operation of the PFSF is not expected to have any measurable impact on the local meteorology or air quality. The heat given off from the surface of the casks will only have a trivial effect on the temperature of the air in the immediate vicinity of the casks and should have no discernable off-site impact on the atmosphere.

Precipitation events could result in some very localized fogging as water is evaporated from the surface of the casks but will only occur under high ambient humidity conditions during which time natural fogging events will be likely. The downwind extent of any such fogging will be very limited and the frequency of occurrence will be very small as the site area receives very little rainfall throughout the year (approximately 8 inches per year).

There are no significant air pollution sources associated with the operation of the PFSF. The only fuel burning equipment to be operated on-site will be small space heating furnaces, the infrequent use of a small emergency generator for testing purposes, and the storage cask transporter. Small space heating sources of air pollutants (less than one million Btu per hour heat input) are exempt from the Utah air quality regulations. The storage cask transporter is powered by a 220 horsepower diesel engine and is considered to be a mobile source which is not regulated by the DEQ. While it is considered that operation of the emergency diesel generator will be so infrequent as to have trivial emissions, the following quantifies emissions from the emergency diesel generator on a very conservative basis, assuming that it operates 500 hours per year.

The PFSF will utilize a 250 horsepower diesel generator during operation to supply back-up electrical power when normal service is interrupted. Criteria pollutant emissions

estimates for this engine are provided using uncontrolled emission factors from the latest version of AP-42 Chapter 3.3, "Gasoline and Diesel Industrial Engines" (Supplement B, October, 1996) for diesel fueled engines. AP-42 assumes that all particulate matter is less than or equal to 1 micrometer. Also, the emission factor shown for VOC is actually based on total organic compounds (TOC) which is conservative for VOC. The annual emissions below assume a maximum of 500 operating hours per year.

The emission factors used and estimates of criteria pollutant emissions are summarized as follows:

Pollutant	Emission Factor (lb/hp-hr)	Hourly Emissions (lb/hr)	Annual Emissions (tons/yr)
NO_x	0.031	7.75	1.94
SO_2	0.00205	0.51	0.13
PM-10/PM-2.5	0.0022	0.55	0.14
CO	0.00668	1.67	0.42
VOC	0.00247	0.62	0.16
Pb	N/A	N/A	N/A

The air pollutant emissions from the private vehicles driven by the operational labor force of approximately 42 workers are not regulated under EPA or state regulations as they are mobile sources which are regulated at the manufacturer level.

The emissions estimates for the line-haul locomotives used for cask transport to the PFSF facility are provided in Section 4.4.3 which considers the number of locomotives used over the course of a year along with the total mileage covered, locomotive speed and appropriate air pollutant emission factors.

The annual air pollutant emissions from the small switchyard locomotive that will operate on the PFSF site are estimated in the same manner as those from the line-haul locomotives but using emission factors for switch locomotives. These emission factors are also based on current estimates (1997) provided by the Internet Web site DieselNet (http://www.dieselnet.com). EPA standards for locomotives with remanufactured engines were not applied since these engines are not likely to be used in the Low Corridor rail system.

The air pollutants for which emissions estimates are provided include hyrdocarbons (HC), carbon monoxide (CO), nitrogen oxides (NO_x), and particulate matter (PM). The emission factors used in this estimate are expressed as grams per break horsepower per hour (g/bhp-hr) and are summarized below:

HC	CO	NO_x	PM
1.1	2.4	19.8	0.41

Annual switch locomotive operation is estimated to be 520 hours corresponding to 2 hours per day, 5 days per week, and 52 weeks per year. Therefore, assuming a 1,500 bhp locomotive engine, the annual air pollutant emissions in tons per year resulting from switch locomotive operation are as follows:

HC	CO	NO_x	PM
1.0	2.1	17.0	0.4

4.2.4 Effects on Hydrological Resources

Potable water needs during operation of the PFSF are minimal (approximately 1500 gallons per day), similar to a light industrial facility with a 24-hour-a-day contingent of security personnel. Highest water demand is associated with a larger daytime work-force

as well as operation of the concrete batching plant. It is anticipated that surface storage tanks will be erected for potable water, emergency fire water, and for the batching plant, as it is unlikely that water wells drilled into the main valley aquifer will yield adequate quantities of water for these purposes on demand. Several wells on the site may be required to meet demand. In the event that onsite water quality or quantity are inadequate, potable water will be obtained directly from the Reservation's existing supply or an additional well or wells will be drilled east of the site and outside of the OCA, where water supplies are likely to be more satisfactory.

Localized drawdown of the valley aquifer will occur in the vicinity of the wells, the extent of which cannot be estimated until the wells are drilled, developed, and pump-tested. Future site water wells will be located and developed such that its drawdown influence will have no impact on any public, domestic, or irrigation water supply wells in Skull Valley. A few isolated stock watering wells may exist several miles downgradient of the site, but are not likely to be affected due to the distances involved and the large size of the aquifer.

The RA will be constructed to collect and drain storm-water to a detention pond at the north edge of the RA. The pond is free-draining and sized to accommodate a 100-year storm event. Water that may collect here will dissipate by evaporation and percolation into the subsoils. Operation of the detention pond will have a very local, sporadic effect on the subsurface hydrology. This water will slowly migrate northward and will most likely be transpired by vegetation at the ground surface or will be brought to the surface by capillary action and evaporated.

Storm-water that drains into the detention pond is not expected to be radiologically contaminated for the following reasons:

- the canisters are sealed by welding that precludes leakage of the canisters,

- measures are applied at the originating nuclear power plants when fuel is loaded into the canisters to prevent contamination of the canister outer surfaces,
- the canisters are not permitted to be transported to the PFSF unless surveys determine that they are free of surface contamination,
- a contamination survey of the canister is again performed after the canister is received at the PFSF to ensure that the canister is not contaminated,
- following loading of canisters into storage casks at the PFSF, contamination surveys are performed on the surfaces of the storage casks to verify they are free of contamination.

Also, monitoring of contaminants in the detention pond is not required under current National Pollutant Discharge Elimination System (NPDES) storm water regulations since the storm-water flows into an on-site detention pond with no possibility of discharge to the waters of the United States. A NPDES storm water permit, with its associated monitoring and reporting requirements, is not applicable to PFSF operations and it is not planned to sample for non-radiological contaminants.

Nevertheless, PFS considers it prudent to obtain samples of water from the detention pond to verify that storm-water runoff is contamination free. Precipitation in Skull Valley ranges from 7 to 12 inches per year. Most of the relatively small volume of water in the cask storage area produced by a typical rainstorm will probably settle into the 1 ft thick compacted gravel surface surrounding the storage pads and not drain to the detention pond. Only during a substantial rain event would water be expected to drain from the cask storage area to the detention pond. In addition, it is considered likely that the only time sufficient freestanding water would be available in the detention pond for sampling purposes would be after a substantial rain event. PFS will obtain a sample of water from the detention pond following a rain that is sufficient to collect freestanding water and analyze the sample.

Drainage ditches around the perimeter of the storage area lead to rip-rap flow spreaders that return the collected water to the natural drainage. No significant changes to the surface hydrology are anticipated from these structures. Earthen berms constructed along the southern and western sides of the storage area, as well as east of the site (perpendicular to the access road), serve to divert probable maximum flood (PMF) flows away from the site. These berms will function only during this highly unlikely event and have little effect on the natural surface hydrology.

4.2.5 Effects on Mineral Resources

No mineral resources have been identified at or near the PFSF site. Therefore, no impact to this resource is expected from operation of the facility.

4.2.6 Effects on Socioeconomics

During the operational life of the proposed PFSF, 42 full-time positions will be required to staff activities. Table 4.2-1 provides an anticipated personnel breakdown for each position required during operation of this project.

The operational workforce will be drawn from labor pools in Tooele County and the Salt Lake City metropolitan area. These employees will be current residents who will commute daily to the project site. Consequently, project operation will not induce the in-migration of families with school-age children, and there will be no impact on housing availability or levels of government services (eg, police, fire, schools). The earnings of operational personnel and the spending of related salaries at local retail and service establishments in the Tooele County area will benefit the local economy.

Operation of the proposed PFSF will result in a significant benefit to Tooele County. Although the PFSF is on Reservation lands and consequently is not subject to County

taxes, the PFSF will provide a fee to the County in consideration of increased county resources needed to support the PFSF activities. In addition, taxes will accrue to the County from the 1.25 percent local option sales tax on local purchases. This increase in revenue could benefit local populations by reducing current tax rates, funding improvements to local infrastructure, or other initiatives identified by local government.

Because the project's socioeconomic impacts will be predominantly beneficial, no mitigation measures are required.

4.2.7 Effects of Noise and Traffic

Due to the remoteness of the facility from sensitive receptors, there will be no noise impacts from facility operation. As previously discussed, minor noise impacts may result from the combination of construction and operational traffic along Skull Valley Road. However, these impacts will be minor because activities generating excess noise will occur on weekdays during daylight hours. As indicated in Table 4.1-3, the ADT during the operational phase is estimated to be 503 from December 2011 through November 2021, then decreasing to 409 after November 2021. The additional traffic will not affect the level of service (LOS) on Skull Valley Road. The average peak-hour volume will increase to 104 vehicle trips for the first 10 years of operation and result in an increased traffic generated equivalent sound level between Iosepa and Route 199 of 2 dBA to 69 dBA at 50 ft. This level is 2 dBA higher than FHWA guidelines for category B (67 dBA exterior noise level for residences), but, because of the undeveloped nature of Skull Valley (only 2 residences within 50 ft of the roadway) no significant noise impacts are anticipated from this minor increase in sound levels.

4.2.8 Effects on Regional Historic, Cultural, Scenic, and Natural Features

4.2.8.1 Regional Historic and Cultural Resources

No regional historic, archeological, architectural, or cultural resources were identified in areas utilized for project operation. Therefore, no impacts on these resources will result from operation of the proposed facility.

4.2.8.2 Scenic Resources

The Facility will introduce new visual features to the Skull Valley landscape. These features include: a 2.5-mile access road extending west from Skull Valley Road; overhead power transmission lines that will parallel the access road; 24-hour overhead site lighting for the PFSF; perimeter fencing for the PFSF; three one-story support buildings; and the Canister Transfer Building. These features are typical of the dispersed human settlement features found in Skull Valley.

Most views of the facility will be from vehicles traveling on Skull Valley Road. There are no primary viewing areas or scenic viewpoints within the 5-mile radius. The boundary of the Deseret Peak Wilderness Area is located 6 miles east of the facility, but recreational access to the Wilderness is from the eastern side of the Stansbury Mountains.

As described earlier in Section 4.1.8, the facility will be sited about 1.5 miles west of the Skull Valley Road and will not be immediately visible to traffic traveling north or south along the road. Views of the facility from a vehicle traveling from the south will be screened by Hickman Knolls until the vehicle is about 3.5 miles south of the entrance to the site access road. From that point on Skull Valley Road, the facility will appear as a mid-ground feature over 3 miles from the viewer. The facility will not dominate the view

or detract from views of the Cedar Mountains on the opposite side of Skull Valley, because of its low profile and small size relative to the expansive mountain range. Views of the facility from a vehicle traveling from the north will be screened by a low lying ridge between Skull Valley Road and the facility. The facility will not come into the viewer's full field of vision until the vehicle was about 1.5 miles north of the entrance to the access road. At that point the facility will be more than 2 miles from the viewer and will appear as a mid-ground feature that will not detract from views of the Cedar Mountains in the background.

Because the visual features of the facility are mostly typical of other previously constructed visual features within the valley, the facility will not look out of place or be an unusual focal point. The three, one-story support buildings will not exceed 26 feet in height. The Canister Transfer Building will be 92-feet high, but viewed from Skull Valley Road at a distance of about 2 miles it will not appear as a dominant feature in the landscape. The buildings also will be viewed from the roadway at an elevation approximately 130 feet above the grade elevation of the buildings, hence their height will not block views of the background features, such as the Cedar Mountains.

The overhead security lighting will be the most apparent long-term visual change resulting from the facility. The RA will be illuminated 24 hours a day. Light will be delivered by 130-foot-high light poles that will support four 1000-watt high-pressure sodium vapor lamps. Additionally, in the southern portion of the RA, along the railroad tracks, 400W HPS floodlights (with asymmetrical patterns) will be mounted on the 130-ft light poles at a height of 40-ft. The lighting will be installed and oriented to minimize the amount of illumination that extends offsite.

Figures 10, 12, 14, 16, and 18, included in Appendix 4A, show how the facility might appear at night as viewed from various vantage points. Direct glare from the facility itself is screened from view by existing terrain, at road level, at points 3.5 miles south of

the main entrance road and 1.5 miles north of the main entrance road, however some skyglow (light scattered by particles in the atmosphere around the facility) will be evident. Skyglow is generally lower in areas with low humidity and fewer airborne pollutants, conditions which are usually present at the PFSF.

Nearby Visual Impacts

Lighting fixtures were selected which minimize horizontal and above horizontal glare from the lighting elements. Shading and reflector techniques are employed to minimize wasted light and lighting elements (high-pressure sodium) are selected to achieve lighting efficiencies. Because the Skull Valley Road grade is approximately 130 feet above the facility grade, and 130 foot lighting poles are utilized for facility lighting, direct glare from the lighting fixtures is eliminated. Passersby would view reflected light from the facility buildings, concrete pads and storage casks. Reflected light is much more diffuse than direct light and less annoying to people, especially over the long distances involved (greater than 2.5. miles).

Vehicular traffic on the Skull Valley Road is much less at night than during the daytime hours. Most normal traffic on the road is from local residents commuting to/from work, and U.S. Army/Dugway Proving Ground day shift workers commuting to/from from Interstate-80 (ref. PFSF ER Section 4.2.2). As a result of the facility design features described and the low nighttime traffic expected in the immediate area of the facility, minimal visual impact is expected.

Distant Visual Impacts

The facility will be apparent at night from various distant vantage points. Four specific areas will be addressed: The Skull Valley Band of Goshute village, the Deseret Peak

recreation area in the Stansbury Mountains, the Cedar Mountains, and from Interstate-80 at the north end of Skull Valley.

The facility will be located approximately 3.5 miles W-NW of the Skull Valley Band of Goshute Indian village. Most of the tribal households are located in a 1 block cluster around the Tribal Community Center. The facility would be readily seen by village residents, but because of the distance and the limited height of the facility structures, would not present an obtrusive profile (see Figure 12 of Appendix 4A). The grade elevation of the village is approximately 250 feet higher than the facility grade, and, as in the case of viewers on Skull Valley Road, village residents would not see direct glare from the facility lighting fixtures. Skyglow at a distance of 3.5 miles would not be expected to interfere with any nighttime activities in the village, such as stargazing, etc.

The Deseret Peak Wilderness is located within the Stansbury Mountain Unit of the Wasatch-Cache National Forest, approximately 9 miles east of the facility. Annual recreation visits to the Deseret Peak Wilderness is estimated at 18,000. Elevations in the Deseret Peak Wilderness range from 900 to 6,500 feet above the facility grade. Access to the area is from the eastern side of the Stansbury Mountains. Overnight camping is limited to less than groups of ten and to less than 3 days. No permanent camping facilities are located on the western side of the Stansbury Mountain ridge line, and it is unlikely that any individuals would hike to the top of Deseret Peak during nighttime hours due to the hostile environment and for safety reasons. Nighttime views of the facility from this area would therefore be extremely infrequent, and, due to the distance and elevations involved, not overly obtrusive (see Figure 10 & 18 of Appendix 4A).

Recreational visits to the Cedar Mountains, approximately 7 miles west of the facility, have been estimated to be less than 3,000 visitor days. Most of those trips are by off-highway vehicles, which typically travel during daylight hours. Elevations in the Cedar

Mountains area range from 300 to 2,400 feet above the facility grade. While some occasional overnight camping in the Cedar Mountains does occur, there are no established camping areas in the region within view of the facility. Due to the infrequent use of the area after dark as well as the distance and elevations involved, the nighttime views of the facility are not expected to be obtrusive.

Direct views of the facility from Interstate-80 at the north end of Skull Valley are generally shielded by topographical features and the low elevation of the freeway as compared to the site. Some skyglow may be faintly visible in the distance on extremely clear nights, but nearby lighted structures (such as Akzo Salt and facilities at Delle) and homesteads will dominate the landscape. Given the great distances involved and the lighting features employed at the facility, nighttime views of the facility are not expected to be obtrusive.

These features will not present a significant impact on the area's scenic resources nor will the facility be inconsistent with the visual resource management (VRM) objectives that the BLM has established for its abutting property. Public land administered by the BLM within the 5-mile study radius has a VRM classification of Class IV. VRM Class IV lands allow activities that may result in major modifications to the existing character of the landscape and that may dominate the view and be a major focal point for the viewer. A Class IV designation anticipates high levels of change in the visual character of the landscape, yet attempts should be made to control the impact of activities through repetition of visual elements, sensitive siting, and minimization of disturbances (BLM, 1988).

Appendix 4A presents artist's concepts of the PFSF viewed from locations that the public would reasonably find accessible, including the highest accessible point (private road) of Deseret Peak, the Skull Valley Band of Goshute tribal village, the Pony Express Store on the reservation, and from the Skull Valley Road on the reservation.

4.2.9 Radiological Effects

The storage system is a passive design with the spent fuel stored dry within sealed canisters. Under normal conditions, there will be no handling of individual fuel assemblies at the PFSF. There are no liquid or gaseous radioactive effluents released from the PFSF to the surrounding environment under normal conditions of operation. Potential effects of radioactive material releases from the PFSF during postulated off-normal and accident conditions are assessed in Chapter 5, including impacts of accidents on the surrounding population.

4.2.9.1 Radiation to the Nearby Population and Onsite Personnel

4.2.9.1.1 Nearby Population

During normal conditions, the PFSF operations will emit radiation that will be monitored with thermoluminescent dosimeters (TLDs) posted along the perimeter of the RA and along the OCA boundary fence. Effects of radiation emitted from the storage casks to the environment are assessed in Sections 7.3 and 7.6 of the PFSF SAR, where doses are estimated to offsite individuals.

The site is located a substantial distance from population centers, and there are no towns within 10 miles of the PFSF. There are about 36 residents within the 5-mile study radius of the PFSF, with the nearest residence located approximately 2 miles east-southeast of the PFSF. The nearest town, Dugway, is a military town on the Dugway Proving Grounds with a population of approximately 1,700, located about 12 miles south of the PFSF. Terra, a small residential community of about 120 people, is located 10 miles east-southeast of the PFSF.

Figure 3.1-1 shows the PFSF OCA boundary fence, which serves as the site boundary. Areas at and beyond the OCA fence are considered to be offsite. Maximum dose rates of 1.94 E-3 mrem/hr (HI-STORM) and 1.21 E-3 mrem/hr (TranStor) were calculated at

the OCA boundary fence 600 meters from the RA fence at its closest points of approach. These dose rates are comprised of direct and scattered gamma and neutron radiation assumed to emanate from 4,000 storage casks and are conservatively based on the assumption that all 4,000 casks contain fuel with 40-GWd/MTU burnup and 10-year cooling time. For these conditions, a hypothetical individual spending 2,000 hours a year at the OCA fence will receive a maximum annual dose of 3.88 mrem, which is below the 25 mrem annual dose limit to any real individual located beyond the controlled area boundary of 10 CFR 72.104.

The nearest residence is located approximately 2 miles east-southeast of the PFSF. As discussed in Section 7.3 of the PFSF SAR, a total dose rate of 2.7 E-6 mrem/hr is estimated at about 2 miles from the fully loaded PFSF, taking no credit for intervening shielding from berms, natural terrain, or buildings at the PFSF. Assuming full-time occupancy (8,760 hrs/yr), this equates to an annual dose of about 0.024 mrem, which is well within the 25 mrem annual dose limit of 10 CFR 72.104. Doses to other members of the surrounding population from the PFSF will be less. This represents a negligible impact to the surrounding population from normal operations at the PFSF.

4.2.9.1.2 Onsite Personnel

The PFSF operational organization is shown in SAR Figure 9.1-3. A list of personnel identified in Figure 9.1-3 that are expected to receive occupational radiation exposure is provided below, identified by the following four categories: (1) personnel receiving, transferring, and moving spent nuclear fuel to storage; (2) personnel involved with security, inspection, and maintenance; (3) personnel at the facility not directly associated with Items 1 or 2; and (4) personnel involved at the proposed Intermodal Transfer Point. Following each organizational breakout there is an indication of which of the above categories these personnel are involved with and the number of personnel involved. For instance, the instrument/electrical and mechanical maintenance personnel are involved in receipt, transfer, and moving SNF to storage (Category 1), performing

maintenance operations (Category 2), and they are also involved in intermodal transfer operations (Category 4). The radiation protection personnel and Emergency Preparedness/Training Coordinator (who provides health physics backup) are involved in receipt, transfer, and moving SNF to storage (Category 1), performing radiological inspections/surveillances at the PFSF (Category 2), and could provide any necessary health physics coverage of intermodal transfer operations (Category 4).

Instrument/Electrical Maintenance personnel (Cats. 1, 2, and 4)	(4)
Mechanical Maintenance/Operations personnel (Cats. 1, 2, and 4)	(4)
Quality Assurance personnel (Cats. 2 and 4)	(3)
Emergency Preparedness/Training Coordinator, health physics backup (Cats. 1, 2, and 4)	(1)
Radiation Protection personnel (Cats. 1, 2, and 4)	(3)
Security personnel (Cats. 2 and 4)	(18)
Nuclear Engineering (Cat. 3)	(1)
Transportation Specialist	(1)
Total number of personnel expected to receive occupational exposure	(35)

As seen from the above, most of the personnel in the PFSF operational organization are expected to receive occupational exposure. A list of personnel identified in SAR Figure 9.1-3, Operational Organization, that are not expected to receive occupational exposure under any of the above listed Categories 1 – 4 is provided below.

Nuclear Engineering Secretary	(1)
Administrative Assistant	(1)
Administrative Secretary	(1)
Public Relations Coordinator	(1)

Financial/Purchasing Specialist	(1)
Total number of personnel not receiving occupational exposure	(5)

SAR Section 7.4 provides an estimate of occupational radiation doses to personnel working at the PFSF as a result of canister transfer operations, security inspections, storage cask surveillance and maintenance.

4.2.9.2 Effects of Radiation on Wildlife

Regarding the effects of ionizing radiation on wildlife, National Biological Service, 1994, under the section entitled "Effects: Ionizing Radiations", states the following:

> "Overall, the lowest dose rate at which harmful effects of chronic irradiation have been reliably observed in sensitive species is about 1 Gray/year (Gy/year). This value for acute radiation exposures is about 0.01 Gy."

> "In general, the primitive organisms are the most radioresistant taxonomic groups and the more advanced complex organisms - such as mammals - are the most radiosensitive (Fig. 7). The early effects of exposure to ionizing radiation result primarily from cell death; cells that frequently undergo mitosis are the most radiosensitive, and cells that do not divide are the most radioresistant. Thus, embryos and fetuses are particularly susceptible to ionizing radiation, and very young animals are consistently more radiosensitive than adults..."

The 1 Gray/year threshold of harmful effects stated in National Biological Service, 1994, Reference 1 is equal to 100 rad/year.

Regarding the effects of chronic radiation on mammals, IAEA 1992, Section 2.2.2.2, concludes the following:

"Overall it may be concluded that a dose rate of ≈ 10 mGy · d^{-1} represents the threshold at which slight effects of radiation become apparent in those attributes, e.g. reproductive capacity, which are of importance for the maintenance of the population. The laboratory studies tend to indicate a slightly higher threshold, but this may be due to other stresses being fewer or less severe than those experienced by natural populations."

10 mGy/day is equal to 1000 mrad/day, or 1 rad/day.

Regarding the effects of chronic radiation on birds, Section 2.2.2.3 of IAEA 1992 states the following:

"Studies of chronic irradiation of bird populations are inherently more difficult because of bird's mobility: hence relatively little work has been done in this area. A few investigators (e.g. [111, 112]) have studied the nesting success of passerine birds in irradiated ecosystems. In these studies, exposure rates of 21 R·d^{-1} (0.2 Gy·d^{-1}) caused embryonic mortality. In contrast, the breeding success of swallows and wrens exposed to 18-160 μC · kg^{-1}· d^{-1} (≈0.7 - 6 mGy·d^{-1}) appeared essentially normal [113]. However, large dose rates (1 Gy·d^{-1}) reduced hatching success [99]. Longevity was not investigated in these studies. The minimum chronic exposure level at which effects on reproduction or mortality would become manifest does not seem to be well established."

The ≈0.7 to 6 mGy/day for which breeding success of swallows and wrens appeared normal equates to 70 to 600 mrad/day. The upper limit of 600 mrad/day equates to:

(600 mrad/day) (365 days/year) (1 rad / 1000 mrad) = 219 rad/yr

Section 2.2.2.4 of IAEA 1992 discusses reptiles, relating the effects of a study of chronic radiation exposure of ≈2 rad/day on different species of lizards. The study concluded that there were no significant differences in sex ratios, age distributions,

or life spans between irradiated and control iguanid lizards, but after one or two years females of two other lizard species occupying the same enclosure became sterile. IAEA 1992 includes discussion of possible reasons for the differences, but does not provide a minimum chronic exposure level for adverse effects of ionizing radiation to lizard populations.

Based on the above information, PFS uses the 1 Gray/year value from National Biological Service, 1994, (which is a more recent publication than IAEA 1992), the "lowest dose rate at which harmful effects of chronic irradiation have been reliably observed in sensitive species" as the criteria for acceptability at the PFSF. As stated above, this equates to an annual dose of 100 Rad.

4.2.9.2.1 Potential for Wildlife in the Vicinity of Storage Casks

As discussed in Section 4.2.2, avian species are likely to be attracted to the casks, buildings, and light posts for perching and potential nesting because of the limited perching/nesting sites available in the valley. In addition, the exterior surfaces of the casks are at above-ambient temperatures, which will be attractive to birds, small mammals, and reptiles, during the winter. Section 4.2.2 also discusses measures that will be implemented to keep wildlife away from the storage casks.

4.2.9.2.2 Calculated Doses to Wildlife in the Vicinity of Storage Casks

The following discussion evaluates external radiation dose from the storage casks to animals in the vicinity of the PFSF. Doses to animals from radioactivity released to the environment are not evaluated since (unlike nuclear power plants) there are no radioactive liquid or gaseous effluents released from the PFSF. As stated in SAR Section 7.6.3, "The canisters are high integrity vessels sealed by welding and breach of a canister is not a credible event. Since there will be no liquid or gaseous effluents

released from the PFSF, there will be no doses attributable to effluents in the areas surrounding the PFSF."

Animals could find reasonably good habitat beyond the perimeter road that runs along the outside of the nuisance fence and surrounds the PFSF. Dose rates at the security fence produced by the PFSF cask array assumed to contain 4,000 casks have been calculated and are discussed in PFSF SAR Section 7.3.3.5. Holtec's analysis of 4,000 HI-STORM casks estimated dose rates at the north security fence (maximum dose rates) of 1.19 mrem/hr. SNC's analysis of 4,000 TranStor casks estimated dose rates at the north security fence of 0.455 mrem/hr. For reasons discussed in SAR Section 7.3.3.5, the dose rates calculated by the vendors from the array of 4,000 casks are considered to be conservative. As shown in PFSF SAR Figure 1.2-1, the nuisance fence is 20 ft from the security fence; there is a 10 ft wide strip of land between the nuisance fence and the perimeter road; and the perimeter road is 20 ft wide (also surfaced with compacted crushed rock). Therefore, the distance from the security fence to the outside of the perimeter road is 50 ft. It is conservative to consider doses to animals at the security fence.

Assuming an animal is continuously present at the security fence, and assuming the maximum dose rate at this fence calculated by Holtec and SNC, the annual dose would be:

Dose = (1.19 mrem/hr) (8,760 hrs/yr) (1 rem/1000 mrem) = 10.4 rem

An annual dose of 10.4 rem is below the 100 rad/year PFSF criteria, and harmful effects would not be expected even in sensitive species. The equivalent dose in units of rads is lower than the rem dose (if some of the dose is from neutrons), since quality factors having values greater than or equal to unity are used to multiply the rad dose (energy deposited) to arrive at the rem dose (damage effects on soft body tissue). While the quality factor for gamma radiation is 1 (Table 1004(b).1 of 10 CFR 20), quality factors for neutron radiation vary from 2 for low energy neutrons up to 11 for higher

energy neutrons up to 20 MeV (Table 1004(b).2 of 10 CFR 20). Presenting doses to animals in units of rads could be misleading, since biological effects of neutrons would not be accounted for. Doses here are specified only in units of rem, or mrem, since these units account for the greater biological damage to soft body tissue produced by neutron vs. gamma radiation and are thus more informative than mrad units for the purpose of evaluating the effects of radiation on wildlife, and the equivalent PFSF criteria for wildlife is considered to be 100 rem/year.

Dose rates and annual doses were calculated for animals assumed to be in contact with both HI-STORM and TranStor storage casks in PFSF Calculation No. 05996.02-UR(D)-008. The analysis assumed that an animal is in contact with a HI-STORM or a TranStor storage cask containing relatively hot PFSF spent fuel, represented by PWR fuel having 40,000 MWd/MTU burnup and 10 years cooling time (PFSF SAR Section 7.3.3.5). In addition to radiation from the cask contact, the analysis also included calculation of the contribution to the total dose rate from neighboring casks in the array. It was assumed that neighboring casks are the same model as the contact cask (HI-STORM or TranStor), and are loaded with average or typical PFSF spent fuel, represented by PWR fuel having 35,000 MWd/MTU burnup and 20 years cooling time (PFSF SAR Section 7.4).

Dose rates were calculated at two locations: 1) in contact with an inlet duct at the bottom of a cask, and 2) on top of the cask, in contact with the center of the storage cask lid. It is conservative to assume the animal is on contact with the inlet duct of a cask containing relatively hot PFSF fuel, since dose rates at the inlet ducts are higher than dose rates at the concrete at the base of the cask away from the inlet ducts due to scattered radiation paths through the cooling air ducts. The dose point identified in the vendor SARs at the top of the storage casks is at the center of the cask lid. Therefore, it is assumed that birds that perch on top of a storage cask are located in the center, in contact with the lid. Based on the total dose rates calculated for animals in contact with

the air inlet ducts and tops of the HI-STORM and TranStor storage casks, annual doses were estimated assuming that the animals were in contact with the cask for one-half year (4,380 hours) and spend the remainder of their time at a location where dose rates are insignificant by comparison.

The following is a compilation of dose rates and annual doses for animals assuming contact with a storage cask 50% of the time, determined in PFSF Calculation No. 05996.02-UR(D)-008.

Receptor Point Location	Gamma Dose Rate (mrem/hr)	Neutron Dose Rate (mrem/hr)	Total Dose Rate (mrem/hr)	Annual Dose Assuming Animal Spends 1/2 Year in Contact with Cask (Rem/year)
Contact with Air Inlet Duct of HI-STORM cask, PWR fuel	11.43	2.56	14.0	61.3
Contact with Top of HI-STORM cask (center lid), PWR fuel	7.01	3.20	10.2	44.7
Contact with Air Inlet Duct of TranStor cask, PWR fuel	22.0	4.75	26.8	117
Contact with Top of TranStor cask (center lid), PWR fuel	21.8	98.6	120	526
Contact with Top of TranStor cask (center lid), BWR fuel	23.2	125.2	148	648

Calculated annual doses to animals that could spend time in contact with the HI-STORM storage cask inlet ducts and lid are less than the 100 rad/year PFSF criterion. Calculated annual doses to animals that could spend time in contact with the TranStor storage cask inlet ducts are slightly in excess of the 100 rad/year PFSF criterion, while annual doses to a bird postulated to be in contact with the top of the TranStor storage cask for one-half the time during a year are well above this criterion. Shielding on top of the storage casks differs significantly between the HI-STORM and TranStor designs. While the steel canister lids provides similar shielding for the two designs, the HI-STORM storage cask lid includes a 10.5 inch thick concrete plug in addition to approximately 5 inches of steel, whereas the TranStor storage cask lid is 0.75 inch

steel. This results in higher dose rates above the TranStor storage cask, consisting primarily of neutron radiation.

Since animals on contact with storage casks could potentially exceed the 100 rad/year PFSF criteria for wildlife, PFS will take actions to assure wildlife does not spend significant amounts of time inside the PFSF Restricted Area fence as discussed in Section 4.2.2.

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4.3 EFFECTS OF CONSTRUCTION AND OPERATION OF THE SKULL VALLEY ROAD TRANSPORTATION CORRIDOR

This section of the report discusses impacts on the existing environmental baseline, described in Chapter 2, associated with utilizing the Skull Valley corridor to transport casks from the Intermodal Transfer Point (ITP) to the PFSF.

Two means of cask transport from the railroad mainline to the PFSF are under consideration, heavy haul tractor/trailer via Skull Valley Road or rail transport via a new rail line. This section describes the heavy haul transportation alternative via Skull Valley Road. Section 4.4 describes the new rail line which is the preferred means of cask transport to the PFSF.

4.3.1 Effects on Geography, Land Use, and Demography

The Intermodal Transfer Point will require alteration of approximately 11 acres of land for the building, access road, and rail sidings. This estimate assumes that conventional construction practices will occur and that no additional land acquisition will be required. A 500 ft access road will be constructed connecting the ITP to the existing frontage road. The proposed ITP is located on previously disturbed public land administered by the BLM that is currently not in use. No relocation of residential, commercial, or industrial structures is anticipated under this alternative. There are no known wetlands or other environmentally sensitive areas near the ITP and access road. Demographic impacts will also be minimal.

The portion of the existing Skull Valley Road that will accommodate transportation of storage casks is approximately 24 miles long, beginning at Interstate 80 near Timpie nd continuing south to the PFSF site. An additional 1.8 miles of frontage road between the intermodal transfer point and Skull Valley Road will also be utilized.

Utilization of heavy haul equipment for cask transportation will result in the transportation vehicle passing within approximately 50 ft of 2 two story residences located along Skull Valley Road. Additional survey work will be performed to identify and mitigate any potential impacts to these residences.

4.3.2 Effects on Ecological Resources

Heavy haul transportation of storage casks from the intermodal transfer point to the PFSF (approximately 26 miles) will not require any land disturbance or widening of the existing frontage or Skull Valley Roads to accommodate the specialized heavy haul tractor/trailer. About 11 acres of land will be disturbed at the intermodal transfer point for the building, access road, and rail sidings. In general, the small amount of vegetation lost will be a minor impact as much of this land is composed of common habitat types, such as desert shrub/saltbush. Areas that are temporarily disturbed during construction will be revegetated. A detailed revegetation plan will be developed in consultation with the BLM for the ITP. The plan will be developed during construction and will incorporate the latest requirements/recommendations for soil preparation, type of seed mix, time of year to plant, watering frequency, etc. The revegetation plan will follow guidelines currently used by the BLM such as the Interagency Forage and Conservation, Planting Guide for Utah, EC 433, or later documents in effect at the time the plan is developed.

No federal or state-listed threatened or endangered plant species are known to occur within the ITP and Skull Valley Road transportation areas (letters from USFWS, Utah Field Office, dated February 10, 1997, February 27, 1997, and July 31, 1998 and UDWR, 1997).

Increased traffic on Skull Valley Road during construction and project operations could result in temporary minor impacts on wildlife that frequent the road area by altering individual behavioral patterns for some species (including mule deer, black-tailed jack

rabbits, and pronghorn antelope) and increasing rates of carrion. Section 4.1.7 discussed the anticipated increase in traffic volume.

The Horseshoe Springs Wildlife Management Area (WMA), located approximately 9.5 miles south of Timpie, is a wetland/riparian area that has been designated an Area of Critical Environmental Concern (ACEC) by the Bureau of Land Management (BLM). Because the wetland/riparian habitat at Horseshoe Springs is located approximately 1100 ft west of the road, transportation activities are unlikely to affect any species located at the springs, other than a temporary disturbance. Therefore, the Horseshoe Springs area should not be adversely impacted by transportation corridor activity.

The UDWR recommended (UDWR letter dated March 27 1997) that precautions need to be taken to ensure that water pollution does not occur, to protect the speckled dace, mink, and high interest amphibian species. If pollution does occur, current methodology for containment and cleanup should be used. No water pollution is likely to occur as a result of this project. However, spill prevention and emergency cleanup plans will be established.

The proposed intermodal transfer point is at a previously disturbed site on public land administered by the BLM. Potential mitigation or protection measures will be developed in consultation with UDWR to ensure that no further adverse affects will result from project activities at this location.

According to the BLM (personal communication with K. Gardner, Wildlife Biologist, Salt Lake City District Office, BLM, February 25, 1997) raptor nests may be located in trees along the Skull Valley Road, primarily at ranch sites. Many raptors are sensitive species and may be afforded some level of protection by the Endangered Species Act,Migratory Bird Act, Bald and Golden Eagle Protection Act, BLM, and/or UDWR (Utah Code 23-13-2(43)) restrictions. BLM and UDWR restrictions prohibit construction activities within 0.5 miles of an active raptor nest during nesting activities. No impacts on protected

raptor nests are anticipated since no construction activities will occur within 0.5 miles of current nesting locations.

The peregrine falcon and occasional transient bald eagles are the only federally or state listed endangered or threatened species occurring in the transportation corridor (letters from USFWS, Utah Field Office, February 10, 1997, February 27, 1997, and July 31, 1998 and UDWR, 1997). Peregrine falcons nesting at Timpie Springs hunt only within the northern 10 miles of the transportation corridor. Construction activities at the intermodal transfer point area are unlikely to affect the falcon's forage base of small mammals and birds because of the small amount of land to be altered in this area. Protection measures will be developed in consultation with UDWR and USFWS prior to initiation of construction, to ensure that there are no adverse impacts on falcons nesting at Timpie Springs.

4.3.3 Effects on Air Quality

There will be minor construction impacts on air quality resulting from the alteration of 11 acres of land for the Intermodal Transfer Building, which involves moving approximately 10,000 cubic yards of earth. Emissions of particulate matter with an aerodynamic diameter less than or equal to a nominal 10 microns (PM-10) are estimated for construction activities including: clearing/excavation; vehicular traffic on unpaved roads; wind erosion from temporary topsoil piles; material handling; bulldozing; compacting; and grading. Emissions of PM-10, nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC) are also estimated from construction vehicle operation. Calculations of concentrations of these pollutants in ambient air are not meaningful as there are no sensitive receptors in the vicinity of the facility that can be impacted by these emissions.

Estimates of air pollutant emissions due to construction activities are determined on the basis of estimated material handling (e.g., cubic yards of topsoil moved) and reasonable

assumptions regarding construction equipment mileage and hours of operation during the construction period. Emissions estimates are provided for fugitive dust (PM-10) caused by clearing / excavation; vehicular traffic on unpaved roads; wind erosion from temporary topsoil piles; material handling; bulldozing; compacting; and grading. Applicable gaseous criteria pollutant emissions from equipment use (i.e., NO_x, CO, PM, and VOC) are also provided. Most of the construction activities are assumed to be occurring simultaneously during any given construction month for purposes of ensuring conservatism in these emissions estimates.

The emission factors used in the estimates for construction activities are taken from the 5th edition of EPA's AP-42 document (EPA, 1998) assuming reasonable levels of emissions control as needed to satisfy DEQ requirements. On-road truck exhaust emissions are based on emission factors taken from the pending 5th edition of EPA's AP-42 document (EPA, 1998a). These factors apply to heavy duty diesel powered vehicles (HDDV) operated at high altitudes (~5,550 ft MSL) for model year 1996 or later at the federal test method speed of 19.6 mph. Non-road construction equipment exhaust emission factors are taken from EPA's Nonroad Emissions Model (EPA, 1998b).

The construction equipment exhaust emission factors used in this calculation are as follows:

On-Road Dump and Watering Truck Exhaust (grams/mile @ 19.6 mph):

$E(NO_x) = 6.5$
$E(CO) = 17.2$
$E(VOC) = 4.7$
E(PM) = N/A

Non-Road Construction Equipment Exhaust (grams/bhp-hr):

Bulldozers: $E(NO_x) = 10.4$
$E(CO) = 1.8$
$E(VOC) = 0.56$
$E(PM) = 0.50$

Roller: $E(NO_x) = 9.2$
$E(CO) = 3.9$
$E(VOC) = 0.74$
$E(PM) = 0.94$

Loader: $E(NO_x) = 10.4$
$E(CO) = 7.9$
$E(VOC) = 2.2$
$E(PM) = 1.35$

The estimated air pollutant emissions associated with the construction of the Intermodal Transfer Building are summarized in Table 4.3-1.

The effects on air quality of cask transport between the ITP and the PFSF for heavy haul transportation have been quantified relative to annual air pollutant emissions and impacts on sensitive receptors. The assessment considers the number and types of vehicles used over the course of a year along with the total mileage covered, vehicle speed and appropriate air pollutant emission factors. Sensitive receptor impacts are determined in a conservative manner based on the few residences located along Skull Valley Road. There are no residences along the access road.

It is expected that 2-4 round trips per week will be required for the Skull Valley Road heavy haul option. Each trip would bring one full cask from the ITP to the storage facility and return one empty cask to the ITP. However, it is possible that the truck dropping off a full cask will return without the empty cask resulting in an empty truck being sent to deliver the empty cask to the ITP requiring an additional round trip. This should occur no more than half the time for a maximum of two additional rounds trips per week to pick up the empty casks left behind at the storage facility. This would result in a maximum of six round trips per week or 312 round trips per year. With a one way mileage of approximately 26 miles, the worst case truck mileage would be about 20,000 miles per year. The estimated truck speed is expected to be 20 miles per hour (mph).

The annual air pollutant emissions potential resulting from the heavy haul alternative are estimated on the basis of the vehicle miles traveled per year and the EPA standards that apply to heavy duty vehicles (HDV). The EPA HDV standards vary by model year of vehicle. For purposes of these estimates, the 1994 standards are assumed for the heavy duty diesel trucks that would be used for cask transport.

The air pollutants for which emissions estimates are provided include HC, CO, NO_x and PM. The emission factors used in this assessment are expressed as grams per brake horsepower per hour (g/bhp-hr) and are summarized below for heavy duty trucks:

Pollutant	Emission Rate, g/bhp-hr
HC	1.3
CO	15.5
NO_x	5.0
PM	0.1

The annual hours of operation can be calculated based on an annual mileage of 20,000 miles and the maximum speed of 20 mph to be 1,000 hours. Therefore, assuming a 450 bhp heavy duty diesel truck engine, the worst case annual air pollutant emissions potential in tons per year are:

Pollutant	Emissions, tons/yr
HC	0.6
CO	7.7
NO_x	2.5
PM	0.05

It can be concluded that the emissions from diesel truck operations are minimal when compared to existing (1994) Tooele County emissions that are 3-4 orders of magnitude higher.

The localized impacts of the truck traffic on residences along Skull Valley Road were examined using the EPA CAL3QHC, Version 2.0 dispersion model dated 95221 (EPA 1995c). This is the EPA recommended method for such analyses (EPA 1992). This model is based on the California Line Source (CALINE3) dispersion model with the inclusion of algorithms to estimate the length of vehicle queues at signalized intersections. This model calculates CO concentrations at sensitive receptors near highways and arteries due to free flow traffic, as well as for idling vehicles at intersections. CO is the pollutant emitted in the greatest amounts from most vehicles.

The input data to the model consist of vehicular emission rates, roadway geometries (i.e., number, width, and length of lanes), meteorological conditions, traffic volumes, signal timings, and receptor locations. In the case of cask transport, free flow conditions with no intersection idling were assumed. The receptors (i.e., residences) were conservatively assumed to be located on both the east and west sides of the road with a separation distance of 50 feet between the road and residences. The CO emission rate for heavy duty trucks discussed earlier was used in this analysis along with an assumed maximum speed of 20 mph. A conservative one truck per hour was assumed as a peak traffic volume. A meteorological condition of E-stability class and a wind speed of 1.0 meter per second was also employed in the analysis, considering 36 different wind direction 10-degree azimuth ranges.

The CAL3QHC model results were negligible for a 1-hour ground level concentration due to the very infrequent passage of the cask truck. Much more traffic volume per hour is needed for quantifiable concentrations to occur.

Therefore it can be concluded that insignificant impacts of criteria pollutants are expected as a result of the cask transport along Skull Valley Road corridor.

4.3.4 Effects on Hydrological Resources

Hydrologic features along the existing Skull Valley Road corridor consist of shallow, intermittent drainages that head in the steep canyons of the Stansbury Mountains, east of the road. These drainages lead to shallow roadside ditches, and culverts convey any runoff beneath the road to the west. Running water or water standing in the ditches has not been observed at any location between the PFSF and the ITP area between June 1996 and May 1998.

Springs occur at several locations along Skull Valley Road, surfacing at various distances west of the highway. Utilizing the ITP frontage and Skull Valley Roads to accommodate heavy haul vehicles is judged to have no additional impact on the existing hydrological resources along the road right-of-way.

4.3.5 Effects on Mineral Resources

No mineral resources have been identified at the ITP and along the ITP frontage and Skull Valley Roads. Therefore, no impact to this resource is expected. Refer to Section 4.1.5 for additional discussion on Skull Valley mineral resources, claims and leases.

4.3.5.1 Imported Materials Required for Construction

The type and quantity of required imported materials necessary for construction of the ITP site are provided in Table 4.1-6. PFS does not intend to obtain any required imported construction materials from Federal or Tribal lands, but plans to obtain materials from private, commercial sources in and around the Skull Valley area. Refer to Section 4.1.5.1 for additional information on aggregate sources located in and near Skull Valley in Tooele County, Utah.

4.3.5.2 Excess Materials Resulting from Construction Activities

The quantity estimates from the current design indicate that construction of the ITP will only generate excess material resulting from stripping operations. This quantity, approx. 9,300 cubic yards, would be used as slope dressing at the ITP. The roadway embankment would be "over built" i.e. its slope would be flatter than the proposed 2 horizontal to 1 vertical. The stripped material would contain organic material and therefore would promote the growth of vegetation on the slope. This would increase the stability of the slope and decrease the potential for erosion. No material will be disposed of off site.

4.3.6 Effects on Socioeconomic Resources

Minor short-term employment will result from construction activities associated with the intermodal transfer point. These activities will utilize a small local labor force commuting daily to the project area and will not require relocation. Therefore it is anticipated that no adverse impacts on socioeconomic resources will result from these activities. Operationally, the infrequent transport of casks along Skull Valley Road will have no adverse socioeconomic impacts.

Number of Workers for Activities at the Intermodal Transfer Point

Construction

The estimate of 130 workers from Section 4.1.1 does not apply to construction at the ITP. As stated in Section 4.3.1, construction at the ITP will involve alteration of 11 acres of land for the gantry crane enclosure (Metal building), access road, and rail siding. The work will involve earthwork to level the site, grade the access road, and prepare the rail bed, pour the building foundation, erect the gantry crane and metal building, install building electrical and mechanical infrastructure, lay railroad track, pave the access road, and install site fencing. Equipment will include bulldozers, scrapers,

dump trucks, front end loaders, compactors, graders, water trucks, rail lying equipment, mobile crane, cement trucks, and an asphalt paver. The work will be performed within a year, principally during daytime hours and is estimated to take approximately 35 workers including equipment operators, laborers, electricians, iron workers, concrete finishers, and construction supervision staff.

Operation

The number of workers stated in Section 4.1.1 for operation of the storage facility (43 workers) does include the workers required for operations at the ITP. As noted in Section 4.3.7, it is expected that 2-4 round trips per week will be required to move the shipping casks from the ITP to the storage facility. Transfer of a shipping cask will involve moving a rail car loaded with a cask from a siding to the gantry crane, lifting the shipping assembly off the rail car and moving it onto the heavy haul trailer, and transferring the cask from the ITP to the storage facility. This process is estimated to require a 4-man crew. Since the ITP is not normally manned, the work crew that transfers the shipping cask from the rail car to the heavy haul trailer will be the same 4-man crew that will transport the heavy haul trailer to the storage facility. These activities will be conducted principally during daytime hours.

4.3.7 Effects of Noise and Traffic

It is expected that 2-4 round trips per week will be required for the heavy haul transportation of casks along the 26-mile segment of the existing ITP frontage and Skull Valley Roads. The heavy haul tractor/trailer will travel at an estimated 20 mph resulting in a brief maximum sound level, 50 feet from Skull Valley Road, of 85 dBA. This is similar to a conventional tractor trailer at normal highway speeds, however, the duration of the noise will be longer due to the slower speed. Due to the infrequency of these trips and because of the undeveloped nature of Skull Valley (only 2 residences within 50 ft of the roadway) no significant noise impacts are anticipated from this minor

increase in sound levels. Since each occasional pass by is an isolated event, the maximum sound levels, rather than the hourly energy average sound level, which is much lower, is reported here.

Typical Time of Day of Shipments

Typically, work at the ITP will be planned for day shift hours. As shipments arrive at the ITP, crews will be dispatched to drive the empty heavy haul tractor/trailer to the ITP as necessary during work hours. Transfer of a shipping cask from a rail car to the heavy haul trailer will take approximately 4 hours. Therefore, the return trip with a loaded heavy-haul vehicle would be near the end of the same day.

Time to travel from the ITP to the PFSF

The time for the heavy-haul shipment to travel from the ITP to the PFSF is determined as follows:

> The heavy-haul vehicle will travel a minimum of 20 mph in accordance with UDOT Utah Regulations for Legal and Permitted Vehicles, Section 600.
>
> The travel distance from the ITP to the PFSF is 26 miles.
>
> Therefore, 26 miles / 20 mph = 1.3 hours

Assume with start and stop time the trip will take approximately 1.5 hours.

Pilot/Escort Vehicle Requirements

In accordance with UDOT Utah Regulations for Legal and Permitted Vehicles, Section 600 (Oversize Loads), pilot/escort vehicles will be required in the front and rear of the heavy haul tractor/trailer due to its length. The distance between the pilot/escort vehicles and the heavy haul vehicle is not specified in the Regulations but is presented in the Utah Escort Certification Manual as follows: The front pilot/escort vehicle needs to be far enough ahead to alert the load vehicle driver of any upcoming problems. The rear pilot/escort vehicle needs to be far enough behind to warn trailing vehicles of the slow/oversize load ahead. These distances are based on the escort's judgement and depend on traffic levels, highway conditions, and heavy-haul vehicle speed. It is anticipated that the pilot/escort vehicles will need to travel no more than approximately 1000 ft from the heavy-haul vehicle since Skull Valley Road has little traffic and is flat and straight allowing long sight distances.

Distance and Time Required to Pass Heavy-Haul Shipment

The current level of service (LOS) on Skull Valley Road is level A (least use) so it is anticipated that there will be very few vehicles desiring to pass the heavy-haul vehicle. The heavy-haul vehicle will be moving at a slower rate of speed (estimated at near the minimum of 20 mph) than the posted limit of 55 miles per hour, which will require other traffic to reduce travel speed or make passing maneuvers. Because of the distances between the heavy-haul vehicle and pilot/escort vehicles, it is assumed that vehicles desiring to pass will do so in three passes versus one long passing maneuver. Passing the pilot/escort (two-axle truck, i.e., pickup) and heavy-haul vehicles should present few problems because of the large difference in vehicle speeds, the highway is straight providing ample passing distance/maximum visibility, and there would most likely be no oncoming traffic. Assuming the heavy-haul vehicle, which is approximately 175 ft long, is traveling 20 mph and the passing vehicle has slowed somewhat from 55 mph to 45

mph and is starting and ending their passing maneuver in the same lane 100 ft from the heavy-haul vehicle, the time and distance required to pass would be:

45 mph = 66 fps, 20 mph = 29 fps

distance traveled by passing vehicle (d) = (66 fps) x time (t)

= 100' (behind) + 175' (truck length) + 29t (truck travel dist.) + 100' (ahead)

66t = 375 + 29t
37t = 375
t = 10.1 sec

d = 66 x 10.1 = 667 ft

Limits on heavy haul transport at night

UDOT Utah Regulations for Legal and Permitted Vehicles, Section 600.3 state that overweight/oversize vehicles are generally prohibited from operating during hours of darkness. However, there are provisions in the regulations where movement after dark is permitted if it is determined by the Department to be in the best interest of safety and convenience.

As discussed in section 4.1.7.1, the current level of service (LOS) on Skull Valley Road is level A. The heavy haul tractor/trailers will be moving at a slower rate of speed (estimated at 20 mph) than the posted limit of 55 miles per hour, requiring other traffic to reduce travel speed or make additional passing maneuvers. Due to the infrequent number of round trips per week (2-4) and the ample opportunity for passing maneuvers afforded along Skull Valley Road, the heavy haul transportation of casks along the 26-

mile segment of the existing ITP frontage and Skull Valley Roads will have minimal impact on traffic and will not lower the LOS. There will be no affect on emergency response time for public safety vehicles.

4.3.8 Effects on Regional Historical, Cultural, Scenic, and Natural Features

The heavy haul transportation of casks involves utilizing a 26-mile segment of the existing ITP frontage and Skull Valley Roads. The ITP, including access road and new rail siding will occupy approximately 25 acres of previously disturbed land. Section 106 of the National Historic Preservation Act, as amended, requires that federal agencies take into account the effects of undertakings on properties listed or eligible for listing in the National Register of Historic Places. The Advisory Council on Historic Preservation (ACHP) regulations (36 CFR 800) set forth a consultation process among the federal agency, the SHPO, and the ACHP. For the purposes of compliance with Section 106, the area of potential effect means the geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if such properties exist (36 CFR 800.2(c)).

A Class III cultural resource survey in the area of potential effect at the intermodal transfer point was performed in May and June 1999. In Utah, a Class III survey includes a literature search of prior surveys, a walkover of the project area, and sufficient subsurface testing to determine whether any potentially significant sites meet the criteria for listing in the National Register of Historic Places. The results of the survey are discussed in Section 2.9.1. No regional historic, archeological, architectural, or cultural resources were identified in areas surveyed.

Section 3.3.2 describes operations involving transport of shipping casks to the PFSF by means of heavy haul vehicle. The ITP has multiple sidings to receive single purpose trains transporting spent nuclear fuel (in-bound) and to process the return of cars (out-

bound) for another spent fuel delivery cycle. The viewing vista for the traveling public is essentially limited to the I-80 corridor. The adjacent frontage road, which provides access to the MagCorp facility approximately 13 miles north of the ITP, offers little difference to the viewing public from those traveling on I-80 as they are in close proximity to each other. The view of the ITP from I-80 / frontage road is very similar to those with regard to other existing industrial facilities along I-80 (salt plants and the Timpie, UT siding area which is frequently used by Union Pacific).

The rail equipment parked on the sidings, including loaded casks (or cask) awaiting transfer to the heavy haul trailer and the railroad equipment awaiting pickup by Union Pacific, would be in full view of the traveling public on east and westbound I-80. This view, at the closest point, is approximately 550 feet.

Appendix 4A presents artist's concepts of the ITP as viewed from I-80.

4.4.2 Effects on Ecological Resources

The Low Corridor rail line will require alteration of 155 acres of public land administered by the BLM for the life of the PFSF. Generally, the ecological resources in the vicinity of the Low transportation corridor are similar to those found in the Skull Valley transportation corridor and at the PFSF site. No federal or state-listed threatened or endangered plant species are known to occur within the Low Corridor transportation area (letters from USFWS, Utah Field Office, dated February 10, 1997, February 27, 1997, and July 31, 1998 and UDWR, 1997).

Ecological resources potentially affected by construction of the Low Corridor rail line include both terrestrial vegetation and wildlife. Within the 200-foot right-of-way, construction activities would temporarily remove 776 acres of greasewood and desert shrub/saltbrush habitat. The 40-foot wide permanent rail line width required for operation will result in the permanent loss of approximately 155 acres while approximately 621 acres would be actively revegetated and restored to previous conditions after construction. This small amount of vegetation is minor compared to the over 1 million acres of desert shrub/saltbrush within Tooele County. There are also no unique vegetation habitat features in areas proposed for vegetation removal. A detailed revegetation plan will be developed in consultation with the BLM for the rail line. The plan will be developed during construction and will incorporate the latest requirements/recommendations for soil preparation, type of seed mix, time of year to plant, watering frequency, etc. The revegetation plan will follow guidelines currently used by the BLM such as the Interagency Forage and Conservation, Planting Guide for Utah, EC 433, or later documents in effect at the time the plan is developed.

Construction activities related to the Low Corridor will temporarily disturb resident wildlife species. Larger mammals would temporarily avoid the construction area, but likely return following the completion of construction. Prior to construction, a comprehensive wildlife survey should be conducted to assure that no kit fox, burrowing

owls, northern harriers, or ferruginous hawks are nesting (or denning) within 0.5 mile of the rail line. If any animals are located, mitigation plans such as construction timing restrictions should be implemented and alternative nest (or den) site locations should be established in consultation with the BLM, UDWR, and FWS to offset the loss of these sites due to construction and improve habitat for local populations.

Impacts to wild horses, mule deer and pronghorn antelope could occur if rail cars traveling the corridor collide with these animals. In addition, the rail corridor has the potential to divide natural wildlife travel corridors between the west and east sides of Skull Valley during construction. Because most of the water resources are concentrated on the east side of Skull Valley, construction and operation of the rail line could cause some wild horses, mule deer, and pronghorn antelope to avoid the area. Other animals may habituate to the noise of new construction and continue to cross the rail corridor. The level of impact to the local population of these species from construction and operation is expected to be minimal.

All other ecological resources identified in Section 2.3.3, such as migratory peregrine falcons, should not be adversely affected by construction activities, since these activities are temporary in nature. Additional consultation relative to threatened and endangered species may be required with the BLM and USFWS.

4.4.3 Effects on Air Quality

Although the construction of the Low Corridor rail line will require a significant amount of alteration of public land administered by the BLM, the overall impacts on air quality from construction and operation will be minor and limited to the general vicinity of the corridor. Any impacts will mainly be associated with emissions of fugitive dust from construction activities and from locomotive emissions during cask transport operations. No long-term impacts on the local meteorology/climatology will result from these activities.

Emissions of particulate matter with an aerodynamic diameter less than or equal to a nominal 10 microns (PM-10) are estimated for activities related to the construction of the Low Corridor Railroad Line including: clearing/grubbing; vehicular traffic on unpaved roads; wind erosion from temporary topsoil piles; material handling; bulldozing; compacting; scraping and grading. Emissions of total particulate matter (PM), nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC) are also estimated from construction vehicle operation and locomotive use for the installation of ballast, ties, and rail. Calculations of concentrations of these pollutants in ambient air are not meaningful as there are no sensitive receptors in the vicinity of the rail corridor that can be impacted by these emissions.

Estimates of air pollutant emissions due to construction activities are determined on the basis of estimated material handling (e.g., cubic yards of topsoil and cut moved) and reasonable assumptions regarding construction equipment mileage and hours of operation during the construction period. PM-10 emissions estimates are provided for fugitive dust caused by clearing/grubbing; vehicular traffic on unpaved roads; wind erosion from temporary topsoil piles; material handling; bulldozing; compacting; scraping and grading. Applicable gaseous criteria pollutant emissions from equipment use (i.e., NO_x, CO,, PM, and VOC) are also provided. Most of the construction activities are assumed to be occurring simultaneously during any given construction month for purposes of ensuring conservatism in these emissions estimates.

The emission factors used in the estimates for construction activities are taken from the 5th edition of EPA's AP-42 document (EPA, 1998) assuming reasonable levels of emissions control as needed to satisfy DEQ requirements.

On-road dump truck exhaust emissions are based on emission factors taken from the pending 5th edition of EPA's AP-42 document (EPA, 1998a). These factors apply to heavy duty diesel powered vehicles (HDDV) operated at high altitudes (~5,550 ft MSL) for model year 1996 or later at the federal test method speed of 19.6 mph. Non-road

construction equipment exhaust emission factors are taken from EPA's Nonroad Emissions Model (EPA, 1998b). The locomotive emission factors used are conservatively based on 1997 estimates provided by the Internet Web site DieselNet (http://www.dieselnet.com). The construction equipment exhaust emission factors (E) used in this calculation are as follows:

On-Road Dump Truck and Watering Truck Exhaust (grams/mile @ 19.6 mph):

$E(NO_x) = 6.5$
$E(CO) = 17.2$
$E(VOC) = 4.7$
E(PM) = N/A

Non-Road Construction Equipment Exhaust (grams/bhp-hr):

Graders:
$E(NO_x) = 9.5$
$E(CO) = 2.4$
$E(VOC) = 1.0$
$E(PM) = 0.76$

Scrapers:
$E(NO_x) = 8.6$
$E(CO) = 3.9$
$E(VOC) = 0.47$
$E(PM) = 0.96$

Bulldozers:
$E(NO_x) = 10.4$
$E(CO) = 1.8$
$E(VOC) = 0.56$
$E(PM) = 0.50$

Roller:
$E(NO_x) = 9.2$
$E(CO) = 3.9$
$E(VOC) = 0.74$
$E(PM) = 0.94$

Locomotive Operation (grams/bhp-hr):

$E(NO_x) = 13.5$
$E(CO) = 1.5$
$E(VOC) = 0.5$
$E(PM) = 0.34$

The estimated air pollutant emissions associated with the construction of the Low Corridor Rail Line are summarized in Table 4.4-1.

Similarly, the effects on air quality of the Low Corridor rail line cask transport between Low and the PFSF were assessed relative to annual air pollutant emissions since there are no residences to be impacted along the entire corridor. This assessment considers the total locomotive mileage, vehicle speed, and appropriate locomotive air pollutant emission factors. Generally, there will be 1-2 locomotive round trips per week; with each trip transporting full casks to PFSF, and returning back to Low Junction with empty casks. It is also possible that additional trips would be required to deliver empty casks to the mainline rail siding for pickup by the mainline train. The additional 2 round trips results in a bounding case of a maximum of 4 round trips per week, yielding 13,312 vehicle miles of rail travel per year. The largest train is expected to consist of 2 1500-horsepower locomotives with 6 cars containing casks, 2 empty cars, and a security car. The maximum train speed is expected to be 20 miles per hour.

The annual air pollutant emissions potential are estimated on the basis of annual vehicle miles traveled and emissions of current model diesel locomotive engines. The latter were based on current estimates (1997) from the Internet web site DieselNet. EPA standards were not applicable since they only apply to remanufactured engines, which may not be the case for the Low Corridor rail system. The criteria air pollutants for which emissions are provided include HC, CO, NO_x, and PM, expressed as grams per brake horsepower per hour and are summarized below for line haul locomotives:

Pollutant	Emission Rate, g/bhp-hr
HC	0.5
CO	1.5

NO_x	13.5
PM	0.34

At an average speed of 20 mph, the annual hours of locomotive operation, for 13,312 miles traveled, is 665.6 hours. Therefore, assuming 3,000 bhp locomotive for the two locomotives, the annual air pollutant emissions potential in tons/year is:

Pollutant	Emissions, tons/yr
HC	1.1
CO	3.3
NO_x	29.7
PM	0.7

It can be concluded that the emissions from the rail transport operations are trivial, when compared to existing (1994) Tooele County emissions that are 3-4 orders of magnitude higher.

4.4.4 Effects on Hydrological Resources

Because there are no existing surface water bodies and ground water is over 100 ft below the surface, it is unlikely that the rail line will have any impact on hydrological resources.

4.4.5 Effects on Mineral Resources

No mineral resources have been identified along the rail line corridor. Therefore, no impact to this resource is expected from the construction of a rail line. Refer to Section 4.1.5 for additional discussion on Skull Valley mineral resources, claims and leases.

4.4.5.1 Imported Materials Required for Construction

The type and quantity of required imported materials necessary for construction of the rail line are provided in Table 4.1-6. PFS does not intend to obtain any required imported construction materials from Federal or Tribal lands, but plans to obtain materials from private, commercial sources in and around the Skull Valley area. Refer to Section 4.1.5.1 for additional information on aggregate sources located in and near Skull Valley in Tooele County, Utah.

4.4.5.2 Excess Materials Resulting from Construction Activities

The rail line will generate excess material from stripping operations, approx. 125,000 cubic yards (40' x 169,127' x 0.5'). This material will be used to stabilize side slopes. Assuming a length of slope of 11.2' (for a 5' high embankment) and a length of 169,127 feet and both a left and right embankment, the depth of "excess" soil works out to be less than one foot (10.5"). The rail line as currently designed will also generate approx. 131,000 cubic yards of excess common fill. As the design is refined during final design, this quantity will be reduced. Any remaining excess material will be used as embankment material. No material will be disposed of off site.

4.4.6 Effects on Socioeconomics

No adverse impacts on socioeconomic resources are anticipated as a result of the new rail line. Minor short-term employment will result from construction activities associated with the rail line. These activities will utilize a local labor force commuting daily to the project area and will therefore not induce relocation of families and associated impacts on local government services.

Number of Workers for Activities at the Low Corridor Rail Line

Construction

The estimate of 130 workers from Section 4.1.1 applies to construction of the storage facility and not the Low Corridor Rail siding or rail line. The rail siding consists of three siding tracks just off the UP mainline approximately 2400 ft long. The rail line consists of 32 miles of railroad track. Both the rail siding and rail line will be constructed as one project utilizing the same construction crews. Construction activities will be conducted primarily during daylight hours and will be completed in approximately one-year.

During construction of the rail line, an estimated peak work force of 125 workers will be required for various tasks. The bulk of the manpower will be for the earthwork. This work will involve clearing, cutting and filling, installing culverts, contouring the ground for the required profile, finish grading, and seeding. The equipment will include bulldozers, scrapers, dump trucks, front-end loaders, compactors, graders, and water trucks. This portion of the work is estimated to take approximately 109 workers including equipment operators, laborers, electricians, iron workers, concrete finishers, and construction supervision staff.

The remainder of the work involves laying the sub ballast, ballast, ties, track, and spikes. A track-laying machine with dedicated work locomotives will be utilized. Approximately 16 workers will be required to support the track-laying machine.

Operation

The number of workers stated in ER Section 4.1.1 for operation of the storage facility (43 workers) does include the workers required for operation of the rail line. As noted in Section 4.4.7, there will generally be 1-2 locomotive round trips per week. Typically, 2 personnel will be required to operate the locomotives and perform the necessary coupling and uncoupling operations at the siding. The delivery of a train to the PFSF

from the siding area could occur at any time of the day although daytime hours are preferred in order to minimize shift schedule impacts.

4.4.7 Effects of Noise and Traffic

The distances between the proposed rail line and the residences along Skull Valley Road are on the order of 5 to 10 miles. The construction noise is not expected to be audible along Skull Valley Road.

Sound level predictions were made for the locomotive and rail cars delivering the casks to the site. The train noise predictions were based upon methodologies outlined in C.M. Harris's Handbook of Noise Control. The propagation calculations were made using atmospheric absorption at standard conditions. No credit was taken for ground absorption or wind and thermal gradients. The levels predicted are maximum levels which could occur with the receptor down wind. During calm clear days or receptor upwind conditions, the levels would be at least 20 dBA less than indicated.

There are some ranches and residences along Skull Valley Road between I-80 and the PFSF site. The proposed rail line parallels Skull Valley Road from the site northward to Low Junction. The distance between the rail alignment and Skull Valley Road in this region is approximately 5 miles. The maximum locomotive and rail car noise would be 31 dBA at Skull Valley Road, which may occasionally be just audible if the ambient sound level drops into the 20s dBA. Where the alignment turns east to the site, the levels may occasional reach 45 dBA and be audible.

North of 8 Mile Spring Road, Skull Valley Road veers north-northeast and the distance from the rail line increases to 7 miles at Horseshoe Springs, and to 10 miles where Skull Valley road intersects I-80. The predicted maximum rail noise to receptors along Skull Valley Road (near Eight Mile Spring Road) is 26 dBA, and 19 dBA at the

intersection of I-80 and Skull Valley Road. The train is not expected to be generally audible in this area.

Traffic on east-west roads is not expected to be affected or public safety threatened. The proposed new rail line will cross several roads. Most of the roads are little more than dirt jeep trails that are subject to little, if any, use. Eight Mile Spring Road, however, is graded. It appears that ranchers use the road to access the interior of Skull Valley, and that hunters and other recreationists travel the road on an infrequent basis to gain access to the southern end of the Cedar Mountains. Because of the unimproved nature of the roads, traffic usually proceeds at a reduced speed. The new rail line will be used only once or twice a week, with the trains traveling at approximately 20 miles per hour. Because the area is flat, unoccupied and unwooded, users of both the roads and rail line will have a virtually unlimited field of vision. Based on these factors, it is unlikely that the rail line will have any impact on traffic or vehicular safety.

4.4.8 Effects on Regional Historical, Cultural, Scenic, and Natural Features

The Class I cultural resource inventory for the Low Corridor rail line conducted in May 1998 included a study area of a mile wide corridor centered over the proposed rail line. The Class I Survey concluded that there is only a low probability of encountering archeological or historical sites in the proposed rail line corridor or ITP area.

A Class III Cultural Resource Inventory has been completed for the Low Transportation Corridor (P-III Associates, Inc., 1999a). In Utah, a Class III survey includes a literature search of prior surveys, a walkover of the project area, and sufficient subsurface testing to determine whether any potentially significant sites meet the criteria for listing in the National Register of Historic Places. The Class III inventory confirmed the location of the Hastings Cutoff (site 42T0709) along the Low Transportation Corridor, and resulted in the discovery of an additional site (42T01187) and eight isolated finds. None of the

isolated finds are considered eligible for inclusion in the National Register of Historic Places (NRHP).

Site 42T01187 is a rock alignment and cairn. The rock alignment is located approximately 550-ft East of the rail line centerline and therefore will be avoided by construction activities and operation of the rail line. Site 42T0709 is the Hastings Cutoff Trail in the immediate vicinity of the Low Transportation Corridor. This portion of the trail cannot be avoided by the Low Corridor rail line and therefore a Treatment Plan to preserve the significant historical data of the Hastings Cutoff in Skull Valley has been prepared (P-III Associates, Inc., 1999b.)

The Low Corridor rail line will add a visual element to Skull Valley. However, due to the variations in the rolling topography and the low profile of the rail line (essentially at grade level), the rail line will not be obviously visible from most locations in the valley. The Low Corridor rail line will be an apparent change in the visual landscape only in the developed areas near I-80 and from high elevations in the Cedar Mountains. Although the rail line represents a change in the landscape, it will be consistent with the visual resource management classification (VRM Class IV) established by BLM for the Low Corridor and with other developments in the area, such as I-80, the mainline railroad along I-80, and the Skull Valley Road. Because of the low level of recreational use of the area and lack of nearby residences, the Low Corridor is not expected to be a significant impact to the scenic environment.

To reduce the potential for increased range fires that may be caused by rail transport, the 40 ft wide rail line corridor will be cleared of vegetation to provide a buffer zone in preventing fires. Also the elevation of the rail line will be constructed close to grade to allow emergency fire vehicles access over the rail bed.

Section 3.3.1 describes operations involving the preferred mode of "direct rail" transport of shipping casks to the PFSF, utilizing a new 32-mile long rail-line originating at Low, Utah and terminating at the PFSF. At Low, adjacent to the mainline, multiple sidings are provided to facilitate the arrival of each single purpose train transporting SNF to the PFSF and for the cars "out-bound" from the PFSF for the start of another SNF delivery cycle. At the PFSF, rail sidings are also provided within the protected area. These sidings facilitate the receipt of single purpose SNF trains and the return of empty cask cars for the start of another spent fuel delivery cycle.

Westbound I-80 vehicular traffic, traveling at the posted speed limit of 75-mph, approaching the Low siding area, would have a limited opportunity for viewing a SNF train or empty cars that are stationary at the siding area. Since the siding area is substantially below grade (at grade to 27' deep), the stationary SNF train or parked empty cars would be hidden from view or partially visible due to the natural topography of the siding area. Eastbound I-80 traffic approaching the Low area would be visually blocked from seeing the siding area until after passing the highway overpass crossing I-80 at which point the siding area would be adjacent to or behind the viewing public. Again, the stationary SNF train or empty cars would be hidden or only partially visible due to the topography of the area and the fact that the siding area will be substantially below grade. The view of any of the rail equipment on the sidings would be limited to the upper portion of a car or locomotive.

The only other vehicular roads in the area from which members of the public could potentially see the Low rail siding area are two unimproved roads and one improved road. One of the unimproved roads is north of I-80, starting at the vehicle overpass crossing I-80 and heading north and east away from the Low siding area. The traveling public would not typically use this unimproved road and further the rail equipment on the Low siding cannot clearly be seen from the road due to natural topography, the presence of I-80, and the fact that the siding area will be substantially below grade.

A second unimproved road, a short portion of which is a remnant of the abandoned old US 40, exists south and immediately adjacent to the Low siding area. This unimproved road crosses the new rail-line near the Cedar Mountains heading east and follows the rail corridor until the road turns south along the base of the Cedar Mountains. This unimproved road provides only a partial view of the rail equipment on the Low siding, due to natural topography and the fact that the siding area will be substantially below grade. This road is not used by the traveling public but provides off road access to the Western region of Skull Valley from the north.

The only improved (paved) road in the vicinity of the Low siding area heads west and north from the vehicular overpass crossing I-80. This improved road would have a short vantage point for observation of the start of the siding area at the mainline railroad before "rounding the mountain" heading north. This view provides a minimum viewing opportunity to the traveling public due to natural topography and distance to the siding area.

In comparison, the Low siding area offers less of a viewing vista than other existing industrial areas along I-80 including the two salt plants (Morton and Cargil) and the existing rail sidings at Timpie, Utah.

Appendix 4A presents artist's concepts of the PFS rail siding area at Low as viewed from the I-80 off-ramp, and of the Low Corridor rail line as viewed from a number of vantage points accessible to the viewing public, including I-80, the I-80 off-ramp, the I-80 frontage road west of Low, the old US 40, and from the Cedar Mountains near the middle of Skull Valley.

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4.5 RESOURCES COMMITTED

Several resources will be permanently committed as a result of construction and operation of the PFSF. Development of the PFSF and access road will require the permanent commitment of raw materials used in the building structures, concrete storage casks, storage pads, and road building materials. These include cement, sand, aggregate, steel, asphalt, and other building materials. Construction of the Low Corridor rail line will require the permanent commitment of ballast and subballast material, and construction of the ITP will require commitment of the same types of construction materials used at the PFSF, along with ballast and subballast. Table 4.1-6 identifies quantities of imported materials estimated for construction of the Low Corridor rail line, the Intermodal Transfer Point, and the PFSF and access road, and Table 4.1-7 identifies sources of aggregate in the Skull Valley area. Sufficient quantities of the needed materials are available in the region to meet construction needs.

Development of this facility will also require the commitment of approximately 22 acres of land for the access road corridor. The new rail line will require an additional 155 acres of land. It is planned at this time to return the PFSF land area to its original habitat following decommissioning. Some additional acreage will be lost if the facility buildings are retained. These modifications will permanently alter the vegetation and wildlife habitat within the affected area.

Following is an assessment of water needs for construction and operation of the Low Corridor rail line, the Intermodal Transfer Point, and the PFSF.

4.5.1 Water Needs for the Low Corridor Rail Line Construction and Operation

The majority of water required during construction of the rail line will primarily be for wetting haul roads to minimize fugitive dust emissions and for providing water for soil compaction. The required quantity of water from SWEC Calculation 05996.01-P-002, Rev 4, is approximately 165,000 gal/day.

This quantity of water, suitable for construction, is available from private water sources located within 15 miles of Timpie and Low, Utah. Alternate or additional water sources that may become available during the course of the project will be considered by PFS.

Additional water will be required for making concrete for the culverts on the rail line. The quantity of water required for making this concrete is minimal in terms of the project requirements. Drinking water for construction personnel will be supplied in bottles/containers purchased from local commercial suppliers.

Water required during operation of the rail line will be exclusively to provide drinking water for personnel, and it will be supplied in drinking water bottles/containers from the PFSF.

4.5.2 Water Needs for the Intermodal Transfer Point (ITP) Construction and Operation

Water for construction of the ITP will be required for making concrete for the gantry crane enclosure foundation, for controlling dust, and for making compacted fill (soil compaction). The required quantity of water from SWEC Calculation 05996.01-P-002, Rev 4, is approximately 18,800 gal/day for soil compaction and dust control and 2,400 gal/day for concrete production.

The total daily water required for construction of the ITP is 18,800 + 2,400 = 21,200 gal/day. The quantity of water required for soil compaction and dust control is available from private water sources located within 15 miles of Timpie and Low, Utah. Alternate or additional sources that may become available during the course of the project will be considered by PFS. Water for making the concrete will be obtained from the PFSF site, where the concrete is mixed at the onsite batch plant. Drinking water for construction personnel will be supplied in bottles/containers purchased from local commercial suppliers.

Water requirements at the ITP during operation will be to provide drinking water and water for the restroom. These requirements will be minimal since the ITP is staffed only intermittently. Water will be supplied from an onsite storage tank and distribution system. The tank will be refilled periodically by a local commercial drinking water supplier.

4.5.3 Water Needs for the Skull Valley Road

There are no improvements planned for Skull Valley Road and, therefore, no requirements for water.

4.5.4 Water Needs for the PFSF Construction and Operation

Water for construction of the PFSF will be required for compacting soils, making soil cement and concrete, controlling dust, and worker use. The required quantity of water from SWEC Calculation 05996.01-P-002, Rev 4, is as follows:

Soil Compaction

- The volume of water required for soil compaction, which is assumed to be required during earthwork during all of Phase 1 Period 1, 5 months of Phase 1 Period 2, and 2 months of Phase 1 Period 3 = 10,200 gal/day.

Soil Cement

- The volume of water required for soil cement , which is assumed to be placed during the first 6 weeks of Phase 1 construction (SE quadrant), the first 6 weeks of Phase 2 construction (SW quadrant) and the first 12 weeks of Phase 3 (Northern half of the pad emplacement area) = 159,000 gal/day

Concrete

- Volume of water required during Phase 1, Period 2 for making concrete to construct the Canister Transfer Building, the Security & Health Physics Building foundation, and half of the storage pads in the SE quadrant = 6,000 gal/day
- Volume of water required during Phase 1, Period 3 for making concrete to

construct the foundations for the Administration Building and Operations & Maintenance Building and half of the storage pads in the SE quadrant = 2,200 gal/day.

- Volume of water required during Phase 2 for making concrete to construct the storage pads in the SW quadrant and 200 storage casks per year = 2,500 gal/day.
- Volume of water required during Phase 3 for making concrete to construct the storage pads in the northern half of the site and 200 storage casks per year = 3,500 gal/day.
- Volume of water required during the years from 2012 to 2021 to make concrete to construct 200 storage casks per year = 1,700 gal/day.

Dust Control

- Dust control is required during earthwork activities, which occurs over the entire 18 months of Phase 1, the first 6 weeks of Phase 2 (SW quadrant earthwork), and the first 12 weeks of Phase 3 (Northern half pad earthwork) = 9,400 gal/day

Worker Use

- Volume of water required for worker use during facility construction = 3,300 gal/day.
- Volume of water required for worker use during Phase 2 and 3 and Years 2012 to 2021 pad and storage cask construction = 1,800 gal/day.
- Volume of water required for worker use during operation = 1,800 gal/day.

4.5.5 Summary of PFSF Water Requirements

9/00 - 10/00, Phase 1, Period 1 (2 months)

- First 6 weeks = 182,300 gal/day (3,300 from wells + 179,000 trucked in)
- Remaining weeks = 22,900 gal/day (3,300 from wells + 19,600 trucked in)

11/00 - 5/01, Phase 1, Period 2 (7 months)

- First 5 months = 28,900 gal/day (9,300 from wells + 19,600 trucked in)
- Remaining 2 months = 18,700 gal/day (9,300 from wells + 9,400 trucked in)

6/01 - 3/02, Phase 1, Period 3 (9 months)

- First 2 months = 25,100 gal/day (5,500 from wells + 19,600 trucked in)
- Remaining 7 months = 14,900 gal/day (5,500 from wells + 9,400 trucked in)

Years 2002 through 2006, Phase 2 + operations (5 years)

- First 6 weeks = 182,600 gal/day (3,600 from wells + 179,000 trucked in)
- Remainder of 5 yr. period = 6,100 gal/day (all from onsite wells)

Years 2007 through 2011, Phase 3 + operations (5 years)

- First 12 weeks = 182,600 gal/day (3,600 from wells + 179,000 trucked in)
- Remainder of 5 yr. period = 7,100 gal/day (all from onsite wells)

Years 2012 through 2021, Operations w/ cask construction (10 years)

- 5,300 gal/day (all from onsite wells)

Years 2022 through end of facility life, Operations only (20 years)

- 1800 gal/day (all from onsite wells)

Water for worker use and for making concrete will be obtained from onsite wells. As stated in Section 4.2.4, it is anticipated that surface storage tanks will be erected for potable water, emergency fire water, and for supplying water to the concrete batch plant, as it is unlikely that water wells drilled into the aquifer beneath the site will yield adequate quantities of water on demand for these purposes. Several wells on the site may be required to meet the daily demand. In the event that onsite water quality or quantity are inadequate, potable water will be obtained directly from the Reservation's existing supply, or an additional well or wells will be drilled east of the site, where the quantity and quality

of ground water are likely to be more satisfactory. These wells would be outside of the OCA , but they would still be on the Reservation.

The remaining quantity of water, suitable for construction, is available from private water sources located within 15 miles of Timpie and Low, Utah. Alternate or additional water sources that may become available during the course of the project will be considered by PFS. PFS provided one reputable Tooele County contractor pertinent information on water needs for construction of the PFSF, the ITP, and the Low Corridor, and asked if existing water sources in northern Skull Valley could supply these needs. This contractor has an extensive work history on large construction projects, similar to the PFS project, in the Utah West Desert. The contractor indicated that, based on historical experience, sufficient quantity and quality of water is available in the northern end of the Stansbury Mountain range to supply the needs for construction of the PFSF and the Low Corridor rail line or the Intermodal Transfer Point (ITP) in the time period identified.

It is anticipated that wells drilled into the aquifer beneath the site will yield more water than required for making concrete and worker use during site construction and operation. Localized drawdown of the aquifer caused by the site water wells is not expected to have any effects on adjacent water well users.

As indicated in SWEC Calculation 05996.01-P-002, Rev 4, the maximum anticipated withdrawal rate for the proposed PFSF water well will be approximately 9,300 gal/day (6.5 gpm or 10.5 ac-ft/yr) during the first nine months of construction, and it will decrease thereafter. Over a 42-year period (Years 2000 through 2042), the average withdrawal rate from the well will be approximately 1,720 gal/day (1.2 gpm or 1.9 ac-ft/yr). It should be noted that six existing wells within five miles of the site have water rights ranging from approximately 11 to 1,600 ac-ft/yr.

4.5.6 Permeability of Aquifer Underlying the PFSF

The permeability of the aquifer underlying the PFSF is determined in SWEC Calculation 05996.02-G(B)-15, Rev 1 based on the results of a short-duration constant head test that was performed at the PFSF site in January 1999. This test was performed in a 2-inch diameter well that was installed in Boring CTB-5 in the area proposed for constructing the Canister Transfer Building. The location of this observation well is identified as CTB-5(OW) on Figure 2.6-11. As indicated in this calculation, the permeability of the soils near the measured groundwater surface is estimated to be approximately 5.0×10^{-5} cm/sec. This calculated permeability compares favorably with the results of a regional study of the adjacent Bonneville Region (Bedinger et al., 1990), which indicated that the fine-grained basin fill deposits had a permeability of approximately 2.3×10^{-5} cm/sec.

Details of the installation of Observation Well CTB-5(OW) and the results of the constant head test are included in Attachment A of SWEC Calculation 05996.02-G(B)-15, Rev 1. This well is screened from 142 to 152 feet below the ground surface in a dense, uniform, sandy silt to silty sand material. The sand pack around the well screen extends from 125.5 to 157 feet below ground surface. The top of ground water was measured to be approximately 124.5 feet below ground surface.

4.5.7 Radius of Influence for Proposed PFSF Water Well

Approximations of radius of influence (R) for the PFSF water well were made in SWEC Calculation 05996.02-G(B)-15, Rev 1, based on estimated aquifer parameters. In an ideal aquifer, without recharge, R is a function of the transmissivity, the storage coefficient, and the duration of pumping. By adapting the Jacob formula and neglecting recharge, R can be estimated by use of the following equation (Eq 4.5 of Powers, 1992):

$$R = (T\,t / 4{,}790\,S)^{0.5}$$

Where: R = radius of influence (feet)
T = transmissivity (gpd/ft)
t = pumping time (minutes)
S = storage coefficient (dimensionless)

The above equation is intended for confined aquifers, but results obtained for water table aquifers are reasonable, provided the drawdown is not a large percentage of the original saturated thickness. The proposed PFSF water well will be installed in deposits that are expected to exhibit hydraulic characteristics that are more representative of a water table aquifer than a confined aquifer.

Transmissivity for that portion of the aquifer affected by pumping is estimated by multiplying the aquifer permeability of 0.142 ft/day (i.e., 5.0×10^{-5} cm/sec) by the screen length of the PFSF water well. Assuming the screen length is approximately 100 feet, the resulting transmissivity equals 14.2 ft^2/day. The pumping time over a 42-year period equals approximately 2.21×10^7 minutes. As indicated on page 61 of Freeze and Cherry (1979), the usual range of storage coefficient (S) varies from 0.01 to 0.3 for a water table aquifer. For this range of values, the radius of influence varies from approximately 1,300 to 7,000 feet.

These estimates conservatively assume that no recharge occurs throughout the life of the project. Section 2.4.2.1 indicates that annual precipitation in Skull Valley ranges from 7" to 12"; therefore, it is clear that recharge will occur. Any precipitation that occurs will result in a decrease in the radius of influence of the pumped well discussed above, resulting in even less impact to other groundwater users in the vicinity of the PFSF.

As indicated in Figure 2.5-2, the nearest well is approximately 9,500 feet away. Therefore, since the maximum radius of influence, calculated based on very

conservative assumptions, is only 7,000 ft, operation of the PFSF water well will have no adverse impacts to private or Reservation groundwater users.

Past measurements of water levels in wells in Skull Valley indicate that the withdrawal of water from wells has not appreciably altered the natural balance (Hood and Waddell, 1968). Limited well records indicate that water levels fluctuated no more than five feet from an average mean. Only in the immediate vicinity of the Town of Dugway (16 miles from the PFSF), where water has been pumped for public supply, have water levels declined appreciably in response to pumping, indicating changes in aquifer storage (Hood and Waddell, 1968).

Similarly, operation of the site will have no effects on existing groundwater quality. At present, groundwater quality at the site has not been determined, but it will be tested when wells are constructed at the site. Since the water demands at the site during construction and operation are relatively modest and there are no ground water users within or immediately adjacent to the site, there will not be any impacts caused by groundwater withdrawal at the site.

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4.6 DECONTAMINATION AND DECOMMISSIONING

4.6.1 Decommissioning Plan

Prior to the end of the PFSF life, canisters loaded with spent fuel will be transferred from storage casks into shipping casks and transported off site. Since the canisters are designed to meet DOE guidance applicable to multi-purpose canisters for storage, transport and disposal of spent fuel, the fuel assemblies will remain sealed in the canisters such that decontamination of the canisters is not required. Following shipment of the canisters off site, the PFSF will be decommissioned by identification and removal of any residual radioactive material, and performance of a final radiological survey. Additional details on decommissioning are found in License Application Appendix B, "Preliminary Decommissioning Plan."

4.6.2 Decommissioning Facilitation

The design features of the dry cask storage concept, to be utilized at the PFSF, provide for the inherent ease and simplicity of decommissioning the facility in conformance with 10 CFR 72.130. Details of these design features and measures that will be taken to both minimize the potential for contamination and facilitate any decontamination efforts which may be required are found in License Application Appendix B, "Preliminary Decommissioning Plan."

4.6.3 Cost of Decommissioning and Funding Method

The cost of decommissioning the PFSF, excluding the storage casks, is estimated to be $1,631,000. The cost of decommissioning the storage casks is estimated to be $17,000 each. Decommissioning the PFSF will be funded by a letter of credit coupled

with an external sinking fund. Decommissioning the storage casks will be funded by prepayment of $17,000 to an externalized escrow account for each cask to be utilized.

4.6.4 Long Term Land Use and Irreversible Commitment of Resources

Following removal of all the storage casks from the PFSF and decontamination of the storage pads and Canister Transfer Building, as necessary, disposition of the storage pads and PFSF buildings (Canister Transfer Building, Security and Health Physics Building, Operations and Maintenance Building and Administration Building) will be decided in conjunction with the Skull Valley Band of Goshute Indians. The Band will retain ownership of the property on which the PFSF is located throughout the construction, operation, and decommissioning phases of the PFSF, with the land leased from the Band by the PFSLLC. The Band will be consulted prior to dismantlement of the PFSF buildings, and their preferences accommodated as to the future of the buildings, which could function in some other usage that will benefit the Band. PFS is obligated (and is collecting sufficient advanced funding) to remove these buildings if the tribe does not foresee uses for them.

The cask storage area consists of up to 500 reinforced concrete storage pads; each pad 64 ft. long, by 30 ft. wide, and 3 ft. thick. The areas between and around the storage pads are surfaced with compacted gravel. Following characterization of the storage pads, any necessary decontamination, and release of the storage pads for unrestricted use, storage pads can be excavated, cut into smaller sections, and trucked off-site for disposal at a local landfill. The storage pads could be sectioned using a method such as diamond wire cutting, or alternatively could be left in place. The preferred alternative for decommissioning of the concrete storage pads is to leave them in place and cover the cask storage area with soil and replant with native vegetation to minimize soil erosion. In either case, the former cask storage area will be covered with topsoil and replanted with native vegetation. Soil from the flood diversion berms south

of the storage area and east of the storage area could be used to cover the former cask storage area, or, alternatively, soil could be trucked in from outside the PFSF.

In the event the entire removal of the pads is performed, this would involve removal of 106,667 CY of material [(64-ft X 30-ft X 3-ft) X 500 pads = 106,667 CY]. Using a 20 CY truck and a factor of 0.9 to allow for void spaces, yields approximately 5,926 truckloads [106,667/(20 X 0.9) = 5,926]. Since decommissioning will occur many years into the future, location of a suitable landfill cannot be determined at this time.

After the PFSF cask storage area is resurfaced with topsoil suitable for supporting native vegetation, the land is essentially returned to its original condition. There is no irreversible commitment of natural resources associated with the long term plans for the PFSF land, unless the Band chooses to keep some of the buildings or other structures intact for their own use.

At the intermodal transfer point the rail siding, pre-engineered metal building and foundation, and access road will be dismantled and removed. The area will be covered with topsoil and replanted with native vegetation. There is no irreversible commitment of natural resources associated with the intermodal transfer point.

It is anticipated that the low corridor rail line will be utilized by others in the Skull Valley and will not be dismantled and removed. This would result in a permanent commitment of about 155 acres of public land administered by the BLM associated with the rail line.

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to the general population, and then combined the result with the accident possibilities to produce an expected risk to the public. The Yucca Mountain EA concluded that shipment of spent fuel by rail from all US reactors to a permanent repository will result in a population dose of about 1,200 man-rem, which will produce less than one fatality over an assumed 28 year shipping period, including both normal transport and accident risks.

The Yucca Mountain EA also found that non-radiological impacts follow the same general pattern as the radiological impacts in that truck shipments represent a greater risk than rail shipments, and that "In all cases, non-radiological fatalities and injuries far exceed those due to the radiological nature of the cargo." (Yucca Mountain EA, page 5-97)

The Record of Decision on a Nuclear Weapons Non-proliferation Policy Concerning Foreign Research Reactor Spent Nuclear Fuel concludes, on page 24, "The analyses in the Final EIS demonstrate that the impacts to the environment, workers, or the public, from any of these modes of ground transport will be small and within the applicable regulatory limits." (DOE, 1996).

4.7.5.1 Additional PFSF Transportation Information for NRC RADTRAN Analysis

Fuel Shipping Scenarios

The operators of individual reactors within the PFS consortium are expected to ship both in single and multiple cask shipments over the life of the facility depending upon the needs of the specific reactor facility. These cask shipments will be on single use trains. These trains will proceed directly from the individual reactor site without any other anticipated grouping with other facilities and proceed directly to the PFSF via either Low or Timpie. Should such cask grouping occur in the future, it would consist of a single use train, stopping at a power reactor facility, or a heavy-haul pickup point from

a power reactor facility, along the way to attach additional rail cars with loaded casks. It would not involve the switching of rail cars with casks between multiple use trains in general switchyards but would only occur on a reactor licensee's site or the heavy-haul access to rail near the licensee's site.

There will be no such grouping in the vicinity of the PFSF site as there are no licensed reactor facilities in the immediate proximity to the site. Therefore these groupings should not affect the results of the RADTRAN transportation analysis in the vicinity of the PFSF.

Private Fuel Storage plans to ship spent fuel from each reactor site to the PFSF by rail car only. These rail cars will travel in trains containing anywhere from one to six cask cars. The trains will also be provided with a car capable of carrying persons to provide the appropriate oversight and safeguards. The shipments will be single-use trains when containing spent fuel and will proceed directly to the PFSF site without any interruptions other than those necessary for crew changes and refuelings. Casks will be picked up at the utility site and when this arrangement is not possible, PFS will assist utilities in making heavy haul arrangements to the nearest appropriate rail location. Casks coming from the east and south will enter the vicinity of the PFSF on the rail lines through Salt Lake City, Utah and Ogden, Utah. Shipments from the west will generally enter the vicinity of the PFSF on the Union Pacific line coming from the southwest through Tooele, Utah or from the west on the Union Pacific line which approaches Low Junction.

PFS will either own the over-the-road locomotives to provide for some of the advanced operating characteristics, which may be installed on newer locomotives or lease them. Regardless of ownership, either PFS personnel or Union Pacific personnel will operate trains from the terminal point at Low over the short rail line into the PFSF. The railroad to be built into the site will be owned by Private Fuel Storage and the cars used to carry

casks as well as the staff car that travels with each train will be owned by PFS. If over-the-road locomotives are owned by PFS they will also be used for on-site positioning.

If PFS does not own the locomotives used for the long-haul transportation, a pusher vehicle will be used to position individual cars in the switching yard. If PFS owns over-the-road locomotives, most likely those same locomotives will be used for car positioning at the PFSF.

If heavy haul trucks are used via an inter-modal point, a pusher vehicle to position rail cars will be available at the inter-modal transfer site. This positioning motor vehicle will be owned and provided by PFS.

The average number of rail shipments (trains) per year to the PFSF is anticipated to be 50. The average number of casks on trains coming into Utah will be three. The maximum number of cask cars on any one train is anticipated to be six. The shipments outbound from the PFSF will have their frequency and composition determined by the federal facility receiving the fuel. It is assumed that a larger numbers of casks (up to the maximum of twelve) would be included on the average outbound shipment, as sufficient quantity of canisters for shipment will exist at the PFSF and the federal receiving facility would be in a position to off-load a full train.

The planned rail shipments will be conducted as follows. PFS will ship empty transportation casks in mixed freight service cask cars to the reactor plants. These casks will contain unused spent fuel canisters with the internals prepared for each reactor. The shipments will be delivered to those plants with rail service on their spur. Heavy haul arrangements will be used as necessary from a rail head to those reactor plants which do not have a direct rail spur into the site. The casks will be loaded by reactor plant personnel and prepared for shipment with support from Private Fuel Storage as needed. The transportation cask are then loaded on the rail car provided by PFS, which is designed to use for general interchange over the railroad shipping. In the

event of reactor sites without direct rail access, heavy haul and/or barging will be used to transport the loaded fuel casks to the nearest rail points.

The trains handling loaded spent fuel casks will be single use unit trains (non-mixed shipments) whose sole function will be to ship spent fuel to the PFSF. The trains could consist of anywhere from one to six cask cars, depending on the needs of the facility and the shipping schedules that are enumerated over a period of time. The train which will be built to specifications outlined by the American Association of Railroads under its proposed standards for nuclear fuel shipments, will then proceed by a predetermined route (selected by Private Fuel Storage in cooperation with the host railroads, and approved by the NRC (10 CFR 73.37(b)(7)) to the PFS facility. Train speeds are expected to be similar to those transporting standard freight. The single-use trains will be continuously operated (as opposed to being put on sidings and potentially left unattended during crew changes or movement of cars in the makeup of trains). The trains, other than for refueling and crew changes, will continue either through Low to the PFS site railroad or to the intermodal transfer point.

The rail shipments will be provided with safeguards in accordance with federal regulations. Notifications as prescribed in the 10 CFR 73.37 will be complied with. Once the rail shipments reach the PFSF, the cars will be positioned individually in the canister transfer building at such a point as to permit the facility's crane to remove the shipping cask from the rail car. If the inter-modal point is used, the shipping cask/cradle/impact limiter assembly will be transferred by crane from the rail car to a heavy haul truck. At that point, the rail shipment portion of the transit would terminate. The rail equipment, insofar as cars for the transportation casks, will be owned by PFS and built to the AAR standards. A rail car to transport the security staff responsible for safeguards as part of the train will also be provided by PFS and modeled in accordance with the AAR requirements for integrated train operation while carrying spent fuel. The locomotives may or may not be owned or leased by Private Fuel Storage.

Materials To Be Shipped By PFS

The materials being shipped to the PFSF are spent nuclear fuel assemblies from PWR and BWR light water reactors. Included with some of the assemblies are the burnable poison rod control components that are associated with the fuel assemblies. Only spent fuel assemblies and associated components and no greater-than-Class C waste will be shipped to or stored at the PFSF.

Physical descriptions of fuel assemblies (weights and dimensions) that can be shipped to the PFSF are included in PFSF SAR Table 3.1-3, which provides bounding design fuel characteristics. These bounding characteristics include maximum assembly width, length, weight, active fuel length, and maximum number of assemblies per PWR and BWR canisters. Additional details regarding fuel physical parameters is provided in Tables 12.3.1 (PWR Fuel Assembly Characteristics) and 12.3.2 (BWR Fuel Assembly Characteristics) of Holtec International's HI-STORM Storage TSAR, including number of fuel rods, number of control thimbles, fuel pellet diameter, fuel rod pitch, cladding thickness, and clad outer diameter.

Chemical descriptions of the materials being shipped are as follows: The fuel is uranium oxide (UO_2) matrix with primarily Zircaloy cladding, but some stainless steel cladding, as identified in PFSF SAR Table 3.1-3. The PWR burnable poison rod control components that are associated with the fuel assemblies contain boron carbide and are clad in stainless steel or Zircaloy. The BWR fuel rods contain gadolinium as a burnable poison inside the fuel rods. It is planned to ship four mixed-oxide fuel assemblies to the PFSF that are currently stored in the San Onofre Unit 1 spent fuel pool.

The curie levels of significant radioisotopes are provided in Table 7.3.1 of the HI-STAR TSAR (Holtec 1997) for MPC-24 (PWR) and MPC-68 (BWR) canisters. As discussed in Section 7.3.1 of the HI-STAR TSAR, these levels are based on the assumptions that the

PWR fuel assemblies are B&W 15X15 with a burnup of 40,000 MWd/MTU, 5 years cooling time and an enrichment of 3.4%; and the BWR fuel assemblies are GE 7X7 with a burnup of 40,000 MWd/MTU, 5 years cooling time and an enrichment of 3.0%. The radionuclide inventories are conservative, since these fuel assemblies are too "hot" to be permitted to ship in the HI-STAR shipping package. As stated in Section 7.3.1 of the HI-STAR TSAR, "The Technical Specifications in Chapter 12 limit the fuel assembly burnup well below 40,000 MWD/MTU for both PWR and BWR fuel at 5 years of cooling time. This ensures that the inventory used in this calculation exceeds that of the fuel authorized for storage in accordance with the Technical Specifications."

Section 4.0 ("Containment") of the TranStor Shipping Cask SAR (SNC 1997) does not list all the significant radionuclides, focusing on Kr-85, H-3, and Co-60.

As discussed in Section 7.4 of the PFSF SAR, average spent fuel at the PFSF is considered to be represented by PWR fuel having 35,000 MWd/MTU burnup and 20 years cooling time. The DOE OCRWM LWR Radiological Database (DOE 1992) identifies an average enrichment of 3.43% for PWR fuel with this burnup. The OCRWM LWR Radiological Database was used to obtain an estimate of the radionuclide inventory of all isotopes that contribute 0.1% or more of the total activity for PWR fuel having 35,000 MWd/MTU burnup, 20 years cooling time, and 3.43% enrichment. While H-3, I-129, Ru-106 and Cs-134 contributed less than 0.1% of the total inventory, they are considered to be significant radionuclides and their activity level was obtained from output of the OCRWM LWR Radiological Database, with the "all isotopes greater than the database cutoff" option selected. The database output is in curies per metric ton initial heavy metal (MTIHM). In order to convert this to the radionuclide inventory in a canister, the values output by the OCRWM LWR Radiological Database are multiplied by 0.469 MTU/assembly (the maximum PWR assembly fuel loading, from Section 5.2.1.1 of the TranStor Shipping Cask SAR, and by 24, since both the HI-STAR and TranStor shipping

casks are designed to contain 24 PWR fuel assemblies. The results are listed in the following table:

Isotope	Curies per MTIHM, as Output by the OCRWM LWR Radiological Database	Curies per Canister
H-3	2.694E+02	3.032E+03
CO-60	6.453E+02	7.263E+03
NI-63	3.798E+02	4.275E+03
KR-85	2.661E+03	2.995E+04
SR-90	4.759E+04	5.357E+05
Y-90	4.760E+04	5.358E+05
RU-106	5.490E–01	6.180E+00
I-129	3.328E–02	3.746E-01
CS-134	2.057E+02	2.315E+03
CS-137	6.866E+04	7.728E+05
BA-137M	6.495E+04	7.311E+05
PM-147	6.512E+02	7.330E+03
SM-151	3.640E+02	4.097E+03
EU-154	2.004E+03	2.256E+04
EU-155	4.060E+02	4.570E+03
PU-238	2.722E+03	3.064E+04
PU-239	3.595E+02	4.047E+03
PU-240	5.160E+02	5.808E+03
PU-241	5.221E+04	5.877E+05
AM-241	2.920E+03	3.287E+04
CM-244	1.208E+03	1.360E+04
Total	2.963E+05	3.335E+06

The above table provides the estimated average curie level in the spent fuel, for a canister shipped to the PFSF. It does not include Co-60 in crud plated out on the outside of fuel rods. This quantity can be estimated using the methodology applied in Section 7.3.2 of the HI-STAR TSAR, accounting for decay of Co-60 for the 20 year cooling time estimated for the average fuel shipped to the PFSF.

Estimated Dose Rates at One Meter From a Shipping Cask

Dose rates associated with the HI-STAR and TranStor shipping casks were evaluated for normal conditions of transport, assuming the casks contain representative average PFSF fuel, considered to be PWR fuel having 35 GWd/MTU burnup and 20 years cooling time (PFSF SAR Section 7.4). The vendor SARs provide dose rate information on contact with accessible external surfaces of the shipping package/transport vehicle, and 2 meters from the vertical planes represented by the outer lateral surfaces of the transport vehicle, per 10 CFR 71.47. This vendor dose rate information is based on the shipping package containing design basis fuel, which has higher burnup and shorter cooling time than the PFSF representative average spent fuel.

In order to estimate dose rates at 1 meter from the shipping packages assumed to contain representative average PFSF fuel, it was necessary to interpolate between the contact and 2 meter dose rates, then scale the dose rates based on the relative gamma and neutron source strength of the different fuels. Dose rates at the contact and 2 meter points of interest for HI-STAR design basis fuel were taken from Tables 5.4.2, 5.4.3, 5.4.4, 5.4.8 and 5.4.10 of the HI-STAR Shipping Cask SAR (design basis PWR spent fuel having 40 GWd/MTU burnup, 10 year cooling time, and 3.7% enrichment), and from Table 5.5-11 of the TranStor Shipping Cask SAR (design basis PWR spent fuel having 40 GWd/MTU burnup, 8 year cooling time, and 3.02% enrichment). Linear interpolation was used to estimate total dose rates at 1 meter, which is conservative, and the fraction of gamma vs. neutron radiation contribution to the total dose rate was assumed to be the same as that at the contact dose point.

The interpolation was based on actual distances between the contact and "2 meter" dose points used by the different vendors. For instance, Holtec evaluates the side contact dose point on contact with the side of the shipping package, whereas SNC evaluates the dose on contact with the personnel barrier, whose radius is the same as that of the impact limiters. Both vendors evaluate axial contact dose rates on the axial surfaces of the top and bottom impact limiters. However, for the 2 meters from the transport vehicle dose points, SNC considers that the front and back edges of the transport vehicle correspond to the ends of the impact limiters, whereas Holtec considers the edges of the transport vehicle to be 6 ft from the ends of the impact limiters.

Gamma and neutron scaling factors were used to scale from the HI-STAR and TranStor representative design basis fuels identified above to the PFSF representative average fuel, applying the source scaling methodology described in Section 5.4.1 of the TranStor Storage Cask SAR. Gamma and neutron source strengths for the fuels being compared were determined from the DOE's OCRWM LWR Radiological Database (DOE/RW 1992).

Averaging the dose rates estimated for the HI-STAR and TranStor shipping casks (essentially assuming an equal number of shipments in each type of cask) results in the following dose rate estimates at 1 meter from a shipping cask transporting PFSF representative average fuel:

Shipping Package Dose Point Location	Total Dose Rate (mrem/hr)
Side, 1 meter from Cask Outer Surface	7.7
Top, 1 meter from Top Impact Limiter	1.2
Bottom, 1 meter from Bottom Impact Limiter	13.6

Burnup (MWd/MTU) and Average Cooling Time of Spent fuel Shipped to the PFSF

PFS does not have a firm schedule that lays out the year in which specific fuel assemblies might be shipped from specific nuclear power plants. This will be determined by the individual utilities based on their spent fuel storage needs at that time. Thus, in order to provide an estimate of the burnup and average cooling time of spent fuel that might be shipped in any given year, PFS is providing an estimate based on two scenarios.

The first assumes that approximately 500 MTU of spent fuel is shipped from member reactor sites annually as presented in Table 4.7-1. Assuming that spent fuel shipments begin in 2002, an estimate of average burnups shipped annually and the average cooling time is provided. Beginning in approximately 2020, it may be necessary to ship less than 500 MTU per year in order to maintain the minimum cooling time of 10 years after discharge from the reactor that is required by the currently planned cask designs. It is assumed that reactors may increase burnups up to 70,000 MWd/MTU at some point in the future and the cask designs will be modified to accommodate shipment of such fuel prior to the need to ship such fuel.

The second assumes that approximately 1,000 MTU of spent fuel is shipped from member reactor sites annually as presented in Table 4.7-2. Assuming that spent fuel shipments begin in 2002, an estimate of average burnups shipped annually and the average cooling time is provided. Beginning in approximately 2007, it may be necessary to ship less than 1,000 MTU per year in order to maintain the minimum cooling time of 10 years after discharge from the reactor that is required by the currently planned cask designs. It is assumed that reactors may increase burnups up to 70,000 MWd/MTU at some point in the future and the cask designs will be modified to accommodate shipment of such fuel prior to the need to ship such fuel.

While quantities of spent fuel in excess of 1,000 MTU could be shipped annually if additional reactors planned to ship spent fuel to the PFSF, the range of burnups and cooling times provided in Tables 4.7-1 and 4.7-2 should provide an average bounding estimate for such a scenario.

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4.8 REFERENCES

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TABLE 4.1-3 (Sheet 1 of 2)
SKULL VALLEY ROAD TRAFFIC/NOISE SOUTH OF IOSEPA

	Average Daily Traffic (ADT)	Morning 2-hour commute (vehicles/hr)	Non-peak traffic (vehicles/hr)	Evening 2-hour commute (vehicles/hr)	Sound Level During Peak Traffic Volume (dBA @50')
Existing Traffic	325	54	9	54	67
Construction Phase 1-Period I (Sept. 1 to Oct. 31, 2000)					
First 6 weeks	885	149	39	149	72
Remainder of period	843	145	35	145	72
Construction Phase 1-Period II (Nov. 1, 2000 to May 31, 2001)					
First 5 months	671	128	18	128	71
Last 2 months	667	127	17	127	71
Construction Phase 1-Period III (June 1, 2001 to Mar. 1,2002)					
First 2 months	623	123	13	123	70
Last 7 months	619	123	13	123	70

TABLE 4.1-3 (Sheet 2 of 2)
SKULL VALLEY ROAD TRAFFIC/NOISE SOUTH OF IOSEPA

	Average Daily Traffic (ADT)	Morning 2-hour commute (vehicles/hr)	Non-peak traffic (vehicles/hr)	Evening 2-hour commute (vehicles/hr)	Sound Level During Peak Traffic Volume (dBA @50')
Construction Phase 2 (March 1, 2002 to November 30, 2006)					
First 6 weeks	569[4]	111	17	111	69
Remainder of 5-yr period	521	106	12	106	69
Construction Phase 3 (March 1, 2007 to November 30, 2011)					
First 12 weeks	579	112	18	112	69
Remainder of 5-yr period	531	107	13	107	69
Operation					
December 2011 thru November 2021 (10 years)	501	104	10	104	69
After November 2021	409	81	0	81	68

[4] ADTs and peak volume figures include traffic generated by Facility operation which begins June 1, 2002

Table 4.1-4

ESTIMATED CONSTRUCTION RELATED POLLUTANT EMISSIONS FOR THE PFSF

Activity	Pollutant	Emission Rate (tons/month)	Basis
Clearing/Excavation • vehicular traffic on unpaved and paved roads • wind erosion • material handling • bulldozing • scraping • grading • watering	PM10	15.5	Assumes 355,320 total construction vehicle miles traveled in one year
Concrete Batch Plant	PM10	0.6	Assumes 125,300 cubic yards of concrete used in one year
Vehicle Operation	NO_x CO VOC	0.4 0.5 0.1	Assumes 355,000 total vehicle miles traveled in one year

Table 4.1-5

ESTIMATED CONSTRUCTION AIR QUALITY IMPACTS FOR THE PFSF

Source	Pollutant	Estimated Impact (µg/m³)		Standard (µg/m³)
		Skull Valley Rd	Residences	
Fugitive Dust Sources	PM10			
	24-hour	27.3	16.5	150
	Annual Avg	3.4	2.1	50
Concrete Batch Plant	PM10			
	24-hour	37	20	150
	Annual Avg	5	3	50

Table 4.1-6
(Sheet 1 of 2)
IMPORTED CONSTRUCTION MATERIAL QUANTITIES

Item	Quantity (CY)	Material Specification
PFSF Construction Phase I	**19 Months**	
Concrete Aggregate		
Small (Sand)	21000	1. UDOT Section 505, Table 505-3 (sand)
Large (Crushed rock)	29000	2. UDOT Section 505, Table 505-1; (1" gradation)
Crushed Rock Grading		
Access Road Base	22000	3. UDOT Section 301, Table 301-1; (1" gradation)
Storage & Building Areas	53000	4. UDOT Section 301, Table 301-1; (1 1/2" gradation)
Fill Materials		
Struct. Fill	0	5. Select, well-graded fill; (1 1/2" minus)
Common Fill	121000	6. Native soil, no deleterious material; Plasticity Index = 10-15
Asphalt Paving	16500 (Tons)	9. Bituminous mix (3/8" minus)
PFSF Construction Phase II	**10 Years**	
Concrete Aggregate		
Small (Sand)	47500	1. UDOT Section 505, Table 505-3 (sand)
Large (Crushed rock)	66500	2. UDOT Section 505, Table 505-1; (1" gradation)
Crushed Rock Grading		
Storage Area	30500	4. UDOT Section 301, Table 301-1; (1 1/2" gradation)
Fill Materials		
Struct. Fill	0	5. Select, well-graded fill; (1 1/2" minus)
PFSF Construction Phase III	**10 Years**	
Concrete Aggregate		
Small (Sand)	59500	1. UDOT Section 505, Table 505-3 (sand)
Large (Crushed rock)	83000	2. UDOT Section 505, Table 505-1; (1" gradation)
Crushed Rock Grading		
Storage Area	53500	4. UDOT Section 301, Table 301-1; (1 1/2" gradation)
Fill Materials		
Struct. Fill	0	5. Select, well-graded fill; (1 1/2" minus)
Common Fill	26000	6. Native soil, no deleterious material; Plasticity Index = 10-15

Table 4.1-6

(Sheet 2 of 2)

IMPORTED CONSTRUCTION MATERIAL QUANTITIES

Direct Rail Alternative		
Subballast	225,000	7. Union Pacific Std., AREA Subballast Spec. (Exhibit "H")
Ballast	95,732	8. Union Pacific Std., Gradation 3 (Exhibit "G")
Intermodal Transfer Point		
Concrete Aggregate		
Small (Sand)	1150	1. UDOT Section 505, Table 505-3 (sand)
Large (Crushed rock)	1600	2. UDOT Section 505, Table 505-1; (1" gradation)
Crushed Rock Grading		
Access Road Base	650	3. UDOT Section 301, Table 301-1; (1" gradation)
Oval Track Base	3000	4. UDOT Section 301, Table 301-1; (1 1/2" gradation)
Subballast	5450	7. Union Pacific Std., AREA Subballast Spec. (Exhibit "H")
Ballast	4300	8. Union Pacific Std., Gradation 3 (Exhibit "G")
Structural Fill	2700	5. Select, well-graded fill; (1 1/2" minus)
Asphalt Paving	2800 (Tons)	9. Bituminous mix (3/8" minus)

Notes:
All quantities are in-place cubic yards unless otherwise noted

Table 4.1-7

AGGREGATE SOURCES IN THE SKULL VALLEY AREA

Materials and Locations					
Type of Material	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Site 5**
Sand	200,000 tons	150,000 tons	200,000 tons	NA	NA
Crushed Rock(1")	300,000 tons	250,000 tons	300,000 tons	NA	NA
Small Road Base (≤ 1")	200,000 tons	150,000 tons	200,000 tons	NA	NA
Large Road Base (approx. 1.5")	200,000 tons	150,000 tons	200,000 tons	NA	NA
Structural Fill Material (1 ½ " minus)	200,000 tons	150,000 tons	200,000 tons	NA	NA
Common Fill	200,000 tons	150,000 tons	200,000 tons	NA	NA
Sub-Ballast	200,000 tons	150,000 tons	200,000 tons	NA	NA
Ballast	NA	NA	NA	400,000 tons	400,000 tons

Site 1: The Stansbury West Pit, approximately 17 miles North of the PFSF
Site 2: The Hickman Knolls Pit, approximately 6 miles West of the PFSF
Site 3: The Willow Creek Pit, approximately 48 miles North-East of the PFSF
Site 4: The Corral Canyon Quarry, approximately 38 miles North-NorthEast of the PFSF
Site 5: The Marble Head Quarry, approximately 35 miles North of the PFSF

Note: Distances reported to the five sites above are highway/road miles.

TABLE 4.2-1

ESTIMATED OPERATION LABOR FORCE (PFSLLC FINANCIAL PLAN 1997).

POSITION	NUMBER OF STAFF
PFSF Manager	1
Secretary	2
Mechanical Technicians	3
General Plant Workers	2
Elec./Inst. Technicians	3
Transportation Specialist	1
Nuclear Engineer	3
Licensing Engineer	1
HP Manager	1
HP Technicians	2
QA Lead	1
QA Technicians	2
Emergency Response Leader	1
Public Relations Coordinator	1
Security Captain	1
Security Force	15
Finance & Purchasing Specialist	1
Administrative Assistant	1
Total	**42**

TABLE 4.3-1

ESTIMATED CONSTRUCTION RELATED POLLUTANT EMISSIONS FOR INTERMODAL TRANSFER POINT

Activity	Pollutant	Emission Rate (tons/year)	Annual Basis
Clearing/Construction • clearing/excavation • vehicular traffic on unpaved roads • material handling / batch / continuous drop • wind erosion from piles • bulldozing/compacting • watering	PM-10	2.86	172 dump truck miles 42 concrete truck miles 28 asphalt truck miles 565 water truck miles 1,300 front end loader miles 520 hours bulldozer operation 260 hours of compacting 21,815 tons soil handled 17,000 tons backfill handled
Construction Vehicle Operation	NO_x CO VOC PM	3.48 1.34 0.35 0.28	Assumes 6,007 total construction vehicle miles traveled in one year

TABLE 4.4-1

ESTIMATED CONSTRUCTION RELATED POLLUTANT EMISSIONS FOR LOW CORRIDOR RAIL LINE

Activity	Pollutant	Emission Rate (tons/month)	Annual Basis
Clearing/Construction • vehicular traffic on unpaved roads • material handling / batch / continuous drop • wind erosion from piles • bulldozing/compacting • grading • scraping • watering	PM-10	29.8	292,032 miles for trucks delivering subballast 80,454 scraper miles 22,935 water truck miles 1,000 grader miles 3,328 hours bulldozer operation 3,328 hours of compacting 885,000 tons of cut handled 85,000 tons topsoil handled
Construction Vehicle Operation	NO_x CO VOC PM	6.16 2.96 2.11 0.55	Based on the total miles of trucks delivering subballast, and grader, scraper, bulldozer, watering truck and compactor operations
Locomotive Operation	NO_x CO HC PM	4.64 0.52 0.17 0.12	Assumes 1,664 hours of locomotive use in one year for installation of ballast, ties, and rail

TABLE 4.7-1

AVERAGE BURNUP AND COOLING TIME

500 MTU/YEAR

Expected Shipment Year	Annual MTU	MTU Wt'd Disch Date	MTU Wt'd Burnup	MTU Wt'd Cooling Yrs
2002	489.6	1975.08	19,714	26.9
2003	509.6	1979.58	26,357	23.4
2004	503.9	1982.35	26,948	21.7
2005	492.8	1984.55	27,309	20.5
2006	519.4	1986.54	28,082	19.5
2007	487.5	1988.38	28,504	18.6
2008	498.0	1990.05	31,574	18.0
2009	482.0	1991.60	34,273	17.4
2010	520.0	1993.10	34,401	16.9
2011	518.1	1994.73	39,802	16.3
2012	481.2	1996.32	42,382	15.7
2013	498.5	1997.93	44,383	15.1
2014	517.9	1999.57	44,673	14.4
2015	491.3	2001.17	47,071	13.8
2016	474.2	2002.98	48,070	13.0
2017	505.8	2004.82	48,535	12.2
2018	520.7	2006.81	50,082	11.2
2019	490.1	2008.89	50,495	10.1
2020	493.2	2010.73	50,806	9.3
2021	495.9	2012.50	52,730	8.5
2022	499.7	2013.90	50,774	8.1
2023	509.2	2016.00	52,799	7.0
2024	492.7	2018.25	51,281	5.8
2025	516.0	2021.55	53,963	3.5
2026	550.3	2026.71	51,478	-0.7

Beginning in 2020, it may become necessary to ship less than 500 MTU per year in order to maintain the minimum cooling time of 10 years after discharge from the reactor. In 2020 and subsequent years the average discharge burnup for the remaining 3,557 MTU of spent fuel is estimated to range between 50,800 and 70,000 MWD/MTU.

TABLE 4.7-2

AVERAGE BURNUP AND COOLING TIME

1000 MTU/YEAR

Expected Shipment Year	Annual MTU	MTU Wt'd Disch Date	MTU Wt'd Burnup	MTU Wt'd Cooling Yrs
2002	999.2	1977.37	23,102	24.6
2003	996.7	1983.44	27,127	19.6
2004	1006.9	1987.43	28,286	16.6
2005	980.0	1990.81	32,902	14.2
2006	1038.1	1993.91	37,097	12.1
2007	979.7	1997.14	43,400	9.9
2008	1009.2	2000.35	45,840	7.7
2009	980.0	2003.93	48,310	5.1
2010	1010.8	2007.82	50,282	2.2
2011	989.1	2011.62	51,771	-0.6
2012	1009.0	2014.96	51,796	-3.0
2013	1008.7	2019.94	52,653	-6.9
2014	550.3	2026.71	51,478	-12.7

Beginning in 2007, it may become necessary to ship less than 1,000 MTU per year in order to maintain the minimum cooling time of 10 years after discharge from the reactor. In 2007 and subsequent years the average discharge burnup for the remaining 7,537 MTU of spent fuel is estimated to range between 43,000 and 70,000 MWD/MTU.

APPENDIX 4A

ARTIST'S CONCEPTS OF THE PFSF, INTERMODAL TRANSFER POINT, AND THE LOW CORRIDOR RAIL LINE / SIDINGS

ARTIST'S CONCEPTS OF THE PFSF, INTERMODAL TRANSFER POINT, AND THE LOW CORRIDOR RAIL LINE / SIDINGS

Artist's concepts of the PFSF on the Skull Valley Band of Goshute reservation, the Low Corridor Rail Line / sidings, and the Intermodal Transfer Point are presented in Figures 1 through 18. The vantage points used focused on locations the viewing public would reasonably find accessible. Locations include the siding area at Low, UT and mid-valley for the rail corridor; the Intermodal Transfer Point viewed from I-80; and the storage facility itself is viewed from the highest accessable point (private road) of Deseret Peak, the Skull Valley Band of Goshute tribal village, the Pony Express Store on the reservation and from Skull Valley Road on the reservation.

The following index can be used to correlate each Figure with the viewing location.

FIGURE 1: PFS Rail Siding Area at Low from the I-80 Off-ramp -- Looking south from the I-80 westbound off-ramp at Low, toward the UP main line and rail siding area, one cannot see the rail line, rail sidings, nor trains, since the tracks are 15' to 27' below grade from left to right in the center of the photo.

FIGURE 2: PFS Rail Line at Low from I-80 -- Looking east from the I-80 median near the Low exit, one can barely see the PFS rail line and trains emerging at grade near the center-left side of the photo. In this photo the rail line is about 15' below grade in the right-center portion of the photo and thus, cannot be seen from this point.

FIGURE 3: PFS Rail Line from the I-80 Off-ramp -- Looking east from the I-80 westbound off ramp at Low, one can see a little more of the PFS train than in Figure 2, since this vantage-point is at a slightly higher elevation.

FIGURE 4: PFS Rail Line from West of Low -- Looking east from the paved I-80 frontage road at a point west of Low, one cannot see the rail line at all since it is some

27' below grade at the connection point to the UP mainline railroad. However, the slight cut in the terrain near the center-left side of the picture, near the series of utility poles, indicate where the rail line begins.

FIGURE 5: PFS Rail Line from Old US 40 -- Looking north from the old US Route 40 (now abandoned), one can see I-80 and the overpass over the UP mainline. Near the right of the photo, one can barely see the tops of the PFS locomotives as the train emerges eastbound from Low where the rail line and siding are 27'-15' below grade left to right in the photo.

FIGURE 6: PFS Rail Line from Cedar Mountains at Mid-valley -- Looking east from the foothills of the Cedar Mountains at a point near the middle of Skull Valley near a promontory accessible to the public, one can see the PFS line running left to right near the center of the photo.

FIGURE 7: PFS Intermodal Transfer Point -- Looking north from the I-80 median, one would see this view of the PFS Intermodal Transfer Point (ITP) and rail siding adjacent to the UP main-line tracks. Light poles, fences, and access road are visible in this view.

FIGURE 8: PFS Intermodal Transfer Point at Night -- From the same vantage-point of Figure 7, this is a nighttime view of the PFS Intermodal Transfer Point (ITP) looking north from the I-80 median.

FIGURE 9: PFS Facility from Deseret Peak -- Looking west from the highest accessible point (private road) near Deseret Peak in the Stansbury Mountains east of the PFS site, one can see the general layout of the facility and buildings. The access road and power poles enter into the facility from the east (left of photo) while the rail line enters from the west (right of photo). The batch plant/cask manufacturing area is located north of the Canister Transfer Building. Earthen berms are visible on the south and west sides of the facility and also intersect the access road on the left side of the photo.

FIGURE 10: PFS Facility from Deseret Peak at Night – From the same vantage-point as Figure 9, this is how the PFS Facility will appear with nighttime illumination.

FIGURE 11: PFS Facility from Goshute Village -- Looking west from the Village where about 30 members of the Skull Valley Band of Goshute reside, one can barely see the PFS facility some 3 1/2 miles away in the distance. Power poles along the access road are also visible in this view.

FIGURE 12: PFS Facility from Goshute Village at Night -- From the same vantage-point as Figure 11, this is how the PFS Facility will appear with nighttime illumination.

FIGURE 13: PFS Facility from Pony Express Store -- Looking northwest from the Pony Express Store operated by the Skull Valley Band, one can barely see the PFS facility some 2 1/2 miles away in the distance. Power poles along the access road are also visible in this view. Although the Pony Express Store is closer to the facility than the Goshute Village, it is at a lower elevation, therefore less of the facility is visible from the Pony Express Store.

FIGURE 14: PFS Facility from Pony Express Store at Night -- From the same point as Figure 13, this is how the PFS Facility will appear with nighttime illumination.

FIGURE 15: PFS Facility from Skull Valley Road -- Looking west from Skull Valley Road, one can see the general layout of the PFS facility and buildings some 2 miles in the distance. The batch plant/cask manufacturing area is located north of the Canister Transfer Building. Earthen berms are visible on the south and west sides of the facility and also intersect the access road on the left side of the photo. Power poles along the access road are also visible in this view.

FIGURE 16: PFS Facility from Skull Valley Road at Night -- From the same point as Figure 15, this is how the PFS Facility will appear with nighttime illumination.

FIGURE 17: PFS Facility from West of Deseret Peak – Looking west from the highest accessible point near Deseret Peak (at the entrance to Antelope Canyon located at the approximate center of the SW ¼ of Section 30, T4S R7W) in the Stansbury Mountains 6 miles east of the PFS site, one can see the general layout of the facility and buildings. At this distance, little detail of the facility can be discerned.

FIGURE 18: PFS Facility from West of Deseret Peak at Night – From the same vantage-point as Figure 17, this is how the PFS Facility will appear with nighttime illumination.

All background photos except Figure 15 (16 night) were taken with an Olympus Stylus Zoom 115 DLX, 38-115 mm, compact camera using the 38-mm lens setting (not magnified) with the exception of Figure 9. Figure 9 was taken in a previous year (10/7/98) as part of an unrelated field survey in the Stansbury Mountains. The Skull Valley Band of Goshute granted permission for a PFS survey team to cross the eastern side of the reservation into the Stansbury Mountains. The photo used for Figure 9 was extracted from a multi-picture view of the Skull Valley taken for reference during this survey. The shot was taken from the mouth of Antelope Canyon located at the approximate center of the SW ¼ of Section 30, T4S R7W on the western flank of Deseret Peak. Because this photo was taken for reference purposes, the shot used the full zoom feature of the Olympus camera (115-mm setting) to bring up the detail at the location of the PFS siting area. For this reason the two views of the site area (Figure 9 and Figure 11) give a different perspective of distance. However, the artist did compensate for this effect in his work on Figure 9.

The photo background used for Figure 15 (16) was taken with a Minolta SLR Zoom, 35-80 mm camera owned by the artist using the 35-mm setting (not magnified). This

figure(s) was originally created to provide the closest and clearest viewing perspective of the site area from Skull Valley road. It should be noted that the viewpoint for Figure 13 (PFS Facility from the Pony Express Store) is also physically located adjacent to the Skull Valley Road but at a ½ mile greater distance to the site area and subject to a more obscured viewing perspective.

To create the artist sketches, an initial photo survey was conducted with a skilled graphic artist. The proposed view using the initial backgrounds was then discussed in a meeting with the NRC in Salt Lake City on September 1, 1999 to verify their acceptability. A second photographic survey was then conducted to verify the appropriateness of the final background views and to also finalize in the field with the artist what would be seen from the vantage point contained within each view. The in-field verification process following the two photo survey efforts directly supported the subsequent artistry used in adding overlays to the background photos to complete the final sketches.

The artistry itself is based on the engineering drawings of the storage area, Intermodal Transfer Point, Low rail siding area, and rail equipment; topographic maps of the respective areas to identify physical reference points and features; and the aforementioned field surveys to visually review the area and generate additional reference points. In addition, the artist was the same person who took the aerial photos using the Minolta SLR. The unique visual perspective from the air allowed the artist to identify key ground reference points that were used in locating and scaling the various scenic additions to the photo backgrounds. These same reference points were used in the generation of the artists renderings.

To supplement the use of physical mapped or observed field references to locate and size PFS features at the storage area, a photo scale created from a previous series of artist sketches was reused. This scale was created by photographing buildings of a known size and spacing in downtown Salt Lake City at a known distance. The same

Minolta SLR camera and settings used in the aerial photography were used for the reference photo. A graphic scale was then created to provide relative dimensions from known reference points originating from topographic maps or observable on the background photos (e.g.- seismic test lines across the site north/south, east/west). This provided a means of scaling the PFS features to fit a known area in a specific view. Ultimately all of the above reference information coupled with the skill of the artist contributed to the completion of the overlays which were then added to the photo backgrounds.

Figures 9 and 10, the day and night view of the PFS site from Deseret Peak include all of the NRC desired requested features (buildings, berms, batch plant, access road, rail road, and light poles) and the 35 foot high power poles along the access road. There are no plans to illuminate the access road from Skull Valley road to the PFS siting area. Therefore, in the night view of the site area (Figure 10), the access road will not be visible.

Additional artist sketches of the facility from Deseret Peak are provided as Figures 17 and 18. These photographs were taken with the same camera as the other photographs (Olympus Stylus Zoom 115 DLX, 38-115 mm, compact camera using the 38-mm lens setting, not magnified).

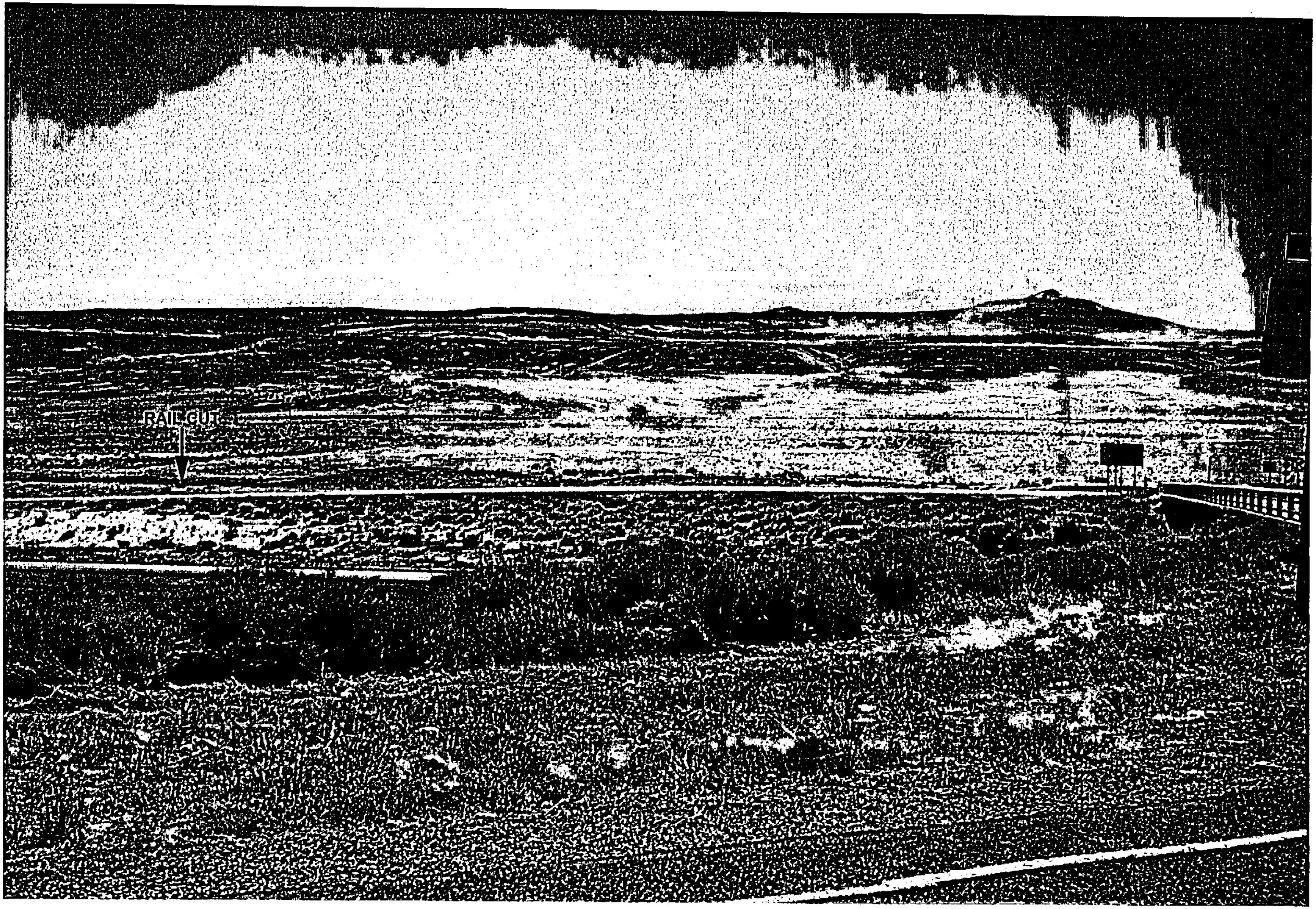

Figure 1
PFS Rail Siding Area at Low from the I-80 Off-ramp

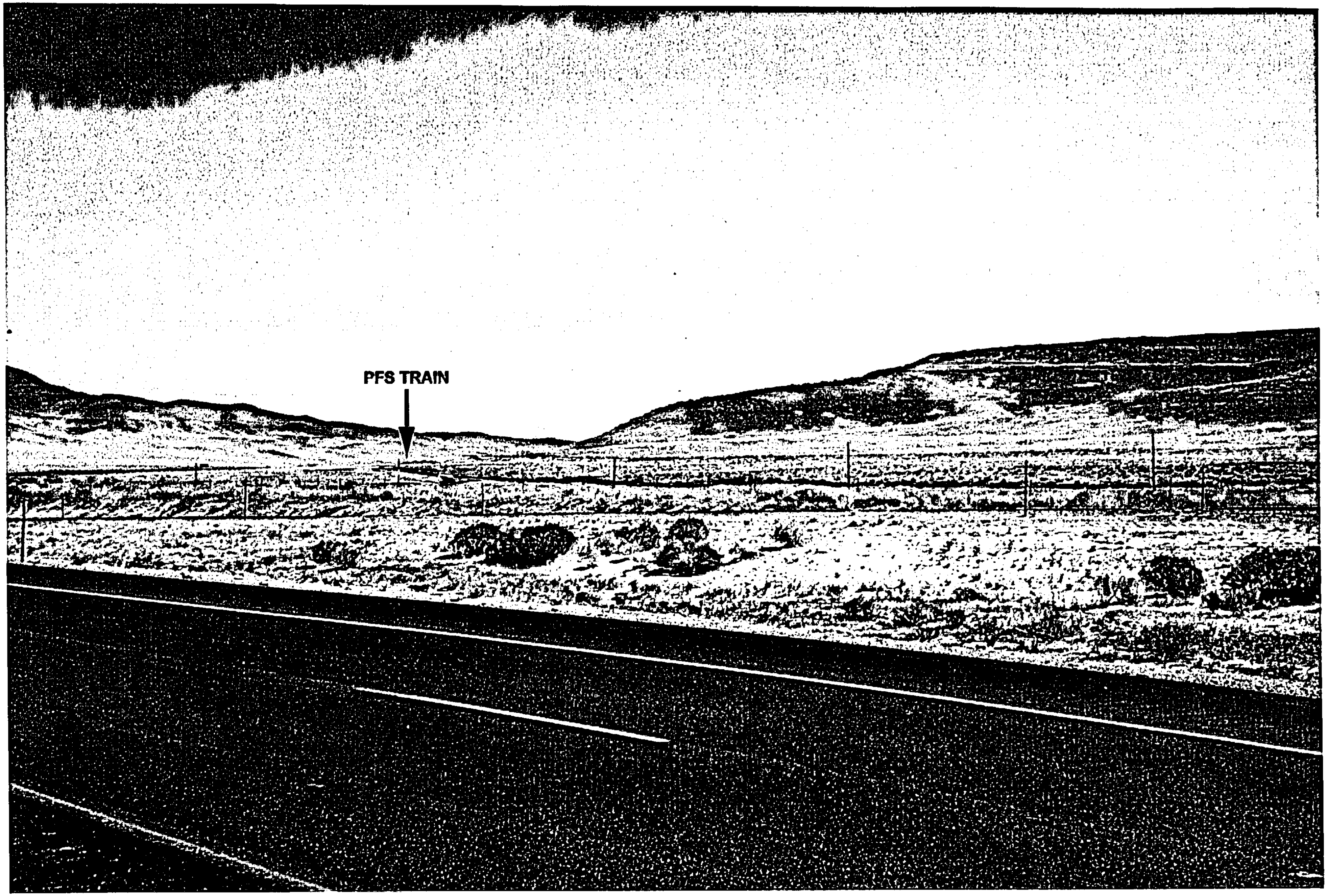

Figure 2
PFS Rail Line at Low from I-80

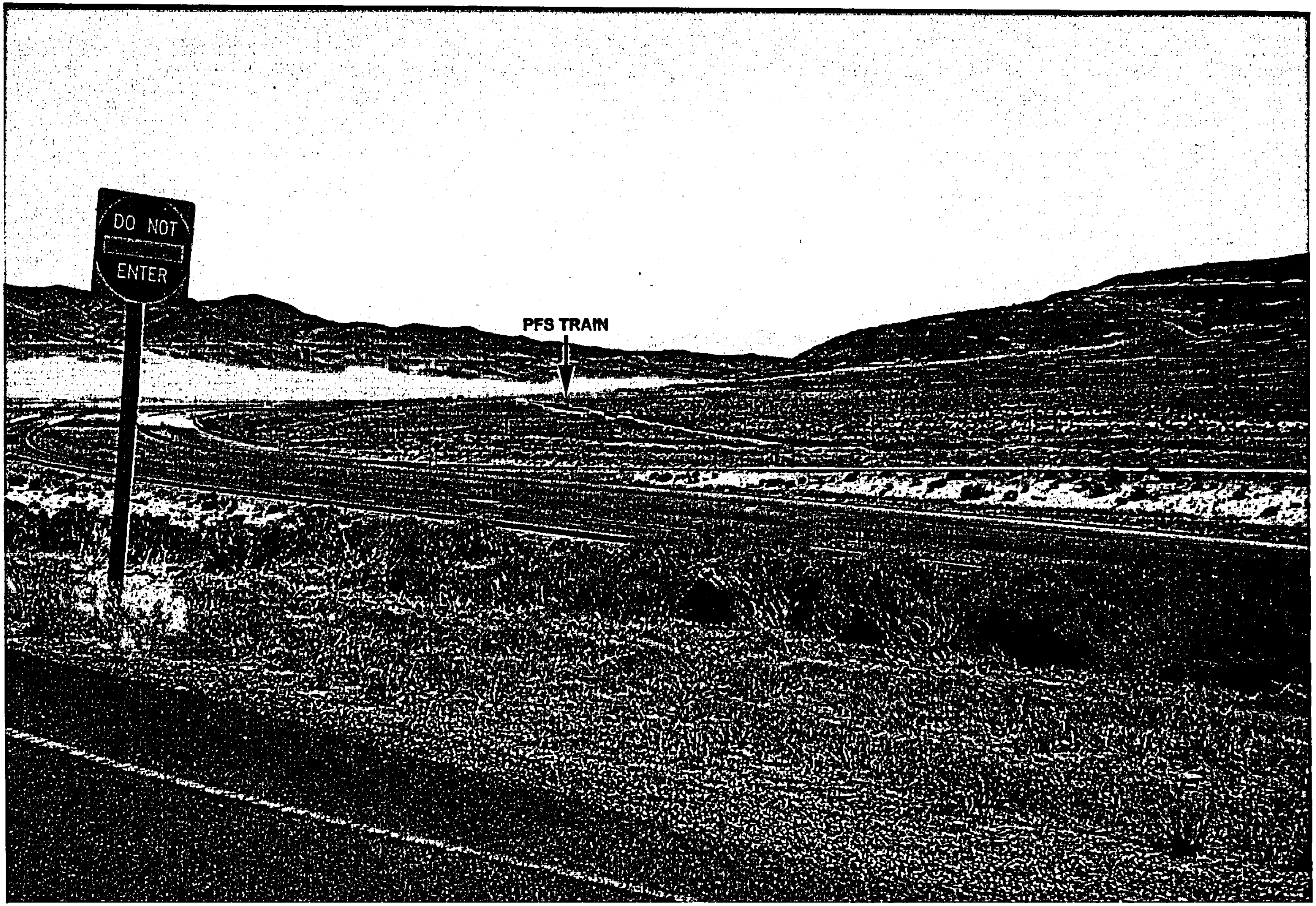

Figure 3
PFS Rail Line from the I-80 Off-ramp

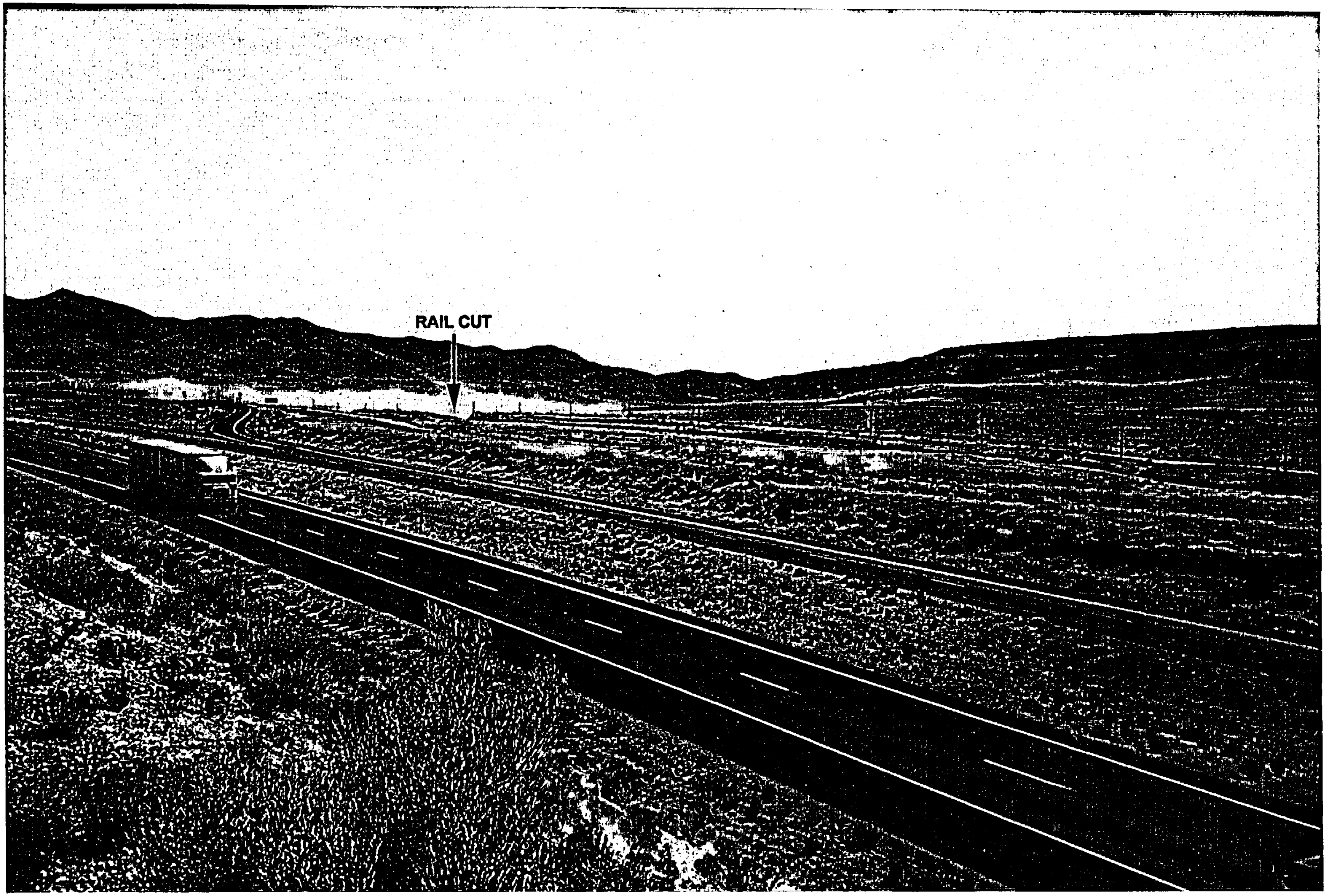

Figure 4
PFS Rail Line from West of Low

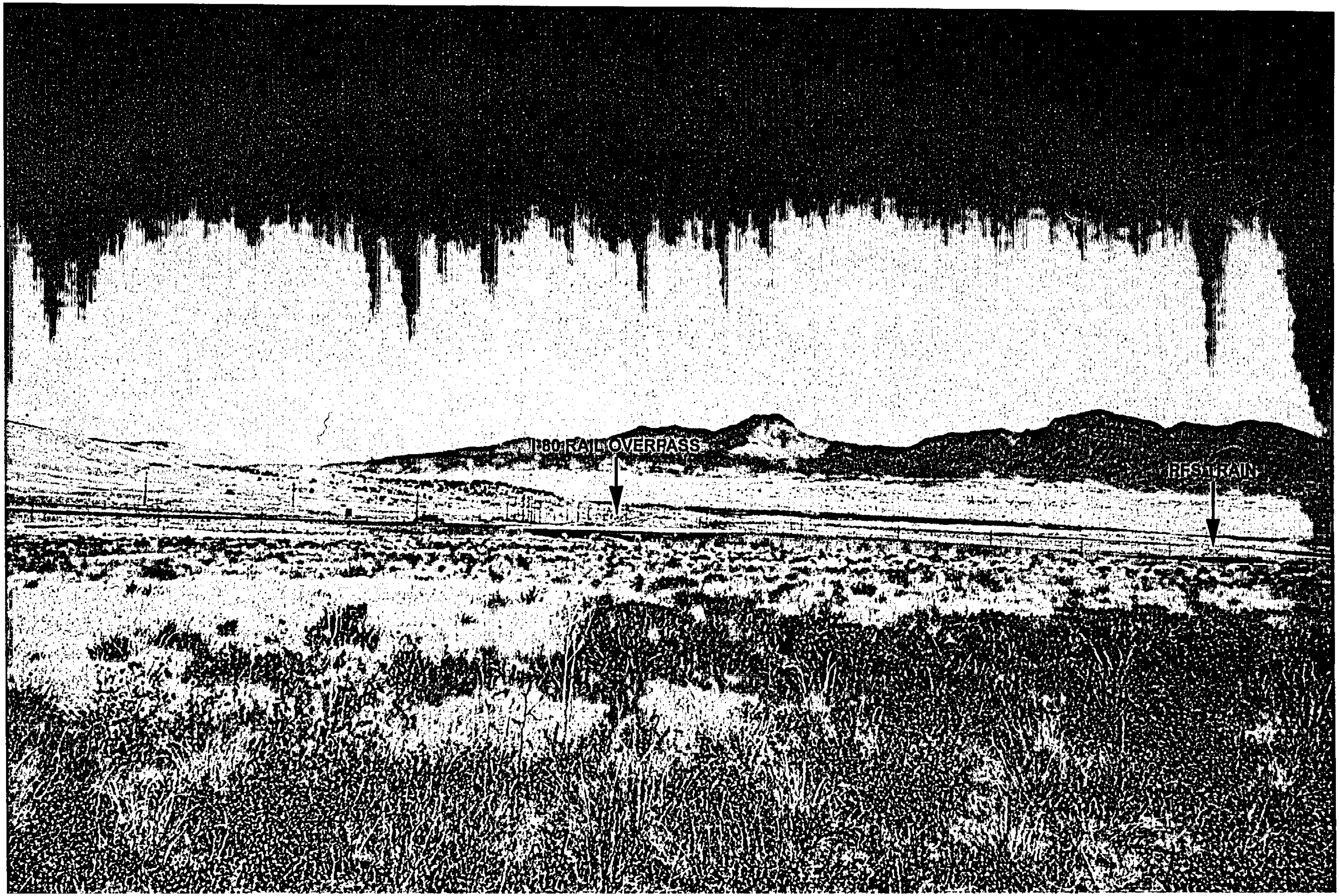

Figure 5
PFS Rail Line from Old US 40

Figure 6
PFS Rail Line from Cedar Mountains at Mid-valley

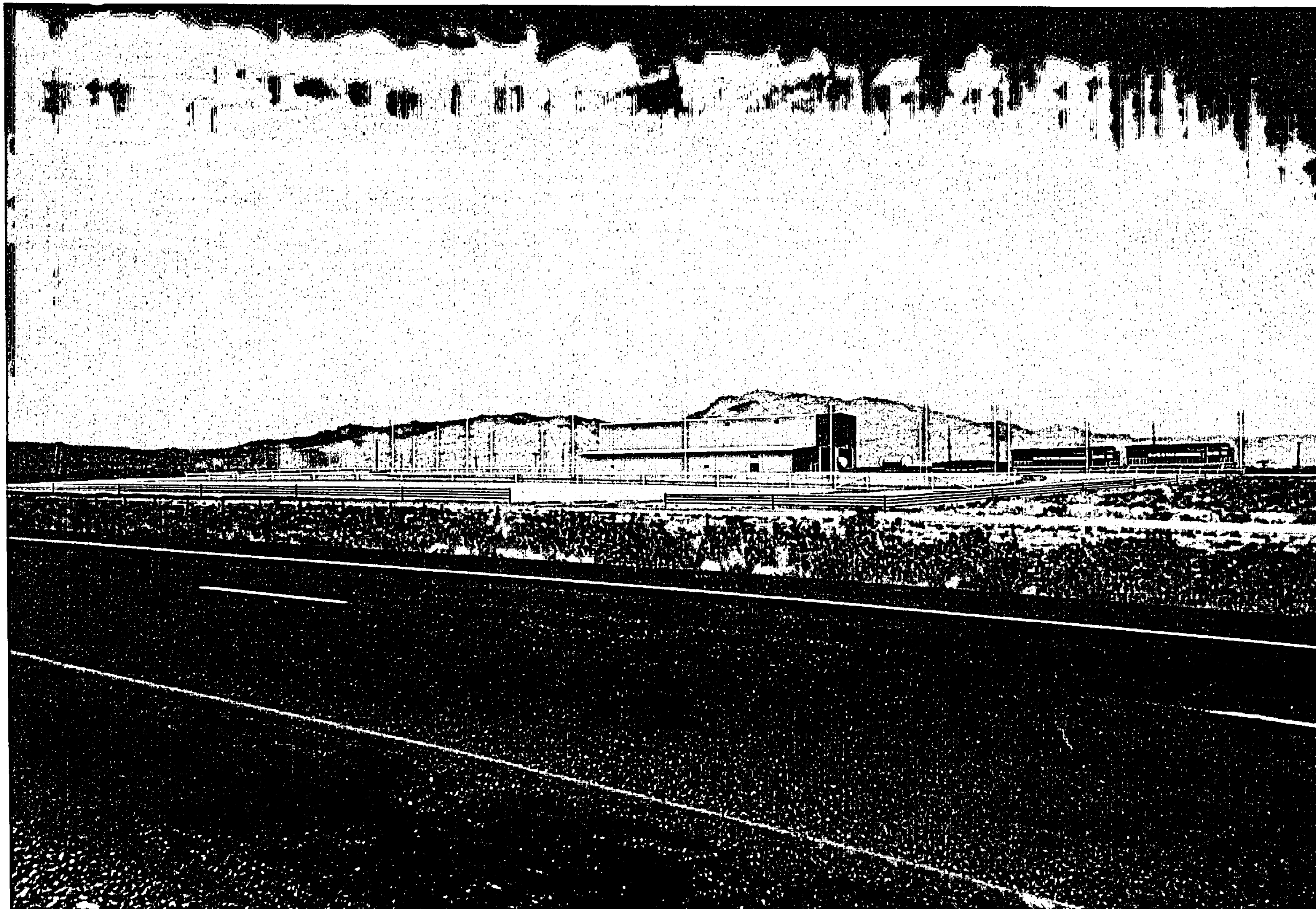

Figure 7
PFS Intermodal Transfer Point

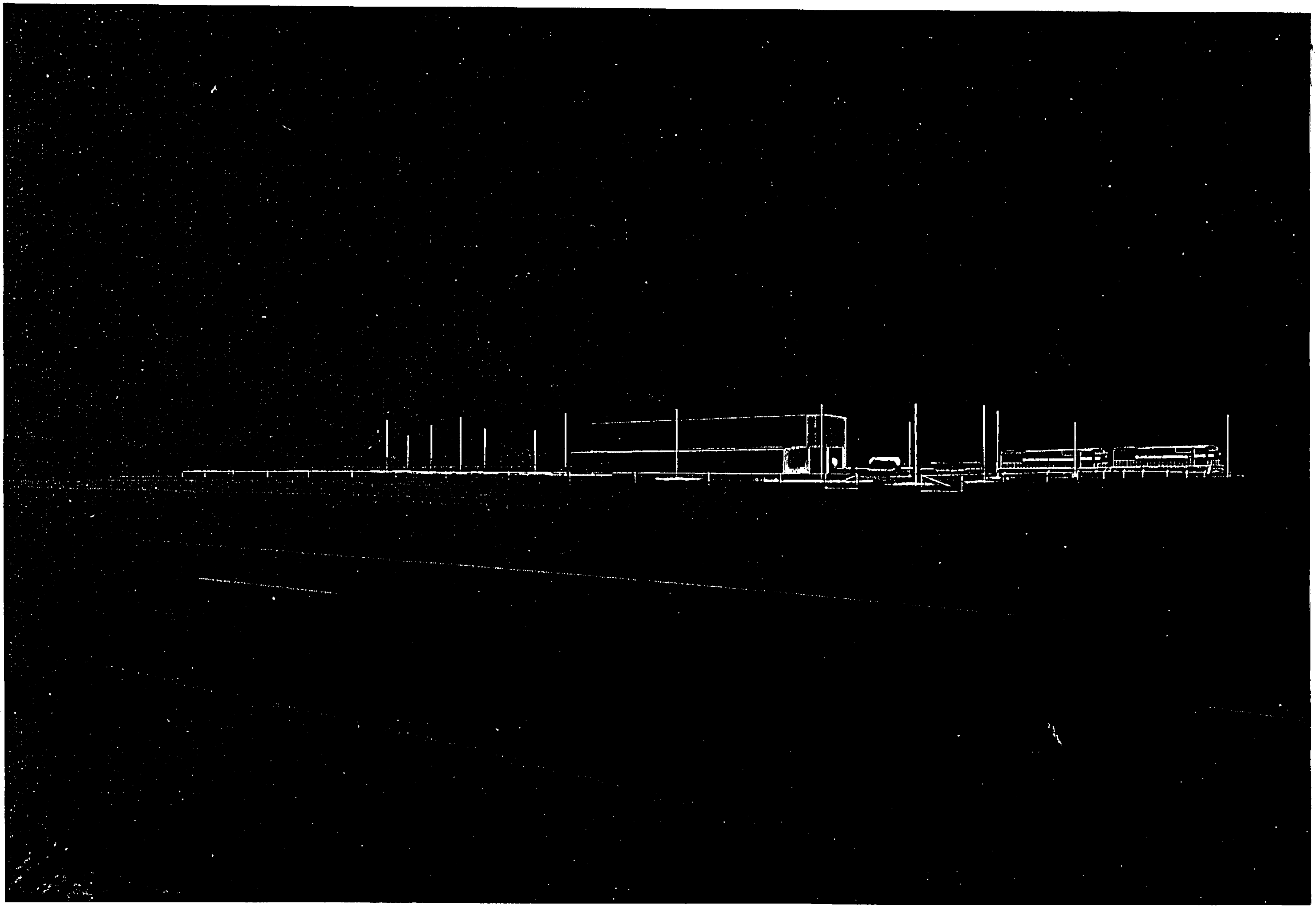

Figure 8
PFS Intermodal Transfer Point at Night

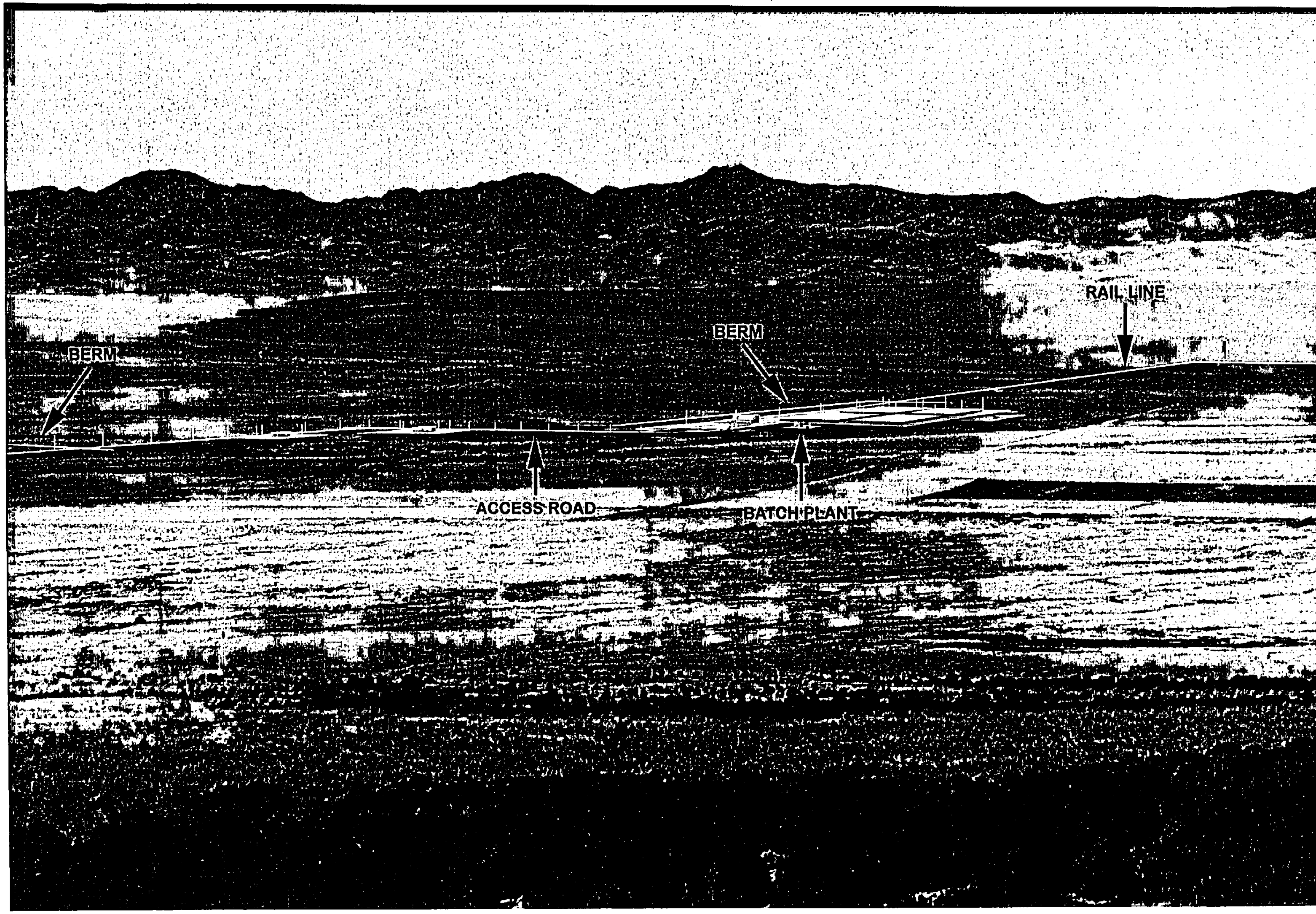

Figure 9
PFS Facility from Deseret Peak

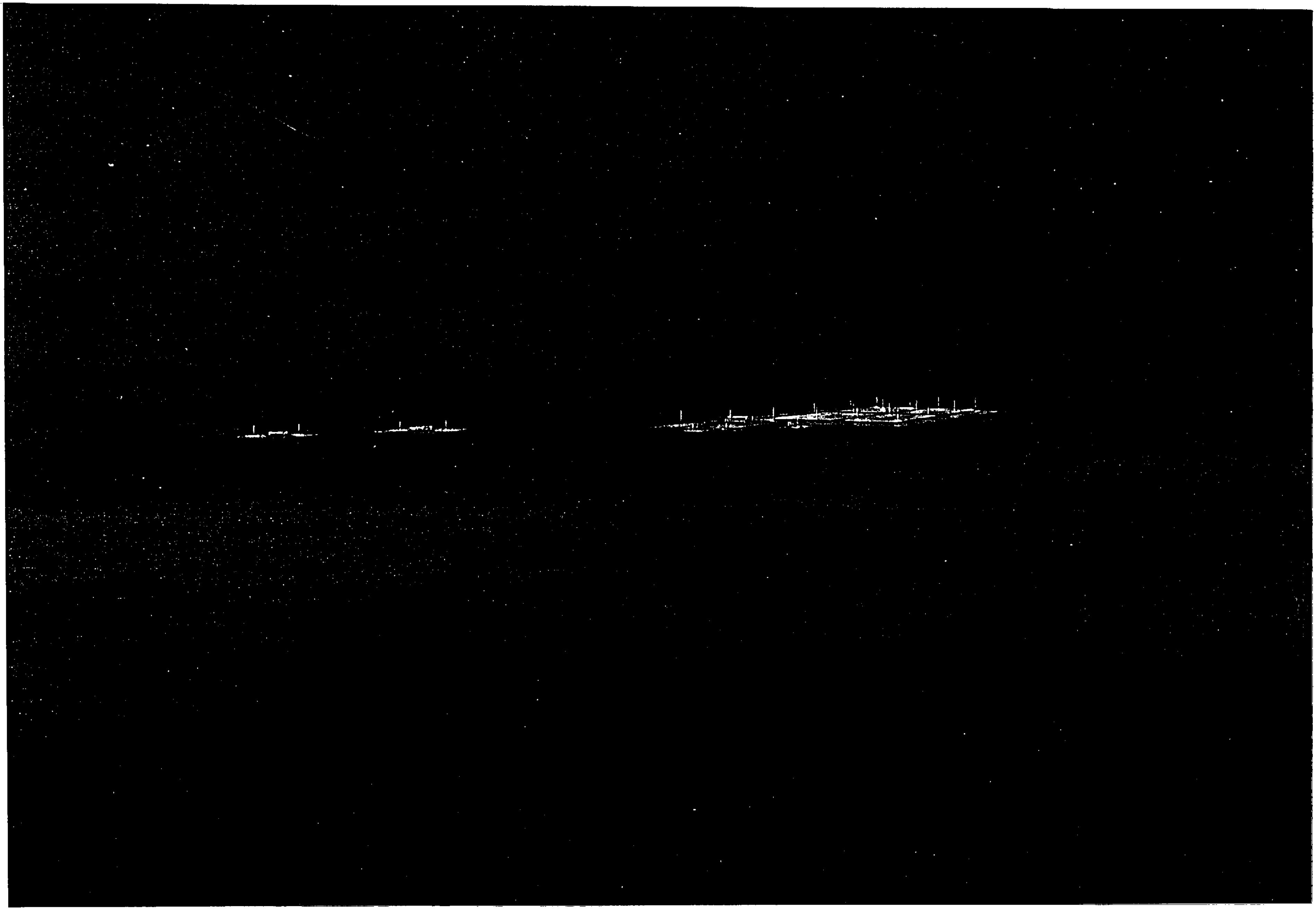

Figure 10
PFS Facility from Deseret Peak at Night

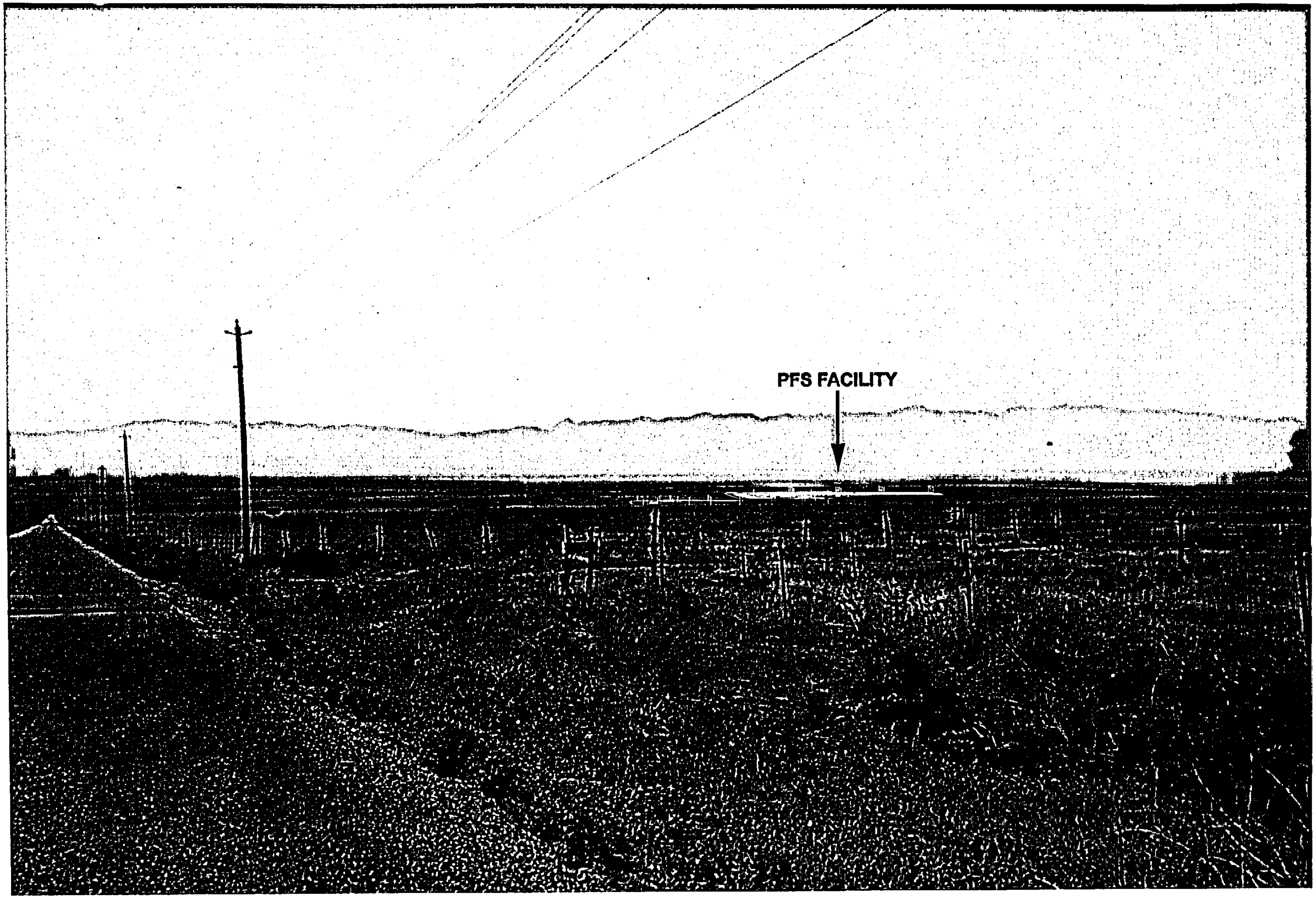

Figure 11
PFS Facility from Goshute Village

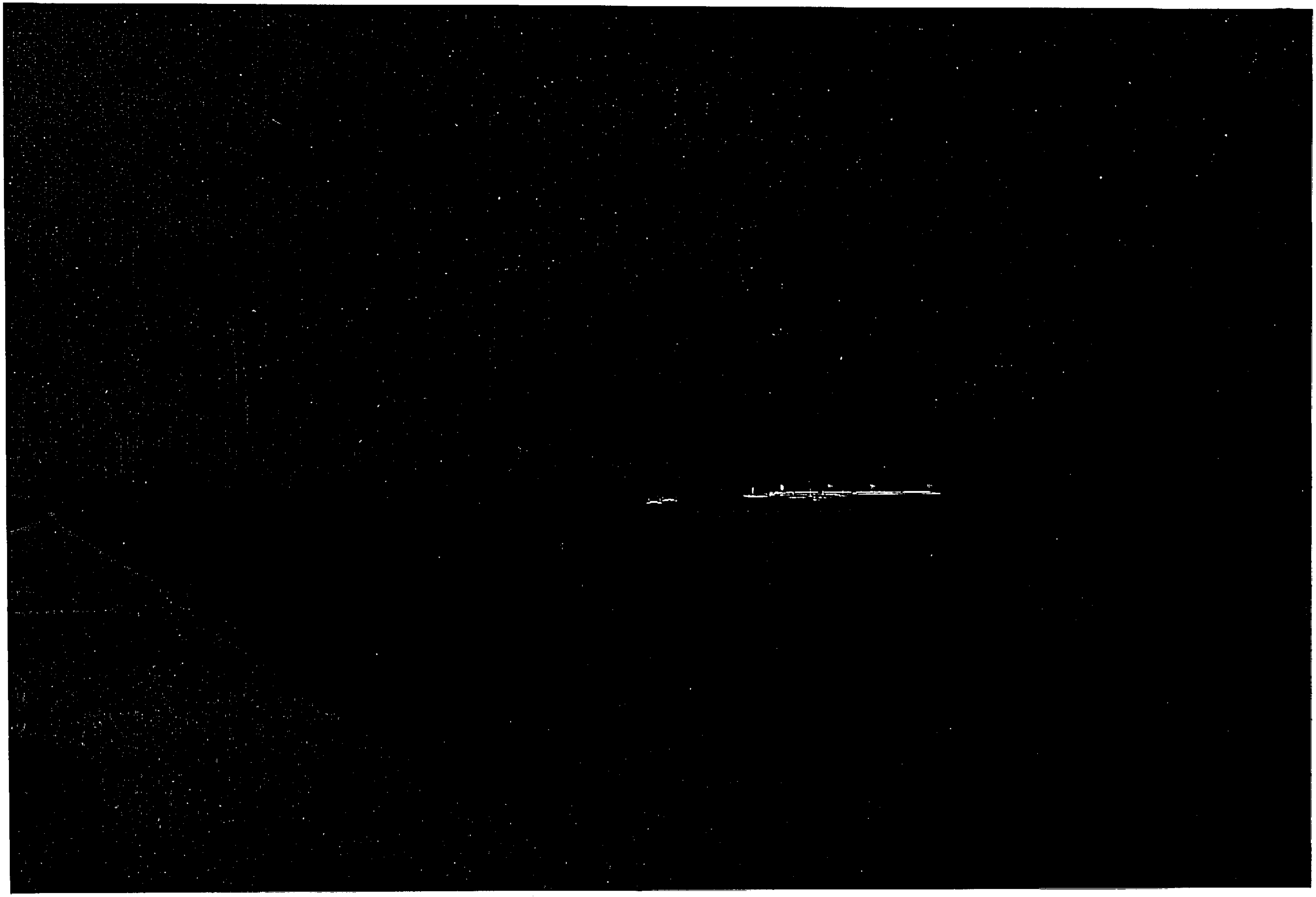

Figure 12
PFS Facility from Goshute Village at Night

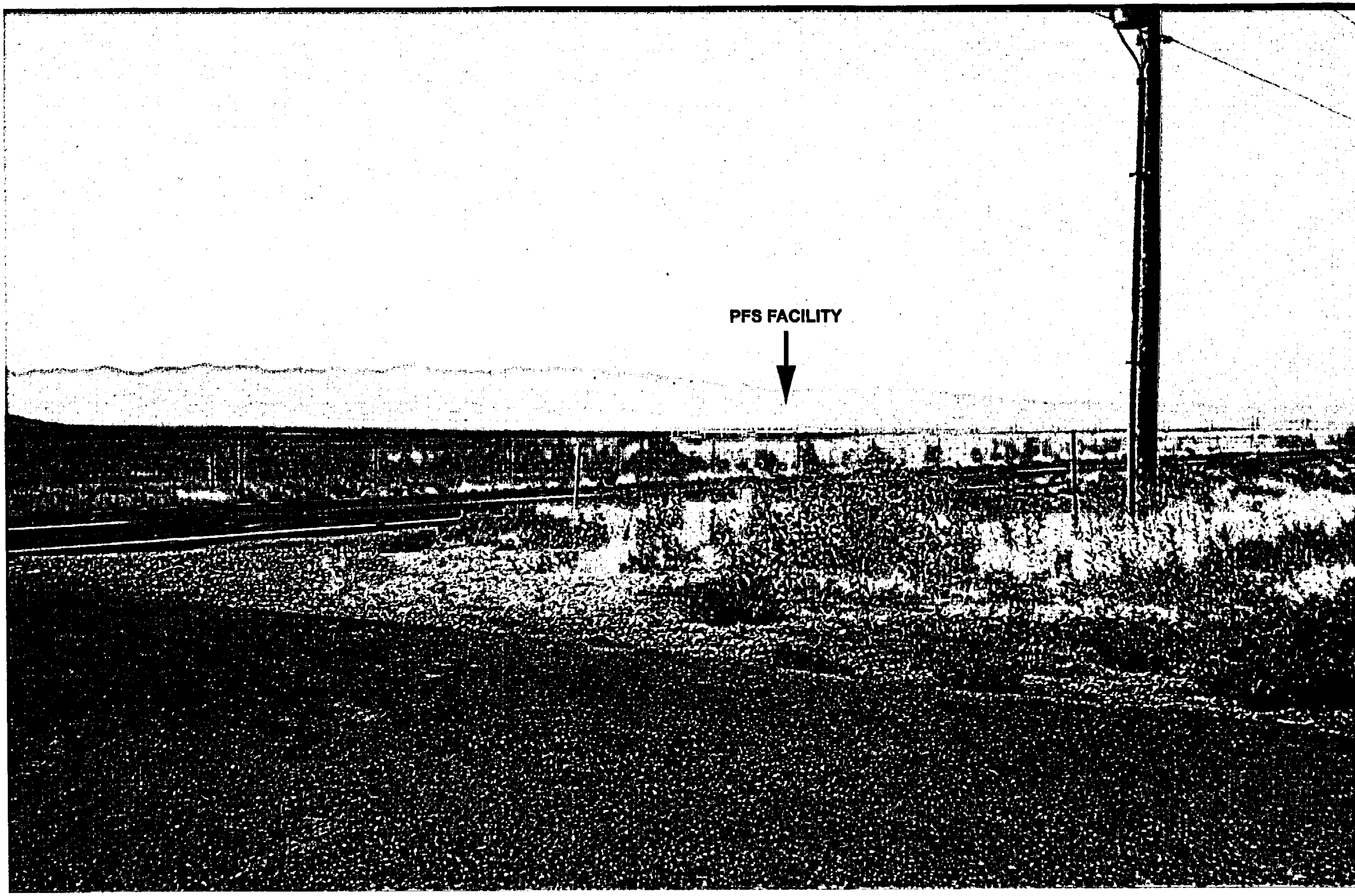

Figure 13
PFS Facility from Pony Express Store

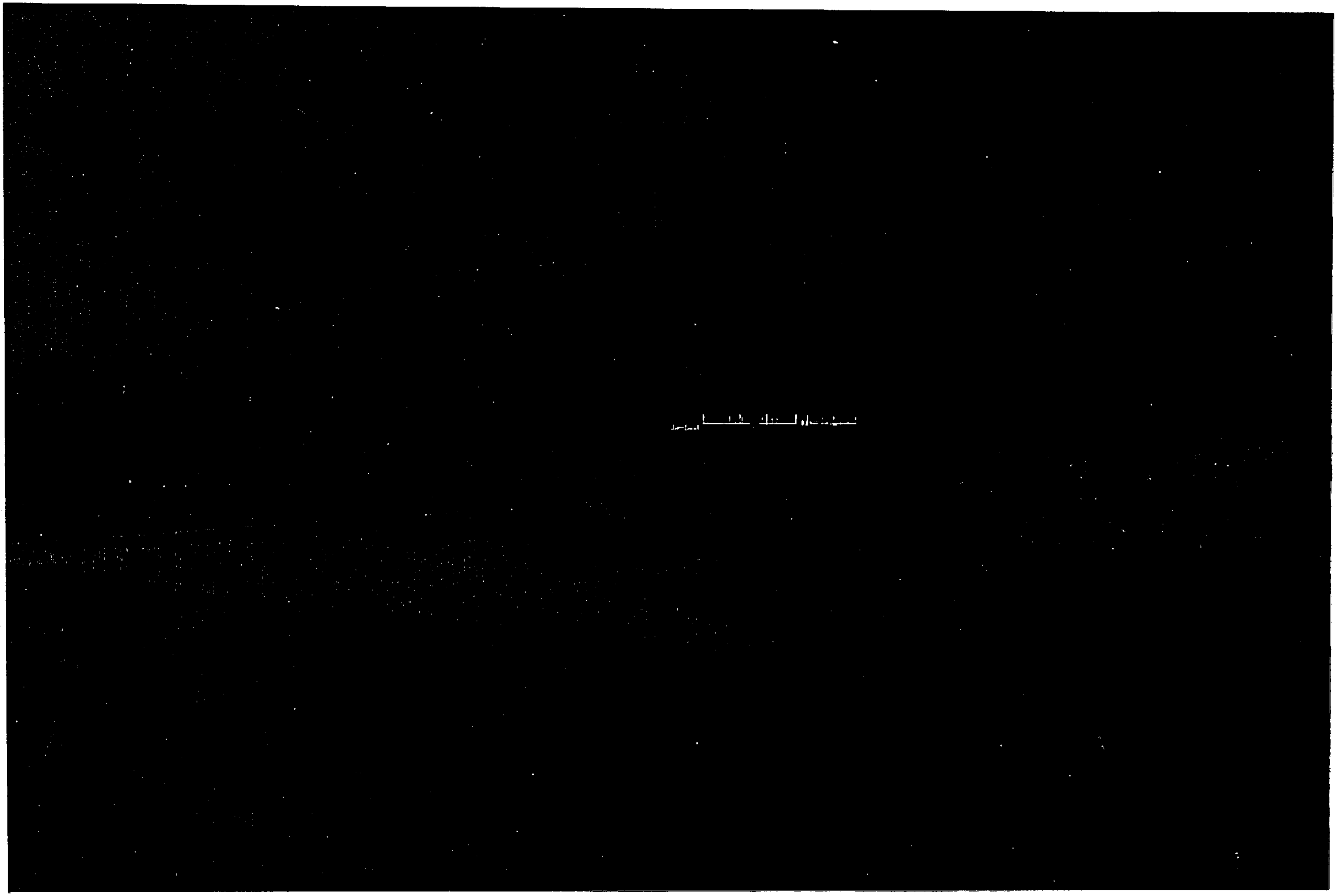

Figure 14
PFS Facility from Pony Express Store at Night

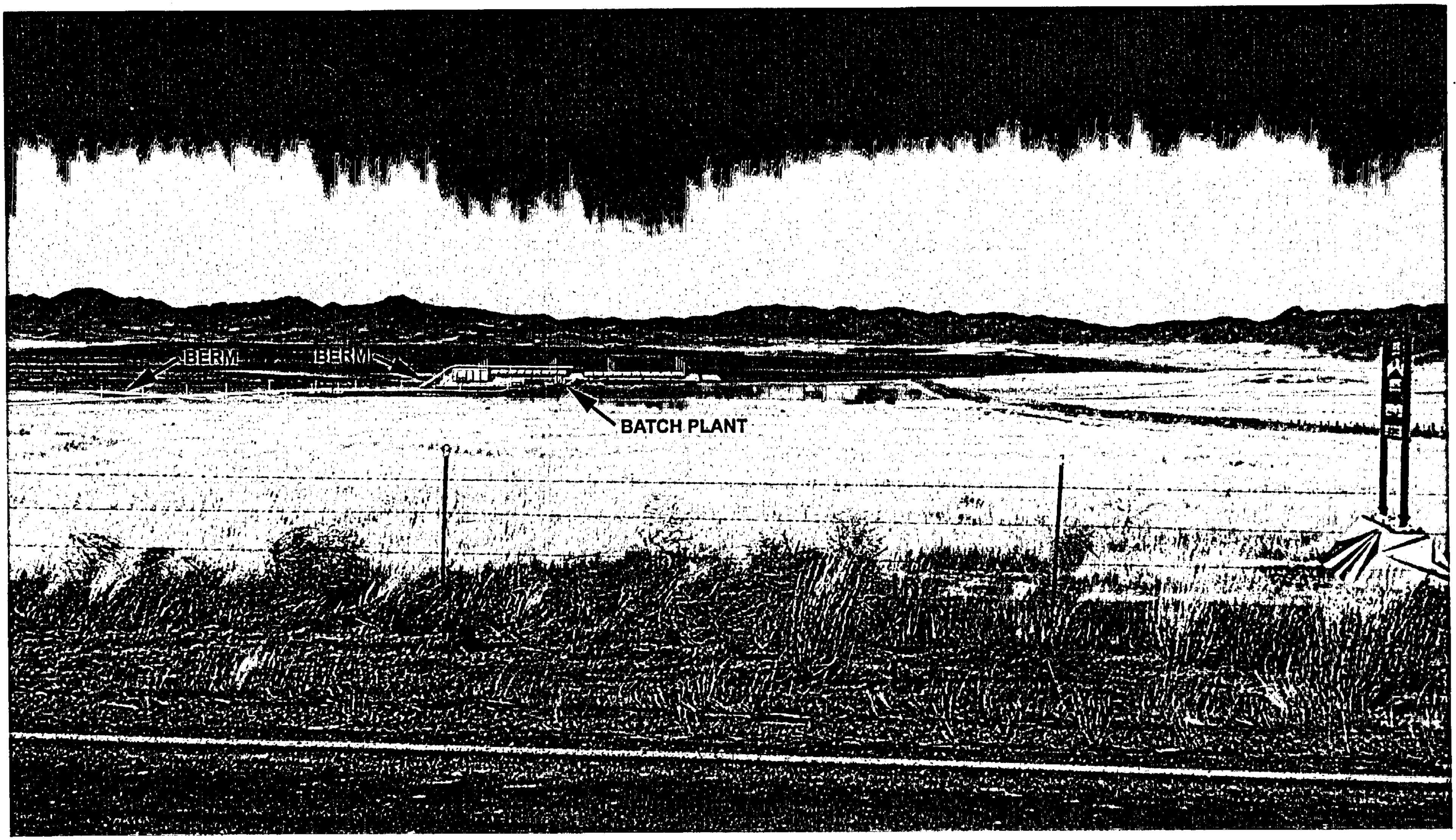

Figure 15
PFS Facility from Skull Valley Road

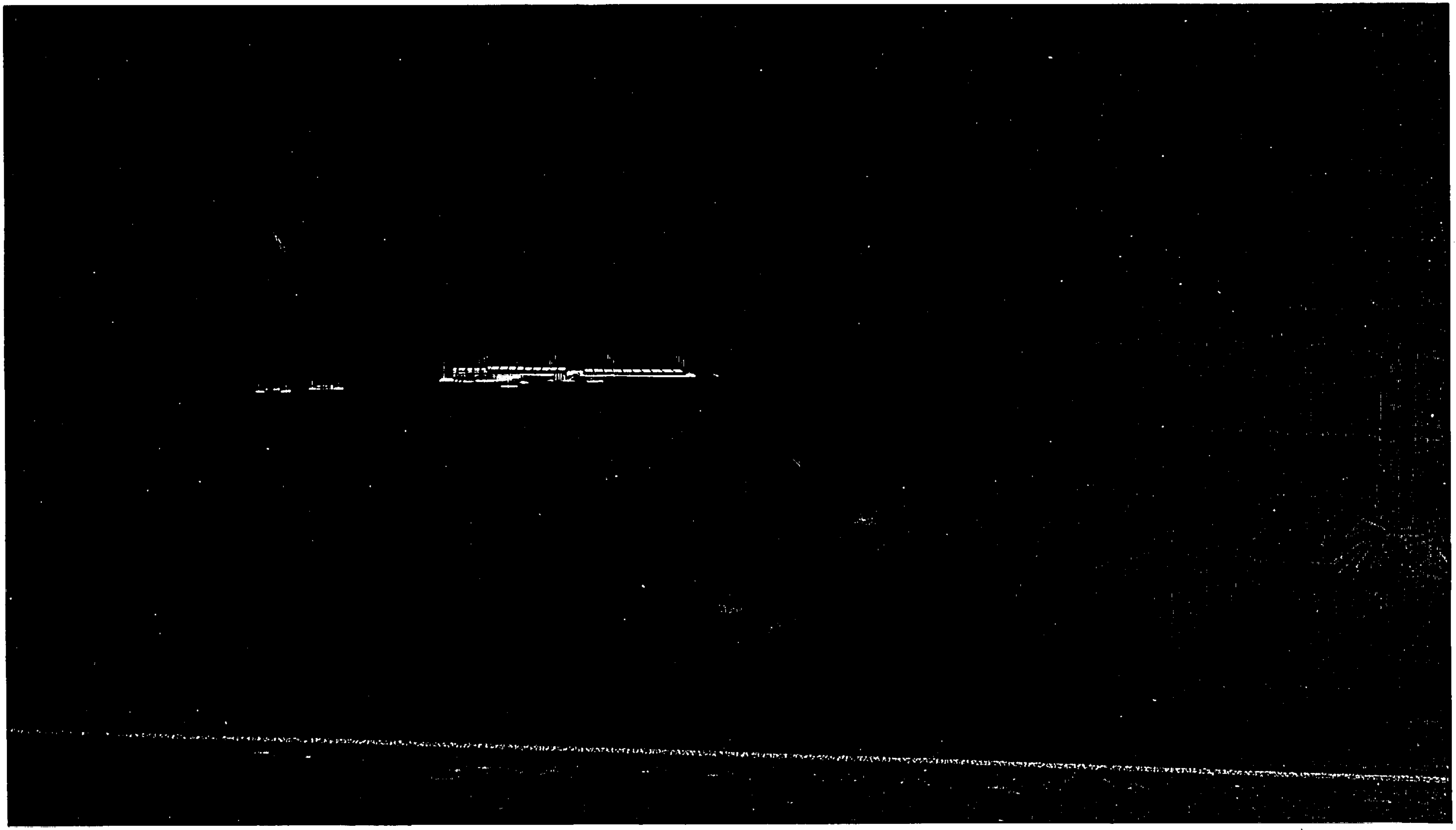

Figure 16
PFS Facility from Skull Valley Road

Figure 17
PFS Facility from West of Deseret Peak

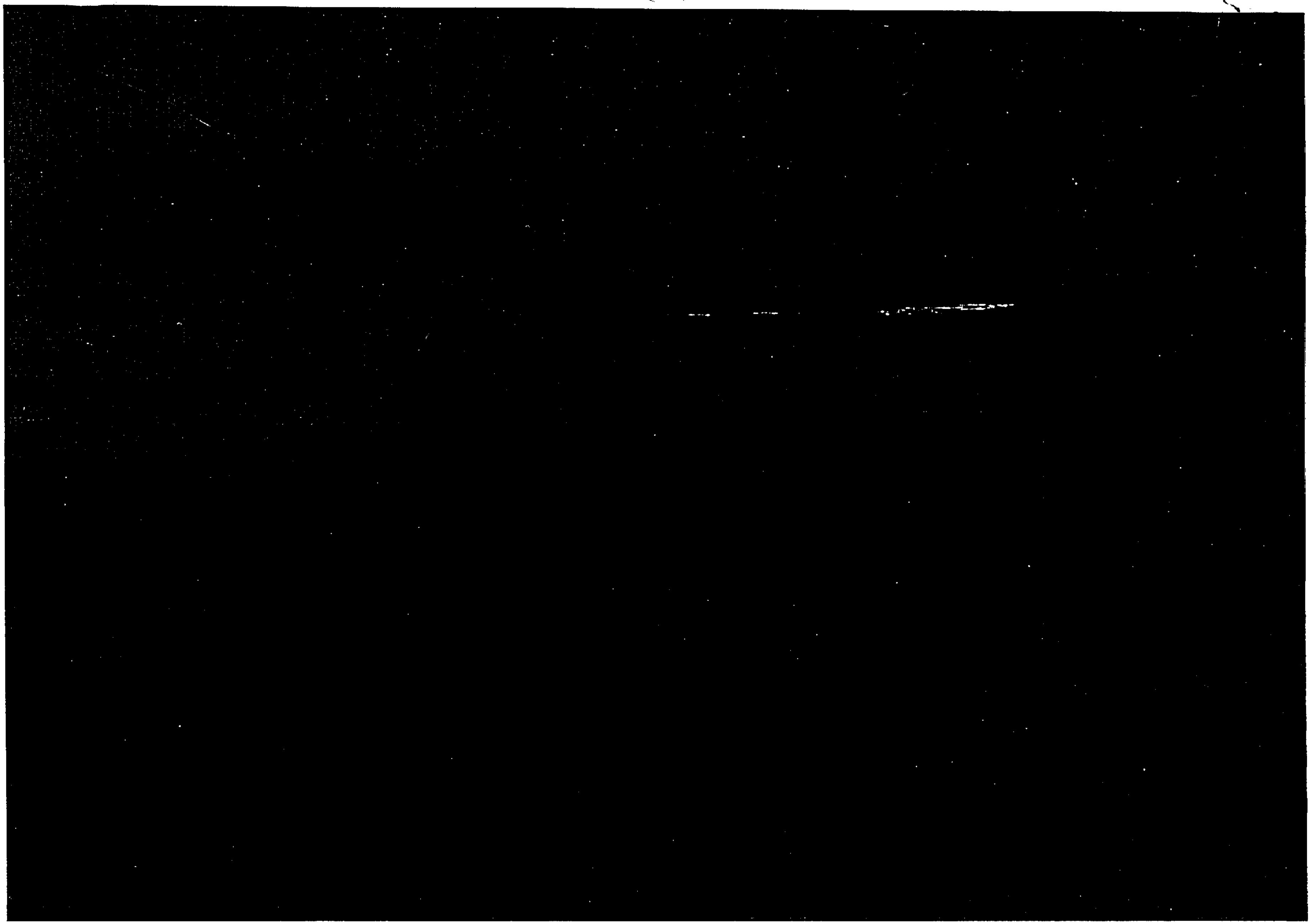

Figure 18
PFS Facility from West of Deseret Peak at Night

7. Two solar radiation sensors (one as spare),
8. One tower boom,
9. One matrix radiation cable,
10. One recording rain gauge (tipping bucket),
11. Precipitation heater cables,
12. One analog barometric pressure sensor,
13. One Campbell Scientific CR10X datalogger with weather tight enclosure,
14. One 12V 20-amp/hour battery,
15. One 20-watt solar panel,
16. Datalogger software (including sigma theta calculation),
17. Data display software with archiving,
18. One Opto-Isolated RS232 interface,
19. One phone modem (1200 baud),
20. Full height grounding for lightning protection
21. One signal line surge protector

The detailed specifications that the vendor was required to meet are provided in Table 6.1-1.

The system is designed to assure at least a 90 percent data recovery and to minimize extended periods of instrument outage through the use of spare parts and surveillance procedures. The initial calibration of all instruments, sensors, recorders, and test equipment, including spare parts and spare instruments was performed by Climatronics and audited by Stone & Webster. Future calibrations will be performed at 6 month intervals. A calibration history is kept for each sensor and recorder and for the test equipment. The measurements for wind speed, wind direction, and temperature are traceable to the National Institute of Standards and Technology (NIST). The instruments used for calibration have a certificate traceable to NIST, where applicable.

All data collected by the meteorological monitoring system are validated by a Certified Consulting Meteorologist (CCM) using validation procedures that compare monitored values with other sources of nearby meteorological data where possible and by checking values against a set of reasonableness criteria for each parameter. Meteorological parameter values that fall outside of prescribed ranges are checked for validity using other sources of data where possible and by examining the synoptic conditions that caused the readings.

A summary of the on-site data collected from December 1996 through December 1998 is provided in Table 6.1-2.

6.1.2 Radiological Monitoring Program

Background radiological characteristics of the PFSF site are described in Section 2.10. A survey of the area gamma radiation levels and a radiological analysis of the surface soil were performed, with the results presented in Section 2.10. PFS will establish a preoperational radiological environmental baseline at the PFSF site. The baseline will sample for radioactivity levels in soil, groundwater, vegetation, and the flesh of non-migratory mammals. The background radioactivity levels at the PFSF site will therefore be established prior to the beginning of PFSF operation. An ongoing radiological monitoring program is not necessary since the storage facility utilizes dry storage casks and does not have an effluent stream which could affect the environment.

Three thermoluminescent dosimeters (TLDs) are being used to measure the area gamma levels. Two TLDs are located on the PFSF meteorological tower (location shown in Figure 6.1-1) and one on the outside of the Pony Express convenience store located immediately south of the tower. Measurements were taken for a period of 126 days. The mean dose rate from background radiation was determined to be 0.28 mrem/day, or 102 mrem/yr. Five surface soil samples were collected at the PFSF site

and analyzed for gross background alpha / beta radiation and for the radionuclide concentrations of naturally occurring radioactive materials. The approximate locations of the samples were at the center and each of the four corners of the site.

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6.2 PROPOSED OPERATIONAL MONITORING PROGRAMS

There are no effluent releases from the storage system utilized at the PFSF. After the canisters are loaded with spent fuel at the originating nuclear power plant, the canisters are vacuum dried, backfilled with helium, welded closed, and tested to verify leak tightness. As discussed in PFSF SAR Sections 4.2.1.5.5 and 4.2.2.5.5, the canister vessels and their closures are fully welded. The canister confinement barrier has no bolted closures or mechanical seals. The canister closures have redundant welds that are tested by liquid penetrant or magnetic particle inspection to verify their integrity. Canister welds are also hydrostatically tested and closure welds are helium leak tested at the nuclear power plants where fuel loading is performed, providing added assurance of weld integrity. Potentially contaminated gases that are purged from the canisters during the closure process are handled by the gaseous radwaste system at the nuclear power plant shipping the fuel. The canisters are ASME Section III vessels designed to remain leak-tight for long-term storage at the PFSF. Under normal, off-normal and credible accident conditions of transport, handling, storage, and removal offsite, the potential does not exist for breach of the canister and release of radioactive material associated with the spent fuel from inside the canister. Therefore since there are no credible scenarios that release effluents, the PFSF has no site effluent monitoring system.

Since the canister is entirely welded with a redundant closure system, no direct monitoring of the closure is required, in accordance with NRC guidance. Section 7.0.V.2 of NUREG-1536 states: "The NRC staff has found that casks closed entirely by welding do not require seal monitoring." Section 7.0.V.4 of NUREG-1536 states that for normal conditions: "If the confinement boundary is welded ..., the staff accepts that no discernible undetected leakage is credible. Hence, the dose at the controlled area boundary from atmospheric release is negligible." Section 11.4.2.1 of NUREG-1567 (draft report for comment) states: "The NRC has accepted that storage confinement

casks of acceptable design and construction that are sealed by welding do not require monitoring for possible radiation release. This is consistent with not monitoring other welded joints in the confinement system following fabrication and acceptance testing. Monitoring capability and/or surveillance for potential radioactive material release should be proposed for storage casks that do not have welded closure seals."

Nevertheless, TLDs will be located along the perimeter of the RA and along the OCA boundary fence and they provide a passive means of continuously monitoring radiation levels at these boundaries. While the primary purpose of the TLDs is to monitor the direct radiation emanating from the storage casks, they do provide a means for detecting a radionuclide release.

Airborne monitoring will be performed in the Canister Transfer Building during canister handling operations. The monitoring will be accomplished by means of continuous air monitors located in the exhaust of each canister transfer cell. The continuous air monitors will include local alarm to warn operating personnel in the unlikely event of an airborne release, remote alarm in the Security and Health Physics Building alarm station to ensure coverage at all times, and charting capability to provide data necessary to quantify any release. The Canister Transfer Building will also use area radiation monitors for monitoring the general building dose rate from casks and canisters during canister transfer operations.

TLD's will be used along the boundaries of the Restricted Area and Owner Controlled Area to record radiation dose data.

6.3 REFERENCES

ANSI/ANS-2.5, Determining Meteorological Information at Nuclear Power Sites, 1984.

Regulatory Guide 1.23, Onsite Meteorological Programs, (Safety Guide 23), February 1972.

NUREG-1536, Standard Review Plan for Dry Cask Storage Systems, U.S. NRC, Final Report, January 1997.

NUREG-1567, Standard Review Plan for Spent Fuel Dry Storage Facilities, U.S. NRC, Draft Report for Comment, October 1996.

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CHAPTER 7

ECONOMIC AND SOCIAL EFFECTS OF FACILITY CONSTRUCTION AND OPERATION

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7.2 BENEFITS

The categories of direct and indirect benefits of the Private Fuel Storage Facility are based on those set forth in Table 1 of Regulatory Guide 4.2.

7.2.1 Direct Benefits

Chapter 1 demonstrates that there is a need to provide centralized, interim storage of spent fuel for some nuclear generating plants; to allow for the complete dismantlement and decommissioning of other nuclear plants; and to allow for the standardized packaging and staging of spent fuel in a uniform manner prior to its shipment to a federal spent fuel storage facility and/or repository. The availability of the PFSF would provide insurance for those reactors which may be unable to increase at-reactor spent fuel storage or where increased on-site storage would not be economically advantageous. Therefore, the direct benefits of the storage facility are reducing the risk of interruptions in the operation of existing nuclear power plants, as well as the unfettered decommissioning of permanently shut down commercial reactors.

Several U.S. reactors have already used all available space in their spent fuel pools and have built onsite ISFSIs for continued storage of spent fuel generated through operation of the plants. Some of these utilities have received limited, conditional approval from their states for additional onsite storage for their reactors for a period of time which would not allow operation through the end of licensed life, potentially resulting in premature shutdown. Some of the conditions attached to additional storage approval are very costly and burdensome. Other reactors are approaching the time when their spent fuel pool capacity will be exhausted and will be required to build additional onsite storage capacity or shut down. Recent studies indicate that 26 reactors will run out of storage pool space by January 1998, and 46 will run out by

2002. By 2015, 93 of the nation's reactors will have exhausted their spent fuel pool capacity (Radwaste, 1997). If no other alternative storage capacity is provided, many of these reactors will be forced to shut down before the end of their licensed lifetime.

Other direct benefits include reduced costs for centralized storage in comparison to continued onsite spent fuel storage at some reactors, allowing for early dismantlement and disposal of wastes, and reduced handling of spent fuel by packaging in a transportable, canister-based, storage cask system. Recent estimates place the savings to utilities and their customers of a centralized interim storage facility over construction of additional on-site storage facilities for spent fuel at $1.995 billion (ERI, 1997), assuming an interim storage facility opens in 2002 and a 40 year operating period. LLW disposal costs have risen significantly over the last 10 years, over 960%, a rate much faster than the rate of inflation (see Figure 7.2-1). Because of the rapid escalation of Low Level Waste (LLW) burial charges and the continuing uncertainty of burial site availability, delayed decommissioning for these permanently shutdown reactors will result in significantly increased LLW disposal costs.

Packaging spent fuel in multi-purpose storage and transportation canisters will eliminate the need to directly handle the spent fuel at the PFSF. Reduced handling will result in lower operational costs for utilities.

The direct benefits for the Skull Valley Band of Goshute Indians (Band) are shown to be a steady revenue stream for the Tribal Government and Band members, a diverse set of meaningful jobs for tribal members and training/development opportunities for other Band members. Currently Skull Valley Band of Goshute Indians have an enrollment of 119 members, with about 30 members of the Band living on the reservation. Six of these members are over the age of eighteen. The balance of the enrollment reside in the outlying cities or out-of-state. Two adult Band members from the reservation are

students; one Band member is an elected tribal official, and other Band members are employed off the reservation in nearby communities working within the agriculture, forestry, and fisheries class of industry.

Members living off the reservation are employed in similar positions and also include artisans, nurses, and construction workers. Approximately 50 % of the enrolled membership living off the reservation have expressed interest in returning to the reservation if jobs and housing were available. The presence of the PFS facility will provide this opportunity to all enrolled Band members.

The Band has no natural resources other than the raw land itself. Because the Skull Valley Goshute Reservation is located in an area that has been designated as a waste zone by the State of Utah, the Band must rely on economic development programs that are consistent with the numerous waste processing and testing facilities that surround the Reservation. Until 1995 about 90% of the Band's income to fund programs came from the lease of the Tekoi rocket motor testing facility on the reservation. However, the scale of these activities has reduced significantly in recent years. The Band has decided against business relationships with businesses not consistent with industrial activities in Tooele County and of interest to the Band.

The addition of the PFS facility to the reservation will provide a base income to the Band as a whole. Lease payments by PFS will provide economic benefits for the community of Skull Valley Band members living on the reservation; on potential social, educational, and economic development of the reservation; and the welfare of the Band members who live in other communities. Individual job opportunities will also exist which will further enhance and support the economic stability of the Band. The Band, through a budgeting process, allocates all of the financial resources for the betterment of the Band on a yearly basis. Many of the activities conducted on the reservation,

including maintenance, operation of the Pony Express Store, and the operation of Tribal governance are presently volunteer positions due to the lack of financial resources. The Band is in the process of developing financial strategies to provide for the long-term financial security and standard of living improvement for all enrolled Band members from their business ventures which includes their business opportunity with PFS. Improvements contemplated for the reservation include housing, schools, day-care, medical facilities, higher education opportunities, and commercial improvements to the Pony Express Store.

7.2.2 Indirect Benefits

The indirect benefits of the PFSF over its operating life include payments to Tooele County as cask surcharges, tax revenues to the State of Utah from sales taxes, a short term increase in regional employment due to the facility construction and a long term increase in employment during its operation, as described in Section 9.1 of the Safety Analysis Report. Using the 15,000 MTU base case, the amount of state tax payments is estimated to be $53.5M, based on a review that PFS performed on the Utah tax structure. Payments to Tooele County are estimated to be $91.2M, based on a proposed agreement that was negotiated between PFS and the County. Site payroll (exclusive of facility construction or canister manufacture) is estimated to be $81M. This estimate is based on actual staff positions and anticipated pay for each position, including benefits. Other local expenditures, including operations support and utilities, is estimated to be $79M. Local expenditures for operations support are based on the number of personnel involved, and utilities are based on the number of buildings and the estimated utility load for these buildings. The construction of casks and canisters if done locally is estimated to be $747M. Payroll expenditures for Phase I construction are estimated to be approximately $30 M. This includes the cost of constructing the

Low Corridor rail line, but does not include the cost of constructing the Intermodal Transfer Point.

Other indirect benefits include local procurement of materials and supplies for the construction and operation of the facility from the surrounding region. Procurement of casks and other goods, as well as possible local fabrication of canisters will have a large impact on the local area. Each dollar earned which is spent in the local economy has a multiplier effect, further increasing the positive spending impact on the local area.

It is estimated that U.S. operating nuclear plants reduce the emission of 86 million metric tons of carbon into the air each year (NEI, 1997). Likewise, a significant amount of nitrogen oxide and sulfur dioxide emissions are also prevented. Plants which are shut down or not relicensed due to lack of spent fuel storage availability will likely be replaced with fossil generation. In the U.S. Clean Air Act and the Global Climate Action Plan, aggressive goals for reduced emissions have been established. Compliance and attainment of these goals would be jeopardized by plants idled due to lack of spent fuel storage capability.

The indirect benefits for the Band include increased traffic and business at their convenience store during construction and operation, and an increased profile for the Band in the Utah business economy, potentially bringing new economic development initiatives to the Band. Other indirect benefits will include construction of a rail line to the site which will provide opportunities for further Band economic development projects. In addition, the project will provide improved access to the western portion of the reservation and improved electric and phone services through upgraded distribution and communications lines to the reservation area.

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7.3 COSTS

The categories of direct and indirect costs of the PFSF are based on those recommended from Table 2 of Regulatory Guide 4.2.

The direct costs of the PFSF include initial costs to site the facility, the costs to engineer and construct the facility and annual costs associated with the Tribal lease, maintenance, operation, transportation, security, license fees, and taxes. The estimated capital cost for the PFSF is $100 million, including engineering and licensing, construction, not including the storage canisters and casks. The total life cycle cost for the facility and its operation over its projected 40 year operating life, using a 3.8% real interest rate, is $1.1888 billion, including all the above categories and a 2010 repository opening (PFSLLC, 1997). For a 2015 repository opening year, the life cycle cost is $1.1803 billion. Appendix 7A provides a summary of the assumptions used in calculating the PFS facility costs and benefits for a range of other facility sizes and discount rates. Appendix 7B provides a summary of at-reactor spent fuel storage costs. Appendix 7C summarizes the net benefits (avoided costs) of building the PFS facility.

The indirect costs, which are derived from socioeconomic and environmental impacts of the facility, are minimal due to the remote location and small size of the actual storage area.

These total project costs are less than the total project benefits gained by reduced fuel storage costs, continued plant operation and early decommissioning as described in Section 7.2. The PFSF life cycle costs and benefits are summarized in Table 7.3-1.

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TABLE 7.3-1
PRIVATE FUEL STORAGE FACILITY
LIFE CYCLE AVOIDED COSTS (NET BENEFITS)
EXPECTED CASE
($ in thousands)

Repository Opening Date	2010	2015
Repository Size	16,600 MTU	20,000 MTU
Operating Expenses	$1,188,800	$1,180,300
Environmental Costs	negligible	negligible
TOTAL	$1,188,800	$1,180,300
Project Benefits to Utilities	$1,557,300	$2,049,500
Net Project Benefit	$ 368,500	$ 869,200

Notes: 1. Benefits and Costs discounted using a 3.8% Real Interest Rate.
2. Operating expenses include decommissioning costs, interest and depreciation.

APPENDIX 7A

AVOIDED COST ANALYSES ASSUMING REPOSITORY IN 2010 AND 2015

PFS has used a discount rate of 3.8 percent for the discounted cash flow analysis. The avoided costs are also calculated using a 7 percent discount rate, the current discount rate required by the Office of Management and Budget Circular A-94, and the summary results are shown in Appendix 7B for comparison purposes. The justification for using the 3.8 percent rate is as follows:

1) The OMB Circular A-94 which suggests the use of 7 percent for the discount rate is dated October 29, 1992 – nearly seven years ago. Section 8.b.1 which suggests the 7 percent rate, also has a statement at the end of the paragraph which states "Significant changes in this rate will be reflected in future updates of this circular". No updates to this section of the circular have been made available, however the appendices (e.g. Appendix C) to the Circular have been updated as recently as January, 1999. Appendix C outlines real interest rates for discounting federal project cash flows and suggests real interest rates in the range of 2.8 percent (assuming treasury bills are the source of funding). Private sector projects such as PFS would have somewhat higher real interest rates due to higher borrowing rates than the federal government, however not high enough to result in 7 percent overall. Because of the lack of current updates to the Circular, and given the changes in the cost of borrowing money and rates of inflation which have occurred since 1992, it is appropriate to consider more appropriate real interest rates for discounted cash flows.

2) A review of recent activity in the bonding market (a common source of funding for utility projects) indicates that municipal or utility bonds are being sold at 7 percent or less. For example, a recent bond issue by Northern States Power was at 6-7/8 percent. Published numbers in the Wall Street Journal indicate that municipal bonds are currently (Bond Buyer - October 1999) being offered at approximately 6-5/8 percent. Since municipal bonds are the likely source of funding for PFS, these indicate that it is appropriate to use a nominal interest rate of around 6-5/8 percent.

3) Recent published data on rates of inflation show rates at approximately 2-3/4 percent. (Standard and Poors McGraw Hill DRI inflation index for October, 1999).

Combining a nominal interest rate of 6-5/8 percent and an inflation rate of 2-3/4 percent, the calculated real interest rate to be used for discounted cash flow analysis equals:

1.0663/1.0275 = 1.038 or a 3.8% real interest (discount) rate for NPV

Note: While 3.8 percent was used as the discount rate for the NPV calculations, we have included in the reference materials calculations at a 7 percent real interest rate for comparison purposes.

a. Analysis for 2010 Repository

Table 5.1-1a provides a projection of the costs for at-reactor spent fuel storage for a 2002 Private Fuel Storage (PFS) facility assuming that a repository begins operation in 2010. This analysis assumed that only PFS members would use the facility. Table 5.1-1b provides a projection of the costs for the PFS members for the 2010 No Action Alternative. Projected at-reactor storage costs for PFS members are estimated to be $1.0 billion (constant 1999$). Under the 2010 No Action Alternative, total at-reactor storage costs for PFS members are estimated to be $2.1 billion. Assuming a 3.8% real discount rate, PFS member costs for a 2002 facility are approximately $601 million (NPV 3.8%) and for the 2010 No Action Alternative, approximately $1.1 billion (NPV 3.8%). This represents a potential savings in at-reactor storage costs of $1.0 billion (constant 1999$) or $0.5 billion (NPV 3.8%). After subtracting the PFS Facility costs of $999.3 million (constant 1999$) and $ 604.9 million (NPV 3.8%), the net avoided costs are $30.4 million (constant 1999$) and minus $ 97.3 million (NPV 3.8%).

Table 5.1-1a

Case 11	2002 PFSF, PFS Only, 6,600 MTU Capacity, 40 Years, 2010 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
CLINTON 1	0	10	$ -	$ 80	$ 80
COOK	0	10	$ -	$ 80	$ 80
FARLEY	0	10	$ -	$ 80	$ 80
HATCH	145	10	$ 33	$ 80	$ 113
INDIAN PT 1	0	28	$ -	$ 17	$ 17
INDIAN PT 2	0	10	$ -	$ 80	$ 80
LACROSSE	0	17	$ -	$ 136	$ 136
MONTICELLO	0	10	$ -	$ 80	$ 80
OYSTER CRK 1	60	10	$ 18	$ 80	$ 98
PRAIRIE ISL	198	10	$ 38	$ 80	$ 118
SAN ONOFRE 1	0	14	$ -	$ 8	$ 8
SAN ONOFRE	0	10	$ -	$ 80	$ 80
VOGTLE	0	10	$ -	$ 80	$ 80
Total Cost (Constant 1999$)			$ 88	$ 961	$ 1,049
Total Cost (NPV @3.8%)			$ 82	$ 519	$ 601

Table 5.1-1b

Case 12	No PFSF, 2010 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
CLINTON 1	222	12	$ 43	$ 96	$ 139
COOK	2	18	$ 13	$ 144	$ 157
FARLEY	29	16	$ 18	$ 128	$ 146
HATCH	608	18	$ 74	$ 144	$ 218
INDIAN PT 1	0	36	$ -	$ 22	$ 22
INDIAN PT 2	99	20	$ 34	$ 160	$ 194
LACROSSE	0	29	$ -	$ 232	$ 232
MONTICELLO	8	21	$ 20	$ 168	$ 188
OYSTER CRK 1	60	25	$ 18	$ 200	$ 218
PRAIRIE ISL	374	20	$ 54	$ 160	$ 214
SAN ONOFRE 1	0	28	$ -	$ 17	$ 17
SAN ONOFRE	329	15	$ 48	$ 120	$ 168
VOGTLE	378	11	$ 80	$ 88	$ 168
Total Cost (Constant 1999$)			$ 401	$ 1,678	$ 2,079
Total Cost (NPV @3.8%)			$ 297	$ 811	$ 1,108

Table 5.1-2a provides a projection of the costs for at-reactor spent fuel storage for a 2002 PFS facility with the maximum capacity of 38,000 MTU assuming that a repository begins operation in 2010. Due to the facility throughput rates assumed in this analysis, the maximum rate of 40,000 MTU was not achieved. Table 5.1-2b provides a projection of at-reactor storage costs for the 2010 No Action Alternative. Projected at-reactor storage costs for all reactors are estimated to be $8.1 billion (constant 1999$). Under the 2010 No Action Alternative, total at-reactor storage costs for all reactors are estimated to be $13.2 billion. Assuming a 3.8% real discount rate, at-reactors storage costs for a 2002 facility are approximately $4.5 billion (NPV 3.8%) and for the 2010 No Action Alternative, approximately $6.8 billion (NPV 3.8%). This represents a potential savings in at-reactor storage costs of $5.1 billion (constant 1999$) or $2.3 billion (NPV 3.8%). After subtracting the PFS Facility costs of $2.411 billion (constant 1999$) and $ 1.534 billion (NPV 3.8%), the net avoided costs are $2.709 billion (constant 1999$) and $ 757.1million (NPV 3.8%).

This analysis assumed that the PFS facility would operate as an interim spent fuel storage facility for all reactor sites and that a geological repository would be operational in 2010. For purpose of modeling this scenario, it was assumed that spent fuel acceptance priority was based on fuel age. It is expected that the costs for at-reactor storage for the 2002 PFS scenario would be even lower if spent fuel acceptance was modeled based on an individual reactor's need for storage capacity, thus increasing the benefits.

Table 5.1-2a

Case 13	2002 PFSF, 38,000 MTU, 40 Year Operation, 2010 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
ARK NUCLEAR	207	10	$ 40	$ 80	$ 120
B VALLEY	0	11	$ -	$ 88	$ 88
BIG ROCK 1	0	16	$ -	$ 128	$ 128
BRAIDWOOD	0	11	$ -	$ 88	$ 88
BROWNS FERRY	0	10	$ -	$ 80	$ 80
BRUNSWICK	155	10	$ 39	$ 80	$ 119
BYRON	0	11	$ -	$ 88	$ 88
CALLAWAY 1	20	11	$ 22	$ 88	$ 110
CALVERT CLF	268	10	$ 51	$ 80	$ 131
CATAWBA	0	12	$ -	$ 96	$ 96
CLINTON 1	89	12	$ 32	$ 96	$ 128
COMANCHE PK	0	6	$ -	$ 48	$ 48
COOK	0	10	$ -	$ 80	$ 80
COOPER STN	43	8	$ 21	$ 64	$ 85
CRYSTAL RVR 3	0	10	$ -	$ 80	$ 80
DAVIS BESSE 1	146	10	$ 34	$ 80	$ 114
DIABLO CNYN	30	11	$ 23	$ 88	$ 111
DRESDEN 1	0	26	$ -	$ 16	$ 16
DRESDEN	0	9	$ -	$ 72	$ 72
DUANE ARNOLD	0	8	$ -	$ 64	$ 64
FARLEY	0	11	$ -	$ 88	$ 88
FERMI 2	184	11	$ 43	$ 88	$ 131
FITZPATRICK	30	8	$ 20	$ 64	$ 84
FORT CALHOUN	0	7	$ -	$ 56	$ 56
GINNA	5	10	$ 24	$ 80	$ 104
GRAND GULF 1	152	11	$ 36	$ 88	$ 124
HADDAM NECK	0	18	$ -	$ 144	$ 144
HARRIS 1	0	12	$ -	$ 96	$ 96
HATCH	255	11	$ 43	$ 88	$ 131
HOPE CRK 1	7	12	$ 21	$ 96	$ 117
HUMBOLDT BAY	0	26	$ -	$ 208	$ 208
INDIAN PT 1	0	28	$ -	$ 17	$ 17
INDIAN PT 2	0	7	$ -	$ 56	$ 56
INDIAN PT 3	0	10	$ -	$ 80	$ 80
KEWAUNEE	20	7	$ 19	$ 56	$ 75
LACROSSE	0	22	$ -	$ 176	$ 176
LASALLE	0	11	$ -	$ 88	$ 88
LIMERICK	92	9	$ 32	$ 72	$ 104
MAINE YANKEE	0	17	$ -	$ 136	$ 136
MCGUIRE	0	11	$ -	$ 88	$ 88
MILLSTONE	167	12	$ 42	$ 96	$ 138

Table 5.1-2a (continued)

Case 13	2002 PFSF, 38,000 MTU, 40 Year Operation, 2010 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
MONTICELLO	0	9	$ -	$ 72	$ 72
NINE MILE PT	244	12	$ 47	$ 96	$ 143
NORTH ANNA	233	11	$ 44	$ 88	$ 132
OCONEE	447	9	$ 84	$ 72	$ 156
OYSTER CRK 1	60	16	$ 18	$ 128	$ 146
PALISADES	147	9	$ 33	$ 72	$ 105
PALO VERDE	210	11	$ 42	$ 88	$ 130
PEACH BOTTOM	51	9	$ 32	$ 72	$ 104
PERRY 1	0	12	$ -	$ 96	$ 96
PILGRIM 1	0	8	$ -	$ 64	$ 64
POINT BEACH	169	8	$ 34	$ 64	$ 98
PRAIRIE ISL	200	9	$ 38	$ 72	$ 110
QUAD CITIES	0	8	$ -	$ 64	$ 64
RANCHO SECO 1	0	21	$ -	$ 168	$ 168
RIVER BEND 1	34	12	$ 23	$ 96	$ 119
ROBINSON 2	99	9	$ 45	$ 72	$ 117
SALEM	0	11	$ -	$ 88	$ 88
SAN ONOFRE 1	0	20	$ -	$ 12	$ 12
SAN ONOFRE	41	11	$ 24	$ 88	$ 112
SEABROOK 1	0	9	$ -	$ 72	$ 72
SEQUOYAH	5	11	$ 20	$ 88	$ 108
SOUTH TEXAS	0	10	$ -	$ 80	$ 80
ST LUCIE	79	11	$ 29	$ 88	$ 117
SUMMER 1	0	11	$ -	$ 88	$ 88
SURRY	359	7	$ 71	$ 56	$ 127
SUSQUEHANNA	415	11	$ 62	$ 88	$ 150
TMI 1	0	9	$ -	$ 72	$ 72
TROJAN	0	19	$ -	$ 152	$ 152
TURKEY PT	0	7	$ -	$ 56	$ 56
VOGTLE	94	10	$ 37	$ 80	$ 117
VT YANKEE	13	8	$ 26	$ 64	$ 90
WASH NUCLEAR 2	165	12	$ 39	$ 96	$ 135
WATERFORD 3	158	12	$ 39	$ 96	$ 135
WATTS BAR 1	0	5	$ -	$ 40	$ 40
WOLF CREEK 1	22	12	$ 22	$ 96	$ 118
YANKEE-ROWE 1	0	20	$ -	$ 160	$ 160
ZION	0	17	$ -	$ 136	$ 136
Total Cost (Constant 1999$)			$ 1,346	$ 6,724	$ 8,071
Total Cost (NPV @3.8%)			$ 1,122	$ 3,367	$ 4,489

Table 5.1-2b

Case 14	No PFSF, 2010 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
ARK NUCLEAR 1	468	18	$ 62	$ 144	$ 206
B VALLEY 2	46	12	$ 14	$ 96	$ 110
BIG ROCK 1	0	25	$ -	$ 200	$ 200
BRAIDWOOD 2	177	11	$ 35	$ 88	$ 123
BROWNS FERRY 3	79	19	$ 21	$ 152	$ 173
BRUNSWICK 2	388	19	$ 74	$ 152	$ 226
BYRON 2	105	12	$ 29	$ 96	$ 125
CALLAWAY 1	204	14	$ 38	$ 112	$ 150
CALVERT CLF 2	510	19	$ 74	$ 152	$ 226
CATAWBA 2	0	13	$ -	$ 104	$ 104
CLINTON 1	222	12	$ 43	$ 96	$ 139
COMANCHE PK 2	0	7	$ -	$ 56	$ 56
COOK 2	2	18	$ 13	$ 144	$ 157
COOPER STN	128	20	$ 34	$ 160	$ 194
CRYSTAL RVR 3	0	18	$ -	$ 144	$ 144
DAVIS BESSE 1	300	18	$ 47	$ 144	$ 191
DIABLO CNYN 2	323	13	$ 48	$ 104	$ 152
DRESDEN 1	0	34	$ -	$ 20	$ 20
DRESDEN 3	200	21	$ 33	$ 168	$ 201
DUANE ARNOLD	77	20	$ 23	$ 160	$ 183
FARLEY 2	29	16	$ 18	$ 128	$ 146
FERMI 2	334	11	$ 56	$ 88	$ 144
FITZPATRICK	181	20	$ 32	$ 160	$ 192
FORT CALHOUN	1	20	$ 20	$ 160	$ 180
GINNA	76	21	$ 32	$ 168	$ 200
GRAND GULF 1	349	14	$ 53	$ 112	$ 165
HADDAM NECK	0	26	$ -	$ 208	$ 208
HARRIS 1	0	12	$ -	$ 96	$ 96
HATCH 2	608	18	$ 74	$ 144	$ 218
HOPE CRK 1	189	13	$ 37	$ 104	$ 141
HUMBOLDT BAY	0	35	$ -	$ 280	$ 280
INDIAN PT 1	0	36	$ -	$ 22	$ 22
INDIAN PT 2	99	20	$ 34	$ 160	$ 194
INDIAN PT 3	12	19	$ 22	$ 152	$ 174
KEWAUNEE	95	20	$ 25	$ 160	$ 185
LACROSSE	0	29	$ -	$ 232	$ 232
LASALLE 2	112	14	$ 27	$ 112	$ 139
LIMERICK 2	380	10	$ 59	$ 80	$ 139
MAINE YANKEE	0	26	$ -	$ 208	$ 208
MCGUIRE 2	258	15	$ 45	$ 120	$ 165
MILLSTONE 3	412	14	$ 70	$ 112	$ 182

Table 5.1-2b (continued)

Case 14	No PFSF, 2010 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
MONTICELLO	8	21	$ 20	$ 168	$ 188
NINE MILE PT 2	470	13	$ 66	$ 104	$ 170
NORTH ANNA 2	512	17	$ 70	$ 136	$ 206
OCONEE 3	757	20	$ 112	$ 160	$ 272
OYSTER CRK 1	60	25	$ 18	$ 200	$ 218
PALISADES	254	21	$ 42	$ 168	$ 210
PALO VERDE 3	703	11	$ 85	$ 88	$ 173
PEACH BOTTOM 3	416	20	$ 72	$ 160	$ 232
PERRY 1	96	12	$ 27	$ 96	$ 123
PILGRIM 1	70	20	$ 31	$ 160	$ 191
POINT BEACH 2	323	20	$ 48	$ 160	$ 208
PRAIRIE ISL 2	374	20	$ 54	$ 160	$ 214
QUAD CITIES 2	129	20	$ 26	$ 160	$ 186
RANCHO SECO 1	0	29	$ -	$ 232	$ 232
RIVER BEND 1	228	14	$ 40	$ 112	$ 152
ROBINSON 2	120	21	$ 48	$ 168	$ 216
SALEM 2	3	16	$ 16	$ 128	$ 144
SAN ONOFRE 1	0	28	$ -	$ 17	$ 17
SAN ONOFRE 3	330	15	$ 48	$ 120	$ 168
SEABROOK 1	69	10	$ 24	$ 80	$ 104
SEQUOYAH 2	254	16	$ 42	$ 128	$ 170
SOUTH TEXAS 2	0	11	$ -	$ 88	$ 88
ST LUCIE 2	265	15	$ 64	$ 120	$ 184
SUMMER 1	49	15	$ 20	$ 120	$ 140
SURRY 2	599	20	$ 94	$ 160	$ 254
SUSQUEHANNA 2	791	14	$ 96	$ 112	$ 208
TMI 1	0	20	$ -	$ 160	$ 160
TROJAN	0	27	$ -	$ 216	$ 216
TURKEY PT 4	0	20	$ -	$ 160	$ 160
VOGTLE 2	378	11	$ 80	$ 88	$ 168
VT YANKEE	103	20	$ 36	$ 160	$ 196
WASH NUCLEAR 2	320	14	$ 54	$ 112	$ 166
WATERFORD 3	280	14	$ 49	$ 112	$ 161
WATTS BAR 1	0	5	$ -	$ 40	$ 40
WOLF CREEK 1	168	14	$ 34	$ 112	$ 146
YANKEE-ROWE 1	0	27	$ -	$ 216	$ 216
ZION 2	0	26	$ -	$ 208	$ 208
Total Cost (Constant 1999$)			$ 2,605	$ 10,587	$ 13,192
Total Cost (NPV @3.8%)			$ 1,973	$ 4,808	$ 6,781

Table 5.1-3a provides a projection of the costs for at-reactor spent fuel storage for a 2002 PFS facility operating at the expected capacity of 16,600 MTU assuming that a repository begins operation in 2010. (The expected capacity would be 20,000 MTU under the 2015 No Action Alternative). Table 5.1-3b provides a projection of at-reactor storage costs for the 2010 No Action Alternative. Projected at-reactor storage costs for the reactors in this scenario are estimated to be $3.9 billion (constant 1999$). Under the 2010 No Action Alternative, total at-reactor storage costs for the reactors evaluated in this scenario are estimated to be $7.1 billion. Assuming a 3.8% real discount rate, at-reactor storage costs for a 2002 facility are approximately $2.5 billion (NPV 3.8%) and for the 2010 No Action Alternative, approximately $4.1 billion (NPV 3.8%). This represents a potential savings in at-reactor storage costs of $3.3 billion (constant 1999$) or $1.6 billion (NPV 3.8%). After subtracting the PFS Facility costs of $1.856 billion (constant 1999$) and $ 1.189 billion (NPV 3.8%), the net avoided costs are $1.402 billion (constant 1999$) and $ 368.5 million (NPV 3.8%).

Table 5.1-3a

Case 9	2002 PFSF, 16,600 MTU Capacity, 40 Year Operation, 2010 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
BIG ROCK 1	0	11	$ -	$ 88	$ 88
CALVERT CLF	264	11	$ 51	$ 88	$ 139
CLINTON 1	35	10	$ 27	$ 80	$ 107
COOK	0	10	$ -	$ 80	$ 80
COOPER STN	4	10	$ 16	$ 80	$ 96
CRYSTAL RVR 3	0	12	$ -	$ 96	$ 96
DRESDEN 1	0	25	$ -	$ 15	$ 15
DRESDEN 2 & 3	0	11	$ -	$ 88	$ 88
DUANE ARNOLD	0	10	$ -	$ 80	$ 80
FARLEY	0	10	$ -	$ 80	$ 80
FITZPATRICK	30	10	$ 20	$ 80	$ 100
FORT CALHOUN	0	10	$ -	$ 80	$ 80
GINNA	5	11	$ 24	$ 88	$ 112
HADDAM NECK	0	13	$ -	$ 104	$ 104
HATCH	222	11	$ 39	$ 88	$ 127
HUMBOLDT BAY	0	26	$ -	$ 208	$ 208
INDIAN PT 1	0	28	$ -	$ 17	$ 17
INDIAN PT 2	0	10	$ -	$ 80	$ 80
INDIAN PT 3	0	11	$ -	$ 88	$ 88
KEWAUNEE	9	10	$ 18	$ 80	$ 98
LACROSSE	0	19	$ -	$ 152	$ 152
MAINE YANKEE	0	12	$ -	$ 96	$ 96
MONTICELLO	0	11	$ -	$ 88	$ 88
OYSTER CRK 1	60	11	$ 18	$ 88	$ 106
PALISADES	148	11	$ 33	$ 88	$ 121
PILGRIM 1	0	11	$ -	$ 88	$ 88
POINT BEACH	169	11	$ 34	$ 88	$ 122
PRAIRIE ISL	198	13	$ 38	$ 104	$ 142
QUAD CITIES	0	11	$ -	$ 88	$ 88
RANCHO SECO 1	0	18	$ -	$ 144	$ 144
ROBINSON 2	60	10	$ 39	$ 80	$ 119
SAN ONOFRE 1	0	16	$ -	$ 10	$ 10
SAN ONOFRE	0	10	$ -	$ 80	$ 80
TROJAN	0	15	$ -	$ 120	$ 120
TURKEY PT	0	11	$ -	$ 88	$ 88
VOGTLE	0	10	$ -	$ 80	$ 80
VT YANKEE	13	11	$ 26	$ 88	$ 114
YANKEE-ROWE 1	0	15	$ -	$ 120	$ 120
ZION	0	12	$ -	$ 96	$ 96
Total Cost (Constant 1999$)			$ 381	$ 3,473	$ 3,855
Total Cost (NPV @3.8%)			$ 347	$ 2,196	$ 2,543

Table 5.1-3b

Case 10	No PFSF, 2010 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
BIG ROCK 1	0	25	$ -	$ 200	$ 200
CALVERT CLF	510	19	$ 74	$ 152	$ 226
CLINTON 1	222	12	$ 43	$ 96	$ 139
COOK	2	18	$ 13	$ 144	$ 157
COOPER STN	128	20	$ 34	$ 160	$ 194
CRYSTAL RVR 3	0	18	$ -	$ 144	$ 144
DRESDEN 1	0	34	$ -	$ 20	$ 20
DRESDEN 2 & 3	200	21	$ 33	$ 168	$ 201
DUANE ARNOLD	77	20	$ 23	$ 160	$ 183
FARLEY	29	16	$ 18	$ 128	$ 146
FITZPATRICK	181	20	$ 32	$ 160	$ 192
FORT CALHOUN	1	20	$ 20	$ 160	$ 180
GINNA	76	21	$ 32	$ 168	$ 200
HADDAM NECK	0	26	$ -	$ 208	$ 208
HATCH	608	18	$ 74	$ 144	$ 218
HUMBOLDT BAY	0	35	$ -	$ 280	$ 280
INDIAN PT 1	0	36	$ -	$ 22	$ 22
INDIAN PT 2	99	20	$ 34	$ 160	$ 194
INDIAN PT 3	12	19	$ 22	$ 152	$ 174
KEWAUNEE	95	20	$ 25	$ 160	$ 185
LACROSSE	0	29	$ -	$ 232	$ 232
MAINE YANKEE	0	26	$ -	$ 208	$ 208
MONTICELLO	8	21	$ 20	$ 168	$ 188
OYSTER CRK 1	60	25	$ 18	$ 200	$ 218
PALISADES	254	21	$ 42	$ 168	$ 210
PILGRIM 1	70	20	$ 31	$ 160	$ 191
POINT BEACH	323	20	$ 48	$ 160	$ 208
PRAIRIE ISL	374	20	$ 54	$ 160	$ 214
QUAD CITIES	129	20	$ 26	$ 160	$ 186
RANCHO SECO 1	0	29	$ -	$ 232	$ 232
ROBINSON 2	120	21	$ 48	$ 168	$ 216
SAN ONOFRE 1	0	28	$ -	$ 17	$ 17
SAN ONOFRE	329	15	$ 48	$ 120	$ 168
TROJAN	0	27	$ -	$ 216	$ 216
TURKEY PT	0	20	$ -	$ 160	$ 160
VOGTLE	378	11	$ 80	$ 88	$ 168
VT YANKEE	103	20	$ 35	$ 160	$ 195
YANKEE-ROWE 1	0	27	$ -	$ 216	$ 216
ZION 2	0	26	$ -	$ 208	$ 208
Total Cost (Constant 1999$)			$ 926	$ 6,187	$ 7,113
Total Cost (NPV @3.8%)			$ 742	$ 3,359	$ 4,101

b. Analysis for 2015 Repository

The avoided costs were also requested for a PFS facility operating at the expected capacity assuming a 2015 No Action Alternative.

Table 5.1-4a provides a projection of the costs for at-reactor spent fuel storage for a 2002 PFS facility operating at the expected capacity of 20,000 MTU assuming that a repository begins operation in 2015. Table 5.1-4b provides a projection of at-reactor storage costs for the 2015 No Action Alternative. Projected at-reactor storage costs are estimated to be $4.0 billion (constant 1999$). Under the 2015 No Action Alternative, total at-reactor storage costs for are estimated to be $8.8 billion. Assuming a 3.8% real discount rate, at-reactors storage costs for a 2002 facility are approximately $2.6 billion (NPV 3.8%) and for the 2015 No Action Alternative, approximately $4.6 billion (NPV 3.8%). This represents a potential savings in at-reactor storage costs of $4.8 billion (constant 1999$) or $2.0 billion (NPV 3.8%). After subtracting the PFS Facility costs of $1.854 billion (constant 1999$) and $ 1.180 billion (NPV 3.8%), the net avoided costs are $2.912 billion (constant 1999$) and $ 869.2 million (NPV 3.8%).

Table 5.1-4a

Case 1	2002 PFSF, 20,000 MTU Capacity, 40 Year Operation, 2015 Repository							
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)		Post Shutdown Storage Costs ($ Millions)		Total Storage Costs ($ Millions)	
BIG ROCK 1	0	12	$	-	$	96	$	96
CALVERT CLF	264	9	$	51	$	72	$	123
CLINTON 1	35	10	$	27	$	80	$	107
COOK	0	13	$	-	$	104	$	104
COOPER STN	4	11	$	16	$	88	$	104
CRYSTAL RVR 3	0	13	$	-	$	104	$	104
DRESDEN 1	0	25	$	-	$	15	$	15
DRESDEN 2 & 3	0	11	$	-	$	88	$	88
DUANE ARNOLD	0	11	$	-	$	88	$	88
FARLEY	0	12	$	-	$	96	$	96
FITZPATRICK	30	11	$	20	$	88	$	108
FORT CALHOUN	0	11	$	-	$	88	$	88
GINNA	5	11	$	24	$	88	$	112
HADDAM NECK	0	13	$	-	$	104	$	104
HATCH	222	12	$	39	$	96	$	135
HUMBOLDT BAY	0	26	$	-	$	208	$	208
INDIAN PT 1	0	28	$	-	$	17	$	17
INDIAN PT 2	0	11	$	-	$	88	$	88
INDIAN PT 3	0	14	$	-	$	112	$	112
KEWAUNEE	9	11	$	18	$	88	$	106
LACROSSE	0	19	$	-	$	152	$	152
MAINE YANKEE	0	13	$	-	$	104	$	104
MONTICELLO	0	11	$	-	$	88	$	88
OYSTER CRK 1	60	12	$	18	$	96	$	114
PALISADES	148	11	$	33	$	88	$	121
PILGRIM 1	0	11	$	-	$	88	$	88
POINT BEACH	169	11	$	34	$	88	$	122
PRAIRIE ISL	198	11	$	38	$	88	$	126
QUAD CITIES	0	11	$	-	$	88	$	88
RANCHO SECO 1	0	18	$	-	$	144	$	144
ROBINSON 2	60	10	$	39	$	80	$	119
SAN ONOFRE 1	0	16	$	-	$	10	$	10
SAN ONOFRE	0	11	$	-	$	88	$	88
TROJAN	0	15	$	-	$	120	$	120
TURKEY PT	0	11	$	-	$	88	$	88
VOGTLE	0	10	$	-	$	80	$	80
VT YANKEE	13	11	$	26	$	88	$	114
YANKEE-ROWE 1	0	15	$	-	$	120	$	120
ZION	0	13	$	-	$	104	$	104
Total Cost (Constant 1999$)			$	381	$	3,609	$	3,991
Total Cost (NPV @3.8%)			$	347	$	2,253	$	2,600

Table 5.1-4b

Case 3	No PFSF, 2015 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
BIG ROCK 1	0	30	$ -	$ 240	$ 240
CALVERT CLF	648	24	$ 86	$ 192	$ 950
CLINTON 1	324	17	$ 52	$ 136	$ 529
COOK	216	23	$ 34	$ 184	$ 457
COOPER STN	128	25	$ 34	$ 200	$ 387
CRYSTAL RVR 3	30	23	$ 23	$ 184	$ 260
DRESDEN 1	0	39	$ -	$ 23	$ 62
DRESDEN 2 & 3	231	26	$ 36	$ 208	$ 501
DUANE ARNOLD	93	25	$ 24	$ 200	$ 342
FARLEY	160	21	$ 30	$ 168	$ 379
FITZPATRICK	212	25	$ 35	$ 200	$ 472
FORT CALHOUN	28	25	$ 23	$ 200	$ 276
GINNA	76	26	$ 32	$ 208	$ 342
HADDAM NECK	0	31	$ -	$ 248	$ 279
HATCH	788	23	$ 91	$ 184	$ 1,086
HUMBOLDT BAY	0	40	$ -	$ 320	$ 360
INDIAN PT 1	0	41	$ -	$ 25	$ 66
INDIAN PT 2	133	25	$ 38	$ 200	$ 396
INDIAN PT 3	81	24	$ 30	$ 192	$ 327
KEWAUNEE	121	25	$ 28	$ 200	$ 374
LACROSSE	0	34	$ -	$ 272	$ 306
MAINE YANKEE	0	31	$ -	$ 248	$ 279
MONTICELLO	8	26	$ 20	$ 208	$ 262
OYSTER CRK 1	60	30	$ 18	$ 240	$ 348
PALISADES	254	26	$ 42	$ 208	$ 530
PILGRIM 1	70	25	$ 31	$ 200	$ 326
POINT BEACH	385	25	$ 54	$ 200	$ 664
PRAIRIE ISL	465	25	$ 62	$ 200	$ 752
QUAD CITIES	150	25	$ 28	$ 200	$ 403
RANCHO SECO 1	0	34	$ -	$ 272	$ 306
ROBINSON 2	120	26	$ 48	$ 208	$ 402
SAN ONOFRE 1	0	33	$ -	$ 20	$ 53
SAN ONOFRE	510	20	$ 62	$ 160	$ 752
TROJAN	0	32	$ -	$ 256	$ 288
TURKEY PT	3	25	$ 11	$ 200	$ 239
VOGTLE	598	16	$ 113	$ 128	$ 855
VT YANKEE	120	25	$ 37	$ 200	$ 382
YANKEE-ROWE 1	0	32	$ -	$ 256	$ 288
ZION 2	0	32	$ -	$ 248	$ 248
Total Cost (Constant 1999$)			$ 1,122	$ 7,636	$ 8,757
Total Cost (NPV @3.8%)			$ 852	$ 3,798	$ 4,650

Update of Unit Costs

It should be noted that the costs provided in the analysis "Utility At-Reactor Spent Fuel Storage Costs for the Private Fuel Storage Facility Cost Benefit Analysis, Energy Resources International, Inc. (ERI), ERI-2025-9701, December 1997 (1997 ERI Study) were based on 1993 costs components contained in a Department of Energy (DOE) contractor report, At-Reactor Dry Storage Issues, Revision, 1, TRW Environmental Safety Systems, Inc., December 10, 1993 (TRW 1993) and were not escalated to current year dollars at that time in order to be conservative. Since this RAI requested that a net present value calculation be performed for the analysis of utility at-reactor storage costs in addition to the constant dollar estimate provided, it is reasonable to remove the conservatism in the original cost estimates and use realistic unit costs that better reflect the fact that dry storage costs have increased since the 1997 ERI Study was completed. The unit costs used throughout this response have been updated to 1999 constant dollars. However, since there are no recent publicly available references that could be cited as a source for new unit costs, the unit costs contained in TRW 1993 were escalated to 1999 dollars in order to more accurately reflect current market costs seen at reactor sites for dry storage.

So that the additional cases evaluated in the 1997 ERI study and provided in the February 18, 1999 RAI response 15-2, table 15-2(a) are consistent with the costs used to respond to RAI 5-1, the following cost scenarios are also updated in this response.

- 2002 ISF Members Only, 2015 Repository and 2015 No Action Alternative, Members Only
- 2002 ISF Maximum Capacity, 2015 Repository and 2015 No Action Alternative

Table 5.1-5a provides a projection of the costs for at-reactor spent fuel storage for a 2002 PFS facility assuming that a repository begins operation in 2015. This analysis assumed that only PFS members would use the facility. Table 5.1-5b provides a projection of the costs for the PFS members assuming for a 2015 No Action Alternative. Projected at-reactor storage costs for PFS members are estimated to be $1.0 billion (constant 1999$). Under the 2010 No Action Alternative, total at-reactor storage costs for PFS members are estimated to be $2.6 billion. Assuming a 3.8% real discount rate, PFS member costs for a 2002 facility are approximately $0.6 billion (NPV 3.8%) and for the 2010 No Action Alternative, approximately $1.3 billion (NPV 3.8%). This represents a potential savings in at-reactor storage costs of $1.6 billion (constant 1999$) or $0.7 billion (NPV 3.8%). After subtracting the PFS Facility costs of $999.3 million (constant 1999$) and $ 604.7 million (NPV 3.8%), the net avoided costs are $595.3 million (constant 1999$) and $ 87.9 million (NPV 3.8%).

Table 5.1-5a

Case 5	2002 PFSF, PFS Only, 8,000 MTU Capacity, 40 Years, 2015 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
CLINTON 1	0	10	$ -	$ 80	$ 80
COOK	0	10	$ -	$ 80	$ 80
FARLEY	0	10	$ -	$ 80	$ 80
HATCH	145	10	$ 33	$ 80	$ 113
INDIAN PT 1	0	28	$ -	$ 17	$ 17
INDIAN PT 2	0	10	$ -	$ 80	$ 80
LACROSSE	0	17	$ -	$ 136	$ 136
MONTICELLO	0	10	$ -	$ 80	$ 80
OYSTER CRK 1	60	10	$ 18	$ 80	$ 98
PRAIRIE ISL	198	10	$ 38	$ 80	$ 118
SAN ONOFRE 1	0	14	$ -	$ 8	$ 8
SAN ONOFRE	0	10	$ -	$ 80	$ 80
VOGTLE	0	10	$ -	$ 80	$ 80
Total Cost (Constant 1999$)			$ 88	$ 961	$ 1,049
Total Cost (NPV @3.8%)			$ 82	$ 519	$ 601

Table 5.1-5b

Case 6	No PFSF, 2015 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
CLINTON 1	324	17	$ 52	$ 136	$ 188
COOK	216	23	$ 34	$ 184	$ 218
FARLEY	160	21	$ 30	$ 168	$ 198
HATCH	788	23	$ 91	$ 184	$ 275
INDIAN PT 1	0	41	$ -	$ 25	$ 25
INDIAN PT 2	133	25	$ 38	$ 200	$ 238
LACROSSE	0	34	$ -	$ 272	$ 272
MONTICELLO	8	26	$ 20	$ 208	$ 228
OYSTER CRK 1	60	30	$ 18	$ 240	$ 258
PRAIRIE ISL	465	25	$ 62	$ 200	$ 262
SAN ONOFRE 1	0	33	$ -	$ 20	$ 20
SAN ONOFRE	510	20	$ 62	$ 160	$ 222
VOGTLE	598	16	$ 113	$ 128	$ 241
Total Cost (Constant 1999$)			$ 520	$ 2,124	$ 2,644
Total Cost (NPV @3.8%)			$ 361	$ 933	$ 1,294

Table 5.1-6a provides a projection of the costs for at-reactor spent fuel storage for a 2002 PFS facility with the maximum capacity of 38,000 MTU assuming that a repository begins operation in 2015. Table 5.1-6b provides a projection of at-reactor storage costs for the 2015 No Action Alternative. Projected at-reactor storage costs for all reactors are estimated to be $12.1 billion (constant 1999$). Under the 2015 No Action Alternative, total at-reactor storage costs for all reactors are estimated to be $16.8 billion. Assuming a 3.8% real discount rate, at-reactor storage costs for a 2002 facility are approximately $5.7 billion (NPV 3.8%) and for the 2010 No Action Alternative, approximately $7.9 billion (NPV 3.8%). This represents a potential savings in at-reactor storage costs of $4.7 billion (constant 1999$) or $2.2 billion (NPV 3.8%). After subtracting the PFS Facility costs of $2.411 billion (constant 1999$) and $ 1.535 billion (NPV 3.8%), the net avoided costs are $2.293 billion (constant 1999$) and $ 623.5 million (NPV 3.8%).

This analysis assumed that the PFS facility would operate as an interim spent fuel storage facility for all reactor sites and that a geological repository would be operational in 2015. For purposed of modeling this scenario, it was assumed that spent fuel acceptance priority was based on fuel age. It is expected that the costs for at-reactor storage for the 2002 PFS scenario would be even lower if it was assumed that spent fuel acceptance was modeled based on an individual reactor's need for storage capacity, thus increasing the benefits.

Table 5.1-6a

Case 7	2002 PFSF, 38,000 MTU, 40 Year Operation, 2015 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
ARK NUCLEAR	207	19	$ 40	$ 152	$ 192
B VALLEY	0	17	$ -	$ 136	$ 136
BIG ROCK 1	0	18	$ -	$ 144	$ 144
BRAIDWOOD	0	16	$ -	$ 128	$ 128
BROWNS FERRY	0	19	$ -	$ 152	$ 152
BRUNSWICK	194	19	$ 44	$ 152	$ 196
BYRON	0	17	$ -	$ 136	$ 136
CALLAWAY 1	20	19	$ 22	$ 152	$ 174
CALVERT CLF	268	19	$ 51	$ 152	$ 203
CATAWBA	0	18	$ -	$ 144	$ 144
CLINTON 1	111	17	$ 33	$ 136	$ 169
COMANCHE PK	0	12	$ -	$ 96	$ 96
COOK	0	19	$ -	$ 152	$ 152
COOPER STN	45	17	$ 21	$ 136	$ 157
CRYSTAL RVR 3	0	19	$ -	$ 152	$ 152
DAVIS BESSE 1	146	19	$ 34	$ 152	$ 186
DIABLO CNYN	30	18	$ 23	$ 144	$ 167
DRESDEN 1	0	26	$ -	$ 16	$ 16
DRESDEN	0	14	$ -	$ 112	$ 112
DUANE ARNOLD	0	17	$ -	$ 136	$ 136
FARLEY	0	20	$ -	$ 160	$ 160
FERMI 2	222	16	$ 46	$ 128	$ 174
FITZPATRICK	30	17	$ 20	$ 136	$ 156
FORT CALHOUN	0	16	$ -	$ 128	$ 128
GINNA	0	14	$ 24	$ 112	$ 136
GRAND GULF 1	5	19	$ 36	$ 152	$ 188
HADDAM NECK	152	20	$ -	$ 160	$ 160
HARRIS 1	0	17	$ -	$ 136	$ 136
HATCH	255	20	$ 43	$ 160	$ 203
HOPE CRK 1	0	18	$ 21	$ 144	$ 165
HUMBOLDT BAY	0	26	$ -	$ 208	$ 208
INDIAN PT 1	0	28	$ -	$ 17	$ 17
INDIAN PT 2	0	16	$ -	$ 128	$ 128
INDIAN PT 3	0	19	$ -	$ 152	$ 152
KEWAUNEE	20	16	$ 19	$ 128	$ 147
LACROSSE	0	22	$ -	$ 176	$ 176
LASALLE	0	19	$ -	$ 152	$ 152
LIMERICK	92	15	$ 32	$ 120	$ 152
MAINE YANKEE	0	20	$ -	$ 160	$ 160
MCGUIRE	0	20	$ -	$ 160	$ 160
MILLSTONE	167	19	$ 42	$ 152	$ 194

Table 5.1-6a (continued)

Case 7	2002 PFSF, 38,000 MTU, 40 Year Operation, 2015 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
MONTICELLO	0	14	$ -	$ 112	$ 112
NINE MILE PT	284	18	$ 50	$ 144	$ 194
NORTH ANNA	233	20	$ 44	$ 160	$ 204
OCONEE	447	18	$ 84	$ 144	$ 228
OYSTER CRK 1	60	19	$ 18	$ 152	$ 170
PALISADES	147	14	$ 33	$ 112	$ 145
PALO VERDE	250	16	$ 46	$ 128	$ 174
PEACH BOTTOM	51	18	$ 32	$ 144	$ 176
PERRY 1	0	17	$ -	$ 136	$ 136
PILGRIM 1	0	15	$ -	$ 120	$ 120
POINT BEACH	169	15	$ 34	$ 120	$ 154
PRAIRIE ISL	200	18	$ 38	$ 144	$ 182
QUAD CITIES	0	15	$ -	$ 120	$ 120
RANCHO SECO 1	0	22	$ -	$ 176	$ 176
RIVER BEND 1	67	19	$ 26	$ 152	$ 178
ROBINSON 2	99	13	$ 45	$ 104	$ 149
SALEM	0	20	$ -	$ 160	$ 160
SAN ONOFRE 1	0	22	$ -	$ 13	$ 13
SAN ONOFRE	41	20	$ 24	$ 160	$ 184
SEABROOK 1	0	15	$ -	$ 120	$ 120
SEQUOYAH	10	20	$ 21	$ 160	$ 181
SOUTH TEXAS	0	16	$ -	$ 128	$ 128
ST LUCIE	79	20	$ 29	$ 160	$ 189
SUMMER 1	0	20	$ -	$ 160	$ 160
SURRY	409	16	$ 76	$ 128	$ 204
SUSQUEHANNA	415	19	$ 62	$ 152	$ 214
TMI 1	0	18	$ -	$ 144	$ 144
TROJAN	0	21	$ -	$ 168	$ 168
TURKEY PT	0	16	$ -	$ 128	$ 128
VOGTLE	129	16	$ 41	$ 128	$ 169
VT YANKEE	13	15	$ 26	$ 120	$ 146
WASH NUCLEAR 2	165	19	$ 39	$ 152	$ 191
WATERFORD 3	158	19	$ 39	$ 152	$ 191
WATTS BAR 1	0	9	$ -	$ 72	$ 72
WOLF CREEK 1	22	19	$ 22	$ 152	$ 174
YANKEE-ROWE 1	0	21	$ -	$ 168	$ 168
ZION	0	20	$ -	$ 160	$ 160
Total Cost (Constant 1999$)			$ 1,376	$ 10,702	$ 12,078
Total Cost (NPV @3.8%)			$ 1,141	$ 4,569	$ 5,710

Case 8	No PFSF, 2015 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
ARK NUCLEAR 1	590	23	$ 73	$ 184	$ 257
B VALLEY 2	112	17	$ 19	$ 136	$ 155
BIG ROCK 1	0	30	$ -	$ 240	$ 240
BRAIDWOOD 2	338	16	$ 50	$ 128	$ 178
BROWNS FERRY 3	162	24	$ 28	$ 192	$ 220
BRUNSWICK 2	473	24	$ 86	$ 192	$ 278
BYRON 2	259	17	$ 43	$ 136	$ 179
CALLAWAY 1	296	19	$ 46	$ 152	$ 198
CALVERT CLF 2	648	24	$ 86	$ 192	$ 278
CATAWBA 2	0	18	$ -	$ 144	$ 144
CLINTON 1	324	17	$ 52	$ 136	$ 188
COMANCHE PK 2	58	12	$ 20	$ 96	$ 116
COOK 2	216	23	$ 34	$ 184	$ 218
COOPER STN	128	25	$ 34	$ 200	$ 234
CRYSTAL RVR 3	30	23	$ 23	$ 184	$ 207
DAVIS BESSE 1	331	23	$ 49	$ 184	$ 233
DIABLO CNYN 2	524	18	$ 66	$ 144	$ 210
DRESDEN 1	0	39	$ -	$ 23	$ 23
DRESDEN 3	231	26	$ 36	$ 208	$ 244
DUANE ARNOLD	93	25	$ 24	$ 200	$ 224
FARLEY 2	160	21	$ 30	$ 168	$ 198
FERMI 2	424	16	$ 63	$ 128	$ 191
FITZPATRICK	212	25	$ 35	$ 200	$ 235
FORT CALHOUN	28	25	$ 23	$ 200	$ 223
GINNA	76	26	$ 32	$ 208	$ 240
GRAND GULF 1	468	19	$ 63	$ 152	$ 215
HADDAM NECK	0	31	$ -	$ 248	$ 248
HARRIS 1	0	17	$ -	$ 136	$ 136
HATCH 2	788	23	$ 91	$ 184	$ 275
HOPE CRK 1	299	18	$ 46	$ 144	$ 190
HUMBOLDT BAY	0	40	$ -	$ 320	$ 320
INDIAN PT 1	0	41	$ -	$ 25	$ 25
INDIAN PT 2	133	25	$ 38	$ 200	$ 238
INDIAN PT 3	81	24	$ 30	$ 192	$ 222
KEWAUNEE	121	25	$ 28	$ 200	$ 228
LACROSSE	0	34	$ -	$ 272	$ 272
LASALLE 2	322	19	$ 45	$ 152	$ 197
LIMERICK 2	589	15	$ 78	$ 120	$ 198
MAINE YANKEE	0	31	$ -	$ 248	$ 248
MCGUIRE 2	467	20	$ 64	$ 160	$ 224
MILLSTONE 3	559	19	$ 85	$ 152	$ 237

Table 5.1-6b (continued)

Case 8	No PFSF, 2015 Repository				
Plant Name	Estimated Additional Storage (MTU)	Estimated Years of Storage Post Shutdown	Additional Storage Costs ($Millions)	Post Shutdown Storage Costs ($ Millions)	Total Storage Costs ($ Millions)
MONTICELLO	8	26	$ 20	$ 208	$ 228
NINE MILE PT 2	580	18	$ 75	$ 144	$ 219
NORTH ANNA 2	712	22	$ 89	$ 176	$ 265
OCONEE 3	827	25	$ 118	$ 200	$ 318
OYSTER CRK 1	60	30	$ 18	$ 240	$ 258
PALISADES	254	26	$ 42	$ 208	$ 250
PALO VERDE 3	1021	16	$ 112	$ 128	$ 240
PEACH BOTTOM 3	491	25	$ 81	$ 200	$ 281
PERRY 1	207	17	$ 37	$ 136	$ 173
PILGRIM 1	70	25	$ 31	$ 200	$ 231
POINT BEACH 2	385	25	$ 54	$ 200	$ 254
PRAIRIE ISL 2	465	25	$ 62	$ 200	$ 262
QUAD CITIES 2	150	25	$ 28	$ 200	$ 228
RANCHO SECO 1	0	34	$ -	$ 272	$ 272
RIVER BEND 1	331	19	$ 49	$ 152	$ 201
ROBINSON 2	120	26	$ 48	$ 208	$ 256
SALEM 2	96	21	$ 24	$ 168	$ 192
SAN ONOFRE 1	0	33	$ -	$ 20	$ 20
SAN ONOFRE 3	510	20	$ 62	$ 160	$ 222
SEABROOK 1	177	15	$ 34	$ 120	$ 154
SEQUOYAH 2	444	21	$ 60	$ 168	$ 228
SOUTH TEXAS 2	0	16	$ -	$ 128	$ 128
ST LUCIE 2	380	20	$ 75	$ 160	$ 235
SUMMER 1	122	20	$ 26	$ 160	$ 186
SURRY 2	650	25	$ 99	$ 200	$ 299
SUSQUEHANNA 2	1011	19	$ 114	$ 152	$ 266
TMI 1	0	25	$ -	$ 200	$ 200
TROJAN	0	32	$ -	$ 256	$ 256
TURKEY PT 4	0	25	$ -	$ 200	$ 200
VOGTLE 2	598	16	$ 113	$ 128	$ 241
VT YANKEE	120	25	$ 37	$ 200	$ 237
WASH NUCLEAR 2	419	19	$ 63	$ 152	$ 215
WATERFORD 3	373	19	$ 57	$ 152	$ 209
WATTS BAR 1	0	9	$ -	$ 72	$ 72
WOLF CREEK 1	265	19	$ 43	$ 152	$ 195
YANKEE-ROWE 1	0	32	$ -	$ 256	$ 256
ZION 2	0	32	$ -	$ 248	$ 248
Total Cost (Constant 1999$)			$ 3,195	$ 13,588	$ 16,783
Total Cost (NPV @3.8%)			$ 2,280	$ 5,588	$ 7,868

Appendix 7B
At-Reactor Spent Fuel Storage Cost Summaries

Parameters for Spent Fuel Acceptance Scenarios

Assumptions	Case 1	Case 3	Case 5	Case 6	Case 7	Case 8
PFSF Operation Date	2002 PFSF	No PFSF	2002 PFSF	No PFSF	2002 PFSF	No PFSF
Repository Operation Date	2015	2015	2015	2015	2015	2015
Peak PFSF Capacity (MTU)	20,000	0	8,000	0	40,000	0
Reactors in Comparison	51	51	19	19	all	all
License Duration (Years)	40		40		40	

Assumptions	Case 9	Case 10	Case 11	Case 12	Case 13	Case 14
PFSF Operation Date	2002 PFSF	No PFSF	2002 PFSF	No PFSF	2002 PFSF	No PFSF
Repository Operation Date	2010	2010	2010	2010	2010	2010
Peak PFSF Capacity (MTU)	16,600	0	6,600	0	40,000	0
Reactors in Comparison	51	51	19	19	all	all
License Duration (Years)	40		40		40	

At-Reactor Spent Fuel Storage Cost Summary (Millions Constant 1999$)

	Comparisons of Costs for PFSF versus 2015 Repository Only Systems					
Cost Category	**Case 1 versus Case 3**		**Case 5 versus Case 6**		**Case 7 versus Case 8**	
PFSF Operation Date	Case 1 2002 PFSF	Case 3 No PFSF	Case 5 2002 PFSF	Case 6 No PFSF	Case 7 2002 PFSF	Case 8 No PFSF
Operating Reactor Storage	$ 381.4	$ 1,121.6	$ 88.2	$ 519.6	$ 1,376.4	$ 3,195.3
Shutdown Reactor Storage	$ 3,609.4	$ 7,635.8	$ 961.2	$ 2,124.4	$ 10,702.0	$ 13,587.8
Total Utility At-Reactor Storage	$ 3,990.8	$ 8,757.4	$ 1,049.4	$ 2,644.0	$ 12,078.4	$ 16,783.1
PFSF At-Reactor Storage Benefit	$ 4,766.6		$ 1,594.6		$ 4,704.7	
PFS Facility Cost	$ 1,854.0		$ 999.3		$ 2,411.3	
Net Benefit (Avoided Cost)	**$ 2,912.6**		**$ 595.3**		**$ 2,293.4**	

	Comparisons of Costs for PFSF versus 2010 Repository Only Systems					
Cost Category	**Case 9 versus Case 10**		**Case 11 versus Case 12**		**Case 13 versus Case 14**	
PFSF Operation Date	Case 9 2002 PFSF	Case 10 No PFSF	Case 11 2002 PFSF	Case 12 No PFSF	Case 13 2002 PFSF	Case 14 No PFSF
Operating Reactor Storage	$ 381.4	$ 926.4	$ 88.2	$ 400.7	$ 1,346.6	$ 2,605.2
Shutdown Reactor Storage	$ 3,473.4	$ 6,186.8	$ 961.2	$ 1,678.4	$ 6,724.4	$ 10,586.8
Total Utility At-Reactor Storage	$ 3,854.8	$ 7,113.2	$ 1,049.4	$ 2,079.1	$ 8,071.0	$ 13,192.0
PFSF At-Reactor Storage Benefit	$ 3,258.4		$ 1,029.7		$ 5,121.0	
PFS Facility Cost	$ 1,856.0		$ 999.3		$ 2,411.3	
Net Benefit (Avoided Cost)	**$ 1,402.4**		**$ 30.4**		**$ 2,709.7**	

At-Reactor Spent Fuel Storage Cost Summary (Millions NPV 1999$ - 3.8% Real Interest Rate)

	Comparisons of Costs for PFSF versus 2015 Repository Only Systems					
Cost Category	Case 1 versus Case 3		Case 5 versus Case 6		Case 7 versus Case 8	
PFSF Operation Date	Case 1 2002 PFSF	Case 3 No PFSF	Case 5 2002 PFSF	Case 6 No PFSF	Case 7 2002 PFSF	Case 8 No PFSF
Operating Reactor Storage	$ 346.9	$ 851.8	$ 82.1	$ 360.7	$ 1,141.0	$ 2,280.0
Shutdown Reactor Storage	$ 2,253.3	$ 3,797.9	$ 519.3	$ 933.3	$ 4,569.0	$ 5,588.0
Total Utility At-Reactor Storage	$ 2,600.2	$ 4,649.7	$ 601.4	$ 1,294.0	$ 5,710.0	$ 7,868.0
PFSF At-Reactor Storage Benefit	$ 2,049.5		$ 692.6		$ 2,158.0	
PFSF Facility Cost	$ 1,180.3		$ 604.7		$ 1,534.5	
Net Benefit (Avoided Cost)	**$ 869.2**		**$ 87.9**		**$ 623.5**	

	Comparisons of Costs for PFSF versus 2010 Repository Only Systems					
Cost Category	Case 9 versus Case 10		Case 11 versus Case 12		Case 13 versus Case 14	
PFSF Operation Date	Case 9 2002 PFSF	Case 10 No PFSF	Case 11 2002 PFSF	Case 12 No PFSF	Case 13 2002 PFSF	Case 14 No PFSF
Operating Reactor Storage	$ 346.9	$ 741.7	$ 82.1	$ 297.5	$ 1,122.2	$ 1,973.1
Shutdown Reactor Storage	$ 2,196.1	$ 3,358.6	$ 519.3	$ 811.5	$ 3,367.3	$ 4,807.9
Total Utility At-Reactor Storage	$ 2,543.0	$ 4,100.3	$ 601.4	$ 1,109.0	$ 4,489.5	$ 6,781.0
PFSF At-Reactor Storage Benefit	$ 1,557.3		$ 507.6		$ 2,291.5	
PFSF Facility Cost	$ 1,188.8		$ 604.9		$ 1,534.4	
Net Benefit (Avoided Cost)	**$ 368.5**		**$ (97.3)**		**$ 757.1**	

At-Reactor Spent Fuel Storage Cost Summary (Millions NPV 1999$ - 7.0% Real Discount Rate)

	Comparisons of Costs for PFSF versus 2015 Repository Only Systems					
Cost Category	Case 1 versus Case 3		Case 5 versus Case 6		Case 7 versus Case 8	
PFSF Operation Date	Case 1 2002 PFSF	Case 3 No PFSF	Case 5 2002 PFSF	Case 6 No PFSF	Case 7 2002 PFSF	Case 8 No PFSF
Operating Reactor Storage	$ 326.8	$ 705.6	$ 78.7	$ 279.6	$ 1,013.1	$ 1,814.6
Shutdown Reactor Storage	$ 1,696.2	$ 2,470.5	$ 361.0	$ 561.1	$ 2,703.0	$ 3,179.0
Total Utility At-Reactor Storage	$ 2,023.0	$ 3,176.1	$ 439.7	$ 840.7	$ 3,716.1	$ 4,993.6
PFSF At-Reactor Storage Benefit	$ 1,153.1		$ 401.0		$ 1,277.5	
PFSF Facility Cost	$ 871.5		$ 437.8		$ 1,108.8	
Net Benefit (Avoided Cost)	**$ 281.6**		**$ (36.8)**		**$ 168.7**	

	Comparisons of Costs for PFSF versus 2010 Repository Only Systems					
Cost Category	Case 9 versus Case 10		Case 11 versus Case 12		Case 13 versus Case 14	
PFSF Operation Date	Case 9 2002 PFSF	Case 10 No PFSF	Case 11 2002 PFSF	Case 12 No PFSF	Case 13 2002 PFSF	Case 14 No PFSF
Operating Reactor Storage	$ 326.8	$ 635.8	$ 78.7	$ 241.3	$ 1,000.3	$ 1,632.0
Shutdown Reactor Storage	$ 1,665.7	$ 2,293.3	$ 361.0	$ 515.6	$ 2,217.7	$ 2,902.3
Total Utility At-Reactor Storage	$ 1,992.5	$ 2,929.1	$ 439.7	$ 756.9	$ 3,218.0	$ 4,534.3
PFSF At-Reactor Storage Benefit	$ 936.6		$ 317.2		$ 1,316.3	
PFSF Facility Cost	$ 880.8		$ 437.8		$ 1,108.8	
Net Benefit (Avoided Cost)	**$ 55.8**		**$ (120.6)**		**$ 207.5**	

APPENDIX 7C

SUMMARY OF AVOIDED COSTS (PFS NET BENEFITS)

Repository Open Date	Size (MTU)	Avoided Costs Constant 1999$	Avoided Costs NPV 3.8%	Avoided Costs NPV 7%
2010	16,600	$1,402,400,000	$368,500,000	$ 55,800,000
2010	6,600	$ 30,400,000	$(97,300,000)	$(120,600,000)
2010	38,000	$2,709,700,000	$757,100,000	$ 207,500,000
2015	20,000	$2,912,000,000	$869,200,000	$ 281,600,000
2015	8,000	$ 595,300,000	$ 87,900,000	$ (36,800,000)
2015	38,000	$2,293,400,000	$623,500,000	$ 168,700,000

CHAPTER 8

FACILITY SITING AND DESIGN ALTERNATIVES

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proposed by the Skull Valley Band of Goshute Indians. This process applied further criteria such as the host community preferences, additional transportation infrastructure needs, additional cost factors and additional environmental factors. Further field investigations of alternative sites on the Skull Valley Reservation were performed by Stone & Webster and documented in a report, "Phase I – Preliminary Environmental Assessment Report," dated December 1996. The process culminated in the selection of a primary and an alternate ISFSI site for consideration on the Skull Valley Indian Reservation in northwestern Utah, described further in the sections below.

8.1.3.2 Candidate Area

The Skull Valley Band Executive Council determined the allowed candidate site search area on the reservation. The offered land on the Skull Valley Indian Reservation encompassed all of Sections 6 and 7 of T5S/R8W in Tooele County (Figure 8.1-1). Each of these two sections are approximately 600 acres in size, thus offering some flexibility in actual placement of the approximately 100 acre facility.

8.1.3.3 Potential Sites

Two potential locations, Site A and Site B, were identified by the PFSLLC on the Skull Valley Indian Reservation within the area proposed by the Skull Valley Band Executive Council. These sites are located in Sections 6 and 7 of T5S/R8W, Tooele County (Figure 8.1-2). The two potential sites were evaluated using the criteria in Table 8.1-3 and a final site was selected. Only minor differences in the two sites existed. Input was received from the Band in locating the access road from the final site to the Skull Valley Road. The other site is included as an alternative site.

8.1.3.3.1 Information Associated with the Wyoming Site

Mineral Resources

The Wyoming site and local transportation route from the mainline railroad lies within the Wind River Coal Basin, an area underlain by thin layers of sub-bituminous grade coal (Groff and Jones, 1986). Coal has been mined mainly along the edges of the basin where the coal-bearing layers are at or near the surface. The nearest exposure of rocks known to be coal bearing is at least 8 miles to the north of the site. No mines or prospects have been identified at this location (Groff and Jones, 1986). Coal could be expected to occur at some unknown depth beneath the Wyoming site. However, it is very unlikely that it could be mined economically in the near future with today's technology and still compete with abundant near-surface reserves found elsewhere.

The Wind River Basin also contains oil and natural gas at several locations. The nearest known location is about 5 miles to the east of the site at the small, abandoned Shoshoni gas field (De Bruin and Hostetler, 1991). Two abandoned exploratory or wildcat wells appear to have been drilled approximately 0.75 miles northwest of the site. De Bruin (1993) includes the site area within the present productive limit of the Tertiary age, Fort Union Formation gas play. The potential for oil or gas beneath the site would have to be considered unknown at this time.

The "Metallic and Industrial Minerals of Wyoming" map (Harris et al., 1985) indicates no past or present mining activity at or near the Wyoming site. A small uranium prospect is located about 2.5 miles northwest of the site near the active rail line west of Bonneville. Feldspar has been mined in the past in the nearby Owl Creek Mountains and processed at the plant just north of the site. The plant is presently used to process and ship trona that is mined at several locations out of the area.

In summary, there are presently no known mineral resources at the Wyoming site or along the transportation corridor.

Protected Species

PFS has not conducted any rare and endangered species surveys at this site. It is unlikely that any Federal or State-listed threatened or endangered species inhabit the site area. A Wyoming Natural Diversity Database search (letter received November 19, 1999 from Rebekah Smith, WYNDD Data and Biological Assistant) retrieved 1 animal record and 7 plant records (of two species).

Of the occurrences found, Owl Creek Miner's Candle (*Cryptantha subcapitata)* is the most sensitive species. The entire worldwide distribution of the Owl Creek Miner's Candle is in this area of Wyoming, the Owl Creek Mountains around Boysen Reservoir. Two of the known four occurrences in the world are within the project area or the surrounding buffer (one township). Their habitat consists of sandy-gravelly slopes and desert ridges in sparsely vegetated cushion plant communities. The plants are potentially threatened by surface-disturbing activities, but their relative inaccessible habitat has kept the populations somewhat secure.

Roroppa calycina is a regional endemic found along mudflats around reservoirs. Their visibility depends on the height of the water

The common loon (*Gavia immer)* is included in the most sensitive class of Species of Special Concern (SSC1) designated by the Wyoming Game and Fish. It is also on the USFS Regions 2 and 4 Sensitive species list, although there is little land managed by the USFS in the area of interest. This particular occurrence was an observation of migrating birds feeding in a mostly un-forested area.

The site visit included a probable identification of a nesting pair of ferruginous hawks on the west side of the bluff situated about 0.5 miles east of the site area. The ferruginous hawk is a hawk of the open plains and is a species of "special concern" in Wyoming as well as a "candidate species" for the USFWS.

In addition, the presence of prairie dog communities in the site area suggests the possible presence of the Federal-listed black-footed ferrets, a predator relying heavily on prairie dogs as prey. The black-footed ferret is a Federal endangered species.

Regional Historical and Cultural Resources

No Traditional Cultural Properties (TCPs) are known to be located within the impact area of the Wyoming site. The nearest cultural property listed in the National Register of Historic Places (it is unclear whether this is listed as a TCP or just a significant prehistoric site) is the Castle Gardens Petroglyph Site, which is located in Moneta, over 20 miles to the southeast.

Information on ethnobiological resources for this region is not available through any published reports and can only be obtained by contacting each Native American group in the region. Since PFS did not select this site, it did not contact any Native American groups for information on ethnobiological resources.

Demographics

The Wyoming site is located in Fremont County. The area surrounding the site is extremely rural but contains two small communities: Shoshoni, located just over 2 miles to the south-southwest; and Bonneville, about 1 mile north. The U.S. Census counted a total population of 527 people in Shoshoni in 1990 (population Estimates Program, Population Division, U.S. Census Bureau – SU-98-9). Although there is no specific census count, it is estimated that approximately 60 people resided in Bonneville in

1990, based on a house count of 22 houses multiplied by a Fremont County persons per household factor of 2.74. Less than 1 percent of the total 1990 county population was Black, about 18.5 percent was of Native American decent, and about 4 percent were Hispanic (1990 Census Profile 1 for Fremont County). Specific information on ethnicity for either Bonneville or Shoshoni was not found. Median household income in Fremont County was $22,260 in 1990, with about 19% of the population living below the poverty level.

Nearest Residences and Nearest Wells

Water well records obtained from the State of Wyoming in 1996 indicate the presence of domestic water wells approximately 4500 ft southwest and 4500 ft northwest from the center of the proposed site area, located near Shoshoni, WY. Photographs taken at the site during the initial evaluation indicate residential buildings at both these locations. These locations would both be on the theoretical downstream flowpath from the proposed storage site.

For comparison purposes, the nearest residence with a domestic well in Skull Valley, UT is approximately 2.5 miles southeast from the center of the proposed PFSF site. This location is in the upstream flow direction from the PFSF. There are no domestic water wells, in the downstream flowpath (lower elevations near center of valley) from the site, between the PFSF and Interstate 80.

Radiation Dose Considerations to Nearest Resident and Nearby Population

The Wyoming site location is in the southeast quarter of Section 23, Township 38, Range 94. There are two residences nearest the site, at approximately the same distance from the site boundary. For comparison purposes, the distance to the nearest residences from the boundary of the Wyoming site is approximately 1/3 of the distance to the nearest residence from the Skull Valley PFSF. Based on dose rates vs. distance analyses performed for the PFSF cask storage area (SAR Section 7.3.3.5), the dose

rate at the nearest residences to the Wyoming site is estimated to be more than an order of magnitude greater than that calculated for the residence nearest the Skull Valley PFSF. However, it is also estimated that the dose rate to individuals living in the nearest residences to the Wyoming site from a 4,000 cask array would be below the 25 mrem/yr limit of 10 CFR 72.104(a), assuming continuous occupancy.

The center of the town of Shoshoni is approximately 8,200 ft (2,500 meters) from the west boundary of the Wyoming site, and the 1990 population was 527, based on 1990 census data. The center of the town of Bonneville is approximately 7,100 ft (2,165 meters) from the north boundary of the Wyoming site, and it is estimated that approximately 60 people resided in Bonneville in 1990, based on a house count of 22 houses multiplied by a Fremont County persons per household factor of 2.74. In comparison with the PFSF located in Skull Valley Utah, there are no towns within 10 miles of the PFSF. The nearest town to the PFSF, Dugway, is a military town on the Dugway Proving Grounds with a population of approximately 1,700, located about 12 miles south of the PFSF. Terra, a small residential community of about 120 people, is located 10 miles east-southeast of the PFSF. As stated in PFSF ER Section 4.2.9, there are about 36 residents within the 5-mile study radius of the PFSF. Since all 36 residents are located 2 miles or greater from the PFSF, annual doses to these 36 residents would be essentially negligible. Based on dose rate vs. distance estimates from a 4,000 cask array, annual population exposures to the residents living within 2 miles of the Wyoming site, which includes the towns of Shoshoni and Bonneville, would be more than an order of magnitude higher than exposures to the population within 5 miles of the Skull Valley PFSF. Whereas 10 CFR 72.104(a) limits the annual dose equivalent to any real individual located beyond the ISFSI controlled area, regulations do not specify a limiting dose to the nearby population from an ISFSI.

8.1.3.4 Proposed Site

The locations of the proposed (Site A) and alternative (Site B) sites are shown in Figure 8.1-2. The preferred site was selected over the alternate primarily because of its greater distance to the nearest resident, and its more favorable elevation.

The proposed site is located near the western edge of the Skull Valley Indian Reservation, north of the Hickman Knolls outcropping and west of Skull Valley Road, a County Highway, the main thoroughfare through the reservation. The proposed site is in a remote location of the reservation, approximately 2 miles from the nearest residence, and 3.5 miles from the Skull Valley Band Village, which contains approximately 30 residents in 7 owner-occupied homes and 4 trailers.

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8.3 ALTERNATIVE OF CONSTRUCTING A NEW HEAVY HAUL ROAD FROM LOW, UTAH TO THE PFSF INSTEAD OF THE RAIL LINE

Construction of a new heavy haul road from Low, Utah to the PFSF site instead of a rail line is feasible, based on the environmental considerations discussed below. However, a rail line along this route would be the preferred alternative. Rail transport of a shipping cask from the nuclear power plant where the spent fuel is loaded into a canister directly to the PFSF site obviates the need for transfer of the shipping cask to a heavy haul trailer at an intermediate point (the Intermodal Transfer Point -ITP), and thus improves transportation efficiency. The addition of a second road through Skull Valley that parallels the Skull Valley Road opens up the western portion of Skull Valley to vehicular traffic, which PFS believes is an undesirable impact to Skull Valley. As discussed below, the area of land permanently impacted by a heavy haul road is substantially greater than that permanently impacted by a railroad, due to the greater width associated with such a road. Laying a 34 ft wide strip of asphalt along the 32 mile Low Corridor is considered to have a greater impact on the environment than installation of the ties and rails needed for rail transport over the same route.

As discussed in Section 4.4.6, both the Low rail siding and Low Corridor rail line will be constructed as one project utilizing the same construction crews. An estimated 125 workers will be required for this project, with the bulk of the manpower involved in earthwork. Construction activities will be conducted primarily during daylight hours and will be completed in approximately one year. Section 4.3.6 estimates that construction of the ITP 1.8 miles west of Timpie, Utah would require a about 35 workers and take approximately one year. This is also considered to be a reasonable estimate for the construction of an ITP at Low, which would be required if a new road were constructed to the PFSF. Construction of a heavy haul road from Low to the PFSF using the Low Corridor is considered to require roughly the same work force as that estimated for the rail project, about 125 workers, and take approximately one year, with construction

activities conducted primarily during daylight hours. As with construction of the rail line, the majority of these workers would be involved with earthwork.

The following table presents a comparison of the construction materials that would be needed for each of the two transport alternatives, direct rail vs. heavy haul. The table is based on the assumption that the heavy haul road is 34 ft wide, with two 12 ft wide lanes and two 5 ft wide shoulders. The entire 34 ft road width is underlain by a 12 inch compacted aggregate base. The two 12 ft wide lanes would consist of 8 inches thick asphalt, and the two 5 ft wide shoulders would consist of 4 inches thick asphalt. The table includes an ITP which would also be required at Low for the transfer of a shipping cask from a rail car arriving on the Union Pacific main line to a heavy haul trailer. For estimating purposes, the quantities of material for the ITP 1.8 miles west of Timpie are used in the following table for a similar ITP at Low.

	Volume of Material in cubic yards			
Type of Construction Material	32 Mile Long Heavy Haul Road	Intermodal Transfer Point	Total for Heavy Haul Alternative	Total for Low Corridor Rail Alternative
Gross Cut	815,500	22,000	837,500	884,400
Gross Fill	819,500	31,000	850,500	627,800
Aggregate Base	213,000	3,700	216,700	0
Asphalt Concrete	121,100	1,400	122,500	0
Ballast	0	4,300	4,300	95,700
Subballast	0	5,400	5,400	225,100

Although construction of an ITP at Low and a heavy haul road along the Low Corridor are feasible, the Low Corridor rail line is the preferred means of transporting shipping casks between the Union Pacific main rail line and the PFSF site since it optimizes operating efficiency and does not open up the west side of Skull Valley (Low Corridor) to vehicular traffic.

Differences in Environmental Impacts

Section 4.4, "Effects of Construction and Operation of the Low Corridor Rail Line", addresses effects on the following: geography, land use, anddemography; ecologic resources; air quality; hydrological resources; mineral resources; socioeconomics; noise and traffic; and regional historical, cultural, scenic, and natural features. Differences in environmental effects between a rail line and heavy haul road are considered for each of these areas in the following paragraphs. In addition, a heavy haul road along the Low Corridor would require location of the ITP near Low instead of its present location 1.8 mile west of the intersection of Skull Valley Road and I-80.

Geography, Land Use, and Demography

Section 4.4.1 states that construction of a new rail line will require the alteration of approximately 776 acres of land along the rail line, which is the area involved in a construction right-of-way that is approximately 200 ft wide and running the 32 mile length of the rail line. Since the construction right-of-way for a heavy haul road would also be approximately 200 ft, the same area of land would be affected by construction of a heavy haul road (approximately 776 acres). Section 4.4.1 states that the new rail line will require the permanent alteration of 155 acres, based on an affected area 32 miles long and 40 ft wide. The width permanently affected by the heavy haul road would be greater, approximately 60 ft. The area of land permanently affected by the 60 ft wide 32 mile long heavy haul road would be 1.5 times that permanently affected by the rail line, or 233 acres.

Construction activities associated with a heavy haul road would temporarily disturb resident livestock and cause them to avoid the construction area, the same as would be the case for construction of the rail line, as discussed in Section 4.4.1. Effects on livestock due to the operational phase would be the result of traffic along the Low Corridor. Sections 3.3.1 and 3.3.2 discuss the number of trains vs. heavy haul trucks needed to provide PFSF with 200 loaded shipping casks on the average per year (4

casks per week). For the direct rail alternative, PFS would receive an average of one train per week carrying 4 loaded shipping casks per train. While one return trip could transport 4 empty shipping casks from the PFSF back to Low, based on timing considerations it is likely that another trip would be made to transport all 4 empty shipping casks back to Low, for an average of 2 rail round trips per week expected. For the heavy haul alternative, PFS would receive an average of 4 shipping casks transported by heavy haul truck per week. While a truck could transport an empty shipping cask back to the ITP on its return trip, based on timing considerations it is likely that some trips would return to the ITP without a cask. It is anticipated that, on average, 6 heavy haul truck round trips would be required to transport 4 loaded casks to the PFSF and haul 4 empty casks back to the ITP each week. Therefore, it is considered that the heavy haul alternative would require about 3 times the number of round trips as rail. Even so, it is considered that the heavy haul trucks traveling along the Low Corridor would not have a significant adverse affect on livestock, and there would be little difference from effects associated with direct rail, discussed in Section 4.4.1. Due to the infrequent number of trips (6 round trips on average per week for transporting 200 casks per year to and from the PFSF) and slow speed of the heavy haul trucks (20 mph), collisions with livestock are not anticipated and range fences on either side of the road are not necessary. Livestock would be able to freely cross the road to access rangeland on either side. Other effects (recreational land use, crossing arryos, demographics) of a heavy haul road would be essentially the same as discussed for the Low Corridor rail line in Section 4.4.1.

A heavy haul road along the Low Corridor would require location of the ITP at Low instead of its present location 1.8 miles west of the intersection of Skull Valley Road and I-80. The relocated ITP would be about the same size as discussed in Section 4.3.1, affecting approximately 11 acres of land that would require alteration for the building housing the gantry crane, access road and rail sidings. The land that would be affected at Low is public land administered by the BLM that is not currently in use,

much of which has been previously disturbed in the construction of old U.S. 40, Interstate 80, and the railroad.

Effects on Ecological Resources

Construction and operation of a heavy haul road in place of the Low Corridor rail line would affect ecological resources differently by impacting different acreages of land. Rail line construction would temporarily remove approximately 776 acres of greasewood and desert shrub/saltbrush habitat (Section 4.4.2), but permanently alter only 155 acres of public land administered by the BLM. Heavy haul road construction would also temporarily affect approximately 776 acres, but permanently alter 233 acres of public land administered by the BLM. With the exception of areas of land affected by the two different modes of transportation, the ecological effects discussed in Section 4.4.2 for construction and operation of the rail line would be about the same as for construction and operation of a heavy haul road along the same route.

In addition to the area of land affected by the 32 mile long heavy haul road, approximately 11 acres of land would be affected by the addition of the ITP at Low. These 11 acres are for the gantry crane building, access road and rail sidings. As discussed in Section 2.3.3.1, the entire Low railhead area, located between Interstate 80 and the old U.S. 40 road, is grassland. Vegetation at the Low railhead that would be impacted by construction of an ITP is dominated by invasive annuals such as cheatgrass, which likely invaded the area partly as the result of disturbance from U.S. 40, Interstate 80, and the railroad. No federal or state-listed threatened or endangered plant species are known to occur within the railhead area at Low or along the 32 mile Low Corridor.

Section 4.4.2 discusses potential effects on wildlife of construction/operation of the Low Corridor rail line. This information would also apply to a heavy haul road along the Low Corridor.

Peregrine falcons have been known to nest at the Timpie Waterfowl Management Area. Approximately the northern 1/3 of the Low Corridor would be within 15 miles of potential nesting sites and therefore could potentially be within the feeding range of peregrine falcons. As noted in Section 4.3.2, construction activities at the ITP 1.8 miles west of Timpie are unlikely to affect the falcon's forage base of small mammals and birds because of the small amount of land altered in the area (approximately 11 acres). For the same reason, construction of an ITP at Low would also be unlikely to affect the falcon's forage base. In addition, an ITP at Low would be along the outer reaches of the foraging range of falcons nesting at the Timpie Waterfowl Management Area.

Effects on Air Quality

The air quality effects associated with constructing a heavy haul road would not be significantly different from those associated with construction of the rail line. Fugitive dust emissions associated with road construction involving approximately 776 acres would be similar to that for the rail line construction, also involving approximately 776 acres. Road construction would involve the placement of 32 miles of asphalt, approximately 34 ft wide (two 12 ft lanes and two 5 ft shoulders). Assuming that the asphalt is trucked in, as is planned for the Skull Valley access road, air emissions from asphalt production would be associated with the relatively distant production plant and not the road construction. Pollutant emissions from grading, bulldozing, and dump-truck operation involved in construction of a heavy haul road would be similar to that calculated for construction of the Low Corridor rail line in ER Table 4.4-1.

The air quality impacts associated with construction of the 11 acre ITP, documented in Section 4.3.3, would be essentially the same regardless of whether the ITP is constructed at its planned location near Timpie, or at Low.

During PFSF operation, air emissions produced by heavy haul trucks traveling along the Low Corridor can be estimated using calculated emissions for heavy haul vehicles using the Skull Valley Road (Section 4.3.3). Four round trips on average per week are necessary to meet the average of 200 casks per year PFSF loading rate, with a heavy haul truck transporting loaded shipping casks to the PFSF and returning to the ITP with empty casks. Accounting for trucks dropping off full casks and returning without casks, Section 4.3.3 assumes 312 round trips per year (6 round trips per week) to calculate pollutant emissions, with the heavy haul trucks assumed to travel at 20 mph. For the same number of trips on a Low Corridor heavy haul route, air pollutant emissions would be somewhat higher due to the 32 mile distance vs. the 26 mile distance of the Skull Valley Road. Therefore, pollutant emissions from heavy haul vehicle trips along a Low Corridor heavy haul route can be estimated by multiplying the emissions rate of each of the pollutants listed in Section 4.3.3 for operation by a factor of (32 mi / 26 mi =) 1.23. Section 4.3.3 concluded that the quantity of air emissions from diesel trucks hauling shipping casks along the Skull Valley Road would be minimal compared to Tooele County emissions that are 3-4 orders of magnitude higher. The same conclusion would apply for diesel trucks hauling shipping casks along a Low Corridor heavy haul road, since calculated emissions for the Low Corridor route would only be a factor of 1.23 times greater than those associated with the route using the Skull Valley Road (shown in Section 4.3.3).

Effects on Hydrological Resources

As stated in Section 4.4.4 for the Low Corridor rail line, there are no existing surface water bodies and ground water is over 100 ft below the surface. Therefore, it is unlikely that either a rail line or a heavy haul road would have any impact on hydrological resources.

Effects on Mineral Resources

As stated in Section 4.4.5 for the Low Corridor rail line, no mineral resources have been identified along the rail line corridor. Therefore, no impact to this resource is expected for a rail line or a heavy haul road.

Effects on Socioeconomics

No adverse impacts on socioeconomic resources are anticipated as a result of the new rail line or a heavy haul road along the Low Corridor. As stated in Section 4.4.6 for the rail line, "minor short-term employment will result from construction activities associated with the rail line. These activities will utilize a local labor force commuting daily to the project area and will therefore not induce relocation of families and associated impacts on local government services." The same is true for a heavy haul road.

Effects of Noise and Traffic

A heavy haul vehicle traveling along the Low Corridor would produce less noise than locomotives. Therefore, the discussion of noise effects in Section 4.4.7 for locomotives travelling along the Low Corridor rail line provides a conservative assessment of the effects of noise that could be produced by heavy haul trucks traveling along a road in the Low Corridor. Use of the heavy haul transport mode would result in approximately three times as many round trips as rail transport, with about 6 heavy haul round trips on average per week anticipated to transport 200 loaded shipping casks from the ITP to the PFSF and 200 empty shipping casks back to the ITP in an average year. As discussed in Section 4.4.7, because of the unimproved nature of the roads crossing the Low Corridor, the infrequent off-road traffic proceeds at a reduced speed. Heavy haul trucks will only travel at approximately 20 mph. Because the area is flat, unoccupied and unwooded, users of both the Low Corridor heavy haul road and roads that cross this road would have a virtually unlimited field of vision. Based on this, it is unlikely that

a heavy haul road would have any impact on traffic or vehicular safety, even with three times the number of trips than that expected for rail usage.

Effects on Regional Historical, Cultural, Scenic, and Natural Features

The discussion in Section 4.4.8 for the rail line would also apply to a heavy haul road in the Low Corridor. A heavy haul road could result in slightly greater visual impact due to the permanently affected area of the road being 60 ft wide, whereas the rail line involves a 40 ft wide corridor cleared of native vegetation to provide a buffer zone in reducing the propagation of fires.

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8.4 REFERENCES

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CHAPTER 9

ENVIRONMENTAL APPROVALS AND CONSULTATION

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- 17 additional acres (e.g., security) of soil contiguous and adjacent to the proposed road.

Thus, approximately 164 acres of soil will be disturbed during the construction of the PFSF and ancillary facilities on the Skull Valley Indian Reservation.

Once the storm water permit application NOIis filed with EPA Region VIII, coverage under the General Permit is received by default 48 hours after filing. However, several activities must be conducted prior to filing an NOI. These activities include an endangered species assessment, the preparation of a Stormwater Management Pollution Prevention Plan (SWPPP), and a verification of the existence and/or absence of applicable local, county, State, or Tribal environmental programs.

The NOI will provide general information about the site such as name, location, dates, and other general information relevant to the nature of the construction activities. The extensive information that has been gathered on endangered species (see Chapter 2) has been reviewed relative to General Permit requirements and it has been determined that it is sufficient to satisfy Part 1.B.3.e.(2)(b) of the General Permit. Within the SWPPP, there will be provisions outlining erosion and sediment controls, soil stabilization practices, structural controls, and other best management practices that will be employed during construction to protect offsite waters from adverse impacts from construction-related storm water runoff. The SWPPP will also outline maintenance and inspection requirements and identify Best Management Practices (BMP's) for the effective management of storm water runoff from the concrete batch plant. The detention basin will also be appropriately sized to meet the applicable criteria in the EPA Region VIII General Permit.

The SWPPP will be maintained onsite throughout the construction process and will be updated as appropriate. This document will also be made available for review, upon request, to the EPA Region VIII Director, the Band, and other authorized individuals.

Once construction has been completed, a separate NPDES permit is not required for the operation of the PFSF since facility operations will not result in the discharge of process wastewater. In addition, facility operations are not subject to storm water permit regulations.

A Spill Prevention, Control and Countermeasures Plan (SPCC Plan) may need to be developed since all diesel fuel storage tanks at the PFSF will be placed above the ground. This fuel tank orientation may lead to the exceedance of the 40 CFR 112 SPCC permitting threshold, which will simply require the preparation of a SPCC plan that will be stamped by a Professional Engineer and maintained onsite.

Drinking Water and Groundwater Protection

Drinking water needs for PFSF construction and operation activities are expected to be met using surface storage tanks fed by one or more wells drilled on the PFSF site, as discussed in Section 4.2.4. In the event that onsite water quantity or quality are inadequate, potable water will be obtained directly from the Reservation's existing supply or an additional well or wells will be drilled east of the site and outside of the OCA, where water supplies are likely to be more satisfactory. All applicable Safe Drinking Water Act (SDWA) enabling regulations associated with treatment to ensure meeting National Primary Drinking Water Standards for non-transient, non-community drinking water systems will be met.

Sanitary wastewater from PFSF construction and operation activities will be disposed of using two (2) septic tank/leach field systems, each with a design capacity to serve 20 or

more people. All PFSF floor drains will be designed to ensure that inadvertent spills of oil, antifreeze, and other chemicals, will not enter the sanitary waste leach field system. The size of these septic tank/leach field systems will require an Underground Injection Control (UIC) registration with EPA Region VIII since septic tank/leach fields with a design capacity to serve 20 or more people are classified as Class V injection wells per 40 CFR 144.26(a). This enabling regulation identifies the need to provide information on nature and type of injection wells and their operating status before injection of fluids can begin. This information must be filed with EPA shortly before placing the sanitary systems into service.

Preservation of Air Quality

Construction and operation activities at the PFSF are not expected to have any measurable impact on the local air quality since no significant criteria or hazardous air pollution emissions will occur. Gaseous criteria pollutant emissions at the PFSF are limited to small propane space heating furnaces, a standby emergency diesel generator, a fire pump diesel, heavy haul trucks, cask transporters, and worker's private vehicles.

Small space heating sources of air pollutants less than one million per Btu per hour heat input are exempt from applicable air quality regulations. The emergency and fire pump diesels, which are non-construction stationary sources of air pollutants smaller than 150kW, and not operating more than 250 hours per year, will not trigger any 40 CFR 60 New Source Performance Standards (NSPS) nor 40 CFR 52 Prevention of Significant Deterioration (PSD) levels. Moreover, the heavy haul trucks, transporters, and private vehicles are considered mobile sources, which are not regulated by the EPA. Finally, the quantity of criteria and hazardous air pollutants expected to be emitted during PFSF operations are not of sufficient magnitude to trigger Clean Air Act (CAA) Title V (40CFR 71) compliance regulations.

Any potential air quality-related impacts associated with the construction of the PFSF will result from gaseous pollutant emissions from diesel-powered construction equipment, and from fugitive dust emissions from excavation activities and construction equipment. In addition, the concrete batch plant will also be a source of fugitive dust emissions. There are no regulations governing the generation of fugitive dust resulting from construction activities. However, for a project of this size, steps need to be taken to minimize fugitive dust emissions. Accordingly, a BMP Emissions Control Plan will be developed to provide assurance that fugitive dust emissions will be effectively managed and minimized throughout all of the construction phases of the project. This Plan, which will be integrated into the SWPPP, will include dust control techniques, such as watering and/or chemical stabilization of potential dust sources.

There are no expected airborne effluents of radionuclides from normal PFSF operation. Accordingly, the 40 CFR 191.03(a) offsite dose limit of 25 mrem is not exceeded and airborne effluent monitoring will not be required.

The diesel tanks for the standby emergency diesel generator and the diesel fire pump will be located above ground.The small levels of Volatile Organic Compound (VOC) emissions will be well within 40 CFR 52 and 40 CFR 60 compliance levels.

Refrigerants used for air conditioning at the PFSF will consist of Class II refrigerants (i.e., non-ozone depleting substances). Therefore, Permitting for Clean Air Act Title VI, Stratospheric Ozone Protection, relative to the usage and storage of refrigerants will not be required.

9.1.6 The Surface Transportation Board (STB)

In order for PFS to implement either of the two alternative means proposed for cask transport from the railroad mainline at Low, Utah to the PFSF – construction and operation of a new rail line to the PFS (the preferred alternative) or use of heavy haul tractor/trailer via Skull Valley Road – regulatory authority must first be obtained from the United States Surface Transportation Board (STB). As to the first alternative, the STB would have to approve construction and operation of a new rail line and associated sidings between Low, Utah and a point in the south-central portion of the Skull Valley, Utah, where PFS would construct the PFSF. As to the second alternative, the STB would have to approve the construction of a run-around track and sidings at a point approximately 1.8 miles west of Timpie, Utah, where PFS would construct an Intermodal Transfer Point that would be employed to transfer spent nuclear fuel casks transported on existing rail lines to truck for movement to the PFSF. A Notice of Intent to construct rail lines was filed with the STB on August 6, 1999. PFS anticipates filing an application for STB approval of the foregoing actions, or a request for exemption from formal approval requirements, in mid-December 1999.

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Preservation of Air Quality

Similar to the PFSF, construction and operation activities at Low Corridor rail line and ITP are not expected to have any measurable impact on the local air quality.

Since air pollution emissions generated from the operation and construction of the Low Corridor rail line and the ITP will be either mobile sources, or below regulated levels for stationary sources, no Utah Regulation R307-15 approvals should be required from the State of Utah, which administers the Clean Air Act Title V regulations.

Any potential air quality-related impacts associated with the construction of the Low Corridor rail line and ITP will result from gaseous pollutant emissions from diesel-powered construction equipment, and from fugitive dust emissions from excavation activities and construction equipment. In addition, the concrete batch plant will also be a source of fugitive dust emissions. Fugitive dust generated by construction activities of the rail line and ITP will be minimized as prescribed by Utah Regulation R307-12. A Construction Emissions Control Plan (CECP), will be developed to provide assurance that fugitive dust emissions will be effectively managed and minimized throughout all of the construction phases of the project. This Plan, will also be integrated into the SWPPP, and submitted to UDEQ.

Pollution Prevention and Waste Management

Pollution prevention practices will be encouraged at the ITP. No RCRA wastes will be generated during operations. However, should operational activities result in the generation of minor quantities of hazardous wastes, they will be identified, stored, and disposed of in accordance with CESQG requirements.

9.2.2 Utah State Historic Preservation Office (USHPO)

Construction activities that do not take place on the reservation require compliance with applicable Utah State Historic Preservation Office (USHPO) requirements, as part of the NRC NEPA review.

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DOCUMENT CONTROL

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Appendix A Tab - Proposed Technical Specifications Tab	
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DOCUMENT CONTROL

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TS-34	0
Appendix B Tab - Preliminary Decommissioning Plan Tab	
i	0
ii	0
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<u>Canisters</u>: The spent fuel canisters will be shipped off-site prior to the commencement of facility decommissioning. These activities are considered part of PFSF operations, and the associated costs are therefore not included in the decommissioning cost estimate.

<u>Transfer casks</u>: There will be four transfer casks; two for each vendor design, one of which will be used at the PFSF and the other which will be used at the various reactor sites. The transfer casks will not become activated due to their relatively short duration of exposure to the spent fuel canisters, but they may become contaminated. Using the same assumptions as for the shipping cask, the final decontamination and dismantlement of the transfer casks is estimated to cost $5,000 per cask in labor and material disposal costs, for a total of $20,000.

<u>Canister Transfer Building</u>: For the purpose of preparing a decommissioning cost estimate, the Canister Transfer Building operations area of 46,000 square feet is assumed to require decontamination. The cost of decontamination is estimated to be $5 per square foot for labor, materials and waste disposal. This cost is based on $1/s.f. for general decontamination efforts plus an additional $4/s.f. to perform a more intense cleaning of those areas with potentially higher contamination levels. These areas will require a reduction in cleaning rate per time unit and a corresponding increase in the unit cost. The total estimated cost to decommission the Canister Transfer Building is $230,000.

<u>Storage pads</u>: The concrete storage pads will only be used for sealed storage casks and it is not anticipated that they will become activated or contaminated. The only mechanism which could result in contamination of a storage pad is by having a contaminated canister which was not detected prior to insertion in a storage cask. The possibility of such an occurrence is remote, but is addressed for decommissioning

purposes by assuming up to 10 percent of the storage pad area will require surface decontamination. The maximum number of storage pads is 500, with each having an area of 64 ft by 30 ft, for a total area of 960,000 square feet. Ten percent of this area is 96,000 square feet, which takes no credit for the area protected by the bottom of each storage cask. A storage pad decontamination cost of $1/s.f. is utilized based on actual experience at the La Crosse nuclear power plant undergoing decontamination in 1997, including labor and materials. Therefore decontamination of this area is estimated to cost $96,000. Storage pad waste disposal cost from decontamination efforts is estimated to be $145,000 based on $100/c.f. for packaging, plus $100/c.f. for transportation, plus $300/c.f. for disposal of an assumed 290 c.f. of low level waste. The total estimated cost to decontaminate the storage pads is $241,000.

Final Site Survey: A final site survey will be performed to verify decontamination and decommissioning efforts and the absence of radioactive materials. A final site survey is estimated to cost $260,000 based on essentially re-performing the characterization survey, with an additional $10,000 contingency.

Independent Verification Survey: This survey, to be performed by a contractor selected by the NRC, is a validation of the results of the final site survey. An independent verification survey is estimated to cost $50,000 based on sampling 20% of the areas covered in the final survey.

The total estimated cost of PFSF decommissioning is estimated to be $1,631,000 plus $17,000 per cask for each storage cask actually utilized. It should be noted that this total includes $400,000 and $200,000 for decommissioning of the shipping casks and transfer casks respectively. These higher amounts were incorrectly reported in an earlier version of the Preliminary Decommissioning Plan and were left in the estimate as an overall contingency factor.