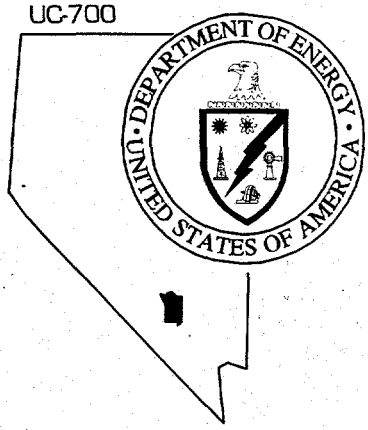
Nevada
Environmental
Restoration
Project

DOE/NV-479-Rev. 1
UC-700



Streamlined Approach for Environmental Restoration Plan for Corrective Action Unit 416, Mud Pit, Project Shoal Area

Controlled Copy No.: ____

Revision No: 1

July 1997

Environmental Restoration
Division

U.S. Department of Energy
Nevada Operations Office

DOE/NV--479-Rev. 1
UC-700

STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION PLAN FOR CORRECTIVE ACTION UNIT 416, MUD PIT, PROJECT SHOAL AREA

DOE Nevada Operations Office
Las Vegas, Nevada

Controlled Copy No.: ____

Revision: 1

July 1997

STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION PLAN FOR CORRECTIVE ACTION UNIT 416, MUD PIT, PROJECT SHOAL AREA

DISCLAIMER

Approved by: Janet Appenzeller-Wing Date: 7/2/97

Janet Appenzeller-Wing, Project Manager
Offsites Subproject

Approved by: Stephen A Mellington Date: 7/2/97

Stephen A. Mellington, Project Manager
Nevada Environmental Restoration Project

Table of Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

AEC	U.S. Atomic Energy Commission
bgs	Below ground surface
CAS	Corrective Action Site(s)
CAU	Corrective Action Unit(s)
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DQO	Data Quality Objective(s)
EPA	U.S. Environmental Protection Agency
FFACO	*Federal Facility Agreement and Consent Order*
ft	Foot (feet)
ft^3	Cubic foot (feet)
km	Kilometer(s)
m	Meter(s)
m^3	Cubic meter(s)
mg/kg	Milligram(s) per kilogram
mg/L	Milligram(s) per liter
mi	Mile(s)
NA	Not analyzed
NAC	*Nevada Administrative Code*
ND	Not detected
NDEP	Nevada Department of Environmental Quality
NTS	Nevada Test Site
pCi/g	PicoCurie(s) per gram
PPE	Personal protective equipment
PSA	Project Shoal Area
SAFER	Streamlined Approach for Environmental Restoration
TCLP	Toxicity Characteristic Leaching Procedure
TPH	Total petroleum hydrocarbon(s)
SBM	U.S. Bureau of Mines
yd^3	Cubic yard(s)

1.0 Introduction

This plan addresses the actions necessary for the restoration and closure of the Project Shoal Area (PSA), Surface Corrective Action Unit (CAU) 416, Mud Pit (Corrective Action Site No. 57-09-01), a pit that was used to store effluent produced during drilling of the Post-Shot Borehole PS-1 in 1963. This plan describes the activities that will occur at the site and the steps that will be taken to gather enough data to obtain a notice of completion from the Nevada Division of Environmental Protection (NDEP). This plan was prepared under the Streamlined Approach for Environmental Restoration (SAFER) concept, and it will be implemented with the *Federal Facility Agreement and Consent Order* (FFACO) (FFACO, 1996) and the *Industrial Sites Quality Assurance Project Plan* (DOE/NV, 1994).

The SAFER process is being employed at this CAU where enough information exists about the nature and extent of contamination to propose an appropriate corrective action without completing a Corrective Action Decision Document and Corrective Action Plan. This process combines elements of the Data Quality Objective (DQO) process and the observational approach to help plan and conduct corrective actions. DQOs are used to identify the problem and define the type and quality of data needed to complete the investigation phase of the process. This has already been completed for the mud pit so it will not be repeated here. The DQOs for the mud pit are presented in the *Corrective Action Investigation Plan for Project Shoal Area, CAU No. 416* (DOE/NV, 1996). This observational approach provides a framework for managing uncertainty and planning decision making.

The SAFER concept recognizes that technical decisions may be made based on incomplete, but sufficient, information and the experience of the decision maker. Any uncertainties are addressed by documented assumptions that are verified by sampling and analysis, data evaluation, on-site observations as planned activities progress, and by contingency plans as necessary. If, at any time during the site closure, new information is developed that changes the conceptual site model defined during the DQO process and indicates that the closure method or underlying assumptions should be revised, the decision maker will redirect the closure activities with the appropriate authorization to more appropriately protect human health and the environment. The NDEP will be notified of the changes and this plan will then be amended.

Following completion of SAFER activities, a closure report will be prepared and submitted to the NDEP.

Adequate process knowledge currently exists to propose mud removal as the corrective action for the mud pit. The process knowledge included the review of historical records and the results of the fall 1996 mud pit characterization activities and was used to determine the constituents of concern and the most appropriate SAFER cleanup approach.

Corrective action at the mud pit will be achieved in three phases. The first phase will be the excavation, hauling, and disposal of the mud in the pit which has total petroleum hydrocarbon (TPH) levels that exceed the state regulatory level. The second phase will be the collection of samples from under the mud pit to confirm that all of the contaminated material has been removed. The third phase will be the recontouring of the drainage in which the mud pit is constructed. A decision diagram for this process is presented in Figure 1-1.

This plan reflects the following assumptions:

- The volume of material to be removed from the mud pit is less than 123 cubic meters (m^3) (162 cubic yards [yd^3]).
- The material will be disposed of at the Nevada Test Site (NTS) Area 6 Hydrocarbon Landfill.
- The material in the old mud pit berm is not contaminated with THP and can be used to recontour the mud pit area.

If, at any time during the closure activities, information is discovered that invalidates any assumption, this plan will be amended, if possible, depending on the nature of the new information, and amendments will be provided to NDEP for approval. No work will be conducted on site from the time the invalidating information is discovered to the time approval of the amended SAFER Plan is received from NDEP.

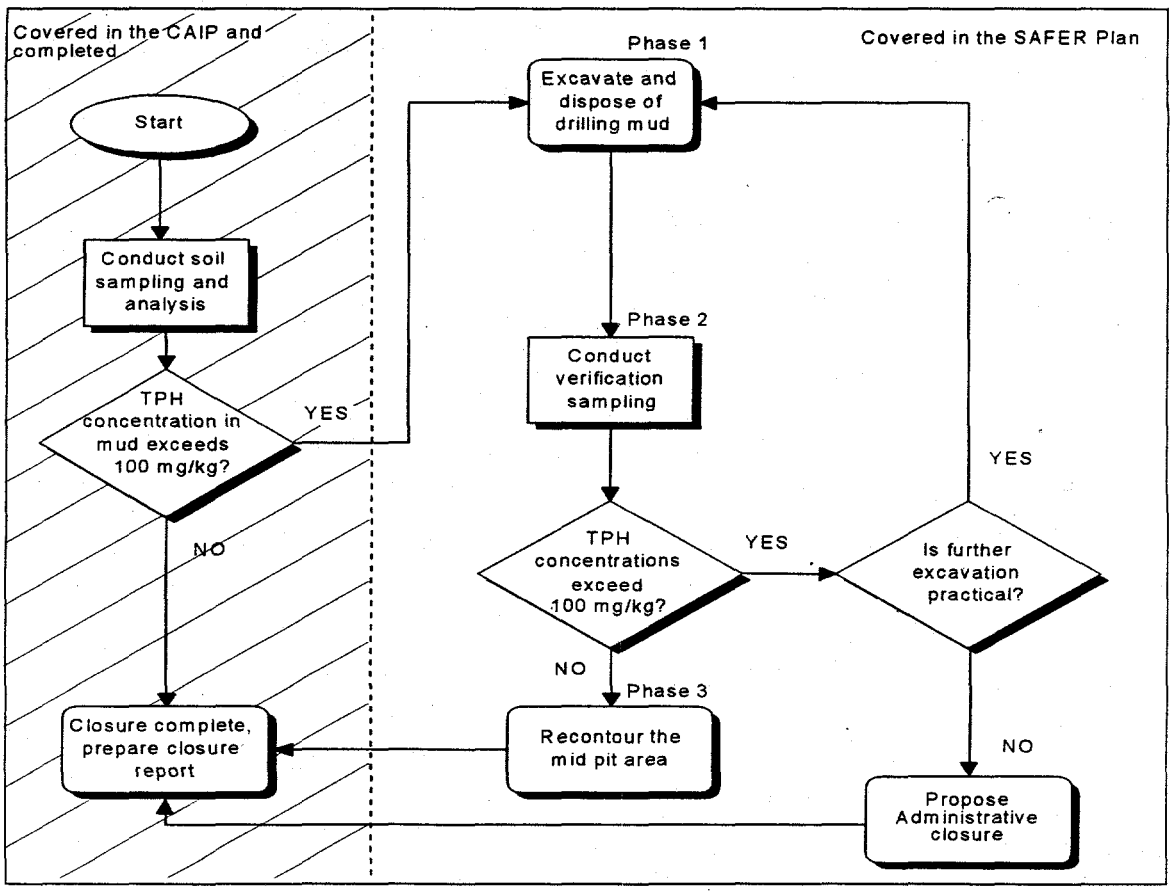


Figure 1-1
SAFER Decision Diagram, Project Shoal Area, Nevada

2.0 Unit Description and Closure Objectives

The mud pit is located on the Project Shoal Area in the northern Sand Springs Mountain Range in Churchill County, Nevada (Figure 2-1).

2.1 Project Shoal Area

Project Shoal, part of the Vela Uniform Program, was a joint effort of the Department of Defense and the Atomic Energy Commission (AEC) to study the effects of different geological media (e.g., granite) on seismic waves produced by underground nuclear explosions and to determine if seismic waves produced from underground nuclear explosions could be differentiated from natural earthquakes (DRI, 1988, Section A.3.4.2). The PSA was selected as the tentative Project Shoal Site in 1961. After a year-long geologic exploration of the area, the PSA was confirmed as the chosen site, and preparations for the test began in late 1962.

The Shoal event consisted of detonating a nuclear device with a 12.5-±0.5 kiloton yield on October 26, 1963 (Gardner and Nork, 1970). The device was placed in granitic rock 369 meters (m) (1,211 feet [ft]) below ground surface (bgs).

Post-shot drillback activities began on October 28, 1963 (AEC, 1970), and consisted of drilling and sampling one post-shot vertical borehole (PS-1) into the event cavity and reopening and sampling the U.S. Bureau of Mines (USBM) No. 1 borehole located approximately 135.5 m (445 ft) from the PS-1 hole. The location of the deep boreholes (PM-1, PM-2, PM-3, PM-8, ECH-A, ECH-D, PS-1, USBM No. 1, and the emplacement shaft and drift) drilled for the event are shown on Figure 2-2 (AEC, 1970).

Records of data collected from the PS-1 and USBM No. 1 borehole explorations indicated that the shot cavity collapsed, producing a rubble-filled chimney 52 m (171 ft) in diameter and 109 m (356 ft) high with an 11-m (36-ft) void at the top (Korver et al., 1964, pp. 4-5). Virtually all of the high-level radiation from Project Shoal is believed to be confined in the insoluble melt rubble mixture at the bottom (lowest 10 m [33 ft]) of the chimney. There was no venting of particulate debris during or after the explosion although some radionuclides, mostly gaseous, may have been injected into fractures as far as 135 m (443 ft) from the shot point. Some short-lived gaseous radionuclides (Iodine ^{131}, Xenon^{133m}, and Xenon^{133}), were brought to the surface

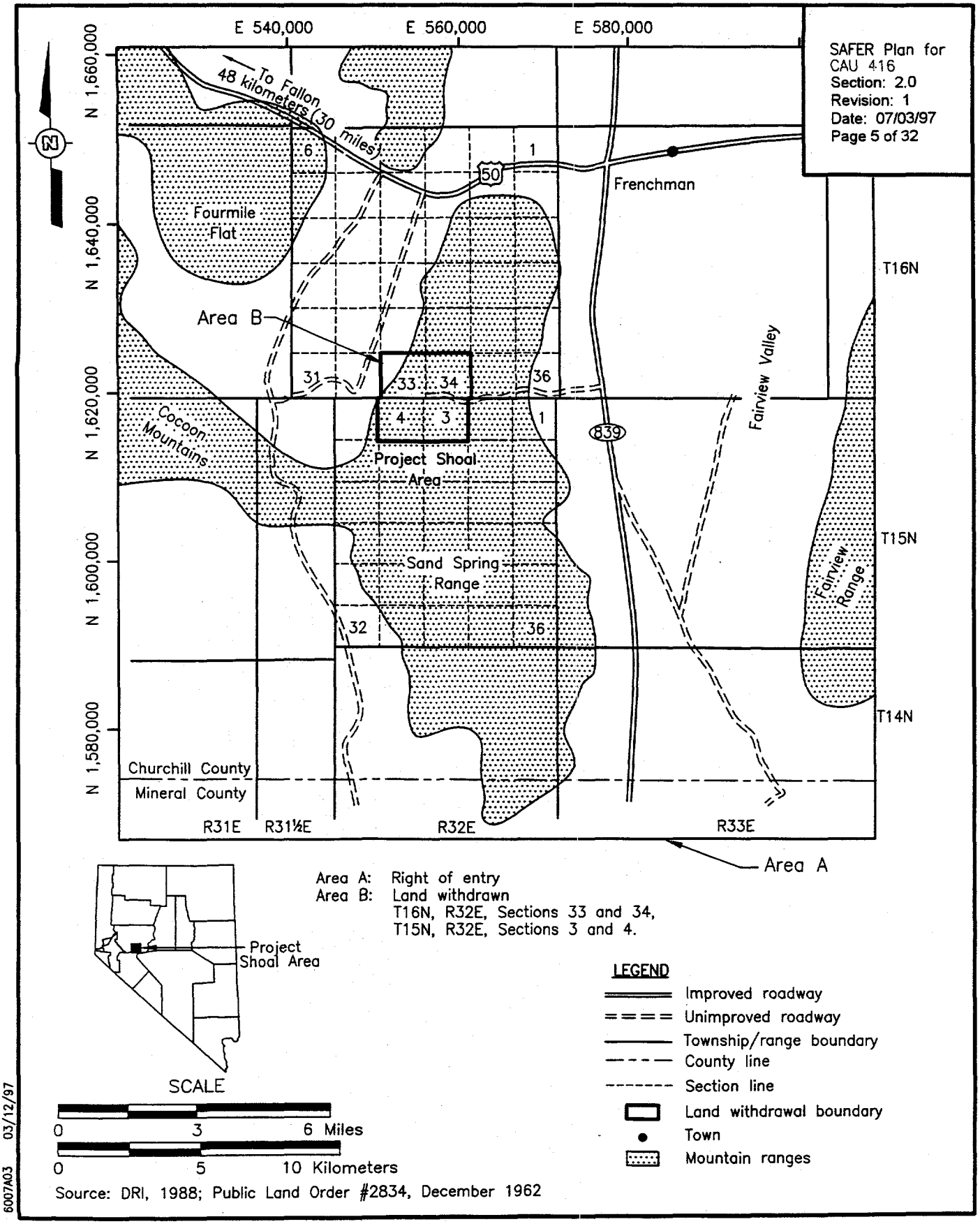
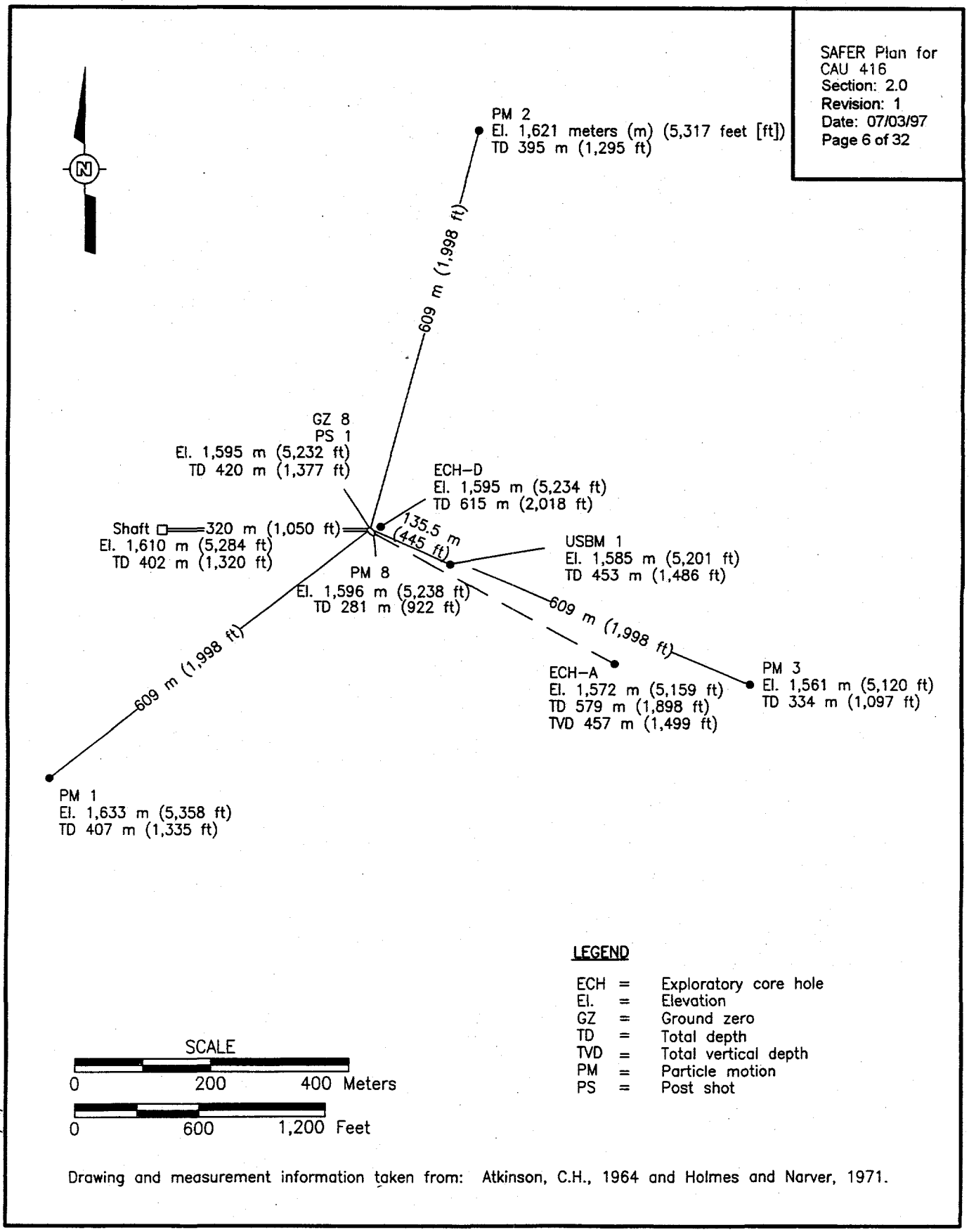


Figure 2-1
Project Shoal Area



Drawing and measurement information taken from: Atkinson, C.H., 1964 and Holmes and Narver, 1971.

6007A05 03/12/97

Figure 2-2
Location of Deep Borings, Project Shoal Area

through the PS-1 drill rig effluent vent-line system during drillback operations (Eubank and Ward, 1964).

These radionuclides were trapped by filters and were subsequently mixed with clean soil and buried in the mud pit area beneath uncontaminated soil (Gardner and Nork, 1970). All equipment was decontaminated and/or removed from the Project Shoal Area.

Deactivation of the site commenced on October 28, 1963. All vehicles, equipment, and surface structures, except for the head frame of the emplacement shaft, were removed by January 31, 1964, and the site was placed on "caretaker standby" status. The shaft was covered with a concrete slab, and all exploratory boreholes leading to the cavity were sealed with grout or sand and abandoned. In July 1964, the site was placed in an "unattended standby" status with no surface structural or radiological safety hazards (Giller, 1970).

2.2 Site Location and Description

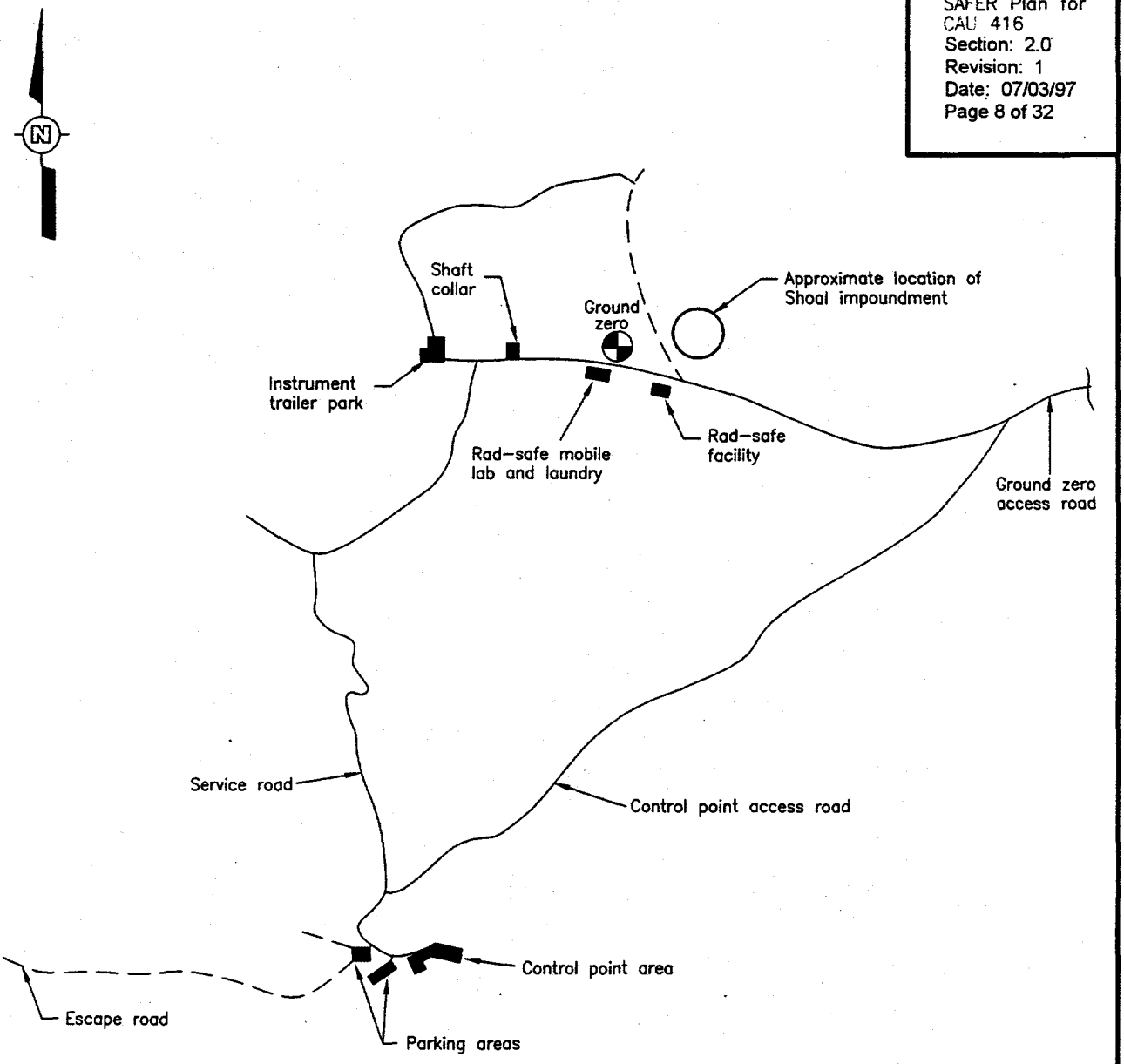
Historical documentation indicates there is one mud pit (CAS 57-09-01) at the Project Shoal Area. One document describes the location as being, "... at the head of the creek at the east edge of the GZ (Ground Zero) pad" (Gardner and Nork, 1970). This location matches the locale of the "post-shot mud pit site" that was sampled in Fauver's 1986, *Hazardous Waste Installation Assessment Report* (Fauver, 1986), which describes the site as being located "north of the Rad-Safe facility" (Figure 2-3).

The estimated volume of material in the mud pit is approximately 123 m^3 (162 yd^3). The volume was estimated by averaging the depth of the mud pit, 0.5 m (1.5 ft) (as encountered in the borings) and multiplying by 246 square meters (2,700 square feet), the estimated surface area of the mud pit.

2.3 Process Knowledge

Process knowledge is based on the review of pre-event site characterizations, operations, closure reports, aerial photos, and the mud pit characterization activities conducted in the fall of 1996.

All process knowledge records are available for review at the IT Corporation offices in Las Vegas. The historical records used to compile process knowledge are listed in Section 7.0, "References," of this plan.



SCHEMATIC
NOT TO SCALE

6007A08 03/12/97

Source: Fauver, 1986

Figure 2-3
Approximate Location of Project Shoal Area Impoundment

The PSA mud pit was used to store drilling effluent that was produced during drilling of the post-shot borehole PS-1. Since the PS-1 borehole was drilled into the event cavity, radiological contaminants produced from the test were the primary concern. A daily log for the post-shot borehole drilling operation is contained in the *Project Manager's Report Project Shoal* (AEC, 1964, Appendix C). The drilling log indicates that the fluids used to drill PS-1 were bentonite drilling mud, air, and air-mist. The daily log does not indicate the use of any diesel or other drilling mud additives except for loss-of-circulation materials. The types of lost circulation materials used were cotton seed husks and cane fibers. Based on the information contained in the daily log, contamination of the drilling mud by TPH or other substances such as barium (from barite) or chromium (from chrome lignosulfonate) was not expected. However, diesel, barite, and chromium lignosulfonate additives have been used in drilling mud at other U.S. Department of Energy (DOE) sites such as the Central Nevada Test Area.

The drilling log indicates that air was used to drill through rock (prior to the circulation loss), from 30.5 to 183 m (100 to 600 ft) bgs, and air-mist (a mixture of air, water, and detergent) was used to drill from 183 m (600 ft) bgs to the bottom of the PS-1 hole at approximately 424 m (1,391 ft) bgs. All contaminated soil and cuttings resulting from the post-shot drilling activities were reportedly combined with clean soil and buried in the mud pit.

In the fall of 1996, the mud pit was characterized. Ten soil borings were completed in the pit; three were completed downgradient from the pit; three were completed upgradient; one was completed east; and one was completed west of the mud pit (Figures 2-4 and 2-5).

One or two soil samples were collected from each soil boring; 16 samples were collected from the mud pit (four of which were waste characterization samples); and nine samples were collected from outside the mud pit. The samples were analyzed for gross alpha, gross beta, total barium, total chromium, tritium, gamma spectroscopy, and TPH except for the waste characterization samples which were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals instead of total barium and total chromium. The results of the mud pit sampling are presented in Table 2-1. Several of the samples from inside the mud pit exceeded the *Nevada Administrative Code* 459 (NAC) Action Level for TPH; however, the results for the gross alpha, gross beta, tritium, and gamma spectroscopy are within expected values for a granitic terrain and the total barium, and total chromium are well below the proposed Subpart S action levels.

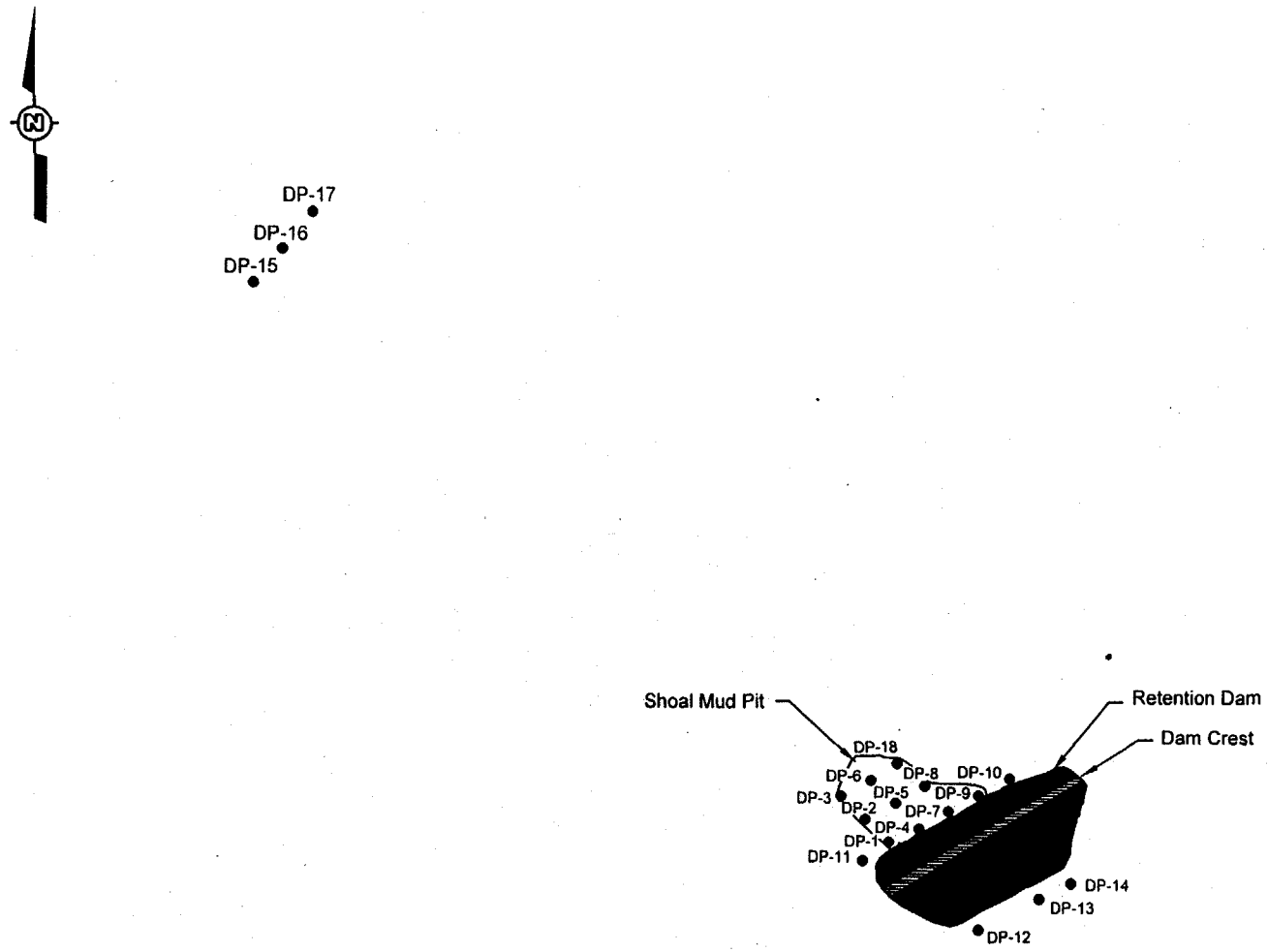


Figure 2-4
Shoal Mud Pit Sample Location Map with Upgradient Locations

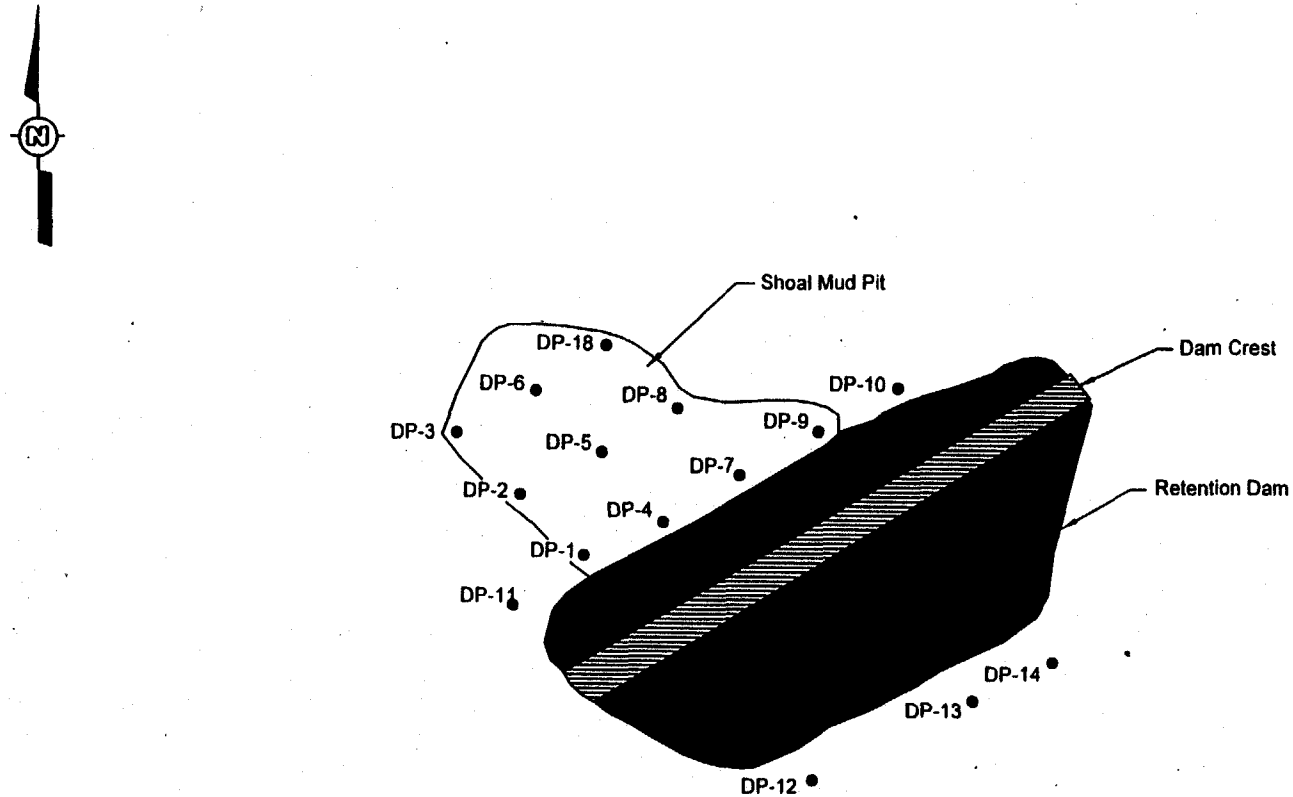


Figure 2-5
Shoal Mud Pit Sample Location Map

During drilling of the monitoring wells, samples of the effluent being discharged in the sumps were sampled and analyzed. No chemical or radiological contaminants were found in any of the samples.

2.4 Waste Inventory

Based on the results of the recent mud pit characterization, the entire 123 m^3 (162 yd^3) of mud in the pit is assumed to be contaminated with TPH. Values for TPH in the pit ranged from non-detect to 900 milligrams per kilogram (mg/kg). The radionuclides reported to have been buried in the pit $Iodine^{131}$, $Xenon^{133m}$, and $Xenon^{133}$ all had half lives of less than 10 days and have decayed to below Minimum Detectable Activity.

2.5 Closure Standards

The site must have soil TPH concentrations below the NDEP Action Level of 100 mg/kg.

Table 2-1
Shoal Mud Pit Analytical Data
(Page 1 of 4)

Sample Location	Sample #	Depth (meters)	Depth (feet)	Sample Date	Matrix	Arsenic mg/L[a]	Barium mg/L	Barium mg/kg[b]	Cadmium mg/L	Chromium mg/L	Chromium mg/kg	Lead mg/L	Mercury mg/L	Selenium mg/L
TCLP Listing (40 CFR 261.24)						**5.0 mg/L**	**100 mg/L**		**1.0 mg/L**	**5.0 mg/L**		**5.0 mg/L**	**0.2 mg/L**	**1.0 mg/L**
DP-1	PSS00001	0-0.61	0-2	9/15/96	Soil	NA[c]	NA	234	NA	NA	7.7 J	NA	NA	NA
DP-1	PSS00002	0.61-1.22	2-4	9/15/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA
DP-2	PSS00005	0-0.31	0-1	9/15/96	Soil	0.02 U	1.2 B	NA	0.005 U	0.042 B	NA	0.025 B	0.0001 U	0.028 U
DP-2	PSS00006	0-0.31	0-1	9/15/96	Soil	0.02 U	1.2 B	NA	0.005 U	0.046 B	NA	0.03 B	0.0001 U	0.028 U
DP-3	PSS00007	0-0.31	0-1	9/15/96	Soil	NA	NA	206	NA	NA	12.6 J	NA	NA	NA
DP-4	PSS00008	0-0.61	0-2	9/15/96	Soil	NA	NA	437	NA	NA	10.9 J	NA	NA	NA
DP-4	PSS00009	0.61-1.22	2-4	9/15/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA
DP-5	PSS00010	0-0.61	0-2	9/15/96	Soil	0.023 B	2.7	NA	0.0078 B	0.092 B	NA	0.014 U	0.0001 U	0.028 U
DP-5	PSS00011	0.61-0.91	2-3	9/15/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA
DP-6	PSS00013	0-0.76	0-2.5	9/15/96	Soil	NA	NA	240	NA	NA	9.7 J	NA	NA	NA
DP-7	PSS00014	0-0.61	0-2	9/15/96	Soil	NA	NA	710	NA	NA	10.7 J	NA	NA	NA
DP-7	PSS00024	0.61-0.91	2-3	9/15/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA
DP-8	PSS00015	0-0.61	0-2	9/6/96	Soil	0.26 U	0.95	NA	0.013 U	0.11	NA	0.17U	0.0001 U	0.21 U
DP-9	PSS00016	0-0.91	0-3	9/15/96	Soil	NA	NA	235	NA	NA	7.9 J	NA	NA	NA
DP-10	PSS00017	0-0.91	0-3	9/6/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA
DP-11	PSS00018	0-0.91	0-3	9/6/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA
DP-12	PSS00019	0-0.91	0-3	9/16/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA
DP-13	PSS00020	0-0.91	0.3	9/16/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA
DP-14	PSS00021	0-0.31	0-1	9/16/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA
DP-15	PSS00022	0-0.61	0-2	9/16/96	Soil	NA	NA	104	NA	NA	7.4 J	NA	NA	NA
DP-15	PSS00023	0-0.61	0-2	9/16/96	Soil	NA	NA	84.2	NA	NA	6.4 J	NA	NA	NA
DP-16	PSS00026	0-0.91	0-3	9/16/96	Soil	NA	NA	141	NA	NA	10.2 J	NA	NA	NA
DP-17	PSS00027	0-0.91	0-3	9/16/96	Soil	NA	NA	103	NA	NA	10.2 J	NA	NA	NA
DP-18	PSS00028	0-0.61	0-2	9/15/96	Soil	NA	NA	292	NA	NA	18.5 J	NA	NA	NA
DP-18	PSS00029	0.61-0.70	2-2.3	9/15/96	Soil	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 2-1
Shoal Mud Pit Analytical Data
(Page 2 of 4)

Sample Location	Sample #	Depth (meters)	Depth (feet)	Sample Date	Matrix	Silver mg/L	Gross Alpha pCi/g[d]	Gross Beta pCi/g	Bismuth-214 pCi/g	Cesium-137 pCi/g	Lead-212 pCi/g	Lead-214 pCi/g	Potassium-40 pCi/g
TCLP Listing (40 CFR 261.24)						**5.0 mg/L**							
Background Radiological Concentrations[e]							**12 - 45**	**7 - 56**	**0.41 - 3.47**	**0.17 - 3.08**	**0.86 - 2.9**	**0.30 - 1.37**	**10.5 - 30.7**
DP-1	PSS00001	0-0.61	0-2	9/15/96	Soil	NA	20.1	18.9	ND[f]	0.21 U	0.88	1.00	25.3
DP-1	PSS00002	0.61-1.22	2-4	9/15/96	Soil	NA	32.3	23.2	ND	0.19 U	1.2	0.68	24.5
DP-2	PSS00005	0-0.31	0-1	9/15/96	Soil	0.01 U	10.6	22.3	ND	0.27 U	0.96	1.22	18.5
DP-2	PSS00006	0-0.31	0-1	9/15/96	Soil	0.01 U	21.0	20.8	ND	0.23 U	0.78	0.92	23.2
DP-3	PSS00007	0-0.31	0-1	9/15/96	Soil	NA	10.2	20.5	ND	0.25 U	1.23	0.8	26.8
DP-4	PSS00008	0-0.61	0-2	9/15/96	Soil	NA	23.8	20.7	ND	0.35 U	1.23	0.99	16.4
DP-4	PSS00009	0.61-1.22	2-4	9/15/96	Soil	NA	27.4	27.3	ND	0.22 U	1.48	1.21	25.1
DP-5	PSS00010	0-0.61	0-2	9/15/96	Soil	0.01 U	27.7	18.5	ND	0.22 U	1.01	1.31	15.5
DP-5	PSS00011	0.61-0.91	2-3	9/15/96	Soil	NA	46.4	40.1	1.14	0.39 U	1.86	1.06	16.9
DP-6	PSS00013	0-0.76	0-2.5	9/15/96	Soil	NA	17.0	21.0	ND	0.25 U	1.11	0.83	23.8
DP-7	PSS00014	0-0.61	0-2	9/15/96	Soil	NA	30.7	24.0	0.67	0.24 U	0.94	0.85	24.7
DP-7	PSS00024	0.61-0.91	2-3	9/15/96	Soil	NA	35.0	25.3	0.99	0.21 U	1.43	0.99	23.7
DP-8	PSS00015	0-0.61	0-2	9/6/96	Soil	0.016 U	33.7	20.7	ND	0.24 U	0.98	ND	21.8
DP-9	PSS00016	0-0.91	0-3	9/15/96	Soil	NA	28.1	25.1	ND	0.18 U	1.41	1.09	24.8
DP-10	PSS00017	0-0.91	0-3	9/6/96	Soil	NA	66.0	24.6	0.68	0.25 U	0.5	0.87	27.2
DP-11	PSS00018	0-0.91	0-3	9/6/96	Soil	NA	37.7	27.4	ND	0.38 U	2.2	ND	22.1
DP-12	PSS00019	0-0.91	0-3	9/16/96	Soil	NA	19.6	24.2	ND	0.25 U	1.12	1.03	24.8
DP-13	PSS00020	0-0.91	0.3	9/16/96	Soil	NA	40.6	57.9	1.26	0.20 U	1.34	1.12	27.7
DP-14	PSS00021	0-0.31	0-1	9/16/96	Soil	NA	53.9	37.7	1.33	0.24 U	2.04	1.11	20.7
DP-15	PSS00022	0-0.61	0-2	9/16/96	Soil	NA	23.9	27.1	1.03	0.24 U	1.01	0.95	23.2
DP-15	PSS00023	0-0.61	0-2	9/16/96	Soil	NA	25.4	27.3	1.36	0.23 U	0.85	0.93	25.4
DP-16	PSS00026	0-0.91	0-3	9/16/96	Soil	NA	35.9	30.0	0.82	0.23 U	1.04	0.83	21.2
DP-17	PSS00027	0-0.91	0-3	9/16/96	Soil	NA	27.3	25.8	ND	0.39 U	ND	ND	17
DP-18	PSS00028	0-0.61	0-2	9/15/96	Soil	NA	15.3	18.5	ND	0.46 U	ND	1.75	17.1
DP-18	PSS00029	0.61-0.70	2-2.3	9/15/96	Soil	NA	56.9	47.1	ND	0.24 U	1.17	0.91	18.7

Table 2-1
Shoal Mud Pit Analytical Data
(Page 3 of 4)

Sample Location	Sample #	Depth (meters)	Depth (feet)	Sample Date	Matrix	Radium-226 pCi/g	Radium-228 pCi/g	Thallium-208 pCi/g	Thorium-234 pCi/g	Tritium pCi/g	Diesel mg/kg	Waste Oil mg/kg
NAC 459.9973											100 ppm	100 ppm
Background Radiological Concentrations						0.89 - 2.0	0.67 - 2.4	0.94 - 3.38	0.5 - 3.5			
DP-1	PSS00001	0-0.61	0-2	9/15/96	Soil	ND	ND	ND	ND	0.005	25 U	180
DP-1	PSS00002	0.61-1.22	2-4	9/15/96	Soil	3.11	ND	0.48	ND	0.0008	NA	NA
DP-2	PSS00005	0-0.31	0-1	9/15/96	Soil	ND	ND	0.31	ND	0.006	25 U	130
DP-2	PSS00006	0-0.31	0-1	9/15/96	Soil	ND	1.03	0.3	ND	0.005	25 U	140
DP-3	PSS00007	0-0.31	0-1	9/15/96	Soil	ND	ND	0.72	ND	-0.006	25 U	50
DP-4	PSS00008	0-0.61	0-2	9/15/96	Soil	ND	ND	0.34	ND	-0.002	25 U	300
DP-4	PSS00009	0.61-1.22	2-4	9/15/96	Soil	ND	ND	0.48	ND	0.005	NA	NA
DP-5	PSS00010	0-0.61	0-2	9/15/96	Soil	5.23	1.41	0.35	ND	0.076	180	900
DP-5	PSS00011	0.61-0.91	2-3	9/15/96	Soil	ND	ND	ND	ND	0.01	NA	NA
DP-6	PSS00013	0-0.76	0-2.5	9/15/96	Soil	3.75	1.53	0.44	ND	0.003	40	93
DP-7	PSS00014	0-0.61	0-2	9/15/96	Soil	ND	ND	0.32	1.94	0.003	25 U	190
DP-7	PSS00024	0.61-0.91	2-3	9/15/96	Soil	ND	ND	0.48	ND	0.002	NA	NA
DP-8	PSS00015	0-0.61	0-2	9/6/96	Soil	ND	ND	0.37	ND	0.011	300 U	300 U
DP-9	PSS00016	0-0.91	0-3	9/15/96	Soil	ND	1.59	0.72	ND	-0.002	25 U	25 U
DP-10	PSS00017	0-0.91	0-3	9/6/96	Soil	ND	ND	0.34	ND	-0.004	NA	NA
DP-11	PSS00018	0-0.91	0-3	9/6/96	Soil	ND	ND	ND	ND	0.013	NA	NA
DP-12	PSS00019	0-0.91	0-3	9/16/96	Soil	5.78	ND	0.36	ND	-0.003	NA	NA
DP-13	PSS00020	0-0.91	0.3	9/16/96	Soil	ND	1.76	0.57	ND	-0.009	NA	NA
DP-14	PSS00021	0-0.31	0-1	9/16/96	Soil	ND	ND	0.39	ND	-0.005	NA	NA
DP-15	PSS00022	0-0.61	0-2	9/16/96	Soil	2.84	1.23	0.36	ND	ND	NA	NA

Table 2-1
Shoal Mud Pit Analytical Data
(Page 4 of 4)

Sample Location	Sample #	Depth (meters)	Depth (feet)	Sample Date	Matrix	Radium-226 pCi/g	Radium-228 pCi/g	Thallium-208 pCi/g	Thorium-234 pCi/g	Tritium pCi/g	Diesel mg/kg	Waste Oil mg/kg
NAC 459.9973											**100 ppm**	**100 ppm**
Background Radiological Concentrations						**0.89 - 2.0**	**0.67 - 2.4**	**0.94 - 3.38**	**0.5 - 3.5**			
DP-15	PSS00023	0-0.61	0-2	9/16/96	Soil	ND	ND	0.42	ND	ND	NA	NA
DP-16	PSS00026	0-0.91	0-3	9/16/96	Soil	3.43	ND	0.31	1.87	ND	NA	NA
DP-17	PSS00027	0-0.91	0-3	9/16/96	Soil	ND	ND	0.74	ND	ND	NA	NA
DP-18	PSS00028	0-0.61	0-2	9/15/96	Soil	ND	ND	1.06	ND	-0.003	110	890
DP-18	PSS00029	0.61-0.70	2-2.3	9/15/96	Soil	ND	ND	0.37	ND	0.005	NA	NA

[a] Milligrams per liter

[b] Milligrams per kilogram

[c] Not analyzed

[d] PicoCuries per gram

[e] This is background for soil; radioactivity in igneous rocks is generally higher than in sedimentary rocks; igneous rocks with higher silica content (i.e., granite) have higher radioactivity levels than those with a lower silica content.

[f] Not detected; no minimum detectable activity given.

J = Reported result is quantitatively estimated.

U = Compound/element was analyzed for but not detected.

B = The reported value is below the Contract-Required Detection Limit, but above the Instrument Detection Limit.

3.0 Field Activities

The approach for the remedial action to be conducted under this SAFER Plan is to excavate the mud pit material, load it into trucks, transport it to a permitted disposal facility for disposal, conduct post-excavation sampling and analysis to verify that all contamination has been removed, re-grade and restore the pit location, and prepare a Closure Report.

3.1 Constituents of Concern

Based on process knowledge, the only Constituent of Concern is total petroleum hydrocarbon. No other Constituents of Concern were identified in the historical data or during the mud pit characterization process.

3.2 Remediation

Total Petroleum Hydrocarbon results for Sample Points DP-1, DP-2, DP-4, DP-5, DP-7, DP-8, and DP-18 ranged from 110 to 300 mg/kg as diesel and 130 to 900 mg/kg as waste oil. All other sample points were below the 100-mg/kg TPH Action Level for cleanup listed in the *Nevada Administrative Code* 459 (NAC, 1995). Impacted soils exceeding the 100-mg/kg TPH Action Level in the mud pit will be excavated using a front end-loader and/or backhoe. The approximate area as shown in Figure 3-1 will be excavated to an approximate depth of 0.6 m (2 ft). The 0.6-m (2-ft) initial excavation depth was selected based on the results from the sample points that exceeded the 100-mg/kg TPH Action Level. Requirements for the samples are listed on Table 3-1.

Confirmational soil samples will be collected at the bottom of the excavation (as described in Section 3.3). The soil samples will be submitted for TPH as diesel and waste oil analysis (U.S. Environmental Protection Agency Method 8015, Modified) (EPA, 1996) to determine if the soils exceeding the Action Level were removed. If sample results indicate soils are still present that exceed the Action Level, an additional 15 centimeters (6 inches) of soil will be excavated followed by additional confirmation sampling and analysis of the soil. This activity will be repeated until TPH analytical results in the confirmation samples are evaluated to be below the 100 mg/kg Action Level or until the excavation encounters bedrock. If the TPH concentration in the bedrock still exceeds the 100 mg/kg Action Level, an administrative closure will be requested from the state.

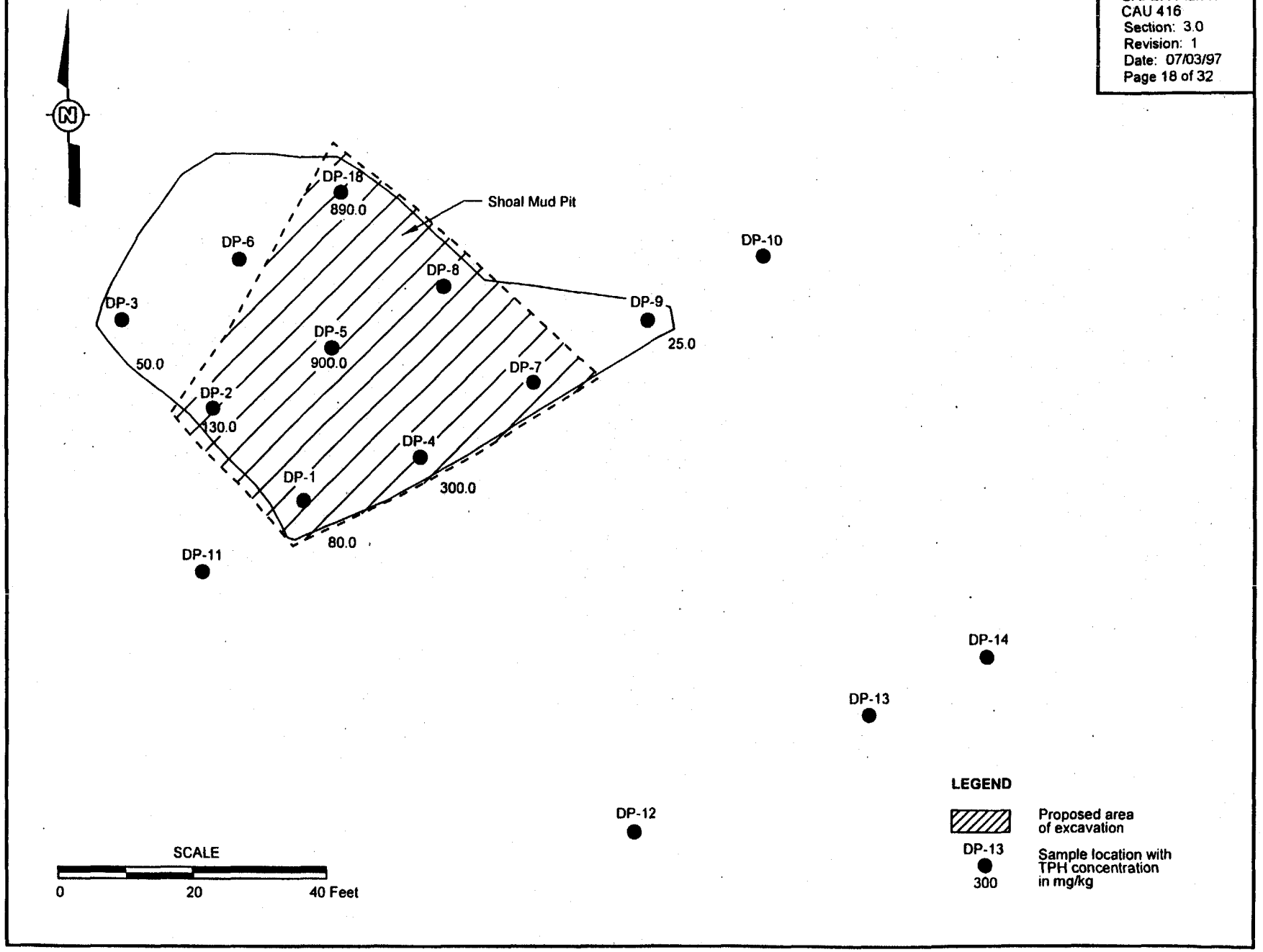


Figure 3-1
Shoal Mud Pit Area to be Excavated

Table 3-1
Project Shoal Area Mud Pit Confirmation Sampling Requirements

Sample Location	Number of Samples	Sample Type	Constituent of Concern	Analytical Method	Container Type and Volume Required	Preservative
Mud Pit	8	Soil	TPH	8015 Waste Oil[a]	8-ounce glass with poly lined cap	Cool 4°C
Mud Pit	8	Soil	TPH	8015 Waste Oil[a]	8-ounce glass with poly lined cap	Cool 4°C

[a]EPA SW-846, Test Method for Evaluating Solid Waste, 3rd Edition (EPA, 1996)

Excavated materials will be temporarily stockpiled on 20-mil plastic (or equivalent) near the excavation area. At the end of each work day, the excavated soil will be covered with plastic weighted on the edges to prevent precipitation and/or aerial spread. An alternative to soil stockpiling that may be used at the site is containerization of the excavated soil in flexible bulk containers. Flexible bulk containers ("super sacks") are constructed of woven polyester and/or polypropylene. The super sacks proposed for use at the site will have an approximate capacity of 1.1 m^3 (40 cubic feet [ft^3]) and will be able to be tied shut to eliminate the need to place a tarp on the load during transport. The super sacks will be stockpiled on a 20-mil plastic liner (or equivalent) until loaded and secured on an end-dump or flatbed trailer.

Even though field screening of the mud pit surface and analytical results for the samples collected and analyzed in 1996 indicated no elevated levels of radionuclides, the excavated materials will be transported to the NTS for disposal in the Area 6 Hydrocarbon Landfill, located approximately 480 kilometers (km) (300 miles [mi]) from the site. The decision to dispose of the TPH-impacted soil at the NTS is predominantly based on a combined disposal and transportation cost savings of 26 to 50 percent in comparison to a private facility located approximately 176 km (110 mi) from the site.

3.3 Verification

Excavation activities will be stopped when all of the mud pit material has been removed down to native soil or bedrock over the entire area of the pond. To verify that the excavation has been sufficient, the native material will be sampled and analyzed. If the analytical results meet the

closure standards and no other constituents of concern are found, and if concurrence is obtained from NDEP, the site will be recontoured; no further action will be required; and the site will be considered restored and closed. If the analytical results do not meet the closure standards, additional material will be removed and confirmation sampling will be conducted again.

To verify that all of the contaminated material has been removed, seven verification samples will be collected. The samples will be collected from selected locations within the mud pit impoundment. The samples will be collected from the underlying native material at the locations indicated on Figure 3-2 and analyzed for TPH waste oil and TPH diesel only.

3.4 Clean Closure

The objective of the SAFER activities at the Project Shoal mud pit is to remove material with TPH concentrations above the closure standard and to gather adequate data to confirm the decision for clean closure. The nature and extent of contamination in the mud pit were defined in the fall of 1996. The cleanup will be conducted in three phases. The first phase will include the excavation, shipping, and disposal of the contaminated drilling mud. The second phase will involve confirmation sampling and analysis to verify the adequacy of the remedial action. The third phase will be the recontouring of the drainage where the mud pit is located.

Verification samples for the mud pit will be collected and analyzed to determine if additional soil needs to be excavated and disposed of. If each sample meets the closure standard set in Section 2.5, "Closure Standards," the site may be restored and clean-closed. If the verification samples indicate that constituents of concern are present in the soil above the closure standard presented in Section 2.5, additional excavation and disposal will take place as described in Section 3.2. Additional verification samples will be collected and analyzed; this sequence may be repeated as necessary until all areas are demonstrated to meet the closure standard presented in Section 2.5. All samples will be collected and managed in accordance with U.S. Environmental Protection Agency (EPA) quality control protocols as reflected in the *Resource Conservation and Recovery Act* (RCRA) *Industrial Sites Quality Assurance Project Plan* (DOE/NV, 1994).

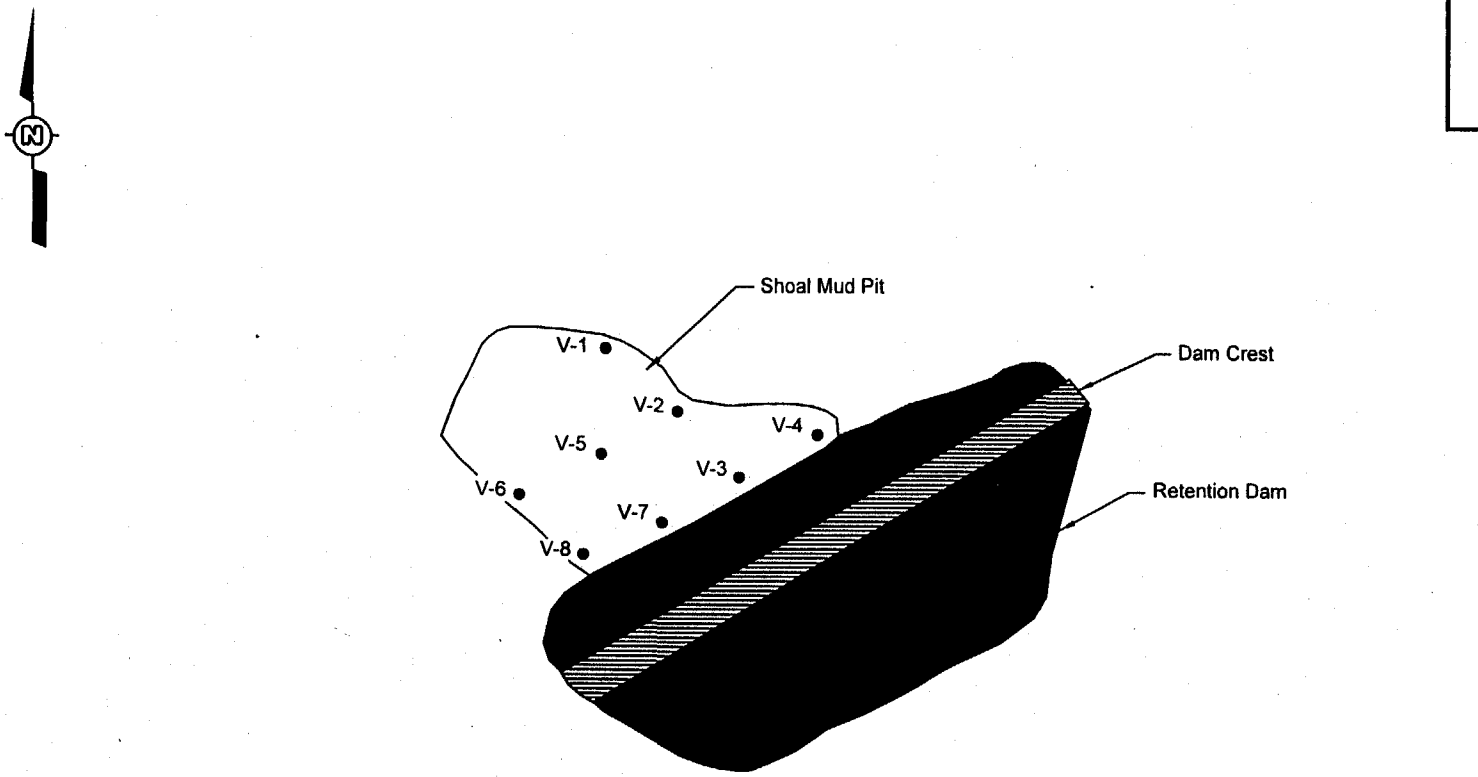


Figure 3-2
Shoal Mud Pit Verification Sample Location Map

The laboratory will provide Contract Laboratory Procedure-type data packages with the analyses, and ten percent of the verification samples collected will be validated (a minimum of one sample per analysis) by third-party data validators.

3.5 Site Restoration

The mud pit will require minimal site restoration activities. After excavation and removal of the soils exceeding the 100-mg/kg TPH Action Level and confirmation sampling activities, regrading of the mud pit area will be done to reestablish the approximate original topography. Since the mud pit was constructed in a drainage area, only minimal work will be done on the northern area of the mud pit; however, the southern area of the mud pit and the area south of the berm will be regraded. This will be accomplished by using the existing soil berm on the southern end of the mud pit as fill for the excavated mud pit area as well as areas south of the berm. No revegetation is planned for the area.

3.6 Schedule

After approval of the SAFER Plan, it will take approximately three weeks to complete preparations and mobilize to the site. Removal of the mud pit material will take approximately two days.

Verification sampling will take approximately one day. The samples will be submitted with a requested 24-hour turnaround on the results so that it should not take more than three days from the beginning of verification sampling to receipt of the analytical results.

Once the results of the verification samples have proven that the excavation has gone far enough, the area will be recontoured using the material in the mud pit berm. This will take approximately one day.

4.0 Reports

Reports during field activities and after completion of the SAFER process will be provided to NDEP by U.S. Department of Energy, Nevada Operations Office (DOE/NV).

Daily reports of field activities will be faxed to NDEP while field activities are ongoing. In addition, DOE/NV will verbally inform NDEP as soon as is practical of any substantial changes in scope or schedule. If it is determined that this plan requires significant amendments, NDEP will be notified as soon as practical; this plan will be amended; and NDEP's concurrence of the modified plan will be solicited.

If clean closure is achieved within six months of receipt of validated laboratory results from final field activities, DOE/NV will provide a written closure report to NDEP documenting that closure was completed in accordance with this plan and will include all analytical results to verify that clean closure did occur. Chemical laboratory analytical results, in addition to waste characterization and disposition information, will be included in the closure report. The report will describe the SAFER Plan activities for each unit and request a notice of completion from NDEP.

5.0 Waste Management

The proposed site activities will generate the following wastes:

- TPH-impacted soil
- Equipment decontamination rinsate
- Disposable sampling equipment (e.g., plastic, paper, aluminum foil, and sample containers)
- Personal protective equipment (PPE)

Prior to and during excavation, radiological screening of the soil will be conducted to satisfy radiological "green tag" requirements for disposal of soil in the Area 6 Hydrocarbon Landfill. TPH-impacted soil will be temporarily stockpiled on 20-mil plastic (or equivalent) near the excavation area. At the end of each workday, the excavated soil will be covered with plastic weighted on the edges to prevent precipitation and/or aerial spread. Flexible bulk containers ("super sacks") constructed of woven polyester and/or polypropylene may be used at the site instead of stockpiling. The flexible bulk containers, if used, have an approximate capacity of 1.1 m^3 (40 ft^3) and will be able to be tied shut to eliminate the need to tarp the load during transport. The super sacks will be stockpiled on a 20-mil plastic liner (or equivalent) until loaded and secured on an end dump or flatbed trailer. The excavated, TPH-impacted soils will be transported to the NTS for disposal at the Area 6 Hydrocarbon Landfill (located approximately 480 km [300 mi] from the site).

Decontamination rinsate will be generated from cleaning of the excavation equipment. The excavation equipment will be cleaned using scrub brushes and hand-operated sprayers to minimize the quantity of rinsate generated. The buckets of the equipment will be cleaned using a mixture containing Alconox and tap water followed by a tap water rinse. The rinsate will be captured by a plastic liner below the equipment and solidified using the excavated TPH-impacted soil. The solidified rinsate will be transported with the TPH-impacted soil to the NTS for disposal in the Area 6 Hydrocarbon Landfill.

Disposable sampling equipment and PPE will be contained in either 208-liter (55-gallon) drums or flexible bulk containers. The sampling equipment and PPE will be transported to the NTS and disposed of in an NTS sanitary landfill.

All loads of waste transported from the site will be covered with the exception of materials that have been contained in flexible bulk containers or equivalent.

6.0 Site-Specific Health and Safety Plan

The health and safety protocols for the field activities related to the implementation of this SAFER Plan will be delineated in a Site-Specific Health and Safety Plan (SSHASP). This SSHASP, controlled separately from this SAFER Plan, is not included as part of this plan, but will be available upon request prior to the start of field activities. The SSHASP sets forth the specific requirements and procedures that will be followed while performing operations under this SAFER Plan. The SSHASP includes the following information:

- Engineering and administrative protective measures
- Monitoring for site-specific chemical and radiological contaminants
- Personal protective equipment and its use
- Site control
- Emergency communications
- Emergency reporting protocol
- Decontamination
- Site characterization
- Training

All field activities will be performed in accordance with the applicable SSHASP, and all field personnel involved in these activities will be familiar with requirements of the SSHASP. All visitors to the work sites will be required to abide by these procedures.

The objective of the SSHASP is the protection of workers during SAFER Plan activities. This will be accomplished through compliance with DOE Orders, Occupational Safety and Health Administration Regulations, and the DOE/NV *NV/YMP Radiological Control Manual* (REECo, 1994), as well as the SSHASPs. Many of the operations conducted under the DOE/NV ERP are regulated under the DOE Orders and Title 29 of the *Code of Federal Regulations*.

Due to unique logistics, hazards, and site conditions, individual groups of sites and/or tasks require the production of a SSHASP. It is considered a living document, and as new information becomes available, changes will be made as appropriate, with concurrence and approval of the Subproject Manager.

7.0 References

AEC, see U.S. Atomic Energy Commission.

Desert Research Institute. 1988. *CERCLA Preliminary Assessment of DOE's Nevada Operations Office Nuclear Weapons Testing Areas.* Las Vegas, NV.

DOE, see U.S. Department of Energy.

DRI, see Desert Research Institute.

Eubank, B.F. and A.W. Ward. 1964. *On-site Health and Safety Report*, VUF-1012. Prepared for AEC/NVO. Mercury, NV: Reynolds Electrical & Engineering Co., Inc.

Fauver, D.N. 1986. *Hazardous Waste Installation Assessment Report.* Las Vegas, NV: Reynolds Electrical & Engineering Co., Inc.

Federal Facility Agreement and Consent Order of 1996, Appendix VI. Agreed to by the Nevada Division of Environmental Protection, the U.S. Department of Energy, and the U.S. Department of Defense. Las Vegas, NV.

Gardner, M.C. and W.E. Nork. 1970. *Evaluation of the Project Shoal Site, Fallon, Nevada, for Disposition, Including Identification of Restrictions, Part I,* NVO-1229-105. Report prepared for AEC/NVO. Las Vegas, NV.

Giller, E.B., Major General, USAF, Assistant General Manager for Military Applications. U.S. Atomic Energy Commission. 1970. Letter to R.E. Miller, 31 August. Washington, DC.

Gretsky, P. IT Corporation. 1996. Letter to Bob Bangerter, DOE/NV, about radionuclide levels in groundwater monitoring well pads, 4 December.

Korver, J.A., C.R. Boardman, and D.E. Rawson. 1964. *The Shoal Postshot Environment,* SDK 65-5. Lawrence Radiation Laboratory.

Nevada Administrative Code. 1995. NAC 459, "Control of Hazardous Materials."

REECo, see Reynolds Electrical and Engineering, Inc.

Reynolds Electrical and Engineering, Inc. 1994. *NV/YMP Radiological Control Manual,* DOE/NV 10630-59. Las Vegas, NV.

U.S. Atomic Energy Commission, Nevada Operations Office. 1964. Project Managers Report, Project Shoal, NVO-11. Las Vegas, NV.

U.S. Atomic Energy Commission, Nevada Operations Office. 1970. *Site Disposal Report, Fallon Nuclear Test Site (Shoal), Churchill County, Nevada,* NVO-73. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1994. *Resource Conservation and Recovery Act Industrial Sites Quality Assurance Project Plan, Nevada Test Site, Nevada.* Prepared by IT Corporation for DOE/NV. Las Vegas, NV.

U.S. Department of Energy, Nevada Operations Office. 1996. *Corrective Action Investigation Plan for Project Shoal Area, CAU No. 416.* Prepared by IT Corporation for DOE/NV. Las Vegas, NV.

U.S. Environmental Protection Agency. 1996. *Test Methods for Evaluation, Solid Waste, Physical Chemical Methods,* SW 846, Third Edition. Washington, DC.

Appendix A

Response to NDEP Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

1. Document Title/Number Draft SAFER Plan for Project Shoal, Mud Pit
2. Document Date April 1997
3. Revision Number REV. 0
4. Originator/Organization IT Corporation
5. Responsible DOE/NV ERP Project Mgr. Janet Appenzeller-Wing
6. Date Comments Due
7. Review Criteria
8. Reviewer/Organization/Phone No. Karen Beckley, NDEP
9. Reviewer's Signature

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
Page 4 of 31		"If at any time during the closure activities, information is developed that invalidates any assumption, this plan will be amended, and amendments will be provided to NDEP for approval." If information is "discovered" (as apposed to developed), a determination needs to be made if the Plan can be amended depending on the type of problem that is encountered. The Plan must also clearly state that activities will stop and not proceed without NDEP approval.	The text was changed to read "...information is **discovered** that invalidates..." and the following was added at the end of the paragraph. "No work will be conducted on site from the time the invalidating information is discovered to the time approval of the amended SAFER Plan is received from NDEP."	
Page 18 of 31		"...are evaluated to be below the 100 mg/kg Action Level or until the excavation encounters bedrock." DOE needs to discuss what activities will occur if action levels above 100 mg/kg in bedrock is encountered.	Added at the end of the paragraph: "If the TPH concentration in the bedrock exceeds the 100 mg/kg Action Level, an administrative closure will be requested from the state."	

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

Document Title/Number Draft SAFER Plan for Project Shoal, Mud Pit Revision Number 0

Reviewer/Organization Karen Beckley, NDEP

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
Page 21 of 31		"Since the material in the sumps has been determined to be non-hazardous, confirmation sampling will not be conducted in those areas." NDEP has not received and concurred with the analytical results of the sampling of the sumps. The drilling effluent sumps cannot be removed prior to NDEP review and concurrence of the sampling results.	The analytical results from the samples collected from the sumps by IT in October and December 1996 and the samples collected from the sumps by DRI in March 1997 are attached. Nothing will be done with the effluent in the sumps until approval is received from NDEP.	
Page 25 of 31		"...NDEP has approved the discharge of the liquid from the sumps to the ground surface..." In a telephone conversation with B. Bangerter on November 25, 1996, and a letter to DOE from NDEP on March 4, 1997, NDEP stated concern that DOE had not sent any results of well water sampling to include the fluid pumped into the sumps. This issue must be resolved PRIOR to any activity being conducted with the fluid contained in the sumps.	The analytical results from the samples collected from the sumps by IT in October and December 1996 and the samples collected from the sumps by DRI in March 1997 are attached. Nothing will be done with the effluent in the sumps until approval is received from NDEP.	

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET

Document Title/Number Draft SAFER Plan for Project Shoal, Mud Pit Revision Number 0

Reviewer/Organization Karen Beckley, NDEP

10. Comment Number/ Location	11. Type[a]	12. Comment	13. Comment Response	14. Accept
General		NDEP will not approve the SAFER Plan for Mud Pit (CAS 57-09-01) with the incorporation of the closure of the effluent sumps. The effluent sumps will be utilized during well development activities. These sumps are part of the subsurface CAU and governed by the Fluid Management Plan. Additionally, the issues identified in the June 9, 1997 letter from NDEP to DOE that relate to the ROC associated with these sumps, must be addressed in documents related to CAU 447.	All references to the effluent sumps were removed from the document.	
Page 3 of 35		The decision diagram states "Amend SAFER Plan to incorporate the new information. Resume field activities under revised plan." Field activities should not be conducted unless DOE has concurrence from NDEP for the revised plan. This verbiage is stated in the text of the document, however, the diagram does not convey the same message.	The diagram was changed to indicate that if the bed rock was contaminated above the 100 mg/kg action level, and additional excavation was not feasible, an administrative closure would be requested.	
Page 35 of 35		Table A-1 is incomplete and needs to be revised if the information is pertinent to the Mud Pit. The headers across the top of the chart are missing. What constituents are the values representing? DOE must also compare how these values relate to regulatory requirements.	The table relates to the effluent sumps and since all reference to the effluent sumps has been removed the table is no longer included in the document.	

[a]Comment Types: M = Mandatory, S = Suggested.

Return Document Review Sheets to DOE/NV Environmental Restoration Division, Attn: QAC, M/S 505.

Distribution List

	Copies
Janet Appenzeller-Wing DOE/Nevada Operations Office Environmental Restoration Division P.O. Box 98518, M/S 505 Las Vegas, NV 89193-8518	1 (Controlled)
Paul J. Liebendorfer Bureau of Federal Facilities Division of Environmental Protection 333 W. Nye Lane, Room 138 Carson City, NV 89706-0851	2 (Controlled)
Chuck Bulik Bureau of Federal Facilities Division of Environmental Protection 555 E. Washington, Suite 4300 Las Vegas, NV 89101	1 (Controlled)
Sabrina D. Bonnell DOE/Nevada Operations Office Environmental Restoration Division P.O. Box 98518, M/S 505 Las Vegas, NV 89193-8518	1 (Controlled)
Martha DeMarre DOE Public Reading Room P.O. Box 98521, M/S NLV040 Las Vegas, NV 89193-8521	1 (Controlled)
Timothy White IT Corporation 4330 S. Valley View, Suite 114 Las Vegas, NV 89103	1 (Controlled)
Rosa Silver IT Corporation 4330 S. Valley View, Suite 114 Las Vegas, NV 89103	2 (Controlled)

Distribution List

	Copies
DOE/Nevada Operations Office Technical Information Resource Center P.O. Box 98518, M/S 505 Las Vegas, NV 89193-8518	1
U.S. Department of Energy Office of Scientific and Technical Information 175 Oak Ridge Turnpike P.O. Box 62 Oak Ridge, Tennessee 37831	2
DOE Public Reading Room P.O. Box 98521, M/S NLV040 Las Vegas, NV 89193-8521	1
Dave Madsen Bechtel Nevada P.O. Box 98521, M/S NTS306 Las Vegas, NV 89193-8521	1