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Engineering Evaluation/Cost Analysis for TSF-07 Disposal Pond at Test Area North

May 2009

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Prepared for the
U.S. Department of Energy
DOE Idaho Operations Office

ABSTRACT

An Engineering Evaluation/Cost Analysis has been prepared for public comment and evaluates alternatives to address risks from surface soil contamination at the former TSF-07 Disposal Pond located at the Test Area North on the Idaho National Laboratory Site. The TSF-07 Disposal Pond was an active wastewater land application facility that received wastewater from a variety of sources, including treated sewage effluent, low-level radioactive waste, and cold process water from the Technical Support Facility. Use of the pond was discontinued in 2007 and the wastewater land application permit was closed in 2008. The soil poses an unacceptable risk to a future resident from Cs-137 and to ecological receptors from mercury. The scope of the Engineering Evaluation/Cost Analysis is limited to addressing risks from TSF-07 surface soil as a Comprehensive Environmental Response, Compensation, and Liability Act non-time-critical removal action. The objective of this removal action is to reduce risk to human health and the environment to acceptable levels by mitigating or eliminating the release. This document satisfies environmental review requirements and provides for stakeholder involvement in evaluating remedial alternatives and selecting a preferred alternative. Three alternatives are under consideration as part of this document: (1) No Action, (2) Removal and Disposal with Institutional Controls, and (3) Containment. Alternative 2 is the preferred alternative and involves removal of contaminated soils and implementation of institutional controls.

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ACRONYMS

ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DEQ	[Idaho] Department of Environmental Quality
DOE	Department of Energy
DOE Idaho	Department of Energy Idaho Operations Office
EE/CA	engineering evaluation/cost analysis
EPA	Environmental Protection Agency
GPRS	Global Positioning Radiometric Scanner
GPS	global positioning system
ICDF	Idaho CERCLA Disposal Facility
INL	Idaho National Laboratory
NPR	New Production Reactor
NTCRA	non-time critical removal action
OU	operable unit
RAO	removal action objective
ROD	record of decision
TAN	Test Area North
TBC	to be considered
TSF	Technical Support Facility
UTL	upper tolerance limit
WAC	waste acceptance criteria
WAG	waste area group

Engineering Evaluation/Cost Analysis for TSF-07 Disposal Pond at Test Area North

1. INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) has been prepared in accordance with Section 300.415(b)(4)(i) of the "National Oil and Hazardous Substances Pollution Contingency Plan" (National Contingency Plan) (40 CFR 300) and assists the U.S. Department of Energy Idaho Operations Office (DOE Idaho) in identifying the most effective alternative for addressing risks from surface soil contamination associated with the TSF-07 Disposal Pond located at Test Area North (TAN) of the Idaho National Laboratory (INL) Site (Figure 1). The scope of the EE/CA is limited to addressing risks from TSF-07 surface soil as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 USC § 9601) non-time-critical removal action (NTCRA). The approach satisfies environmental review requirements and provides for stakeholder involvement, while providing a framework for selecting the preferred alternative for the site. Three alternatives are under consideration as part of this EE/CA: (1) No Action, (2) Removal and Disposal with Institutional Controls, and (3) Containment. The preferred alternative is Alternative 2.

This EE/CA identifies the objectives of the removal action and analyzes the effectiveness, implementability, and estimated cost of the proposed action to satisfy these objectives. Following the issuance of this EE/CA for public comment, and consideration of comments received during the public review period, an Action Memorandum documenting the selected alternative will be issued to the Administrative Record by DOE Idaho with concurrence from the Idaho Department of Environmental Quality (DEQ) and U.S. Environmental Protection Agency (EPA).

The TSF-07 Disposal Pond, located at TAN, was an active wastewater land application facility when it was evaluated for remediation under Operable Unit (OU) 1-10. The OU 1-10 Feasibility Study (Blackmore et al. 1997) and Proposed Plan (DOE-ID 1998) evaluated a number of different alternatives, including (1) removal and disposal and (2) limited action consisting primarily of institutional controls, which was the selected remedy. Because the pond was still operational when other elements of the OU 1-10 Record of Decision (ROD) (DOE-ID 1999) were completed, TSF-07 was administratively transferred to OU 10-08 in order to facilitate the close-out of Waste Area Group (WAG) 1. The discharges to the pond have since ceased, the wastes have been removed from the discharge system, the discharge system has been flushed, and the wastewater land application permit has been closed. The OU 10-08 Proposed Plan (DOE-ID 2008) stated that the "site will be sampled again and data will be evaluated in the next CERCLA 5-year review, to occur in 2010, to determine if the selected remedy is appropriate or whether a different remedy should be selected." Additional data collected in June 2008 have indicated that Cs-137 in the eastern portion of the inlet ditch exceeds the acceptable risk-based concentration for a future resident based on a soil exposure pathway. The Cs-137 in the remaining areas should decay to acceptable levels by 2095. A reevaluation of mercury data indicates that a 0.2-acre area adjacent to the ditch that historically held standing water poses unacceptable ecological risks based on soil exposure. The site does not pose a threat to groundwater. Performance of the proposed NTCRA will address surface soil contamination in an expedited manner relative to implementation of the action under the OU 10-08 ROD,[a] thereby reducing potential risks earlier and ensuring effective use of available resources under the Idaho Cleanup Project.

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a. Draft Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites, DOE/ID-11385, in process.

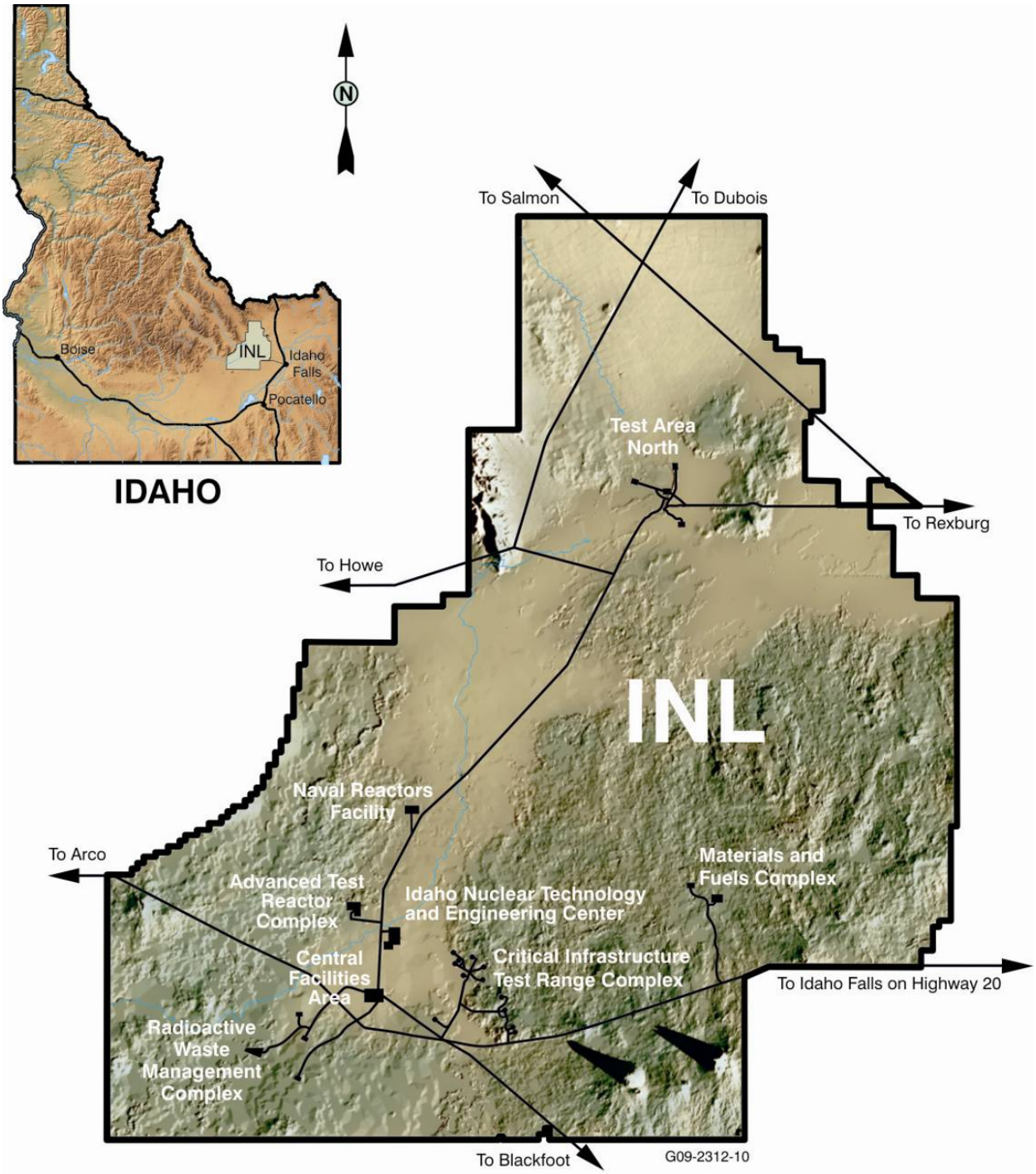

Figure 1. Map of the Idaho National Laboratory Site showing the location of major facilities.

1.1 Purpose

Under the National Contingency Plan, an EE/CA must be prepared for all NTCRAs. This report fulfills that requirement. DOE Idaho proposes the action with agreement from Idaho DEQ and EPA (i.e., the Agencies).

Based on review of the National Contingency Plan factors (40 CFR 300) for determining whether it is appropriate to perform a removal action, it has been concluded that performing the proposed activity as an NTCRA is appropriate and consistent with the relevant National Contingency Plan criteria. Performance of this removal action will place the TSF-07 area in a configuration that is protective of human health and the environment. Without implementation of the proposed alternative, a potential threat of release of hazardous substances exists, and, without action, adverse threats to human health and the environment eventually could occur. As the lead agency, the U.S. Department of Energy (DOE) has determined that a removal action is an appropriate means to accomplish the final end state and achieve environmental review requirements. Both DEQ and EPA concur that the proposed action is warranted to reduce potential for exposure to unacceptable levels of Cs-137 and mercury contamination and achieve a configuration that is protective of human health and the environment.

This EE/CA will become part of the Administrative Record for the Idaho Cleanup Project at the INL Site. It will be made available for public comment. The Administrative Record is on the Internet at http://ar.inel.gov/ and is available to the public at the following locations:

Albertsons Library	INL Research Library
Boise State University	DOE Public Reading Room
1910 University Drive	1776 Science Center Drive
Boise, ID 83725	Idaho Falls, ID 83415
(208) 426-1625	(208) 526-1185

2. SITE CHARACTERIZATION

This section summarizes background information, including a description of the TSF-07 area at TAN, the nature and extent of contamination, available analytical data, and the prior risk assessment. This section also reevaluates risk using new information.

2.1 Site Description and Background

2.1.1 Idaho National Laboratory Site and Idaho Cleanup Project

The INL Site, managed by DOE, is located 51 km (32 mi) west of Idaho Falls, Idaho (Figure 1). The INL Site occupies 2,305 km^2 (890 mi^2) of the northeastern portion of the Eastern Snake River Plain. In 1949, the U.S. Atomic Energy Commission established the INL Site, which was called the National Reactor Testing Station at that time. Its purpose was to conduct nuclear energy research and related activities. It was redesignated the Idaho National Engineering Laboratory in 1974 and then the Idaho National Engineering and Environmental Laboratory in 1997. In 2005, to better focus the laboratory's missions, DOE established the Idaho Cleanup Project to bring the environmental management mission to completion and re-designated the site as the INL Site to better reflect the laboratory's new research directions.

DOE Idaho controls all land within the INL Site. Public access is restricted to public highways, DOE Idaho-sponsored tours, special-use permits, and the Experimental Breeder Reactor I National Historic Landmark. In addition, DOE Idaho supports the Shoshone-Bannock tribal members' need for access to areas on the INL Site for cultural and religious purposes.

The INL Site is located primarily in Butte County; however, it also occupies portions of Bingham, Bonneville, Clark, and Jefferson counties. The 2000 census indicated the following populations (in parentheses) for cities in the region: Idaho Falls (50,730), Pocatello (51,466), Blackfoot (10,419), Arco (1,026), and Atomic City (25). Surface water flows on the INL Site consist mainly of three streams draining intermountain valleys to the north and northwest of the INL Site: (1) the Big Lost River, (2) the Little Lost River, and (3) Birch Creek. All of the channels terminate on the INL Site. Flows from Birch Creek and the Little Lost River seldom reach the INL Site because of irrigation withdrawals upstream. The Big Lost River and Birch Creek may flow onto the INL Site before the irrigation season or during high-water years, but the terminal reaches are usually dry. In those few wetter years when the Big Lost River carries water to the end of its channel, the water sinks into the ground.

2.2 Previous CERCLA Activities at the INL Site

The INL Site was added to the EPA's National Priority List of sites contaminated with hazardous substances on November 21, 1989 (CERCLIS Identification Number 4890008952). On December 9, 1991, DOE Idaho entered into the Federal Facility Agreement and Consent Order (DOE-ID 1991) to address the remediation of contaminated areas. The Federal Facility Agreement and Consent Order divided the INL Site into 10 WAGs corresponding to the major facilities and areas at the Site. Comprehensive RODs have been signed for nine of the 10 WAGs. Remedial actions have been completed at WAGs 1, 2, 4, 5, 6, 8, and 9. Remediation is ongoing at WAGs 3, 7, and 10. The ROD has yet to be completed for OU 10-08.

Remedial actions have addressed various contaminated soil sites across the INL Site. Remediation of contaminated soil, buried wastes, and groundwater continues at TAN, the Idaho Nuclear Technology and Engineering Center, and the Radioactive Waste Management Complex. Long-term monitoring and institutional controls are required for soil contamination sites where residual contamination remains in place.

2.3 Test Area North

Located in the northern portion of the INL Site, the original mission of TAN was to support the U.S. Air Force in its efforts to create a nuclear-powered airplane, beginning in 1954. Although the Air Force project was terminated in 1961, this and subsequent projects resulted in the development of four sub-areas at TAN: the Initial Engine Test Facility (decommissioned in 2001), the Water Reactor Research Test Facility (decommissioned in 2004), the Technical Support Facility (TSF) (decommissioned in 2008), and the Contained Test Facility. The U.S. Army selected the TAN Contained Test Facility as the site for their Specific Manufacturing Capability program, which continues to produce armor for combat vehicles.

2.3.1 TSF-07 Disposal Pond

The TAN/TSF Sewage Treatment Facility (TAN-623), which fed water to the TSF-07 Disposal Pond, was located southwest of the TSF area and served the buildings in the TSF area of TAN (see Figure 2). The facility treated raw wastewater by biologically digesting the majority of the organic waste and other major contaminants and then applying the wastewater to land for infiltration and evaporation. The TAN/TSF Sewage Treatment Facility Disposal Pond (the facility was designated as the TAN-740 pond) consists of a main disposal pond and an overflow pond, both of which are located within an

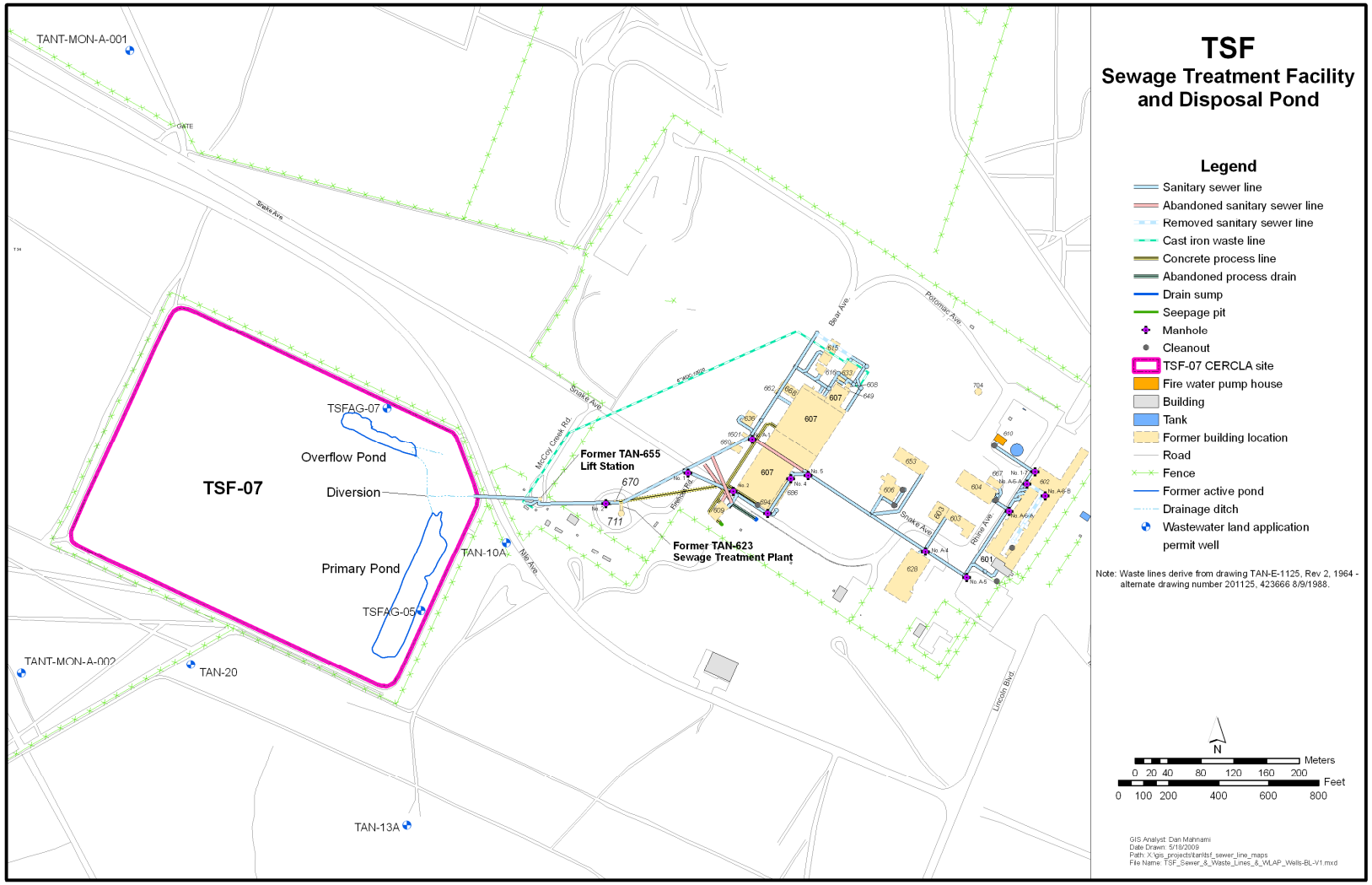

Figure 2. Map of Test Area North/Technical Support Facility Sewage Treatment Facility and Disposal Pond.

unlined, fenced area. The TAN-740 pond area was designated as TSF-07 for administrative purposes under CERCLA and will be referred to as TSF-07 throughout this document. The pond is surrounded by a 5-ft-tall earthen berm. The overflow pond was rarely used (only when the water was diverted to it for brief periods of cleanup and maintenance).

The purpose of the TSF-07 pond was final disposal of wastewater from a variety of sources, including treated sewage effluent, low-level radioactive waste, and cold process water. Process drain effluent consisted of industrial effluent, primarily steam condensate and boiler blowdown; water softener and demineralizer discharges; and cooling, heating, and air conditioning water. Process drain effluent was mixed with treated sanitary waste at the Liquid Waste Lift Station (TAN-655) and was discharged to the TSF-07 pond. The lift station and treatment facility were both removed in 2008. Historically, the pond received discharges of approximately 11,000 gpd of mostly clean water until it was shut down in November 2007. Prior to the removal of the lift station and treatment facility, the collection system, manholes, and Sewage Treatment Facility structures were flushed and drained. It is estimated that a total of 282,000 gal were discharged through the system during November 2007 until wastewater flows to the disposal pond ceased on November 29, 2007. This flushing resulted in the deposition of solid material below the end of the sewer pipe at the eastern end of the ditch.

2.4 Source, Nature, and Extent of Contamination

Wastewater was applied to the TSF-07 pond from 1972 to 2007; some evaporated and the remainder migrated vertically down into the soil column. The active pond area in the past does not appear to have ever exceeded 3.2 acres. It is concluded that 31.8 of the 35 acres inside the TSF-07 fence were not radiologically contaminated because wastewater effluent from the TAN/TSF Sewage Treatment Facility did not reach this area.

The *Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory* (Blackmore et al. 1997) details sampling of surface water, sediments, subsurface soil, and perched water associated with the TSF-07 pond from multiple investigations. The Remedial Investigation/Feasibility Study includes results of a 1993 evaluation of historical and analytical data. The combined results indicate presence of metals in soil, including arsenic, mercury, and thallium. The concentration of mercury in surface soil samples collected in 1988 and 1989 is shown on Figure 3. Two samples exceeded risk-based concentrations for mercury. One sample from the discharge ditch was 206 mg/kg, and one anomalous sample in the cattail area north of the ditch was 4,040 mg/kg.[b] The soil samples also tested positive for organic compounds, including tetrahydrofuran. Radionuclides were detected in sediments and shallow subsurface soil, including Co-60, Cs-137, and Sr-90, with Co-60 and Cs-137 detected to 10–11 ft below ground surface.

To assess the impact of operations on the pond since the time of the previous sampling events and to help define the extent of contamination within the pond, sampling and analysis of the sediments and subsurface soil were conducted during 2008 in accordance with the "Sampling Procedure for Test Area North TSF-07 Disposal Pond (ESP-034-07)" (SPR-176). The sampling and analysis consisted of a dual approach, including wide-area scans covering the majority of the pond and sampling and analysis of the 3.2-acre active disposal area within the TSF-07 pond. The wide-area scans were designed to determine whether windblown contamination existed outside of the 3.2-acre area that historically received wastewater discharge.

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b. Rehak (1988) indicated that the 1988 sample results for mercury, including the result of 4,040, was in ppb [µg/kg]. Medina 1993 indicated the 1988 results for mercury were in ppm [mg/kg]. A third sample located near the edge of the overflow pond was incorrectly shown on Figure 13 in Medina (1993) as 53.1 mg/kg. Mercury was not detected at that location, which is consistent with the rest of the data for the edge of the overflow pond. The value shown (53.1 mg/kg) was actually for chromium.

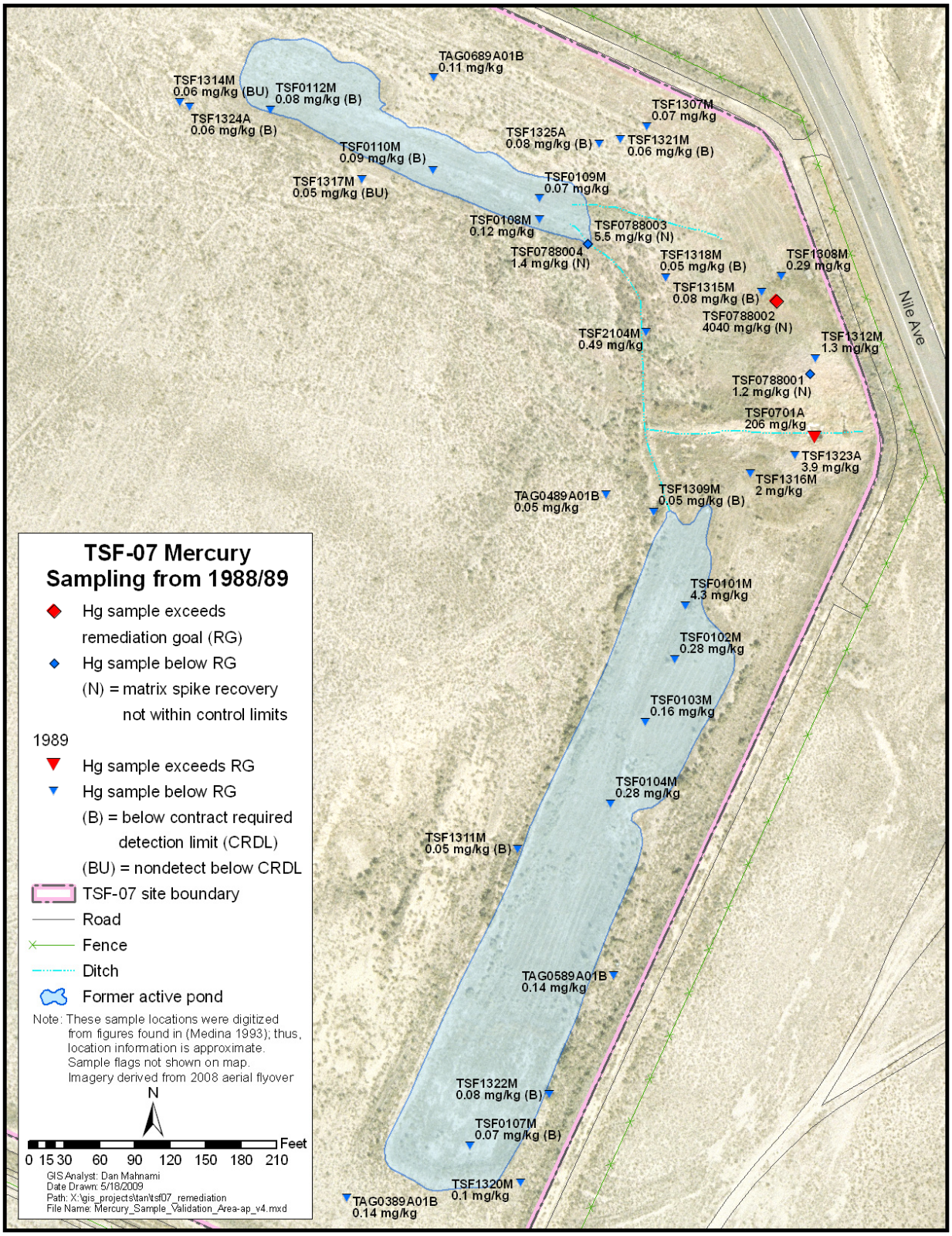

Figure 3. Mercury data from 1988 and 1989 surface soil samples.

Wide-area scan surveys were conducted on the TSF-07 Disposal Pond using the Global Positioning Radiometric Scanner (GPRS) system. The GPRS consists of two large plastic scintillation detectors coupled to a Trimble global positioning system (GPS) that is mounted on a four-wheel-drive vehicle. Radiation and position data are logged using a personal computer in the vehicle. The GPRS geographic coordinates (latitude and longitude) are recorded at least every 2 seconds during the survey. The vehicle is driven no faster than 5 mph during the survey, with the detectors positioned 1 m above the surface. A standard radiation source was used to check the response of the detectors prior to each survey. The response of the GPRS detectors is recorded in counts per second with the relative intensity of detector response to ambient radiation field being mapped using the GPS data. The spatial distribution of radiation fields and radioactivity in the area are inferred from the map. In practice, the GPRS has proven to be an effective screening tool for identifying the location of potential contamination in large areas.

Figure 4 provides the results of the GPRS survey of the TSF-07 Disposal Pond. Some areas to the southwest of the discharge point and to the west of the main disposal area could not be surveyed because the undulating topography precluded access of the four-wheel-drive vehicle to those locations. Also, the vehicle could not access the discharge ditch because of the presence of vegetation, the topography, and the concrete diversion. Results confirm that the areas outside of the main disposal and primary overflow ponds are not radiologically contaminated. The area near the discharge ditch—where the soil was sufficiently saturated to support the growth of cattails—shows radiological contamination. The overflow pond shows lower levels of radiological contamination than the main drainage pond. The survey confirmed that the area outside the active ponds was not radiologically contaminated.

Soil samples were collected in 2008 and submitted for radionuclide analyses (Sr-90 and gamma-emitting radionuclides), volatile organic compounds, including tetrahydrofuran, which had been determined to be a contaminant of concern in the Final Record of Decision for Test Area North Operable Unit 1-10 (DOE-ID 1999), and toxicity characteristic leaching procedure. No tetrahydrofuran was detected. Cesium-137 concentrations from 2008 are shown on Figure 5 and summarized in Table 1. Strontium-90 and Cs-137 were frequently detected with maximum concentrations of 49.6 ± 0.3J pCi/g (duplicate result of 62.9 ± 0.4 J pCi/g)[c] and 475 ± 18 pCi/g (duplicate result of 566 ± 21 pCi/g), respectively. The highest detected concentrations were encountered in the solid material that had been discharged during the final decontamination and decommissioning activities at TSF. Cesium-137 concentrations decreased with depth. The 10^{-4} risk-based concentration for residential use in 2095 and cleanup in 2009 is 43.3 pCi/g. The contamination that exceeds this risk-based concentration appears to be limited to the top 6 in. of soil at the site. Based upon the wide-area scans and analytical data, the Cs-137 concentrations that would exceed the human health risk-based level exist primarily in the solid material that was discharged during the final decontamination and decommissioning activities and the top 6 in. of soil residing in the eastern half of the ditch between the sewer pipe and the diversion. Although no samples were taken from the cattail area in 2008, it is expected that elevated concentrations exist in this area as well. Other radionuclides were intermittently detected, primarily Co-60 (maximum of 12.0 ± 0.9J pCi/g), with Eu-152 detected in one surface soil sample at a concentration of 5.77 ± 0.4 pCi/g.

Table 1. Summary of contaminant of concern data from 2008 sampling at TSF-07 (includes duplicates).

Contaminant of Concern	Number of Samples	Number of Detects	Minimum Concentration	Maximum Concentration (pCi/g)	Exposure Point Concentration (Method)
Cs-137	44	41	Nondetect	475 ± 18 566 ± 21 (duplicate)	200 pCi/g (99% UCL)[a]

a. 99% Kaplan-Meier (Chebyshev) UCL.

UCL upper confidence limit

c. Definition of laboratory data flags: J = Estimated value.

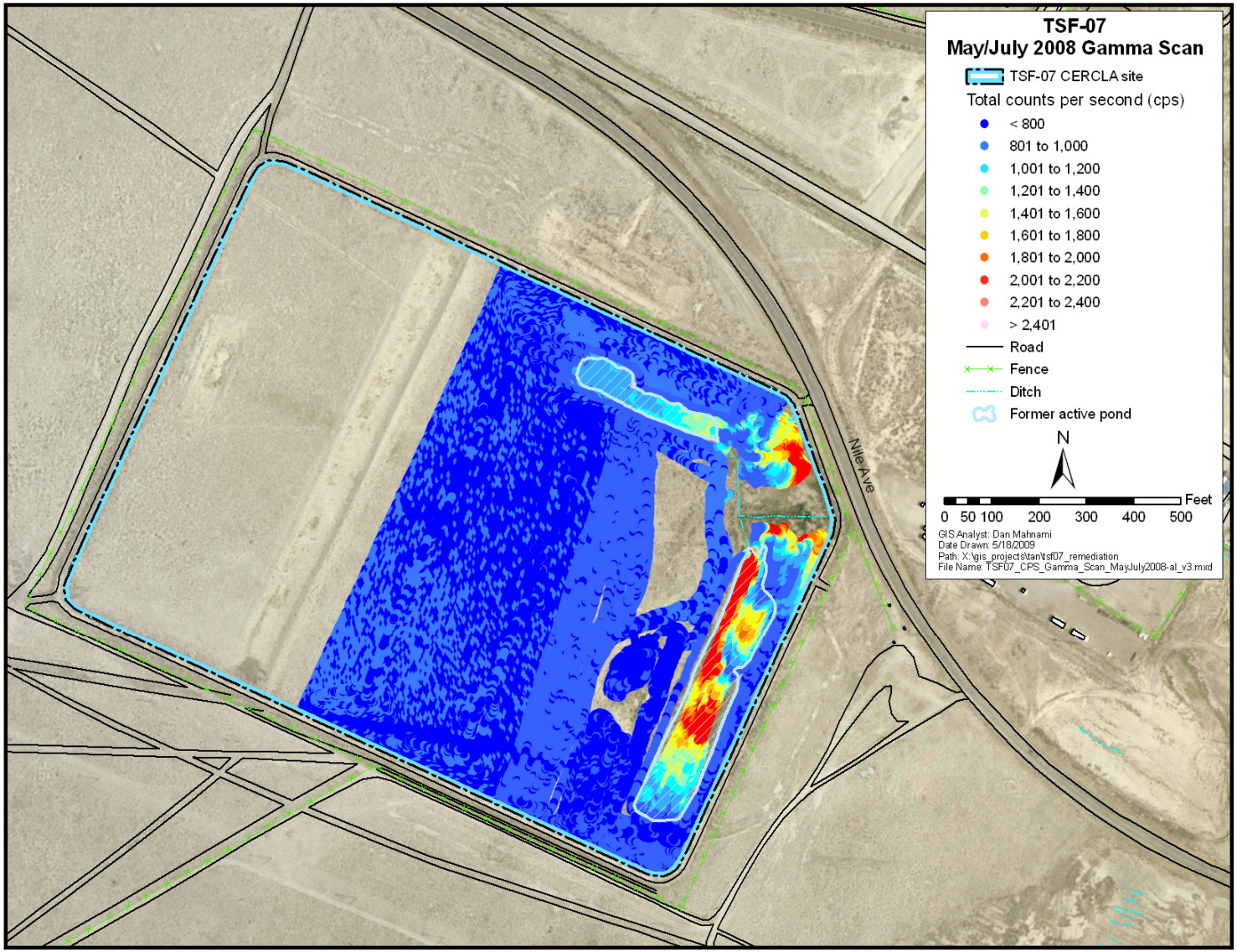

Figure 4. Global Positioning Radiometric Scanner survey results.

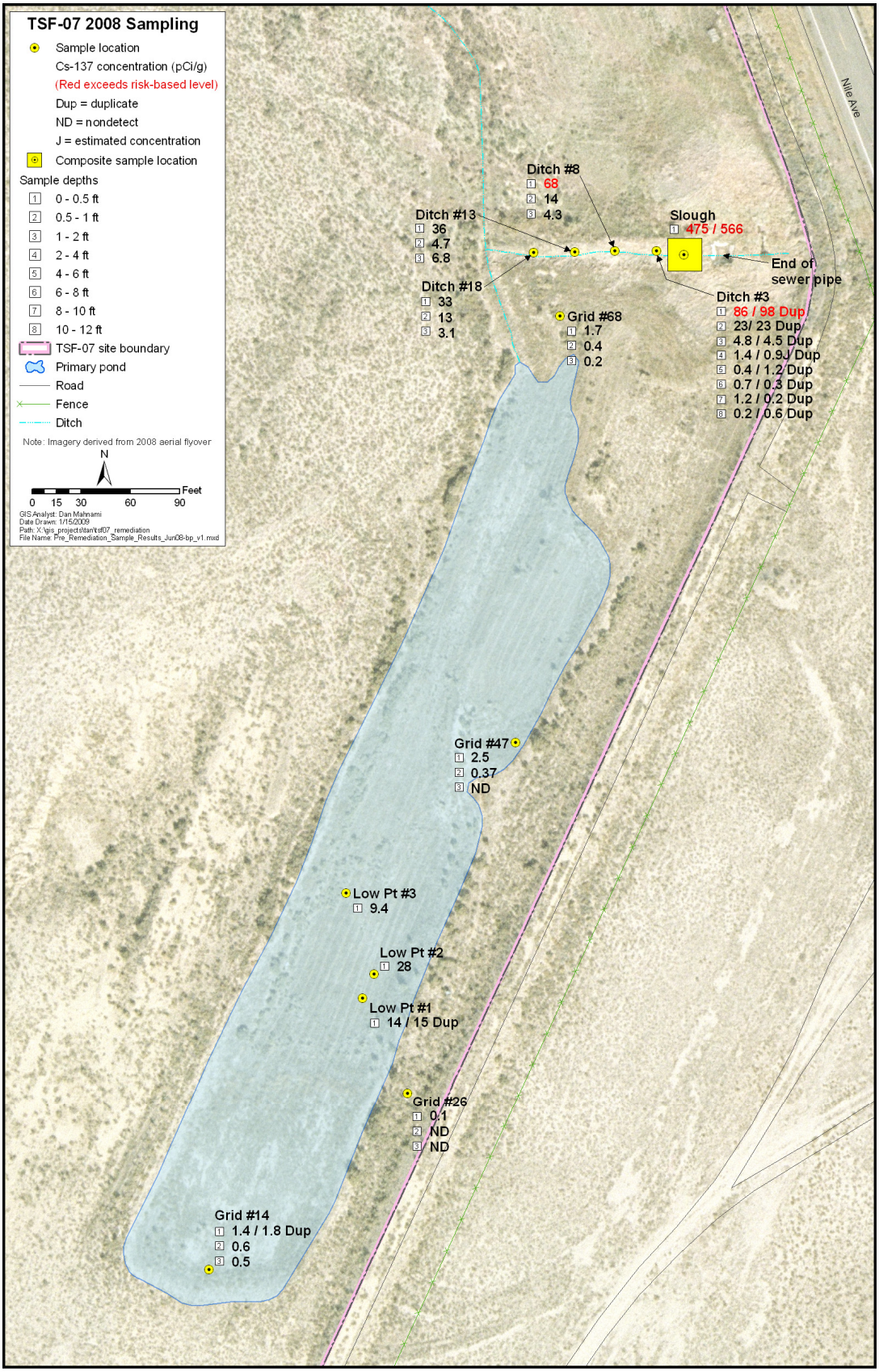

Figure 5. TSF-07 characterization results for Cs-137 – June 2008.

2.5 Risk Evaluation

The OU 1-10 baseline risk assessment identified Cs-137 and Ra-226, as contaminants of concern for human health, and tetrahydrofuran, mercury, arsenic, and thallium as contaminants of concern for ecological risk (Blackmore et al. 1997). The results of this analysis are reevaluated in this EE/CA for several reasons: (1) new information was collected for Cs-137 and tetrahydrofuran, (2) new information became available concerning the radium analysis, and (3) an updated mercury cleanup level (also known as remediation goal) is appropriate for this site.

2.5.1 Human Health

For human health, the risk based on the exposure point concentration in Table 2 from Cs-137 contamination at TSF-07 is unacceptable (1×10^{-3}) for a future resident, as shown on Table 2. These data indicate that the eastern portion of the inlet ditch exceeds risk-based concentrations for Cs-137. When the old Cs-137 data from 1989 are decayed to 2009, the only data point that would exceed a 10^{-4} risk for a future resident in 2095 (after accounting for decay) occurs in the eastern portion of the ditch (see Section 4.2, Figure 6). These data are consistent with the new data collected in 2008.

Table 2. Human health risks for TSF-07 Disposal Pond.

Human Health Risk Residential Scenario (future)		
Contaminant of Concern	Excess Cancer Risk	Threshold Cancer Risk
Cs-137	1×10^{-3}	10^{-4}
Note: Shaded numbers indicate risks that exceed acceptable levels.		

Table 3 presents a screening of the soil data collected in 2008 at TSF-07. The maximum detections of these samples were compared to risk-based concentrations protective of the future resident at 2095 and ecological receptors. As can be seen, other than Cs-137, which is already identified as a COC, only Eu-152 and Sr-90 exceed the risk-based concentration at 10^{-6}. However, the maximum Eu-152 detection is below the 10^{-5} risk-based concentration and Eu-152 can be eliminated as a concern. Sample E0340704201RH and its duplicate (49.6 pCi/g and 62.9 pCi/g) are the only detections over the 10^{-5} risk-based concentration of 19.7 pCi/g for Sr-90. This sample is in the slough area and has an associated high detection of Cs-137 (475 pCi/g). It should be noted that Co-60 exceeds the risk-based concentration for the current outdoor worker at two locations—these locations are collocated with the Cs-137 hot spots as well. Therefore, the Co-60 and Sr-90 hot spots are collocated with the Cs-137 hot spots. The samples were not analyzed for total mercury in 2008.

The OU 1-10 baseline risk assessment (Blackmore et al. 1997) identified other contaminants of concern. Radium exceeded risk-based levels for a future resident. A subsequent analysis (Giles 1998) found that the radium data obtained by gamma spectrometric analysis were biased high due to U-235 interference. This is discussed in Giles (1998) when the sampling performed at TSF-07 was evaluated to determine a background concentration of Ra-226. Giles (1998) found that the corrected average Ra-226 concentrations were less than the upper tolerance limits (UTLs) for U-238 and represented background concentrations. Two separate methods of analysis concluded that the radium was at background concentrations.

Table 3. Screening of 2008 TSF-07 soil data for human health and ecological risk against maximum detected values (bolded values in last column are taken forward in the risk assessment).

Detected Contaminants	Maximum Source Concentration (mg/kg or pCi/g)	Units	Background Concentration (mg/kg or pCi/g)	Maximum Concentration > Background?	Nontoxic Metal?	Risk-Based Concentration 10^{-6} or HQ>1[a] (mg/kg or pCi/g)	Maximum Concentration > RBC?	Ecological Screening Value[b] (mg/kg or pCi/g)	Maximum Concentration > Screening Values?	Remains a COPC?	
										HHRA	ECO
Cs-137	566	pCi/g	0.82	Yes	No	4.78E-01	Yes	4.95E+03	No	**Yes**	No
Co-60	12	pCi/g	NA	NA	No	4.99E+03	No	1.18E+03	No	No	No
Eu-152	5.77	pCi/g	NA	NA	No	4.53E+00	Yes	2.18E+03	No	No[c]	No
Nb-94	0.292	pCi/g	NA	NA	No	1.53E+00	No	1.87E+03	No	No	No
Sr-90	62.9	pCi/g	0.49	Yes	No	1.97E+00	Yes	3.34E+03	No	**No[d]**	No
Acetone	0.054	mg/kg	NA	NA	No	6.10E+03	No	5.53E-01	No	No	No
Benzene	0.0013	mg/kg	NA	NA	No	1.10E+00	No	5.50E+00	No	No	No
Carbon disulfide	0.02	mg/kg	NA	NA	No	3.60E+01	No	5.91E-01	No	No	No
Ethylbenzene	0.012	mg/kg	NA	NA	No	5.70E+00	No	5.52E+01	No	No	No
Tetrachloroethene	0.28	mg/kg	NA	NA	No	5.70E-01	No	3.33E+00	No	No	No
Toluene	0.013	mg/kg	NA	NA	No	5.00E+02	No	6.04E+01	No	No	No
Trichloroethene	0.039	mg/kg	NA	NA	No	2.80E+00	No	1.74E+01	No	No	No
Xylene	0.021	mg/kg	NA	NA	No	6.00E+01	No	2.78E-01	No	No	No
Ammonia	55.7	mg/kg	NA	NA	No	1.40E+07	No	NA	NA	No	NA

a. The risk-based concentrations for radionuclides were developed for the future resident by decaying the EPA Preliminary Remediation Goals for the current resident to 2095. These Preliminary Remediation Goals are found at http://epa-prgs.ornl.gov/radionuclides/download.shtml (EPA 2007). The risk-based concentration for nonradionuclides is taken from Region 6 Human Health Medium-Specific Screening Levels found at http://www.epa.gov/Region6/6pd/rcra_c/pd-n/screen.htm (EPA 2009).

b. The ecological screening levels are taken from the OU 10-04 Comprehensive Remedial Investigation/Baseline Feasibility Study (DOE-ID 2001).

c. Eu-152 is eliminated as a contaminant of potential concern because the maximum concentration is below the 10^{-5} risk-based concentration.

d. Sample E0340704201RH and its duplicate (49.6 pCi/g and 62.9 pCi/g) are the only detections over the 10^{-5} risk-based concentration of 19.7 pCi/g for Sr-90. Sr-90 was not identified as a contaminant of concern in OU 1-10. However, the Sr-90 hot spot is collocated with a Cs-137 hot spot and will be remediated.

COPC contaminant of potential concern
ECO ecological risk assessment
EPA U.S. Environmental Protection Agency
HHRA human health risk assessment
HQ hazard quotient
NA not applicable
OU operable unit
RBC risk-based concentration

For noncarcinogens, a hazard quotient greater than 1 is considered unacceptable for human health. In the OU 1-10 baseline risk assessment, mercury had a hazard quotient of 1 for a future resident; and arsenic had a hazard quotient of 0.2. All other noncarcinogens were less than 0.05 and did not contribute significantly to the hazard index. Further evaluation of the arsenic concentrations indicates that these values should be considered to be background (see Section 2.5.2). The groundwater pathway was assessed in the OU 1-10 baseline risk assessment and mercury and Cs-137 were not contaminants of concern for this pathway (Tables B-71 and B-72 in Blackmore et al. 1997).

2.5.2 Ecological Health

Evaluation of the 2008 data presented in Table 3 indicates no contaminants were detected at levels of concern for ecological receptors. The OU 1-10 risk assessment (using the 1988 and 1989 data) concluded that tetrahydrofuran, mercury, arsenic, and thallium pose unacceptable ecological risks.

Sampling for tetrahydrofuran occurred during three different sampling events—in 1988, 1989, and 2008. Review of the data collected in 1988 indicates that tetrahydrofuran was detected as a tentatively identified compound (Rehak 1988) in concentrations less than the contract-required quantitation limit and in the laboratory's method blanks (Medina 1993). This indicates that the pond sediment samples could have gotten contaminated in the laboratory and these data are suspect. Data collected in 1989 indicated tetrahydrofuran exceeded risk-based concentrations for ecological risk (Medina 1993). However, in 2008, all soil samples were nondetect for tetrahydrofuran (Dieter 2008). Because the volatility of tetrahydrofuran is high, it is assumed that it has evaporated over the 20 years since the 1989 samples were collected. Based on the new data, tetrahydrofuran is eliminated as a contaminant of concern for ecological risk.

Soil sampling for arsenic and thallium was performed in both 1988 and 1989. These contaminants were analyzed in 2008 using the toxicity characteristic leaching procedure, which includes arsenic and thallium, and were mostly nondetect and all well below Resource Conservation and Recovery Act characteristic levels. Arsenic concentrations from data analyzed in 1988 ranged from 1.7 to 12.5 mg/kg, which, at the high end, is above the 95%/95% UTL for background (5.8 mg/kg) established at the INL Site in Rood, Harris, and White (1996). However it is accepted that the background for arsenic presented in Rood, Harris, and White (1996) is too conservative for various soils at the INL Site. Of the results from the 1988 sampling, the highest arsenic concentration in soil was 12.5 mg/kg.

The background for arsenic provided in Rood, Harris, and White (1996) is from one of the most limiting soil types on the INL Site. As discussed in detail in Appendix K of the OU 10-04 Comprehensive Remedial Investigation/Feasibility Study (DOE-ID 2001), soil type and characteristics found at the INL Site vary greatly, depending on location, and the background values in Rood, Harris, and White (1996) are not always appropriate for other soil types. Rood, Harris, and White (1996) used a data set representing the most limiting soil type on the INL Site to determine background concentrations. Rood, Harris, and White (1996) evaluated the largest background data sets for metals, which are the background studies by Martin et al. (1990, 1992) and the New Production Reactor (NPR) sampling (Anderson 1992). These studies were evaluated for differences in sampling, sample preparation, and analytical techniques. The Martin study (Martin et al. 1992) was eliminated for determining background for arsenic because the metals were analyzed by inductively coupled plasma, and the detection levels were not low enough to define background for a few metals, including arsenic (Rood, Harris, and White 1996). As stated on page C-11 of Martin et al. (1990):

> Certain metals reported are more typically analyzed by Furnace AA [atomic absorption, ed.] … but for the purpose of this study, were analyzed by ICP [inductively coupled plasma, ed.]: therefore, the detection limits of these metals are high and do not meet the Contract Laboratory Protocol…. The affected metals are antimony, arsenic, lead, selenium, silver, and thallium.

The NPR study analyzed these metals using furnace AA and achieved lower detection limits.

As discussed in detail in the "Post Remediation Risk Evaluation and Data Summary Report for TSF-09/18/21, TSF-46/47/48, TSF-53, TSF-06 Area 1 and the TAN-607 NTCRA Soil Remediation Sites" (EDF-6686), the NPR soil type is different from the soil at TAN. Therefore, the background values determined from these data are not representative of the soils at TAN. The Post Remediation Risk Evaluation (EDF-6686) found that, using the arsenic concentrations from Shacklette and Boerngen (1984) for the western states, it is conservatively anticipated about 68% of samples in a randomly selected suite at background should fall below 10.45 mg/kg and 95% should fall below 21.6 mg/kg. Of the samples collected in 1988, all are below 12.5 mg/kg; therefore, arsenic results collected during 1988 should be considered to be at background levels based on this criterion.

Thallium concentrations in soil analyzed in 1988 ranged from 0.3 W to 0.3 UW mg/kg[d] and are below the Rood, Harris, and White (1996) 95%/95% UTL background of 0.4 mg/kg.

In 1989, both arsenic and thallium concentrations in soil were determined using inductively coupled plasma. As stated above, the inductively coupled plasma method is not the best option for defining low-level concentrations (Martin et al. 1992; Rood, Harris, and White 1996) and, currently, other methods are preferred. The arsenic in the samples collected in 1989 ranged from 1.7 to 39 B mg/kg and thallium ranged from 0.19 to 38 BJ mg/kg.[e] Comparing these results with the Martin et al. (1992) study indicates that all the arsenic samples and all but one of the thallium concentrations are within the range of the soils sampled to represent background at TAN. For arsenic, the Martin et al. (1992) concentrations range from nondetects to 75.7 mg/kg; for thallium, concentrations range from nondetect to 34.8 mg/kg. Although the maximum thallium data from the TSF-07 pond is above the maximum reported for background in the Martin et al. (1992) study, the thallium reported in Medina (1993) is ubiquitous throughout the TSF-07 pond and shows no apparent pattern. The other contaminants show a pattern, with highest concentrations in the eastern portion of the discharge ditch and near the ditch where standing water supported the growth of cattails. Therefore, arsenic and thallium data from the TSF-07 are considered comparable in concentration to background data in Martin et al. (1992) using the same analytical method and are eliminated as contaminants of concern.

Mercury concentrations in 1988 and 1989 were at levels that could pose an unacceptable risk to ecological receptors. The cleanup level for mercury-contaminated soil (8.4 mg/kg) that was developed for CFA-04 (VanHorn and Stacey 2002) was evaluated for use at the TSF-07 pond.[f] Because methyl mercury is more toxic to ecological receptors than inorganic mercury compounds, a percentage of mercury in the CFA-04 pond soil was considered to be methyl mercury to ensure conservatism. The properties of the soil

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d. Definition of laboratory data flags: U = Analyte was analyzed for but not detected. Analyte result was below the Contract Required Detection Limit. W = Post-digestion spike for Furnace Atomic Absorption analysis is out of control limits (85 – 115%), while sample absorbance is less than 50% of spike absorbance. This flag also indicates that the result is not a recommended analyte by the preparation method used.

e. Definition of laboratory data flags: B = Value less than the Contract Required Detection Limit, but greater than or equal to the Instrument Detection Limit. J = Estimated value.

f. VanHorn, Robin, 2009, "Evaluation of the Remediation Goal for Ecological Receptors at TSF-07," EDF-9231 (in process).

that affect mercury speciation and transformation at the two pond sites are similar. Therefore, the CFA-04 pond remediation goal for ecological receptors is acceptable for use at the TSF-07 pond.

2.5.3 Risk Assessment Summary

Evaluation of the data collected indicates that Cs-137 concentrations within the ditch and pond bottom remain a concern for human health. However, only the Cs-137 concentrations in the eastern end of the ditch exceed a risk-based level for a future resident in 2095. The concentrations of Cs-137 in samples from the rest of the TSF-07 pond will decay to acceptable levels by 2095. Hot spots for Co-60, Sr-90, and mercury are collocated with the Cs-137 hot spots. Several contaminants of concern identified in the OU 1-10 baseline risk assessment (Blackmore et al. 1997) were eliminated as an ecological concern (tetrahydrofuran, arsenic, and thallium). Mercury remains a contaminant of concern for ecological receptors in two hot spots: the eastern end of the ditch and the cattail area north of the ditch, as shown on Figure 3.

3. IDENTIFICATION OF REMOVAL ACTION OBJECTIVES AND SCOPE

The removal action objective (RAO) is to limit total human health excess cancer risk to 10^{-4} for workers and future residents. The preferred alternative recommends removal and disposal of contaminated soil that exceeds the 10^{-4} residential risk-based level in 2095 for Cs-137 and the ecological cleanup level of 8.4 mg/kg for mercury. The risk-based level for the future resident for Cs-137 is 6.0 pCi/g in 2095 and was calculated from the EPA *Preliminary Remediation Goals for Radionuclides* web site (EPA 2007). Although this Cs-137 cleanup level differs from the OU 1-10 ROD (DOE-ID 1999), this value is from the current EPA preliminary remediation goals and is consistent with the OU 10-08 Proposed Plan. These risk-based levels are protective of human and ecological receptors. Institutional controls would be maintained until the site can be released for unrestricted residential use.

Due to radioactive decay, the remediation goal depends on the year the cleanup is performed. The calculated residential remediation goal for year 2095 of 6.0 pCi/g is used to calculate the remediation goal for any year from the present to 2095 by dividing the remediation goal by an exponential decay factor. This decay factor was calculated as $[e^{-\lambda t}]$, where λ is the Cs-137 decay rate constant (0.023 yr^{-1}) and t is the decay time (in years) between the cleanup date and 2095 when the future residential exposure scenario begins. Based on assumed remediation in 2009, the remediation goal (current-year threshold for implementation in 2009) for the NTCRA is 43.3 pCi/g.

The scope of the proposed NTCRA is limited to addressing soil contaminated with Cs-137 contamination in excess of the 2009 remediation threshold of 43.3 pCi/g at TSF-07 and 8.4 mg/kg for mercury (see Section 2.5.2). The human health cleanup level for Cs-137 is protective of ecological receptors.

4. IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Three alternatives are under consideration for TSF-07 in this EE/CA: (1) No Action, (2) Removal and Disposal with Institutional Controls, and (3) Containment. Alternatives for remediating TSF-07 were previously developed and analyzed as part of the OU 1-10 and OU 10-08 CERCLA processes. Relevant information from those analyses is summarized in this section.

4.1 Alternative 1—No Action

Alternative 1 is a hypothetical and conservative baseline established for comparison reasons. Alternative 1 does not involve active remedial activities beyond environmental monitoring currently conducted at the INL Site as part of Site-wide activities. Because contamination would remain at the site above risk-based levels, environmental monitoring would include biotic monitoring (e.g., collection and analysis of vegetation and small mammals) and collection and analysis of surface soil for site-specific contaminants. Alternative 1 would not eliminate, reduce, or control risks to human health and the environment.

DOE Idaho cannot implement a no action alternative (i.e., no administrative or physical controls) because it would put workers at risk and would not meet the requirements of federal orders and state and federal laws. Therefore, the No Action alternative cannot be considered a viable alternative and is not considered further, although a cost comparison is included in Section 5.

4.2 Alternative 2—Removal and Disposal with Institutional Controls

Alternative 2 will address surface soil contamination that exceeds the RAOs in a 0.2-acre area, as shown on Figure 6. The top layer (approximately 1 ft) of soil in this area will be removed. Following this, a total of 3.2 acres, as shown on Figure 6, will be field screened for Cs-137 using a real-time gamma spectrometry system to identify any additional contaminated soil for removal. Because other contaminants (including mercury) are collocated with the Cs-137 contamination, field screening for Cs-137 will be used to identify additional soil requiring removal. Following each removal, the newly excavated area will be field screened for Cs-137 and excavated as necessary until the soil screens below the remediation goal for Cs-137. For cost-estimating purposes, a total of 3.2 acres of soil removal is included as part of the proposed alternative to address potential uncertainty with the extent of soil contamination. Because analytical data show the contaminant concentrations are limited to surface soil, estimates are based on removal of the top foot of soil.

Alternative 2 would employ field screening for Cs-137 to identify areas that exceed the cleanup levels. Heavy equipment would be used to excavate soil. Contaminated soil would be stockpiled to determine mercury levels and whether soil could be disposed of at the Idaho CERCLA Disposal Facility (ICDF) or would need to be disposed of off the INL Site at an approved facility. Soil that meets the ICDF waste acceptance criteria (WAC) would be disposed of at the ICDF. Water spray or other dust suppression methods would be employed to control fugitive dust. Staging of soil in piles may be implemented as necessary to facilitate efficient and safe excavation activities. Verification of the extent of Cs-137 contamination will be based on field screening or other appropriate measurements. Verification samples for mercury will be collected from excavated areas. The excavated areas would be backfilled with clean soil or berm material and revegetated to natural conditions. The CERCLA program typically returns contaminated sites to preexisting conditions. Because the berm is not suspected of being contaminated and supports vegetation, including sagebrush, the berm will remain in place unless portions are needed for fill material.

Institutional controls will be maintained until the site can be released for unrestricted residential use (no later than 2095). Institutional controls will consist of actions to minimize potential threats to human health and the environment. In particular, the site will be posted with warning signs identifying site hazards and contact information. The site will be periodically inspected to ensure site conditions are acceptable. Until Cs-137 concentrations in the TSF-07 pond decay to below risk-based levels for unrestricted land use, the site will be evaluated in the INL Site 5-year review conducted under CERCLA.

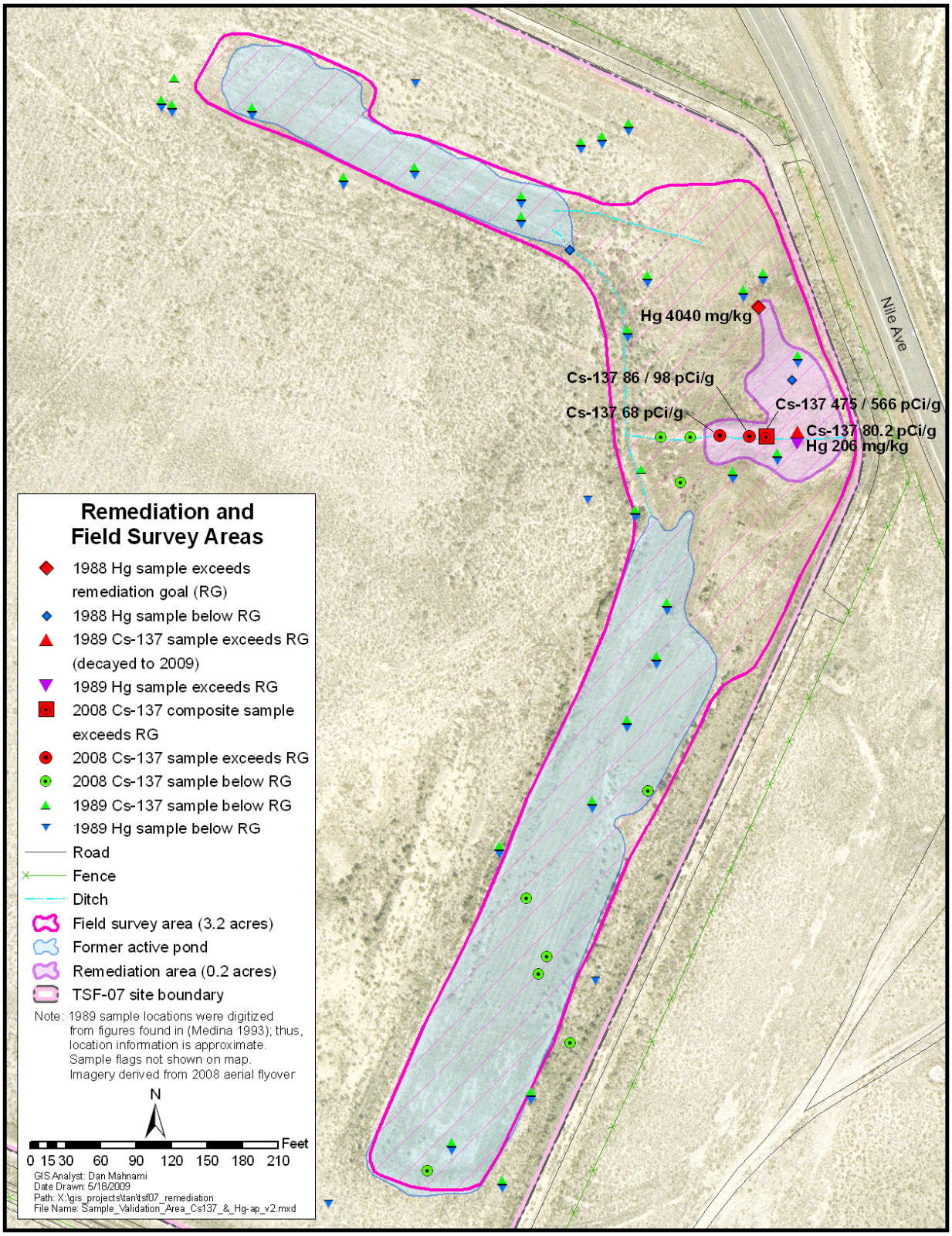

Figure 6. Remediation and field survey areas under Alternative 2.

4.3 Alternative 3—Containment

Alternative 3 consists of covering the contaminated site with a native soil cover. The native soil cover would consist of a layer of INL Site soil and surface vegetation or a layer of rock to control surface exposures to subsurface radionuclides. The cover would consist of 3.05 m (10 ft) of clean INL Site native soils, with surface vegetation, rock armor, or other suitable material. Major work elements include clearing and grubbing the site, establishing a compacted soil foundation, and then adding native soil to bring the total thickness above the contaminated soils to the minimum required thickness to inhibit biotic intrusion by plants and animals into mercury-contaminated soil.

Alternative 3 would also include environmental monitoring, cap integrity monitoring, and maintenance (e.g., repair of visible degradation, including cracks, erosion, biotic intrusion). Institutional controls would be required until Cs-137 decayed to acceptable levels. Similar to Alternative 2, the site will be posted with warning signs and periodically inspected. Five-year site reviews would be conducted to evaluate the effectiveness of the native soil cover and the need for additional environmental monitoring requirements.

5. ALTERNATIVE ANALYSIS

In accordance with the "Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA" (EPA 1993), alternatives are evaluated with respect to three criteria: (1) effectiveness, (2) implementability, and (3) cost. Public acceptance of the preferred alternative will be considered after the public has had an opportunity to review and comment on the EE/CA.

Effectiveness includes two threshold criteria: protectiveness and the ability to meet the applicable or relevant and appropriate requirement (ARARs). Implementability is evaluated based on technical feasibility; availability of equipment, personnel, services, and disposal facilities; and administrative feasibility. Costs are estimated, including capital costs, operations and maintenance costs, and present net worth costs.

The No Action alternative (Alternative 1) is included in this EE/CA for completeness. As discussed in Section 4.1, the No Action alternative cannot be considered a viable alternative because it does not satisfy RAOs or otherwise protect human health and the environment and is not considered further. However, the alternative is included for comparative purposes in the cost analysis.

5.1 Effectiveness of the Alternatives

The subcriteria for evaluating effectiveness are (1) protectiveness; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume through treatment; and (5) short-term effectiveness.

5.1.1 Overall Protection of Human Health and the Environment

Alternatives 2 and 3 are anticipated to provide effective, long-term protection of human health and the environment. For Alternative 2, the removal of soil contaminated with Cs-137 and mercury eliminates unacceptable exposure to a future resident and ecological receptors. Consolidation of contaminated soil with elevated levels of contamination within a controlled disposal facility where waste management controls are in place ensures personnel exposure is minimized. Although Alternative 3 would leave site contamination in place, the cap would result in protection of human health and the environment. The cap would contain Cs-137-contaminated soil while it decayed to acceptable levels and would prevent biointrusion into mercury-contaminated soil.

5.1.2 Compliance with ARARs and TBCs

Section 121 of CERCLA (42 USC § 9621) requires the responsible CERCLA implementing agency to ensure that the substantive standards of the Hazardous Waste Management Act/Resource Conservation and Recovery Act and other applicable laws will be incorporated into the federal agency's design and operation of its long-term remedial actions and into its more immediate removal actions. DOE Idaho is the implementing agency for this NTCRA. Both DEQ and EPA concur that an NTCRA is warranted to protect human health and the environment. Through the NTCRA process, the risks presented in this document will be mitigated in a timely manner. Table 4 lists the proposed ARARs that have been identified for Alternatives 2 and 3.

For Alternative 2, compliance with emissions control ARARs is ensured by performing excavation using water sprays and other techniques for dust suppression, as needed. An appropriate hazardous waste determination for soil that may contain hazardous wastes (e.g., toxicity characteristic metals such as mercury) must be performed to support onsite management, control, and disposal of soil. Both alternatives would meet DOE orders that are to be considered (TBC) for radioactive waste management and disposal. Institutional controls, consistent with EPA's "Region 10 Final Policy on the Use of Institutional Controls at Federal Facilities" (EPA 2006), will be implemented to control exposures from the site until the end of the institutional control window in 2095.

Wastes generated through implementation of Alternative 2 would be dispositioned at appropriate waste disposal facilities, either on or off the INL Site, in accordance with the WAC of those facilities. For contaminated soil/wastes generated during the action, the ICDF would be the preferred disposal location for wastes meeting the ICDF WAC.

5.1.3 Long-Term Effectiveness and Permanence

Long-term effectiveness and permanence are evaluated in terms of the ability of the alternatives to effectively control residual risk from the site and the reliability of the controls over time. Both alternatives would leave some contamination at the site, although Alternative 2 is designed to remove areas of soil contaminated with COCs above remediation goals and would therefore reduce site contamination to lower levels than Alternative 3. Alternative 3 primarily relies upon containment of contamination to prevent worker exposures and to inhibit biotic intrusion by plants and animals. Each alternative would achieve levels of residual risk that are protective of both human health and the environment and that satisfy the RAO that limits total human health excess cancer risk to 10^{-4} for workers and future residents.

Both Alternatives 2 and 3 would require access restrictions and institutional controls in order to be protective over time. Implementation of institutional controls for Alternative 3 would be more involved given the requirement to maintain and monitor effective performance of the cap; whereas, the controls for Alternative 2 are primarily limited to access controls (e.g., warning signs) until the end of the assumed institutional control window in 2095, at which point the Cs-137 contamination would have decayed to acceptable levels.

5.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The proposed alternatives do not rely upon treatment to achieve protection of human health and the environment. Alternative 2 may require treatment of toxic metals (e.g., mercury) in order to support disposal of contaminated soils off the INL Site. However, based on existing characterization information showing that metals did not exceed toxicity characteristic levels based on the 2008 sampling that was performed, it is not anticipated that treatment of the soils will be required.

Table 4. Summary of applicable or relevant and appropriate requirements for alternatives.

Requirement (Citation)	Alternative Applicability		Comments
	Alternative 2	Alternative 3	
Clean Air Act and Idaho Air Regulations			
"Toxic Substances," IDAPA 58.01.01.161	√		Applies to any toxic substances emitting during implementation of the removal action.
<10 mrem/yr, 40 CFR 61.92, "Standard"	√		Applies to the soil-handling activities.
"Emission Monitoring and Test Procedures," 40 CFR 61.93	√		Applies to the soil-handling activities.
"Compliance and Reporting," 40 CFR 61.94(a)	√		Applies to the soil-handling activities.
"Rules for Control of Fugitive Dust," and "General Rules," IDAPA 58.01.01.650 and .651	√	√	Applies to the soil-handling activities.
RCRA and Idaho Hazardous Waste Management Act			
Generator Standards:			
IDAPA 58.01.05.006, "Standards Applicable to Generators of Hazardous Waste," and the following, as cited in it:			
"Hazardous Waste Determination," 40 CFR 262.11	√		Applies to waste that would be generated during the removal action or to soil that may contain RCRA hazardous waste. Implementation of the action will include characterization to determine if soils require management as RCRA hazardous waste.
General Facility Standards:			
IDAPA 58.01.05.008, "Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," and the following, as cited in it:			
"Closure and Post-Closure Care," 40 CFR 264.310(a)(1) through (a)(5), 40 CFR 264.310(b)(1), and 40 CFR 264.310(b)(5)		√	Specific landfill closure performance criteria are included for the containment alternative as relevant and appropriate requirements due to the presence of toxic metals (e.g., mercury).

Table 4. (continued).

Requirement (Citation)	Alternative Applicability		Comments
	Alternative 2	Alternative 3	
"Temporary Units (TU)," 40 CFR 264.553	√		RCRA hazardous soil or waste may be treated or temporarily stored in a temporary unit prior to disposal.
"Staging Piles," 40 CFR 264.554	√		RCRA hazardous soil or waste may be temporarily staged prior to disposal.
"Use and Management of Containers," 40 CFR 264.171-178	√		Applies to containers used during the removal and treatment of hazardous waste.
Land Disposal Restrictions:			
IDAPA 58.01.05.011, "Land Disposal Restrictions," and the following, as cited in it:			
"Applicability of Treatment Standards," 40 CFR 268.40(a)(b)(e)	√		Applies to hazardous waste and secondary waste, if treatment is necessary to meet the disposal facility's WAC or if treatment is required before placement.
"Treatment Standards for Hazardous Debris," 40 CFR 268.45	√		Applies to hazardous debris, if treatment is necessary to meet the disposal facility's WAC or if treatment is required before placement.
"Alternative LDR Treatment Standards for Contaminated Soil," 40 CFR 268.49	√		Applies to contaminated soil, if treatment is necessary to meet the disposal facility's WAC or if treatment is required before placement.
To-Be-Considered Requirements			
"Radiation Protection of the Public and the Environment," DOE O 5400.5, Chapter II(1)(a,b)	√	√	Applies before, during, and after the removal action. Substantive design and construction requirements would be met to keep public exposures as low as reasonably achievable.
"Radioactive Waste Management," DOE O 435.1	√	√	Applies to the general decommissioning before, during, and after the removal action. Substantive design and construction requirements would be met to protect workers.

Table 4. (continued).

Requirement (Citation)	Alternative Applicability		Comments
	Alternative 2	Alternative 3	
"Region 10 Final Policy on the Use of Institutional Controls at Federal Facilities" (EPA 2006)	√	√	Applies to residual waste following completion of the removal action.

CFR *Code of Federal Regulations*
DOE Department of Energy
EPA Environmental Protection Agency
IDAPA Idaho Administrative Procedures Act
LDR land disposal restriction
RCRA Resource Conservation and Recovery Act
WAC waste acceptance criteria

5.1.5 Short-Term Effectiveness

In general, Alternative 2 poses higher risks to onsite workers for potential exposure to contaminants during implementation; however, radiation monitoring and control measures have been demonstrated to effectively mitigate risks in other INL Site removal actions and remedial activities. Equipment operator exposures would be minimized to the extent possible using established radiological control work practices and procedures that are designed to keep exposures as low as reasonably achievable (ALARA). Engineering (e.g., shielding) and administrative controls (e.g., respiratory protection equipment) would be implemented as appropriate based on applicable hazard analyses and approved work control documentation.

Controlling worker exposure during surveillance and maintenance and/or cleanup activities is based on (1) the current administrative control levels for worker radiation exposure (<700 mrem per year), (2) the goal of avoiding any significant increase in craft labor solely for the purpose of distributing estimated radiation exposures among more workers, and (3) the mandate that work be performed in accordance with the Idaho Cleanup Project radiation protection standards, the ALARA radiation exposure standard, and Integrated Safety Management System practices and guidelines.

Optimization techniques are used to ensure that worker radiation exposure is ALARA in accordance with 10 CFR 835, "Occupational Radiation Protection," and Integrated Safety Management System practices and guidelines. Evaluation of alternatives in the area of radiation protection includes meeting the requirements of DOE O 5400.5, "Radiation Protection of the Public and the Environment." In addition, worker radiation exposure is considered on a Site-wide collective basis, because overall exposure to the worker population must be addressed relative to administrative control levels.

Risks from physical hazards and typical industrial-type accidents must be mitigated for both alternatives. Implementation of appropriate hazard evaluation, planning, and work control measures for the excavation activities would be required to control these hazards to removal action workers. Significant experience at the INL Site performing similar remedial work has demonstrated that risk from such hazards can be effectively mitigated.

5.2 Implementability of the Alternatives

Implementability is evaluated based on technical and administrative feasibility and availability of equipment, personnel, services, and disposal facilities. Technical and administrative feasibility also considers any technical and administrative issues raised through consultation with state representatives.

5.2.1 Technical and Administrative Feasibility

Alternative 2 is technically feasible. The methods for performing these activities have been performed at the INL Site and can be planned and engineered using existing available knowledge and procedures. Existing on-Site disposal facilities are available to receive most of the waste to be generated by the activities. Use of the NTCRA process is an appropriate means to document the work, provide for public involvement, and obtain requisite approvals to perform the work. Alternative 3 is also technically feasible and is similar to other remedial alternatives that have been implemented at the INL Site. Alternative 3 is generally expected to be easier to implement than Alternative 2 due to reduced handling of contaminated soils and associated radiological work control requirements.

5.2.2 Availability of Equipment, Personnel, and Services

Equipment to support both alternatives is available at the INL Site. End-loaders and trackhoes are available on-Site as are transport trucks. Trained personnel are available to perform the soil removal and transportation function.

5.2.3 State and Community Acceptance

Preparation of this document has been coordinated with State of Idaho representatives. DEQ concurs that the proposed action is warranted to reduce potential for exposure to unacceptable levels of Cs-137 and mercury contamination and to protect human health and the environment. Community acceptance of the action will be assessed through evaluation of comments received on this EE/CA. Agency responses to significant comments received from the public will be documented in the Action Memorandum that will be part of the Administrative Record for the site.

5.3 Cost of the Alternatives

Cost estimates have been prepared for the alternatives evaluated in this EE/CA (Table 5). The estimates were prepared in accordance with "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study" (EPA 2000). Costs are calculated for both capital expenditures and future operation and maintenance expenses. EPA guidance requires that the cost for alternatives be calculated as present net worth costs, which are sometimes referred to as net present value, to represent the costs in current dollars. However, given the short schedule duration of the proposed alternative (i.e., less than 1 year), it is concluded that a present worth cost estimate is not relevant for this alternative.

Table 5. Cost estimates for the three alternatives.

	Cost of Alternatives		
Cost Element	Alternative 1 – No Action	Alternative 2 – Removal and Disposal with Institutional Controls[a]	Alternative 3 – Containment
Capital Costs	$0.0M	$2.02M	$4.0M
Operations and Maintenance Costs	$0.4M	$0.07M	$1.6M
Total Costs	$0.4M	$2.09M[b]	$5.6M[c]

a. Roseland (2009)
b. Costs in current dollars for Alternative 2 due to short duration for alternative implementation.
c. Cost in net present value as presented in (Blackmore et al. 1997).

For Alternative 1, all long-term maintenance of the ditch, berms, fences, and diversion structures is assumed to be terminated.. Because soil above risk-based levels would remain, the site will be monitored. Biotic and soil monitoring costs are included in Alternative 1 and are based on cost estimates for monitoring similar sites in the OU 10-08 Feasibility Study (Holdren et al. 2008).

Costs for Alternative 2 are primarily capital costs. Major capital costs include costs for construction-related tasks (excavation and transportation of soil), site surveying, radiological screening, revegetation, and demobilization of the site. Operation and maintenance costs relate to implementing required institutional controls during the period before 2095 when the Cs-137 contamination levels decay

to a point that unrestricted access to the site is possible. Operation and maintenance costs are based on costs developed under OU 10-08. Costs for Alternative 3 are based on cost estimate data developed for the Comprehensive Remedial Investigation/Feasibility Study for OU 1-10 (Blackmore et al. 1997).

5.4 Comparative Analysis Summary

Table 6 shows the results of analyzing Alternatives 2 and 3 for effectiveness, implementability, and cost. The No Action alternative is not included in the summary because it does not meet the criteria for effectiveness i.e., it is not protective of human health and the environment and it does not satisfy ARARs.

Table 6. Comparison of alternatives against removal action criteria.

Criteria	Alternative 2 – Removal and Disposal with Institutional Controls	Alternative 3 – Containment
Effectiveness	Addresses the proposed NTCRA objective.	Addresses the proposed NTCRA objective.
	Provides protection of human health and the environment and complies with ARARs.	Provides protection of human health and the environment and complies with ARARs.
	Reduces COC inventory associated with the site.	Poses less potential risk of radiological exposure to workers in the short term. Involves hauling large amounts of earthen materials for the cover, posing increased industrial risks.
	Operational features provide protection of workers and the public in the short term.	
Implementability	Alternative is feasible to implement. Involves hauling moderate amounts of earthen materials. Also involves easily implemented radiological control techniques for excavation and transportation.	Alternative is feasible to implement. Involves hauling large amounts of earthen materials.
Cost	Total cost = $2.09 million.	Total cost = $5.6 million.

ARAR applicable or relevant and appropriate requirement
COC contaminant of concern
NTCRA non-time-critical removal action

6. PREFERRED REMOVAL ACTION ALTERNATIVE

The preferred removal action alternative is Alternative 2 (Removal and Disposal with Institutional Controls). The preferred alternative meets the proposed RAOs regarding long-term risk, adequately controls short-term worker risk and radiation exposure, is more cost-effective, and provides an end state for TSF-07 that achieves protection of human health and the environment. The Agencies conclude Alternative 2 is consistent with the RAOs of the comprehensive WAG RODs and is compliant with ARARs. Wastes generated through implementation of Alternative 2 would be dispositioned at appropriate waste disposal facilities, either on or off the INL Site, in accordance with the WAC of those facilities. Performance of the proposed NTCRA will address surface soil contamination in an expedited manner relative to implementation of the action under the OU 10-08 ROD, thereby reducing potential risks earlier and ensuring effective use of available resources.

7. SCHEDULE

The proposed schedule for the non-time-critical removal action for the TSF-07 Disposal Pond is shown in Table 7. After the 30-day public comment period, the Agencies will publish an Action Memorandum, which responds to public comments and selects a removal alternative. If the Agencies select Alternative 2, DOE plans to start the removal action in August 2009. Depending on the extent of contamination found, soil removal could take up to 4 months. DOE will publish a removal action report in spring 2010. Institutional controls will be required until Cs-137 concentrations decay below risk-based levels, which will be no later than 2095.

Table 7. TSF-07 proposed schedule.

Activity	Date
Begin 30-day public comment period	May 22, 2009
Publish Action Memorandum	July 20, 2009
Begin soil removal	August 1, 2009
Finish soil removal	November 30, 2009
Publish removal action report	June 1, 2010

8. REFERENCES

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