Appendix E

History of Contamination, Initial Response, and Basis for Action

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Fifty-five release sites, in total, were evaluated in the *Comprehensive Remedial Investigation/Feasibility Study for Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory."* Eight of these sites were identified as having actual or threatened releases of hazardous substances that could present a possible threat to human health and the environment. The remaining 47 sites were determined to not represent an unacceptable risk to human health and the environment; therefore, these sites required no further action. The *Explanation of Significant Differences to the Record of Decision for Test Reactor Area Operable Unit 2-13* identified seven of the 47 sites, which were listed previously as no action sites, as requiring specific institutional controls to prevent a possible threat to human health and the environment.[b] The following paragraphs describe the contamination, the response taken, and the risk basis for the eight sites identified in the Comprehensive Remedial Investigation/Feasibility Study for Test Reactor Area (footnote a) and the seven sites added by the Explanation of Significant Differences (footnote b). The remaining 40 "no action" site determinations were based on the land use assumption made in the Final Record of Decision, Test Reactor Area, Operable Unit 2-13.' These assumptions were reviewed during completion of this 5-year review.

TRA-03: Warm Waste Pond (Sediments)

The Warm Waste Pond encompasses an area of approximately 1.71 ha (3.74 acres) and is located 27 m (90 ft) east of the Test Reactor Area (TRA) facility along the security fence. The Warm Waste Pond was comprised of three cells: (1) Cell 1952, (2) Cell 1957, and (3) Cell 1964 (named for the year in which each was constructed). All three cells received low-level radionuclides and Resource Conservation and Recovery Act (RCRA) listed hazardous, contaminated wastewater discharged from TRA reactor operations until 1993, when a lined evaporation pond replaced the Warm Waste Pond. In addition, radiologically contaminated material from the 1993 Operable Unit (OU) 2-10 interim action was placed into Cell 1952, and radiologically contaminated soil from the 1995 OU 10-06 removal action was placed in the 1957 cell. This contaminated soil from the OU 10-06 removal action originated from the North Storage Area, Boiling Water Reactor Experiment, Test Area North, and Argonne National Laboratory-West. Cells 1952 and 1957 also contain contaminated soil and asphalt from 1992 stockpiles and the contaminated structure formerly located east of Cells 1952 and 1957.

In the 1993 Warm Waste Pond interim action, sediments that exceeded 690 pCi/g for Cs-137 were removed from Cell 1964 and were placed into Cell 1952 along with material generated during the 1992

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a. DOE-ID, 1997a, *Comprehensive Remedial Investigation/Feasibility Study for the Test Reactor Area Operable Unit 2-13 at the Idaho National Engineering and Environmental Laboratory*, DOE/ID-10531, Revision 0, **U.S.** Department of Energy Idaho Operations Office. February 1997.

b. DOE-ID, 2000a, *Explanation of Significant Differences to the Record of Decision for Test Reactor Area Operable Unit 2-13.* DOEJID-10744, Revision 0, **U.S.** Department of Energy Idaho Operations Office, **U.S.** Environmental Protection Agency, and Idaho Department of Health and Welfare, Division of Environmental Quality, May 2000.

c. DOE-ID, 1997b, *Final Record of Decision, Test Reactor Area, Operable Unit 2-13,* DOEJID-10586, Revision 0, U.S. Department of Energy Idaho Operations Office, December 1997.

Warm Waste Pond removal action of the windblown soil contamination area. Cells 1952 and 1957 were covered with clean fill. Cell 1964 was covered with 10 ft of clean fill. Cell 1957 was not capped because it was to be used for disposal of other Idaho National Engineering and Environmental Laboratory (INEEL) radiologically contaminated soil. Data indicate that radionuclides were strongly adsorbed onto the surficial sediments and that soil contamination generally did not extend below a depth of 0.6 m (2 ft) below the bottom of the cells, for all cells.

Before the OU 2-13 remedial action, calculated excess cancer risks were greater than or equal to 10^{-04} for occupational exposure to external radiation from Co-60, Cs-137, Eu-152, and Eu-154 in the soil. Calculated excess cancer risks are greater than or equal to 10^{-04} for 100-year residential exposure to Cs-137.

TRA-06: Chemical Waste Pond

In 1962, the Chemical Waste Pond began operating as an unlined infiltration pond designed to receive chemical waste from a demineralization plant at TRA. The Chemical Waste Pond is located east of TRA, outside of the boundary fence. It received effluent at an average discharge of 15 gal/min; the effluent contained mineral salts, primarily calcium and magnesium carbonate. In addition, solid and liquid waste, including corrosives, was disposed of directly into the pond until 1982. It is estimated that an additional equivalent of three or four 55-gal drums were dumped into the Chemical Waste Pond. Records show that acid from the Central Facilities Area vehicle storage facility was drained directly into the Chemical Waste Pond in August 1992. Several releases of acid to the pond occurred in the late 1980s. These also were corrosive (D002), hazardous waste. It is not known if the releases in the late 1980s contained any other RCRA-characteristic hazardous waste (metals). The Chemical Waste Pond retained its land disposal unit status under the *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory,* because it had been used as a RCRA site.[d]

In 1990, sediments collected from the pond were analyzed for the metals known to be constituents of the effluent from the demineralization process. The analytes included silver, arsenic, barium, cadmium, chromium, copper, mercury, nickel, lead, selenium, and zinc. Only barium (3,830 mg/kg) and mercury (133 mg/kg) are present in the Chemical Waste Pond's sediments above background levels of 333.0 mg/kg and 0.02 mg/kg, respectively.

Release of RCRA-characteristic hazardous waste occurred in May and June 1995, when approximately 287,100 gal of liquid (used to neutralize and flush out-of-service acid and caustic tanks) was disposed of into the pond. After disposal, it was determined that the liquids contained 0.3 mg/L of mercury, which exceeds the 40 *Code of Federal Regulations* (CFR) 261.24 regulatory level of 0.2 mg/L.[e] Sample data collected during spring 1998 determined that the Chemical Waste Pond's sediments are not RCRA-characteristic hazardous waste. Before the remedial action, the hazard index for residential use was greater than or equal to 1 for mercury.

TRA-OS: Cold Waste Pond

The Cold Waste Pond (CWP) is located approximately 450 ft southeast of the TRA security fence's southeast corner. The pond has been a disposal site for nonradionuclide wastewater since its construction in 1982. The CWP consists of two cells (southern and northern) that were used for cold wastewater

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d. DOE-ID, 1991, *Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory,* Administrative Record *No.* 1088-06-29-120, **U.S.** Department of Energy Idaho Operations Office; **U.S.** Environmental Protection Agency, Region 10; Idaho Department of Health and Welfare, December 4, 1991.

e. 40 **CFR** 261.24, 2003, "Toxicity Characteristic," *Code of Federal Regulations,* Office of the Federal Register, February 2003.

disposal from cooling tower blow-down, air conditioning units, secondary system drains, floor drains, and other nonradioactive drains throughout TRA. Historically, only one of the two cells was used at a time, and flow of wastewater was alternated from one cell to the other on an annual basis. Radionuclides have been detected at concentrations slightly above INEEL background levels in several samples collected from the CWP. These low levels of radionuclides found in the CWP's berms are thought to result from windblown soil contamination rather than effluents discharged to the CWP.

Before the remedial action, the calculated occupational excess-cancer risk was greater than or equal to 10^{-04} for Cs-137, and the calculated 1,000-year residential excess cancer risk was greater than 10^{-04} for arsenic. The combined 1,000-year residential hazard index for arsenic, barium, mercury, and cadmium was equal to 1.0.

TRA-13 Sewage Leach Pond

The Sewage Leach Pond is located east of the TRA boundary fence. It consists of two cells: (1) Cell 1950 and (2) Cell 1965. Both cells received discharge from sanitary sewer drains. Process knowledge indicates that effluent was limited to domestic sewage (footnote a). However, low-level radionuclides were detected in the bottom of Cell 1950 and in a sludge pit located south of the Sewage Treatment Plant. The contamination source has been attributed to windblown soil contamination originating from the Warm Waste Pond. The Sewage Leach Pond was removed from service in 1995. Analytical data from the Sewage Leach Pond indicate that RCRA-characteristic hazardous waste was not present.

TRA-15: Soil Surrounding Hot Waste Tanks at TRA-613

The TRA-15 site is the location of underground Tanks 1 and 2 that leaked radiologically contaminated and possibly hazardous waste to surrounding soil. Four underground tanks are located at this site. Leaks from Tank 1 were determined to be the source of subsurface contamination identified in the 1993–1994 timeframe. The TRA-15 site also serves as a corollary €or release sites associated with the Hot Waste System. Calculated excess occupational and 100-year residential cancer risks are greater than or equal to 10^{-04} for Cs-137.

TRA-19: Soil Surrounding Radiological Tanks 1 and 2 at TRA-630

The TRA-19 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) site—the soil surrounding Tanks 1 and 2 at TRA-630 (near location 15 in Figure 3)—consists of subsurface soil contamination suspected to be caused by either leaks from a radionuclide-contaminated drain line originating at the Gamma Facility Building (TRA-641) or by releases from four underground catch tanks associated with the Materials Test Reactor. The four tanks from the Materials Test Reactor were contained on a bermed concrete pad. The tanks were removed and replaced with new ones in 1985 and 1986 and a concrete vault constructed using the existing concrete pad. The original tanks were found to be intact upon removal and, though the outside surface appeared to be degrading, the fiberglass liners had not been breached. Therefore, no releases from the tanks were suspected. However, several spills inside the new vault had been reported from pipe-cutting operations during tank removal, from reconnecting pipelines to the new tanks, and from a damaged waste drain line running from the TRA-641 building, possibly accounting for the contamination. Calculated excess occupational and 100-year residential cancer risks are greater than 10^{-04} for Cs-137.

Sewage Leach Pond Berm and Soil Contamination Area

The Sewage Leach Pond berm and soil contamination area is a fence-enclosed radiation control area surrounding the Sewage Leach Pond, approximately 475 x 480 ft. The source of the surface soil

contamination has been attributed to windblown soil contamination originating from the Warm Waste Pond. Analytical data from the Sewage Leach Pond berm and soil contamination area indicate that no RCRA-characteristic hazardous waste was present.

During the 1993 interim action at the Warm Waste Pond, Cs-137 hot spots were excavated from the Sewage Leach Pond berm. The excavated, contaminated soil was placed in Warm Waste Pond Cell 1952.

Before remedial action of the Sewage Leach Pond berm, calculated excess occupational cancer risks were greater than 10^{-04} for Cs-137 and Co-60 (less than 30 years for Co-60). The calculated excess 100-year residential cancer risks were greater than 10^{-04} for Ag-108m and Cs-137. The calculated hazard indices were greater than 1 for Zn and Hg.

The soil Contamination area surrounding the Sewage Leach Pond has a calculated excess occupational risk greater than 10^{-04} for less than 30 years. The excess 100-year residential cancer risk is acceptable at less than 10^{-04}.

Brass Cap Area

The Brass Cap Area is located in the center of TRA, near the TRA-630 building, and southeast of Site TRA-19 between TRA-635 and TRA 632. A brass marker was placed in the concrete to designate the area of subsurface contamination. The radionuclide contamination in the soil at this site is attributed to leaking warm-waste lines. The contamination under the concrete was determined to extend to approximately 10 ft below ground surface. After the contamination was discovered, the leaking waste line was repaired and contaminated soil in the immediate proximity of the repaired waste line was removed. The excavation was backfilled with clean soil and resurfaced with concrete.

Calculated excess occupational and 100-year residential cancer risks are greater than 1E-04 for Cs-137. Calculated excess occupational cancer risks also are greater than 1E-04 for Co-60 for less than 30 years.

Polychlorinated Biphenyl Spill at TRA-619

This site is located in TRA's northeastern portion, on the east side of the TRA-619 building. A transformer that used polychlorinated biphenyl-containing oil operated from about 1960 until it was replaced in 1983. The old transformer leaked oil onto the concrete pad and surrounding soil. Soil samples collected in 1989 indicated that polychlorinated biphenyls (PCBs) were present in the soil around the concrete pad at concentrations up to 360.5 parts per million (ppm). In November 1990, approximately 12 yd' of soil was removed from around the transformer pad. The excavated area extended 1 ft beyond the pad on all sides and approximately 3 ft below ground surface. The confirmation soil samples collected subsequent to the excavation indicated that the highest PCB concentration was 22 ppm in the soil surrounding the concrete pad, which is less than the 25-ppm action level for industrial areas, but greater than the 10 ppm allowed for unrestricted use.[f] The excavation area was backfilled with a minimum of 0.6 m (2 ft) of clean soil.

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f. 40 CFR 761.125, 2003, "Requirements for PCB **Spill** Cleanup," ***Code*** of ***Federal*** *Regulations*, Office of the Federal Register, **April** 2003.

Polychlorinated Biphenyl Spill at TRA-626

This site is a PCB spill located in TRA's east-central portion, near the northeast comer of the TRA-626 building. A pyranol-unit substation transformer was present here from about 1956 to 1988. Pyranol transformer oil contains equal parts of trichlorobenzene and PCBs. The transformer leaked oil onto the concrete pad and surrounding soil. Though trichlorobenzene was not analyzed, the *Preliminary Scoping Track 2 Summary Report for the Test Reactor Area Operable Unit 2-04: Fuel Spills* stated that since trichlorobenzene is a volatile organic compound, complete volatilization was expected in the INEEL's desert conditions.[g] Analysis of soil samples collected in 1989 indicated that PCBs were present in concentrations greater than the 25-ppm action level for industrial areas, but greater than the 10 pprn allowed for unrestricted use (40 CFR 761.125). In 1990, the concrete pad and some contaminated soil, totaling 28 yd^3 of material, were removed. Analysis of post-excavation soil samples indicated that nine samples had PCB concentrations greater than 25 ppm, and an additional 9 yd^3 of soil was removed. The second set of post-excavation soil samples indicated that the highest soil PCB concentration was 24 ppm. The excavation was backfilled with 4 ft of clean soil.

Polychlorinated Biphenyl Spill at TRA-653

This CERCLA site is a PCB spill located in TRA's south-central portion, which is on the north side of the TRA-653 building. A transformer that used oil-containing PCBs operated from about 1960 until its replacement in 1980. The transformer leaked oil onto the concrete pad and surrounding soil. Both the transformer and the concrete pad were removed in 1980, and a replacement transformer was installed on a new pad. Soil samples collected in 1989 indicated that PCBs up to 107.2 ppm were present in the soil around the replacement pad. In September 1990, approximately 8 yd^3 of soil was removed from three sides of the existing pad. No soil was excavated from the 2-ft-wide area between the building and the pad, where PCBs had been detected at only 2 ppm. The second set of post-excavation soil samples indicated that the highest PCB concentration was 16 ppm, which is greater than the 10 ppm allowed for general unrestricted use (40 **CFR** 761.125[4]). The excavation was backfilled with approximately 2 ft of clean soil.

TRA-04: Warm Waste Retention Basin

The Warm Waste Retention Basin is located in TRA's southeastern portion, which is south of the TRA-636 building and is a large, rectangular underground concrete structure divided into two cells. It is buried 10 ft below ground surface and holds 720,000 gal of liquid. The basin retains wastewater in route to the Warm Waste Pond, in order to delay passage and allow time for short-lived radionuclides to decay. Waste was transferred to the Warm Waste Pond by several different pipelines and, at one time, through the sump pump pit. The basin was leaking from sometime in the 1970s to 1993, including pipeline leaks and leaks from the basin at an estimated rate of 86,000 gal/day, allowing contamination to enter the perched water zone. Waste streams discharged to the Warm Waste Retention Basin had concentrations of metals and radionuclides that could result in unacceptable levels of contamination in sediments contacting these liquids. It was removed from service in August 1993, with the exception of the north end, which is the collection point for wastewater discharged to the new evaporation pond (TRA-715). Flow paths from the inlet sump to the Warm Waste Retention Basin were isolated to prevent further leakage; this was accomplished by grouting the weirs closed, which effectively isolated the two sections of the basin.

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g. Sherwood, J., R. Filemyr, D. Meadows, and J. Tucker, *1994, Preliminary Scoping Track 2 Summary Report for the Test Reactor Area Operable Unit 2-04: Fuel Spill,* **EGG-ER-11110,** Revision *2,* Idaho National Engineering and Environmental Laboratory, March **1994.**

The current excess cancer residential cancer risk is greater than 10^{-04} for 10 ft and less for 30 years due to potential exposure to Co-60 and Cs-137. Risk evaluation was not done for contamination at 40 ft deep, where contamination is suspected.

TRA-34: North Storage Area

The TRA-34 is located immediately north of the TRA facility's security fence and encompasses an area of approximately 2.25 acres. This area was used to temporarily store equipment and materials (such as reactor parts, pumps, and casks). It is divided into two sections: (1) the Hot Storage Area and (2) the Cold Storage Area. The Hot Storage Area was used to store material with low-level radionuclide contamination, and the Cold Storage Area was used to store nonradiologically contaminated equipment and material, which often contained lead bricks, cadmium sheets, chunks of concrete, and wood scraps.

A gamma radiation survey, which was conducted in 1992, indicated that the soil in both the Hot Storage Area and Cold Storage Area was contaminated with radionuclides (Ag-108m, Cs-137, and Eu-152). The source of contaminated soil in the Hot Storage Area and the Cold Storage Area is suspected to result from the storage of lead bricks, lead shot, and cadmium fuel grids. Though the surface of the North Storage Area is covered with soil, vegetation is sparse and the potential exists that contamination could be transported outside the boundary of the North Storage Area by high winds. Some soil was removed in the summers of 1995 and 1996, which reduced the risk at this site. The calculated excess current residential cancer risk is greater than 10^{-04} for silver-108m, Cs-137, and Eu-152.

Hot Tree Site

The TRA-43 CERCLA site, Hot Tree Site, is located in the center of TRA, west of the TRA-649 building. Screening of the spruce tree's branches indicated that it had been contaminated with gamma-emitting radionuclides. The tree was removed, boxed, and disposed of in May 1994. After removal of the tree, soil borings were collected for field screening approximately 2 ft below ground surface in the area of the tree. In addition, the root system was surveyed. Three additional surface soil samples were collected and submitted to the Radiation Measurements Laboratory for analysis. The results of sampling were evaluated in the OU 2-13 baseline risk assessment. The risk assessment showed that an unacceptable risk does not exist at this site because of low contaminant concentrations in the soil. The calculated current residential excess cancer risk is greater than 1E-04 for 30 years due to potential exposure to Cs-137. The highest radiologically contaminated area was west of the tree, indicating that an abandoned warm waste line was the source of contamination. The warm waste line is a carbon-steel line that originated from the Gamma Facilities Building (TRA-641), approximately 3 m (10 ft) west and 1.8 m (6 ft) bgs from the tree site. Waste transferred through the line consisted of low-pressure, demineralized acidic water. The waste's acidic condition could have contributed to the deterioration of the line. The line was cut and capped in 1983, and it is no longer expected to be a potential source of contamination. Since it is believed that the line was drained and there was no leak test performed, this line was submitted for evaluation and acceptance under the ***Federal Facility Agreement and Consent Order for the Idaho National Engineering Laboratory*** as new CERCLA Site ID# TRA-61 on March 9, 2000. It was recommended that this site did not meet the criteria for acceptance as a new site. The responsible project managers concurred with this recommendation between March 21 and April 2, 2001.

Perched Water and Snake River Plain Aquifer

This CERCLA site is comprised of the perched water and the **SRPA** that underlies the TRA facility and surrounding areas. The perched water zones and SRPA underlying TRA are contaminated due to infiltration and injection of wastewater from the network of multipurpose ponds, retention basins, leaking pipes, and injection wells (USGS-53 and TRA-Disposal).

The perched water bodies are present because about 200 million gal/year of water has been sent to the TRA disposal ponds over the past several decades. A major contributor to contamination in the perched water bodies resulted from discharges to the Warm Waste Pond. The Chemical Waste Pond also contributed to the perched water system until it was removed from service in 1998. Persistence of the perched water is due, in large part, to the Cold Waste Pond currently receiving an average of about 380 gpm annually of uncontaminated wastewater.

Well USGS-53 was completed to 90 ft below ground surface in 1960 and was used for wastewater disposal intermittently between November 1960 and September 1964. Water believed to contain chromates was injected at a reported rate of 100 gpm. Calculations of the injection rate over the operational periods indicate that 220 million gal of wastewater might have been disposed of.[h] Currently, the well is used as a monitoring well, which has been predominantly dry since April 1995.

The TRA-Disposal well is located at the TRA facility's southeast corner, approximately 100 ft north of the Warm Waste Retention Basin. The TRA-D was completed to a depth of 1,271 ft below ground surface in 1963 and screened with 0.25-in. slots from 1,267 to 1,182 ft below ground surface. In November 1964, it entered service. Injection testing in early May 1964 revealed that the well provided insufficient capacity under gravity flow conditions. Additional perforations in the well casing were made in July and August 1964. The perforations were made between 1,070 and 930 ft below ground surface. During the installation of the perforations, the well casing was severed at 1,005 ft below ground surface. Injection tests conducted in August 1964 revealed that the well's capacity was still insufficient. Then, in August 1964, perforations were added from 697 to 512 ft below ground surface. The addition of the second set of additional perforations provided for an overall flow rate of over 1,000 gpm, making the well suitable for daily operations. Disposal began at TRA-D in November 1964. Injection testing indicated that 95% of the injected water discharged into the 590- to 512-ft-below ground surface interval. The TRA-D was removed from service in 1982. The well is now used to monitor the Snake River Plain Aquifer's water level and water quality. Approximately 3,889 million gal of wastewater was disposed of in TRA-D, containing an estimated 14,121 kg of Cr (VI).[i]

An investigation of the perched water zones began in 1990, and the *Record of Decision, Test Reactor Area Perched Water System, Operable Unit 2-12, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho* was issued in December 1992.[j] Based on groundwater modeling and the risk assessment, a determination was made in the OU 2-12 Record of Decision that no remedial actions were necessary to ensure protection of human health and safety and the environment. Groundwater monitoring was mandated to verify that contaminant trends followed the modeled predictions.

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h. Doornbos, Martin H., Julie L. Mattick, Deborah L. McElroy, Leah V. Street, Carolyn S. Blackmore, and Craig A. Dicke, 1991, *Environmental Characterization Report for the Test Reactor Area*, EGG-WM-9690, Revision 0, Idaho National Engineering and Environmental Laboratory, September 1991.

i. Hull, L. C., 1989, *Conceptual Model and Description of the Affected Environment for the TRA Warm Waste Pond (Waste Management Unit TRA-03)*, EGG-ER-8644, Revision 0, Idaho National Engineering and Environmental Laboratory. October 1989.

j. DOE-ID, 1992, *Record of Decision, Test Reactor Area Perched Water System, Operable Unit 2-12, Idaho National Engineering and Environmental Laboratory, Idaho Falls, Idaho*, Doc. Id. 5230, Revision 0, U.S. Department of Energy Idaho Operations Office, December 1992.