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UCRL-AR-128728

Action Memorandum for an Emergency Removal Action at the National Ignition Facility Construction Site, Lawrence Livermore National Laboratory Livermore Site

Technical Editors

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L. L. Berg*

Technical Contributor

D. W. Peifer

February 1998

*Weiss Associates, Emeryville, California

Environmental Protection Department
Environmental Restoration Division

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United States Government **Department of Energy**

memorandum

Date: February 2, 1998

Subject: Emergency Removal Action at the National Ignition Facility Construction Site

From: James Littlejohn, ERD

To: James T. Davis, AMEM

Thru: Joe Cullen and Mike Brown, ERD

1. Purpose

This Action Memorandum follows U.S. Environmental Protection Agency (EPA) guidance (EPA, 1990) and documents for the Administrative Record the Department of Energy's (DOE's) removal and disposal of 112 capacitors and about 766 tons of soil containing polychlorinated biphenyls (PCBs) under an emergency removal action at the National Ignition Facility (NIF) construction site at the Lawrence Livermore National Laboratory (LLNL) Livermore Site (Figs. 1 and 2). The Livermore Site is owned by the U.S. Department of Energy (DOE) and operated by the University of California.

This emergency removal action was executed by DOE/LLNL in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA). DOE/LLNL reported the status of the emergency removal action at the September 9, 1997 Remedial Project Managers' (RPMs') meeting among DOE, EPA, California Department of Toxic Substances Control (DTSC), and the Regional Water Quality Control Board-San Francisco Bay Region (RWQCB). The regulatory agencies concurred with DOE/LLNL's decision to initiate the removal of the capacitors, as specified under the National Oil and Hazardous Substances Contingency Plan (NCP) as prescribed in 40 CFR, Section 300.415. Because this removal action will be funded by DOE, it is not subject to the fund-financed duration and cost limitations of $2 million per 12 months prescribed in 40 CFR Section 300.415(a)(5).

2. Site Conditions and Background

The emergency removal action was conducted in response to environmental and safety concerns related to previously unknown and undocumented buried waste discovered at the NIF construction site. The NIF construction site is located on LLNL property, a CERCLA (Superfund) site (CERCLIS ID# CA2890012584). The waste subject to this removal action was discovered during excavation of the foundation of the NIF building.

2.1. Site Description

The Livermore Site description, history, contaminant distribution, and characterization are presented in the Remedial Investigation report (Thorpe et al., 1990), the Feasibility Study (Isherwood et al., 1990), and the Record of Decision (DOE, 1992). The LLNL Livermore Site is a research and development facility owned by DOE and operated by the University of California, located approximately 45 miles east of San Francisco, and three miles east of the downtown area of Livermore, California (Fig. 1). The Livermore Site comprises approximately 800 acres.

Hills of the Diablo Range flank the site to the south and east. The site is underlain by several hundred feet of interbedded alluvial and lacustrine sediments. Ground water beneath the site varies from about 130 ft in the southeast corner to about 25 ft in the northwest corner. Ground water about two miles west of the site is used for the municipal supply of downtown Livermore. Ground water south and west of the site is used for domestic and agricultural irrigation. Two intermittent streams, Arroyo Seco and Arroyo Las Positas, traverse the area and recharge the ground water during wet periods.

The Livermore Site was converted from agricultural use by the U.S. Navy in 1942. The Navy used the site until 1946 as a flight training base and for aircraft assembly, repair, and overhaul. Solvents, paints, and degreasers were routinely used during this period. Between 1946 and 1950, the Navy housed the Reserve Training Command at the site. In 1950, the Navy allowed occupation of the site by the Atomic Energy Commission (AEC), which formally received transfer of the property in 1951. Under the AEC, the site became a weapons design and basic physics research laboratory. In 1952, the site was established as a separate part of the University of California Radiation Laboratory. Responsibility for the site was transferred to the Energy, Research, and Development Administration in 1975. In 1977, responsibility for LLNL was transferred to DOE, which is currently responsible for the site.

The Livermore Site was placed on the EPA National Priorities List (Superfund) in 1987 following discovery of solvent contamination in ground water. Ground water is used as a drinking water source about two miles west of the site. Contamination from solvents, gasoline, chromium, and tritium exists in the soil and ground water. The site has an active community group, which is led by Tri-Valley Citizens Against a Radioactive Environment (CAREs).

The first ground water was treated at the site as part of a treatability study. The Record of Decision (DOE, 1992) was signed in August 1992 and describes technologies and cleanup levels to be used for cleanup. Ground water pump and treat and soil vapor extraction were selected to remediate the water and soil, respectively. The submittal of treatment system designs started in 1992, with only one design not finalized at this time. Currently operating are four permanent

ground water treatment facilities and seven portable treatment units that treat about 25 million gallons of ground water per month. The portable treatment units have many advantages, including the flexibility to be located at contaminant source areas to accelerate contaminant removal, and save permanent pipeline and building costs. One vapor extraction treatment facility is currently operating at the Livermore Site. At least 18 ground water treatment locations and one additional vapor treatment facility are planned for operation in the future.

Technologies used at the site have included pump and treat (air stripping, ultraviolet light/oxidation) for organics in ground water, ion exchange for metals in ground water, soil vapor extraction for organics in soils, dynamic underground steam stripping for gasoline in ground water and soil, and the portable treatment unit, which is a mobile, containerized ground water pump and treat system.

The waste subject to this Action Memorandum consists of buried capacitors containing PCBs and PCB-contaminated soil. Drums containing concrete were also unearthed near the capacitors (Fig. 3), but are not subject to this removal action because chemical analyses determined that they were nonhazardous substances. The undocumented landfill containing the capacitors was unlined, and the PCB-capacitor waste was subsequently covered with fill after placement.

2.1.1. Removal Site Evaluation

During September 3–12, 1997 (LLNL, 1997), 112 capacitors containing PCBs were unearthed at the NIF construction site located in the northeast quadrant of the LLNL Livermore Site (Figs. 2 and 3). The capacitors and about 766 tons of PCB-contaminated soil were removed and managed as Toxic Substances Control Act (TSCA) hazardous waste.

On September 3, 1997, at approximately 4:45 p.m., four electrical capacitors were unearthed at depths of 10–15 feet in a test pit excavated at the NIF construction site. Three of the capacitors were brought to the surface during excavation and one capacitor remained in the test pit. A 6-ft-diameter area of wet soil was observed around the capacitor remaining in the test pit. One of the capacitors brought to the surface appeared to be damaged and leaking. Information obtained from identification plates on the capacitors indicated that they contained Diaclor, a PCB oil. Handwritten markings on the capacitors indicated that they were removed from service in January 1964.

The affected areas (Fig. 3) included: (1) the capacitor excavation, which included the removed soil, soil removal equipment, and immediate surrounding area, and (2) the western excavation where an additional exploratory excavation test pit found no additional waste but is where the PCB-contaminated backhoe was used. All construction work in and around the affected areas was stopped and the areas were cordoned off and posted with warning signs. On September 3, 1997, it was determined that the amount of PCBs released exceeded the CERCLA reportable quantity of one pound, and verbal reporting of the incident was made to the CERCLA National Response Center, the California Office of Emergency Services, and the Alameda County Environmental Health Department as required by CERCLA and the California Health and Safety Code. Additional verbal reporting to the RWQCB occurred on September 4, 1997 as required by the Porter–Cologne Water Quality Control Act. Although the total amount of PCBs released is not known, it was later determined that the amount of PCBs released exceeded the Toxic Substances Control Act (TSCA)

reportable quantity of 10 pounds; therefore, verbal notification was made to EPA Region IX on September 5, 1997.

Cleanup was initiated within 24 hours after discovery of the capacitors pursuant to the TSCA cleanup policy. A cleanup plan was prepared including post-cleanup verification sampling. On September 9, 1997, the Livermore Site CERCLA regulatory agencies agreed that oversight and cleanup of the PCB contamination would be regulated under CERCLA authority. The regulatory agencies concurred with DOE/LLNL's decision to initiate the removal of the capacitors and agreed with DOE/LLNL's methodology to identify areas requiring remediation and for confirmatory sampling to verify cleanup. The regulatory agencies agreed that the soil cleanup standard (less than 25 parts per million [ppm] PCBs, following TSCA guidance) was appropriate for soil that would be used in the NIF construction project. It was later determined that none of the excavated material met the engineering specifications for use as fill material; therefore, all soil containing PCBs at or over 1 ppm was removed and managed as TSCA hazardous waste.

A total of 112 capacitors were removed from an excavated trench approximately 20-ft wide, 70-ft long, and 17-ft deep. The highest concentration of PCBs detected in soil was 66 ppm. The capacitors were placed in plastic-lined 55-gal drums, moved to LLNL's Hazardous Waste Management TSCA storage facility, and managed appropriately as TSCA waste. The PCB-contaminated soil was placed in 36 trucks operated by registered hazardous waste haulers and shipped to Laidlaw Environmental Services, Grayback, Utah for disposal as TSCA waste. The capacitors were subsequently shipped to Laidlaw Environmental Services-Aptus, Clive, Utah for incineration.

All of the potentially affected soil remaining on the construction site (including the clean overburden that covered the capacitors, the soil from the western excavation, the soil remaining in the capacitor trench after cleanup, and the ground surface in the potentially contaminated areas) was managed consistent with environmental regulations until certified analytical samples indicated that the soil did not contain PCBs (at or above 1 ppm). The clean stockpiled soil will be reused in the NIF construction excavation or in other LLNL Plant Engineering identified projects at the Livermore Site. The excavation equipment was decontaminated and sampled before being removed from the site.

The PCB soil contamination did not extend deeper than 17 ft and did not represent a threat to the ground water, which is approximately 60-ft deep in this locality. The controls established after unearthing of the capacitors mitigated any potential hazard to human health or the environment. All appropriate safety precautions were used to prevent exposure to workers involved with this removal. The complete removal and cleanup of the area ensures that there will be no threat to human health or the environment from these sources in the future.

2.1.2. Physical Location

Land immediately north of the Livermore Site is zoned for industrial use. To the west, the land is zoned for high-density urban use. Sandia National Laboratories, California is located south of the site in an area zoned for industrial development. The area east of LLNL is zoned for agriculture and is currently used as pasture land. With the exception of the red-legged frog, no threatened or endangered species are found at the LLNL Livermore Site. Wetlands are very limited at the Livermore Site and are confined to Arroyo Las Positas along the northern perimeter of the site.

The NIF construction site is located in the northeastern portion of the Livermore Site (Fig. 2). The capacitors were discovered at the southwest area of the NIF building footprint and the closest occupied permanent building to the site is Building 571, Human Resources, which is about 350 ft away (Fig. 3). A frequently traveled road (North Inner Loop Road) is located immediately west of the site.

2.1.3. Site Characteristics

The NIF construction site is located on a large open field in the northeastern portion of the Livermore Site. Topography in the area has changed to some degree over years the site has been used by the U.S. Navy and subsequently LLNL. Depth to ground water in the vicinity of the capacitors is about 60 ft. Construction debris (concrete, rebar, etc.) from prior dumping was anticipated to be found in this area based on previous findings, although no evidence of a landfill containing hazardous waste was identified from historical aerial photographs, source investigations, or ground water monitoring.

2.1.4. Release or Threatened Release of Hazardous Substances, Pollutants, or Contaminants

The capacitors were found under 10 to 15 ft of soil as if stacked and buried in place, but were compromised by rusting and many were leaking when excavated. Soil samples were analyzed for PCBs from the capacitor excavation, western excavation, overburden, and the ground surface in affected areas. Swipe samples were also collected from the equipment after decontamination. Samples collected for metals analyses using Total Threshold Limit Concentration and Soluble Threshold Limit Concentration methodology indicated no elevated metals concentrations. Analytical results are presented in Appendix A. Some samples were analyzed onsite by a uncertified laboratory for screening purposes so timely decisions could be made on the soil disposition. About 29% of the samples analyzed for PCBs were sent to an offsite certified laboratory prior to making decisions regarding additional soil excavation and handling and shipping of soil. Soil samples from the floor of the capacitor excavation were analyzed by a certified laboratory; some duplicate samples from the same location were analyzed onsite (Table A-1; Fig. A-2). The affected areas and equipment were cordoned off to restrict access and prevent the spread of PCB contamination to other areas.

Although the total amount of PCBs released is not known, over 10 pounds of PCBs are believed to have been released to the soil both from rusting of the capacitors and physical damage during excavation. PCBs in soil are classified as hazardous substances, as defined by Section 101(14) of CERCLA, 42 U.S.C. Section 9601 (14), and the National Contingency Plan (NCP), 40 CFR Part 300; and are pollutants or contaminants as defined by Section 101(33) of CERCLA, 42 U.S.C. Section 9601 (33). The presence of these substances in site soils indicates an actual release of hazardous substances into the environment, as defined by Section 101(22) of CERCLA, 42 U.S.C. Section 9601 (22).

PCBs are known to be hazardous to human health and the environment at extremely low levels because they decompose very slowly and are characterized by bioaccumulation and biomagnification (EPA, 1980). PCBs can enter the body through the lungs, the gastrointestinal tract, and the skin. Tests on laboratory animals have shown reproductive failures, birth defects,

gastric disorders, skin lesions, swollen limbs, cancers, tumors, and eye and liver disorders (EPA, 1980). Due to the potential hazards associated with PCBs and potential exposure to construction workers and wildlife in the immediate area, an emergency removal action was implemented immediately.

Ground water elevation data indicate that ground water is about 60 ft below ground surface. No PCBs have been detected in ground water collected from boreholes 100 to 200 ft from the NIF construction site. The localized soil contamination, confirmed by analytical results from the affected area, indicates that the PCB contamination while buried could not be dispersed by wind or surface water, and did not represent a threat to ground water due to its immobility.

2.1.5. National Priorities List Status

The Livermore Site was placed on the National Priorities List in July 1987. A Federal Facility Agreement (FFA) for remediation of the Livermore Site was signed by DOE, EPA, DTSC, and RWQCB in November 1988, and a Record of Decision was signed by DOE and EPA in August 1992. Current ground water activities include ground water remedial action at four permanent ground water treatment facilities and seven portable treatment units. One soil vapor extraction treatment facility is currently operating at the Livermore Site. Six design documents for nine treatment facilities have been submitted to the regulatory agencies over the past five years, and all but one has been finalized. All planned remedial actions have commenced, with the exception of additional portable treatment units and ground water and vapor treatment facilities in the Trailer 5475 area.

2.1.6. Maps, Pictures, and Other Graphic Representations

The NIF construction site, the location of the buried capacitors, the drum removal area, and the western excavation area are presented in Figures 2 and 3.

2.2. Other Actions to Date

2.2.1. Previous Actions

Previous source investigation work in and near the area included exploratory boreholes, soil vapor surveys, geophysical surveys, document research, aerial photograph review, and personnel interviews. Removal actions were previously conducted in nearby areas where unsaturated zone contamination posed a threat to ground water.

Aerial photographs and previous excavations in the general area (e.g., for rerouting pipelines) identified construction (concrete and rebar) and gardening debris in the NIF construction area. None of the debris was anticipated to be hazardous, toxic, or radioactive.

2.2.2. Current Actions

Excavation for the NIF experimental building is completed. Construction of the laser and target area building and optics assembly building has been initiated. Excavation for underground utility installations is scheduled to begin in February 1998. DOE/LLNL are reviewing all prior source investigations and subsequent remediation data to determine if additional surveillance field

work is warranted. Ground water monitoring in the area is ongoing to assess if there are unknown sources that impact ground water quality. A closeout report with this information was released in draft form in November 1997.

2.3. State and Local Authorities' Roles

2.3.1. State and Local Actions to Date

Environmental investigation activities at the Livermore Site are performed under the FFA and CERCLA. The State regulatory agencies, DTSC and RWQCB, as well as the EPA are part of the RPM team that oversees investigations and cleanup activities performed at the Livermore Site. As discussed in Section 2.1.1, the RPMs were briefed on the discovery at the September 9, 1997 RPM meeting and concurred with DOE/LLNL's decision to initiate the removal of the capacitors.

2.3.2. Potential for Continued State/Local Response

No State or local response actions are anticipated other than continued oversight of site cleanup activities under CERCLA. DOE will provide the necessary funding and support for the removal action and remediation of the Livermore Site under its responsibility.

3. Threats to Public Health or Welfare or the Environment

In accordance with the NCP (40 CFR, Section 300.415), the following criteria must be considered in determining the appropriateness of a removal action in addressing threats to public health or welfare or the environment:

(i)* Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.

(ii) Actual or potential contamination of drinking water supplies or sensitive ecosystems.

(iii)* Hazardous substances or pollutants or contaminants in drums, barrels, tanks, or other bulk storage containers, that may pose a threat of release.

(iv) High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate.

(v) Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

(vi) Threat of fire or explosion.

(vii) Other situations or factors that may pose threats to public health or welfare or the environment.

Criteria indicated with an asterisk (*) are relevant and were considered in determining the appropriateness of this emergency removal action for protection of public health and welfare and the environment, and are discussed in Sections 3.1 and 3.2.

3.1. Threats to Public Health or Welfare

Subsections (i) and (iii) in Section 3 apply to this emergency removal action. As discussed in Section 2.1.4, PCBs are known to be hazardous to human health and the environment at extremely low levels. During the time of discovery, about 30 workers were in the area associated with the NIF construction. Although no injuries occurred, workers and local habitat could have been impacted by exposure to PCBs and PCB-bearing soil. PCBs remaining in the deteriorating capacitors prior to disposal posed a potential threat of release. The primary objective of the removal action was to quickly and safely remove the PCBs to eliminate potential exposure and safety threats to onsite workers. Workers performing the cleanup used appropriate levels of personal protective equipment (PPE) and all equipment used in the excavation were thoroughly decontaminated upon completion.

3.2. Threats to the Environment

If not removed immediately, the capacitors would most likely have continued to deteriorate and release PCBs into adjacent soils, thereby increasing the extent of soil contamination and potential ground water contamination in the future. The potential threat of release is relevant to Subsection (iii) of the criteria for determining the appropriateness of a removal action, as discussed in Section 3.

4. Endangerment Determination

Once the capacitors and PCB-contaminated soil were discovered, the actual or threatened releases of hazardous substances from the NIF construction site could have presented an imminent and substantial endangerment to public health or welfare, or the environment if not addressed by implementing the emergency removal action discussed in this Action Memorandum. Isolation of the waste without disposal would have provided only a temporary solution to the threats posed at this locality. The removal action was taken to prevent any threat to worker health and safety.

5. Removal Action Description and Estimated Costs

5.1. Description of Action

The capacitors and PCB-contaminated soil were removed and disposed of in accordance with all applicable environmental regulations. This action addressed the potential exposure to nearby human populations, animals, or the food chain from PCBs, and addressed the threat to the environment posed by the release of additional PCBs into adjacent soil from the deteriorating capacitors.

5.1.1. Removal Action Components

Excavation, removal, and disposal of the capacitors and PCB-contaminated soil at a TSCA-approved facility mitigates the public health threat posed by direct human contact and inhalation and ingestion of PCBs. No soil containing PCBs at or above 1 ppm remains onsite. The removal of PCB contaminants provided a timely response and best possible protection for public health and welfare, and the environment. After the emergency removal action was completed, based on certified analytical results, the site of the capacitor landfill was returned to the NIF project to continue construction activities.

5.1.2. Contribution to Remedial Performance

The removal action is consistent with the overall objectives of the Livermore Site restoration project. The complete removal of the capacitors and soil containing PCBs completes the cleanup of this discovered landfill. A ground water sample was collected in fourth quarter 1997 for PCBs at the closest downgradient monitor well (W-273; Fig. 2) to monitor for any PCBs released to the ground water. No PCBs were detected.

5.1.3. Description of Alternative Technologies

Because of the imminent threat to human health and the environment once the capacitors and PCB-contaminated soil were discovered, excavation, removal, and offsite disposal of the PCB-contaminated materials was determined by DOE, LLNL, and all concerned regulatory agencies to be the best alternative. Therefore, no alternative technologies were considered for this action.

5.1.4. Applicable or Relevant and Appropriate Requirements

Because this was an emergency removal action, state and federal Applicable or Relevant and Appropriate Requirements (ARARs) were not selected prior to cleanup; however, ARARs were agreed to by the regulatory agencies during the removal action. The ARARs for this removal action are the cleanup objectives (Federal Register, 1994) and disposal requirements (40 CFR 761). All ARARs were met in the implementation of this removal action. The removal action and timely response is consistent with the overall objectives of the Livermore Site cleanup.

5.1.5. Project Schedule

The excavation, removal, packaging, and offsite shipment of the contaminated waste began on September 3, 1997. All the PCB-contaminated soil was removed by September 12, 1997 and shipped offsite to Laidlaw Environmental Services, Grayback, Utah. The drummed capacitors were temporarily stored in the LLNL TSCA-waste facility and were shipped on September 29, 1997 to Laidlaw Environmental Services-Aptus, Clive, Utah for incineration.

5.2. Estimated Cost

Estimated cost for the removal action is about $450,000. This includes manpower, transportation and disposal of contaminated soil, capacitors, and cleanup materials; sampling and analyses; and equipment rental.

6. Expected Change in the Situation Should Action been Delayed or not Taken

If the removal action was not taken, the buried waste would have remained inadequately isolated and could potentially leak, which would have increased the chances of future releases to the environment. Additionally, worker safety in the vicinity of the exposed capacitors would not have been adequately addressed.

7. Outstanding Policy Issues

None.

8. Recommendation

This decision document represents the selected removal action of capacitors and PCB-contaminated soil at the NIF construction site at the LLNL Livermore Site, Livermore, California, developed in accordance with CERCLA and the NCP. This document also represents Final Closure of this removal action; however, additional information pertaining to the surrounding areas under investigation will be available once the data are compiled. No additional actions are planned for additional work in the affected areas. This decision is based on the administrative record for the site. The estimated total cost for the removal action is estimated to be about $450,000, which will be funded by the DOE.

The undersigned approved implementation of this removal action.

Apr 27/98

James T. Davis
Associate Manager for Environmental Management
Oakland Operations Office
U.S. Department of Energy

Date

9. References

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LLNL (1997), Letter report from Ellen Raber, Deputy Department Head, Environmental Protection, to Mr. Ariu Levi of Alameda County Environmental Health Department, Hazardous Materials Division, providing a written report within 15 days of verbal notification of activities involving removal of capacitors and soils contaminated with PCBs at the NIF construction site.

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A. Lamarre, Environmental Restoration Program/Division Leader, and J. Steenhoven, Environmental Restoration Deputy Program/Division Leader provided overall direction and technical guidance.

R. Depue of LLNL provided compositional support.

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J. Woods and T. Gabrielli of LLNL conducted sampling, and provided analytical and sample location data.

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J. Morris, M. Hayes, and C. Jones of LLNL provided oversight for Hazardous Waste Management.

J. Greci of LLNL provided technical oversight of the excavation.

Figures

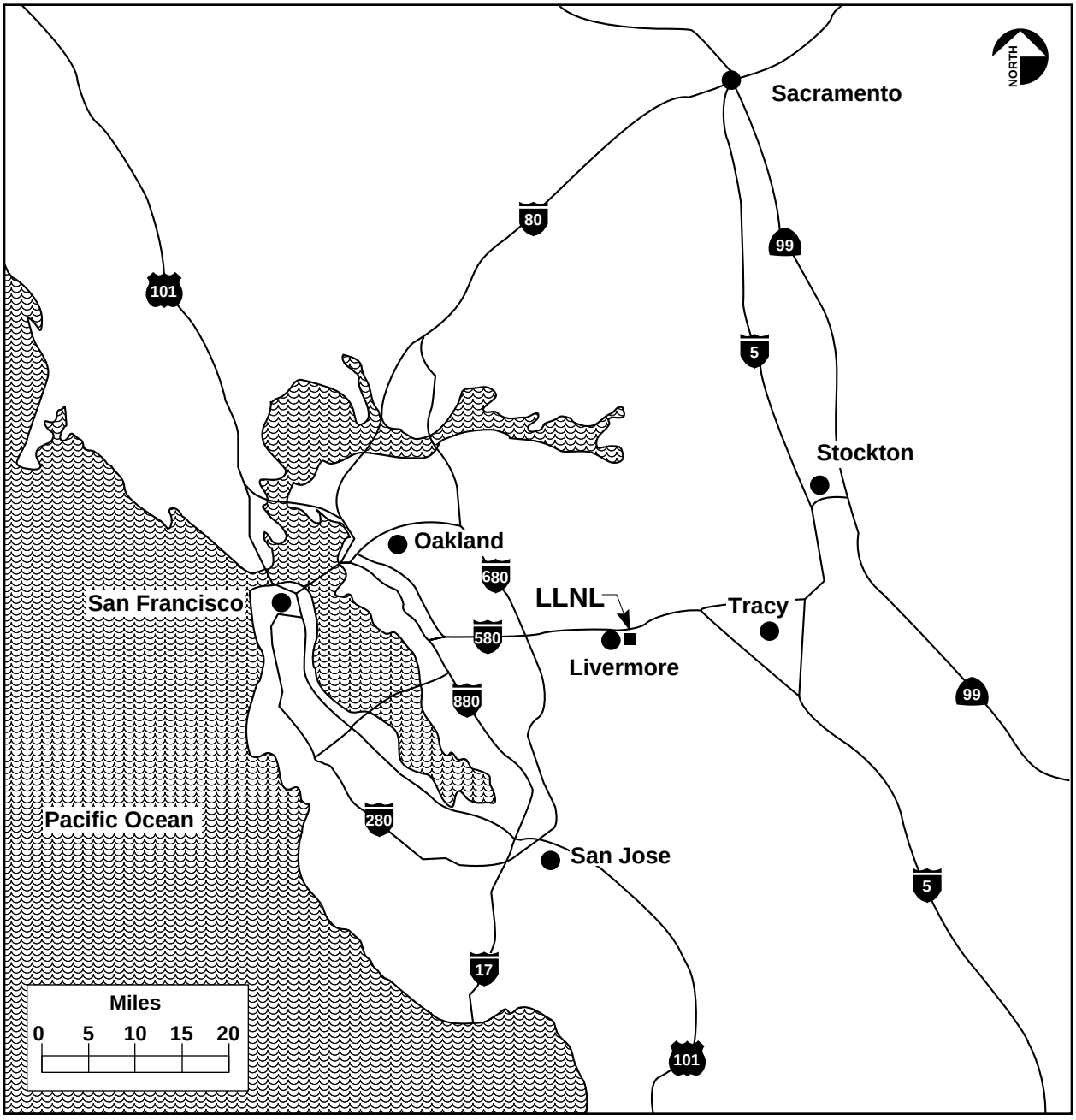

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Figure 1. Location of the LLNL Livermore Site.

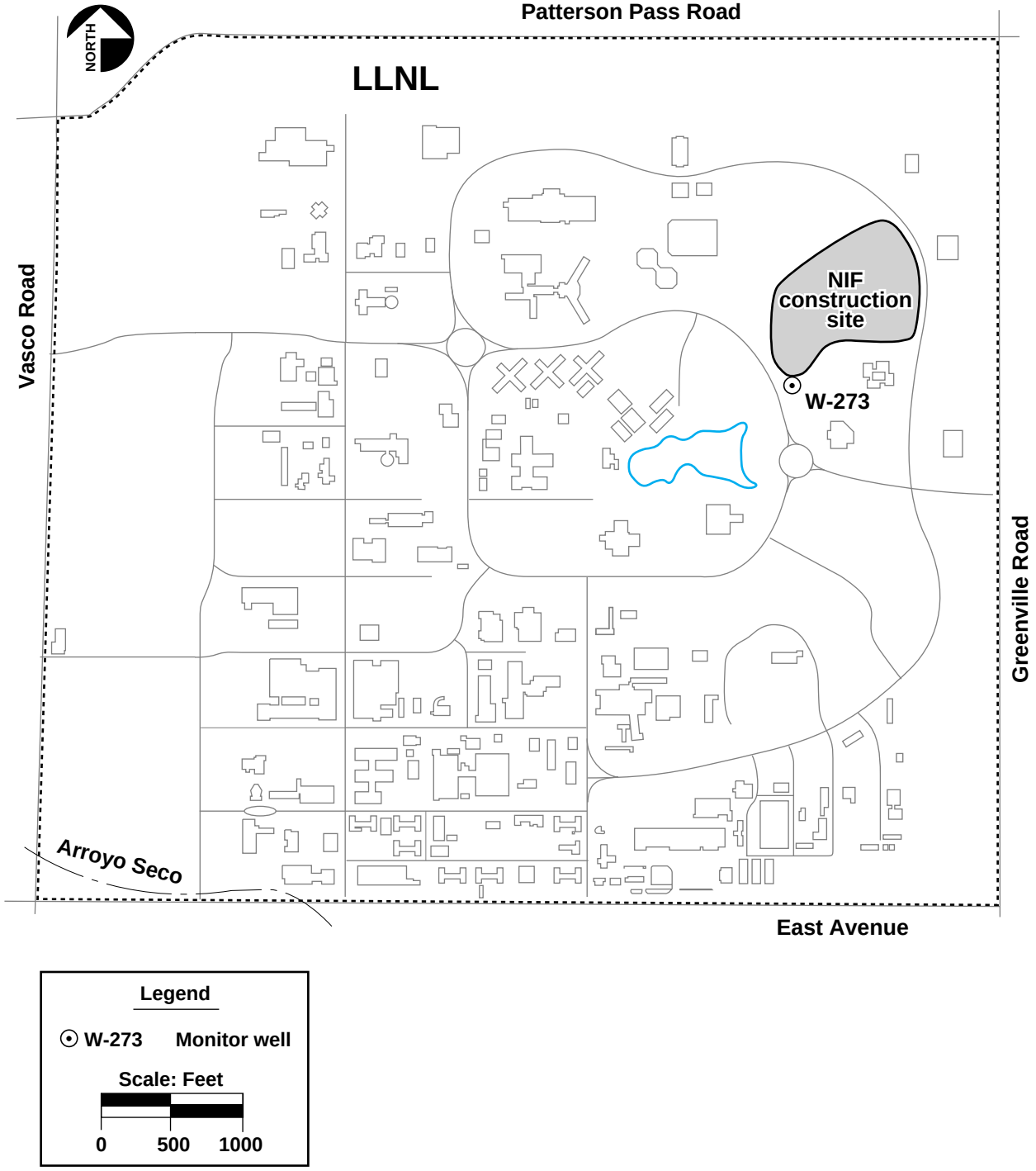

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Figure 2. Location of the NIF construction site at the LLNL Livermore Site.

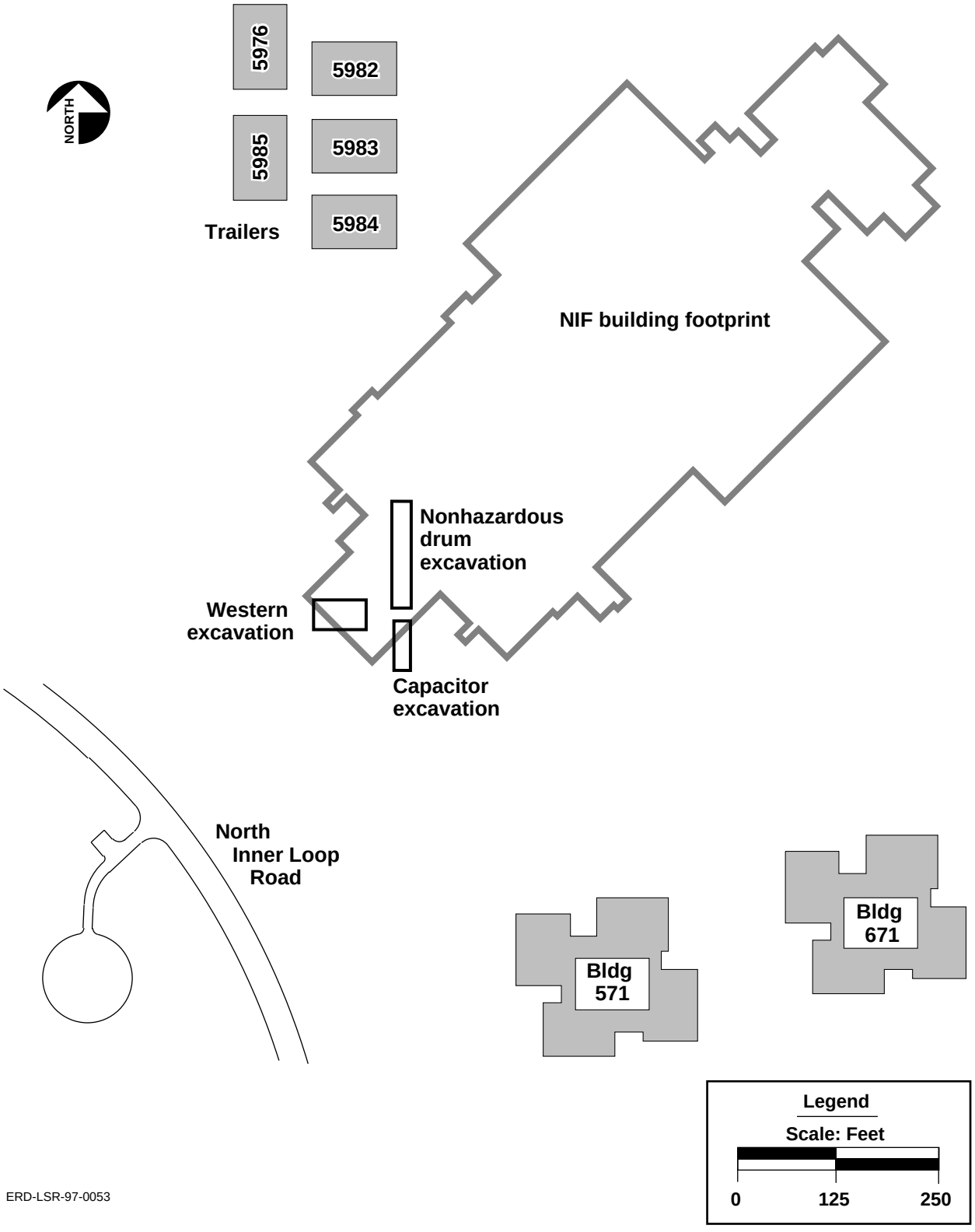

Figure 3. Locations of the capacitor, drum, and western excavations at the NIF construction site.

Appendix A

Analytical Results

Appendix A

Analytical Results

Analytical results from soil samples collected from the capacitor and the western excavation areas are presented in Tables A-1 and A-2, respectively. Some samples were analyzed onsite by a uncertified laboratory (C&MS Environmental Services) for screening purposes so timely decisions could be made on the soil disposition. About 29% of the samples analyzed were sent to an offsite certified laboratory (CLS Labs) prior to making decisions regarding additional soil excavation and handling and shipping of soil. Figure A-1 presents a schematic drawing that correlates sample number prefixes with sample locations. Figure A-2 shows the locations of samples collected from the capacitor excavation that were used to ensure complete removal of the PCB-contaminated soil. Soil samples from the floor of the excavation were analyzed by the certified laboratory; some duplicate samples from the same location were analyzed onsite. Swipe samples analyses performed during the decontamination of the equipment are presented in Table A-3.

Tables A-4 and A-5 present field screening and analytical results for metals. Table A-4 presents Total Threshold Limit Concentration (TTLC) results, and Table A-5 presents Soluble Threshold Limit Concentration (STLC) results. A schematic drawing of approximate metals sample locations is presented on Figure A-3.

Table A-1. Capacitor excavation analytical results.

Sample number	Description	Date	Laboratory	Analysis requested	Results mg/kg (ppm)
15-01	Overburden soil pile	9/07/97	CES	PCBs	< 1
15-02	Overburden soil pile	9/07/97	CES	PCBs	< 1
15-03	Overburden soil pile	9/07/97	CES	PCBs	< 1
15-04	Overburden soil pile	9/07/97	CES	PCBs	< 1
MS-NIF-002-01-04-SO-12u	First soil sample next to capacitor in the excavation	9/03/97	CLS	PCBs	19
012-01 west wall 15′ down	West wall, 15-ft depth	9/06/97	CES	PCBs	3
012-02-11	North wall, 6 ft from west wall, 11-ft depth	9/07/97	CES	PCBs	20–40
012-03-07	North wall, 6 ft from west wall, 7-ft depth	9/07/97	CES	PCBs	6.5–9.3
012-04-11	East wall, 7 ft from south wall, 11-ft depth	9/07/97	CES	PCBs	< 1
012-05-07	East wall, 7 ft from south wall, 7-ft depth	9/07/97	CES	PCBs	4.2–4.7
012-10	South wall, 18 in. from east wall, 12-ft depth	9/08/97	CES	PCBs	< 2
012-11	South wall, 18 in. from east wall, 7-ft depth	9/08/97	CES	PCBs	< 2
012-12	South wall, 18 in. from west wall, 12-ft depth	9/08/97	CES	PCBs	< 2
012-13	South wall, 18 in. from west wall, 7-ft depth	9/08/97	CES	PCBs	< 2
012-06	North wall, 18 in. from west wall, 12-ft depth	9/08/97	CES	PCBs	< 1
012-07	North wall, 18 in. from east wall, 12-ft depth	9/08/97	CES	PCBs	< 1
012-08	North wall, 18 in. from east wall, 7-ft depth	9/08/97	CES	PCBs	< 1
012-09	North wall , 18 in. from west wall, 7-ft depth	9/08/97	CES	PCBs	< 1
14-1	= sample MS-NIF-012-14-1, capacitor excavation west wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1
14-2 T	= sample MS-NIF-012-14-2, capacitor excavation floor, 15-ft depth[a]	9/10/97	CES	PCBs	< 1
MS-NIF-012-14-3-SO-15u	= sample MS-NIF-012-14-3, capacitor excavation floor, 15-ft depth[a]	9/10/97	CLS	PCBs	8.3
14-4	= sample MS-NIF-012-14-4, capacitor excavation east wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1
14-5	= sample MS-NIF-012-14-5[a], split sample with MS-NIF-012-14-6-SO-17u, but was not submitted for analysis	9/11/97	–	–	–
MS-NIF-012-14-6-SO-17u	= sample MS-NIF-012-14-6, capacitor excavation floor, 17-ft depth[a]	9/11/97	CLS	PCBs	< 1
15-1	= sample MS-NIF-012-15-1, capacitor excavation west wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1

Table A-1. (Continued)

Sample number	Description	Date	Laboratory	Analysis requested	Results mg/kg (ppm)
15-2 T	= sample MS-NIF-012-15-2, capacitor excavation floor, 15-ft depth[a]	9/10/97	CES	PCBs	< 1
MS-NIF-012-15-3-SO-15u	= sample MS-NIF-012-15-3, capacitor excavation floor, 15-ft depth[a]	9/10/97	CLS	PCBs	< 1
15-4	= sample MS-NIF-012-15-4, capacitor excavation east wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1
16-1	= sample MS-NIF-012-16-1, capacitor excavation west wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1
16-2 T	= sample MS-NIF-012-16-2, capacitor excavation floor, 15-ft depth[a]	9/10/97	CES	PCBs	66
MS-NIF-012-16-3-SO-15u	= sample MS-NIF-012-16-3, capacitor excavation floor, 15-ft depth[a]	9/10/97	CLS	PCBs	38
16-4	= sample MS-NIF-012-16-4, capacitor excavation east wall 12-ft depth[a]	9/10/97	CES	PCBs	< 1
16-5	= sample MS-NIF-012-16-5[a], split sample with MS-NIF-012-16-6-SO-17u, but was not submitted for analysis	9/11/97	–	–	–
MS-NIF-012-16-6-SO-17u	= sample MS-NIF-012-16-6, capacitor excavation floor, 17-ft depth[a]	9/11/97	CLS	PCBs	< 1
17-1	= sample MS-NIF-012-17-1, capacitor excavation west wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1
17-2 T	= sample MS-NIF-012-17-2, capacitor excavation floor, 15-ft depth[a]	9/10/97	CES	PCBs	< 1
MS-NIF-012-17-3-SO-15u	= sample MS-NIF-012-17-3, capacitor excavation floor, 15-ft depth[a]	9/10/97	CLS	PCBs	< 1
17-4	= sample MS-NIF-012-17-4, capacitor excavation east wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1
18-1	= sample MS-NIF-012-18-1, capacitor excavation west wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1
18-2 T	= sample MS-NIF-012-18-2, capacitor excavation floor, 15-ft depth[a]	9/10/97	CES	PCBs	< 1
MS-NIF-012-18-3-SO-15u	= sample MS-NIF-012-18-3, capacitor excavation floor, 15-ft depth[a]	9/10/97	CLS	PCBs	< 1
18-4	= sample MS-NIF-012-18-4, capacitor excavation east wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1
19-1	= sample MS-NIF-012-19-1, capacitor excavation west wall, 12-ft depth[a]	9/10/97	CES	PCBs	< 1

Table A-1. (Continued)

Sample number	Description	Date	Laboratory	Analysis requested	Results mg/kg (ppm)
19-2 T	= sample MS-NIF-012-19-2, capacitor excavation floor, 15-ft depth[a]	9/10/97	CES	PCBs	2
MS-NIF-012-19-3-SO-15u	= sample MS-NIF-012-19-3, capacitor excavation floor, 15-ft depth[a]	9/10/97	CLS	PCBs	56
19-4	= sample MS-NIF-012-19-4, capacitor excavation east wall, 12-ft depth[a]	9/10/97	CES	PCBs	1
19-5	= sample MS-NIF-012-19-5[a], split sample with MS-NIF-012-19-6-SO-17u, but was not submitted for analysis	9/11/97	–	–	–
MS-NIF-012-19-6-SO-17u	= sample MS-NIF-012-19-6, capacitor excavation floor, 17-ft depth[a]	9/11/97	CLS	PCBs	< 1
19-7	= sample MS-NIF-012-19-7, capacitor excavation east wall, 12-ft depth[a]	9/11/97	CES	PCBs	< 1
20-1	= sample MS-NIF-012-20-1, ground surface surrounding capacitor excavation[a]	9/10/97	CES	PCBs	< 1
20-2	= sample MS-NIF-012-20-2, ground surface surrounding capacitor excavation[a]	9/10/97	CES	PCBs	< 1
20-3	= sample MS-NIF-012-20-3, ground surface surrounding capacitor excavation[a]	9/10/97	CES	PCBs	< 1
20-4	= sample MS-NIF-012-20-4, ground surface surrounding capacitor excavation[a]	9/10/97	CES	PCBs	1.6
20-5	= sample MS-NIF-012-20-5, ground surface surrounding capacitor excavation[a]	9/10/97	CES	PCBs	1.4
20-6	= sample MS-NIF-012-20-6[a], resample of sample location 20-5 after removal of about 2 inches of surface soil	9/11/97	CES	PCBs	< 1
20-7	= sample MS-NIF-012-20-7[a], resample of sample location 20-4 after removal of about 2 inches of surface soil	9/11/97	CES	PCBs	< 1

[a] See Figure A-2 for sampling locations.

Notes:

CES = C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore, Calif.

CLS = CLS Labs, Rancho Cordova, Calif.

mg/kg = milligrams per kilogram.

ppm = parts per million.

Table A-2. Western excavation analytical results.

Sample number	Description	Date	Laboratory	Analysis requested	Results mg/kg (ppm)
008-01	West soil pile	9/6/97	CES	PCBs	< 1
008-02	West soil pile	9/6/97	CES	PCBs	< 1
009-01	Pit	9/6/97	CES	PCBs	< 1
010-01	East soil pile	9/6/97	CES	PCBs	< 1
MS-NIF-008-03-01-SC-0u	West soil pile	9/7/97	CLS	PCBs	< 0.020
MS-NIF-008-04-01-SC-0u	West soil pile	9/7/97	CLS	PCBs	< 0.020
MS-NIF-008-04-02-SC-0u	West soil pile	9/8/97	CLS	PCBs	< 0.020
MS-NIF-008-05-01-SC-0u	West soil pile	9/7/97	CLS	PCBs	0.024
MS-NIF-008-06-01-SC-0u	West soil pile	9/7/97	CLS	PCBs	< 0.020
MS-NIF-008-07-01-SC-0u	West soil pile	9/7/97	CLS	PCBs	< 0.020
MS-NIF-008-08-01-SC-0u	West soil pile	9/7/97	CLS	PCBs	0.022
MS-NIF-008-09-01-SC-0u	West soil pile	9/8/97	CLS	PCBs	< 0.020
MS-NIF-008-10-01-SC-0u	West soil pile	9/8/97	CLS	PCBs	< 0.020
MS-NIF-008-11-01-SC-0u	West soil pile	9/8/97	CLS	PCBs	< 0.020
MS-NIF-008-12-01-SC-0u	West soil pile	9/8/97	CLS	PCBs	< 0.020
MS-NIF-008-13-01-SC-0u	West soil pile	9/8/97	CLS	PCBs	< 0.020
MS-NIF-009-02-01-SC-0u	Pit	9/8/97	CLS	PCBs	< 0.020
MS-NIF-009-03-01-SC-0u	Pit	9/8/97	CLS	PCBs	< 0.020
MS-NIF-009-04-01-SC-0u	Pit	9/8/97	CLS	PCBs	< 0.020
MS-NIF-009-05-01-SC-0u	Pit	9/8/97	CLS	PCBs	< 0.020
MS-NIF-009-05-02-SC-0u	Pit	9/8/97	CLS	PCBs	< 0.020
MS-NIF-009-06-01-SC-0u	Pit	9/8/97	CLS	PCBs	< 0.020
MS-NIF-010-02-01-SC-0u	East soil pile	9/8/97	CLS	PCBs	0.044
MS-NIF-010-03-01-SC-0u	East soil pile	9/8/97	CLS	PCBs	< 0.020
MS-NIF-010-04-01-SC-0u	East soil pile	9/8/97	CLS	PCBs	< 0.020
MS-NIF-010-05-01-SC-0u	East soil pile	9/8/97	CLS	PCBs	0.069

See Figure A-1 for sampling locations.

Notes:

CES = C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore, Calif.

CLS = CLS Labs, Rancho Cordova, Calif.

mg/kg = milligrams per kilogram.

ppm = parts per million.

Table A-3. Swipe sample analytical results.

Sample number	Description	Date	Laboratory	Analysis requested	Results (μg/swipe)
Ex Bucket Swipe	First excavator bucket swipe	9/05/97	CES	PCBs	< 10
Ex Bucket Swipe #2	Second excavator bucket swipe	9/05/97	CES	PCBs	< 10
Blank	Blank	9/08/97	CES	PCBs	< 10
RSL-511-4 #1	Loader bucket	9/08/97	CES	PCBs	16
RSL-511-4 #2	Loader bucket	9/08/97	CES	PCBs	12
RSL-511-4 #3	Loader bucket	9/08/97	CES	PCBs	< 10
RSL-511-4 #4	Loader bucket	9/08/97	CES	PCBs	10
RSL-511-4 #5	Loader tire	9/08/97	CES	PCBs	< 10
RSL-511-4 #6	Loader tire	9/08/97	CES	PCBs	< 10
RSL-511-4 #7	Loader tire	9/08/97	CES	PCBs	< 10
RSL-511-4 #8	Loader tire	9/08/97	CES	PCBs	< 10
122-19-01	Excavator bucket teeth	9/08/97	CES	PCBs	67
122-19-02	Excavator bucket teeth	9/08/97	CES	PCBs	38
122-19-03	Excavator bucket teeth	9/08/97	CES	PCBs	< 10
122-19-04	Excavator bucket teeth	9/08/97	CES	PCBs	< 10
RSL-511-4 #10	Loader bucket	9/09/97	CES	PCBs	< 10
G71 15450 -01 Tail	Tailgate of truck hauling soil[a]	9/09/97	CES	PCBs	< 10
G71 15450 -02 Bed	Bed of truck hauling soil[a]	9/09/97	CES	PCBs	< 10
G823892-01 Tail	Tailgate of truck hauling soil[a]	9/09/97	CES	PCBs	< 10
G823892-02 Bed	Bed of truck hauling soil[a]	9/09/97	CES	PCBs	< 10
G823893-01 Tail	Tailgate of truck hauling soil[a]	9/09/97	CES	PCBs	< 10
G823893-02 Bed	Bed of truck hauling soil[a]	9/09/97	CES	PCBs	< 10
RSL-511-4 #11	Bottom outside of loader bucket	9/10/97	CES	PCBs	12
RSL-511-4 #12	Loader bucket	9/10/97	CES	PCBs	< 10
RSL-511-4 #13	Outside sides of loader bucket	9/10/97	CES	PCBs	< 10
RSL-511-4 #14	Bottom outside of loader bucket	9/10/97	CES	PCBs	< 10
Excavator 7247-01	Left track of excavator	9/10/97	CES	PCBs	< 10
Excavator 7247-02	Right track of excavator	9/10/97	CES	PCBs	< 10
122-19-05	Excavator bucket	9/12/97	CES	PCBs	< 10
122-19-06	Excavator bucket	9/12/97	CES	PCBs	< 10
122-19-07	Excavator bucket	9/12/97	CES	PCBs	< 10
122-19-08	Excavator bucket	9/12/97	CES	PCBs	< 10

Notes:

μg/swipe = micrograms per swipe.

CES = C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore, Calif.

[a] First part of sample number is the truck's licence plate.

Table A-4 TTLC analyses in the NIF construction site.

Sample number	Date sampled	Sb	As	Ba	Be	Cd	Cr	Co	Cu	Pb	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	K	U
		<---------- mg/kg (ppm) ---------->																		
Capacitor area																				
002-01-02[a]	9/3/97	<1.0	19	110	<0.50	<1.0	14	7.1	8.9	<10	0.070	<5.0	17	<2.5	<2.5	<25	19	15	–	–
Drum area																				
004-01-03[b]	9/5/97	<3	<6	270	0.2	<0.3	61	11	18	27	0.04	1	53	<3	0.6	<6	50	45	2,500	<20
005-02-01[c]	9/5/97	<3	<6	150	0.2	<0.3	45	9.0	11	17	<0.03	1	31	<3	0.7	<6	41	24	1,400	<20
006-03-01[d]	9/5/97	<2	<5	180	0.2	<0.2	47	8.9	13	17	<0.03	1	42	<2	<0.5	<5	43	31	1,700	<10
007-04-01[e]	9/5/97	<2	<5	190	0.08	<0.2	47	10	18	9	<0.03	1	50	<2	0.6	<5	29	24	1,300	<10
014-01-01[f]	9/6/97	<5	<9	200	0.7	<0.5	34	9.9	14	20	0.06	<0.7	33	<5	1	<9	40	32	1,900	<30
014-02-01[g]	9/6/97	<3	<7	180	0.1	<0.3	28	8.2	15	10	0.28	<0.5	29	<3	<0.7	<7	34	49	1,900	<20
014-03-01[h]	9/6/97	<3	6	190	0.3	<0.3	37	10	19	16	0.46	<0.4	45	<3	0.7	<6	38	50	2,400	<20

See Figure A-3 for approximate sampling locations.

[a] Equals sample number MS-NIF-002-01-02-SO-12U. Sample collected at 12-ft depth from the area where the capacitors were discovered. Analyzed by CLS Labs, Rancho Cordova, Calif.

[b] Equals sample number MS-NIF-004-01-03-SC-0U. Sample collected from soil pile excavated from the drum area. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[c] Equals sample number MS-NIF-005-02-01-SC-15U. Sample collected at 15-ft depth from the area where the drums were discovered. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[d] Equals sample number MS-NIF-006-03-01-SC-15U. Sample collected at 15-ft depth from the area where the drums were discovered. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[e] Equals sample number MS-NIF-007-04-01-SC-15U. Sample collected at 15-ft depth from the area where the drums were discovered. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[f] Equals sample number MS-NIF-014-01-01-SO-0U. Sample from the drum excavation. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[g] Equals sample number MS-NIF-014-02-01-SO-0U. Sample from the drum excavation. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[h] Equals sample number MS-NIF-014-03-01-SO-0U. Sample from the drum excavation. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

Notes:

Ag = silver
As = arsenic
Ba = barium
Be = berryllium
Cd = cadmium
Co = cobalt
Cr = chromium
Cu = copper
Hg = mercury
K = potassium
Mo = molybdenum
mg/kg = milligrams per kilogram
Ni = nickel
Pb = lead
ppm = parts per million
Sb = antimony
Se = selenium
Tl = thallium
TTLC = Total Threshold Limit Concentration
U = uranium
V = vanadium
Zn = zinc

Table A-5. STLC analyses in the NIF construction site.

Sample number	Date sampled	Sb	As	Ba	Be	B	Cd	Cr	Co	Cu	Fe	Pb	Mn	Hg	Mo	Ni	Se	Ag	Tl	V	Zn	K	U
		<---------- mg/L (ppm) ---------->																					
Capacitor area																							
002-01-02[a]	9/3/97	<0.30	0.099	8.0	<0.050	<0.50	<0.10	<0.50	<0.50	<0.50	49	<0.50	24	<0.0050	<0.50	0.62	<0.050	<0.50	<0.050	<0.50	0.61	–	–
Drum area																							
004-01-03[b]	9/5/97	<0.05	<0.05	11	0.005	–	<0.005	0.086	0.49	0.12	–	0.44	–	<0.001	<0.008	0.98	0.09	<0.01	<0.1	0.47	0.51	7.4	<0.3
005-02-01[c]	9/5/97	<0.05	<0.05	5.6	0.009	–	<0.005	0.15	0.49	1.5	–	0.1	–	<0.001	0.03	0.74	0.08	<0.01	<0.1	0.51	0.63	3.4	<0.3
006-03-01[d]	9/5/97	<0.05	<0.05	7.0	0.006	–	<0.005	0.054	0.44	0.058	–	0.1	–	<0.001	0.01	1.1	0.09	<0.01	<0.1	0.53	0.06	2.0	<0.3
007-04-01[e]	9/5/97	<0.05	<0.05	8.8	0.002	–	<0.005	0.051	0.45	0.44	–	0.08	–	<0.001	<0.008	0.92	0.1	<0.01	<0.1	0.37	0.35	5.2	<0.3
014-01-01[f]	9/6/97	<0.05	<0.05	6.1	<0.001	–	<0.005	0.14	0.37	4.3	–	0.03	–	<0.001	0.02	0.88	0.1	<0.01	<0.1	0.43	2.0	2.1	<0.3
014-02-01[g]	9/6/97	<0.05	<0.05	8.4	0.004	–	<0.005	0.10	0.34	0.75	–	0.1	–	<0.001	0.02	0.70	0.1	<0.01	<0.1	0.30	0.74	5.4	<0.3
014-03-01[h]	9/6/97	<0.05	<0.05	8.6	0.003	–	0.006	0.063	0.32	0.74	–	0.2	–	<0.001	<0.008	0.49	0.1	<0.01	<0.1	0.26	1.2	5.9	<0.3

See Figure A-3 for approximate sampling locations.

[a] Equals sample number MS-NIF-002-01-02-SO-12U. Sample collected at 12-ft depth from the area where the capacitors were discovered. Analyzed by CLS Labs, Rancho Cordova, Calif.

[b] Equals sample number MS-NIF-004-01-03-SC-0U. Sample collected from soil pile excavated from the drum area. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[c] Equals sample number MS-NIF-005-02-01-SC-15U. Sample collected at 15-ft depth from the area where the drums were discovered. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[d] Equals sample number MS-NIF-006-03-01-SC-15U. Sample collected at 15-ft depth from the area where the drums were discovered. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[e] Equals sample number MS-NIF-007-04-01-SC-15U. Sample collected at 15-ft depth from the area where the drums were discovered. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[f] Equals sample number MS-NIF-014-01-01-SO-0U. Sample from the drum excavation. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[g] Equals sample number MS-NIF-014-02-01-SO-0U. Sample from the drum excavation. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

[h] Equals sample number MS-NIF-014-03-01-SO-0U. Sample from the drum excavation. Analyzed by C&MS Environmental Services, Lawrence Livermore National Laboratory, Livermore Calif.

Notes:

Ag = silver
As = arsenic
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Ba = barium
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Cr = chromium
Cu = copper
Fe = iron
Hg = mercury
K = potassium
Mn = manganese
Mo = molybdenum
mg/L = milligrams per liter
Ni = nickel
Pb = lead
ppm = parts per million
Sb = antimony
Se = selenium
STLC = Soluble Threshold Limit Concentration
Tl = thallium
V = vanadium
U = uranium
Zn = zinc

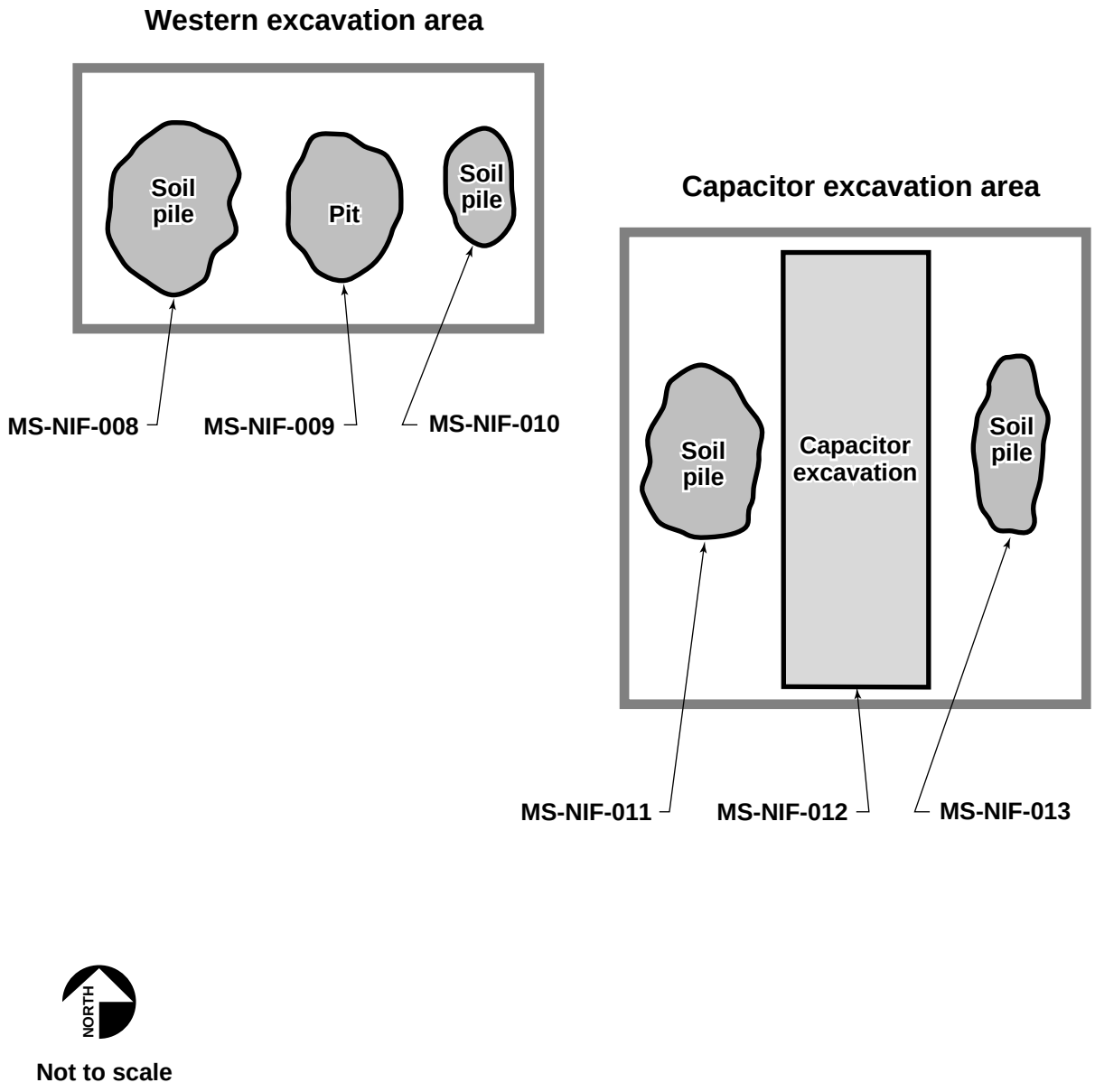

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Figure A-1. Key to sample locations in the western and capacitor excavation areas.

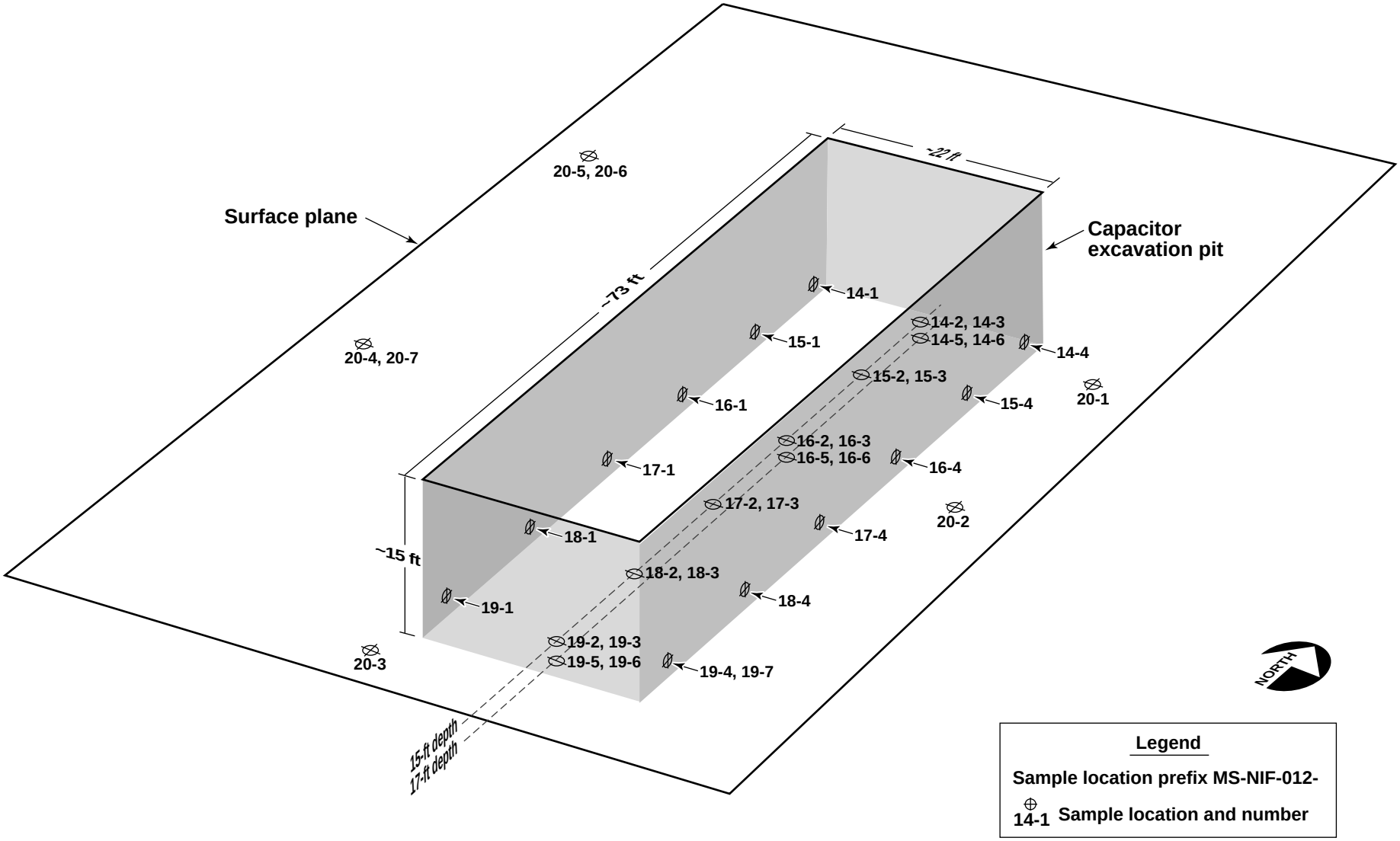

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Figure A-2. Location of MS-NIF-012 samples collected within and adjacent to the capacitor excavation.

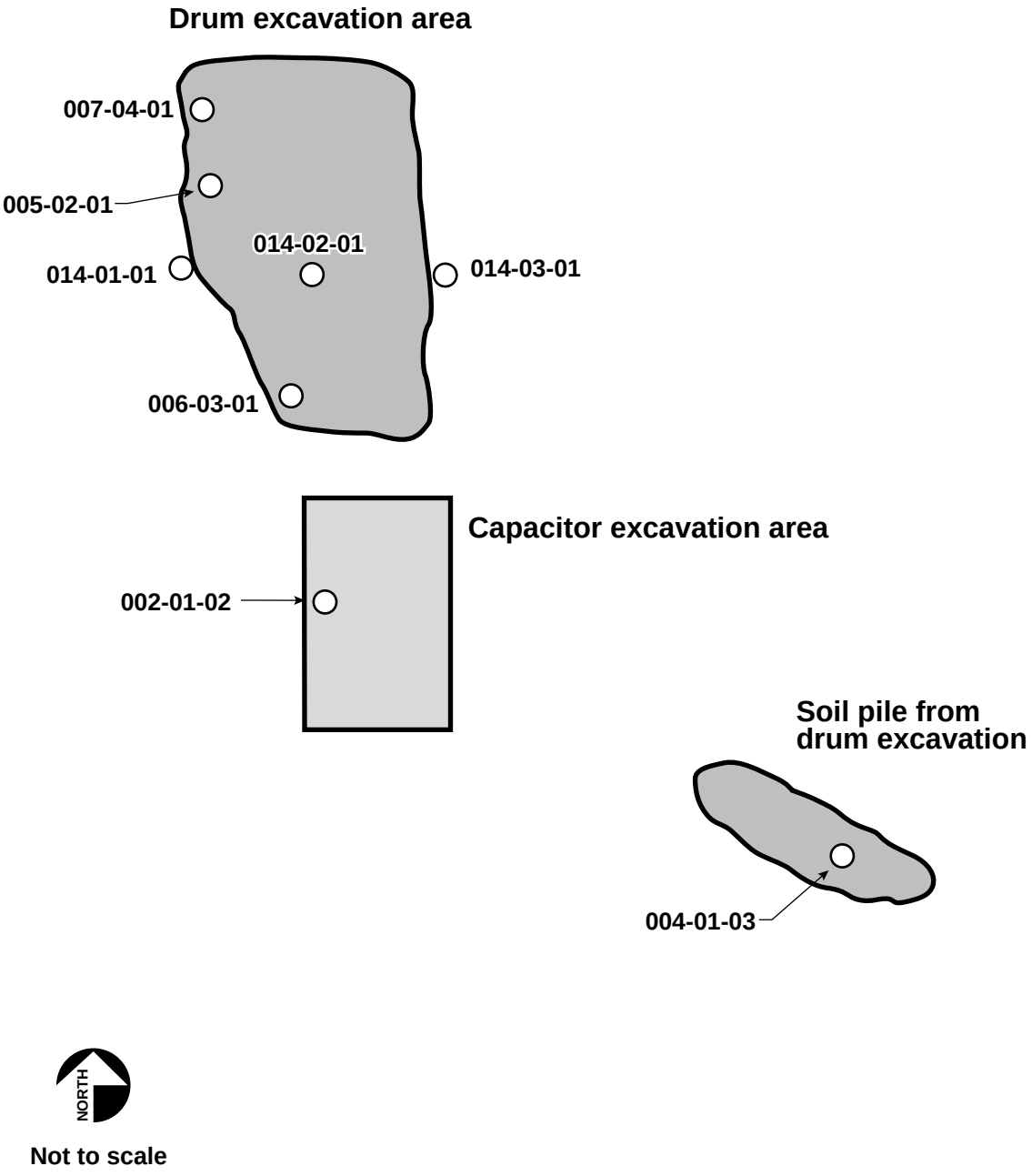

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Figure A-3. Approximate locations of soil analyses for metals.