RECORD OF TECHNICAL CHANGE

Technical Change No. 01 | Page 1 of 2

Project/Job No. 799417.00030040 | Date July 21, 2000

Project/Job Name CAU 490: Station 44 Burn Area

The following technical changes (including justification) are requested by:

Dustin R. Wilson (Name) | Task Manager (Title)

Replace Figure 4-3 with the attached figure. This change is necessary because the coordinates originally obtained for the corners of the Sandia Service Yard (SSY) boundaries could not be verified in the field. In addition, the southwest corner of the site was moved east to exclude Landfill A3-2 (CAU 424). Process knowledge indicates that Landfill A3-2 was adjacent to and outside of the SSY boundary. Figure 4-3 (as revised) was created using coordinates obtained during this field effort to reflect actual site conditions.

The project time will be (Increased)(Decreased)(Unchanged) by approximately -0- days.

Applicable Project-Specific Document(s): *Corrective Action Investigation Plan for Corrective Action Unit 490: Station 44 Burn Area, Tonopah Test Range, Nevada*, Revision 0, DOE/NV–613. U.S. Department of Energy, Nevada Operations Office, June, 2000.

Approved By: Signature Approved Date 07/24/2000

Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Signature Approved Date 07/24/2000

Runore C. Wycoff, Division Director
Environmental Restoration Division

Client Notified Yes X No ___ Date 07/20/2000

NDEP Concurrence Yes ___ No ___ Date 07/24/2000

Contract Change Order Required Yes ___ No X

Contract Change Order No. NA

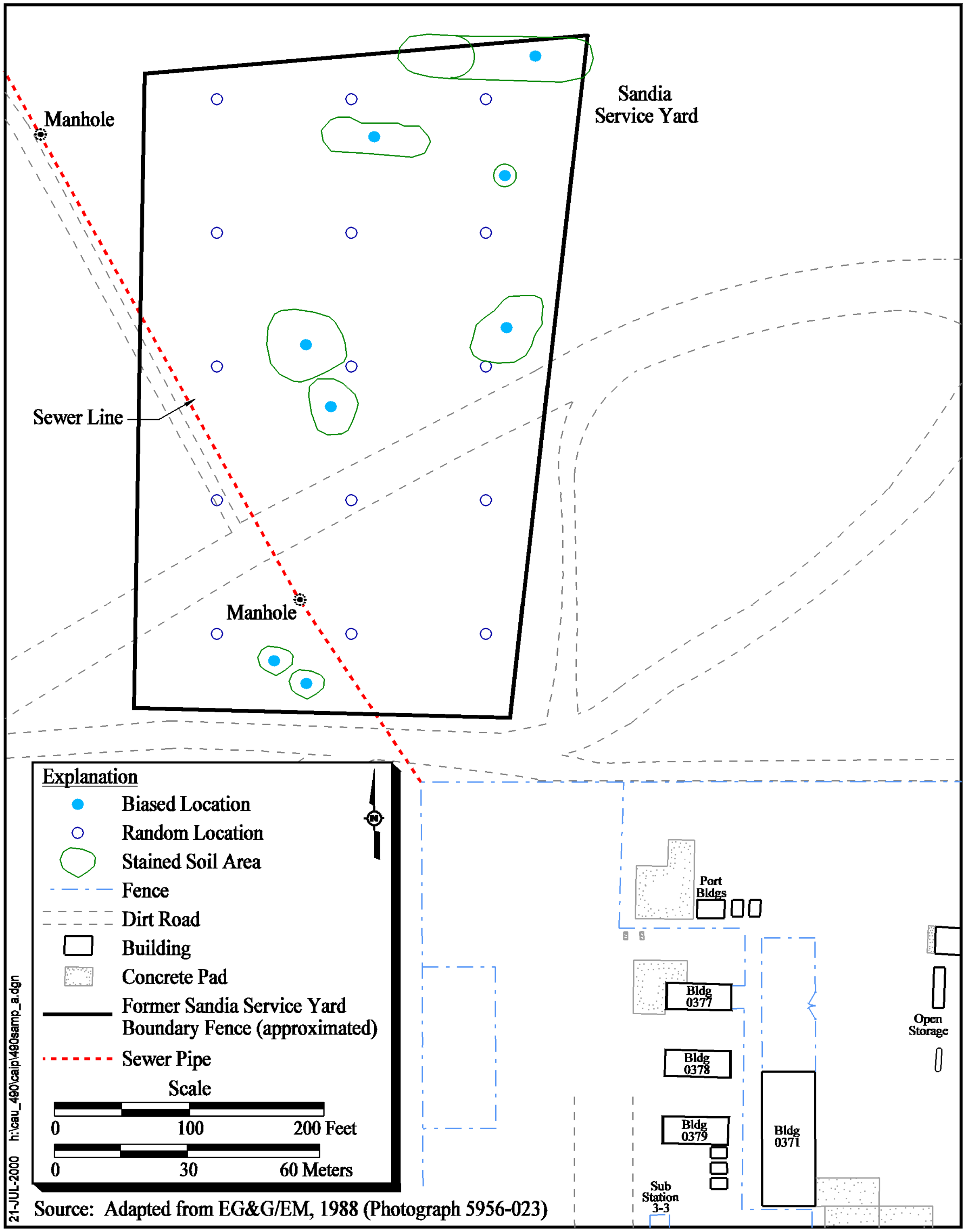

Figure 4-3
Proposed Biased and Random Sample Location Map, Sandia Service Yard, Tonopah Test Range

Nevada
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Project

DOE/NV--613

Corrective Action Investigation Plan for Corrective Action Unit 490: Station 44 Burn Area, Tonopah Test Range, Nevada

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June 2000

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CORRECTIVE ACTION INVESTIGATION PLAN FOR CORRECTIVE ACTION UNIT 490: STATION 44 BURN AREA, TONOPAH TEST RANGE, NEVADA

DOE Nevada Operations Office
Las Vegas, Nevada

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Revision No.: 0

June 2000

CORRECTIVE ACTION INVESTIGATION PLAN
FOR CORRECTIVE ACTION UNIT 490:
STATION 44 BURN AREA,
TONOPAH TEST RANGE, NEVADA

Approved by: Signature Approved Date: 06/09/2000

Janet Appenzeller-Wing, Project Manager
Industrial Sites Project

Approved by: Signature Approved Date: 06/09/2000

Runore C. Wycoff, Division Director
Environmental Restoration Division

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List of Acronyms and Abbreviations

ALARA	As-low-as-reasonably-achievable
bgs	Below ground surface
CADD	Corrective Action Decision Document
CAIP	Corrective Action Investigation Plan
CAS	Corrective Action Site(s)
CAU	Corrective Action Unit(s)
CFR	*Code of Federal Regulations*
CO_2	Carbon dioxide
COPC	Contaminant(s) of potential concern
CV	Coefficient of variation
DoD	U.S. Department of Defense
DOE	U.S. Department of Energy
DOE/NV	U.S. Department of Energy, Nevada Operations Office
DOT	U.S. Department of Transportation
DQO	Data Quality Objective(s)
DRO	Diesel-range organics
EPA	U.S. Environmental Protection Agency
FFACO	*Federal Facility Agreement and Consent Order*
FSL	Field-screening levels
FTA	Fire Training Area
ft	Foot (feet)
gal	Gallon(s)
GPBA	Gun Propellant Burn Area
GPR	Ground-penetrating Radar
HE	High Explosives
HWAA	Hazardous Waste Accumulation Area

List of Acronyms and Abbreviations *(Continued)*

IDW	Investigation-derived waste
ITLV	IT Corporation, Las Vegas Office
LLW	Low-level radioactive waste
mg/kg	Milligram(s) per kilogram
mi	Mile(s)
MS/MSD	Matrix spike/matrix spike duplicate
NAC	*Nevada Administrative Code*
NDEP	Nevada Division of Environmental Protection
NEPA	*National Environmental Policy Act*
NTS	Nevada Test Site
NTSWAC	Nevada Test Site Waste Acceptance Criteria
PAL	Preliminary action level(s)
PCB	Polychlorinated biphenyl(s)
PID	Photoionization detector
PPE	Personal protective equipment
ppm	Part(s) per million
PRG	Preliminary Remediation Goal
QAPP	*Quality Assurance Project Plan*
QA/QC	Quality assurance and quality control
QC	Quality control
RCRA	*Resource Conservation and Recovery Act*
SAA	Satellite Accumulation Area
SNL	Sandia National Laboratories
SSHASP	Site-specific health and safety plan
SSY	Sandia Service Yard
SVOC	Semivolatile organic compound(s)

List of Acronyms and Abbreviations (Continued)

TPH	Total petroleum hydrocarbon(s)
TTR	Tonopah Test Range
UXO	Unexploded ordnance
VOC	Volatile organic compound(s)

Executive Summary

This Corrective Action Investigation Plan for Corrective Action Unit 490, Station 44 Burn Area at Tonopah Test Range has been developed in accordance with the *Federal Facility Agreement and Consent Order* that was agreed to by the State of Nevada, U.S. Department of Energy, and the U.S. Department of Defense. Corrective Action Unit 490 consists of Corrective Action Sites: 03-56-001-03BA, Fire Training Area; RG-56-001-RGBA, Station 44 Burn Area; 03-58-001-03FN, Sandia Service Yard; and 09-54-001-09L2, Gun Propellant Burn Area.

Unknown volumes and concentrations of hydrocarbons and other chemicals may have been released to surface and subsurface soils at the four Corrective Action Sites within Corrective Action Unit 490. The possible releases were the result of various activities that included burning miscellaneous debris at the surface during fire training exercises, burning of gun propellant and deteriorated explosives within subsurface pits, and historic surface spills within the storage yard. Based on site history collected to support the Data Quality Objectives process, contaminants of potential concern vary slightly for each Corrective Action Site. Contaminants of potential concern at the two fire training areas (Fire Training Area and Station 44 Burn Area) are volatile organic compounds, semivolatile organic compounds, total petroleum hydrocarbons, *Resource Conservation and Recovery Act* metals and zinc. Potential contaminants at the burn area south of Area 9 (Gun Propellant Burn Area) are volatile organic compounds, semivolatile organic compounds, metals, total petroleum hydrocarbons, nitroaromatics and nitramines (including nitroglycerine), nitroguanidine, radionuclides (plutonium and uranium), and nitrocellulose. Identified contaminants of potential concern at the Sandia Service Yard are volatile organic compounds, semivolatile organic compounds, total petroleum hydrocarbons, *Resource Conservation and Recovery Act* metals, polychlorinated biphenyls, and pesticides. The generalized conceptual site model for investigating this Corrective Action Unit is as follows:

- Unknown volumes and concentrations of hydrocarbons and other chemicals were possibly released to surface and subsurface soils at the four Corrective Action Sites within Corrective Action Unit 490 as a result of various activities. Released contaminants would have consisted primarily of diesel fuel used as accelerant (water and carbon dioxide were used as the only extinguishing agents), residue from wood and rubber material burning, gun propellant, solid rocket fuel, black powder, and deteriorated explosives (Comp C-4).

- Lateral contamination is not expected to extend beyond defined historical boundaries of each Corrective Action Site.
- Vertical contamination is not expected to extend beyond 15 feet below grade surface at the four Corrective Action Sites.
- Arid climate limits infiltration, while high evapotranspiration rates restrict the mobility of contaminants of potential concern.
- Underground utilities and nearby structures, adverse weather conditions, restricted access, the presence of explosives, and range activities may create practical and/or physical constraints to the field investigation.
- Potential exposures to personnel would be oral ingestion, inhalation, and/or dermal contact with contaminants of potential concern in soils during subsurface investigation activities.

A more detailed conceptual site model is presented in Section 3.0 of this plan. The conceptual site model serves as the basis for the sampling strategy.

The technical approach for investigating this Corrective Action Unit consists of the following activities:

- Conduct exploratory trenching of the fire training ring at the Fire Training Area to field screen and sample subsurface soils for contaminants of potential concern, as well as to delineate the lateral and vertical extent of any contamination.
- Collect surface and shallow subsurface soil samples via direct push in former areas of two wooden structures at the Station 44 Burn Area.
- Collect surface and shallow subsurface soil samples via direct push at biased and random locations throughout the Sandia Service Yard. Biased sample locations will be at noticeably stained soil locations and historically stained soil locations, as identified on aerial photos. Random sample locations will be throughout the remaining area of the yard to account for areas of unknown past activities and possible redistribution associated with regrading activities.
- Collect surface and subsurface soil samples using an excavator and/or hand tools with appropriate explosive avoidance techniques at biased locations in the Gun Propellant Burn Area. Sample locations will be identified through geophysical surveys, aerial photos, surface features, and magnetometer readings. Excavation will begin outside of the suspected disposal features and progress inward to define the lateral extent of any identified disposal feature. Attempts will be made via excavation to determine the vertical limits of any disposal feature

identified. However, if based on field screening, it is determined that vertical contamination extends beyond the capabilities of the excavation technique, drilling may be initiated.

- Field screen select samples for volatile organic compounds, total petroleum hydrocarbons, radiological activity, explosives, and propellant degradation products.

- Analyze select samples for total volatile organic compounds, total semivolatile organic compounds, total *Resource Conservation and Recovery Act* metals, total petroleum hydrocarbons (diesel range organics), total polychlorinated biphenyls, total pesticides, radionuclides (plutonium and uranium), nitroaromatics, nitramines, and nitrocellulose.

- Collect samples from native soils and analyze for geotechnical/hydrologic parameters if debris is encountered during the field investigation.

- Collect and analyze bioassessment samples at the discretion of the Site Supervisor if volatile organic compounds, total petroleum hydrocarbons, or explosives contamination concentrations exceed field-screening levels.

Additional sampling and analytical details are presented in Section 4.0 of this plan. Details of the waste management strategy for the Corrective Action Unit are included in Section 5.0.

Under the *Federal Facility Agreement and Consent Order*, this Corrective Action Investigation Plan will be submitted to the Nevada Division of Environmental Protection for approval. Field work will be conducted following approval of the plan. The results of the field investigation will be used to evaluate corrective action alternatives in the Corrective Action Decision Document.

1.0 Introduction

This Corrective Action Investigation Plan (CAIP) has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the U.S. Department of Energy, Nevada Operations Office (DOE/NV); the State of Nevada Division of Environmental Protection (NDEP); and the U.S. Department of Defense (DoD) (FFACO, 1996).

This CAIP contains the environmental sample collection objectives and the criteria for conducting site investigation activities at the four Corrective Action Sites (CASs) that comprise Corrective Action Unit (CAU) 490, Station 44 Burn Area at the Tonopah Test Range (TTR). The TTR, included in the Nellis Air Force Range, is approximately 255 kilometers (140 miles [mi]) northwest of Las Vegas, Nevada (Figure 1-1).

Corrective Action Unit 490 is comprised of the Fire Training Area (CAS 03-56-001-03BA) located southwest of Area 3, Station 44 Burn Area (CAS RG-56-001-RGBA) located west of Main Lake, Sandia Service Yard (CAS 03-58-001-03FN) located north of the northwest corner of Area 3, and the Gun Propellant Burn Area (CAS 09-54-001-09L2) located south of the Area 9 Compound on the TTR (Figure 1-2).

Historically, the Fire Training Area (FTA) was used for training exercises where tires and wood were ignited with diesel fuel only. Material burning was confined to an area demarcated by a steel ring approximately 15 feet (ft) in diameter. Records indicate that water and carbon dioxide (CO_2) were the only extinguishing agents used during training exercises.

The Station 44 Burn Area was used for fire training exercises and consisted of two wooden structures. Tires, wood, and the structures were ignited with diesel fuel and water was used as the only extinguishing agent. The two burn areas were limited to the building footprints (approximately 10 ft by 10 ft each).

The Sandia Service Yard was used for storage from approximately 1979 to 1993. The area was used to store items including wood, tires, metal, electronic and office equipment, construction debris, and drums of oil/grease. A burn pit, located north of the yard (now designated Landfill Cell A3-1 in CAU 424) received materials for burning. A second burn pit was reportedly located west of the service

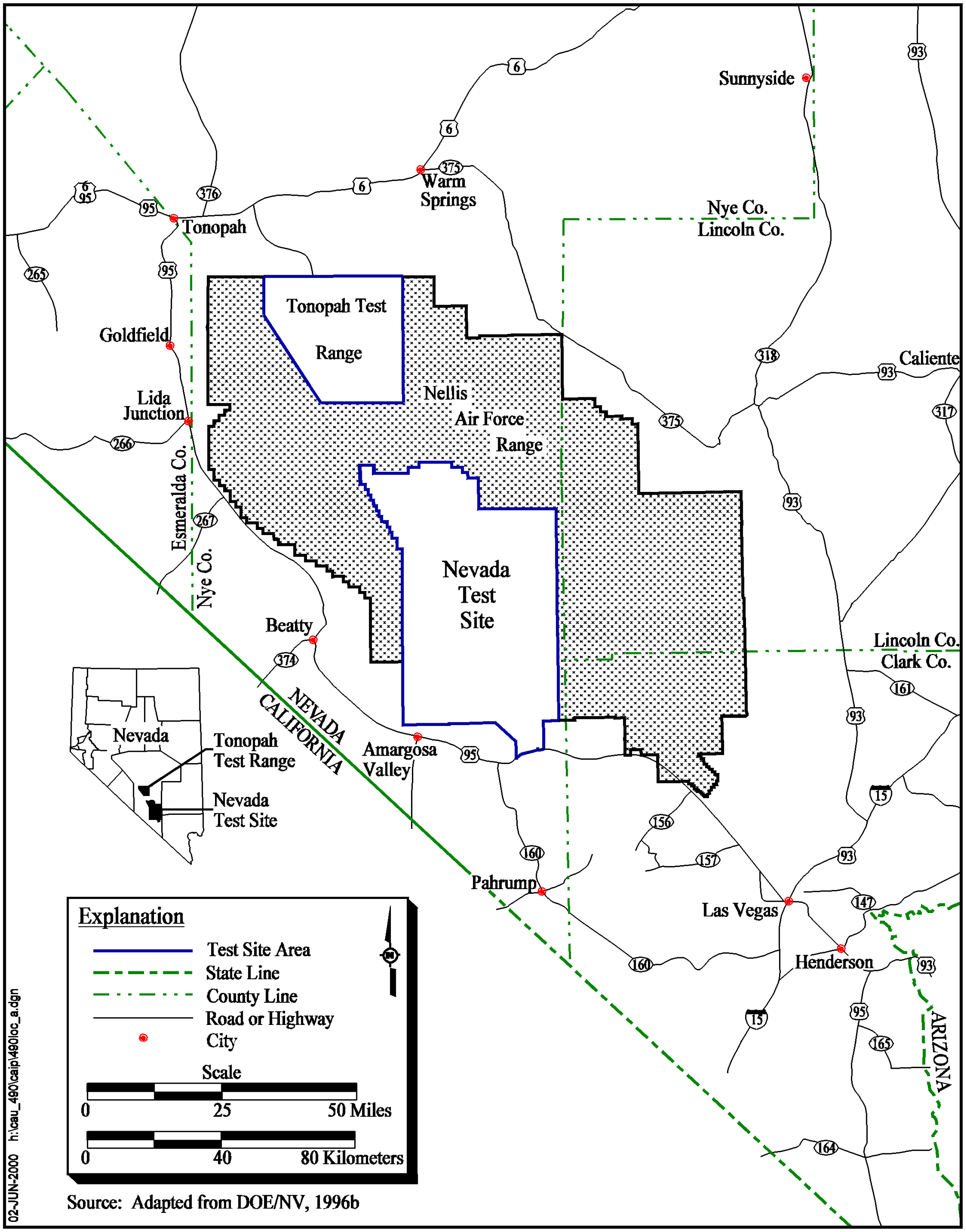

Figure 1-1
Tonopah Test Range Location Map

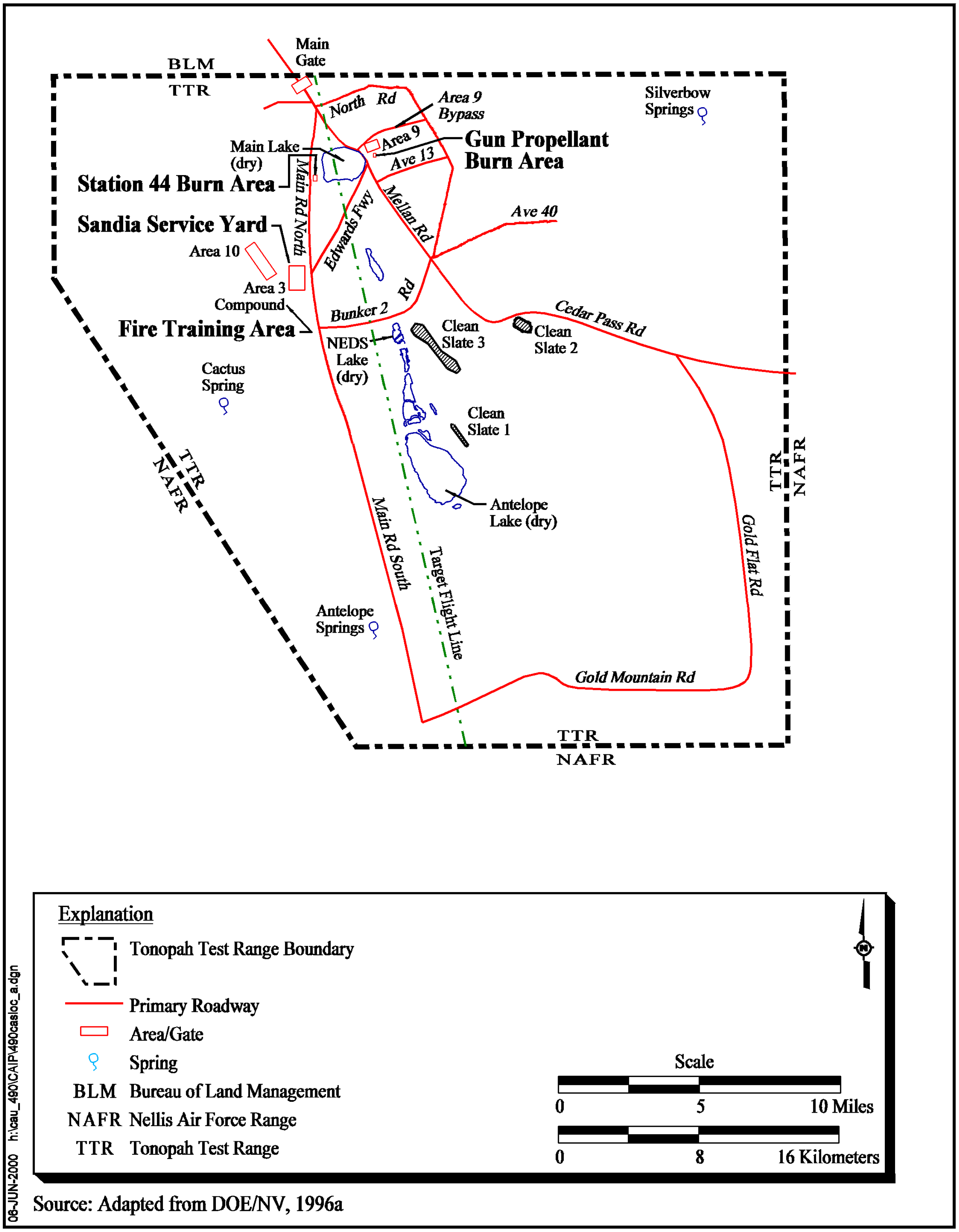

Figure 1-2
Approximate Locations of CAU 490 CASs, Tonopah Test Range

yard and was utilized during the final cleanup of the yard. Landfill Cell A3-2, CAU 424 was the disposal pit for nonburnable material and was located in the western area of the yard.

The Gun Propellant Burn Area was used from the 1960s to 1980s to burn excess artillery gun propellant, solid-fuel rocket motors, black powder, and deteriorated explosives (Comp C-4). Additionally, the area was used for the disposal of experimental explosive items. The site was reportedly cleaned up, but the extent of cleanup activities is unknown.

1.1 Purpose

The purpose of the corrective action investigation plan is as follows:

- Determine if contaminants of potential concern (COPCs) are present at each CAS.
- Determine if COPC concentrations exceed field-screening levels (FSLs).
- Determine if COPC concentrations exceed preliminary action levels (PALs).
- Determine the nature and extent of contamination with enough certainty to support selection of corrective action alternatives for each CAS.

This CAIP was developed using the U.S. Environmental Protection Agency's (EPA) Data Quality Objectives (DQOs) (EPA, 1994) process to clearly define the goals for collecting environmental data, determine data uses, and design a data collection program that will satisfy these goals and uses. A DQO scoping meeting was held prior to preparation of this plan. A brief summary of the DQOs is presented in Section 3.4 and a more detailed summary of the DQO process and results is included in Appendix A.

1.2 Scope

The scope of this CAIP is to resolve the problem statement identified in the DQO process, which states that potentially hazardous wastes were generated at three of the four CASs within CAU 490, and that potentially hazardous and radioactive wastes were generated at the fourth CAS in CAU 490 (see Appendix A). Additionally, existing information about the nature and extent of contamination at the CASs is insufficient to evaluate and select preferred corrective actions for the sites. The scope of the corrective action investigation for each CAS includes the activities described in the following sections to answer the problem statement.

1.2.1 CAS 03-56-001-03BA, Fire Training Area

- Conduct exploratory trenching through the center of the fire training ring to collect soil samples for field screening and laboratory analyses.
- Conduct additional trenching to delineate the lateral and vertical extent of contamination, if necessary. Collect additional samples using drilling methods if FSLs indicate contamination extends vertically beyond excavation capabilities.
- Conduct field screening for volatile organic compounds (VOCs) and Total Petroleum Hydrocarbons (TPH) during excavation and/or drilling activities.
- Collect samples for geotechnical/hydrological and bioassessment analyses. Section 4.1 contains the collection criteria for these samples.

1.2.2 CAS RG-56-001-RGBA, Station 44 Burn Area

- Conduct surface and shallow subsurface soil sampling using direct-push methodology at one to two biased locations within the suspected area of each former wooden structure. These samples will be field screened and submitted for laboratory analyses.
- Conduct step-out borings if FSLs are exceeded.
- Conduct excavation and/or drilling for sample collection if direct-push methods are unsuccessful.
- Conduct field screening for VOCs and TPH at each sample location and interval.
- Collect samples for geotechnical/hydrological and bioassessment analyses. Section 4.1 contains the collection criteria for these samples.

1.2.3 CAS 03-58-001-03FN, Sandia Service Yard

- Conduct biased and random surface and shallow subsurface soil sampling using direct-push methodology. Samples will be field screened and submitted for laboratory analyses.
- Conduct excavation and/or drilling for sample collection if direct-push methods are unsuccessful.

- Conduct field screening for VOCs on all samples and TPH screening on subsurface samples only.
- Collect samples for geotechnical/hydrological and bioassessment analyses. Section 4.1 contains the collection criteria for these samples.

1.2.4 CAS 09-54-001-09L2, Gun Propellant Burn Area

- Conduct excavation and sample handling activities under the guidance of experienced personnel trained in explosives identification and disposal.
- Conduct surface, shallow subsurface, and subsurface soil sampling using excavation, hand tool, and/or drilling methods for field screening and laboratory analyses.
- Conduct field screening for VOCs, explosives, and alpha/beta-emitting radionuclides.
- Collect samples for geotechnical/hydrological and bioassessment analyses. Section 4.1 contains the collection criteria for these samples.

1.3 CAIP Contents

Section 1.0 of this CAIP provides an introduction to this project, including the purpose and scope for this corrective action investigation. The remainder of the document details the investigation strategy. The FFACO (1996) requires that CAIPs address the following elements:

- Management
- Technical aspects
- Quality assurance
- Health and safety
- Public involvement
- Field sampling
- Waste management

The managerial aspects of this project are discussed in the DOE/NV *Project Management Plan* (DOE/NV, 1994a) and the site-specific Field Management Plan that will be developed prior to field activities. The technical aspects of this CAIP are contained in Section 3.0 and Section 4.0 of this document, and in the DQO summary presented in Appendix A. General field and laboratory quality assurance (QA) and quality control (QC) issues, including collection of QC samples, are presented in the *Industrial Sites Quality Assurance Project Plan* (QAPP) (DOE/NV, 1996c). In addition, the methods for field QA/QC are further discussed in approved procedures. Field activities will be performed according to the current version of the IT Corporation, Las Vegas *Health and Safety Plan* (IT, 2000), and will also be supplemented with a site-specific health and safety plan written prior to the start of field work. As required by the DOE/NV Integrated Safety Management System, these documents outline the requirements for protecting the health and safety of workers and the public, and procedures for protection of the environment. No CAU-specific public involvement activities are planned at this time; however, an overview of public involvement is documented in the "Public Involvement Plan" in Appendix V of the FFACO (1996). Field sampling activities are discussed in Section 4.0 of this CAIP and waste management issues are discussed in Section 5.0. The project schedule and records availability information for this CAIP are discussed in Section 6.0 and Section 7.0 provides a list of project references. Appendix B contains project organization information. Appendix C contains analytical requirements for this project. Appendix D contains the Nevada Environmental Restoration Project Document Review Sheets.

2.0 Facility Description

Appendix A provides general background information and knowledge as examined during the DQO process as it relates to the history of the TTR and CAU 490. This information includes historical aerial photographs, drawings and site maps, and interviews with TTR personnel.

2.1 Physical Setting

The TTR is characterized by north-northwest trending mountain ranges and closed alluvial basins. The TTR is situated in a broad, closed structural basin which is bordered by broad plateaus and mesas. Area 3 lies within a broad basin called Cactus Flats, a relatively flat, internally drained basin, covered almost entirely by alluvial material estimated to be greater than 800 ft thick. Topography at TTR indicates that surface water eventually flows into Cactus Flats, which includes Main and Antelope Lakes. Cactus Flats has a mean elevation of approximately 5,300 ft above mean sea level.

Depth to groundwater at the FTA and Sandia Service Yard near Area 3 is estimated at 360 to 395 ft below ground surface (bgs), with directional flow generally to the north-northwest (DOE/NV, 1996b). Groundwater depth at the Gun Propellant Burn Area (GPBA) near Area 9 is estimated at approximately 130 ft and directional flow is generally to the southwest (DOE/NV, 1996b). Depth to groundwater at the Station 44 Burn Area is estimated to be between 130 and 395 ft, with directional flow generally to the southwest (DOE/NV, 1996b).

2.2 Operational History

2.2.1 Fire Training Area

The FTA is located approximately 1,100 to 1,200 ft southwest of the Area 3 west gate, next to storage yard boxcars, and adjacent to the currently maintained Area 3 Primary Hazardous Waste Accumulation Area (HWAA) (Figure 2-1). During a 1998 visit, the site was found to be clear of any stored materials and there was no evidence of any steel tank/ring or surface soil staining as seen on aerial photographs from 1993 and 1994. Some wood pallets, tires, and other debris were found scattered around the general area. The site was originally identified in the Potential Hazardous Waste

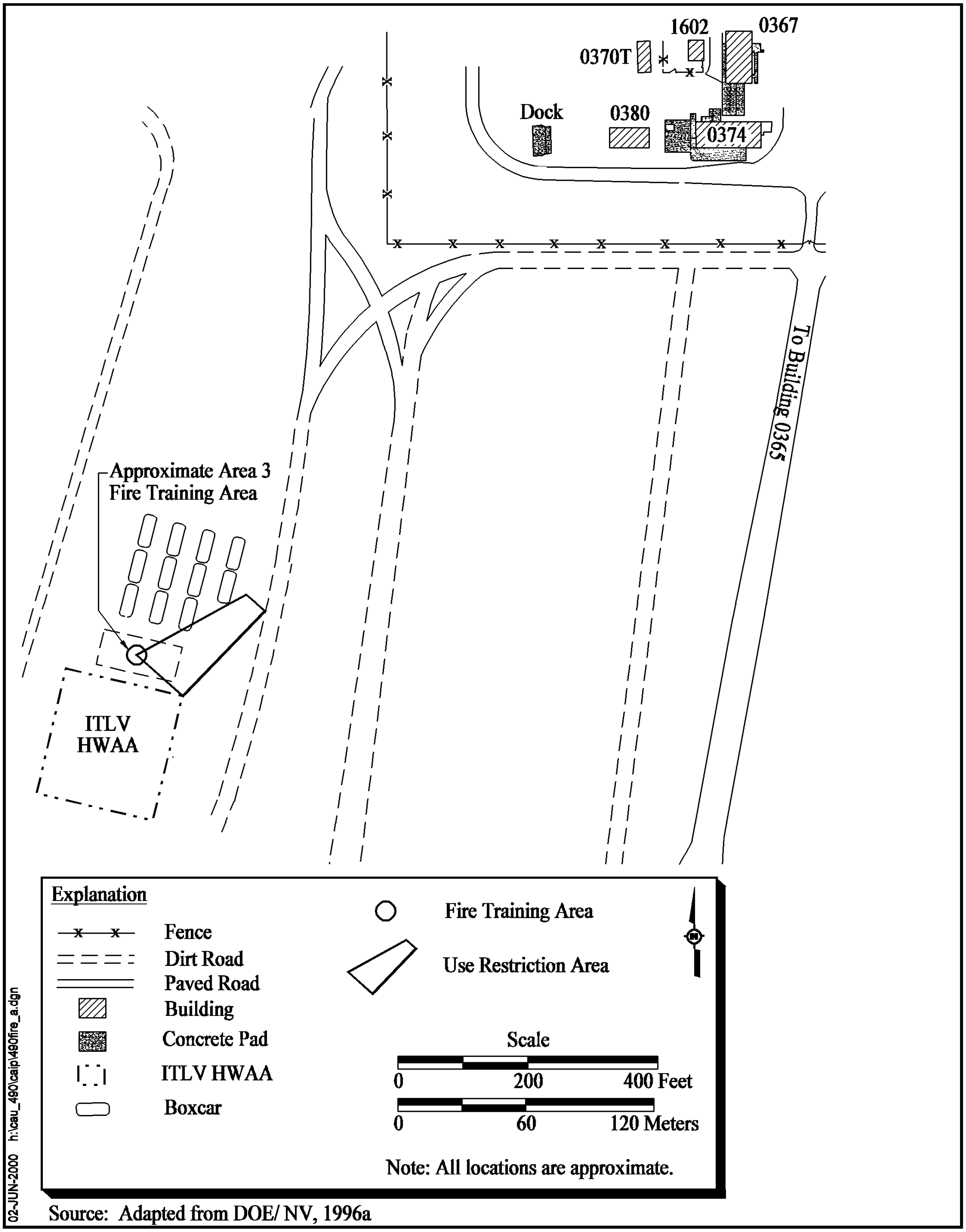

Figure 2-1
Site Location Map, Fire Training Area, Tonopah Test Range

Site Identification and Preliminary Assessment forms and the *Federal Facility Preliminary Assessment Review of TTR* (Ecology and Environment, Inc., 1989).

Aerial photography indicates that the FTA was operational and consisted of a solitary structure until sometime between 1982 and 1987, when the site became a storage area for miscellaneous materials. Site investigations conducted in 1993 indicated some evidence of staining (grey and black in color) was found within a few inches of the surface and an aerial photograph from 1993-1994 indicates various types of equipment, materials, and debris were stored on or near the FTA. Documents indicate a 15-ft diameter steel ring and possibly a 6-ft diameter by 3-ft deep stock tank were present on the site. Historical aerial photographs indicate a dark inner circular structure which may be evidence of the tank's presence. The outer ring diameter is clearly visible on a 1999 aerial photograph; however, the dark inner circular structure seen on previous photos is no longer evident. The site was used for fire training exercises by burning tires and wood, ignited with diesel fuel and extinguished with water or CO_2, within the boundaries of the ring structure. The tank was reported to be filled with sludge from burned materials and it is unknown if the sludge was removed prior to site restoration activities (grading/backfilling). It is also unknown if the stock tank actually existed and if so, whether the tank had a bottom which may have been masked by sludge accumulation. The area is currently being used as an open storage area.

A Facility Investigation Work Plan which describes a soil sampling strategy to determine the existence and extent of soil contamination beneath the FTA was identified; however, there is no evidence that such a plan was ever implemented (DOE/NV, 1994b). A corrective action investigation at CAU 424, Area 3, landfill complex, Landfill A3-8, included a borehole, located northeast of the FTA, which was sampled to a depth of 25 ft. Sample results from this borehole did not indicate any contaminants of concern above PALs and hazardous constituents were present in isolated intervals, at very low levels.

2.2.2 Station 44 Burn Area

Station 44 Burn Area is located east of Main Road, west of Main Lake, and north of the Area 3 Compound (Figure 2-2). The site is currently flat and sparsely vegetated with disturbed areas containing small pieces of metal and charred debris on the surface. There is no apparent surface soil

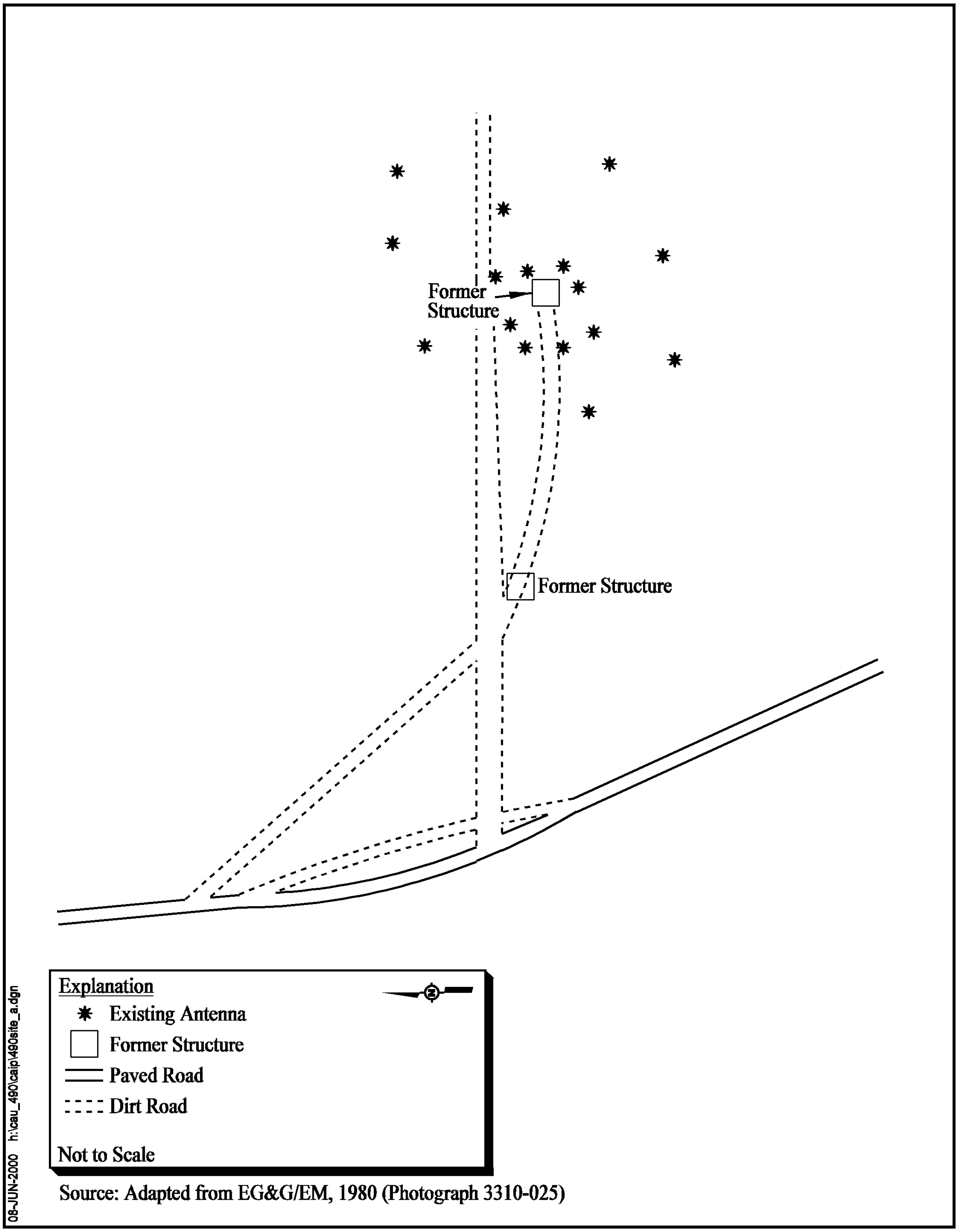

Figure 2-2
Site Location Map of Station 44 Burn Area, Tonopah Test Range

staining. The site was initially identified during the Preliminary Assessment interview process (Zimmerman, 1993).

From approximately 1980 to 1984, the facility was used in fire training exercises. The burn area consisted of two wooden structures that were filled with tires and wood, ignited with diesel fuel, and extinguished with water only. Aerial photographs from 1982 clearly show the two structures intact, while a 1985 high altitude aerial photo seems to show the two structures may have been burned, as indicated by blackened areas in the general vicinity of the structures. Field investigations have identified two burn areas on the site which correlate with the former structure locations.

2.2.3 Sandia Service Yard

The Sandia Service Yard (SSY) facility is located north of the northwest corner of the Area 3 Compound at TTR (Figure 2-3). Dimensions of the SSY are approximately 515 ft by 338 ft. Corrective Action Unit 424, Area 3 Landfill Complex, CAS 03-08-002-A302, Landfill Cell A3-2 is adjacent to the western boundary of the SSY. Additionally, CAU 424, Area 3 Landfill Complex, CAS 03-08-001-A301, Landfill Cell A3-1, an open, ramped burn pit located north of the service yard, has been verified from aerial photographs and visual inspection. Portions of the SSY appear to have been graded over and a dirt road has been routed through the center of the yard. Engineering drawings indicate a sewer line located beneath the west side of the SSY.

The SSY was a temporary storage yard used between 1979 and 1993. Materials identified from aerial photos and documentation as having been stored on the site during the 13-year period include: tires, cables, pallets, furniture, signs, electronic equipment, and drums containing oil, grease, diesel, and polychlorinated biphenyls (PCBs). Reusable materials stored at the site were designated for resale, while unusable materials were discarded into Landfill Cell A3-2. Combustible materials were discarded into the Landfill Cell A3-1 burn pit.

A second burn pit was reportedly located west of the SSY, and was utilized during the final cleanup of the area. The location of this burn pit is unknown and could not be located in aerial photos. This pit received all remaining material, mainly pallets and canvas. Spills from drums stored on the SSY have been identified from aerial photographs and information gathered from interviews. Historical

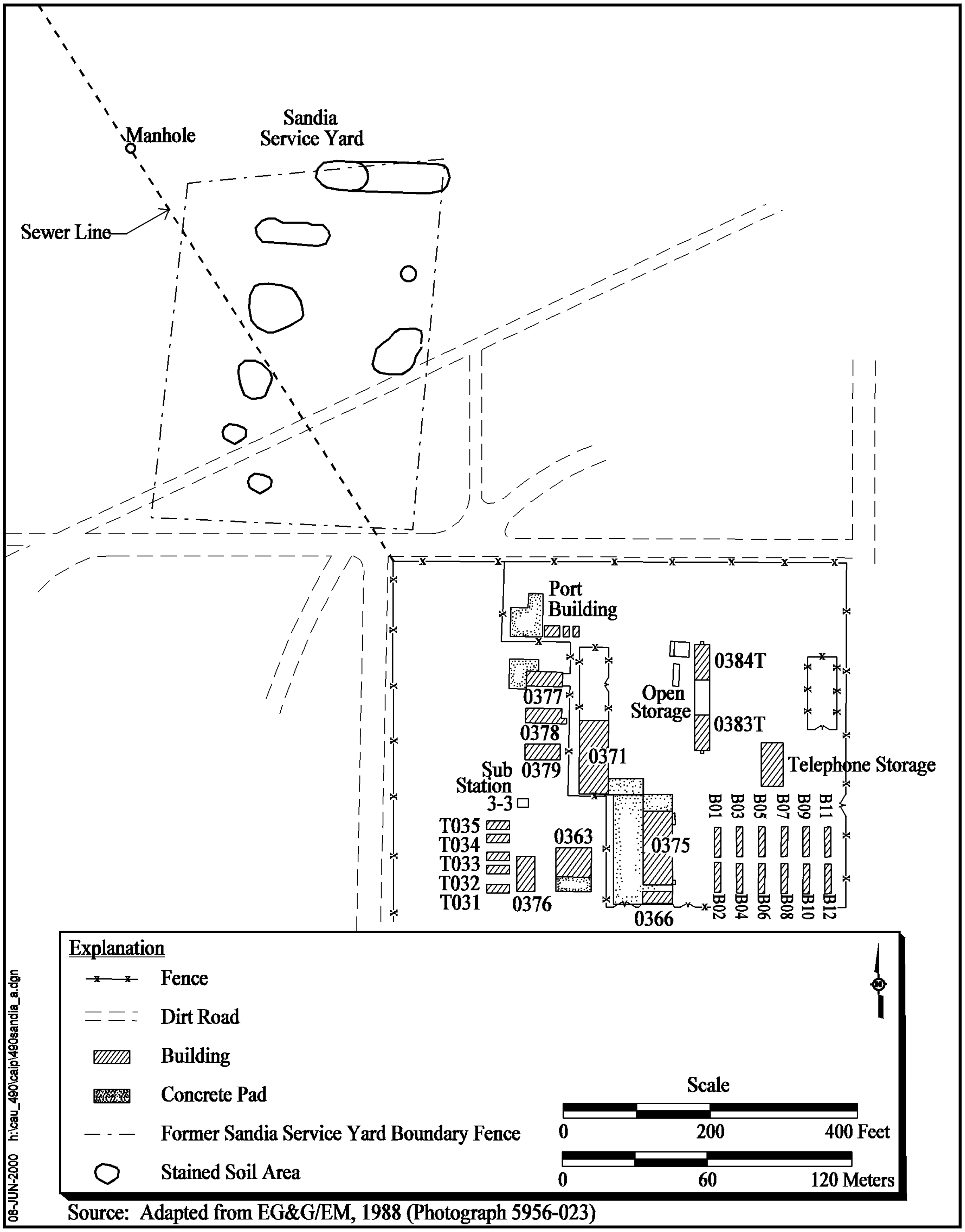

Figure 2-3
Site Location Map, Sandia Service Yard, Tonopah Test Range

documentation indicate that during spill cleanup impacted materials and soils were removed and disposed of in this burn pit.

A geophysical survey of the northern area of the service yard was performed in 1993 and identified four buried, one partially open, and one open landfill cell near Area 3. In 1997, the disposal pit Landfill Cell A3-1 was sampled. Landfill material consisting mainly of wire, metal, burned oil, tire rubber, and free liquid/sludge was identified in all landfill cells, with the exception of Landfill Cell A3-1. All landfill cells associated with CAU 424 have been closed and use restrictions are in place at Landfills A3-1 and A3-8, which prohibits any work occurring on these landfills.

2.2.4 Gun Propellant Burn Area

The GPBA is located on the TTR, approximately 600 ft south of Launcher 2 and just south of the Area 9 Compound fence (Figure 2-4). The area encompasses approximately 140 ft by 180 ft and consists of several burn areas; three pits containing metal debris and two pits which reportedly contained vertically installed, corrugated metal pipes. Current site conditions indicate a relatively flat area with sparse vegetation. There is small debris throughout the site including spent ammunition shell casings, remnants of canvas bags, wood, propellant debris, and miscellaneous metal. Surface soil staining is not apparent.

The GPBA was historically used to incinerate deteriorated explosives, including artillery gun propellant, solid-fuel (including nitroglycerine, nitroguanidine, and nitrocellulose) rocket motors, black powder, and Comp C-4. Additionally, experimental explosive materials were reportedly disposed of in the area. Activities were conducted at the site from the 1960s to the 1980s. Discrepancies exist between documents regarding the number and size of the pits located at the GPBA. Tonopah Test Range documents indicate that three burn areas and three corrugated pipe pits existed on the site and were used to burn excess black powder. Sandia National Laboratories (SNL) documents noted that two shallow pits, and one deep and one shallow vertical corrugated pipe pit were used to burn the black powder. Documents and interviews also indicate that artillery testing took place in the area from approximately 1963 and 1990, and a burn test of a unit containing High Explosives (HE), depleted uranium, and beryllium was conducted at the TTR in 1970. It is not known if the test was conducted at the GPBA.

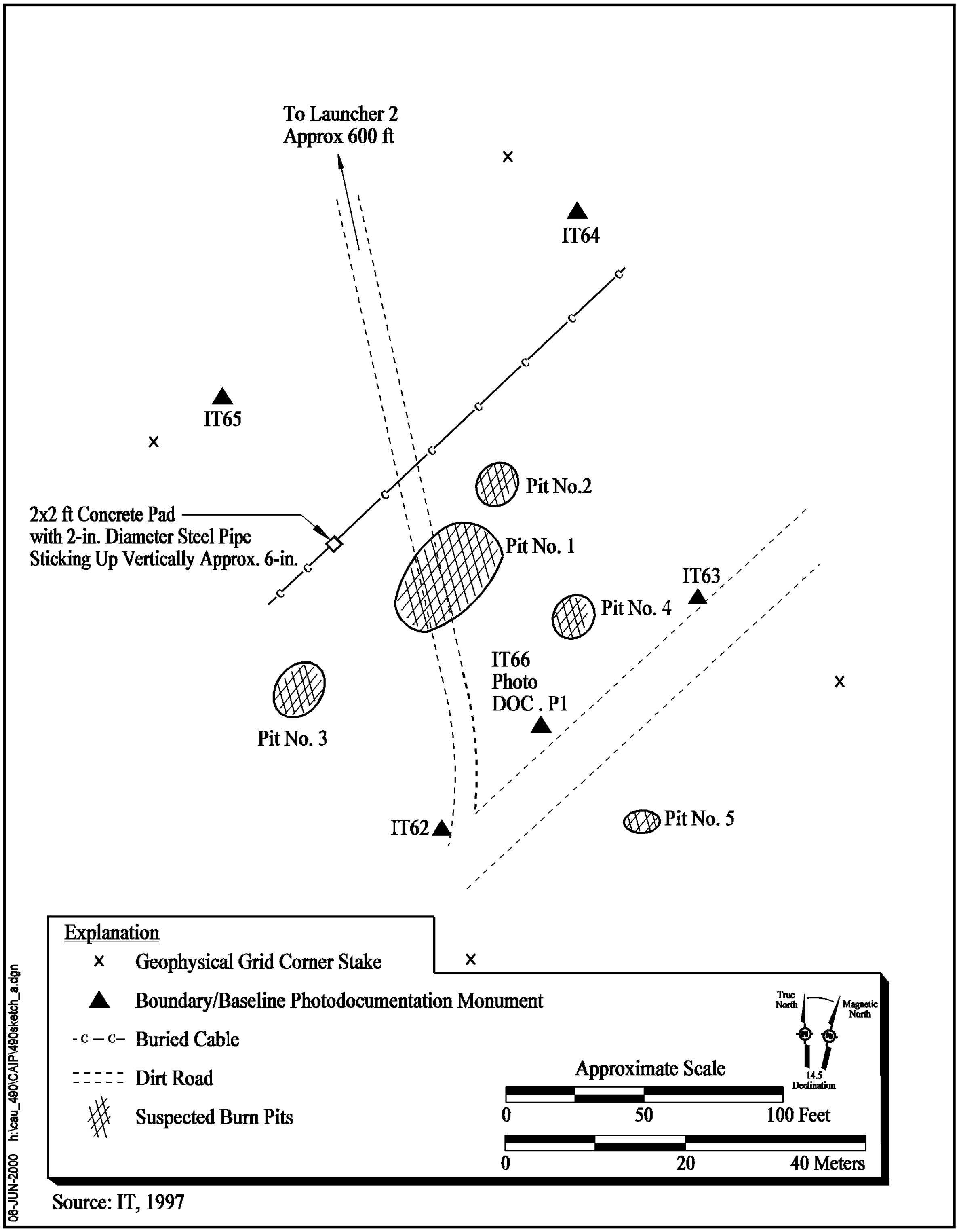

Figure 2-4
Site Sketch of the Gun Propellant Burn Area, Tonopah Test Range

Air sampling was performed in March 1970 in the area and soil samples were collected near the burn pit; however, no results have been identified. In 1993, a Cesium Magnetometer survey, EM-31 survey, and a limited Ground-penetrating Radar (GPR) survey were conducted. These surveys identified five possible pits containing metal debris on the site. The pits ranged in size from 5 ft by 10 ft to 30 ft by 25 ft. Several of the anomalies may be correlated with the small burn pits and the vertical corrugated pipes.

Documents reviewed include references to tests conducted with units containing beryllium and uranium. The GPBA site-specific health and safety plan, contained in the 1994 *Resource Conservation Recovery Act Investigation Work Plan* (DOE/NV, 1994b) indicates that due to site history, precaution should be exercised regarding radiological contamination. Additional documentation indicates that the GPBA may be within a low-level plutonium anomaly extending from Main Lake eastward to south of Area 9, as determined from flight survey data.

2.3 Waste Inventory

Unknown volumes and concentrations of hydrocarbon and chemical contaminants may have been released to surface and subsurface soils at three of the four CASs (FTA, SSY, and Station 44 Burn Area) within CAU 490. In addition to hydrocarbon and chemical contaminants, explosives and radionuclides may have been released at the GPBA. Process knowledge of potential waste inventories for each CAS within CAU 490 is discussed in the following sections.

2.3.1 Fire Training Area and Station 44 Burn Area

At the FTA, water, tires, and/or wood were put into a tank/ring structure and ignited with 1 to 5 gallons (gal) of diesel fuel for each training event. Reportedly, no other accelerants were used and water was the only extinguishing agent used during the exercises. The burning of materials for training was reportedly confined to the tank/ring structure, and it is unknown if the tank/ring structure contained a bottom to restrict infiltration of liquids into subsurface soils.

At the Station 44 Burn Area, tires and wood were placed into two wooden structures ignited with diesel fuel, and extinguished with water as part of training exercises conducted at the site. No other accelerants or extinguishing agents were reportedly used at the site. Interpretation of aerial photographs and documentation indicate that the burn areas were restricted to the two wooden structures.

2.3.2 Sandia Service Yard

Materials reportedly stored temporarily on the site included: tires, cables, wooden pallets, office furniture, electronic equipment, and drums containing oil, grease, diesel fuel, and PCBs. Spills from drummed material were identified from aerial photographs and have most likely not been remediated. Portions of the site were apparently regraded during final clean up activities.

2.3.3 Gun Propellant Burn Area

Nitroglycerine, nitroguanidine, and nitrocellulose have been identified as COPCs at this CAS. These constituents are associated with propellants and were potentially released to the surface and subsurface from incineration of deteriorated and experimental explosives in up to five burn pits located on the site. Materials reportedly disposed of at the site included black powder, Comp C-4, gun propellant (M-30), and solid rocket fuel. Additionally, documentation indicates that a device containing beryllium and uranium may have also been disposed of at this CAS.

2.4 Release Information

Exact quantities of contaminants released at each CAS are unknown. Migration of COPCs at the FTA, Station 44 Burn Area, and GPBA is expected to be limited laterally to areas identified for burning and vertically to shallow subsurface soils. However, spills from drums stored at the SSY may have dispersed contaminants throughout the area. Subsurface releases may have occurred at the GPBA in the vertical disposal pit constructed from corrugated pipe. Additionally, lateral and vertical migration of COPCs is expected to be minimal due to expected low concentrations of possible releases of COPCs, limited driving forces, and relatively low mobility of COPCs identified at each CAS. Site-specific release information is discussed in the following sections.

2.4.1 Fire Training Area and Station 44 Burn Area

Diesel fuel was reportedly used (1 to 5 gals) as an accelerant during fire training exercises which would have resulted in impact to surface soils at the sites. There is the potential for release of

Resource and Recovery Act (RCRA) metals and zinc (from vulcanized tire rubber) to the surface from the burning of tires at both sites. Additionally, the release of lead (from lead-based paint) may have occurred during training exercises conducted at the two buildings located at the Station 44 Burn Area.

2.4.2 Sandia Service Yard

Spills from drums which reportedly contained grease, oil, PCBs, and/or diesel fuel previously stored at the site have been identified from historical aerial photographs. Documentation indicates that spills were most likely not cleaned up. Various debris was discarded and burned in the disposal pits located near the site. The Corrective Action Decisional Document (CADD) for CAU 424 (DOE/NV, 1998) identified wire, burned oil, tire rubber, and free liquid/sludge in Landfill Cell A3-2 located adjacent and west of the service yard. Exact quantities and nature of contaminants released at the site are unknown.

2.4.3 Gun Propellant Burn Area

Incineration of deteriorated explosives (black powder) was conducted on the ground surface at the site from 1960 to 1965. During the life of the site, incineration of propellants, Comp C-4, solid rocket fuel, and experimental explosives was also conducted. Additionally, burn tests of units containing HE, beryllium, and uranium may have occurred at the site. Subsurface releases of COPCs may have occurred as a result of use of a vertical burn pit, constructed of corrugated pipe to an estimated depth of 15 ft bgs. The corrugated pipe was used for inverting and burning rockets.

2.5 Investigation Background

In accordance with the DOE/NV *National Environmental Policy Act* (NEPA) compliance program, a NEPA checklist will be completed prior to commencement of site investigation activities at CAU 490. This checklist compels DOE/NV to evaluate their proposed project against a list of several potential environmental impacts which include, but are not limited to, air quality, chemical use, waste generation, noise levels, and land use. Completion of the checklist results in a determination of the appropriate level of NEPA documentation by the DOE/NV NEPA Compliance Officer.

Site investigation activities associated with CAU 490 have been identified and documented in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* (DOE/NV, 1996b).

2.5.1 Fire Training Area

A Facility Investigation Work Plan, dated May 1994, describes a soil sampling strategy to determine the existence and extent of any vadose-zone soil contamination beneath the FTA that resulted from burning of diesel fuel, wood, and tires. There is no evidence to indicate this sampling effort was conducted. A corrective action investigation conducted in 1998 at CAU 424, Area 3 landfill complex (Landfill A3-8), included a borehole sampled to a depth of 25 ft. General sample results for the group of boreholes within this landfill area did not indicate any contaminants of potential concern. Constituents above PALs were not detected, and hazardous constituents were present only in isolated locations and at very low levels. No documentation exist that indicates geophysical surveys have been conducted at the site.

2.5.2 Station 44 Burn Area

No documentation was found to suggest that previous sampling or geophysical investigations had occurred at this site. Information on historical activities at the Station 44 Burn Area was interpreted from historical aerial photographs and interviews.

2.5.3 Sandia Service Yard

A geophysical survey of the northern area of the SSY was performed in 1990 in an attempt to identify landfills in Area 3. In 1997, Landfill Cells A3-1 and A3-2 were investigated and the results were documented in the CAU 424 CADD, finalized in 1998 (DOE/NV, 1998). The Landfill Cells A3-1 and A3-2 are outside and near the Sandia Service Yard boundaries.

Two boreholes were drilled at the Landfill Cell A3-1 site, to depths of approximately 25 ft bgs. No buried debris or COPCs were identified in soil samples collected from the borehole. Geophysical surveys identified two small buried anomalies within the area of Landfill Cell A3-1.

Six boreholes were drilled at the Landfill Cell A3-2 site, to depths ranging from 10 ft to 25 ft bgs. Landfill materials were encountered from 3 to 10.5 ft bgs in several of the boreholes, and free liquid/sludge was encountered in one borehole at approximately 10 ft bgs. Laboratory analysis of the sludge indicated diesel-range hydrocarbon above the action level. The sludge was removed during closure activities associated with CAU 424. Geophysical surveys indicated buried metallic materials in the area.

2.5.4 Gun Propellant Burn Area

Air sampling was performed at the site in 1970 and soil samples were taken. Results of this sampling effort have not been identified.

Surface geophysical surveys were conducted in 1993 and located five possible disposal pits containing metal debris. The pits ranged in size and may correlate with small burn pits and vertical corrugated pipes identified in photographs and documents. The surveys also located numerous small, buried metallic objects throughout the site.

3.0 Objectives

The DQOs are qualitative and quantitative statements that specify the quality of the data required to support potential courses of action for CAU 490. The DQOs were developed to clearly define the purposes for which environmental data will be used and to design a data collection program that will satisfy these purposes. One element of the DQO process is the formulation of a conceptual site model.

3.1 Conceptual Site Model

The conceptual models for CAU 490 are outlined in detail in Appendix A, Table A.2-1. The scope and strategy of this investigation will be revised if the conceptual model provided in this CAIP fails. The CAU 490 conceptual model may fail if substantially different historical, operational information is discovered, or field observations demonstrate the nature or extent of contamination associated with the CAU is substantially different than anticipated. If necessary, a rescoping of the investigation will be conducted.

3.2 Contaminants of Potential Concern

During the DQO process, COPCs for each CAS were identified through process knowledge and site history. The COPCs vary slightly for each CAS included in CAU 490. The following lists provide the site-specific analytes to be measured to determine the nature of potential contamination at each CAS:

Fire Training Area and Station 44 Burn Area:

- Total VOCs
- Total semivolatile organic compounds (SVOCs)
- Total RCRA metals and zinc
- TPH diesel-range organics (DRO)

Sandia Service Yard:

- Total VOCs
- Total SVOCs
- Total RCRA metals

- TPH
- Total PCBs
- Total Pesticides

Gun Propellant Burn Area

- Total VOCs
- Total SVOCs
- Total Metals
- TPH-DRO
- Nitroaromatics and nitramines (to include nitroglycerine)
- Radionuclides (plutonium and uranium)
- Nitrocellulose
- Nitroguanidine

Tables A.3-1 through A.3-3 in Appendix A list the COPCs to be analyzed for each CAS, including field-screening levels and preliminary action levels. Appendix C provides the analytical requirements which include minimum reporting limits, analytical methods, precision, and accuracy for all the analytes. Specific analyses required for disposal of investigation-derived waste (IDW) is identified in Section 5.0 of this CAIP, Waste Management.

Geotechnical and hydrological analysis may be performed at the Site Supervisor's discretion to support closure in place of subsurface debris. Bioassessment samples may be collected if field screening detects VOC or TPH concentrations greater than field-screening levels. Volatile organic compounds and hydrocarbon contamination may respond to bioremediation based corrective actions.

3.3 Preliminary Action Levels

The following subsections describe the FSLs and PALs for CAU 490. Field-screening levels for on-site field-screening methods will be used to determine the presence of contamination and guide the investigation.

3.3.1 Field-Screening Levels

The following FSLs will be used for on-site field-screening methods:

- Volatile organic compound headspace screening levels using a photoionization detector are established at 20 parts per million (ppm) or 2.5 times background, whichever is greater.

- Total petroleum hydrocarbon screening levels using appropriate field-screening methods (i.e., Hanby or other test kit) are established at 100 ppm.

- Explosives (as an indicator of the presence of degraded explosives and propellant compounds) will be screened with immunoassay field kits with established screening levels as shown in Table A.3-3 (Appendix A).

- Radiation (alpha and beta) screening levels are defined as the mean background activity level plus two times the standard deviation of the mean background activity level (to be determined prior to start of field activities) and monitored during sampling.

Concentrations exceeding FSLs will indicate potential contamination at that sample location. This information will be documented and the investigation will continue to delineate the extent of the contamination. Additionally, this data may be used to select discretionary laboratory sample locations.

3.3.2 Chemical Preliminary Action Levels

Off-site laboratory analytical results will be compared to the following PALs to evaluate the need for possible corrective actions:

- NDEP Corrective Action Regulations 445A.2272 (*Nevada Administrative Code* [NAC], 1998) for purposes of this investigation, EPA Region IX Preliminary Remediation Goals [PRGs] for industrial soils [EPA, 1999])

- TPH concentrations above the TPH limit of 100 ppm per the NAC 445A.2272 (NAC, 1998)

- Nitrocellulose concentrations above 10,000 milligrams per kilogram (mg/kg). Soils containing more than 10 percent (100,000 mg/kg) secondary explosives, on a dry weight basis, are considered to be susceptible to initiation and propagation. Soils containing less than 10 percent by dry weight are considered to be nonreactive (EPA, 1996).

The comparison of laboratory results to preliminary action levels will be discussed in the CADD. Laboratory results above PALs indicate the presence of COPCs at levels that may require corrective action. Laboratory results below PALs indicate that corrective action is not necessary. Based on the results of this field investigation, the evaluation of potential corrective actions and the justification for a preferred action will be included in the CADD.

3.3.3 Radiological Preliminary Action Levels

The PALs for radionuclides in soils are isotope-specific and are defined as the maximum concentration for that isotope found in environmental samples taken from undisturbed background locations. Environmental background samples previously taken in the vicinity of Area 3 and Area 9 at the TTR (in the vicinity of CAU 490) may be compared with the results for environmental samples taken from other undisturbed background locations on the TTR. In addition, the radionuclide concentrations in the CAU 490 and TTR background samples will be compared with the radionuclide concentrations found in environmental samples taken from undisturbed background locations in the vicinity of the TTR, presented in McArthur and Miller (1989) and Atlan-Tech (1992). The PAL for each isotope will be the maximum concentration of that isotope found in any of the samples taken from the undisturbed background location described above.

3.4 Data Quality Objectives Process Discussion

Details of the DQO process are presented in Appendix A. The DQO results for CAU 490 indicate the need for combined biased and/or random sampling approaches. Due to the potential for surface, shallow subsurface, and subsurface migration of COPCs, an investigation consisting of surface and subsurface sampling was identified. Table A.6-1 in Appendix A provides decision points and rules specific to each CAS that will be used to guide the field investigation.

4.0 Field Investigation

This section of the CAIP contains the sampling approach for investigating the CASs which make up CAU 490. All sampling activities will be conducted in compliance with the Industrial Sites QAPP (DOE/NV, 1996c) and other applicable, approved procedures and instructions. Quality assurance and quality control requirements for field and laboratory environmental sampling are provided in Section 4.4.2 and in the Industrial Sites QAPP.

Field activities will be performed in accordance with an approved site-specific health and safety plan (SSHASP) which incorporates the DOE/NV Integrated Safety Management System. Safety, health, and protection of the environment take precedence over expediency. Site personnel will take every reasonable step to reduce the possibility of injury, illness, or accident, and to protect the environment during all project activities. The following will be taken into consideration when assessing the hazards associated with field activities:

- Potential hazards to site personnel and the public include, but are not limited to, chemicals (such as RCRA metals, VOCs, SVOCs, and TPH), explosives, adverse and rapidly changing weather, remote location, heavy equipment operations including direct push, excavation, and drilling activities
- Proper training of all site personnel to recognize and mitigate the anticipated hazards
- Work controls to reduce or eliminate the hazards including engineering controls, substitution of less hazardous materials, and personal protective equipment (PPE)
- Occupational exposure monitoring to prevent overexposures to hazards such as radionuclides, chemicals, and physical agents (heat, cold, high winds)
- Use of the “as-low-as-reasonably-achievable” (ALARA) principle when dealing with radiological hazards
- Emergency and contingency planning and communications to include medical care and evacuation, decontamination and spill control measures, and appropriate notification of project management

4.1 Technical Approach

The following list describes general activities that may be executed during the site investigation for CAU 490. Specific details of activities for individual CASs are provided in Sections 4.3.1 through 4.3.4.

- Conduct exploratory excavation (trenching) to collect surface and subsurface soil samples and to define subsurface features.
  - If contamination extends beyond the capabilities of the excavation technique (approximately 15 ft), drilling may be initiated.
- Collect surface and subsurface soil samples at biased and random locations via direct-push methods.
  - If contamination extends to a depth beyond direct-push capabilities, excavation may be used to collect samples.
- Field screen site-specific samples for VOCs, TPH, explosives, and/or radionuclides.
- Analyze select site-specific soil samples for total VOCs, total SVOCs, total RCRA metals, beryllium, TPH, total PCBs, total pesticides, nitroaromatics, nitramines, nitrocellulose, isotopic uranium, and/or isotopic plutonium.
- Collect samples from the interface of native soils and disposal features, as defined by soil staining, geology, and presence of debris.
- Collect and analyze geotechnical samples if subsurface debris is encountered at the discretion of the Site Supervisor.
- Collect and analyze bioassessment samples if VOCs or TPH significantly exceed field-screening levels, at the discretion of the Site Supervisor.
- Collect quality control samples.

This investigation strategy will allow the nature and extent of contamination associated with the CASs to be determined. In general, the contents of each location and the underlying soil will be investigated until a soil sample from an interval with contaminant concentrations below appropriate field-screening levels is obtained. If this interval was reached by excavation, and is at the vertical limit of excavation capabilities, no additional intervals or samples will be attempted. Should the maximum vertical limit of excavation be reached, and field-screening results indicate the presence of contaminants above FSLs, drilling will be initiated and 5-ft intervals will be maintained until two consecutive samples below FSLs have been obtained. If contamination is more extensive than anticipated, the maximum investigation depth will be limited by the capability of the selected drilling method. If this occurs, the investigation will be rescoped.

4.2 Field Activities

The subsurface investigation of CAU 490 may include excavation, direct push, and drilling methods. Select samples will be field screened for VOCs, TPH, explosives, and/or alpha/beta-emitting radionuclides.

Biased and/or random sampling will be conducted during the field investigation to assess the extent of COPCs and determine if COPC concentrations exceed PALs for the sites. Samples collected from the CASs will be analyzed according to the appropriate COPC table provided in Section A.3.0.

4.2.1 Excavation Activities

Excavation activities will use an excavator and/or hand tools to obtain surface and subsurface soil samples, and to define vertical and lateral extent of contamination in known disposal features. Additionally, excavation will be used to evaluate anomalies as possible disposal areas in the GPBA. These anomalies will be identified through historic geophysical surveys, aerial photographs, current surface features, and magnetometer readings. The anomalies will be evaluated to confirm the presence of disposal features and, if verified, to define the extent of the feature. Excavation will also be utilized for soil sampling if the vertical extent of contamination, as determined through field screening, extends beyond direct-push capabilities. Soils will be collected directly from the backhoe bucket or hand tool immediately upon retrieval and containerized in accordance with approved sampling procedures or instructions.

Damage to roads and utilities will be minimized. Excavated soil will be stored in a manner which will prevent run-on and run-off. Upon completion of the investigation activities, excavated soil will be returned to the excavation nearest its original location as practical.

4.2.2 Direct-Push Methods

The direct-push method will be used to collect site-specific surface (0 to 1 ft bgs) and subsurface (3 to 4 ft bgs) soil samples at biased and/or random locations at the CASs. The number and placement of proposed sampling locations were determined from historical and process knowledge and/or as described in Section A.7.0. Soils will be collected directly from direct-push liners immediately upon retrieval and containerized in accordance with approved sampling procedures or instructions. Excess soils from each direct-push location will be returned to the hole from which it was generated.

4.2.3 Drilling Methods

Should direct push and/or excavation methodology be inadequate to assess the vertical extent of contaminants at any of the CASs, drilling will be initiated. If drilling is required, it will consist of hollow-stem auger or another appropriate drilling method.

If elevated field-screening results are identified during advancement of the initial borings, step-out borings may be advanced to evaluate the extent of lateral and vertical contaminant migration. The location of the initial step-out borings will be dictated by individual site conditions. Based on field-screening results, additional step-outs (beyond the initial step-outs) may also be needed to delineate plume geometry. At a minimum, step-out borings will be advanced to the lowest vertical extent of contamination (as detected by field screening) in the initial locations. Soils will be collected immediately upon retrieval, either directly from a split-spoon if the hollow-stem auger method is used or polyurethane bag after extrusion from the core barrel if the rotary sonic method is used. Soils will then be containerized in accordance with approved sampling procedures or instructions. Excess drill cuttings not collected as samples will be returned to the boring from which they originated or containerized and managed as IDW. Upon completion of sampling activities, all open boreholes will be filled to the ground surface with a bentonite grout mixture.

4.2.4 Field Screening

Site-specific field screening for VOCs, TPH, explosives, and/or radiological activity will be performed to guide the investigation and sampling selection and to assist with health and safety and waste management decisions. The headspace method (PID) and the Hanby test kit will be utilized to field screen for TPH. Field screening for elevated explosives levels (explosive/propellant indicator) will be performed using an immunoassay test kit. An alpha/beta scintillator (i.e., Electra or equivalent) will be utilized to field screen for elevated radiological activity. To avoid the potential for generating mixed waste, TPH screening will not be conducted on any soil from the GPBA. The FSLs for these field-screening methods are detailed in Section 3.3.1.

4.3 CAS Site-Specific Investigation Strategy

4.3.1 Fire Training Area

Surface and subsurface sampling will be conducted using an excavator or other excavation method. One trench will be excavated near the center of the fire training ring (Figure 4-1). Additional trenches may be excavated to define lateral extent of contamination, if necessary. Intrusion into the CAU 424, Landfill Cell Use Restriction Area will not occur during field activities without prior approval from the NDEP and DOE/NV. If contamination extends vertically beyond excavation capabilities, drilling will be initiated. Field screening for VOCs and TPH will be conducted using a PID and the Hanby Test kit, respectively.

Samples will be collected for field screening at depth intervals of 0 to 1 ft, 3 to 4 ft, and at 5-ft intervals thereafter, until a sample interval with field-screening results below FSLs is encountered or to the maximum depth capability of the excavation method. The 3- to 4-ft sample interval may be substituted with an alternative interval that reveals obvious worst-case contamination, at the fill material/native soil interface, and/or the tank bottom/native soil interface. If contamination is detected by field screening, the sample with the highest contaminant concentration will be submitted for laboratory analysis, in addition to a confirmatory clean sample. At a minimum, one surface soil sample, one sample from the tank bottom/native soil interface (as identified or approximated), and one sample from the first interval past the interface that is below FSLs will be submitted. Additionally, samples for field screening will be collected from outside the identified fire training ring to define lateral extent of the feature. Confirmatory soil samples for laboratory analysis will be collected at depths that correlate with samples collected from within the ring. All samples submitted for off-site laboratory analysis will be analyzed for the COPCs listed in Section 3.2. Additional samples may be submitted at the discretion of the Site Supervisor.

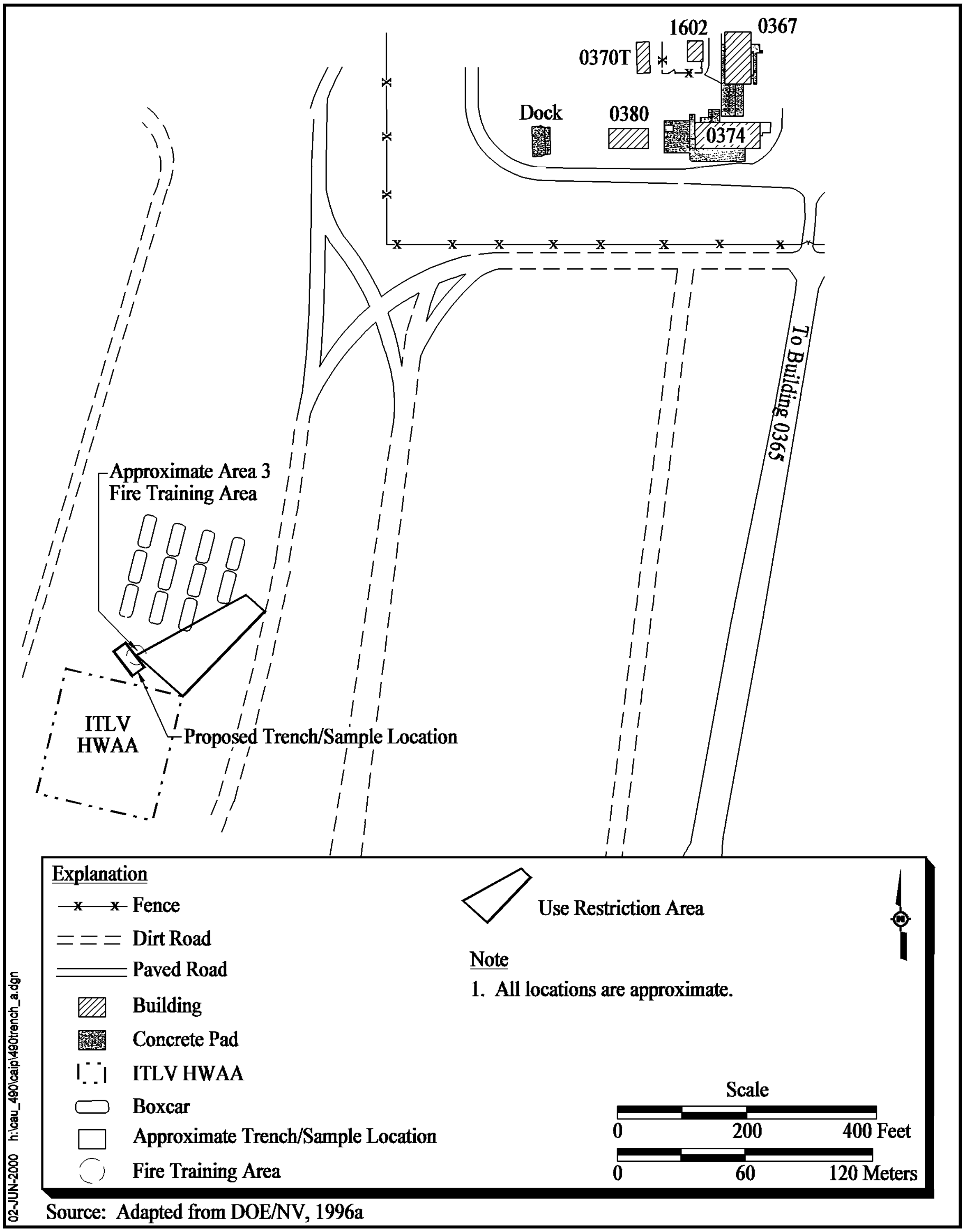

Figure 4-1
Proposed Trench/Sampling Location Map, Fire Training Area
Tonopah Test Range

4.3.2 Station 44 Burn Area

Surface (0 to 1 ft bgs) and shallow subsurface (3 to 4 ft bgs) soil samples will be collected at two biased locations within the suspected area of each wooden structure (Figure 4-2). The planned sample intervals may be substituted with an alternative interval that reveals obvious worst-case contamination. Direct-push methodology will be used to collect the samples. Step-out holes will be pushed in a triangular pattern if field-screening results exceed FSLs. Borings will continue at 2- or 5-ft intervals (determined by the Site Supervisor), if FSLs are exceeded at the 4-ft depth interval. If the depth of contamination exceeds the capability of the direct-push methods, excavation will be initiated. If vertical contamination exceeds the extent of excavation technique, drilling will be initiated. Drilling may be initiated after direct-push at the Site Supervisor's discretion. Field screening for VOCs and TPH will be conducted using a PID and the Hanby Test Kit, respectively.

4.3.3 Sandia Service Yard

Biased and random sampling will be conducted at this CAS. Biased sampling is appropriate because some of the areas of concern are well defined or can be reasonably assumed. Random sampling at the CAS will ensure adequate coverage of potentially contaminated areas that may have been redistributed as a result of regrading the site.

Biased and random sampling will be conducted at this CAS using direct-push methodology. Both surface (0 to 1 ft bgs) and shallow subsurface (3 to 4 ft bgs) samples will be collected and submitted for laboratory analyses from all sample locations (Figure 4-3). The planned sample intervals may be substituted with alternative intervals that exhibit obvious worst-case contamination. Biased sample locations have been identified at noticeably stained soil locations and at historically stained locations depicted on aerial photographs. Random samples will be collected throughout the remaining area of the yard to account for areas of unknown past activities and possible redistribution associated with regrading activities. Should field screening determine that contamination has extended beyond the boundaries of the SSY, project management will be contacted and a decision will be made at that time whether or not to continue the assessment beyond the current CAS boundaries. Borings will continue below the 4-ft depth interval if FSLs are exceeded at any sample location. If the depth of contamination exceeds the capability of direct-push methods, excavation will be initiated. If vertical contamination extends beyond the capability of the excavation technique, drilling will be initiated.

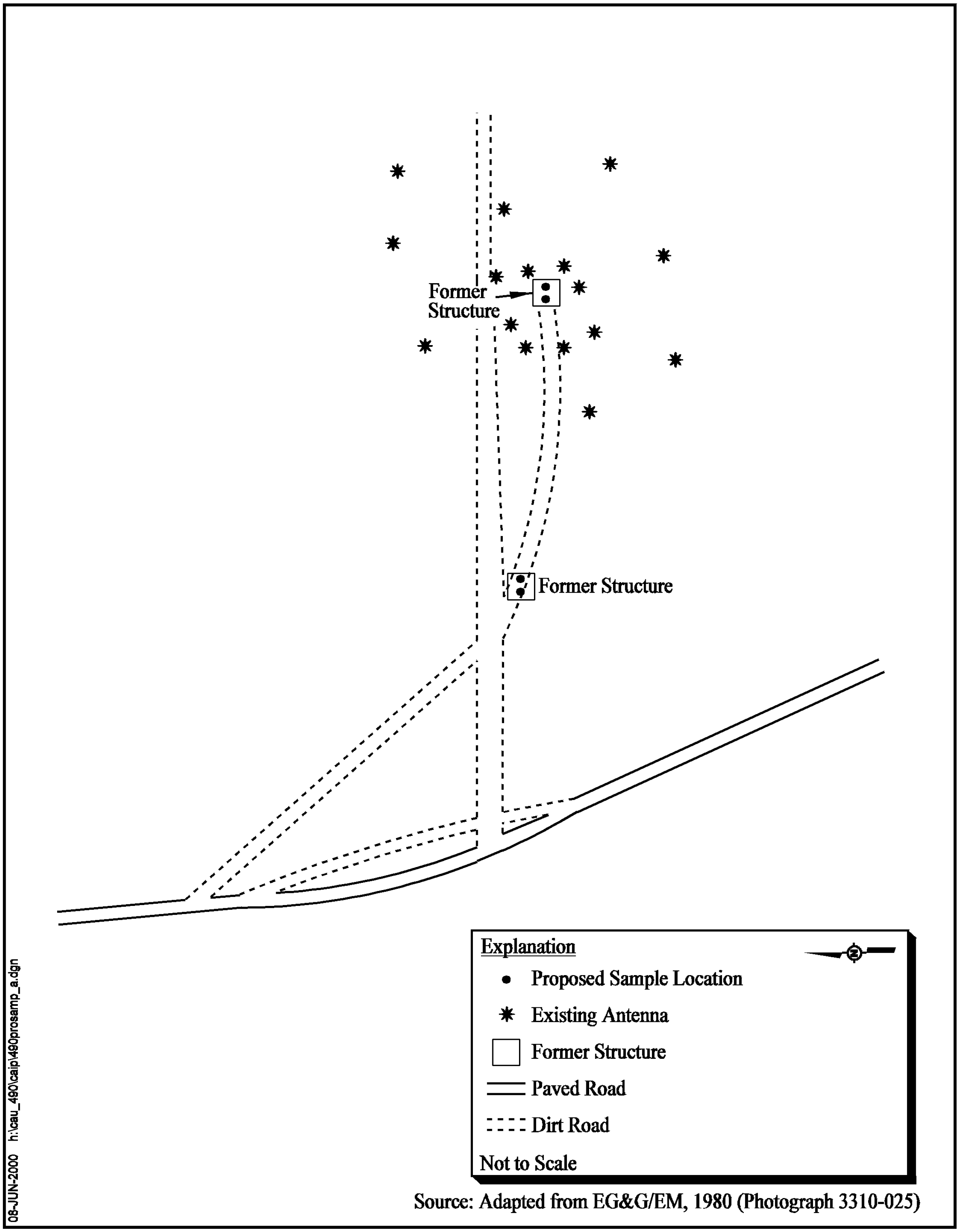

Figure 4-2
Proposed Sample Location Map, Station 44 Burn Area, Tonopah Test Range

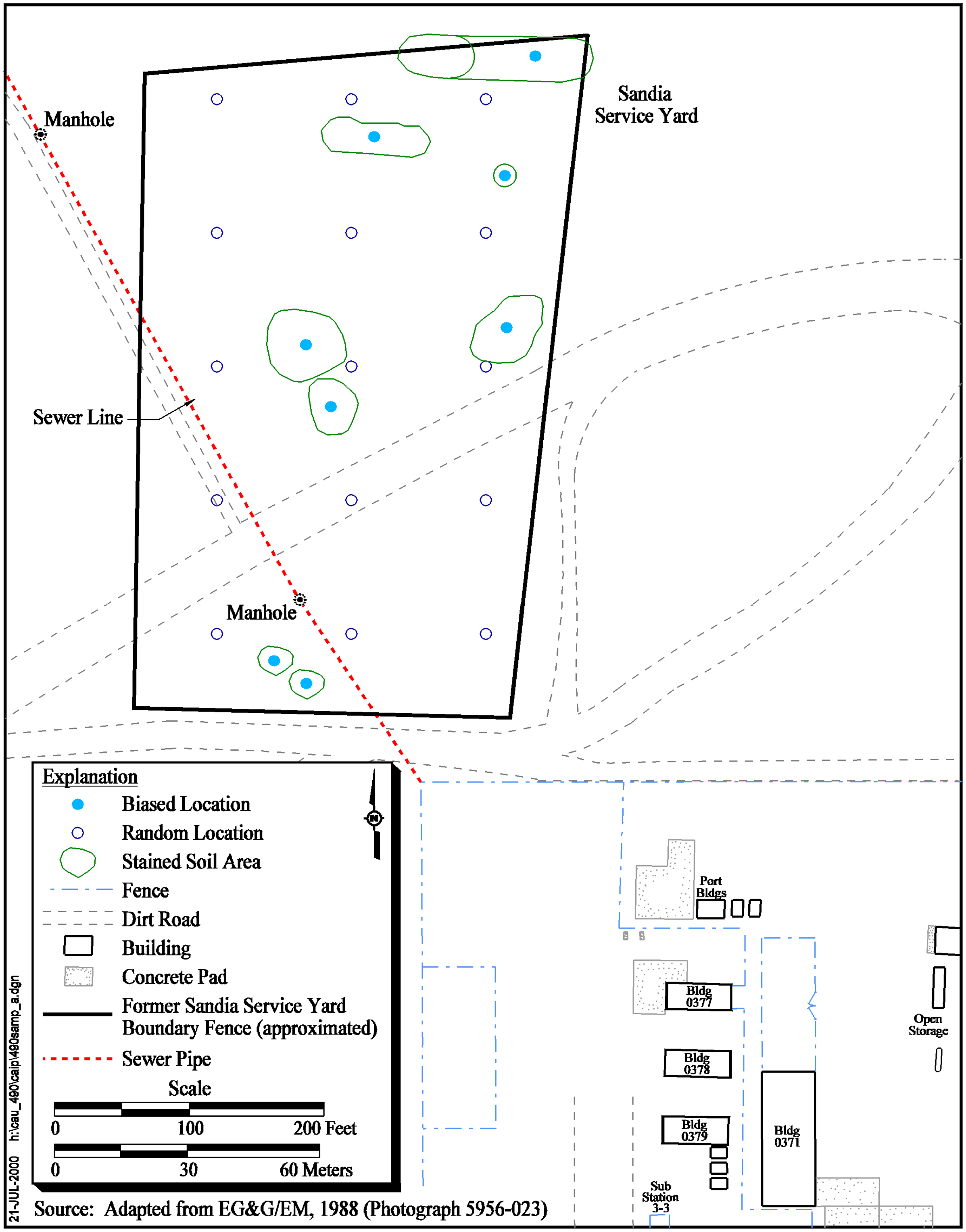

Figure 4-3
Proposed Biased and Random Sample Location Map, Sandia Service Yard, Tonopah Test Range

Drilling may be initiated after direct-push at the Site Supervisor's discretion. Field screening for VOCs (on all samples) and TPH (on subsurface soil samples only) will be conducted using a PID and the Hanby Test Kit, respectively.

The number and locations of the random soil borings were determined by an analysis of the COPCs and use of the program "Visual Sample Plan" (Davidson, 2000). The process used for selecting the number of systematic random soil borings is described in Section A.7.0 of Appendix A. The locations selected for systematic random soil borings are based on an adaptive fill designed to consider the locations of biased sample locations and maximize coverage of the area. The combination of biased and systematic selection of soil boring locations will ensure adequate coverage of the potentially contaminated area associated with this CAS.

4.3.4 Gun Propellant Burn Area

Surface and subsurface samples will be collected at biased locations using a backhoe and/or hand tools employing appropriate explosive ordnance avoidance procedures (Figure 4-4). Biased sample locations will be identified through historical geophysical surveys, aerial photographs, and current surface features, and may be adjusted using magnetometer readings to correlate with suspected disposal features. These features include three suspected burn pit areas, one 15-ft deep vertical pit with corrugated piping, and one 2-ft deep vertical pit with corrugated piping.

In order to establish the lateral extent of each identified disposal feature, trenching will begin approximately ten feet outside the estimated footprint of each anomaly to a depth of approximately 4 ft bgs and progress inward, toward the center of the anomaly. Excavation will progress in 1- to 3-ft lifts, under the supervision of trained unexploded ordnance (UXO) technicians. If a disposal feature cannot be identified during excavation, one confirmatory sample will be collected from the bottom (about 4 ft bgs) of the excavation nearest the estimated center of the disposal feature.

If a disposal feature is identified visually or through field screening during excavation, trenching will be terminated after attempting to progress approximately 5 feet into the disposal feature. Excavation into the disposal feature may be minimized if site conditions indicate an unacceptable risk to personnel. Additional trenching and sampling will be conducted in the same manner at the remaining two to three sides of the disposal feature depending on the characteristics of the feature. One

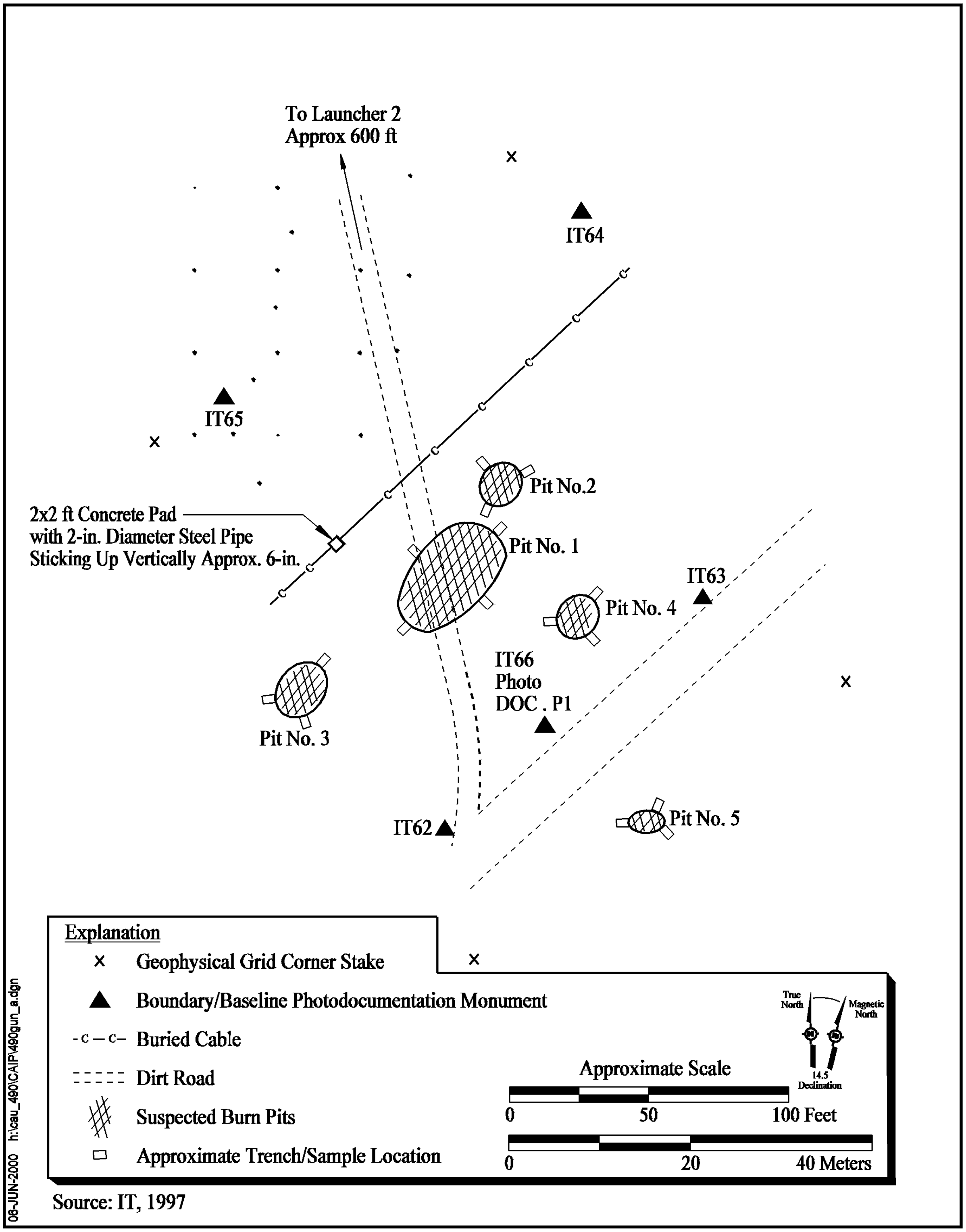

Figure 4-4
Proposed Sample Location Map, Gun Propellant Burn Area
Tonopah Test Range

composite sample from representative surface soils from the vertical endwalls of each trench within the disposal feature, as well as one composite sample of representative soils from the worst-case interval of each trench, based on field screening, will be collected. Additionally, confirmatory samples will be collected from soils in the endwall and bottom of each excavation, outside of the identified disposal feature. If the vertical extent of the disposal feature is determined to exceed 4 ft bgs, excavation will continue vertically, collecting samples at 3-ft intervals, until field screening and/or visual examination indicates the feature has been defined or until the vertical capacity of the excavation technique has been reached. Should field screening indicate that the vertical extent of the disposal feature has been defined, excavation will continue vertically an additional 3 feet and a confirmatory soil sample from the bottom of the excavation will be collected. Should the vertical extent of the disposal feature extend beyond the reach of the excavation method, drilling will be initiated. The borings will be located as close to the disposal feature as possible considering the guidance of trained UXO personnel. No attempt will be made to drill through disposal features. Samples will be collected at 5-ft intervals, below the extent of the excavation, to a maximum of 25 ft bgs or until field-screening results are below FSLs. Field screening will be conducted on all samples for VOCs, explosives, and alpha/beta radionuclides.

4.4 Sampling Criteria

All sampling activities for CAU 490 will be conducted in compliance with the requirements of the Industrial Sites QAPP (DOE/NV, 1996c) and this CAIP. Subsections 4.4.1 through 4.4.5 provide details on the type of sample collection that will be performed during the field investigation. The CAS-specific investigation strategy and proposed sampling locations are provided in Section 4.3. Details of the field screening to be conducted at each CAS are provided in Section 4.3.

Records will be maintained for a visual classification of the soil from boreholes, field-screening measurements, and all other pertinent data. Relevant and required sampling information (e.g., date, time, sample interval) will be documented in accordance with the Industrial Sites QAPP. Approved chain of custody procedures (DOE/NV, 1994a) will be followed to assure sample integrity.

All equipment which contacts soil to be sampled will be decontaminated in accordance with written, approved, and controlled procedures. All sampling equipment will be decontaminated prior to each sampling event to minimize the potential for cross-contamination of samples from different locations.

All of the samples will be field screened and a limited number of these samples will be submitted to the off-site laboratory. Samples to be analyzed will be selected based on the results of field screening and minimum sampling requirements. The actual number of samples analyzed will depend on decisions made in the field.

4.4.1 Environmental Samples

Environmental samples to be collected for laboratory analyses will consist of unused media. Samples targeted for VOC analysis will be given highest priority when being collected and will not be composited. Samples with no volatilization concerns will be collected with priority given to those with the shortest holding times. Samples submitted to the laboratory will be analyzed in accordance with Appendix C.

4.4.2 Quality Control Samples

Quality control samples will be collected as required by the Industrial Sites QAPP (DOE/NV, 1996c). These samples will include trip blanks, equipment blanks, source blanks, field blanks, field duplicates, and matrix spike/matrix spike duplicates (MS/MSD) samples. Except for trip blanks, all QC samples will be analyzed for applicable parameters as listed in Tables A.3-1 through A.3-3 for each CAS. Trip blanks will only be analyzed for VOCs. With the exception of MS/MSD, QC samples will be submitted to the laboratory blind. Additional QC samples may be submitted at the discretion of the Site Supervisor.

4.4.3 Background Samples

Background data on RCRA metals and radionuclides have been previously generated for Area 3 and Area 9 during past investigations and will be used to evaluate data to be presented in the CADD. No background samples will be collected during this investigation.

4.4.4 Geotechnical Samples

In addition to environmental samples, at least one geotechnical sample may be collected from the GPBA to characterize the geologic and hydrologic properties of soils. Analysis of geotechnical parameters listed in Table 4-1 will be performed by an off-site laboratory. The methods shown are minimum standards, and other equivalent or superior testing methods may be used.

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Table 4-1
Geotechnical Analyses

Analysis	Method
Initial moisture content	ASTM[a]D 2216
Dry bulk density	EM[b]-1110-2-1906
Calculated porosity	EM[b]-1110-2-1906
Saturated hydraulic conductivity	ASTM[a]D 5084
Unsaturated hydraulic conductivity	Van Genuchten[c]
Particle-size distribution	ASTM[a]D 422-63(90)
Water-release (moisture retention) curve	ASTM[a]D 3152

[a]American Society for Testing and Materials (ASTM, 1996)
[b]U.S. Army Corps of Engineers (USACE, 1970)
[c]Van Genuchten, 1980

4.4.5 Bioassessment Samples

One or more bioassessment samples may be collected from each CAS, at the discretion of the Site Supervisor, if field-screening results detect VOCs or TPH significantly above FSLs. Bioassessment is a series of tests designed to evaluate the physical, chemical, and microbiological characteristics of soil. These tests include determination of nutrient availability, soil pH, microbial population density, and the availability of the microbial population to grow under enhanced conditions. These samples will be collected within brass sleeves (or other container, as appropriate to the sample collection methodology), so as to preserve the natural physical characteristics of the soil. The data will be used in the evaluation of alternatives in the CADD.

5.0 Waste Management

Management of IDW will be based on regulatory requirements, field observations, field screening, and laboratory analysis of CAU 490 investigation samples. Decontamination activities will be performed according to approved contractor procedures as specified in the field sampling instructions and as appropriate for the COPCs likely to be identified within each CAS.

Waste other than soil is potentially contaminated waste only by virtue of contact with potentially contaminated media. Therefore, sampling and analysis of IDW, separate from analyses of site characterization samples, may not be necessary. However, rinsate or other samples may be taken to support waste management activities (e.g., isotopic uranium soil samples). The data generated as a result of site characterization, and process knowledge and gamma spectrometry will be used, whenever possible, to assign the appropriate waste type (i.e., solid waste (nonhazardous), hazardous, low-level radioactive waste [LLW], or mixed) to the IDW. Solid waste (nonhazardous), hazardous, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with DOE Orders, U.S. Department of Transportation (DOT) regulations, RCRA regulations, State of Nevada requirements and agreements, and permits between DOE and NDEP.

5.1 Waste Minimization

Corrective action investigation activities have been planned to minimize IDW generation. Decontamination activities will only use as much water as necessary to decontaminate equipment and personnel to minimize the amount of rinsate generated. Disposable sampling equipment, decontamination rinsate, and PPE will be segregated to the greatest extent possible to minimize the generation of hazardous, radioactive, and/or mixed waste.

5.2 Potential Waste Streams

Process knowledge indicates the potential for hazardous and/or radioactive materials to be present at CAU 490, GPBA (CAS 09-54-001-09L2). There is a potential that solid (nonhazardous), LLW, hazardous, mixed, and/or hydrocarbon waste may be generated during field activities. Specific waste materials generated during the investigation may include, but are not limited to the following:

- Decontamination rinsate
- Potentially contaminated disposable sampling equipment (e.g., plastic, paper, sample containers, aluminum foil, trowels, hand augers)
- PPE potentially contaminated during field activities

For administrative purposes, waste will be segregated into multiple waste streams: containerized soil, solid waste (nonhazardous), potentially contaminated PPE, and decontamination rinsate. Further segregation may be implemented within each waste stream, as appropriate.

5.3 Investigation-Derived Waste Management

Management requirements for solid waste (nonhazardous), LLW, hydrocarbons, hazardous, and mixed waste are discussed further in the following sections. All IDW generated at CASs 03-56-001-03BA, FTA; RG-56-001-RGBA, Station 44; and 03-58-001-03FN, SSY will be managed according to hazardous waste requirements until a waste determination is made. All IDW generated at CAS 09-54-001-09L2, GPBA will be managed according to mixed waste requirements until a waste determination is made.

Any IDW generated during this investigation will be segregated by waste stream and placed in packages meeting DOT specifications, appropriate for the type and amount of waste generated.

5.3.1 Solid Waste (Nonhazardous)

Solid waste will be contained in plastic bags, dumpsters, or packages and will be disposed of in a solid waste management unit.

5.3.2 Low-Level Radioactive Waste

Low-level radioactive waste, if generated, will be managed and characterized in accordance with DOE Orders and the requirements of the *Nevada Test Site Waste Acceptance Criteria* (NTSWAC) (DOE/NV, 1999). Characterization will be based on laboratory results, field screening, process knowledge, or a combination thereof. Potentially contaminated IDW, such as PPE, will be placed in plastic bags, containerized, and marked with the date and associated sample location. The plastic bags and any other LLW, such as containerized soil, will be placed in marked packages meeting DOT specifications and locked or fitted with tamper-indicating devices (49 *Code of Federal Regulations* [CFR] 172 [CFR, 1999a]). The drums will be staged at a designated Radioactive Materials Area pending disposal in accordance with NTSWAC requirements (DOE/NV, 1999). Drums will be marked "Radioactive Material Pending Analysis" until a final waste characterization can be made.

Rinsate that is potentially contaminated with radioactive material will be collected in packages meeting DOT specifications (49 CFR 172) (CFR, 1999a). The soil characterization results will be applied to the rinsate to determine final disposition, or a separate analysis may be performed.

Any waste to be disposed of in LLW landfills at the NTS will be characterized in accordance with the requirements of the NTSWAC and the contractor-specific waste certification program plan and implementing procedures.

5.3.3 Hazardous Waste

Suspected hazardous waste will be managed in accordance with the procedures outlined in this section, which are based on RCRA and Nevada hazardous waste regulations. Such waste will be placed in properly marked packages meeting DOT specifications as per 49 CFR 172 (CFR, 1999a). Container markings and field records will allow wastes to be traceable back to the source. Additionally, waste may be directly sampled for characterization purposes. The type of container used will be appropriate for the particular waste in storage as specified in 40 CFR 265.172 (CFR, 1999b). No incompatible waste is expected to be generated; however, if incompatible waste is encountered in the field, it will be managed in accordance with 40 CFR 265.177 (CFR, 1999c).

Hazardous waste will be characterized in accordance with the requirements of 40 CFR 261 (CFR, 1999d). Characterization will be based on analytical data, field-screening results, process knowledge, or a combination thereof. Containers holding wastes pending characterization will be identified with "Hazardous Waste Pending Analysis" markings until the regulatory status can be determined. Depending on the nature and amount of waste generated, waste management control areas may be established, such as a Satellite Accumulation Area (SAA) or HWAA.

Hazardous waste will not be stored at the site of generation for more than 90 days unless accumulated in a SAA in accordance with 40 CFR 262.34 (CFR, 1999e). Hazardous waste will be shipped to a permitted hazardous waste treatment, storage, or disposal facility before the expiration of the 90-day storage limit. The waste will be transported by a licensed hazardous waste hauler and accompanied by a Uniform Hazardous Waste Manifest, in accordance with DOT shipping requirements. A copy of the manifest will be provided to the NDEP in accordance with state regulatory requirements.

5.3.4 Mixed Waste

Mixed waste, if generated, will be managed in accordance with RCRA (CFR, 1999d) and NAC regulations (NAC, 1999), as well as DOE requirements for radioactive waste. Where there is a conflict in regulations or requirements, the most stringent will apply. For example, the 90-day accumulation limit and weekly inspections required by RCRA regulations will be applied to mixed waste, even though it is not required for radioactive waste. Conversely, while RCRA does not require traceability, the Nevada Test Site (NTS) waste acceptance program for LLW does; therefore, records allowing traceability will be maintained. Containers holding wastes pending characterization will be identified with "Awaiting or Pending Analysis" markings until the regulatory status can be determined.

In general, mixed waste will be handled in the same manner as hazardous waste, but with the added LLW management program requirements. Mixed waste will be transported to the NTS transuranic waste storage pad pending treatment or disposal. Mixed waste with hazardous constituents that are below land disposal restrictions may be disposed of at the Area 5 Radioactive Waste Management Site. Mixed waste not meeting land disposal restrictions will remain at the transuranic waste storage pad pending development of a treatment plan in accordance with the requirements of the 1995 Mutual Consent Agreement between DOE and the State of Nevada (NDEP, 1995).

5.3.5 Hydrocarbon Waste

The action level for soil contaminated with hydrocarbons is 100 mg/kg in the state of Nevada (NAC, 1998). Containerized soil and associated IDW with TPH levels above 100 mg/kg shall be managed as hydrocarbon waste and shall be disposed of in accordance with all applicable regulations in a hydrocarbon landfill.

5.4 Analysis Required for the Disposal of IDW

Additional analytical data may be required to characterize the IDW. These analyses will support waste classification to meet waste acceptance criteria prior to disposal at on-site NTS and off-site locations. Each of the four CASs have been reviewed to ensure that sufficient analyses to support IDW disposal have been planned and are summarized in Table 5-1. Samples submitted for laboratory analysis will be analyzed according to Appendix C (Analytical Table C.1-1).

Table 5-1
Analysis Required for the Disposal of IDW

Corrective Action Site	Isotopic Uranium	Gamma Spectrometry	Percent of Samples
CAS 03-56-001-03BA Fire Training Area	required	required	25
CAS RG-56-001-RGBA Station 44 Burn Area	required	required	25
CAS 03-58-001-03FN Sandia Service Yard	required	required	25
CAS 09-54-001-09L2 Gun Propellant Burn Area	Met by COPCs samples	Met by COPCs samples	N/A

6.0 Duration and Records Availability

6.1 Duration

After submittal of the Final CAIP for CAU 490 to NDEP (FFACO milestone deadline of August 31, 2000), the following is a tentative schedule of activities (in calendar days):

- Day 0: Preparation for field work will begin.
- Day 45: The field work, including field screening and sampling will begin. Samples will be shipped to meet laboratory holding times.
- Day 120: The field work will be completed.
- Day 185: The quality-assured analytical sample data will be available for NDEP review.
- The FFACO date for the CADD is July 31, 2001.

6.2 Records Availability

Historic information and documents referenced in this plan are retained in the DOE/NV project files in Las Vegas, Nevada, and can be obtained through written request to the DOE/NV Project Manager. This document is available in the DOE public reading rooms located in Las Vegas and Carson City, Nevada, or by contacting the DOE Project Manager. The NDEP maintains the official Administrative Record for all activities conducted under the auspices of the FFACO.

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Appendix A

Data Quality Objectives Worksheets

A.1.0 Introduction

A.1.1 Problem Statement

Potentially hazardous wastes were generated at three of the four CASs within CAU 490, and potentially hazardous and radioactive wastes were generated at the fourth. Existing information about the nature and extent of contamination is insufficient to evaluate and select preferred corrective actions for this site. The following CASs comprise CAU 490, Station 44 Burn Area (TTR):

- CAS 03-56-001-03BA, Fire Training Area
- CAS RG-56-001-RGBA, Station 44 Burn Area
- CAS 03-58-001-03FN, Sandia Service Yard
- CAS 09-54-001-09L2, Gun Propellant Burn Area

These sites will be investigated based on DQOs developed by representatives of NDEP and DOE/NV. This investigation will determine if COPCs are present and if concentrations exceed regulatory levels in soils underlying and immediately surrounding the sites. If COPCs are detected, the lateral and vertical extent of contamination will be determined. This investigation will focus on collection of data adequate to close the site under NDEP, RCRA, and DOE requirements.

A.1.2 DQO Kickoff Meeting

Table A.1-1 lists the participants present at the FFACO-required DQO Kickoff Meeting and any subsequent meetings. The goal of the DQO process is to establish the quantity and quality of environmental data required to support corrective action decisions for the CAU. The process ensures that the information collected will provide sufficient and reliable information to identify, evaluate, and technically defend the chosen corrective action. Unless otherwise required by the results of this DQO and stated in the CAIP, this investigation will adhere to the *Industrial Sites Quality Assurance Project Plan* (DOE/NV, 1996c).

Table A.1-1
DQO Kickoff Meeting Participants

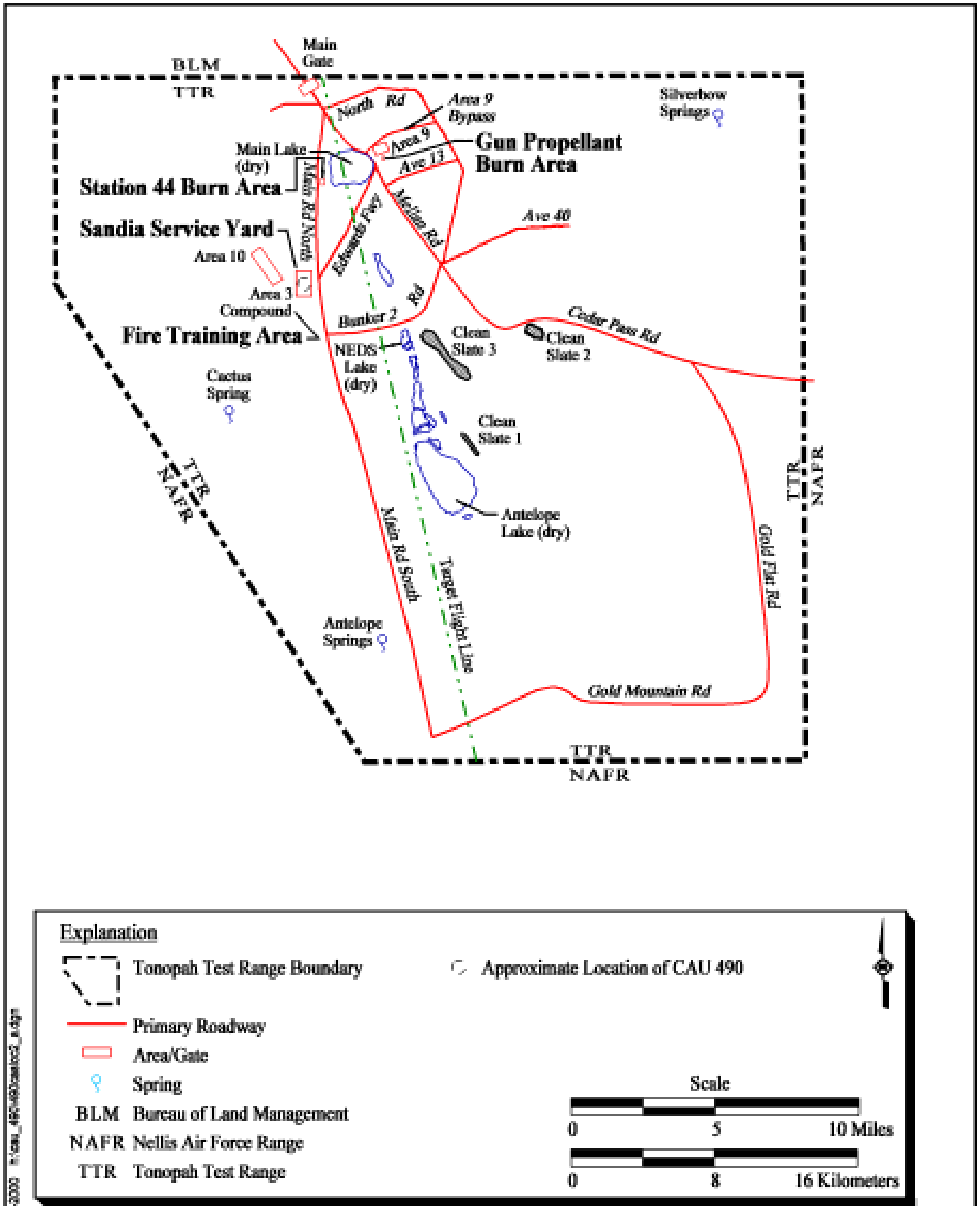
Proposed Participants	Affiliation	Meeting Date
		Kickoff Meeting 01/13/2000
Steven Adams	IT	X
Dawn Arnold	SAIC	X
Kevin Cabble	DOE/NV	X
Lydia Coleman	SAIC	X
Cindy Dutro	IT	X
Brad Jackson	IT	X
Syl Hersh	IT	X
Mark Holmes	IT	X
Clem Goewert	NDEP	X
Dennis Gustafson	BN	X
Craig Stowell	BN	X
Dustin Wilson	SAIC	X
Jeanne Wightman	MACTEC	X

BN - Bechtel Nevada
DOE/NV - U.S. Department of Energy, Nevada Operations Office
IT - IT Corporation
MACTEC - Management Analysis Company Technologies
NDEP - Nevada Division of Environmental Protection
SAIC - Science Applications International Corporation

A.2.0 Conceptual Model

Unknown volumes and concentrations of hydrocarbons and other chemicals may have been released in surface and subsurface soils at the four CASs within CAU 490. The approximate locations of these CASs are shown on Figure A.2-1. These releases were a result of various activities that include burning miscellaneous debris at the surface during fire training exercises, burning of gun propellant and deteriorated explosives within subsurface pits, and historic surface spills within a storage yard. Section 2.0 of the CAIP describes the operational histories, waste inventories, release information, and investigative background for each of the CASs.

An outline of site-specific elements of the conceptual model for CAU 490 is provided in Table A.2-1.



Source: Adapted from DOE/NV, 1996a

Figure A.2-1
Approximate Locations of CAU 490 CASs, Tonopah Test Range

Table A.2-1
Conceptual Model for CAU 490, Station 44 Burn Area (TTR)
(Page 1 of 4)

Conceptual Model Element	Assumptions	Source
Fire Training Area (CAS 03-56-001-03BA)	Location approximately 1,100 ft southwest of Area 3 west gate entrance near boxcars; adjacent to current Area 3 Primary HWAA; FTA as solitary structure until sometime between 1982 and 1987; storage area since at least 1987 (aerial photo)	Zimmerman, 1993 and 1999a; Ecology and Environment, Inc., 1989; SNL, 1992; review of aerial photos (1980 - 1999)
	Historically the FTA was constructed of a 15-ft diameter steel ring; possibility a 6-ft diameter, 3-ft deep stock tank existed within the steel ring; unknown if bottom existed on tank; currently no evidence of structure; no staining of soil on surface but visible within inches of surface (gray to black); no geophysical survey conducted specifically for this CAS; outside ring diameter still clearly visible through 1999 photos although dark inner circular structure no longer evident	Phase I Assessment Form, (IT, 1998c); Review and interpretation of photographs (IT, 1998a); EG&G/EM and BN, 1980 through 1999, TTR Work Plan (DOE/NV, 1996a)
	Used for fire training exercises where tires and wood were ignited with diesel fuel only; burning confined to ring; only water or CO_2 extinguisher used; sludge accumulation is possible at base of tank; unknown if sludge removed prior to grading/backfilling; worst case sample at 3 ft bgs (bottom of tank, if not removed); operational from unknown date to about 1984	Zimmerman, 1993 and 1999a; ER Information Sheet (SNL, 1992); TTR Work Plan (DOE/NV, 1996a)
	CAU 424, Area 3 Landfill Cell A3-8 use restriction marker within circle of FTA; borehole data exists; no COPCs at lower depths; debris encountered in borehole within about 30 ft of the FTA to depth of 5 ft	CAU 424 CADD (DOE/NV, 1998)

Table A.2-1
Conceptual Model for CAU 490, Station 44 Burn Area (TTR)
(Page 2 of 4)

Conceptual Model Element	Assumptions	Source
Sandia Service Yard (CAS 03-58-001-03FN)	Located northwest of Area 3 compound; yard is approximately 515 ft by 338 ft; associated with Landfill Cells A3-2 and A3-1a, CAU 424	TTR Work Plan (DOE/NV, 1996a); Phase I Assessment Form (IT, 1998c); aerial photos, (EG&G/EM and BN, 1980 through 1999)
	Sandia service yard used for storage from 1979 to 1993; stored items included wood, tires, metal, electronic and office equipment, construction debris, drums of oil/grease; northern burn pit (Landfill Cell A3-1a) received material for burning; a second pit was reportedly located west of service yard utilized during final cleanup of yard; Cell A3-2 was the disposal pit for nonburnable material, located on western side of yard	TTR Work Plan (DOE/NV, 1996a); Interviews (Quas, 1999a); (Dubiskas, 1998 and 1999)
	Current site conditions: Yard currently is not used; a dirt road runs through the center; historic aerial photos show possibly stained areas from drums; yard has been partially scraped/graded, but most staining still visible; underground utilities present, some may be unmarked; recent walkover discovered several stained areas; no evidence of second burn pit on west side of yard; small metal scrap debris on surface	CAU 428 investigation and SNL eng. drawing (1989) for utility locations; Phase I Assessment Form, IT, 1998c; aerial photos, aerial photos (EG&G/EM and BN, 1980 through 1999) Interviews (Quas, 1999a; Dubiskas, 1998 and 1999); FADL, (IT, 1999)
	Geophysical surveys conducted for Landfill identification at northern portion of yard; A3-1 cells over 140 ft away from yard boundary; A3-2 cell adjacent to yard; no geophysical evidence of supposed second burn pit used during cleanup activities; geophysics did identify some buried metal within yard boundaries	CADD for CAU 424 (DOE/NV, 1998); CAIP for CAU 424 (DOE/NV, 1997); TTR Work Plan (DOE/NV, 1996a); Geophysical survey report (IT, 1997)
Station 44 Burn Area (CAS 09-54-001-L2)	Two buildings burned for fire training exercises from approximately 1980 to 1984; tires, wood, and the buildings were ignited with diesel fuel only at the surface; water only extinguishing agent identified; burn site limited to area of buildings (approximately 10 ft by 10 ft)	Zimmerman interview, (1993); Phase I Assessment Form, (IT, 1998c); FADLs (IT, 1998b and 1999)
	Current site conditions: flat sparsely vegetated disturbed areas with small pieces of metal and charred debris on the surface; no apparent soil staining; prior foundation indicated by disturbed, soft soil; aerial photos allow identification of former location of buildings	FADL from site visit (IT, 1998b, and 1999); Phase I Assessment Form, (IT, 1998c); EG&G/EM and BN aerial photos, 1980 through 1999)

Table A.2-1
Conceptual Model for CAU 490, Station 44 Burn Area (TTR)
(Page 3 of 4)

Conceptual Model Element	Assumptions	Source
Gun Propellant Burn Area (CAS RG-56-001-RGBA)	Area encompasses approximately 140 ft by 180 ft; consists of several burn areas; five pits containing metallic debris; range in size from (5 ft by 10 ft) to (30 ft by 25 ft) based on geophysical survey; two pits supposedly utilized vertically constructed corrugated metal pipe; geophysics conclusive where buried metal located but inclusive if vertical pipe; depth to top of debris is approximately 1.5 ft bgs in anomaly A-1 and A-2; depth to bottom of debris or disposal features unknown.	Geophysical survey report, (IT, 1997); Phase I Assessment Form, (IT, 1998c); TTR Work Plan, (DOE/NV, 1996a); Interviews with former TTR employees, (Smith, 1994a and b), (Quas, 1999a and b); (SNL, 1988 and 1992)
	Site used to burn excess artillery gun propellant, solid-fuel (including nitroglycerine, nitroguanidine, and nitrocellulose) rocket motors, black powder, and deteriorated explosives (Comp C-4); also used for the disposal of experimental explosive items; active 1960s to 1980s; site cleanup performed but of unknown extent; surface and subsurface burning; burn pit dimensions were 3 ft wide, 2-3 ft deep, 6 ft long; one vertical pipe 15 ft deep, 2-3 ft diameter; one vertical pipe 2 ft deep, 2-3 ft diameter.	Interviews with former TTR employees, (Dubiskas, 1999; Smith, 1994a and b, Quas, 1999a and b); TTR Environmental Assessment (ERDA, 1975); Federal Facility Preliminary Assessment, (Ecology and Environment, 1989)
	Current site conditions: flat sparsely vegetated area with miscellaneous debris lying on ground (canvas bags, wood, metal, rocket debris, electric primers, rifle shells); areas associated with anomalies typically unvegetated; soil staining not apparent; features identified on aerial photos closely match locations of geophysical anomalies A-1, A-2, A-3, and A-4.	IT photographs, (IT, 1998a); Phase I Assessment Form, (IT, 1998c); ER Site Inventory Form, (IT, 1993); IT site visit, FADL, IT, 1999); aerial photos (EG&G/EM and BN, 1982 through 1999)
Lateral extent of potential contaminants	Lateral extent of potential contamination is unknown; however, subsurface effects are limited by relatively low contaminant concentrations and low volume and/or low mobility of constituents.	Process knowledge
	COPCs may have been redistributed across the surface of the Sandia Service Yard and Gun Propellant Burn Area through regrading activities and possible cleanup activities, but lateral contamination is not expected to extend beyond the defined historical boundaries of each site.	Process knowledge
	The radius of lateral contamination is not expected to extend beyond the original ring structure at the FTA, or the area of original wooden structures at the Station 44 Burn Area.	Process knowledge

Table A.2-1
Conceptual Model for CAU 490, Station 44 Burn Area (TTR)
(Page 4 of 4)

Conceptual Model Element	Assumptions	Source
Vertical extent of potential contaminants	The vertical extent of potential contamination is unknown. Vertical extent should be limited by low contaminant concentrations and low volumes, minimal driving forces, relatively low mobility of COPCs	Process knowledge
	At the FTA, water was introduced into a potentially bottomless tank; design of vertically constructed corrugated pipes may have facilitated downward movement of COPCs at the Gun Propellant Burn Area	Process knowledge; Interviews: Zimmerman (1993, 1998, and 1999a); (Quas, 1999a and b)
	Vertical extent of contamination is not expected to extend beyond a depth of 15 ft bgs	Process knowledge
Physical and practical constraints	U.S. Air Force and/or Sandia range activities; underground/aboveground utilities; adverse weather conditions; restricted access; heavy equipment and resource availability; health and safety concerns; approval of the CAIP; potentially explosive/combustible material at the Gun Propellant Burn Area	Site knowledge; Site visits (IT, 1998b and 1999)
Future use	The *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada* states that future use will be similar to current use. Current use only includes industrial and research and development related activities in Area 3 and Area 9.	Assumptions are defined in the *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada (DOE/NV, 1996b)*
Potential exposures	Ingestion, inhalation, or dermal contact (absorption) of COPCs in the soil due to inadvertent exposure during investigation.	Process knowledge
Waste management	No evidence of listed waste has been found; waste will be considered characteristic unless contrary information is discovered during the investigation.	Process knowledge

A.3.0 Potential Contaminants

The COPCs vary slightly for each CAS included in CAU 490. The source of potential contamination at the two fire training areas is petroleum hydrocarbons and other chemicals produced by the burning of miscellaneous materials. The source of potential contamination at the burn area south of Area 9 are nitroaromatics and nitramines and other chemicals produced by the burning of explosives and gun propellants. The source of potential contamination at the Sandia Service Yard is believed to be primarily hydrocarbons. Other chemicals, such as PCBs and pesticides, may have spilled or leaked onto surface soils while equipment and supplies were being stored. Tables A.3-1 through A.3-3 identify the COPCs for each individual CAS. Specific analyses required for the disposal of IDW will be identified in Section 5.0 of the CAIP, Waste Management. Samples submitted for laboratory analysis will be analyzed according to Appendix C of the CAIP.

Table A.3-1
COPCs for the Fire Training Area, CAS 03-56-001-03BA and the Station 44 Burn Area, CAS RG-56-001-RGBA

Potential Contaminants	Field-Screening Method	Field-Screening Level	Preliminary Action Level	Analytical Method	Practical Quantitation Limit (soil/water)
Volatile Organic Compounds	Headspace	20 ppm or 2.5X background (use greater value)	PRGs[a] NAC 445A[b]	See Appendix C	See Appendix C
Semivolatile Organic Compounds	N/A	N/A	PRGs[a] NAC 445A[b]		
Total RCRA Metals and Zinc	N/A	N/A	PRGs[a] NAC 445A[b]		
Total Petroleum Hydrocarbons-Diesel	Hanby	100 ppm	100 ppm NAC 445A[b]		

[a] EPA *Region IX Industrial Preliminary Remediation Goals (PRGs)* (EPA, 1999)
[b] *Nevada Administrative Code* (NAC, 1998)

N/A = Not applicable

Table A.3-2
COPCs for the Sandia Service Yard, CAS 03-58-001-03FN

Potential Contaminants	Field-Screening Method	Field-Screening Level	Preliminary Action Level	Analytical Method	Practical Quantitation Limit (soil/water)
Volatile Organic Compounds	Headspace	20 ppm or 2.5X background (use greater value)	PRGs[a] NAC 445A[b]	See Appendix C	See Appendix C
Semivolatile Organic Compounds	N/A	N/A	PRGs[a] NAC 445A[b]		
Total RCRA Metals	N/A	N/A	PRGs[a] NAC 445A[b]		
Total Petroleum Hydrocarbons	Hanby	100 ppm	100 ppm NAC 445A[b]		
Total PCBs	N/A	N/A	PRGs[a] NAC 445A[b]		
Total Pesticides	N/A	N/A	PRGs[a] NAC 445A[b]		

[a] EPA *Region IX Industrial Preliminary Remediation Goals (PRGs)* (EPA, 1999)
[b] *Nevada Administrative Code* (NAC, 1998)

N/A = Not applicable

Table A.3-3
COPCs for the Gun Propellant Burn Area, CAS 09-54-001-09L2

Potential Contaminants	Field-Screening Method	Field-Screening Level	Preliminary Action Level	Analytical Method	Practical Quantitation Limit (soil/water)
Volatile Organic Compounds	Headspace	20 ppm or 2.5X background (use greater value)	PRGs[a] NAC 445A[b]	See Appendix C	See Appendix C
Semivolatile Organic Compounds	N/A	N/A	PRGs[a] NAC 445A[b]		
Total Metals	N/A	N/A	PRGs[a] NAC 445A[b]		
Total Petroleum Hydrocarbons-Diesel	N/A	N/A	100 ppm NAC 445A[b]		
Nitroaromatics and Nitramines (to include Nitroglycerine)	Explosives immunoassay field test kit	10 ppm (nitroglycerine) 5 ppm (RDX)	PRGs[a]		
Nitroguanidine		15 ppm	PRGs[a]		
Nitrocellulose		50 ppm	10,000 mg/kg[c]		
Radionuclides (plutonium and uranium)	Electra (alpha/ beta scintillator	Mean plus 2 standard deviations of 20 background sample readings	Isotope-specific value based on maximum isotopic background data		

[a]EPA *Region IX Industrial Preliminary Remediation Goals (PRGs)* (EPA, 1999)

[b]*Nevada Administrative Code* (NAC, 1998)

[c] This PAL represents one percent by weight. Soils containing more than 10 percent (100,000 mg/kg) secondary explosives, on a dry weight basis, are considered to be susceptible to initiation and propagation. Soils containing less than 10 percent by dry weight are considered to be nonreactive (EPA, 1996a).

N/A = Not applicable

A.4.0 Decisions and Inputs

A.4.1 Decisions

Decisions to be resolved by the investigation include:

- Determine if COPCs are present at the site.
- Determine if COPC concentrations exceed field-screening levels.
- Determine if COPC concentrations exceed PALs.
- Determine the nature and extent of contamination with enough certainty to develop and evaluate a range of potential corrective actions, including closure in place and clean closure.

A.4.2 Inputs and Strategy

Inputs to the decisions include those elements of information used to support the decisions in addressing the identified problem. A list of information inputs, existing data, identified data gaps, and brief strategies are discussed in Table A.4-1.

Table A.4-1
Decisions, Inputs, and General Strategies
(Page 1 of 3)

Decision	Input	Existing Data	Data Gap	Strategy
Are COPCs present above PALs at site?	Potential contaminant identification	Process knowledge of potentially burned or spilled material	Exact COPCs	Collect laboratory samples; analyze for COPCs
	Potential contaminant concentration	No sampling data available	Do concentrations exceed PALs?	Collect samples from soil; perform field screening and compare results to FSLs; submit samples for laboratory analysis from biased and/or random locations that represent worst case for contamination and confirmatory clean locations; compare results to PALs
	Potential contaminant distribution	Approximate boundaries of sites are known; vertical and lateral extent limited by minimal driving forces, low volumes and concentrations	Vertical and lateral extent of COPCs.	Use excavation, direct-push, or drilling to establish potential depth of COPCs; conduct step-outs as required to determine lateral extent if COPCs are detected; collect laboratory samples to confirm extent

Table A.4-1
Decisions, Inputs, and General Strategies
(Page 2 of 3)

Decision	Input	Existing Data	Data Gap	Strategy
Are potential contaminants migrating?	Meteorologic data	Data on annual precipitation, evapotranspiration, and weather	None identified	No specific meteorological data collection anticipated; general weather and wind speed and direction noted on daily field logs
	Geologic/hydrologic data	General geologic/hydrologic characteristics of site; specific geologic conditions of nearby sites (i.e., CAU 424); background concentrations for arsenic typically higher than PALs	Existence and characteristics of differing permeability zones	Field log all core by qualified geologist; collect and analyze geotechnical samples at discretion of Site Supervisor
	Biological degradation factors	Potential hydrocarbons release; biologic conditions of nearby sites (i.e., CAU 423 and CAU 403)	Biological parameters to evaluate natural biological process	No specific data collection anticipated
	Radioactive decay	Low probability of plutonium and uranium at the Gun Propellant Burn Area only	Presence and type of radionuclides	Establish background; field screen for alpha/beta emitting radionuclides using an alpha/ beta scintillation detector (i.e., Electra) to guide collection of samples for radiological COPCs analysis

Table A.4-1
Decisions, Inputs, and General Strategies
(Page 3 of 3)

Decision	Input	Existing Data	Data Gap	Strategy
Data sufficient to support closure options?	No further action	Historical evidence that COPCs were released to the environment	Presence, concentration, and extent of COPCs	Insufficient evidence to proceed without investigation; collect field and laboratory samples; compare lab results to PALs; if no COPCs above PALs, prepare CADD/CR
	Closure in place	Potential for radiological (at Gun Propellant Burn Area only), RCRA, and TPH constituents; PALs; assume use restrictions	Presence, concentration, and extent of COPCs	Collect field and laboratory samples; compare lab results to PALs; if no COPCs above PALs, prepare CADD/CR; otherwise prepare CADD
	In situ bioremediation	Potential for radiological (at Gun Propellant Burn Area only), RCRA, and TPH constituents; PALs	Presence, concentration, and extent of COPCs; biodegradation parameters	Collect field and laboratory samples; compare lab results to PALs; if no COPCs above PALs, prepare CADD/CR; otherwise prepare CADD
	Clean closure by contaminant removal	Potential for radiological (at Gun Propellant Burn Area only), RCRA, and TPH constituents; PALs	Presence, concentration, and extent of COPCs	Collect field and laboratory samples; compare lab results to PALs; if no COPCs above PALs, prepare CADD/CR; otherwise prepare CADD

A.5.0 Investigation Strategy

Biased and/or random sampling will be conducted during the field investigation to assess the extent of COPCs and determine if COPC concentrations exceed PALs for the sites. Samples collected from the CASs will be analyzed according to the appropriate COPC table as provided in Section A.3.0.

Geotechnical and bioassessment samples may be collected at the Site Supervisor's discretion. Geotechnical samples will be collected if subsurface debris is encountered during the field investigation. The need for bioassessment samples will be based on the nature of contamination established during the field investigation (i.e., extensive VOC, TPH, or explosives contamination).

Investigation of the CASs may include use of an excavator, direct-push method, and/or drilling. All soil samples will be field screened for VOCs. Select samples will be field screened for TPH, explosives, and/or alpha/beta emitting radionuclides.

A.5.1 Fire Training Area

Surface and subsurface sampling will be conducted using an excavator. One trench will be excavated near the center of the fire training ring. Samples will be collected at depth intervals of 0 to 1 ft, 3 to 4 ft, and at 5-ft intervals thereafter until a sample interval with field-screening results below FSLs is encountered or to the extent of the excavator. The 3- to 4-ft sample interval may be substituted with an alternative interval that reveals obvious worst-case contamination or an interface (i.e., tank bottom or fill material/native soil interface). Additional trenches may be excavated to define lateral extent as necessary. Intrusion into the Landfill Cell A3-8 use restriction area will not occur during field activities without obtaining prior approval from NDEP and DOE/NV. If vertical contamination extends beyond the extent of the excavation technique, drilling will be initiated. Field screening for VOCs and TPH will be conducted using a PID and the Hanby Test kit, respectively. Samples identified for laboratory analyses will be analyzed for those parameters listed in Table A.3-1.

A.5.2 Station 44 Burn Area

Surface (0 to 1 ft bgs) and shallow subsurface (3 to 4 ft bgs) samples will be collected at a minimum of one, but no more than two, biased locations within the suspected area of each wooden structure. The planned sample intervals may be substituted with an alternative interval that reveals obvious worst-case contamination. A direct-push method will be used for sample collection. Step-out holes will be pushed in a roughly triangular pattern if field-screening results exceed screening levels. Borings will continue deeper if FSLs are exceeded at the 4-ft depth interval for any sample location with sample collection at 2- or 5-ft intervals, at Site Supervisor's discretion. If depth of contamination exceeds capability of direct-push method, excavation may be initiated. If vertical contamination exceeds the extent of the excavation technique, drilling will be initiated. Drilling may be initiated after direct-push at Site Supervisor's discretion. Field screening for VOCs and TPH will be conducted using a PID and the Hanby Test kit, respectively. Samples identified for laboratory analyses will be analyzed for those parameters listed in Table A.3-1.

A.5.3 Sandia Service Yard

Biased and systematic random sampling will be conducted at this site using a direct-push method. Biased sample locations will be based on noticeably stained soil locations and historically stained locations depicted on aerial photographs. The systematic random sample locations will be based on an adaptive fill designed to consider the biased sample locations and maximize coverage of the area. The "Visual Sample Plan" (Davidson, 2000) program will be used to generate these locations. The process used for selecting the numbers of systematic random sample locations is described in Section A.7.0.

Both surface (0 to 1 ft bgs) and shallow subsurface (3 to 4 ft bgs) samples will be collected and submitted for laboratory analyses from all sample locations. The planned sample intervals may be substituted with an alternative interval that reveals obvious worst-case contamination. Biased samples will be collected at noticeably stained soil locations and at historically stained soil locations based on aerial photo interpretation. Random samples will be collected throughout the remaining area of the yard to account for areas of unknown past activities and possible redistribution associated with regrading activities. Borings will continue deeper if FSLs are exceeded at the 4-ft depth interval for any sample location. If depth of contamination exceeds capability of direct-push method, excavation may be initiated. If vertical contamination exceeds the extent of the excavation technique, drilling will be initiated. Drilling may be initiated after direct-push at Site Supervisor's discretion. Field screening for VOCs (on all samples) and TPH (on subsurface samples only) will be conducted using a PID and the Hanby Test kit, respectively. Samples identified for laboratory analyses will be analyzed for those parameters listed in Table A.3-2.

A.5.4 Gun Propellant Burn Area

Surface and subsurface sample collection will be conducted at biased sample locations using an excavator and/or hand tools with appropriate explosive ordnance avoidance techniques. Biased sample locations will be identified through historic geophysical surveys and aerial photos, current surface features, and magnetometer readings. Excavation will begin outside of an anomaly to a depth of 4 ft bgs and progress towards the center to define the lateral extent of an identified disposal feature. If a disposal feature cannot be identified, one confirmatory sample will be collected from the bottom (about 4 ft bgs) of the excavation nearest the estimated center location of the disposal feature. If identified, excavation and sampling will be conducted on two to four sides of the identified disposal feature. At the interface of native soil and the disposal feature (as defined by soil discoloration, geology, or debris) a soil sample will be collected from both the native soil outside of the disposal feature and either discolored soil or soil from around debris. Excavation will continue vertically down the interface collecting samples approximately every 5 ft until the vertical extent is identified or to the extent of the excavation technique. If the vertical extent is identified, a sample will be collected from native soil at a depth below and near the disposal feature. If the vertical extent is not identified by the extent of the excavation technique, drilling will be initiated. Field screening for VOCs, explosives, and alpha/beta-emitting radionuclides will be conducted. Samples identified for laboratory analyses will be analyzed for those parameters listed in Table A.3-3.

The borings will be located as close to the disposal feature as possible considering the guidance of trained UXO personnel. No attempt will be made to drill through disposal features. Samples will be collected at 5-ft intervals, below the extent of the excavation, to a maximum of 25 ft bgs or until field-screening results are below FSLs.

A.6.0 Decision Rules

The following decision rules are applicable to all four CASs and will be used to guide the investigation and subsequent data evaluation for CAU 490:

- If, in the course of the investigation, either of the following occur, then the investigation will be halted and rescoped as necessary:
  - The conceptual model fails to such a degree that rescoping is required.
  - Sufficient data are collected to support evaluation of corrective actions.
- If field screening indicates no COPCs above field-screening levels, then a sample at the next prescribed subsurface location will be field screened if practical. If no COPCs are indicated, a confirmatory laboratory sample will be submitted from an upper interval.
- If field screening indicates the presence of COPCs above field-screening levels, then the investigation will continue to determine extent of COPCs until field-screening results are below field-screening levels; whereupon, a sample will be submitted for laboratory analysis to verify field-screening results. Samples will also be submitted for laboratory analysis from the subsurface interval that represents the worst-case, field-screening result and at the discretion of the Site Supervisor. Additional samples may be required for waste management purposes.
- If laboratory results indicate the presence of contaminants of concern above PALs, then a CADD will be prepared.
- If no COPCs are identified above PALs, then a CADD/Closure Report will be prepared according to the outline agreed upon by NDEP and DOE/NV. This type of CADD incorporates the elements of the regular CADD and the corrective action plan and serves as the closure report for the site.

Table A.6-1 provides additional decision points and rules.

Table A.6-1
Activity-Specific Decision Points and Rules
(Page 1 of 2)

Investigation Activity	Decision Point	Decision Result	Decision Rule
Fire Training Area (CAS 03-56-001-03BA)			
Excavation	Can an interface be determined (identified by fill/native soil)?	Yes	Field screen the 1-ft depth intervals above and below the interface; submit the interval with highest field screening result
		No	Collect the 3- to 4-ft depth interval
	Do COPCs extend into use restriction area?	Yes	Halt the investigation; notify NDEP
		No	Continue with planned investigation within rest of CAS
	Do COPCs extend vertically beyond extent of excavation technique?	Yes	Collect and submit deepest sample with elevated FSLs within excavation then initiate an appropriate drilling method
		No	Submit sample from upper interval with field-screening results below FSLs
Station 44 Burn Area (CAS RG-56-001-RGBA)			
Direct-push	Do field data indicate potential contamination at depths beyond direct-push capability?	Yes	Continue subsurface investigation by excavation at completion of direct-push sample collection
		No	Continue with planned investigation using direct-push method
Excavation	Do COPCs extend vertically beyond extent of excavation technique?	Yes	Collect and submit deepest sample with elevated FSLs within excavation then initiate an appropriate drilling method
		No	Collect sample from upper interval with field-screening results below FSLs
Sandia Service Yard (CAS 03-58-001-03FN)			
Sample location designation	Can distinct soil stains be determined?	Yes	Use biased and random sample locations as planned
		No	Increase number of random sample locations to ensure adequate coverage of yard (not to exceed total number of planned locations)

Table A.6-1
Activity-Specific Decision Points and Rules
(Page 2 of 2)

Investigation Activity	Decision Point	Decision Result	Decision Rule
Direct-push	Do field data indicate potential contamination at depths beyond direct-push capability?	Yes	Continue subsurface investigation with excavation or drilling at completion of direct-push sample collection
		No	Continue with planned investigation using direct-push method
	Do field data indicate contamination outside of historical service yard boundaries?	Yes	If contamination source is outside the boundaries, the extent of contamination is outside of scope, conceptual model fails; notify NDEP
		Yes	If contamination source is within the boundaries, continue investigation to define lateral and vertical extent
		No	Investigation complete, halt work
Gun Propellant Burn Area (CAS 09-54-001-09L2)			
Excavation	Can disposal feature be identified (i.e., discolored soil, geology, or debris)?	Yes	Continue with planned subsurface investigation
		No	Collect confirmatory sample from the bottom of excavation near the estimated center location of the anomaly
	Can the vertical extent of disposal feature be identified by excavation technique?	Yes	Continue with planned subsurface investigation
		No	Continue the subsurface investigation with drilling at completion of excavation
All CASs			
Drilling	Do field data indicate contamination extends vertically beyond the extent of the selected drilling technique?	Yes	Halt the investigation; conceptual model fails; notify NDEP
		No	Investigation complete

A.7.0 Decision Error

A.7.1 Biased Sampling

Biased and/or random sampling will be conducted at the various CASs within CAU 490. Biased sampling is appropriate because some of the areas of concern are well defined (i.e., through geophysical surveys or physical evidence on the ground surface) or can be reasonably assumed (i.e., based on aerial photo interpretation and landmarks). Random sampling, in addition to biased sampling, will be conducted at the Sandia Service Yard.

The biased sampling strategy targets the worst-case contamination by sampling locations with the highest potential for contamination. This will ensure that the extent of the contamination has been adequately located and identified. Planned sample intervals may be substituted with sample intervals that indicate highest contamination for that sample location as indicated by visual and/or other field-screening techniques. At least one sample with field-screening results below field-screening levels will be obtained from the predetermined sampling locations to define the lower limit of the impact (if any) on soils. Field-screening results will be confirmed by off-site laboratory analysis for these samples.

All soil samples will be field screened for VOCs. Select samples will be field screened for TPH, explosives, and/or alpha/beta-emitting radionuclides. Selected samples from each sample location will be sent to the laboratory for analysis for the appropriate COPCs listed in Tables A.3-1 through A.3-3. This sampling strategy will ensure that contamination in the soil has been adequately located, identified, and quantified.

A.7.2 Random Sampling

Systematic random sampling will be employed for investigation of soil areas at the Sandia Service Yard. This approach will ensure coverage of the potentially contaminated areas that may have been redistributed through regrading or unknown past activities. The number of samples required to characterize the site to a predetermined level of confidence will be calculated using Equation 8 from Chapter 9 of SW-846 (EPA, 1996b), with a confidence level and acceptable sampling error agreed to by the DOE/NV and the NDEP.

Equation 8 from Chapter 9 of SW-846 gives the number of samples required to determine the mean value of a given parameter to within a specified percent error, e_r, with a confidence limit of 90 percent, using an analytical method with a specified coefficient of variation (CV), as:

$$n = \left[t_{0.90,\,n-1}\frac{CV}{e_r}\right]^2,$$

where "t" is the one-tailed 90 percent Student's "t" value for the appropriate number of degrees of freedom (n-1).

The coefficient of variation in the above equation refers to the variability of the specific parameter in the medium being sampled. Its value cannot be determined until sufficient samples from the site have been analyzed. However, in the absence of data regarding the soil variability of the COPCs at the Sandia Service Yard, some assumptions must be made:

- The variability of the analytical method may be used as a first approximation of the variability of the contaminant distribution in the soil.
- The table below shows the average CVs for several chemical methods, as determined from the individual procedures in SW-846.

SW-846 Method	Parameter Measured	% CV
6010B	Metals	21.3
7470A - Water 7471A - Soil	Mercury	69.5
8260B	VOCs	7.5
8270C	SVOCs	9.1
8081A	Pesticides	70.1
8082	PCBs	29.7

For CAU 490, a CV of 50 percent will be assumed. This figure represents a compromise between the very high CVs of the pesticides and the extremely low CVs of the VOCs and SVOCs. It is an acceptable starting point for the purposes of Equation 8.

A relative error of 10 to 20 percent from the true mean at a confidence limit of 90 percent is considered acceptable for planned removal and remedial response studies (EPA, 1989). A relative error of 20 percent will be specified for this site. Substituting the appropriate values for "t" (Taylor, 1990), CV (50 percent) and e_r (20 percent) into this equation and iterating the equation several times gives n = 15. Fifteen random sample locations will be sampled in addition to eight biased sample locations.

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Appendix B

Project Organization

B.1.0 Project Organization

The DOE/NV Industrial Sites Project Manager is Janet Appenzeller-Wing and her telephone number is (702) 295-0461.

The names of the project Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate DOE/NV plan. However, personnel are subject to change, and it is suggested that the Project Manager be contacted for further information. The Task Manager will be identified in the FFACO Biweekly Activity Report prior to the start of field activities.

Appendix C

Analytical Table

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and Radiochemistry Analytical Requirements for Industrial Sites
(Page 1 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD)[a]	Percent Recovery (%R)[b]
ORGANICS						
Total Volatile Organic Compounds (VOCs)	Water	8260B[c]	Analyte-specific estimated quantitation limits[d]	Not Applicable (NA)	14[e]	61-145[e]
	Soil				24[e]	59-172[e]
Toxicity Characteristic Leaching Procedure (TCLP) VOCs						
Benzene	Aqueous	1311/8260B[c]	0.050 mg/L[d]	0.5 mg/L[d]	14[e]	61-145[e]
Carbon Tetrachloride			0.050 mg/L[d]	0.5 mg/L[d]		
Chlorobenzene			0.050 mg/L[d]	100 mg/L[d]		
Chloroform			0.050 mg/L[d]	6 mg/L[d]		
1,2-Dichloroethane			0.050 mg/L[d]	0.5 mg/L[d]		
1,1-Dichloroethene			0.050 mg/L[d]	0.7 mg/L[d]		
Methyl Ethyl Ketone			0.050 mg/L[d]	200 mg/L[d]		
Tetrachloroethene			0.050 mg/L[d]	0.7 mg/L[d]		
Trichloroethene			0.050 mg/L[d]	0.5 mg/L[d]		
Vinyl Chloride			0.050 mg/L[d]	0.2 mg/L[d]		
Total Semivolatile Organic Compounds (SVOCs)	Water	8270C[c]	Analyte-specific estimated quantitation limits[d]	NA	50[e]	9-127[e]
	Soil				50[e]	11-142[e]
TCLP SVOCs						
o-Cresol	Aqueous	1311/8270C[c]	0.10 mg/L[d]	200 mg/L[d]	50[e]	9-127[e]
m-Cresol			0.10 mg/L[d]	200 mg/L[d]		
p-Cresol			0.10 mg/L[d]	200 mg/L[d]		
Cresol (total)			0.30 mg/L[d]	200 mg/L[d]		
1,4-Dichloro-benzene			0.10 mg/L[d]	7.5 mg/L[d]		
2,4-Dinitrotoluene			0.10 mg/L[d]	0.13 mg/L[d]		

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and Radiochemistry Analytical Requirements for Industrial Sites
(Page 2 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD)[a]	Percent Recovery (%R)[b]
Hexachloro-benzene	Aqueous	1311/8270C[c]	0.10 mg/L[d]	0.13 mg/L[d]	50[e]	9-127[e]
Hexachloro-butadiene			0.10 mg/L[d]	0.5 mg/L[d]		
Hexachloro-ethane			0.10 mg/L[d]	3 mg/L[d]		
Nitrobenzene			0.10 mg/L[d]	2 mg/L[d]		
Pentachloro-phenol			0.50 mg/L[d]	100 mg/L[d]		
Pyridine			0.10 mg/L[d]	5 mg/L[d]		
2,4,5-Trichloro-phenol			0.10 mg/L[d]	400 mg/L[d]		
2,4,6-Trichloro-phenol			0.10 mg/L[d]	2 mg/L[d]		
Total Pesticides	Water	8081A[c]	Analyte-specific (CRQL)[e]	NA	27[e]	38-131[e]
	Soil				50[e]	23-139[e]
TCLP Pesticides						
Chlordane	Aqueous	1311/8081A[c]	0.0005 mg/L[e]	0.03 mg/L[d]	27[e]	38-131[e]
Endrin			0.001 mg/L[e]	0.02 mg/L[d]		
Heptachlor			0.0005 mg/L[e]	0.008 mg/L[d]		
Heptachlor Epoxide			0.0005 mg/L[e]	0.008 mg/L[d]		
gamma-BHC (Lindane)			0.0005 mg/L[e]	0.4 mg/L[d]		
Methoxychlor			0.005 mg/L[e]	10 mg/L[d]		
Toxaphene			0.05 mg/L[e]	0.5 mg/L[d]		
Polychlorinated Biphenyls (PCBs)	Water	8082[c]	Analyte-specific contract required quantitation limits (CRQL)[e]	NA	Lab-specific[f]	Lab-specific[f]
	Soil					
Total Herbicides	Water	8151A[c]	1.3 µg/L[c]	NA	Lab-specific[f]	Lab-specific[f]
	Soil		66 µg/kg[c]			
TCLP Herbicides						
2,4-D	Aqueous	1311/8151A[c]	0.002 mg/L[d]	10 mg/L[d]	Lab-specific[f]	Lab-specific[f]
2,4,5-TP			0.00075 mg/L[d]	1 mg/L[d]		

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and Radiochemistry Analytical Requirements for Industrial Sites
(Page 3 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD)[a]	Percent Recovery (%R)[b]
Total Petroleum Hydrocarbons (TPH)	Water Gasoline	8015B modified[c]	0.1 mg/L[g]	NA	Lab-specific[f]	Lab-specific[f]
	Soil Gasoline		0.5 mg/kg[g]			
	Water Diesel		0.5 mg/L[g]			
	Soil Diesel		25 mg/kg[g]			
Nitroaromatics and Nitramines (to include Nitroglycerine)	Water	8332[c]	5 µg/L[y]	NA	Lab-specific[f]	Lab-specific[f]
	Soil		0.35 mg/kg[y]			
Nitroguanidine	Water	CREL 89-35[v] SW-846 8000B[c]	100 µg/L[y]	NA	Lab-specific[f]	Lab-specific[f]
	Soil		6.0 mg/kg[y]			
Nitrocellulose	Water	Paragon-specific[w,x]	2.0 mg/L[y]	NA	Lab-specific[f]	Lab-specific[f]
	Soil		5.0 mg/kg[y]			
Polychlorinated Dioxins and Furans	Water	8280A/8290[c]	0.05 µg/L[c]	NA	Lab-specific[f]	Lab-specific[f]
	Soil		5 µg/kg[c]			
INORGANICS						
Total *Resource Conservation and Recovery Act* (RCRA) Metals						
Arsenic	Water	6010B/7470A[c]	10 µg/L[g,h]	NA	20[h]	75-125[h]
	Soil	6010B/7471A[c]	1 mg/kg[g,h]			
Barium	Water	6010B/7470A[c]	200 µg/L[g,h]			
	Soil	6010B/7471A[c]	20 mg/kg[g,h]			
Cadmium	Water	6010B/7470A[c]	5 µg/L[g,h]			
	Soil	6010B/7471A[c]	0.5 mg/kg[g,h]			
Chromium	Water	6010B/7470A[c]	10 µg/L[g,h]			
	Soil	6010B/7471A[c]	1 mg/kg[g,h]			
Lead	Water	6010B/7470A[c]	3 µg/L[g,h]			
	Soil	6010B/7471A[c]	0.3 mg/kg[g,h]			
Mercury	Water	6010B/7470A[c]	0.2 µg/L[g,h]			
	Soil	6010B/7471A[c]	0.1 mg/kg[g,h]			
Selenium	Water	6010B/7470A[c]	5 µg/L[g,h]			
	Soil	6010B/7471A[c]	0.5 mg/kg[g,h]			
Silver	Water	6010B/7470A[c]	10 µg/L[g,h]			
	Soil	6010B/7471A[c]	1 mg/kg[g,h]			

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and Radiochemistry Analytical Requirements for Industrial Sites
(Page 4 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD)[a]	Percent Recovery (%R)[b]
TCLP RCRA Metals						
Arsenic	Aqueous	1311/6010B[c] 1311/7470A[c]	0.10 mg/L[g,h]	5 mg/L[d]	20[h]	75-125[h]
Barium			2 mg/L[g,h]	100 mg/L[d]		
Cadmium			0.05 mg/L[g,h]	1 mg/L[d]		
Chromium			0.10 mg/L[g,h]	5 mg/L[d]		
Lead			0.03 mg/L[g,h]	5 mg/L[d]		
Mercury			0.002 mg/L[g,h]	0.2 mg/L[d]		
Selenium			0.05 mg/L[g,h]	1 mg/L[d]		
Silver			0.10 mg/L[g,h]	5 mg/L[d]		
Cyanide	Water	9010B[c]	0.01 mg/L[h]	NA	20[h]	75-125[h]
	Soil		1.0 mg/kg[h]			
Sulfide	Water	9030B/9034[c]	0.4 mg/L[c]	NA	Lab-specific[f]	Lab-specific[f]
	Soil or Sediment		10 mg/kg[g]			
pH/Corrosivity	Water	9040B[c]	NA	pH >2[i]	Lab-specific[f]	Lab-specific[f]
	Soil	9045C[c]		pH<12.5[i]		
Ignitability	Water	1010[c]	NA	Flash Point <140° F[d]	NA	NA
	Soil	1030[c]		Burn Rate[c] >2.2 mm/sec nonmetals; >0.17 mm/sec metals		
RADIOCHEMISTRY						
Gamma-emitting Radionuclides[j]	Water	EPA 901.1[k]	Isotope-specific[m]	NA	20	Tracer Yield 30-105 Laboratory Control Sample Yield 80-120
	Soil	HASL 300[l]			35	
Isotopic Plutonium[j]	Water	NAS-NS-3058[n,o]	1 pCi/L	NA	20	
	Soil		0.1 pCi/g Pu-238[p] 0.4 pCi/g Pu-239/240[p]		35	
Isotopic Uranium[j]	Water	NAS-NS-3050[q,r]	2 pCi/L	NA	20	
	Soil		1 pCi/g		35	
Strontium - 90[j]	Water	SM 7500-Sr[s]	5 pCi/L	NA	20	
	Soil	Martin 79[t]	1 pCi/g[u]		35	

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and Radiochemistry Analytical Requirements for Industrial Sites
(Page 5 of 6)

Parameter or Analyte	Medium or Matrix	Analytical Method	Minimum Reporting Limit	Regulatory Limit	Relative Percent Difference (RPD)[a]	Percent Recovery (%R)[b]
Gross Alpha	Water	EPA 900.0[k]	3 pCi/L	NA	20	Tracer Yield 30-105 Laboratory Control Sample Yield 80-120
	Soil	SM 7110[s]	1 pCi/g		35	
Gross Beta	Water	EPA 900.0[k]	4 pCi/L	NA	20	Tracer Yield 30-105 Laboratory Control Sample Yield 80-120
	Soil	SM 7110[s]	3 pCi/g		35	

Table C.1-1
Laboratory Chemical, Toxicity Characteristic Leaching Procedure, and Radiochemistry Analytical Requirements for Industrial Sites
(Page 6 of 6)

[a]RPD is used to Calculate Precision
Precision is estimated from the relative percent difference of the concentrations measured for the matrix spike and matrix spike duplicate analyses of unspiked field samples, or field duplicates of unspiked samples. It is calculated by:
RPD = 100 x $\{(|C_1\text{-}C_2|)/[(C_1+C_2)/2]\}$, where C_1 = Concentration of the analyte in the first sample aliquot, C_2 = Concentration of the analyte in the second sample aliquot.

[b]%R is used to Calculate Accuracy
Accuracy is assessed from the recovery of analytes spiked into a blank or sample matrix of interest, or from the recovery of surrogate compounds spiked into each sample. The recovery of each spiked analyte is calculated by: %R = 100 x $(C_s\text{-}C_u/C_n)$, where C_s = Concentration of the analyte in the spiked sample, C_u = Concentration of the analyte in the unspiked sample, C_n = Concentration increase that should result from spiking the sample

[c]U.S. Environmental Protection Agency's (EPAs) *Test Methods for Evaluating Solid Waste*, 3rd Edition, Parts 1-4, SW-846 (EPA, 1996)

[d]Estimated Quantitation Limit as given in SW-846 (EPA, 1996)

[e]EPA *Contract Laboratory Program Statement of Work for Organic Analysis* (EPA, 1988b; 1994b; 1991; and 1994b)

[f] In-House Generated RPD and %R Performance Criteria
It is necessary for laboratories to develop in-house performance criteria and compare them to those in the methods. The laboratory begins by analyzing 15-20 samples of each matrix and calculating the mean %R for each analyte. The standard deviation (SD) of each %R is then calculated, and the warning and control limits for each analyte are established at ± 2 SD and ± 3 SD from the mean, respectively. If the warning limit is exceeded during the analysis of any sample delivery group (SDG), the laboratory institutes corrective action to bring the analytical system back into control. If the control limit is exceeded, the sample results for that SDG are considered unacceptable. These limits are reviewed after every 20-30 field samples of the same matrix and are updated at least semiannually. The laboratory tracks trends in both performance and control limits by the use of control charts. The laboratory's compliance with these requirements is confirmed as part of an annual laboratory audit. Similar procedures are followed in order to generate acceptance criteria for precision measurements.

[g]*Industrial Sites Quality Assurance Project Plan* (DOE/NV, 1996)

[h]EPA *Contract Laboratory Program Statement of Work for Inorganic Analysis* (EPA, 1988a; 1995; and 1994a)

[i]RCRA Regulations and Keyword Index, 1998 Edition

[j]Isotopic minimum detectable concentrations are defined during the DQO process and specified in the CAIP as applicable

[k]*Prescribed Procedures for Measurements of Radioactivity in Drinking Water* (EPA, 1980) or equivalent method

[l]*Environmental Measurements Laboratory Procedures Manual* (DOE, 1997) or equivalent method

[m]Isotope-Specific Minimum Reporting Limit to be specified in CAIP

[n]*The Radiochemistry of Plutonium* (Coleman, 1965) or equivalent method

[o]*Separation and Preconcentration of Actinides from Acidic Media by Extraction Chromatography* (Horwitz, et al., 1993) or equivalent method

[p]The *Nevada Test Site Performance Objective Criteria* requirement for certifying that hazardous waste has no added radioactivity requires that the total plutonium (the sum of the Pu-238, 239, 240 concentrations) not exceed 0.5 pCi/g (BN, 1995)

[q]*The Radiochemistry of Uranium* (Grindler, 1962) or equivalent method

[r]*Separation and Preconcentration of Uranium from Acidic Media by Extraction Chromatography* (Horwitz, et al., 1992) or equivalent method

[s]*Standard Methods for the Examination of Water and Waste Water* (APHA, 1995) or equivalent method

[t]Determination of Strontium-89 and -90 in soil with Total Sample Decomposition (Analytical Chemistry, 1979) or equivalent method

[u]The 1.0 pCi/g concentration is approximately twice the concentration of fallout Sr-90 in background surface soils reported in the *Environmental Monitoring Report for the Proposed Ward Valley California Low-Level Radioactive Waste Facility* (Atlan-Tech, 1992)

[v]U. S. Army Corps of Engineers, Cold Regions Research and Engineering Laboratory Special Reports 89-35, *Analytical Methods for determining nitroguanidine in soil and water*

[w]Indiana Army Ammunition Plant, 1983. Contamination survey. Aqualab, Inc., Exhibit E, Analytical Procedure for Nitrocellulose, pp. 6-10

[x]*Nitrocellulose in water.* Procedure provided by ERDC, Cold Regions Research and Engineering Laboratory, Hanover, New Hampshire 03755-1290. 8 pages

[y]Paragon Laboratory-generated reporting limits

Definitions:
µg/kg = Microgram(s) per kilogram
mg/kg = Milligram(s) per kilogram
pCi/L = Picocurie(s) per liter
mg/L = Milligram(s) per liter
pCi/g = Picocurie(s) per gram
µg/L = Microgram(s) per liter

C.1.0 References

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Appendix D

Response to NDEP Comments

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET
(Page 1 of 3)

1. Document Title/Number: Draft Corrective Action Investigation Plan for Corrective Action Unit 490: Station 44 Burn Area, Tonopah Test Range, Nevada	2. Document Date: March 2000
3. Revision Number: 0	4. Originator/Organization: IT Corporation
5. Responsible DOE/NV ERP Project Mgr.: Janet Appenzeller-Wing	6. Date Comments Due: April 21, 2000
7. Review Criteria: Full	
8. Reviewer/Organization/Phone No.: Clemens Goewert, NDEP, 486-2865	9. Reviewer's Signature:

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
1) Section 2.2.4, Gun Propellant Area, and Section A.2.0, Conceptual Model		Section 2.2.4, Gun Propellant Area, and Section A.2.0, Conceptual Model, indicate that solid rocket fuel was burned at the site; however, neither section describes contaminants of potential concern (COPCs) due to this rocket propellant. To ensure all COPCs are accounted for, this issue must be addressed in the final CAIP.	Nitroglycerine, nitroguanidine, and nitrocellulose are the COPCs associated with the solid-fuel rocket motors. Text in Sections 2.2.4 and A.2.0 has been modified to specifically include these COPCs.	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET
(Page 2 of 3)

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
2) Section 4.3		Section 4.3 should provide the site specific strategy for conducting this corrective action investigation. The section should include the proposed sampling locations, how these locations were selected, and how the samples are to be collected. The description of the sampling locations are not clearly identified, especially for the Station 44 Burn Area and the Gun Propellant Burn Area. The information on how the sites were selected is not provided. Finally, a description of the methods for sample collection is not clearly presented. Without this clarity, NDEP cannot accept the sampling strategy.	Section 4.3 does provide the site-specific strategies for conducting this corrective action investigation. This section does include proposed sampling locations; however, the following changes have been made for clarification: (1) Figure 4-1 has been changed by deleting “Approximate FTA Boundary” and changing “Fire Ring Area” to “Fire Training Area”; (2) Figure 4-2 has been changed by deleting “Existing Antenna Typ.” and by changing the “Proposed Sample Location” and “Existing Antenna” symbols; (3) No changes were necessary for Figure 4-3 based on this comment; (4) The proposed approximate trench/sampling locations have been added to Figure 4-4 and text in Section 4.3.4 explains how sample locations will be selected during the investigation. The basis for sample location selection is included in Section 4.3. Additional text has been added to Section 4.2 subsections regarding methods for sample collection. This text basically states that sample media will be collected from the sample collection device (i.e., direct-push liner, backhoe bucket, or drilling core sampler/polyurethane bag) upon retrieval and containerized in accordance with approved sampling procedures or instructions. Section 4.3.4 was also modified to allow compositing of samples (excluding those to be analyzed for VOCs) collected from within the potentially contaminated disposal features. This modification will reduce analytical costs and provide adequate characterization data.	In part
3) Appendix A		Appendix A contains the conceptual model for each of the corrective action sites; however, the section does not supply any figures/maps to support the conceptual model.	Figure 1-2 has been added to Section A.2.0 as Figure A.2-1.	Yes

NEVADA ENVIRONMENTAL RESTORATION PROJECT
DOCUMENT REVIEW SHEET
(Page 3 of 3)

10. Comment Number/ Location	11. Type*	12. Comment	13. Comment Response	14. Accept
4) Appendix A Section A.5.0 Investigation Strategy		Appendix A, Section A.5.0, Investigation Strategy, discusses biased and random sampling; however, there is no discussion on how the sample locations will be selected.	Text has been added to Section A.5.3 to discuss the sample location selection. Reference to Section A.7.0 was also added to Section A.5.3 to support selection of the number of sample locations.	Yes

[a] Comment Types: M = Mandatory, S = Suggested.
Return Document Review Sheets to DOE/NV Environmental Restoration Division, Attn: QAC, M/S 505.

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