FEDERAL FACILITY AGREEMENT AND CONSENT ORDER (FFACO)
RECORD OF TECHNICAL CHANGE (ROTC)

Corrective Action Unit (CAU) Number: 114
CAU Description: Area 25 EMAD Facility
CAU Owner: Industrial Sites - Environmental Restoration (ER)

ROTC No. DOE/EMNV--0029-ROTC 1 **Page** 1 of 3

Document Type Streamlined Approach for Environmental Restoration (SAFER) Plan, June 2021 **Date** 10/26/2021

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

Pat Matthews	Environmental Restoration Project Manager
Requestor Name	Requestor Title

Description of Change:

1. Replace Figure 1-2 with the attached figure.

Justification:

1. The figure was accidently imported from the CAU 414 Closure Report instead of the CAU 114 SAFER Plan.

Schedule Impacts:

No impacts to schedule.

ROTC applies to the following document(s):

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Document Type Streamlined Approach for Environmental Restoration (SAFER) Plan, June 2021 **Date** 10/26/2021

Approvals:

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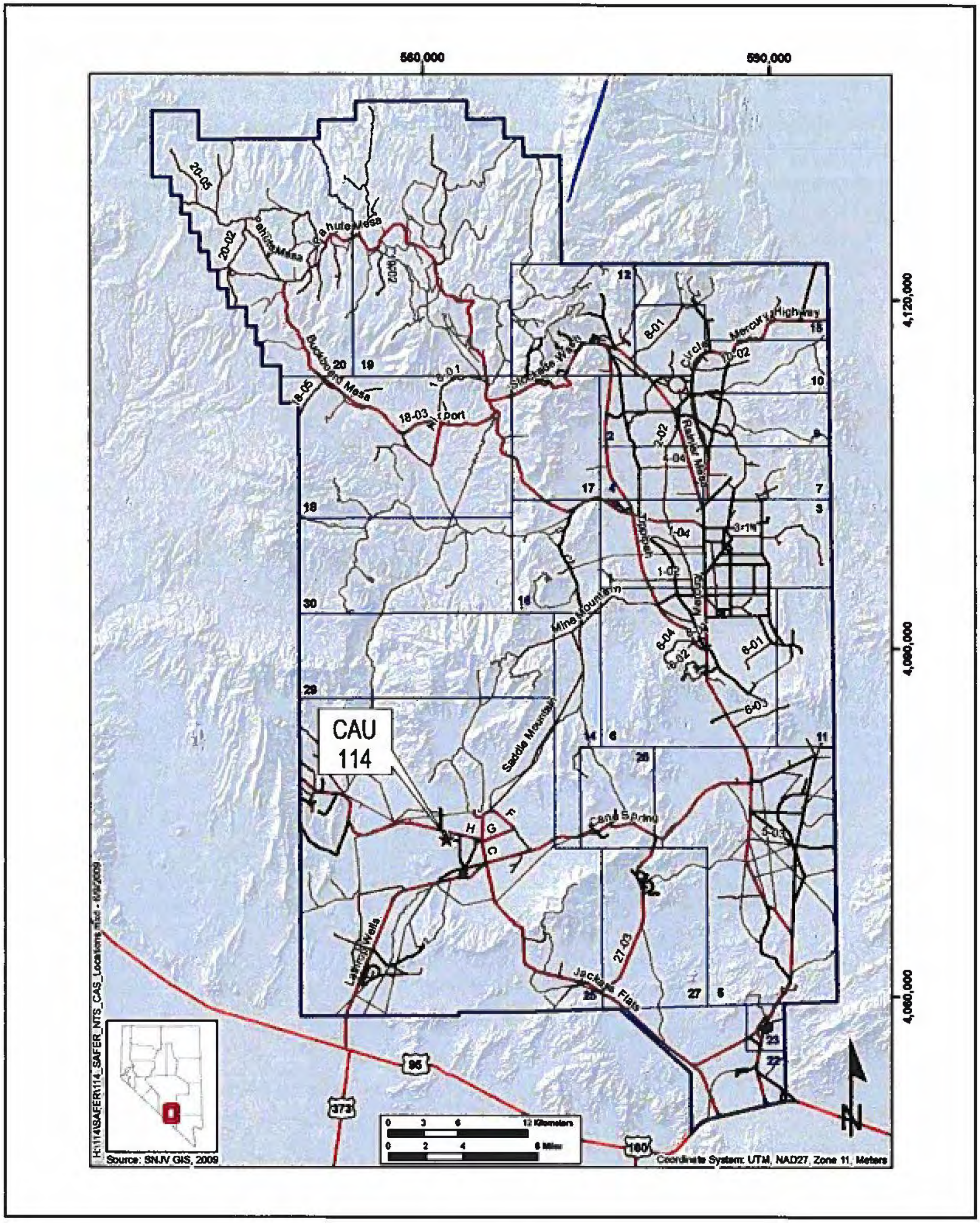

Figure 1-2
CAU 114 Location Map

Environmental
Management
Nevada Program

DOE/EMNV--0029

Streamlined Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 114: Area 25 EMAD Facility Nevada National Security Site, Nevada

Controlled Copy No.: UNCONTROLLED
Revision No.: 0

June 2021

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Environmental Management Nevada Program

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STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION (SAFER) PLAN FOR CORRECTIVE ACTION UNIT 114: AREA 25 EMAD FACILITY NEVADA NATIONAL SECURITY SITE, NEVADA

U.S. Department of Energy, Environmental Management Nevada Program
Las Vegas, Nevada

Controlled Copy No.: UNCONTROLLED

Revision No.: 0

June 2021

STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION (SAFER) PLAN FOR CORRECTIVE ACTION UNIT 114: AREA 25 EMAD FACILITY NEVADA NATIONAL SECURITY SITE, NEVADA

Approved by: KEVIN CABBLE Digitally signed by KEVIN CABBLE Date: 2021.06.22 08:15:39 -07'00' Date: ______________

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Bill R. Wilborn
Deputy Program Manager, Operations
EM Nevada Program

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List of Acronyms and Abbreviations

Ac	Actinium
ACM	Asbestos-containing material
Am	Americium
AST	Aboveground storage tank
ASTM	ASTM International
Be	Beryllium
bgs	Below ground surface
BMP	Best management practice
CAA	Corrective action alternative
CAI	Corrective action investigation
CAS	Corrective action site
CAU	Corrective action unit
Cd	Cadmium
CFR	*Code of Federal Regulations*
cm	Centimeter
Co	Cobalt
COC	Contaminant of concern
COPC	Contaminant of potential concern
CR	Closure report
Cs	Cesium
CSA	Cell Service Area
CSM	Conceptual site model
D&D	Decontamination and decommissioning
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation

List of Acronyms and Abbreviations (Continued)

dpm/100 cm^2	Disintegrations per minute per 100 square centimeters
DQI	Data quality indicator
DQO	Data quality objective
DRO	Diesel-range organics
DTRA	Defense Threat Reduction Agency
DU	Depleted uranium
EIV	Engine Installation Vehicle
EM	Environmental Management
E-MAD	Engine Maintenance, Assembly, and Disassembly
EPA	U.S. Environmental Protection Agency
ETSM	Engine Transport System Maintenance
Eu	Europium
FAL	Final action level
FFACO	*Federal Facility Agreement and Consent Order*
ft	Foot
ft^2	Square foot
gal	Gallon
HEPA	High-efficiency particulate air
HHTT	Hot Hold Transfer Tunnel
HVAC	Heating, ventilation, and air conditioning
HWAA	Hazardous waste accumulation area
IDW	Investigation-derived waste
in.	Inch
K	Potassium
lb	Pound

List of Acronyms and Abbreviations *(Continued)*

LCS	Laboratory control sample
LLW	Low-level waste
m	Meter
M&O	Management and operating
MCC	Manned Control Car
MDC	Minimum detectable concentration
mg/kg	Milligrams per kilogram
mrem/yr	Millirem per year
MS	Matrispike
NAC	*Nevada Administrative Code*
NAD	North American Datum
Nb	Niobium
NCRP	National Council on Radiation Protection and Measurements
ND	Normalized difference
NDEP	Nevada Division of Environmental Protection
NERVA	Nuclear Engine for Rocket Vehicle Application
NNSA/NSO	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office
NNSS	Nevada National Security Site
NNNSWAC	*Nevada National Security Site Waste Acceptance Criteria*
NRDS	Nuclear Rocket Development Station
NSTec	National Security Technologies, LLC
NTS	Nevada Test Site
OPS	Overhead positioning system
PAL	Preliminary action level
Pb	Lead

List of Acronyms and Abbreviations *(Continued)*

PCB	Polychlorinated biphenyl
PPE	Personal protective equipment
ppm	Parts per million
PSM	Potential source material
Pu	Plutonium
QA	Quality assurance
QAPP	Quality Assurance Project Plan
QC	Quality control
RBCA	Risk-based corrective action
RBSL	Risk-based screening level
RCA	Radiologically controlled area
RCRA	*Resource Conservation and Recovery Act*
RESRAD	Residual Radioactive
RL	Reporting limit
RMA	Radioactive material area
RPD	Relative percent difference
RSL	Regional screening level
SAFER	Streamlined Approach for Environmental Restoration
SAIC	Science Applications International Corporation
SFDP	Spent Fuel Demonstration Program
SFHPP	Spent Fuel Handling and Packaging Program
SMS	Selective mineral separator
SNJV	Stoller-Navarro Joint Venture
Sr	Strontium
SSTL	Site-specific target level

List of Acronyms and Abbreviations *(Continued)*

SVOC	Semivolatile organic compound
TBD	To be determined
Th	Thorium
Tl	Thallium
TPH	Total petroleum hydrocarbons
TSCA	*Toxic Substances Control Act*
U	Uranium
UR	Use restriction
UTM	Universal Transverse Mercator
VOC	Volatile organic compound
yd^3	Cubic yard
$\mu g/100\ cm^2$	Micrograms per 100 square centimeters
µR/hr	Microroentgens per hour
%R	Percent recovery

Executive Summary

This Streamlined Approach for Environmental Restoration (SAFER) Plan addresses the actions needed to achieve closure for Corrective Action Unit (CAU) 114, Area 25 EMAD Facility, identified in the *Federal Facility Agreement and Consent Order* (FFACO). CAU 114 comprises the following corrective action sites (CASs) located in Area 25 of the Nevada National Security Site (formerly, the Nevada Test Site):

- 25-41-03, EMAD Facility
- 25-99-23, Manned Control Car (MCC) and Engine Installation Vehicle (EIV)
- 25-33-05, Building 3901, Engine Transport System Maintenance Building

This plan provides the methodology for field activities needed to gather the necessary information for closing CAU 114. There is sufficient information and process knowledge from historical documentation and investigations of similar sites regarding the expected nature and extent of potential contaminants to recommend closure of CAU 114 using the SAFER process. Additional information will be obtained by conducting a field investigation before selecting the appropriate corrective actions for CAU 114. It is anticipated that the results of the field investigation and implementation of corrective actions will support a defensible recommendation that no further corrective action is necessary. The purpose of the corrective action investigation will be to document and verify the adequacy of existing information; to affirm the decision for either clean closure, closure in place, or no further action; and to provide sufficient data to implement the corrective action. The actual corrective action selected will be based on characterization activities implemented under this SAFER Plan. If specific conditions or findings fall outside the bounds of the SAFER Plan, the Nevada Division of Environmental Protection (NDEP) will be consulted to determine the path forward before proceeding. Upon completion of SAFER activities, a closure report will be prepared and submitted to NDEP for review and approval. The schedule for completion of the closure report will be established at the FFACO annual meeting.

The CAU will be investigated based on the data quality objectives (DQOs) developed on April 30, 2009, by representatives of NDEP and the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office. The DQO process was used to identify and define the type, amount, and quality of data needed to determine and implement appropriate corrective actions for CAU 114.

The following text summarizes the SAFER activities that will support the closure of CAU 114:

- Perform site preparation activities (e.g., utilities clearances, radiological surveys).
- Collect samples of materials to determine whether potential source material (PSM) is present that may cause the future release of a contaminant of concern to environmental media.
- If no PSMs are present at a CAS, establish no further action as the corrective action.
- If a PSM is present at a CAS, either:
    - Establish clean closure as the corrective action. The material to be remediated will be removed and disposed of as waste, or
    - Establish closure in place as the corrective action and implement the appropriate use restrictions.
- Confirm the selected closure option is sufficient to protect human health and the environment.

Certain best management practices completed during the corrective action investigation to mitigate health and safety hazards, provide access to sampling locations, or facilitate future demolition will also occur outside the FFACO scope of the CAU 114 SAFER Plan. These activities may include the following:

- Asbestos identification and abatement (regulated under the *Toxic Substances Control Act*)
- Removal of readily removable nonhazardous wastes (e.g., process wastewater, used oils, debris).

This SAFER Plan is a revision to the SAFER Plan originally released as U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2010. *Streamlined Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 114: Area 25 EMAD Facility, Nevada Test Site, Nevada*, Rev. 1, DOE/NV--1328-Rev. 1. Las Vegas, NV. This document will be submitted under the EM Nevada Program and will be issued a new DOE/EMNV document number upon NDEP approval. This SAFER Plan has been developed in accordance with the FFACO that was agreed to by the State of Nevada, DOE, and the U.S. Department of Defense. Under the FFACO, this SAFER Plan will be submitted to NDEP for approval. Fieldwork will be conducted following approval of the plan.

1.0 Introduction

This Streamlined Approach for Environmental Restoration (SAFER) Plan addresses the actions necessary for the closure of Corrective Action Unit (CAU) 114: Area 25 EMAD Facility, located at the Nevada National Security Site (NNSS) (formerly, the Nevada Test Site [NTS]), Nevada. It has been developed in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada, the U.S. Department of Energy (DOE), and the U.S. Department of Defense (FFACO, 1996 as amended).

> ***Note:*** The acronym used for the Engine Maintenance, Assembly, and Disassembly Facility sometimes appears in documents as "E-MAD" and sometimes as "EMAD." Throughout this document, "E-MAD" will be used except when "EMAD" appears in document titles and FFACO descriptions.

A SAFER may be performed when the following criteria are met:

- Conceptual corrective actions are clearly identified (although some degree of investigation may be necessary to select a specific corrective action before completion of the corrective action investigation [CAI]).
- Uncertainty of the nature, extent, and corrective action must be limited to an acceptable level of risk.
- The SAFER Plan includes decision points and criteria for making data quality objective (DQO) decisions.

The purpose of the CAI will be to document and verify the adequacy of existing information; to affirm the decision for either clean closure, closure in place, or no further action; and to provide sufficient data to implement the corrective action. The actual corrective action selected will be based on characterization activities implemented under this SAFER Plan. This SAFER Plan identifies decision points developed in cooperation with the Nevada Division of Environmental Protection (NDEP), where the Environmental Management (EM) Nevada Program will reach consensus with NDEP before beginning the next phase of work.

CAU 114 is located in Area 25 of the NNSS, which is approximately 65 miles northwest of Las Vegas, Nevada (Figures 1-1 and 1-2). CAU 114 is composed of Corrective Action Site (CAS) 25-41-03, EMAD Facility; CAS 25-99-23, Manned Control Car (MCC) and Engine Installation

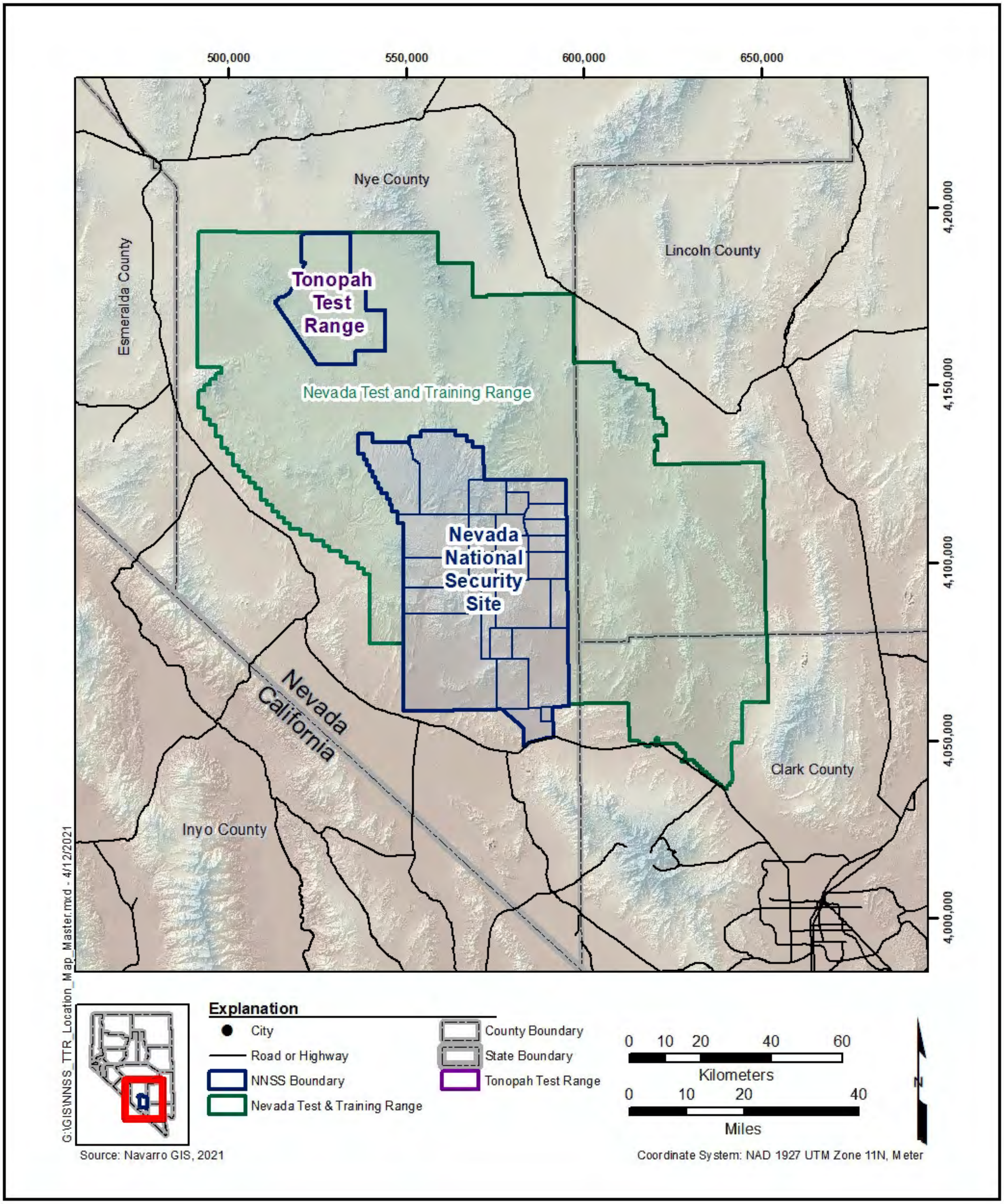

Figure 1-1
Nevada National Security Site

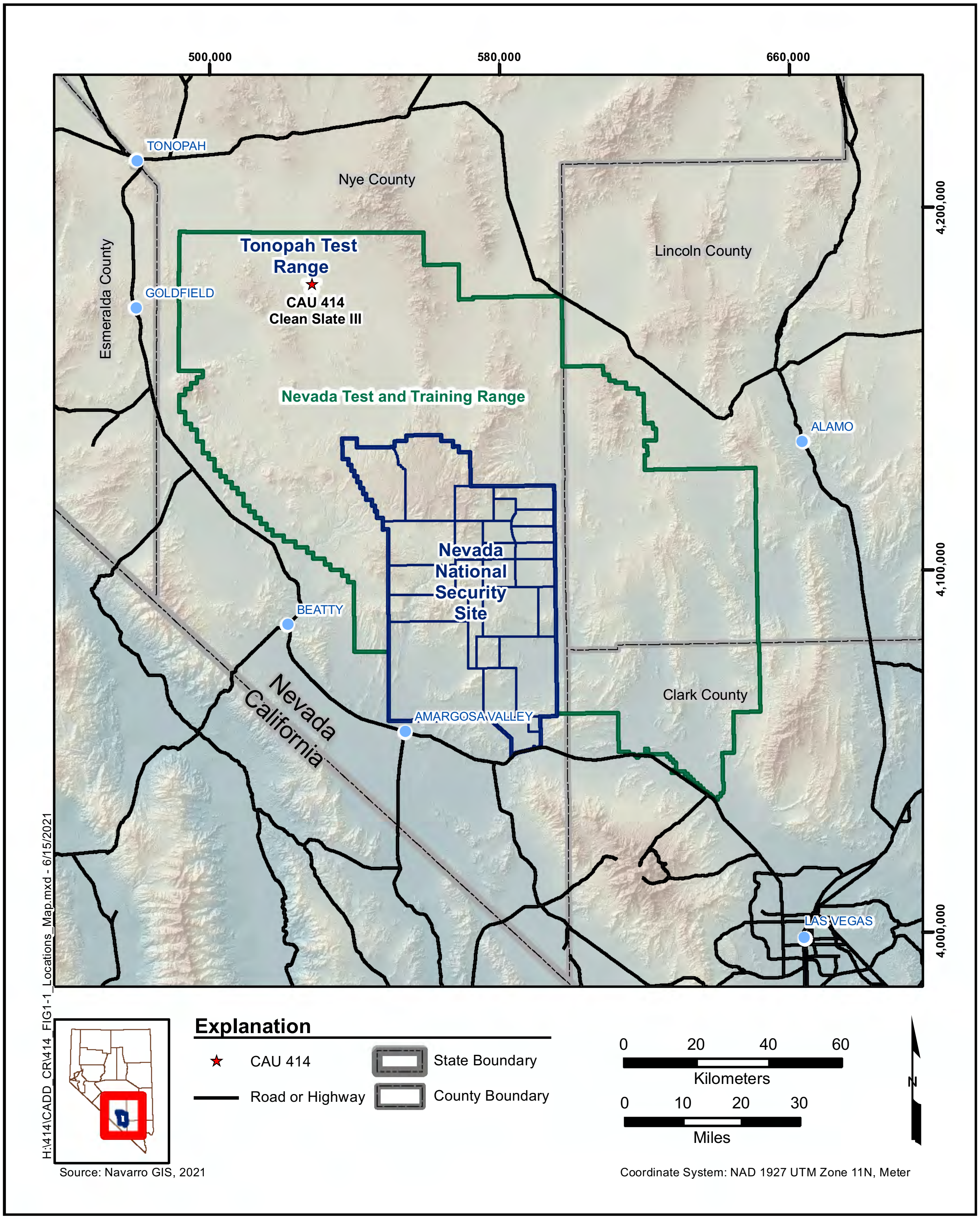

Figure 1-2
CAU 114 Location Map

Vehicle (EIV); and CAS 25-33-05, Building 3901, Engine Transport System Maintenance Building. These CASs consist of potential future releases from wastes suspected to contain a material that may cause the release of a potential source material (PSM) to environmental media (Figure 1-3).

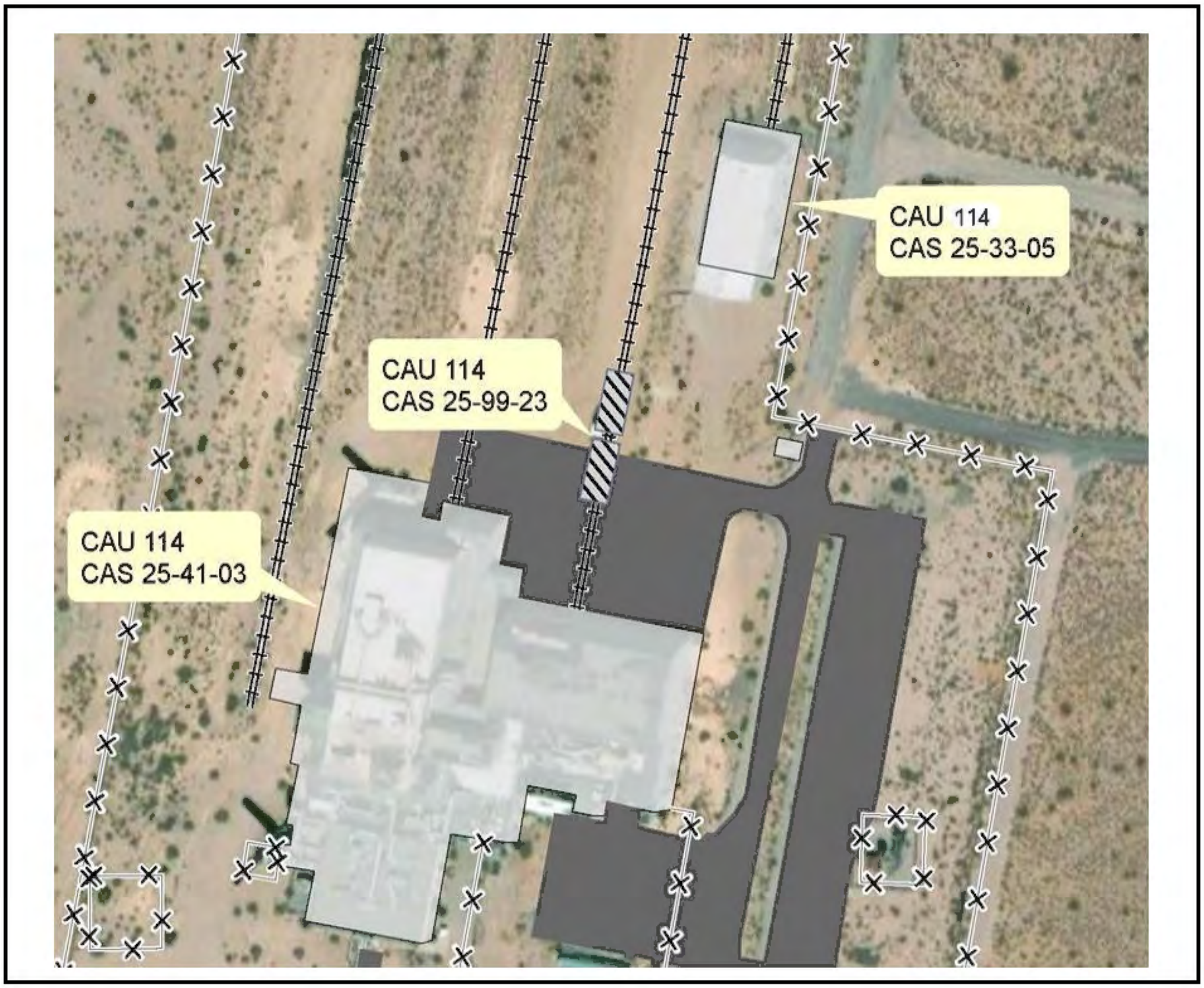

Figure 1-3
CAU 114, CAS Locations

Figure 1-3 shows an aerial photograph with the locations of CAS 25-41-03, E-MAD Facility (Building 3900); CAS 25-99-23, Manned Control Car (MCC) and Engine Installation Vehicle (EIV); and CAS 25-33-05, Building 3901, Engine Transport System Maintenance Building (Train Shed). Any releases identified during the field investigation that are associated with these CASs will be included in the scope of the CAI.

There is sufficient information and process knowledge from historical documentation and investigations of similar sites (i.e., the expected nature and extent of contaminants of potential concern [COPCs]) to recommend closure of CAU 114 using the SAFER process (FFACO, 1996 as amended).

1.1 SAFER Process Description

CAUs that may be closed using the SAFER process have conceptual corrective actions that are clearly identified. The FFACO defines this as "where the parties agree that enough information exists about the nature and extent of contamination to propose an appropriate corrective action before a CAI is completed." Consequently, corrective action alternatives (CAAs) can be chosen before completing a CAI, given anticipated investigation results.

The SAFER process combines elements of the DQO process and the observational approach to plan and conduct closure activities. The DQOs are used to identify the problem and define the type and quality of data needed to complete closure of each CAS or CAS component. The purpose of the CAI phase is to verify the adequacy of existing information used to determine the chosen corrective action and to confirm that closure objectives were met.

The SAFER process requires some degree of investigation to determine whether the appropriate corrective action will be a clean closure, closure in place, or no further action. Based on a detailed review of historical documentation, there is sufficient process knowledge to close CAU 114 using the SAFER process. Any uncertainties are addressed by documented assumptions that are verified by sampling and analysis, data evaluation, and onsite observations, as necessary. Closure activities may proceed simultaneously with site characterization as sufficient data are gathered to confirm or disprove the assumptions made during selection of the corrective action. If, at any time during the closure process, new information is discovered that fall outside the bounds of the SAFER Plan, NDEP will be notified and closure activities will be reevaluated.

1.2 Summary of Corrective Actions and Closures

The decision process for closure of CAU 114 is summarized in Figure 1-4. This process starts with the initial CAI in which the appropriate target population(s) within each CAS component are defined in the DQO process (see Appendix B). The target populations of interest will be sampled using a judgmental sampling design, defined as using biased sampling based on visual and radiological surveys. The objectives of the field activities are to determine whether PSM is present. The process ends with closure of the site based on laboratory analytical results of the samples and the preparation of a closure report (CR). Decision points that require a consensus be reached between EM Nevada Program and NDEP before continuing are indicated in Figure 1-4.

In addition to the previously discussed hold/decision points, work may be temporarily suspended until the issue can be satisfactorily resolved if any of the following unexpected conditions occur:

- Conditions outside the scope of work are encountered.
- Radiological screening yields results that require an upgrade in procedures to continue survey work in specific areas.
- Unanticipated levels of additional contaminants of concern (COCs) are found that were not originally identified as being present at the CAS.
- Unexpected conditions, including unexpected waste and/or contamination, are encountered.
- Other COCs are detected that would require re-evaluating a disposal pathway, such as with hazardous or low-level waste (LLW).
- Unsafe conditions or work practices are encountered.

The targeted corrective action is clean closure and will include removal of contaminated media and identified PSMs (see Section 3.1 for a description of PSM criteria). The alternative corrective action of closure in place with implementation of appropriate use restrictions (URs) will be performed if complete removal of PSMs cannot be accomplished during the SAFER process. The demolition of structures is planned barring any unforeseen circumstances (e.g., funding, re-utilization). When demolition takes place, it will be completed outside the FFACO process. If a UR is implemented in the CR under the FFACO due to PSM and it is feasible to remove the PSM during demolition activities, the CR will be modified under the FFACO process to document the corrective actions and

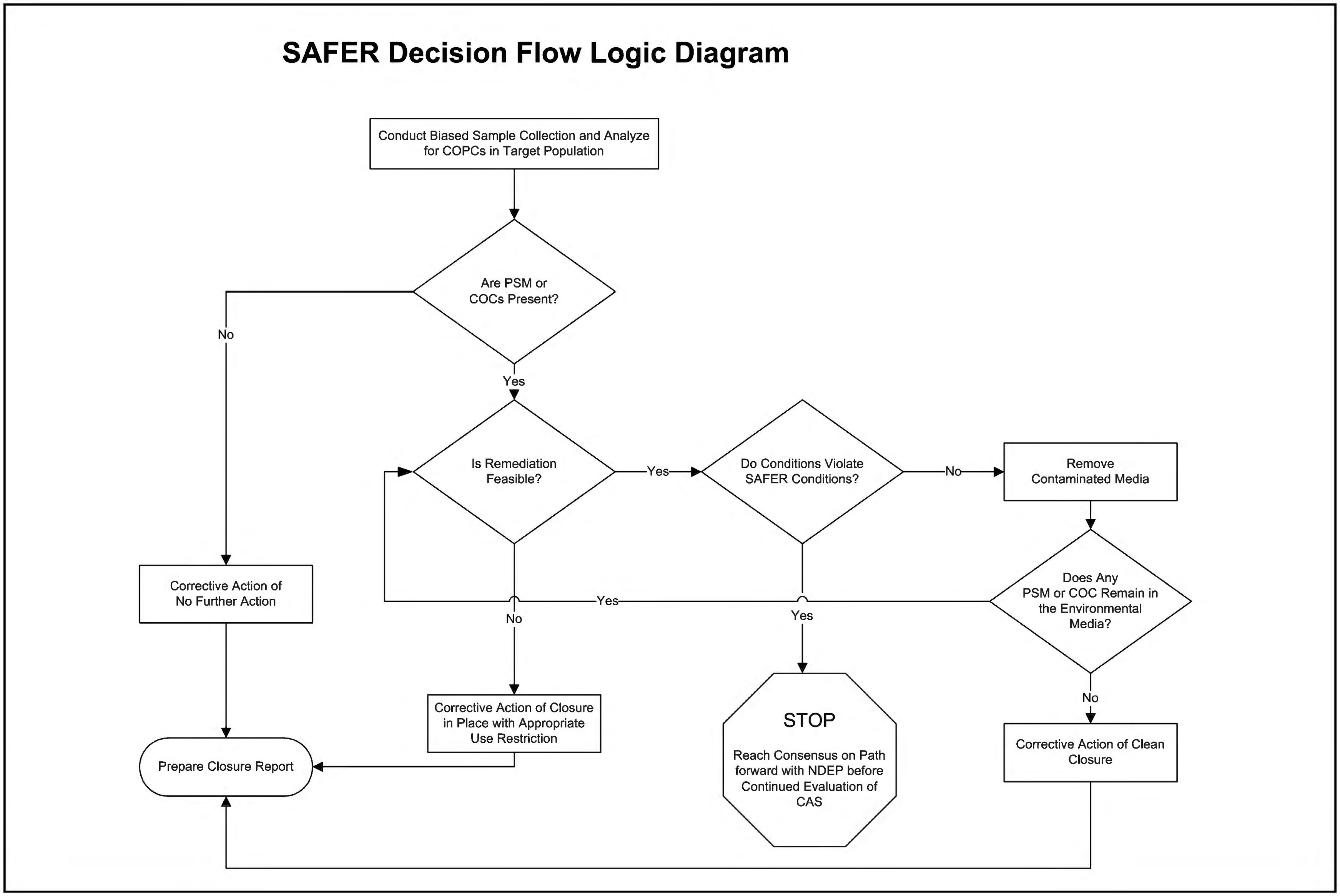

Figure 1-4
CAU 114 Closure Decision Process

remove/modify the UR. For example, it may not be technically feasible to remove certain lead-shielding items (that meet PSM criteria) from inside concrete walls until demolition activities take place, allowing more efficient access to these items.

1.3 Building 3900 End State

The targeted physical end state for Building 3900 following the CAI is that no PSM is present within this building. However, some PSM may remain following the CAI if it is more practical to remove the PSM during demolition activities. Although the final planned physical end state for Building 3900 is demolition and restoration of the area around the E-MAD Facility, these activities will occur independent of FFACO closure. Certain best management practices (BMPs) completed during the CAI to mitigate health and safety hazards, provide access to sampling locations, or facilitate future demolition will also occur outside the FFACO scope of the CAU 114 SAFER Plan. These activities may include the following:

- Asbestos identification and abatement (regulated under the *Toxic Substances Control Act* [TSCA])
- Removal of readily removable nonhazardous wastes (e.g., process wastewater, used oils, debris)

1.4 MCC and EIV End State

The targeted physical end state for the MCC and EIV following the CAI is that no PSM is present in or on this equipment. If PSM remains on the equipment following the CAI, it will be use restricted under the FFACO. If this PSM is removed during demolition activities, the removal will be conducted under the FFACO, and the CR will be modified to remove the UR. Final disposition of the material following PSM removal will occur independent of FFACO closure. Certain BMPs completed during the CAI to mitigate health and safety hazards, provide access to sampling locations, or facilitate future demolition will also occur outside the FFACO scope of the CAU 114 SAFER Plan. These activities may include the following:

- Removal of readily removable nonhazardous wastes (e.g., used oils, debris)

1.5 Train Shed

The planned physical end state for the Train Shed following the CAI is that no PSM is present within this building. Although the final planned physical end state for the Train Shed is demolition and restoration of the area around the building, these activities will occur independent of FFACO closure. Certain BMPs completed during the CAI to mitigate health and safety hazards, provide access to sampling locations, or facilitate future demolition will also occur outside the FFACO scope of the CAU 114 SAFER Plan. These activities may include the following:

- Asbestos identification and abatement
- Removal of readily removable nonhazardous wastes (e.g., process wastewater, used oils, debris)

2.0 Unit Description

This section summarizes the operational history, process knowledge, and available characterization information for CAU 114. Process knowledge has been obtained through review of historical documents, engineering drawings, maps, and interviews with past and present NNSS employees. Based on the available information regarding activities associated with CAU 114 CASs, assumptions were made to develop a conceptual site model (CSM) that describes the most probable scenario for the current conditions (see Section 3.2.5). The CSM was developed by representatives of NDEP and the DOE, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) in the DQOs presented in Appendix B.

The scope of CAU 114 will include any environmental releases associated with activities at CAU 114 CAS locations (defined in Sections 2.1, 2.2, and 2.3). Not included in the scope of CAU 114 are the railroad tracks (CAU 539), and the exterior of the E-MAD Compound (CAU 566).

2.1 CAS 25-41-03, EMAD Facility

2.1.1 Description

CAS 25-41-03 consists of the potential releases to soil associated with historic operations at Building 3900. Building 3900 is located in an area of approximately 25 acres surrounded by a chain-link perimeter fence. Entry to the site is through a security gate at the northeast corner of the chain-link fence. A large asphalt-paved area is at the north side of the building, and railroad tracks are embedded in the blacktop running from the north end of the building beyond the perimeter fence into Area 26.

Building 3900 is an approximately 100,000-square-foot (ft^2), four-story building that is 80 feet (ft) high. The exterior of Building 3900 is irregular in both height and configuration, with the walls constructed of either concrete (with rebar), asbestos-coated corrugated steel, or concrete block. In general, walls requiring shielding are constructed of concrete, while all other walls are constructed of corrugated steel or concrete block. While there are multiple shielded and unshielded loading doors and personnel access doors, there are no exterior windows in the building (DRI, 1996). The roofs of the building are at various floor levels, and most areas are surrounded by guardrails housing a variety of heating, ventilation, and air-conditioning (HVAC) equipment. The interior of Building 3900 consists of three main floors, a partial basement, and a one-room fourth floor. There are approximately 44 rooms that are divided among the following functional areas described in Sections 2.1.1.1 through 2.1.1.5. The functional areas are (1) the Hot Bay Complex, (2) the Operating Galleries and Master Control Room, (3) the Cold Bay Complex, (4) the Machine and Repair Shops, and (5) the Facility Support areas. Figures 2-1 through 2-5 show the floor plans for Building 3900.

2.1.1.1 Hot Bay Complex

The Hot Bay Complex is arranged as a north–south linear progression of shielded areas making up the western half of the facility. The northernmost room is the Hot Bay, which extends south to the Hot Hold Transfer Tunnel (HHTT), which is flanked by the East and West Process Cells. The HHTT leads to the Cell Service Area (CSA) and 12 smaller post-mortem hot cells. The entire Hot Bay is a posted as a Contamination Area. See Figure 2-1 for locations of these rooms.

Hot Bay

The Hot Bay is a three-story hot cell (140 ft long, 66 ft wide, 76 ft high) consisting of 5- to 6-ft-thick concrete walls containing 17 lead-glass shielding windows and a 32-inch (in.) thick concrete ceiling that provides shielding for remote assembly and disassembly of irradiated materials. Railroad tracks that extend north–south from door to door are set in the concrete floor, which features a 1-ft-wide gutter with drains around the perimeter. The main access for hot material to the Hot Bay was by railcar or truck through a 5-ft-thick, 400-ton rolling concrete door (37 ft high, 22 ft wide). Transfer of material to the post-mortem cells via the HHTT was by a smaller railcar through a rolling steel door (18 ft wide, 29 ft high). Special Hot Bay equipment and features included the following:

- A 40-ton overhead bridge crane with a 10-ton hook
- An overhead position system that had capabilities of a retractable rigid-mast crane and bridge-mounted manipulator that handled up to a 20-ton load
- A 35-ft diameter turntable with an 80-ton turning capacity, and a 2.5-by-2.5-ft manway that provided access to the turntable-drive access tunnel, which measured 4 ft wide, 17 ft long, and 12 ft deep
- Two sidewall manipulators mounted on the east wall, each with a 35-ft arm capable of handling up to 600 pounds (lb)

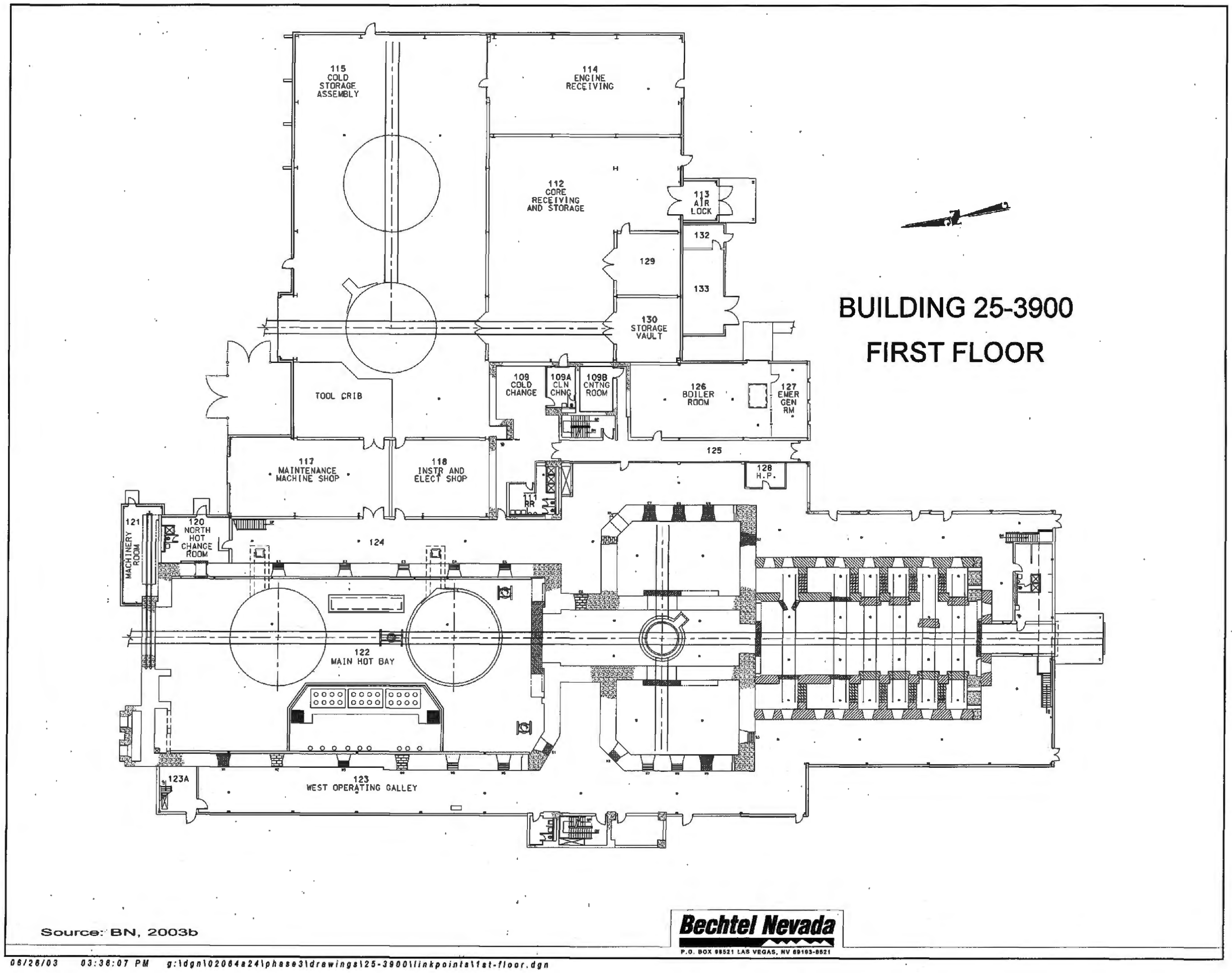

Figure 2-1
EMAD Facility First-Floor Layout

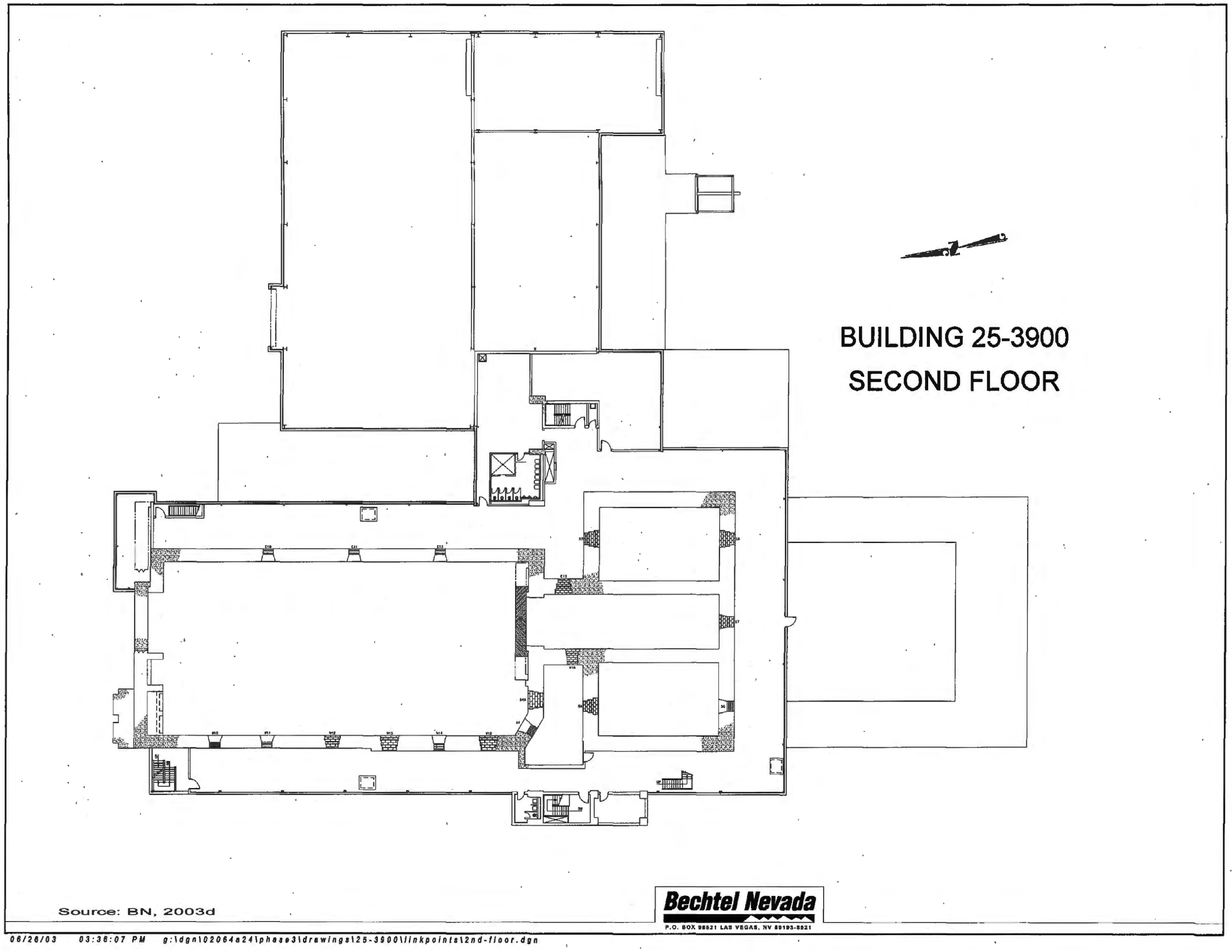

Figure 2-2
EMAD Facility Second-Floor Layout

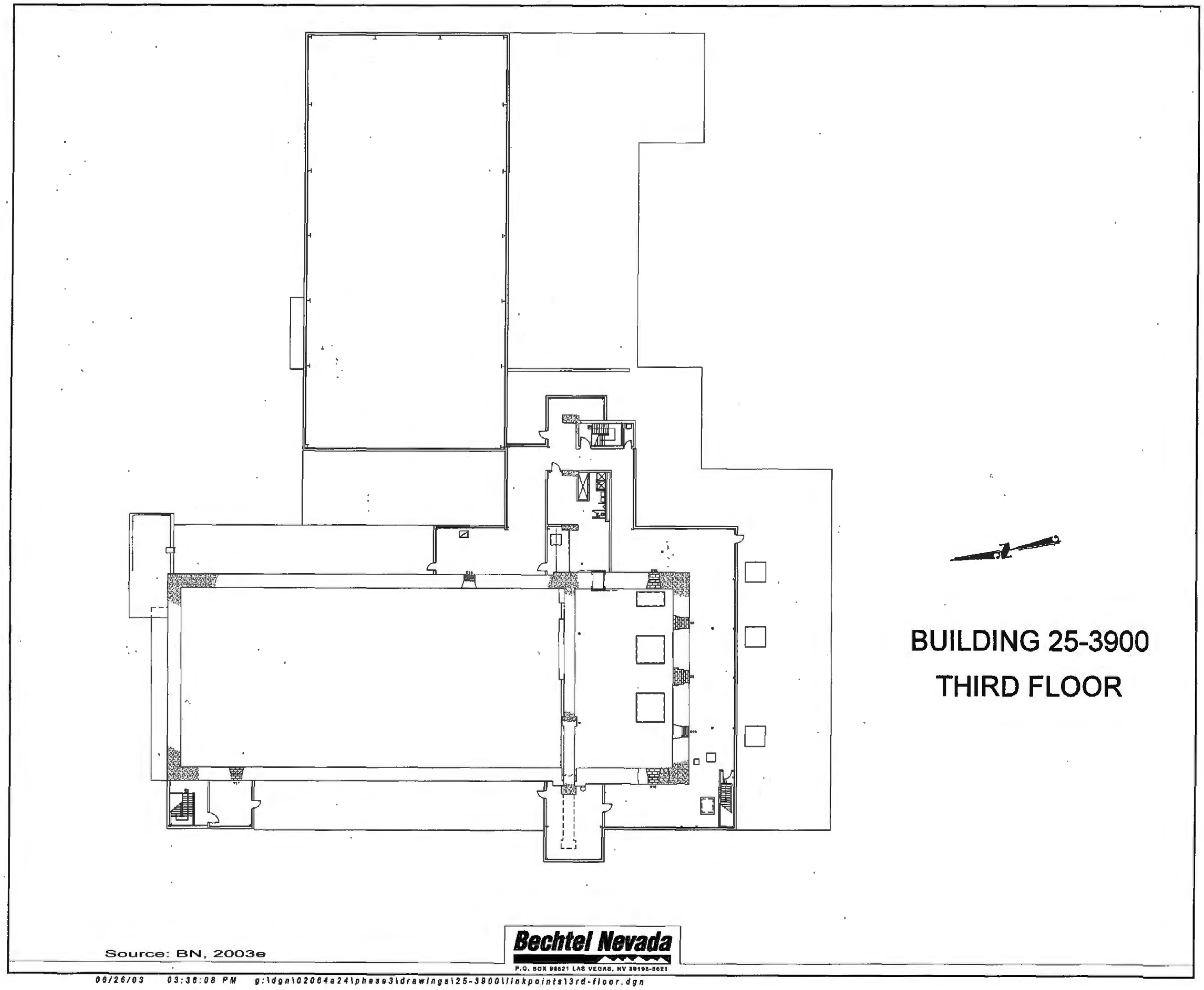

Figure 2-3
E-MAD Facility Third-Floor Layout

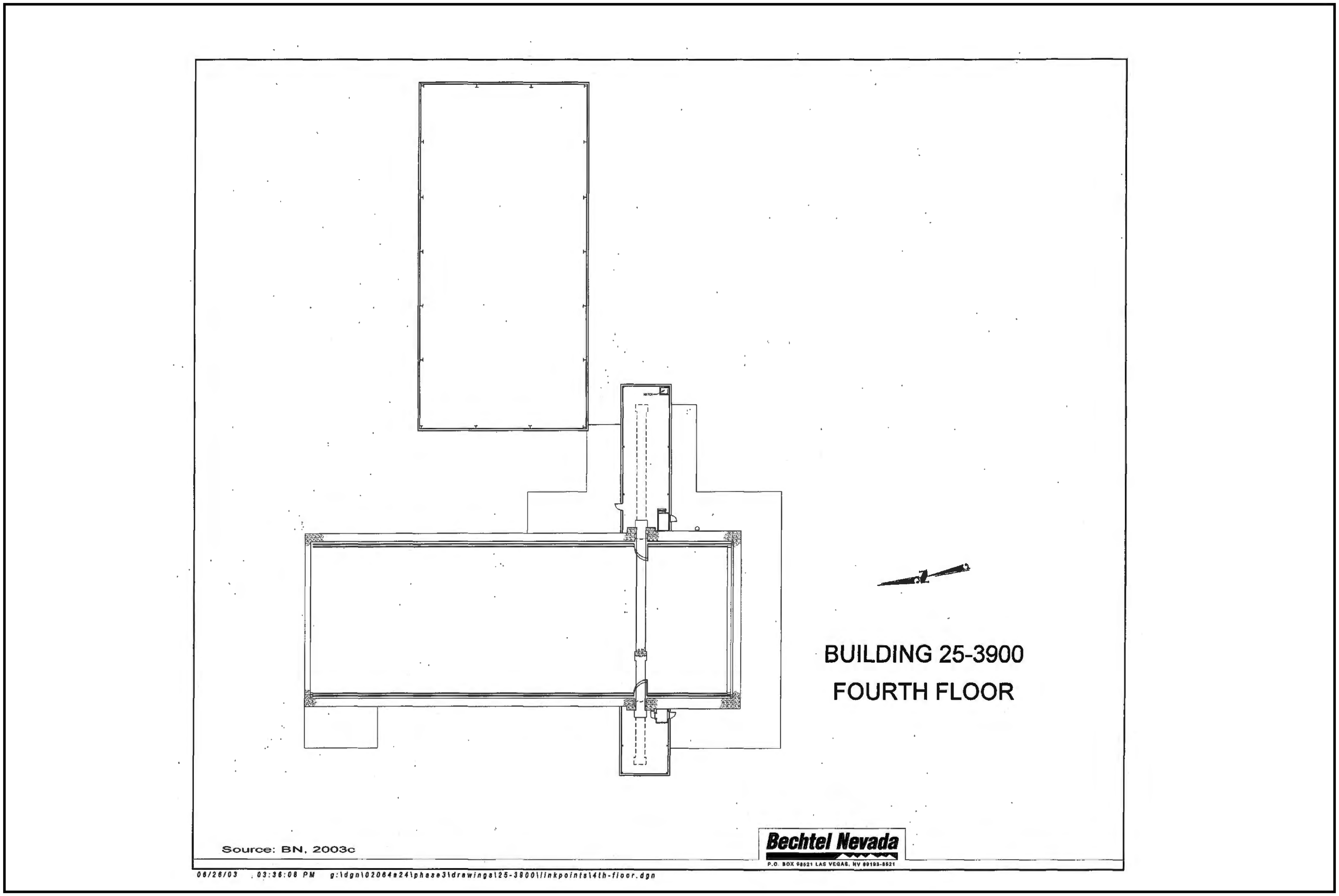

Figure 2-4
E-MAD Facility Fourth-Floor Layout

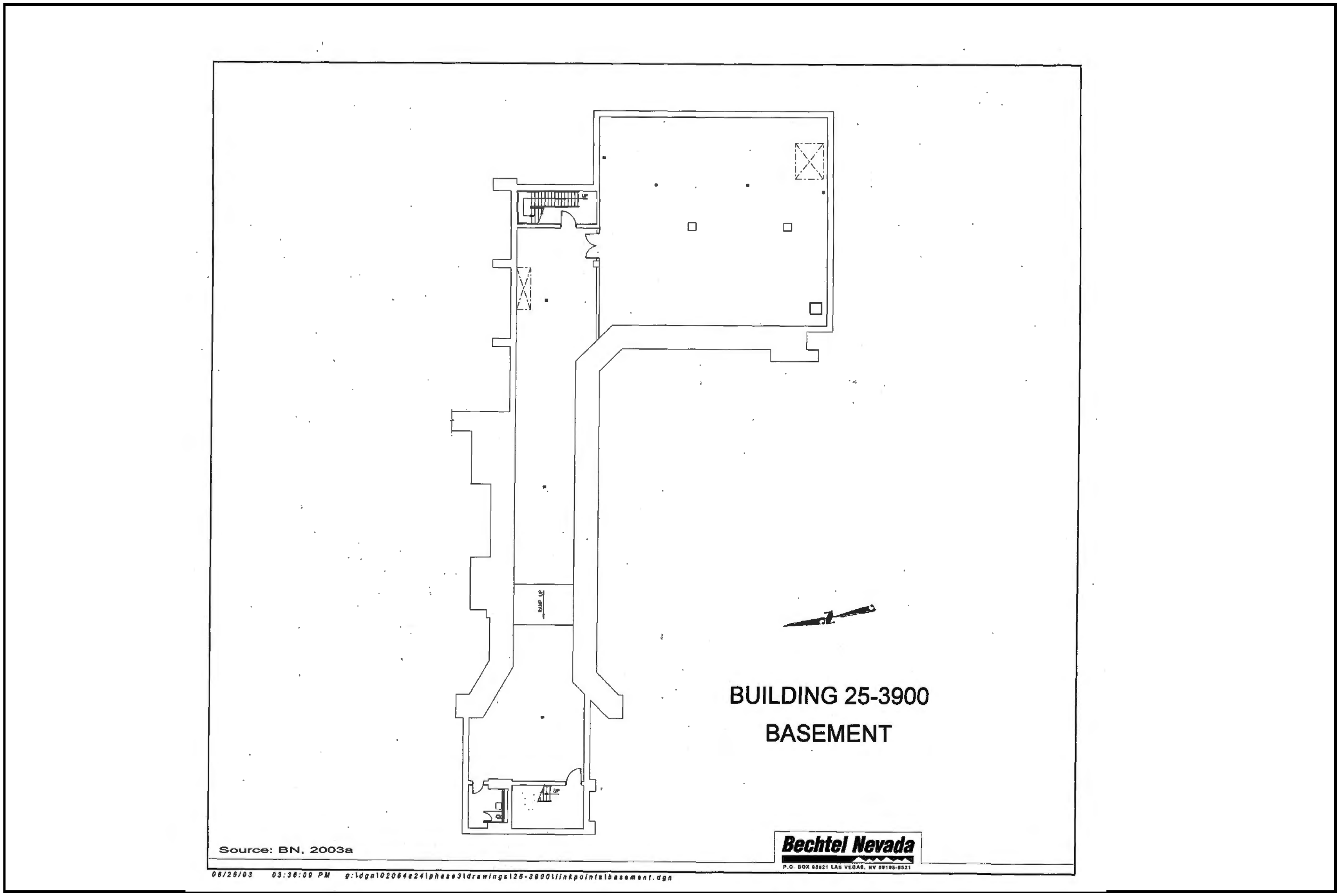

Figure 2-5
E-MAD Facility Basement Layout

- Three scanning and photographic periscopes.
- Ten master-slave manipulators at each of the first-floor viewing windows on the east wall.
- A remote-operated system to transport materials from the north to south end of the facility via the railroad track.
- A shielded fuel storage pit in the floor (5 ft wide, 26 ft long, and 13 ft deep) with 6-ft-thick concrete roof plugs (removable by crane). A lag storage pit in the floor (27 ft wide, 58 ft long, 23 ft deep). Smaller service pits including a survey pit (2 ft diameter, 14 ft deep), a weld pit (2 ft diameter, 20 ft deep), and a transfer pit (2 ft diameter, 27 ft deep).
- A service balcony featuring a heavy concrete shield door used to close off the area so maintenance operations could be performed on the crane while irradiated materials were exposed in the main Hot Bay. The fourth floor consisted of a single small room used to service the shield door and provide access to the roof.

Hot Hold Transfer Tunnel

The HHTT is a concrete shielding area connecting the Hot Bay to the disassembly and examination cells that serves as a holding and transfer area for radioactive components. The area is equipped with a 15-ft turntable with a 75,000-lb load capacity. Materials were remotely transferred to the Process Cells or post-mortem cells via a "dolly" mounted on the railroad tracks. At least one of the "dolly" cars is still located in the HHTT.

East and West Process Cells

The East and West Process Cells (each 46 by 28 by 29 ft), located at each side of the HHTT, were designed for the disassembly of the reactor core into its basic components. It was reported that the East Process Cell was never activated; and viewing windows, equipment, and lighting were not installed (DRI, 1996). The West Process Cell had four shielded windows (one is reported to be filled in with electrical equipment), each equipped with master-slave manipulator arms (currently, only one window has a set). A steel shield door separates this space from the HHTT.

Cell Service Area and Post-mortem Cells

South of the HHTT is the CSA, a long, rectangular space that allows for the remote rail transfer of irradiated materials into any one of the 12 post-mortem (hot) cells. A 7.5-ton crane and a bridge-mounted manipulator serviced this area. According to the Atomic Energy Commission, 90 percent of the remote lab work was performed in these cells (DRI, 1996). On each side of the CSA are two large (16-by-10-by-15-ft) and four small (8-by-10-by-15-ft) post-mortem cells. Each cell has a shielded viewing window with master-slave manipulators and was serviced by a flat car for moving materials between the cell and the CSA (at least two cars remains in the HHTT). A steel shield door at the south end of this area leads to an airlock entry beyond which is a truck loading station serviced by a 25-ton monorail crane.

2.1.1.2 Operating Galleries and Master Control Room

The Operating Galleries were work areas on the "cold" side of the Hot Bay Complex on the first, second, and third floors and served as a protected area for personnel to work at the remote viewing control stations for all hot cells. These areas have asbestos-containing floor tiles, shared concrete walls with the hot cells, steel panel or concrete block walls along the perimeter, and concrete or steel ceilings. More than 40 small manipulator arms were originally located at the first and second-floor viewing windows, and a periscope for detailed viewing was typically installed next to the arms. Various electric panels, gauges, and other equipment are found throughout the operating galleries.

The Master Control Room is located on the second floor and has a wide angle view into the Hot Bay through a shielding window. The Master Control Room functioned as the control center for operating the remote handling equipment (e.g., overhead crane, turntables, shield doors), remote railroad switches (controlled E-MAD and other Area 25 facilities), and telecommunication and video systems. Equipment was shut down or selectively powered from this area.

2.1.1.3 Cold Bay Complex

The Cold Bay complex makes up the east side of the facility and comprises the Cold Bay, the Receiving and Storage area, and the Office area (originally the Engine Receiving Room).

Cold Bay

The Cold Bay, used for the receipt and assembly of nuclear rocket engines without the reactor core, is 140 by 72 by 60 ft and features a 40-ton crane (with a 10-ton hook) and a 34-ft turntable capable of turning an 80-ton load. A 2.5-by-2.5-ft manway provides access to the turntable-drive. The facility railroad tracks enter the Cold Bay from the north wall through a 45-ft tall rolling metal door, extend across the turntable, and end inside the Receiving and Storage area. A second set of tracks run east–west in the concrete floor and end at the turntable. The north and east walls, and the upper portion of the west wall, are metal. The south wall and the lower portion of the west wall are concrete block. The ceiling is corrugated metal supported by steel trusses. On the south wall are a set of double steel casement doors leading to the Receiving and Storage area. A welding shop occupied the northwest corner of the Cold Bay and provides direct access to the electrical and machine shops.

Receiving and Storage Area

The main floor of this space is "L" shaped due to the location of two smaller rooms (Bonded Material Storage Room and Security Vault). The main area has access to an airlock entry at the south end that consists of two sets of double steel casement doors. The floor is concrete with railroad tracks running into the main area. The walls are concrete block, except for the steel south exterior wall. A 10-ton overhead bridge crane services this area.

Office Area

The Office area is located southeast of the Cold Bay and was originally designed to be the Engine Receiving Room. This area was instead divided into 10 office cubicles and an open reception area. The second floor contains several other areas designated for use as office work stations.

2.1.1.4 Machine and Repair Shops

The shops area, located adjacent to the Cold Bay, comprises a machine shop, electric shop, and welding shop that had the basic capabilities necessary for facility equipment fabrication, checkout, maintenance, and repair. A 5-ton bridge crane over the machine shop enabled the handling and movement of heavy items.

2.1.1.5 Facility Support Areas

The Facility Support areas include the boiler room containing two hot water boilers, a hot water pump, and an emergency generator; the compressor room containing air compressors, air-conditioning and refrigeration units, vacuum pumps, and the chilled water distribution system; the counting room; the HVAC control console; and the electrical equipment room containing electrical supply systems. The HVAC system includes two large exhaust stacks (one each at the northwest and southwest corners of the facility). Each stack is 114 ft tall and equipped with a washdown system from which process water would flow to numerous spray nozzles within the stack. Wastewater drains to an adjacent drywell, which consists of 3 cubic yards (yd^3) of "broken stone." An engineering drawing shows a sump pit with a drain line to the drywell of the south stack (AEC/NASA, 1963). It is unknown whether a similar sump pit was installed for the north stack.

Aqueous systems that supported the facility include hot process water, cold process water, potable hot water, potable cold water, heating hot water, condenser water, and chilled water. A 75,000-gallon (gal)-capacity elevated water tank that is located near the southeast corner of the compound serviced Building 3900. Waste systems include the main sanitary sewer system and radioactive waste system (see Section 2.1.3 for previous CAU investigations related to these systems).

2.1.2 History and Process Knowledge

The E-MAD Facility is one of seven separate but interconnected complexes associated with the Nuclear Rocket Development Station (NRDS) in Area 25 in support of the Rover program, whose goal was the development of nuclear rocket reactors for use in the space program (DRI, 1996). The E-MAD Facility supported the second phase of that program consisting of the design and testing of nuclear powered rockets in the Nuclear Engine for Rocket Vehicle Application (NERVA) project (1965 to 1973). The NERVA engines were assembled in the Cold Bay, transported to the Engine Test Stand for testing, and then returned to E-MAD, where remote handling, inspections, and additional testing activities were conducted in the Hot Bay and post-mortem cells.

From 1977 to 1982, the Westinghouse Electric Corporation hosted the Spent Fuel Demonstration Program (SFDP), which involved testing and development activities related to the dry storage of spent nuclear fuel assemblies (DOE/NV, 1983). Primary program activities included receipt of spent fuel assemblies; design and development of sealed canisters for storage demonstrations; and performance of fuel calorimetry and canister gas sampling. The spent fuel program demonstrated three dry spent fuel storage concepts: (1) aboveground storage within two 252-in. high, 104-in. diameter reinforced concrete silos; (2) near surface dry well storage within four steel casing liners grouted into a shallow hole drilled between the rails on the west set of the railroad tracks; and (3) air-cooled vault (or lag storage pit) located inside the Hot Bay (DOE/NV, 1983). All fuel cores were removed from the site in 1989. Since the conclusion of the SFDP in the late 1980s, the E-MAD Facility has been mostly inactive with the exception of Fluid Tech Inc., who occupied portions of the Cold Bay and office areas in the late 1990s. Fluid Tech's primary activities included decontamination of plutonium (Pu) from a historic XF-90 airplane formerly located in Plutonium Valley of the NNSS (Seals, 2004). Other activities included testing of microbial digestion of protective clothing (Garey, 2006). In addition to portions of the Cold Bay, Fluid Tech also used one of the trailers as an office/first-aid station.

2.1.3 Previous Investigations

In 1996, a radiological characterization and decontamination project at the E-MAD Facility was initiated to meet the schedule of a commercial tenant, Kistler Aerospace Corporation, who had plans to use the E-MAD Facility. In February 1997, however, the prospective tenant canceled its request to occupy the facility, and the project was suspended after radiological characterization fieldwork was completed and before any decontamination activity was performed.

Details regarding the survey and sampling results from the facility can be found in the document *Decontamination and Decommissioning Subproject Characterization Report for the E-MAD Decontamination Project* (DOE/NV, 1998b). The evaluation of the survey results confirmed historical knowledge that the primary radiological contaminants are uranium (U) and associated fission products. The evaluation of the chemical analysis showed that the primary building materials do not contain chemical concentrations that would generate *Resource Conservation and Recovery Act* (RCRA) waste. The radiological survey data showed that the extent of contamination has several trends that generally hold true throughout the facility. Relatively high levels of contamination are present on horizontal surfaces such as ledges, brackets attached to walls, the top surfaces of machinery, and the top surfaces of light fixtures. Penetrations also contained relatively high levels of contamination. Typical penetrations were cracks in floors, floor drains, cracks in walls, recessed electrical junction boxes, and the subgrade workings of the railway turntables. Relatively high levels of contamination were also found on oily or greasy surfaces, such as the rollers for the shield doors, the rails for the bridge-mounted equipment, the monorails for the wall-mounted handling units, oily surfaces adjacent to the oil-filled observation windows, cables, and other lubricated machinery. Relatively little contamination was found on vertical and overhead surfaces, such as walls and ceilings. Table 2-1 provides the available maximum radiological measurements for various locations within Building 3900.

Table 2-1
Available Maximum Radiological Measurements for the E-MAD Facility
(Page 1 of 2)

Location	Maximum Net Results (dpm/100 cm^2)				Maximum Net Results (μR/hr)	
	Removable		Total		Exposure Rate at 1 cm	Exposure Rate at 1 m
	Alpha	Beta	Alpha	Beta		
Hot Bay Walls (Room 122)	6,000	37,344	153,000	864,000	120	80
Hot Bay Ceiling (Room 122)	1,371	17,675	6,800	84,400	18	18
Hot Bay Floor (Room 122)	757	7,024	11,930	4,256,000	1,600	190
Hot Bay Turntable, Subgrade (Room 122)	42	434	7,560	600,000	2,000	1,900
Bridge-Mounted Overhead Positioning System (OPS)	1,498	20,690	9,540	118,000	10	10
Bridge-Mounted Crane	747	6,101	11,700	98,300	0	0
Hot Bay OPS Power Strip	331	6,630	5,040	79,000	30	21
Wall-Mounted Handling Unit, North	1,384	53,055	12,400	211,000	0	0
Wall-Mounted Handling Unit, South	3,972	136,844	23,380	1,180,000	0	0
Basement Tank Vault, Walls, Floor, and Tank	11	152	4,230	232,000	0	0
Fuel Rod Cask Welding Pit	7	367	79	1,475	0	0
Fuel Rod Storage Pits Ventilation	20	319	61	1,558	14	14
Crane Maintenance Balcony Wall (Room 306)	214	2,233	4,630	155,500	32	49
Crane Maintenance Balcony Ceiling (Room 306)	520	4,593	6,280	115,000	19	14
Crane Maintenance Balcony Floor (Room 306)	783	7,570	22,500	129,000	36	18
Crane Maintenance Balcony OPS Power Strips	236	2,788	31,600	55,400	0	0
Transfer Tunnel Walls (Room 128)	2,306	13,393	7,714	80,100	39.5	40.5
Transfer Tunnel Ceiling (Room 128)	329	6,648	3,220	31,800	12	12
Transfer Tunnel Floor (Room 128)	29	2,673	11,800	74,800	42	23
Transfer Tunnel Turntable, Subgrade	30	481	31,600	74,700	1,500	1,700
Balcony Hot Change Room Walls (Room 305)	5	59	105	1,529	17	16
Balcony Hot Change Room Ceiling/Ductwork (Room 305)	2	25	49	1,553	10	10
Hallway, Hot Change Room/Balcony	10	51	51	689	7	6.5
North Hot Change Room Walls (Room 120)	54	453	387	7,064	16	14

Table 2-1
Available Maximum Radiological Measurements for the E-MAD Facility
(Page 2 of 2)

Location	Maximum Net Results (dpm/100 cm^2)				Maximum Net Results (μR/hr)	
	Removable		Total		Exposure Rate at 1 cm	Exposure Rate at 1 m
	Alpha	Beta	Alpha	Beta		
North Hot Change Room Ceiling (Room 120)	62	500	700	4,116	10	10
North Hot Change Room Floor (Room 120)	14	375	126	7,988	12	15
Hallway, Hot Change Room/Hot Bay	5	51	175	1,641	7	7
Machinery Room (Room 121)	17	90	358	3,338	12	12
Machinery Room (Room 401)	19	366	42	1,045	8	8.5
Machinery Room (Room 307)	19	163	552	2,436	14	11
Transfer Tunnel Ductwork, Exterior	563	16,970	6,080	65,200	16	12
Hot Bay Ductwork, Interior	192	7,073	1,080	46,900	16	15
Hot Bay Ductwork, Exterior	777	10,277	14,200	165,000	38	19
Hot Bay Outflow Filter Housing	440	3,232	7,890	163,000	20	19
Hot Bay Exhaust Blowers and North Stack	8	360	88	964	4	0

Source: DOE/NV, 1998b

cm = Centimeter
dpm/100 cm^2 = Disintegrations per minute per 100 square centimeters
m = Meter
μR/hr = Microroentgens per hour

The NNSS management and operating (M&O) contractor collected soil and swipe samples at the E-MAD Facility in 2003. Seven bulk soil samples were collected (February 2003) and analyzed for beryllium. The results of the analyses ranged from 0.0628 parts per million (ppm) to 0.4630 ppm (Spezialetti, 2007). Fifteen swipe samples were collected (September 2003) and analyzed for arsenic, beryllium, cadmium, chromium, and lead. The analytical results for arsenic ranged from 0.7 micrograms per 100 square centimeters ($\mu g/100\ cm^2$) to 5.0 $\mu g/100\ cm^2$. The analytical results for beryllium ranged from 0.0 $\mu g/100\ cm^2$ to 0.13 $\mu g/100\ cm^2$. The analytical results for cadmium ranged from 0.03 $\mu g/100\ cm^2$ to 9.3 $\mu g/100\ cm^2$. The analytical results for chromium ranged from 0.66 $\mu g/100\ cm^2$ to 1,800 $\mu g/100\ cm^2$. The analytical results for lead ranged from 2.0 $\mu g/100\ cm^2$ to 3,700 $\mu g/100\ cm^2$ (Spezialetti, 2007). Specific sample locations for the 2003 data are unknown, and the results can only be used to assess initial requirements for personnel protection.

Thirty-five CASs consisting of various types of environmental releases or housekeeping materials related to the historical operations of the E-MAD Facility have previously been investigated and closed under the FFACO: 28 CASs have been closed under the clean closure strategy (22 of which were housekeeping CASs); 6 CASs have been closed under the closure in place strategy (CASs 25-05-06 and 25-25-17 have since had their associated URs lifted); and 1 CAS (25-25-18) was closed under a corrective action of no further action. Since the URs for CAS 25-05-06 (CAU 262) and CAS 25-25-17 (CAU 398) were originally established, practices and procedures relating to the implementation of risk-based corrective actions (RBCAs) have changed. Therefore, these URs were re-evaluated against the current RBCA criteria as defined in the *Soils Risk-Based Corrective Action Evaluation Process* (DOE/EMNV, 2018) This re-evaluation consisted of comparing the original data (the basis for the URs) to risk-based final action levels (FALs) developed using the current Soils RBCA process. The re-evaluation resulted in a recommendation to remove the URs because contamination is not present at the CASs above the risk-based FALs. The potential to remove the other existing URs will be evaluated during the CAU 114 CAI and in consultation with NDEP.

Figure 2-6 shows the locations of the previously investigated CASs by associated CAU number, with the exception of CAU 566 (which covers the entire area within the fence); and Table 2-2 lists the FFACO reports documenting the previous investigations and corrective actions. The corrective actions performed at each of these CASs were reviewed and evaluated to determine (1) the potential impacts of existing URs on the CAU 114 CAI, and (2) whether any component of the CAS was not

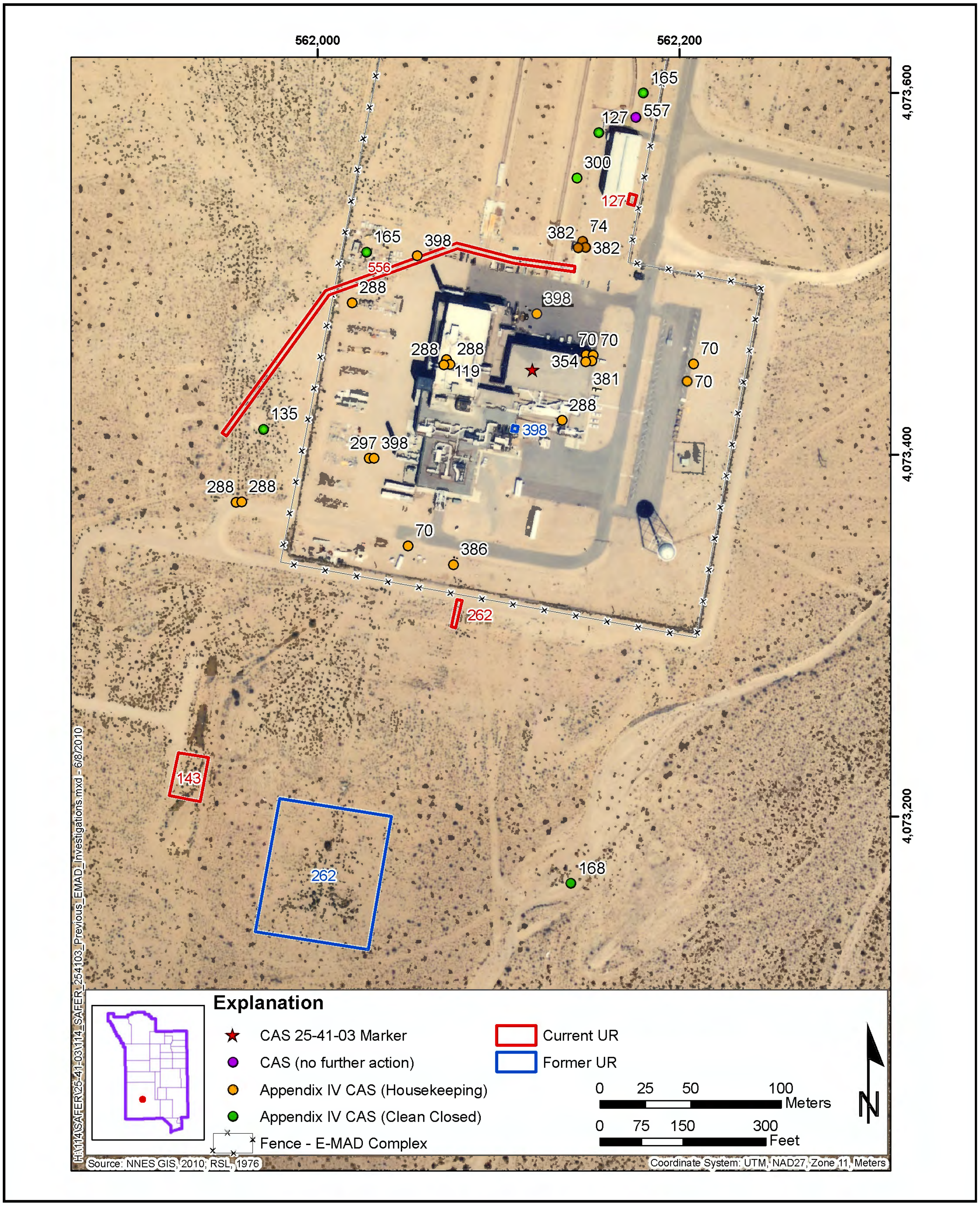

Figure 2-6
Previous Investigations Associated with E-MAD Facility Operations

Table 2-2
Previous CAU Investigations Associated with the E-MAD Facility
(Page 1 of 4)

CAU	CAS	CAS Description	Associated Documents
22 Housekeeping CASs Closed under the Clean Closure Strategy			
70	25-24-08	Batteries (2)	U.S. Department of Energy, Nevada Operations Office. 1995a. *Environmental Restoration Sites Inventory - Non-Hazardous Site Cleanup Verification Summary.* (DOE/NV, 1995a)
	25-24-10	Batteries (6)	
	25-26-11	Lead Bricks (30)	
	25-26-12	Lead Bricks (339)	
	25-26-20	Lead Bricks (52)	
74	25-29-10	Chemicals (paint and oil)	U.S. Department of Energy, Nevada Operations Office. 1995b. *Environmental Restoration Sites Inventory - Site Cleanup Verification Summary.* (DOE/NV, 1995b)
119	25-01-14	Contaminated Storage Tank	U.S. Department of Energy, Nevada Operations Office. 2000a. *Housekeeping Closure Report for Corrective Action Unit 119: Storage Tanks, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--626. (DOE/NV, 2000a)
288	25-23-04	Radioactively Contaminated Crates	U.S. Department of Energy, Nevada Operations Office. 2000b. *Housekeeping Closure Report for Corrective Action Unit 288: Area 25 Engine-Maintenance, Assembly, and Disassembly/Treatability Test Facility Chemical Sites, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--590. (DOE/NV, 2000b)
	25-23-10	Contaminated Materials	
	25-29-01	Miscellaneous Chemicals	
	25-29-04	Miscellaneous Chemicals	
	25-29-07	Ethylene Glycol	
	25-29-09	Miscellaneous Chemicals	
297	25-25-01	Vacuum Pump Oil Recovery	U.S. Department of Energy, Nevada Operations Office. 1999a. *Closure Report for Housekeeping Category Corrective Action Unit 297: Nevada Test Site, Nevada*, Rev. 0, DOE/NV/11718--289. (DOE/NV, 1999a)
354	25-99-15	Highway Flares (fuses)	U.S. Department of Energy, Nevada Operations Office. 1998a. *Closure Report for Housekeeping Category Corrective Action Unit 354: Nevada Test Site*, Rev. 0, DOE/NV/11718--169. (DOE/NV, 1998a)
381	25-99-14	Gas Cylinders (2)	U.S. Department of Energy, Nevada Operations Office. 1996a. *Corrective Action Unit 381 Gas Cylinder Closure Report*, 07-CAU381-002. (DOE/NV, 1996a)

Table 2-2
Previous CAU Investigations Associated with the E-MAD Facility
(Page 2 of 4)

CAU	CAS	CAS Description	Associated Documents
382	25-22-14	Drums (2)	U.S. Department of Energy, Nevada Operations Office. 1996b. *Corrective Action Unit 382 Housekeeping Closure Report.* (DOE/NV, 1996b)
	25-22-15	Drum	
386	25-26-24	Lead Bricks	U.S. Department of Energy, Nevada Operations Office. 1997. *Closure Report for Housekeeping Category Corrective Action Unit 386, Nevada Test Site,* Rev. 1, DOE/NV/11718--129. (DOE/NV, 1997)
398	25-25-02	Oil Spills	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2003b. *Closure Report for Corrective Action Unit 398: Area 25 Spill Sites, Nevada Test Site, Nevada,* Rev. 1, DOE/NV--873-REV 1. (NNSA/NSO, 2003b) **-and-** U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2008b. *Addendum to the Closure Report for Corrective Action Unit 398: Area 25 Spill Sites, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--873-REV 1-ADD. (NNSA/NSO, 2008b)
	25-25-04	Oil Spills	
	25-25-05	Oil Spills	
6 Additional CASs Closed under the Clean Closure Strategy			
127	25-01-06	Aboveground Storage Tank	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2008c. *Closure Report for Corrective Action Unit 127: Areas 25 and 26 Storage Tanks, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--1248. (NNSA/NSO, 2008c)
135	25-02-01	Underground Storage Tanks	U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2001. *Closure Report for Corrective Action Unit 135: Areas 25 Underground Storage Tanks, Nevada Test Site, Nevada,* Rev. 1, DOE/NV--717-Rev. 1. (NNSA/NV, 2001)
165	25-07-06	Train Decontamination Area	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2005. *Closure Report for Corrective Action Unit 165: Area 25 and 26 Dry Well and Washdown Areas, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--1092. (NNSA/NSO, 2005)
	25-59-01	Septic System	
168	25-16-01	Construction Waste Pile	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2007a. *Closure Report for Corrective Action Unit 168: Area 25 and 26 Contaminated Materials and Waste Dumps, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--1178. (NNSA/NSO, 2007a)
300	25-60-02	Bldg 3901 Outfall	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2007b. *Closure Report for Corrective Action Unit 300: Surface Release Areas, Nevada Test Site, Nevada*, Rev. 0, DOE/NV--1222. (NNSA/NSO, 2007b)

Table 2-2
Previous CAU Investigations Associated with the E-MAD Facility
(Page 3 of 4)

CAU	CAS	CAS Description	Associated Documents
5 CASs Closed under the Closure in Place Strategy with URs			
127	25-01-07	Aboveground Storage Tank	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2008c. *Closure Report for Corrective Action Unit 127: Areas 25 and 26 Storage Tanks, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--1248. (NNSA/NSO, 2008c)
262	25-02-06	Underground Storage Tank	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2003a. *Closure Report for Corrective Action Unit 262: Area 25 Septic Systems and Underground Discharge Point, Nevada Test Site, Nevada,* Rev. 1, DOE/NV--897-REV 1. (NNSA/NSO, 2003a) **-and-** U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2008a. *Addendum to the Closure Report for Corrective Action Unit 262: Area 25 Septic Systems and Underground Discharge Point, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--897-REV 1-ADD. (NNSA/NSO, 2008a)
143	25-23-03	Contaminated Waste Dump #2	U.S. Department of Energy, National Nuclear Security Administration Nevada Operations Office. 2002a. *Closure Report for Corrective Action Unit 143: Area 25 Contaminated Waste Dumps, Nevada Test Site, Nevada*, Rev. 0, DOE/NV--807. (NNSA/NV, 2002a)
556	25-60-03	E-MAD Stormwater Discharge and Piping	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2008d. *Corrective Action Decision Document/Closure Report for Corrective Action Unit 556: Dry Wells and Surface Release Points, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--1285. (NNSA/NV, 2008d)
566	25-99-20	EMAD Compound	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2011. *Record of Technical Change to Corrective Action Plan for Corrective Action Unit 566: EMAD Compound, Nevada National Security Site, Nevada*, Rev. 0, DOE/NV--1452; Technical Change No. DOE/NV--1452 CAU 566 CR ROTC-1, 28 July. (NNSA/NSO, 2011)
1 CAS No Further Action			
557	25-25-18	Train Maintenance Bldg 3901 Spill Site	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2009. *Corrective Action Decision Document/Closure Report for Corrective Action Unit 557: Spills and Tank Sites, Nevada Test Site, Nevada*, Rev. 0, DOE/NV--1319. (NNSA/NSO, 2009)

Table 2-2
Previous CAU Investigations Associated with the E-MAD Facility
(Page 4 of 4)

CAU	CAS	CAS Description	Associated Documents
2 CASs with URs Removed			
262	25-05-06	Leachfield	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2003a. *Closure Report for Corrective Action Unit 262: Area 25 Septic Systems and Underground Discharge Point, Nevada Test Site, Nevada,* Rev. 1, DOE/NV--897-REV 1. (NNSA/NSO, 2003a) **-and-** U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2008a. *Addendum to the Closure Report for Corrective Action Unit 262: Area 25 Septic Systems and Underground Discharge Point, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--897-REV 1-ADD. (NNSA/NSO, 2008a)
398	25-25-17	Subsurface Hydraulic Oil Spill	U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2003b. *Closure Report for Corrective Action Unit 398: Area 25 Spill Sites, Nevada Test Site, Nevada,* Rev. 1, DOE/NV--873-REV 1. (NNSA/NSO, 2003b) **-and-** U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2008b. *Addendum to the Closure Report for Corrective Action Unit 398: Area 25 Spill Sites, Nevada Test Site, Nevada,* Rev. 0, DOE/NV--873-REV 1-ADD. (NNSA/NSO, 2008b)

addressed, and therefore should be included in the scope of CAU 114. Although CAS 25-01-14 (CAU 119) is located within the footprint of the E-MAD Facility, it is not believed to have any impact on CAS 25-41-03. CAS 25-01-14 was clean closed under the housekeeping corrective action process (DOE/NV, 2000a).

2.2 MCC and EIV

2.2.1 Description

The Railroad Transportation System was designed to transport, emplace, and retrieve engine assemblies for the NRDS using the rail system installed in Area 25. The Railroad Transport System consisted of an MCC, an EIV, and a prime mover. At times, a specially designed 50-ft flatcar was used to create space between a highly radioactive load and the MCC to reduce the radiation level for the occupants of the control car. The entire system when operating together was directed from the MCC (Drollinger, 1999). The MCC and EIV are located outside the E-MAD Cold Bay. Figure 2-7 is

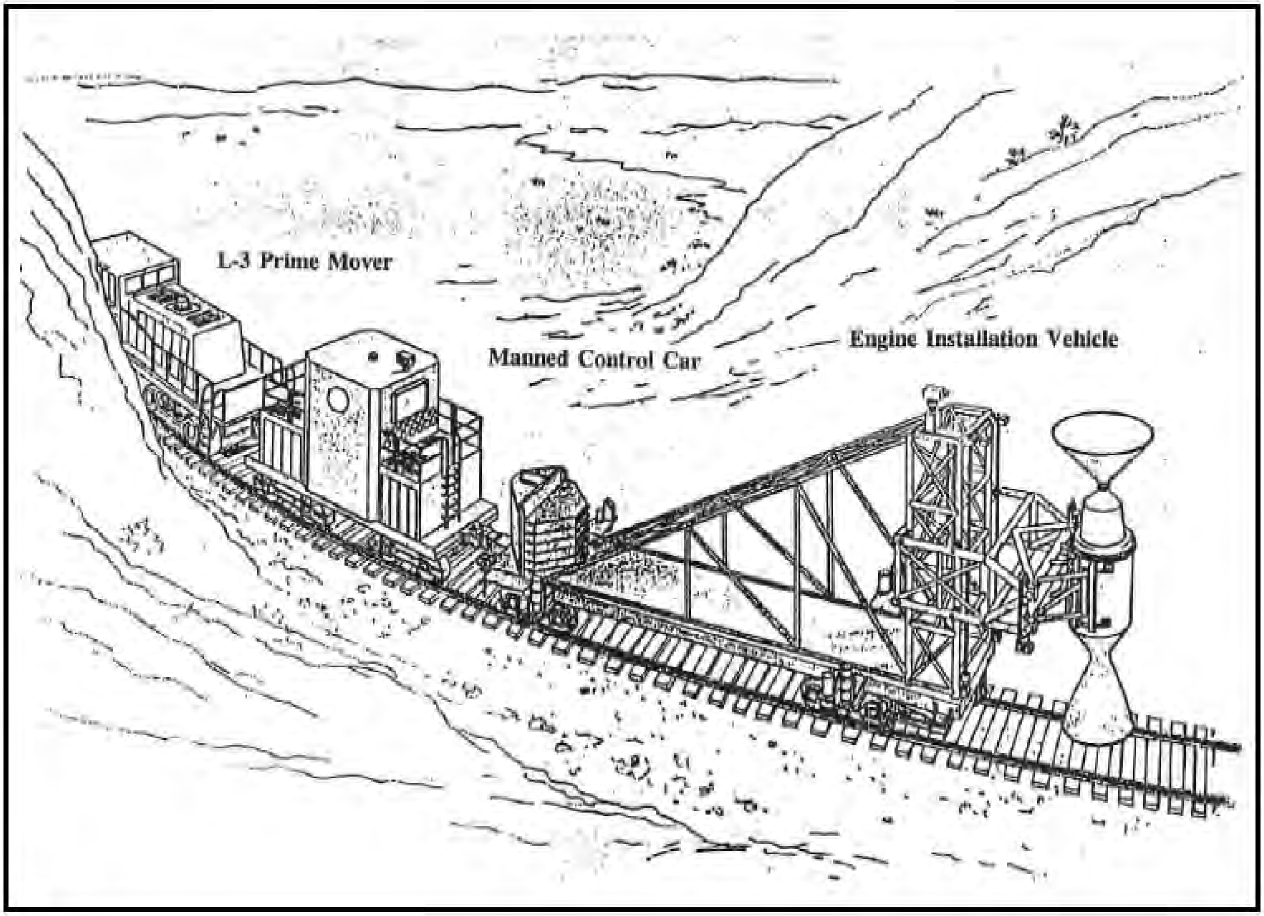

Figure 2-7
Rendering of the Railroad Transport System
Source: Drollinger, 1999

a rendering of the Railroad Transport System. Figure 2-8 is a photo of the MCC and EIV outside the E-MAD Facility.

Three locomotives were used as prime movers. Prime mover L-1 is located inside the southern bunker of the Radioactive Materials Storage Facility. It is included in CAS 25-23-02 of CAU 168 (NNSA/NSO, 2011). The L-2 and L-3 prime movers were released and donated to the Nevada Southern Railway, Nevada State Railroad Museum (Nevada Southern Railway, 2021) in 2010 and 2006, respectively. Therefore, CAS 25-99-23 consists of the MCC and EIV only.

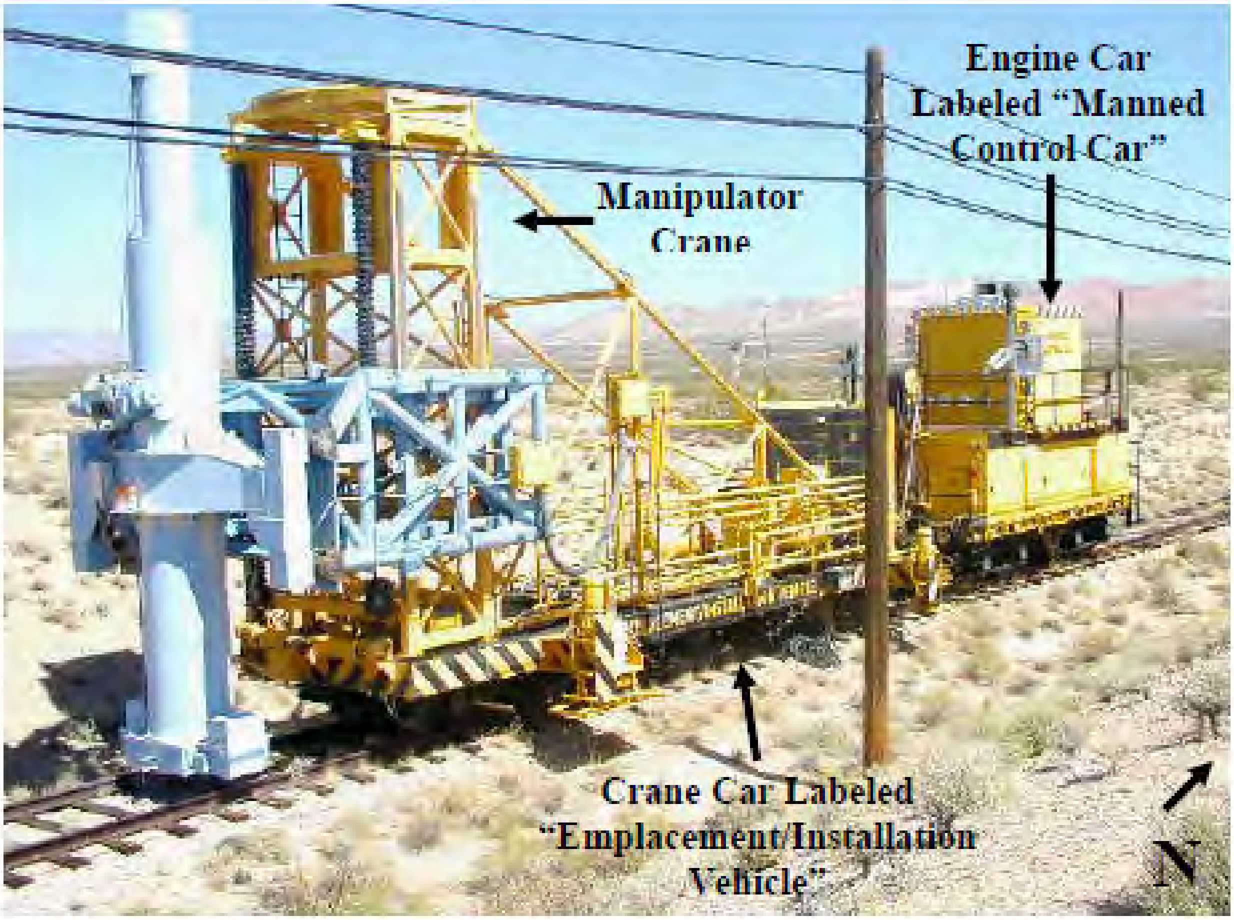

Figure 2-8
MCC and EIV
Source: SNJV, 2007

2.2.2 History and Process Knowledge

The reactor and the non-nuclear engine subsystems were assembled into the complete test engine in the E-MAD building. When assembled, the engine was placed on the EIV for transportation and installation into the test stand. which is located approximately two miles from the E-MAD building. The MCC operators had control over the entire engine transport and test stand installation sequence. Following the engine tests, the engine was remotely disengaged from the test stand, attached to the EIV, and returned to the E-MAD building, where it was remotely disassembled for inspection (Beck et al., 1996).

The MCC is about 32 ft (10 m) long, 13 ft (4 m) wide, and 18 ft (5.5 m) in height; weighs 107 tons (97 metric tons); and has a maximum allowable speed of 6 mph (10 kph). It was equipped with special radioactive shielding, a radiation monitoring system, a fire control system, an emergency escape hatch, an emergency air-breathing system, an air conditioning system, electrical power, emergency tractive power, viewing aids, and compressed air. The emergency air system was able to support two people for four hours. It also has emergency tractive power in case of failure with the prime mover (Drollinger, 1999).

The EIV was used to emplace and remove the nuclear engine or reactor from the test stands. It also served to support and protect the engine or reactor during transport. The vehicle is about 60 ft (18 m) long, 19 ft (5.8 m) wide, and 30 ft (9 m) in height; weighs 70 tons (64 metric tons); and was able to carry 20 tons (18 metric tons). It had the capabilities to move by inches the entire car back and forth in the test stand, level the engine by moving it fore and aft and side to side, and precisely position the object in the test stand with various vertical and lateral carriages. An expanding umbilical system was attached between the EIV and the MCC. Other equipment included a programmed and remote manipulator system, television cameras for viewing the operations, a load readout system, radiation monitor system, dust cover, and a nozzle closure actuator to install or remove the nozzle on the engine (Drollinger, 1999).

The MCC and EIV were in use for the NRDS from 1966 to 1973, when the entire NRDS program was terminated (Beck et al., 1996; Miller, 1984). They were used again during the late 1970s and early 1980s to move, emplace, and retrieve spent fuel assemblies. (Beck et al., 1996) This work was done as part of the Spent Fuel Handling and Packaging Program (SFHPP). The objective of the SFHPP was to develop and demonstrate the ability to successfully encapsulate spent fuel assemblies from commercial power plants and establish the suitability of one or more surface and near-surface concepts for the interim dry storage of the encapsulated fuel assemblies (Dobbins, 1983).

2.2.3 Previous Investigations

No records of characterization studies, to include radiological surveys, have been found.

2.3 Train Shed

2.3.1 Description

CAS 25-33-05 consists of the potential releases to soil associated with the historic operations at the Train Shed Building (Figure 2-9). The Train Shed is in the 25-acre, fenced EMAD complex and is located north of Building 3900 (EMAD). Historical documentation may refer to the Train Shed by other names such as Locomotive Maintenance Shed; Building 3901; and Engine Maintenance Building and Engine Transport System Maintenance.

Figure 2-9
Train Shed
Source: RSL, 1985

The Train Shed was built to service and maintain the locomotives that transported equipment throughout Area 25. The building contained a below-grade (sunken) grease pit that runs the approximate length of the building so the locomotives could be serviced from below. The building was also used for limited treatability tests on Pu-contaminated soil. The building is a Beryllium legacy site area and is currently posted for radiological control as a Contamination Area.

The Train Shed was constructed in 1965. Engineering drawings reflect the building's measurements as 110 ft long, 47.8 ft wide, and 50 ft tall with an overall area of approximately 5,280 ft^2 (NTO/NRDS, 1966). The large, steel-framed building has metal-clad walls and ceilings (IT, 1996). The floor is reinforced concrete slab on a grade; the walls are structural steel frame with insulated aluminum siding attached to a steel-girt; the roof is metal deck with rigid insulation; and the doors are made of steel. The building was designed with a grease pit used for working underneath the trains. The below-grade service pit runs approximately the length of the building, measures approximately 4 ft wide by 10 ft long, includes a drain/sump, and allowed the trains to be serviced from below (AEC/NASA, 1961 and 1964).

2.3.2 History and Process Knowledge

The Train Shed was originally used to service and maintain the locomotives in Area 25 under the Rover program (1958 to 1978). In the 1980s, the Johnston Atoll Project was located inside the Train Shed. This project included limited treatability tests for Pu in soils, specifically for radionuclides Pu-239 and americium (Am)-241 (Bliss, 1992). A soil decontamination machine was developed to separate dense contaminated particles from coarse low-density sand on Johnston Atoll corals and Plutonium Valley (Area 11) soil. This was called the TRUclean Process (Garey, 2006). According to an interviewee, a north wind blew Pu-contaminated soil around the building in May 1988 and, to his knowledge, the building was never opened again (Garey, 2010).

The TRUclean Process started with dry, partially sorted soil that was transported into a large hopper, then passed through a dry-screen (size reduction). The material that passed through the screen fell onto a conveyor, and the oversize material was diverted into a crusher, then sent back onto the conveyor. The conveyor leveled the material and passed it under a gamma counter, and the lightly contaminated "feed soil" was diverted from the conveyor. Next, the feed material/soil was separated by density using the selective mineral separator (SMS). The contaminated concentrate was collected in the SMS, while the remainder of the material passed onto the spiral classifier, which de-watered the "clean soil" discharge. An auger in the spiral classifier continuously fed the de-watered discharge onto a conveyor that leveled the material to a uniform thickness. The conveyor moved the discharge material under another radiological sorter to detect locations of elevated radioactivity, and these radioactive materials were removed. If the discharge was still too contaminated to discard without restriction, it was stored and reprocessed through the machine until a clean discharge was produced or there was no further improvement.

The water removed from the discharge by the spiral classifier then passed through sedimentation tanks, where the fine residue was allowed to settle. Finally, the water was pumped to a plate and frame filter press to remove the remainder of the suspended clay from the water. The filtered water was then recycled back to the SMS (Rogers, 1989).

2.3.3 Previous Investigations

COPCs include radionuclides within the posted areas. Conflicting reports state it may have been common practice to paint over contaminated surfaces such as floors and walls, sealing potential contamination under many layers of paint. Asbestos is another COPC, and transite asbestos may be found within floor tiles, roofing material, and insulation. Chemical hazards may be found within the excess material stored in the building. This material includes hydrocarbons; lead in the paint; and polychlorinated biphenyls (PCBs) within the waste oil and assorted electrical components within the building, specifically the transformer and ballasts located on the east wall of the Train Shed.

A radiological survey of the building was conducted in 1988. Thirty-two random swipe samples were taken from equipment and building materials. Nine of the 32 samples exceeded removable contamination limits of 20 dpm/100 cm^2 (alpha/beta) for unconditional release. Those levels ranged from 22 dpm/100 cm^2 (alpha/beta) to a maximum of 293 dpm/100 cm^2 (alpha) and 25 dpm/100 cm^2 (beta), respectively. The barricaded tool crib area on the west side of the Train Shed had results averaging 50 dpm/100 cm^2 (alpha) (Smith, 1988). Current surface swipes for chemical and radiological contamination reflect low to no surface contamination.

In 2012, a reconnaissance effort at the Train Shed consisted of visual inspections, photographic documentation and radiological and chemical surveys. Radiological and airborne survey results reflected very low levels of alpha and beta/gamma contamination. Chemical swipes reflect contamination of beryllium (Be) cadmium (Cd), and lead (Pb) at the south and west personnel door entrances from just detectable toseven times the surface metals housekeeping threshold.

2.4 Potential Impacts of Existing Use Restrictions to the CAU 114 CAI

CAU 127: CAS 25-01-07, Aboveground Storage Tank

This site, located next to the Train Shed, consisted of releases associated with a 1,000-gal aboveground storage tank (AST), associated piping, and total petroleum hydrocarbons (TPH)-impacted soil. Approximately 20 yd^3 of TPH-impacted soil were excavated to a depth of approximately 5 ft as part of the corrective action. The AST, piping, and concrete pad were removed for disposal. Due to the close proximity of the AST to the Train Shed and the fact that the impacted soil may extend under its structure, the remaining impacted soil was not excavated and was closed in place with administrative controls. A UR for TPH was implemented to prohibit unauthorized intrusive activity, and UR warning signs were posted.

This UR is not expected to have any impact on the CAU 114 CAI due to the location of the UR away from any planned CAU 114 CAI activities.

CAU 262: CAS 25-02-06, Underground Storage Tank

This site consisted of the releases associated with a septic system that received sanitary effluent from Building 3900. The septic tank was found to contain TPH and PCBs above action levels. These COCs were confined within the septic tank, and a UR was implemented as the boundary of the tank itself. This CAS was closed in place by solidifying the tank contents, and by filling the tank, distribution box, and one upstream access point (manhole) with grout.

This UR is not expected to have any impact on the CAU 114 CAI due to the location of the UR outside the perimeter fence and away from any planned CAU 114 CAI activities.

CAU 143: CAS 25-23-03, Contaminated Waste Dump #2

This site consisted of the releases associated with a waste dump (in the form of a trench) that was generated during operation of the E-MAD Facility. Sampling of the waste dump identified radionuclides above FALs including U-235, cesium (Cs)-137, niobium (Nb)-94, and strontium (Sr)-90. A UR was subsequently implemented for subsurface radioactive contamination. The existing fence was modified to include a separate enclosure for only the filled portion of the trench that contains contamination. The fence was posted as “Caution-Underground Radioactive Material” area.

The trench is located approximately 1/4 mile southwest of Building 3900 and lies about 200 yards beyond the E-MAD Facility perimeter fence.

This UR is not expected to have any impact on the CAU 114 CAI due to the location of the UR outside the perimeter fence and away from any planned CAU 114 CAI activities.

CAU 556: CAS 25-60-03, EMAD Stormwater Discharge and Piping

This site consisted of the releases associated with three catch basins, an outfall area, and associated subsurface piping. Sampling results identified PCB contamination above the FAL in the surface and/or shallow subsurface soils around Catch Basin 2, at the outfall, and in soils contained within the catch basins and a manhole. The CAS was closed in place with a corrective action of soil removal; grouting of the catch basins, manholes, and pipe openings; and implementation of a UR for PCB contamination that prohibits surface and subsurface disturbances within 5 ft laterally of the center line of the stormwater drainage system. The UR is located approximately 100 ft north of Building 3900 and extends the width of the north side of Building 3900, angles southwest, and ends beyond the perimeter fencing.

This UR is not expected to impact the CAU 114 CAI; however, there is a possibility that surface soil contamination that overlaps the spatial boundaries of this UR may be identified if biasing factors are present in this area. If evidence of a release is identified within the boundaries of the UR, EM Nevada Program will be informed to provide approval to work within the UR.

3.0 Data Quality Objectives

3.1 Summary of DQO Analysis

This section contains a summary of the DQO process that is presented in Appendix B. The DQO process is a strategic planning approach based on the scientific method that is designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend the recommendation of viable corrective actions (e.g., no further action, clean closure, or closure in place).

The DQO strategy for CAU 114 was developed at a meeting on April 30, 2009. At that time, only CAS 25-41-03, EMAD Facility, was included in the scope of the DQOs. However, the nature of the contamination and the investigation approaches at CAS 25-99-23, Manned Control Car (MCC) and Engine Installation Vehicle (EIV); and CAS 25-33-05, Building 3901, Engine Transport System Maintenance Building are sufficiently similar as to fall completely within the CSM of the original DQO. No changes to the DQOs are necessary with the addition of these two CASs. These two additional CASs also do not involve soil contamination and also have the potential to contain PSM (mainly lead shielding and radiological contamination) that is the same or similar to that found in the EMAD Facility. Therefore, while the DQOs presented herein specifically identify CAS 25-41-03, they will entirely apply to CAS 25-99-23 and CAS 25-33-05.

The DQOs were developed to identify data needs, clearly define the intended use of the environmental data, and to design a data collection program that will satisfy these purposes. During the DQO discussions for this CAU, the informational inputs or data needs to resolve problem statements and decision statements were documented.

The problem statement for CAU 114 is: “Existing information on the nature and extent of potential contamination is insufficient to evaluate and confirm closure of CAS 25-41-03.” To address this question, the resolution of two decisions statements is required:

- Decision I: “Is any waste present at the site likely to result in the introduction of COCs into site environmental media?” If a COC is detected, then Decision II must be resolved.

- Decision II: "Is sufficient information available to meet the closure objectives?" The closure objectives are defined as the following:

  - The volume of waste containing any PSM
  - The information needed to characterize investigation-derived waste (IDW) for disposal
  - The information needed to determine potential remediation waste type

As presented in the CAU 114 DQOs and as described in Section B.8.0, all of the sampling is judgmental based on defined populations of PSM. Therefore, the extent of contamination is defined as the entire PSM, and no extent sampling is required unless soil contamination is discovered. The presence of a COC would require a corrective action. A corrective action may also be necessary if there is a potential for wastes that are present at a site to result in the introduction of COCs into site environmental media. These wastes would be considered PSM, which is defined as waste (solid or liquid) containing contaminants that, if released to soil, would result in soil contamination exceeding a FAL. To determine whether wastes that are present at CAU 114 meet the criteria for PSM, the following conservative assumptions were made:

- Any containment of waste (e.g., fuel/oil reservoirs, pipe, concrete vaults and walls, drums) would fail at some point, and the waste would be released to the surrounding soil.

- A waste, regardless of concentration or configuration, may be assumed to be PSM and handled under a corrective action.

- Based on process knowledge and/or professional judgment, some waste may be assumed to not be PSM if it is clear that it could not result in soil contamination exceeding a FAL (e.g., recognizable building materials such as stainless steel that have been screened for radioactivity).

- If assumptions about the waste cannot be made, then the waste material will be sampled, and the results will be compared to FALs based on the following criteria:

  - For non-liquid wastes, the concentration of any chemical contaminant in soil (following degradation of the waste and release of contaminants into soil) would be equal to the mass of the contaminant in the waste divided by the mass of the waste (no consideration will be given to dilution into the mass of soil).

  - For non-liquid wastes, the dose resulting from radioactive contaminants in soil (following degradation of the waste and release of contaminants into soil) would be calculated using the activity of the contaminant in the waste divided by the mass of the waste (for each radioactive contaminant) and calculating the combined resulting dose using the Residual Radioactive (RESRAD) code (Murphy, 2004) (no consideration will be given to dilution into the mass of soil). ***Note:*** As an initial screening tool, if building materials are primarily externally contaminated and do not present a dose exceeding the FAL to a nearby worker in its current configuration, they will not be considered to meet PSM criteria.

- For liquid wastes, the resulting concentration of contaminants in the surrounding soil would be calculated based on the concentration of contaminants in the wastes and the liquid holding capacity of the soil.

For example, sludge containing a contaminant exceeding an equivalent FAL concentration would be considered to be PSM and would require a corrective action. Ballasts with capacitors are assumed to contain PCBs based on process knowledge. These ballasts/capacitors would be assumed to be PSM without sampling and would require a corrective action. (See Table 4-2 for a list of known or anticipated PSMs associated with CAU 114.) It is possible that some amount of these materials (e.g., lead shot in walls, lead solder) may remain after corrective actions as described in Section 4.0.

Decision I samples will be submitted to analytical laboratories for the analyses listed in Table 3-1. The constituents reported for each analytical method are listed in Table 3-2.

Table 3-1
Analytical Program [a]
(Page 1 of 2)

Analyses	CAU 114
Organic COPCs	
TPH-DRO	X
PCBs	X
SVOCs	X
VOCs	X
Pesticides	X
Inorganic COPCs	
RCRA Metals	X
Total Beryllium	X

Table 3-1
Analytical Program [a]
(Page 2 of 2)

Analyses	CAU 114
Radionuclide COPCs	
Gamma Spectroscopy	X
Isotopic U	X
Isotopic Pu	X
Sr-90	X

[a]The COPCs are the constituents reported from the analytical methods listed.

DRO = Diesel-range organics
SVOC = Semivolatile organic compound
VOC = Volatile organic compound

X = Required analytical method

The list of COPCs is intended to encompass all of the contaminants that could potentially be present at the CAS (or its components). These COPCs were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts (where available), and inferred activities associated with the CAS. Contaminants detected at other similar NNSS sites were also included in the COPC list to reduce the uncertainty about potential contamination at the CAS because complete information regarding activities performed at the E-MAD Facility is not available.

The data quality indicators (DQIs) of precision, accuracy, representativeness, completeness, comparability, and sensitivity needed to satisfy DQO requirements are discussed in Section 7.2. Laboratory data will be assessed in the CR to confirm or refute the CSM and determine whether the DQO data needs were met.

To satisfy the DQI of sensitivity (presented in Section 7.2.6), the analytical methods must be sufficient to detect contamination that is present in the samples at concentrations equal to the corresponding FALs. Analytical methods and minimum detectable concentrations (MDCs) for each CAU 114 COPC are provided in Tables 3-3 and 3-4. The MDC is the lowest concentration of a chemical or radionuclide parameter that can be detected in a sample within an acceptable level of error. The criteria for precision and accuracy in Tables 3-3 and 3-4 may vary from information in the

Table 3-2
Constituents Reported by Analytical Methods

VOCs		SVOCs		TPH	PCBs	Pesticides	Metals	Radionuclides
1,1,1,2-Tetrachloroethane	Carbon tetrachloride	2,3,4,6-Tetrachlorophenol	Di-n-octyl Phthalate	DRO	Aroclor 1016	4,4'-DDD	Arsenic	Pu-238
1,1,1-Trichloroethane	Chlorobenzene	2,4,5-Trichlorophenol	Dibenzo(a,h)anthracene		Aroclor 1221	4,4'-DDE	Barium	Pu-239/240
1,1,2,2-Tetrachloroethane	Chloroethane	2,4,6-Trichlorophenol	Dibenzofuran		Aroclor 1232	4,4'-DDT	Beryllium	Sr-90
1,1,2-Trichloroethane	Chloroform	2,4-Dimethylphenol	Diethyl Phthalate		Aroclor 1242	Aldrin	Cadmium	U-234
1,1-Dichloroethane	Chloromethane	2,4-Dinitrotoluene	Dimethyl Phthalate		Aroclor 1248	Alpha-BHC	Chromium	U-235
1,1-Dichloroethene	Chloroprene	2-Chlorophenol	Fluoranthene		Aroclor 1254	Alpha-Chlordane	Lead	U-238
1,2,4-Trichlorobenzene	cis-1,2-Dichloroethene	2-Methylnaphthalene	Fluorene		Aroclor 1260	Beta-BHC	Mercury	
1,2,4-Trimethylbenzene	Dibromochloromethane	2-Methylphenol	Hexachlorobenzene		Aroclor 1268	Chlordane	Selenium	
1,2-Dibromo-3-chloropropane	Dichlorodifluoromethane	2-Nitrophenol	Hexachlorobutadiene			Delta-BHC	Silver	
1,2-Dichlorobenzene	Ethyl methacrylate	3-Methylphenol[a] (m-cresol)	Hexachloroethane			Dieldrin		Gamma-Emitting
1,2-Dichloroethane	Ethylbenzene	4-Methylphenol[a] (p-cresol)	Indeno(1,2,3-cd)pyrene			Endosulfan I		Ac-228
1,2-Dichloropropane	Isobutyl alcohol	4-Chloroaniline	n-Nitroso-di-n-propylamine			Endosulfan II		Am-241
1,3,5-Trimethylbenzene	Isopropylbenzene	4-Nitrophenol	Naphthalene			Endosulfan Sulfate		Co-60
1,3-Dichlorobenzene	Methacrylonitrile	Acenaphthene	Nitrobenzene			Endrin		Cs-137
1,4-Dichlorobenzene	Methyl methacrylate	Acenaphthylene	Pentachlorophenol			Endrin Aldehyde		Eu-152
1,4-Dioxane	Methylene chloride	Aniline	Phenanthrene			Endrin Ketone		Eu-154
2-Butanone	n-Butylbenzene	Anthracene	Phenol			Gamma-BHC		Eu-155
2-Chlorotoluene	n-Propylbenzene	Benzo(a)anthracene	Pyrene			Gamma-Chlordane		K-40
2-Hexanone	sec-Butylbenzene	Benzo(a)pyrene	Pyridine			Heptachlor		Nb-94
4-isopropyltoluene	Styrene	Benzo(b)fluoranthene				Heptachlor Epoxide		Pb-212
4-Methyl-2-pentanone	tert-Butylbenzene	Benzo(g,h,i)perylene				Methoxychlor		Pb-214
Acetone	Tetrachloroethene	Benzo(k)fluoranthene				Toxaphene		Tl-208
Acetonitrile	Toluene	Benzoic Acid						Th-234
Allyl chloride	Total Xylenes	Benzyl Alcohol						U-235
Benzene	Trichloroethene	Bis(2-ethylhexyl) phthalate						
Bromodichloromethane	Trichlorofluoromethane	Butyl benzyl phthalate						
Bromoform	Vinyl acetate	Carbazole						
Bromomethane	Vinyl chloride	Chrysene						
Carbon disulfide		Di-n-butyl Phthalate						

[a]May be reported as 3,4-Methylphenol or m,p-cresol.

Ac = Actinium
Co = Cobalt
Eu = Europium
K = Potassium
Th = Thorium
Tl = Thallium

Table 3-3
Analytical Requirements for Radiological COPCs for CAU 114

Analysis[a]	Medium or Matrix	Analytical Method	MDC[b]	Laboratory Precision	Laboratory Accuracy
Gamma-Emitting Radionuclides					
Gamma Spectroscopy	Aqueous	EPA 901.1[c]	< PALs	RPD 35%(non-aqueous)[d] 20% (aqueous)[d] ND -2<ND<2[e]	LCS Recovery (%R) 80-120[f]
	Non-aqueous	HASL-300			
Other Radionuclides					
Isotopic U	All	U-02-RC[g]	< PALs	RPD 35% (non-aqueous)[d] 20% (aqueous)[d] ND -2<ND<2[e]	Chemical Yield Recovery (%R) 30-105[h] LCS Recovery (%R) 80-120[h]
Isotopic Pu	Aqueous	Pu-10-RC[g]			
	Non-aqueous	Pu-02-RC[g]			
Sr-90	Aqueous	EPA 905.0[c]			
	Non-aqueous	Sr-02-RC[g]			

[a]A list of constituents reported for each method is provided in Table 3-2.
[b]The MDC is the minimum concentration of a constituent that can be measured and reported with 95% confidence (Standard Methods)[i].
[c]*Prescribed Procedures for Measurement of Radioactivity in Drinking Water* (EPA, 1980).
[d]*Sampling and Analysis Plan Guidance and Template* (EPA, 2000).
[e]*Evaluation of Radiochemical Data Usability* (Paar and Porterfield, 1997).
[f]*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 2009b).
[g]*The Procedures Manual of the Environmental Measurements Laboratory* (DOE, 1997).
[h]Professional judgment and other industry acceptance criteria are used.
[i]Laboratory standard operating procedures in accordance with industry standards and the Analytical Laboratories Statement of Work (Navarro, 2016).

EPA = U.S. Environmental Protection Agency
LCS = Laboratory control sample
ND = Normalized difference
PAL = Preliminary action level
RPD = Relative percent difference
%R = Percent recovery

Industrial Sites Quality Assurance Project Plan (QAPP) as a result of the laboratory being used, or updated/new methods used by the laboratory (NNSA/NV, 2002b).

3.2 Results of the DQO Analysis

3.2.1 Action Level Determination and Basis

The PALs presented in this section are to be used for site screening purposes. They are not necessarily intended to be used as cleanup action levels or FALs. However, they are useful in screening out contaminants that are not present in sufficient concentrations to warrant further evaluation, therefore

Table 3-4
Analytical Requirements for Chemical COPCs for CAU 114

Analysis[a]	Medium or Matrix	Analytical Method	MDC[b]	Laboratory Precision	Laboratory Accuracy
Organics					
VOCs	All	8260[c]	< PALs	Lab-specific[d]	Lab-specific[d]
SVOCs	All	8270[c]	< PALs	Lab-specific[d]	Lab-specific[d]
PCBs	All	8082[c]	< PALs	Lab-specific[d]	Lab-specific[d]
TPH-DRO	All	8015 Modified[c]		Lab-specific[d]	Lab-specific[d]
Pesticides	All	8081[c]		Lab-specific[d]	Lab-specific[d]
Inorganics					
Metals	All	6010/6020[c]	< PALs	RPD 35% (non-aqueous) 20% (aqueous)[e] Absolute Difference ±2x RL (non-aqueous)[f] ±1x RL (aqueous)[f]	MS Recovery (%R) 75-125[c] LCS Recovery (%R) 80-120[c]
Mercury	Aqueous	7470[c]			
	Non-aqueous	7471[c]			

[a]A list of constituents reported for each method is provided in Table 3-2.
[b]The MDC is the minimum concentration of a constituent that can be measured and reported with 99% confidence (EPA, 2009b).
[c]*Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 2009b).
[d]Precision and accuracy criteria are developed in-house using approved laboratory standard operating procedures in accordance with industry standards and the Analytical Laboratories Statement of Work (Navarro, 2016).
[e]*Sampling and Analysis Plan Guidance and Template* (EPA, 2000).
[f]*USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA, 2004).

MS = Matrix spike
RL = Reporting limit

streamlining the consideration of remedial alternatives. The RBCA process used to establish FALs is described in the *Soils Risk-Based Corrective Action Evaluation Process* (DOE/EMNV, 2018). This process conforms with *Nevada Administrative Code* (NAC) Section 445A.227, which lists the requirements for sites with soil contamination (NAC, 2018a). For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2018b) requires the use of ASTM International (ASTM) Method E1739 (ASTM, 1995) to “conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary.”

This RBCA process, summarized in Figure 3-1, defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses:

- **Tier 1 evaluation.** Sample results from source areas (highest concentrations) are compared to action levels based on generic (non-site-specific) conditions (i.e., the PALs established in this SAFER). The FALs may then be established as the Tier 1 action levels, or the FALs may be calculated using a Tier 2 evaluation.
- **Tier 2 evaluation.** Conducted by calculating Tier 2 Site-Specific Target Levels (SSTLs) using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 action levels. The Tier 2 SSTLs are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Total petroleum hydrocarbon concentrations will not be used for risk-based decisions under Tier 2 or Tier 3. Rather, the individual chemicals of concern will be compared to the SSTLs.
- **Tier 3 evaluation.** Conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E1739 that consider site-, pathway-, and receptor-specific parameters.

Evaluation of DQO decisions will be based on conditions at the site following completion of any corrective actions. Any corrective actions conducted will be reported in the CR.

The FALs (along with the basis for their selection) will be defined in the CR, where they will be compared to laboratory results in the evaluation of site closure.

3.2.1.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the EPA regional screening levels (RSLs) as shown in the Generic Tables for the Composite Worker Soil using a target cancer risk of 1E-06 on the https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables website (EPA, 2020a). Background concentrations for RCRA metals and zinc will be used instead of RSLs when natural background concentrations exceed the RSL, as is often the case with arsenic on the NNSS. Background is considered the mean plus two standard deviations of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established RSLs, the protocol used by the EPA Region 9 in establishing RSLs

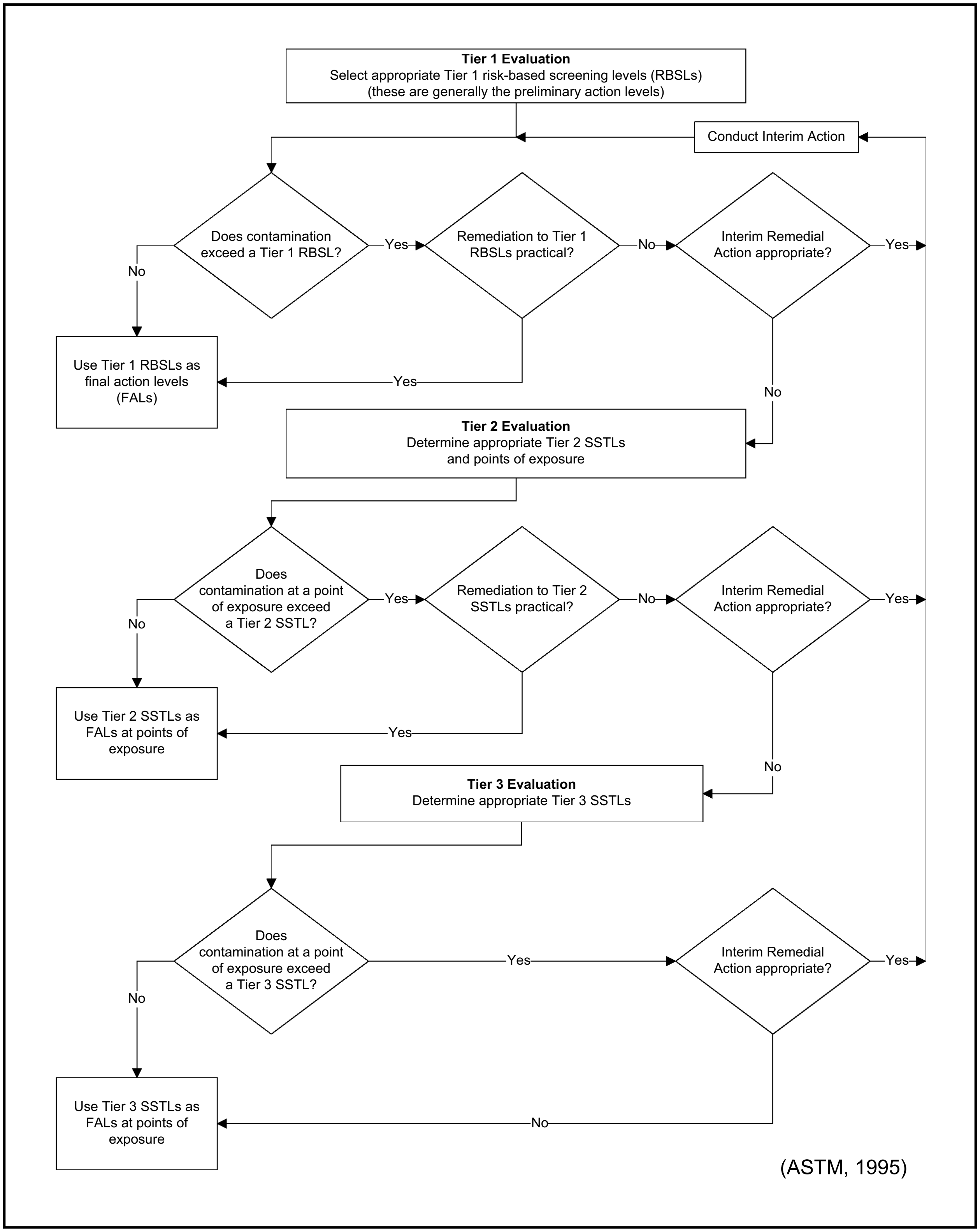

Figure 3-1
Risk-Based Corrective Action Decision Process

(or similar) will be used to establish PALs (EPA, 2020b). If used, this process will be documented in the CR.

3.2.1.2 Total Petroleum Hydrocarbon PALs

The PAL for TPH is 100 milligrams per kilogram (mg/kg) as listed in NAC 445A.2272 (NAC, 2018c).

3.2.1.3 Radionuclide PALs

The PALs for radiological contaminants are based on the National Council on Radiation Protection and Measurements (NCRP) Report No. 129 recommended screening limits for construction, commercial, and industrial land-use scenarios (NCRP, 1999) using a 25-millirem-per-year (mrem/yr) dose constraint (Murphy, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 458.1 (DOE, 2003). These PALs are based on the construction, commercial, and industrial land-use scenario provided in the guidance and are appropriate for the NNSS based on future land uses presented in Section B.2.2.6.

3.2.2 Hypothesis Test

The baseline condition (i.e., null hypothesis) and alternative condition are as follows:

- Baseline condition – Closure objectives have not been met
- Alternative condition – Closure objectives have been met

Sufficient evidence to reject the null hypothesis is as follows:

- The identification of the lateral and vertical extent of COC contamination in media, if present.
- Sufficient information to properly dispose of IDW and remediation waste.

3.2.3 Statistical Model

A judgmental sampling design will be implemented to select sample locations and evaluate DQO decisions for CAU 114 (EPA, 2002). The judgmental sampling design as implemented at CAU 114 assumes that the data are not normally distributed (see Section B.7.1).

3.2.4 Design Description/Option

Because individual sample results, rather than an average concentration, will be used to compare to FALs, statistical methods to generate site characteristics will not be used. Adequate representativeness of the entire target population may not be a requirement to developing a sampling design. If good prior information is available on the target site of interest, then the sampling may be designed to collect samples only from areas known to have the highest concentration levels on the target site. If the observed concentrations from these samples are below the action level, then a decision can be made that the site contains safe levels of the contaminant without the samples being truly representative of the entire area (EPA, 2006).

All sample locations will be selected to satisfy the DQI of representativeness in that samples collected from selected locations will best represent the populations of interest as defined in Section B.5.1. To meet this criterion for judgmentally sampled sites, a biased sampling strategy will be used for Decision I samples to target areas with the highest potential for contamination, if it is present anywhere in the CAS (EPA, 2002). Sample locations will be determined based on process knowledge, previously acquired data, or the field-screening and biasing factors listed in Section B.4.2.1. If biasing factors are present in soils below locations where Decision I samples were removed, additional Decision I soil samples will be collected at depth intervals selected by the Site Supervisor based on biasing factors to a depth where the biasing factors are no longer present. The Site Supervisor has the discretion to modify the judgmental sample locations, but only if the modified locations meet the decision needs and criteria stipulated in this DQO.

3.2.5 Conceptual Site Model and Drawing

The CSM describes the most probable scenario for current conditions at each site and defines the assumptions that are the basis for identifying the future land use, contaminant sources, release mechanisms, migration pathways, exposure points, and exposure routes. The CSM is also used to support appropriate sampling strategies and data collection methods. The CSM has been developed for CAU 114 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs. Figure 3-2 depicts a tabular representation of the conceptual pathways to receptors from CAU 114 sources.

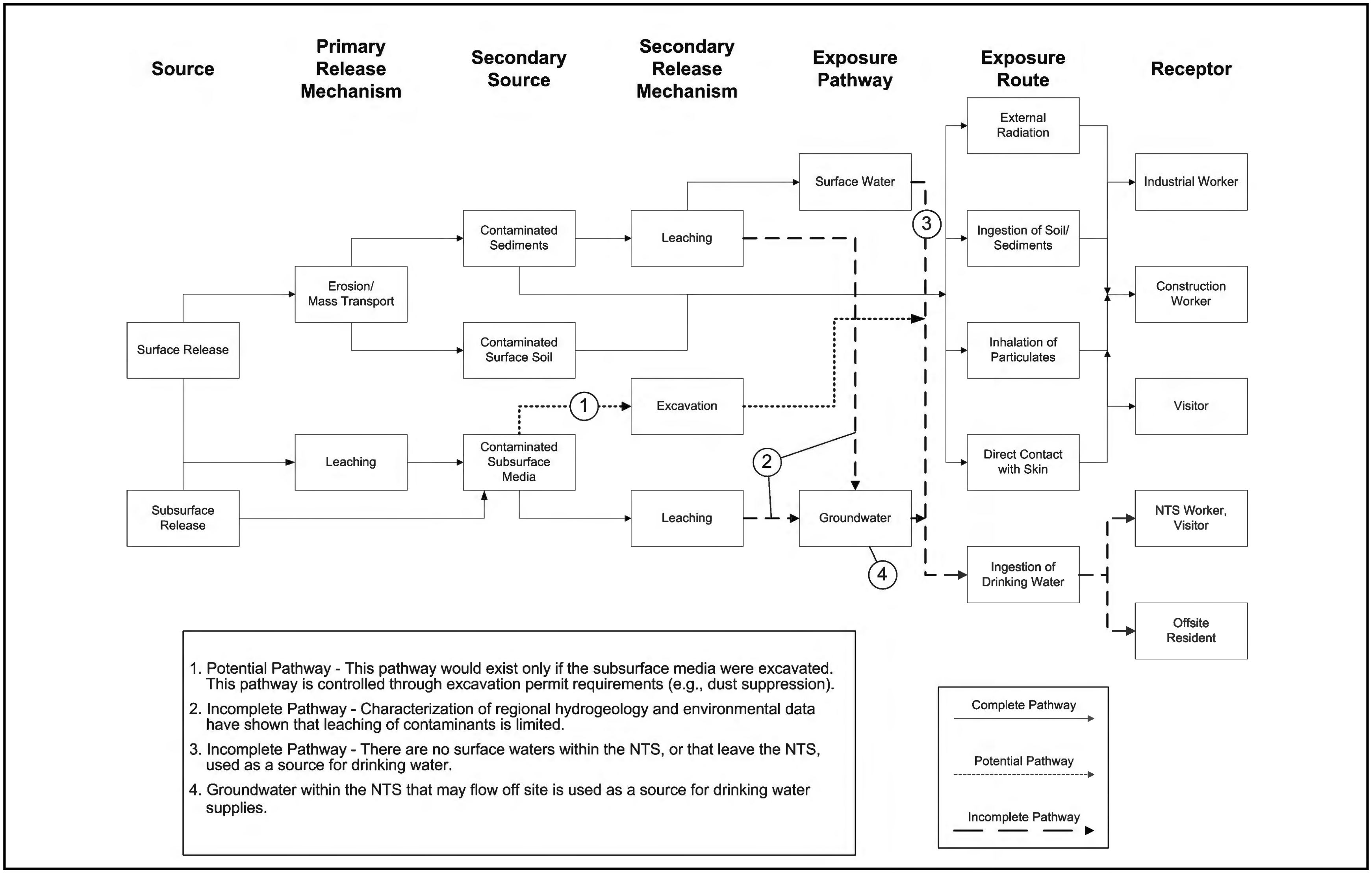

Figure 3-2
Conceptual Site Model Diagram for CAU 114

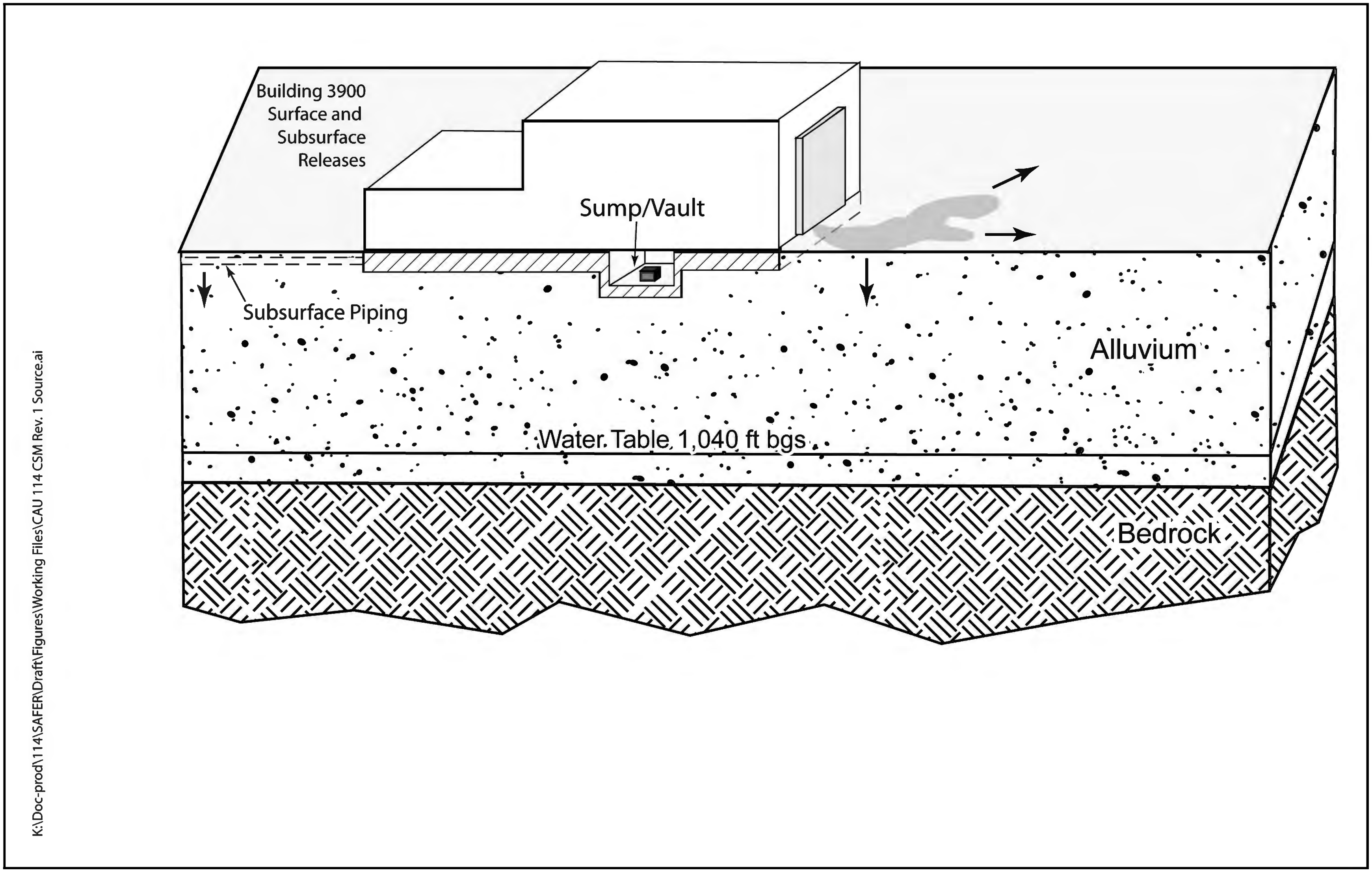

Figure 3-3
Conceptual Site Model for CAU 114

Figure 3-3 depicts a graphical representation of the CSM for potential surface and shallow subsurface releases. If evidence of contamination that is not consistent with the presented CSM is identified during CAI activities (such as soil contamination), NDEP will be notified; the situation will be reviewed; the CSM will be revised; the DQOs will be reassessed; and a recommendation will be made as to how best to proceed. In such cases, participants in the DQO process will be notified and given the opportunity to comment on and/or concur with the recommendation. A detailed discussion of the CSM is presented in Appendix B.

4.0 Field Activities and Closure Objectives

This section of the SAFER Plan provides a description of the field activities and closure objectives for CAU 114. The objectives for the field activities are to determine whether PSMs exist. If clean closure cannot be accomplished during the SAFER, then the extent of the remaining contamination will be determined so that closure alternatives may be implemented. If specific conditions or findings fall outside the bounds of the SAFER Plan, NDEP will be consulted to determine the path forward before proceeding. All sampling activities will be conducted in compliance with the Industrial Sites QAPP (NNSA/NV, 2002b) and other applicable, approved procedures and instructions.

4.1 Contaminants of Potential Concern

The COPCs for CAU 114 are defined as the list of constituents represented by the analytical methods identified in Table 3-1 for Decision I samples taken at each CAS. The constituents reported for each analytical method are listed in Table 3-2.

The list of COPCs is intended to encompass all of the contaminants that could potentially be present at each CAS. These COPCs were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts, and inferred activities associated with the CAS. Contaminants detected at similar NNSS sites were included in the COPC list to reduce the uncertainty about potential contamination at each CAS because complete information regarding activities performed at the CAU 114 site is not available. The following sections discuss each of the COPCs for CAU 114.

4.1.1 Total Petroleum Hydrocarbons

TPH are primarily associated with oils, greases, and fuels required to operate equipment such as that found throughout the E-MAD Facility.

4.1.2 Volatile and Semivolatile Organic Compounds

VOCs and SVOCs are found in fuels, oils, greases, products for cleaning mechanical and electrical parts, and freons. As such, VOCs and SVOCs may be present in all primary and support areas associated with CAU 114 CASs, the support structures, and in the surrounding environment where equipment may have been parked or serviced.

4.1.3 Polychlorinated Biphenyls

Based on visual surveys and process knowledge, it is anticipated that oils from hydraulic equipment associated with CAU 114 CASs may contain PCBs (e.g., locomotives, railcars, hydraulic hoses, compressors, door actuators). PCB-containing items including light ballasts and capacitors are known to be present throughout the area as well as in exterior structures (trailers, shacks, and sheds) and debris piles. There is also the potential for PCB-containing transformers to have been used during the operational history of the E-MAD Facility, although it is believed that any PCB transformers have been previously removed.

4.1.4 RCRA Metals and Beryllium

It is anticipated that RCRA metals may be present in materials throughout areas associated with CAU 114 CASs as well as in materials associated with the exterior CAS components. Lead-containing items include various types of lead shielding (e.g., leaded-glass windows, lead shot, lead bricks, lead plates), lead-acid batteries, and lead fuses. Mercury-containing items include mercury vapor light bulbs, thermostats, and switches. Based upon process knowledge from similar facilities, there is a potential for pipe systems to contain cadmium foil wrapping. Fuel elements containing a mixture of highly enriched uranium dioxide and beryllium oxide were handled in areas associated with CAU 114 CASs as part of the NERVA project and, as a result, Building 3900 is listed as a beryllium legacy site. As such, there is a potential to encounter beryllium surface or soil contamination. All surface soil samples will be analyzed for beryllium. It is also expected that excess chemicals will be identified in CAU 114 CASs that may contain RCRA metals.

4.1.5 Pesticides

Based on process knowledge from similar CASs at the NNSS, pesticides may be present in surface or shallow subsurface soils.

4.1.6 Radionuclides

Process knowledge of previous activities undertaken at the areas associated with CAU 114 CASs provides reasonable expectation of the presence of radionuclide contamination. It is expected that radiological contamination of surfaces (e.g., walls, floors, equipment) will be located primarily in the Hot Bay Complex, but all samples, including soil samples, collected at all the CASs will be analyzed for radionuclides. Potential sources of radiological contamination include, but are not limited to, depleted uranium (DU) counterweights on manipulator arms; radioactive check sources; high-efficiency particulate air (HEPA) ventilation systems; and miscellaneous materials found in the Hot Bay Complex, including any contents in subsurface vaults and pits.

4.2 Remediation

The DQOs developed for CAU 114 identified data gaps that require additional data collection before identifying and implementing the preferred closure alternative for each CAS. A decision point approach, based on the DQOs, for making remediation decisions is summarized in Figure 1-4. The presence of contamination, if any, is assumed to be confined to the spatial boundaries of the areas associated with CAU 114 CASs.

If PSMs that could cause COCs in environmental media are identified within a CAS (or CAS component) based on the initial CAI results, that CAS (or component) will be further assessed before implementing closure activities. If PSMs are not present, the CAS will be recommended for no further action. The objective of the initial investigation strategy is to determine whether PSMs are present. Laboratory analytical results will be used to confirm the presence or absence of PSMs.

If PSMs are present, or it is decided that PSMs may be present based on the presence of biasing factors, that material will be removed, if feasible. Materials that do not meet PSM criteria as defined in Section 3.1 may remain in place.

The judgmental sampling strategy is presented in Appendix B. Predetermined biased sample locations may be justified by the Site Supervisor, based on the criteria for satisfying DQO data needs listed in Appendix B. Additional samples may be collected for waste management characterization and disposal purposes.

The closure strategy for CAU 114 under this SAFER process consists of the following stages, discussed in further detail below:

- Sampling and identifying PSMs
- Removing PSM and assumed PSM

4.2.1 Sampling for COCs and PSMs

Table 4-1 summarizes the sampling approach to achieve closure objectives for CAU 114. PSM samples will be collected from materials that are suspected to contain COPCs and that may cause the future release of a COC to environmental media. For CAU 114, there are materials that have been assumed to meet PSM criteria and will therefore be removed and disposed of, without the need for sampling. Table 4-2 lists the known or anticipated PSMs at CAU 114 and indicates which materials will be sampled and which will be assumed PSM. Detailed information regarding the sampling plan is outlined in Appendix B.

Table 4-1
Sampling Approach for CAU 114

Sample Location	Minimum Number of Sample Locations	Minimum Number of Samples per Location	Sample Collection/Submittal Requirements[a,b]	Sampling Methods
Wastes and PSM, concrete	TBD	1	Collect samples based on identified biasing factors. Submit all samples collected based on biasing factors. Concrete (e.g., walls, floors, foundations) may be sampled (based on radiological surveys) using core drilling techniques.	Hand sampling, backhoe excavation, core drilling

[a]For worker protection, field screening will not be conducted if a strong odor and/or visual evidence suggests contamination is present.
[b]Additional samples may be collected and submitted to the lab at the discretion of the Site Supervisor.

TBD = To be determined

4.3 Verification

The information necessary to satisfy the closure criteria will be generated for CAU 114 by collecting and analyzing samples generated during the field investigation. Verification sampling is conducted to

Table 4-2
Known or Anticipated Potential Source Materials

Potential Source[a]	Material	Contaminants[b]	Sample/Assumed
PCB-containing ballast capacitors	Ballast material	PCBs	Assumed
Excess chemicals	Chemicals	VOCs, SVOCs, RCRA Metals	Sample
HEPA filters	Filter paper	Radiological	Sample
Fluorescent light bulbs	Gases, RCRA Metals	RCRA Metals	Assumed
Freon	Gases	RCRA Metals	Assumed
Mercury vapor lights	Gases, RCRA Metals	RCRA Metals	Assumed
Sodium vapor lights	Gases	RCRA Metals	Assumed
Radiological check sources	Metals	Radiological	Sample
DU counterweights	Metals	Radiological	Assumed
Lead-containing fuses	Metals	RCRA Metals	Assumed
Lead-acid batteries	Metals	RCRA Metals	Assumed
Mercury-containing items	Metals	RCRA Metals	Assumed
Circuit boards	Metals	RCRA Metals, Radiological	Assumed
Lead-glass windows	Metals	RCRA Metals, Radiological	Assumed
Lead solids/shielding	Metals	RCRA Metals, Radiological	Assumed
Mineral oil	Oils	Radiological	Sample
Diesel fuel	Oils	VOCs, SVOCs, Radiological	Sample
Compressor, gear, and hydraulic oils	Oils	VOCs, SVOCs, PCBs, RCRA Metals, Radiological	Sample
Motor oil	Oils	VOCs, SVOCs, PCBs, RCRA Metals	Sample

[a]Other wastes may be identified during the CAI.
[b]The listed contaminants are the best available based on site history and process knowledge. Actual analytical suites will be determined in the field on a case-by-case basis based on process knowledge, field conditions, etc.

Note: Sample vs. assumed - Some PSMs will be assumed that a contaminant is present and be treated as such with no samples being collected or analyzed. Other PSMs will be sampled to determine whether and what contaminants are present.

verify that any removal actions were sufficient to meet removal criteria. If there is no removal, there is no need for verification. If a PSM is present and removed during the SAFER, verification sampling may be required. The final locations and numbers of samples to be collected will be determined in the field based on the presence of any biasing factors as listed in Section B.4.2.1, site conditions, and the professional judgment of the Site Supervisor. All sample locations must meet the DQO decision needs and criteria stipulated in Appendix B. The number and location of verification samples will be justified in the CR.

4.4 Closure

The following activities have been identified for closure of CAU 114 under the FFACO. Other activities may also be conducted outside the FFACO:

- If no PSMs are identified during SAFER activities, a CAA of no further action will be selected.
- If PSMs are identified, then a corrective action is required.
- If PSMs are identified and clean closure cannot be accomplished during the SAFER, then the remaining contamination will be closed under the alternative corrective action of closure in place. The appropriate URs will then be implemented and documented in the CR.
- If PSMs are identified and clean closure can be accomplished during the SAFER, clean closure will be the selected corrective action. The material to be remediated will be removed and disposed of as waste.

After completion of CAI and waste management activities, the following actions will be implemented:

- Removing all equipment, wastes, debris, and materials associated with the CAI.
- Removing all CAI signage and fencing (unless part of a corrective action).
- Grading site to pre-investigation condition (unless changed condition is necessary under a corrective action).
- Inspecting the site and certifying that restoration activities have been completed.

Future activities may include demolition or removal of equipment and structures associated with CAU 114 CASs. When this takes place, it will be completed outside of the FFACO process.

4.5 Duration

Table 4-3 provides a tentative duration of activities (in calendar days) for SAFER activities.

Table 4-3
SAFER Field Activities

Duration (days)	Activity
90	Site Preparation/Mobilization
240	Sampling for COCs and Identification of PSMs
120	Identification and Removal of Assumed PSMs (those that do not require sampling)
90	Sample Analysis/Validation
120	Waste Characterization

5.0 Reports and Records Availability

Supplemental reports and information (other than FFACO reports) generated during ongoing field activities will be provided to NDEP upon request. Historic information and documents referenced in this plan are retained in the EM Nevada Program project files in Las Vegas, Nevada, and can be obtained through written request to the EM Nevada Program Federal Activity Lead. This document is available in the DOE Public Reading Facilities located in Las Vegas and Carson City, Nevada; or by contacting the appropriate DOE Activity Lead or Defense Threat Reduction Agency (DTRA) Program Manager.

6.0 Investigation/Remediation Waste Management

Management of IDW will be based on regulatory requirements, field observations, process knowledge, and laboratory results from CAU 114 investigation samples.

Disposable sampling equipment, personal protective equipment (PPE), and rinsate are considered potentially contaminated waste only by virtue of contact with potentially contaminated media (e.g., soil) or potentially contaminated debris (e.g., construction materials). Therefore, sampling and analysis of IDW, separate from analyses of site investigation samples, may not be necessary for all IDW. However, if associated investigation samples are found to contain contaminants above regulatory levels, conservative estimates of total waste contaminant concentrations may be made based on the mass of the waste, the amount of contaminated media contained in the waste, and the maximum concentration of contamination found in the media. Direct samples of IDW may also be taken to support waste characterization.

Industrial, hazardous, radioactive, and/or mixed waste, if generated, will be managed and disposed of in accordance with applicable DOE orders, U.S. Department of Transportation (DOT) regulations, state and federal waste regulations, and agreements and permits between DOE and NDEP. Materials left in place are not considered to be generated wastes and are not subject to RCRA or the requirements of the sections below.

6.1 Waste Minimization

Investigation activities are planned to minimize IDW generation. This will be accomplished by incorporating the use of process knowledge, visual examination, and/or radiological survey and swipe results. When possible, uncontaminated disturbed media (such as soil removed during trenching) or debris will be returned to its original location. Contained media (e.g., soil managed as waste) as well as other IDW will be segregated to the greatest extent possible to minimize generation of hazardous, radioactive, or mixed waste. Hazardous material used at the sites will be controlled in order to limit unnecessary generation of hazardous or mixed waste. Administrative controls, including decontamination procedures and waste characterization strategies, will minimize waste generated during investigations.

6.2 Potential Waste Types

Waste generated during the CAAs may include the following potential waste types:

- Industrial waste
- Low-level radioactive waste
- Hazardous waste
- Hydrocarbon waste
- Mixed LLW
- *T*TSCA waste: PCBs, asbestos

Process knowledge may be used for waste designation/disposal for commonly disposed items, such as fluorescent and incandescent light bulbs, scrap lead, light ballasts, and capacitors. No sampling for hazardous waste constituents (e.g., RCRA constituents) is required, although radiological surveys may be required to determine whether the waste meets the regulatory requirements of LLW.

The onsite management and ultimate disposition of wastes will be determined based on the waste type (e.g., industrial, low-level, hazardous, hydrocarbon, mixed), or the combination of waste types. A determination of the waste type will be guided by several factors, including, but not limited to, the analytical results of samples either directly or indirectly associated with the waste, historical site knowledge, knowledge of the waste generation process, field observations, field-monitoring/ screening results, and/or radiological survey/swipe results. Onsite IDW management requirements by waste type are detailed in the following sections.

6.2.1 Industrial Waste

Industrial IDW generated at CAU 114 will be collected, managed, and disposed of in accordance with the industrial waste management regulations and the permits for operation of the U10c Industrial Waste Landfill.

6.2.2 Low-Level Radioactive Waste

Low-level waste generated at CAU 114 will be packaged and managed in accordance with all applicable federal, state, and NNSS requirements. Low-level waste may be generated as a result of operations in areas where radioactive materials are or were formerly managed. Low-level waste forms expected at CAU 114 include PPE, debris, tools, and equipment.

Nonhazardous solid waste that exceeds the permissible radiological surface and mass concentration for the U10c Industrial Waste Landfill will be managed as LLW. Low-level radioactive waste, if generated, will be managed in accordance with the contractor-specific waste certification program plan, DOE orders, and the requirements of the current version of the *Nevada National Security Site Waste Acceptance Criteria* (NNSSWAC) (NNSA/NFO, 2016). Potential radioactive waste containers containing soil, PPE, disposable sampling equipment, and/or rinsate may be staged at a designated radioactive material area (RMA) or radiologically controlled area (RCA) when full or at the end of an investigation phase. The waste drums will remain at the RMA pending certification and disposal under the current NNSSWAC requirements (NNSA/NFO, 2016).

6.2.3 Hazardous Waste

This CAU will have waste accumulation areas established according to the needs of the project. Satellite accumulation areas and hazardous waste accumulation areas (HWAAs) will be managed consistent with the current requirements of federal and state regulations (CFR, 2020a; NAC, 2018b). The HWAAs will be controlled for access, and will be equipped with spill kits and appropriate spill containment. Suspected hazardous wastes will be placed in DOT-compliant containers. All containerized hazardous waste will be handled, inspected, and managed in accordance with the current requirements of federal and state regulations. These provisions include managing the waste in containers compatible with the waste type, and segregating incompatible waste types so that in the event of a spill, leak, or release, incompatible wastes shall not contact one another. The HWAAs will be covered under a site-specific emergency response and contingency action plan until such time that the waste is determined to be nonhazardous or all containers of hazardous waste have been removed from the storage area. Hazardous waste will be characterized in accordance with the requirements of Title 40 *Code of Federal Regulations* (CFR) 261 (CFR, 2020a). RCRA-"listed" waste has not been identified at CAU 114. Any waste determined to be hazardous will be managed and transported in accordance with RCRA and DOT requirements to a RCRA-permitted treatment, storage, and disposal facility. These items include mercury-vapor lamps, mercury switches, lead bricks, and similar items.

6.2.4 Hydrocarbon Waste

Hydrocarbon contaminated soil waste containing more than 100 mg/kg of TPH will be managed on site in a drum or other appropriate container until fully characterized. Hydrocarbon waste may be disposed of at a designated hydrocarbon landfill, an appropriate hydrocarbon waste management facility (e.g., recycling facility), or other method in accordance with Nevada regulations and disposal permits issued by NDEP to EM Nevada Program.

6.2.5 Mixed Low-Level Waste

Mixed waste, if generated, shall be managed and dispositioned in accordance with current RCRA requirements, agreements between EM Nevada Program and the State of Nevada, and DOE requirements for radioactive waste. Waste characterized as mixed will not be stored for a period of time that exceeds the requirements of RCRA unless subject to agreements between EM Nevada Program and the State of Nevada. The mixed waste shall be transported via an approved hazardous waste/radioactive waste transporter to the NNSS transuranic waste storage pad for storage pending treatment or disposal. Mixed waste meeting Land Disposal Restrictions may be disposed of at the NNSS Area 5 Radioactive Waste Management Site if the waste meets the current requirements of the NNSSWAC (NNSA/NFO, 2016), the NNSS NDEP permit for a Hazardous Waste Management Facility (NDEP, 2018), and the RCRA Part B Permit Application for Waste Management Activities at the NNSS (DOE/EMNV, 2017).

6.2.6 Toxic Substances Control Act Waste

Waste governed by TSCA (USC, 2018) includes PCB waste (solid or liquid) and asbestos.

6.2.6.1 Polychlorinated Biphenyls

The management of PCBs is governed by TSCA and its implementing current regulations at 40 CFR 761 (CFR, 2020b). PCB contamination may be found as a sole contaminant or in combination with any of the types of waste discussed in this document. For example, PCBs may be a co-contaminant in soil that contains a RCRA “characteristic” waste (PCB/hazardous waste), or in soil that contains radioactive wastes (PCB/radioactive waste), or even in mixed waste (PCB/radioactive/hazardous waste). The IDW will initially be evaluated using analytical results for media samples from the CAI. If any type of PCB waste is generated, it will be managed in accordance with 40 CFR 761 (CFR, 2020b) as well as current State of Nevada requirements (NAC, 2018a), guidance, and agreements with EM Nevada Program.

6.2.6.2 Asbestos-Containing Material

Asbestos-containing material (ACM) has been identified in Building 3900. Piping and tank insulation is suspected of containing asbestos. Floor and ceiling tiles used throughout Building 3900 and in exterior sheds and trailers may also contain asbestos. Asbestos-containing material will be removed by trained asbestos workers. Disposal options for ACM may vary depending on other contaminants present in the waste. All asbestos will be disposed of in accordance with the NNSSWAC (NNSA/NFO, 2016). Friable asbestos will be disposed of at the Mercury Sanitary Landfill. Non-friable asbestos will be disposed of at the U10c Industrial Waste Landfill. Radiologically contaminated asbestos waste will be disposed of at the Low-Level Waste Facility.

7.0 Quality Assurance/Quality Control

The overall objective of the characterization activities described in this SAFER Plan is to collect accurate and defensible data to support the selection and implementation of a closure alternative for CAU 114. Sections 7.1 and 7.2 discuss the collection of required quality control (QC) samples in the field and quality assurance (QA) requirements for laboratory/analytical data to achieve closure. Unless otherwise stated in this SAFER Plan or required by the results of the DQO process (see Appendix B), this CAI will adhere to the Industrial Sites QAPP (NNSA/NV, 2002b).

7.1 Sample Collection Activities

Field QC samples will be collected in accordance with established procedures. Field QC samples are collected and analyzed to aid in determining the validity of sample results. The number of required QC samples depends on the types and number of samples collected. The minimum frequencies of collecting and analyzing QC samples for this CAI, as determined in the DQO process, include the following:

- Trip blanks (1 per sample cooler containing VOC samples)
- Equipment rinsate blanks (1 per sampling event for each type of decontamination method)
- Source blanks (1 per uncharacterized lot of source water)
- Field duplicates (1 per 20 samples)
- Field blanks (minimum of 1 per CAS, additional if field conditions change)
- Laboratory QC samples (1 per 20 samples)

Additional QC samples may be submitted based on site conditions at the discretion of the Task Manager or Site Supervisor. Field QC samples shall be analyzed using the same analytical procedures implemented for associated samples. Additional details regarding field QC samples are available in the Industrial Sites QAPP (NNSA/NV, 2002b).

7.2 Applicable Laboratory/Analytical Data Quality Indicators

The DQIs are qualitative and quantitative descriptors used in interpreting the degree of acceptability or utility of data. Data quality indicators are used to evaluate the entire measurement system and laboratory measurement processes (i.e., analytical method performance) as well as individual analytical results (i.e., parameter performance). The quality and usability of data used to make DQO decisions will be assessed based on the following DQIs:

- Precision
- Accuracy/bias
- Representativeness
- Completeness
- Comparability
- Sensitivity

Table 7-1 provides the established analytical method/measurement system performance criteria for each of the DQIs and the potential impacts on the decision if the criteria are not met. The following subsections discuss each of the DQIs that will be used to assess the quality of laboratory data. The criteria for precision and accuracy in Tables 3-3 and 3-4 may vary from information in the Industrial Sites QAPP as a result of the laboratory used or updated/new methods (NNSA/NV, 2002b).

Table 7-1
Laboratory and Analytical Performance Criteria for CAU 114 DQIs
(Page 1 of 2)

DQI	Performance Metric	Potential Impact on Decision If Performance Metric Not Met
Precision	At least 80% of the sample results for each measured contaminant are not qualified for precision based on the criteria for each analytical method-specific and laboratory-specific criteria presented in Section 7.2.1.	The affected analytical results from each affected CAS component will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Accuracy	At least 80% of the sample results for each measured contaminant are not qualified for accuracy based on the method-specific and laboratory-specific criteria presented in Section 7.2.2.	The affected analytical results from each affected CAS component will be assessed to determine whether there is sufficient confidence in analytical results to use the data in making DQO decisions.
Representativeness	Samples contain contaminants at concentrations present in the environmental media from which they were collected.	Analytical results will not represent true site conditions. Inability to make appropriate DQO decisions.
Decision I Completeness	80% of the CAS-specific COPCs have valid results. 100% of CAS-specific targeted contaminants have valid results.	Cannot support/defend decision on whether COCs are present.

Table 7-1
Laboratory and Analytical Performance Criteria for CAU 114 DQIs
(Page 2 of 2)

DQI	Performance Metric	Potential Impact on Decision If Performance Metric Not Met
Decision II Completeness	100% of COCs used to define extent have valid results.	Extent of contamination cannot be accurately determined.
Comparability	Sampling, handling, preparation, analysis, reporting, and data validation are performed using standard methods and procedures.	Inability to combine data with data obtained from other sources and/or inability to compare data to regulatory action levels.
Sensitivity	Minimum detectable concentrations are less than or equal to respective PALs.	Cannot determine whether COCs are present or migrating at levels of concern.

7.2.1 Precision

Precision is a measure of the repeatability of the analysis process from sample collection through analysis results. It is used to assess the variability between two equal samples.

Determinations of precision will be made for field duplicate samples and laboratory duplicate samples. Field duplicate samples will be collected simultaneously with samples from the same source under similar conditions in separate containers. The duplicate sample will be treated independently of the original sample in order to assess field impacts and laboratory performance on precision through a comparison of results. Laboratory precision is evaluated as part of the required laboratory internal QC program to assess performance of analytical procedures. The laboratory sample duplicates are an aliquot, or subset, of a field sample generated in the laboratory. They are not a separate sample but a split, or portion, of an existing sample.

Precision is a quantitative measure used to assess overall analytical method and field-sampling performance as well as the need to "flag" (qualify) individual parameter results when corresponding QC sample results are not within established control limits.

The criteria used for the assessment of inorganic chemical precision when both results are greater than or equal to 5× reporting limit (RL) are 20 and 35 percent for aqueous and soil samples, respectively. When either result is less than 5× RL, a control limit of ±1× RL and ±2× RL for aqueous and soil samples, respectively, is applied to the absolute difference.

The criteria used for the assessment of organic chemical precision are based on professional judgment using laboratory-derived control limits. The criteria used for the assessment of radiological precision when both results are greater than or equal to 5× MDC are 20 and 35 percent for aqueous and soil samples, respectively. When either result is less than 5× MDC, the ND should be between -2 and +2 for aqueous and soil samples. The parameters to be used for assessment of precision for duplicates are listed in Table 3-4.

Any values outside the specified criteria do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. The performance metric for assessing the DQI of precision on DQO decisions (Table 7-1) is that at least 80 percent of sample results for each measured contaminant are not qualified due to duplicates exceeding the criteria. If this performance is not met, an assessment will be conducted in the CR of the impacts on DQO decisions specific to affected contaminants and CAS components.

7.2.2 Accuracy/Bias

Accuracy is a measure of the closeness of an individual measurement to the true value. It is used to assess the performance of laboratory measurement processes. Accuracy is determined by analyzing a reference material of known parameter concentration or by reanalyzing a sample to which a material of known concentration or amount of parameter has been added (spiked). Accuracy will be evaluated based on results from three types of spiked samples: MS, LCS, and surrogates (organics). The LCS sample is analyzed with the field samples using the same sample preparation, reagents, and analytical methods employed for the samples. One LCS will be prepared with each batch of samples for analysis by a specific measurement.

The criteria used for the assessment of inorganic chemical accuracy are 75 to 125 percent for MS recoveries and 80 to 120 percent for LCS recoveries. For organic chemical accuracy, MS and LCS laboratory-specific percent recovery criteria developed and generated in-house by the laboratory in accordance with approved laboratory procedures are applied. The criteria used for the assessment of radiochemical accuracy are 80 to 120 percent for LCS and MS recoveries.

Any values outside the specified criteria do not necessarily result in the qualification of analytical data. It is only one factor in making an overall judgment about the quality of the reported analytical results. Factors beyond laboratory control, such as sample matrix effects, can cause the measured values to be outside the established criteria. Therefore, the entire sampling and analytical process may be evaluated when determining the usability of the affected data.

The performance metric for assessing the DQI of accuracy on DQO decisions (Table 7-1) is that at least 80 percent of the sample results for each measured contaminant are not qualified for accuracy. If this performance is not met, an assessment will be conducted in the CR of the impacts on DQO decisions specific to affected contaminants and CAS components.

7.2.3 Representativeness

Representativeness is the degree to which sample characteristics accurately and precisely represent characteristics of a population or an environmental condition (EPA, 2002). Representativeness is ensured by carefully developing the CAI sampling strategy during the DQO process such that false-negative and false-positive decision errors are minimized. Meeting the criteria listed below will ensure that sample results will adequately represent actual site characteristics:

- For Decision I judgmental sampling, having a high degree of confidence that the sample locations selected will identify COCs if present anywhere within the CAS (EPA, 2002).
- Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.
- For Decision II, having a high degree of confidence that the sample locations selected will identify the extent of COCs.

These are qualitative measures that will be used to assess measurement system performance for representativeness. The assessment of this qualitative criterion will be presented in the CR.

7.2.4 Completeness

Completeness is defined as generating sufficient data of the appropriate quality to satisfy the data needs identified in the DQOs. For judgmental sampling, completeness will be evaluated using both a quantitative measure and a qualitative assessment. The quantitative measurement to be used to evaluate completeness is presented in Table 7-1 and is based on the percentage of measurements made that are judged to be valid. For the judgmental sampling approach, the completeness goal for targeted contaminants and the remaining COPCs is 100 and 80 percent, respectively. If this goal is not achieved, the dataset will be assessed for potential impacts on making DQO decisions.

The qualitative assessment of completeness is an evaluation of the sufficiency of information available to make DQO decisions. This assessment will be based on meeting the data needs identified in the DQOs and will be presented in the CR. Additional samples will be collected if it is determined that the samples collected do not meet completeness criteria.

7.2.5 Comparability

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another (EPA, 2002). The criteria for the evaluation of comparability will be that all sampling, handling, preparation, analysis, reporting, and data validation were performed using approved standard methods and procedures. This will ensure that data from this project can be compared to regulatory action levels that were developed based on data generated using the same or comparable methods and procedures. An evaluation of comparability will be presented in the CR.

7.2.6 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest (EPA, 2002). The evaluation criterion for this parameter will be that measurement sensitivity (detection limits) will be less than or equal to the corresponding PALs. If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting site characterization objectives. This assessment will be presented in the CR.

7.2.7 Other Analytical Data Evaluation Factors

Factors beyond laboratory control, such as sample matrix effects, can cause the measured values to be outside the established criteria described in Sections 7.2.1 through 7.2.6. Therefore, following current guidance (EPA, 2010; MARLAP, 2004; Paar and Porterfield, 1997), the entire sampling and analytical process as well as the following factors may be evaluated when determining the usability of the affected data:

- Calibration verification, including (when applicable) continuing calibration verifications.
- QC verification, including (when applicable) holding times, sample preservation, blanks, surrogates, and tracers/carriers.
- Comparability to historical data
- Internal standard recoveries
- Instrument performance checks
- Professional judgment

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Appendix A

Project Organization

A.1.0 Project Organization

The EM Nevada Program Industrial Sites/D&D contact is Kevin Cabble. He can be contacted at 702-918-6675. The identification of the activity Health and Safety Officer and the Quality Assurance Officer can be found in the appropriate plan. However, personnel are subject to change, and it is suggested that the appropriate DOE Activity Lead or DTRA Program Manager be contacted for further information.

Appendix B

Data Quality Objectives Process

Note: This appendix comprises the DQOs as determined for the original CAU 114 SAFER Plan (NNSA/NSO, 2010).

B.1.0 Introduction

The DQO process described in this appendix is a seven-step strategic systematic planning method used to plan data collection activities and define performance criteria for the CAU 114, Area 25 EMAD Facility, field investigation. The DQOs are designed to ensure that the data collected will provide sufficient and reliable information to determine the appropriate corrective actions, to verify the adequacy of existing information, to provide sufficient data to implement the corrective actions, and to verify that closure was achieved.

The CAU 114 CAI will be based on the DQOs presented in this appendix as developed by representatives of NDEP and NNSA/NSO. The seven steps of the DQO process presented in Sections B.2.0 through B.8.0 were developed in accordance with the *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006) and the CAS-specific information presented in Section B.2.0.

The DQO process presents a judgmental sampling approach. In general, the procedures used in the DQO process provide:

- A method to establish performance or acceptance criteria, which serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study.
- Criteria that will be used to establish the final data collection design such as:
  - The nature of the problem that has initiated the study and a conceptual model of the environmental hazard to be investigated.
  - The decisions or estimates that need to be made and the order of priority for resolving them.
  - The type of data needed.
  - An analytic approach or decision rule that defines the logic for how the data will be used to draw conclusions from the study findings.
- Acceptable quantitative criteria on the quality and quantity of the data to be collected, relative to the ultimate use of the data.
- A data collection design that will generate data meeting the quantitative and qualitative criteria specified. A data collection design specifies the type, number, location, and physical quantity of samples and data, as well as the QA and QC activities that will ensure that

sampling design and measurement errors are managed sufficiently to meet the performance or acceptance criteria specified in the DQOs.

B.2.0 Step 1 - State the Problem

Step 1 of the DQO process defines the problem that requires study, identifies the planning team, and develops a conceptual model of the environmental hazard to be investigated.

The problem statement for CAU 114 is: "Existing information on the nature and extent of potential contamination is insufficient to evaluate and confirm closure of CAS 25-41-03."

Corrective Action Unit 114 comprises CAS 25-41-03, EMAD Facility, which consists of potential future releases from wastes suspected to contain a material that may cause the release of a COC to environmental media.

B.2.1 Planning Team Members

The DQO planning team consists of representatives from NDEP, NNSA/NSO, Stoller-Navarro Joint Venture (SNJV), and National Security Technologies, LLC (NSTec). The DQO meeting was held on April 30, 2009. The primary decision makers are the NDEP and NNSA/NSO representatives.

B.2.2 Conceptual Site Model

The CSM is used to organize and communicate information about site characteristics. It reflects the best interpretation of available information at any point in time. The CSM is a primary vehicle for communicating assumptions about release mechanisms, potential migration pathways, or specific constraints. It provides a summary of how and where contaminants are expected to move and what impacts such movement may have. It is the basis for assessing how contaminants could reach receptors both in the present and future. The CSM describes the most probable scenario for current conditions at each site and define the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. Accurate CSMs are important as they serve as the basis for all subsequent inputs and decisions throughout the DQO process.

The CSM was developed for CAU 114 using information from the physical setting, potential contaminant sources, release information, historical background information, knowledge from similar sites, and physical and chemical properties of the potentially affected media and COPCs.

The CSM consists of:

- Potential contaminant releases associated with Building 3900.
- Release mechanisms (the conditions associated with the release).
- Potential contaminant source characteristics, including contaminants suspected to be present and contaminant-specific properties.
- Site characteristics including physical, topographical, and meteorological information.
- Migration pathways and transport mechanisms that describe the potential for migration and where the contamination may be transported.
- The locations of points of exposure where individuals or populations may come in contact with a COC associated with a CAS.
- Routes of exposure where contaminants may enter the receptor.

If additional elements are identified during the CAI that are outside the scope of the CSM, the situation will be reviewed, and a recommendation will be made as to how to proceed. In such cases, NDEP will be notified and given the opportunity to comment on, and concur with, the recommendation.

The applicability of the CSM is summarized in Table B.2-1 and discussed below. Table B.2-1 provides information on CSM elements that will be used throughout the remaining steps of the DQO process.

B.2.2.1 Contaminant Release

Any contaminants that could be released from CAU 114, regardless of physical or chemical characteristics, are expected to exist in wastes that are currently contained within Building 3900 but could be released to soil following decomposition of the building. Specific release points are described below.

For CAS 25-41-03, EMAD Facility, the primary locations from which contaminants may be released to the environment are any breached locations in waste lines or drains that leave Building 3900 and are in contact with soil. Contamination could occur if PSMs contained within Building 3900 were released to the environment. Examples include used oils in equipment reservoirs, materials left in

Table B.2-1
Conceptual Site Model Description for CAS 25-41-03 in CAU 114

CAS Identifier	25-41-03
CAS Description	**EMAD Facility**
Site Status	Building 3900 is inactive and abandoned.
Exposure Scenario	Occasional Use
Sources of Potential Soil Contamination	Hazardous or radioactive materials stored at the facility, located in storage vaults and pits, equipment reservoirs, or discharged to drains and waste systems
Location of Contamination/ Release Point	Release points from drains or waste lines leaving Building 3900, or other identified pathways to soil
Amount Released	Unknown
Affected Media	Surface and shallow subsurface soil
Potential Contaminants	VOCs, SVOCs, TPH-DRO, RCRA Metals + Beryllium, PCBs, Gamma Spectrometry, Isotopic U, Isotopic Pu, Sr-90 (+ Pesticides at Building 3900)
Transport Mechanisms	Percolation of precipitation through subsurface media serves as the major driving force for migration of contaminants. Surface water runoff may provide for the transportation of some contaminants within or outside the footprint of the CAS (e.g., storm drain system, debris piles). Leaks from fuel tanks and/or oil reservoirs on equipment located inside Building 3900 onto the soil.
Migration Pathways	Vertical transport is expected to dominate lateral transport due to small surface gradients (with exception of storm drain system).
Lateral and Vertical Extent of Contamination	Contamination, if present, is expected to be contiguous to the release points. Concentrations are expected to decrease with distance and depth from the source. Groundwater contamination is not expected. Lateral and vertical extent of COC contamination is assumed to be within the spatial boundaries.
Exposure Pathways	The potential for contamination exposure is limited to industrial and construction workers, and military personnel conducting training. These human receptors may be exposed to COPCs through oral ingestion, inhalation, and dermal contact (absorption) of soil and/or debris due to inadvertent disturbance of these materials, or irradiation by radioactive materials.

vaults and pits, lead shielding, mercury-containing thermostats and switches, and radioactive check sources. (See Table B.8-1 for a list of known or anticipated PSMs.)

B.2.2.2 Potential Contaminants

The COPCs were identified during the planning process through the review of site history, process knowledge, personal interviews, past investigation efforts (where available), and inferred activities associated with CAS 25-41-03. The list of COPCs is intended to encompass all of the contaminants that could potentially be present. The COPCs applicable to Decision I samples from CAU 114 are defined as the constituents reported from the analytical methods stipulated in Table B.2-2. (See Section 4.1 for a description of the potential sources of the listed COPCs.)

Table B.2-2
Analytical Program[a]

Analyses	CAS 25-41-03 EMAD Facility
Organic COPCs	
TPH-DRO	X
PCBs	X
SVOCs	X
VOCs	X
Pesticides	X
Inorganic COPCs	
RCRA Metals	X
Total Beryllium	X
Radionuclide COPCs	
Gamma Spectroscopy	X
Isotopic U	X
Isotopic Pu	X
Sr-90	X

[a]The COPCs are the constituents reported from the analytical methods listed.

X = Required analytical method

B.2.2.3 Contaminant Characteristics

Contaminant characteristics include, but are not limited to, solubility, density, and adsorption potential. In general, contaminants with large particle size, low solubility, high affinity for media, and/or high density can be expected to be found relatively close to release points. Contaminants with small particle size, high solubility, low affinity for media, and/or low density are found farther from release points or in low areas where evaporation of ponding will concentrate dissolved constituents.

B.2.2.4 Site Characteristics

Site characteristics are defined by the interaction of physical, topographical, and meteorological attributes and properties. Physical properties include permeability, porosity, hydraulic conductivity, degree of saturation, sorting, chemical composition, and organic content. Topographical and meteorological properties and attributes include slope stability, precipitation frequency and amounts, precipitation runoff pathways, drainage channels and ephemeral streams, and evapotranspiration potential.

The E-MAD Facility is located in Jackass Flats in Area 25 of the NTS. Jackass Flats is between Yucca Mountain on the west and southwest and Little Skull Mountain to the south. The Calico Hills are directly north, Mid Valley and Lookout Peak are to the northeast, and Skull Mountain is to the southeast. Jackass Flats is a broad alluvial valley with alluvium and colluvium accumulations up to 1,205 ft (USGS, 1964; DOE, 1988). The alluvium in Jackass Flats is underlain by welded and semi-welded ash-flow and ash-fall tuffs of Tertiary age. Beneath the tuff layers lie Paleozoic carbonate and clastic sediments with a depth of up to 22,000 ft in some areas. The Paleozoic rocks are made up of shales, quartzites, and carbonates of lower to middle Cambrian age; carbonate and thin shale layers of middle Cambrian to Devonian age; and argillites, cherty limestones, and conglomerates of Devonian to Permian age (SNPO, 1970).

Elevation of the flats ranges from 3,600 ft in the north to 3,200 ft in the south, with the E-MAD Facility at 3,520 ft. Surface water flow at the north end of the E-MAD Facility drains to the southwest; at the south end of the facility, surface water drains to the south. The nearest natural water source is Topopah Springs at the head of Topopah Wash 8.7 miles to the north. The closest well to the site is J-11 Water Well, which is located approximately 9,500 ft southeast of the E-MAD Facility. The depth to groundwater as measured from this well is approximately 1,040 ft below ground surface (bgs) (DRI, 1996; USGS and DOE, 2006).

B.2.2.5 Migration Pathways and Transport Mechanisms

Migration pathways include the lateral migration of potential contaminants across surface soils/sediments and vertical migration of potential contaminants through subsurface soils.

The E-MAD Facility is toward the middle of Jackass Flats, about 500 ft west of Topopah Wash. Fortymile Wash, the major drainage in the area, meanders along the east base of Yucca Mountain and the west side of Jackass Flats, and eventually joins with the Amargosa River to the south. Topopah Wash, originating in the Calico Hills, bisects Jackass Flats and also joins with the Amargosa River, farther to the east (DRI, 1996). Contaminants released into the Topopah Wash are subject to much higher transport mechanisms than contaminants released to other surface areas. Topopah Wash is generally dry but is subject to infrequent, potentially intense, stormwater flows. These stormwater flow events provide an intermittent mechanism for both vertical and horizontal transport of contaminants. Contaminated sediments entrained by these stormwater events would be carried by the streamflow to locations where the flowing water loses energy and the sediments drop out. These locations are readily identifiable by hydrologists as sedimentation areas.

Infiltration and percolation of precipitation serves as a driving force for downward migration of contaminants. However, due to the low permeability of the alluvium throughout the area, high potential evapotranspiration rates, and low precipitation rates (approximately 5.72 in. per year as measured from station 4JA [ARL/SORD, 2009]), percolation of infiltrated precipitation at the NTS does not provide a significant mechanism for vertical migration of contaminants to groundwater (DOE/NV, 1992). Environmental contamination is, therefore, expected to be limited to the area near release points.

B.2.2.6 Land-Use and Exposure Scenarios

Human receptors may be exposed to COPCs through oral ingestion, inhalation, or dermal contact (absorption) of soil or debris due to inadvertent disturbance of these materials, or irradiation by radioactive materials. The land-use and exposure scenarios for CAU 114 are listed in Table B.2-3. These are based on NTS current and future land use (DOE/NV, 1998). Although CAS 25-41-03 is located in an area where structures from past activities exist, no facilities are present that would allow these to be used as an assigned work station for NTS site personnel; therefore, CAS 25-41-03 is considered an occasional use area.

Table B.2-3
Land-Use and Exposure Scenarios

CAS	Record of Decision Land Use Zone	Exposure Scenario
25-41-03	**Research Test and Experiment Zone** This area is designated for small-scale research and development projects and demonstrations; pilot projects; outdoor tests; and experiments for the development, QA, or reliability of material and equipment under controlled conditions. This zone includes compatible defense and nondefense research, development, and testing projects and activities.	**Occasional Use Area** Worker will be exposed to the site occasionally (up to 80 hours per year for 5 years). Site structures are not present for shelter and comfort of the worker.

B.3.0 Step 2 - Identify the Goal of the Study

Step 2 of the DQO process states how environmental data will be used in meeting objectives and solving the problem, identifies study questions or decision statement(s), and considers alternative outcomes or actions that can occur upon answering the question(s). Figure B.3-1 depicts the sequential flow of questions, answers, and action alternatives required to fulfill the objectives of the SAFER process.

B.3.1 Decision Statements

The Decision I statement is: "Is any waste present at the site likely to result in the introduction of COCs into site environmental media?" If a COC is detected, then Decision II must be resolved.

The Decision II statement is: "Is sufficient information available to meet the closure objectives?" The closure objectives are defined as the following:

- The volume of waste containing any PSM
- The information needed to characterize IDW for disposal
- The information needed to determine potential remediation waste type

A corrective action will be necessary if there is a potential for wastes that are present at a site to result in the introduction of COCs into site environmental media. These wastes would be considered PSM, which is defined as waste (solid or liquid) containing contaminants that, if released to soil, would result in soil contamination exceeding a FAL. To determine whether wastes that are present at CAU 114 meet the criteria for PSM, the following conservative assumptions were made:

- Any containment of waste (e.g., fuel/oil reservoirs, pipe, concrete vaults and walls, drums) would fail at some point, and the waste would be released to the surrounding soil.

- A waste, regardless of concentration or configuration, may be assumed to be PSM and handled under a corrective action.

- Based on process knowledge and/or professional judgment, some waste may be assumed not PSM if it is clear that it could not result in soil contamination exceeding a FAL.

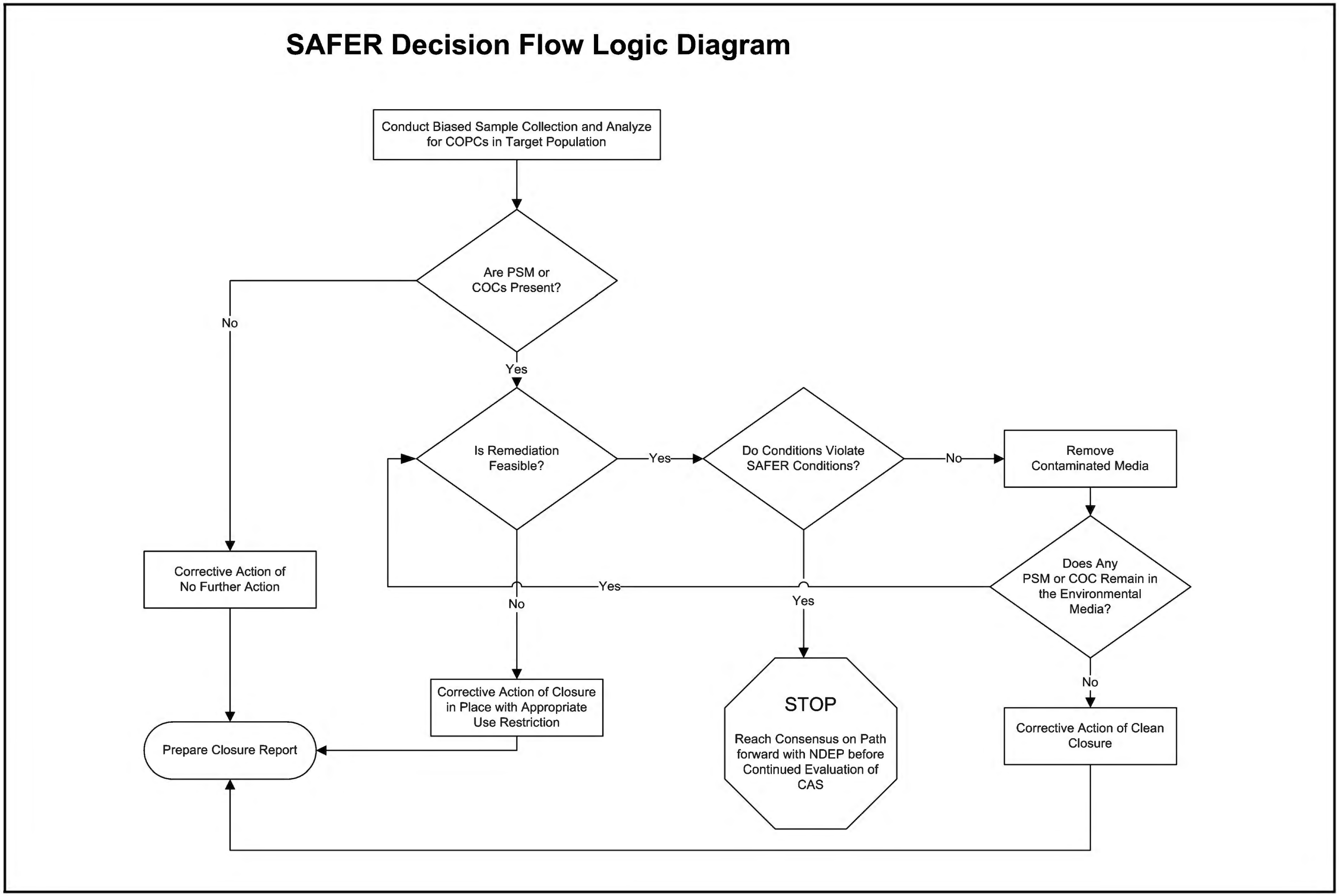

Figure B.3-1
SAFER Closure Decision Process for CAU 114

- If assumptions about the waste cannot be made, then the waste material will be sampled, and the results will be compared to FALs based on the following criteria:

    - For non-liquid wastes, the concentration of any chemical contaminant in soil (following degradation of the waste and release of contaminants into soil) would be equal to the mass of the contaminant in the waste divided by the mass of the waste (no consideration will be given to dilution into the mass of soil).

    - For non-liquid wastes, the dose resulting from radioactive contaminants in soil (following degradation of the waste and release of contaminants into soil) would be calculated using the activity of the contaminant in the waste divided by the mass of the waste (for each radioactive contaminant) and calculating the combined resulting dose using the RESRAD code (Murphy, 2004) (no consideration will be given to dilution into the mass of soil). Note: As an initial screening tool, if building materials are primarily externally contaminated and do not present a dose exceeding the FAL to a nearby worker in its current configuration, it will not be considered to meet PSM criteria.

    - For liquid wastes, the resulting concentration of contaminants in the surrounding soil would be calculated based on the concentration of contaminants in the wastes and the liquid holding capacity of the soil.

For example, sludge containing a contaminant exceeding an equivalent FAL concentration would be considered to be PSM and would require a corrective action. Light ballasts with capacitors are assumed to contain PCBs based on process knowledge. These ballasts/capacitors would be assumed to be PSM without sampling and would require a corrective action.

If sufficient information is not available to meet the closure objectives, then site conditions will be re-evaluated, and additional samples will be collected (as long as the scope of the CAI is not exceeded and any CSM assumption has not been shown to be incorrect).

B.3.2 Alternative Actions to the Decisions

This section identifies actions that may be taken to solve the problem depending on the possible outcomes of the CAI.

B.3.2.1 Alternative Actions to Decision I

If no PSM associated with the CAS is detected, then further assessment of the CAS is not required, and the CAA of no further action will be selected. If a PSM is present and removal is feasible, then clean close the site by removing the PSM. If PSM is present and removal cannot be completed during the SAFER, then the remaining PSM will be closed under the alternative corrective action of closure in place.

If contamination still exists and additional remediation would violate the conditions of the SAFER, then work will stop and a consensus reached with NDEP on the path forward before continuing the investigation of the CAS.

B.3.2.2 Alternative Actions to Decision II

If sufficient information is available to confirm that closure objectives were met, then further assessment of the CAS is not required. If sufficient information is not available to confirm that closure objectives were met, then additional samples will be collected.

B.4.0 Step 3 - Identify Information Inputs

Step 3 of the DQO process identifies the information needed, determines sources for information, and identifies sampling and analysis methods that will allow reliable comparisons with FALs.

B.4.1 Information Needs

To resolve Decision I (determine whether a PSM is present), samples need to be collected and analyzed following these two criteria:

- Samples must be collected from wastes that are most likely to result in the release of a COC (judgmental sampling).
- The analytical suite selected must be sufficiently sensitive to identify any PSM present in the samples.

To resolve Decision II (determine whether sufficient information is available to confirm that closure objectives were met at the CAS), samples must be collected and analyzed to meet the following criteria:

- Samples of the waste or environmental media must provide sufficient information to characterize the IDW for disposal.
- Samples of the waste or environmental media must provide sufficient information to determine potential remediation waste types.
- Samples of waste must provide sufficient information to determine whether materials meet PSM criteria.

B.4.2 Sources of Information

Information to satisfy Decision I will be generated by collecting samples using hand sampling (e.g., grab, auger, bailer), power auguring, core drilling, backhoe excavation, or other appropriate sampling methods. Sampling for PSM will be conducted in areas most likely to contain a PSM (judgmental sampling). These samples will be submitted to analytical laboratories meeting the quality criteria stipulated in the Industrial Sites QAPP (NNSA/NV, 2002). Only validated data from analytical laboratories will be used to make DQO decisions. For some materials, it will be assumed that a contaminant is present based on process knowledge, and that material will be assumed to meet

PSM criteria without the need for sampling. Radiological surveys of Building 3900 surfaces (e.g., walls, flooring, HVAC systems) will be used to determine the extent of any remaining surface contamination and to assist in evaluating the potential for a receptor to receive a dose greater than 25 mrem/yr.

All waste characterization data must be sufficient to meet the quality requirements of the designated waste acceptance criteria. Waste disposal documentation, field surveys, and other appropriate information may also be used to ensure corrective actions were completed as planned.

B.4.2.1 Sample Locations

Design of the sampling approaches for CAU 114 must ensure that the data collected are sufficient for selection of the CAAs. To meet this objective, samples should be collected from locations that most likely contain a PSM, if present. These sample locations, therefore, can be selected by means of biasing factors used in judgmental sampling. Because sufficient data are available to develop a judgmental sampling plan, this approach was used to develop plans for sampling PSM. A judgmental sampling design has been developed for CAU 114 because of the presence and significance of biasing factors.

Field-survey techniques may be used to select appropriate sampling locations by providing semiquantitative data. The following field-survey methods and biasing factors may be used to select biased sample locations at CAU 114:

- Surface area walkover and radiological surveys: A radiological survey instrument will be used to detect elevated radioactivity of soil, surfaces, piping, and various other materials.
- Stains: Any discolored building material or other surfaces.
- Drums, containers, equipment or debris: Materials that may have been used at, or added to, a location, and that may have contained, or come in contact with, hazardous or radioactive substances at some point during their use.
- Preselected areas based on process knowledge of the site: Locations for which evidence such as historical photographs, experience from previous investigations, or interviewee’s input, exists that a release of hazardous or radioactive substances may have occurred.

- Preselected areas based on process knowledge of the contaminant(s): Locations that may reasonably have received contamination, selected on the basis of the chemical and/or physical properties of the contaminant(s) in that environmental setting.

- Experience and data from investigations of similar sites.

- Other biasing factors: Factors not previously defined for the CAI, but become evident once the investigation of the site is under way.

B.4.2.2 Analytical Methods

Analytical methods are available to provide the data needed to resolve the decision statements. The analytical methods and laboratory requirements (e.g., detection limits, precision, and accuracy) are provided in Tables 3-3 and 3-4.

B.5.0 Step 4 - Define the Boundaries of the Study

Step 4 of the DQO process defines the target population of interest and its relevant spatial boundaries, specifies temporal and other practical constraints associated with sample/data collection, and defines the sampling units on which decisions or estimates will be made.

B.5.1 Target Populations of Interest

The population of interest to resolve Decision I is any location within the site that contains PSM. The populations of interest to resolve Decision II ("If PSM is present, is sufficient information available to evaluate potential CAAs?") are:

- Environmental media or IDW that must be characterized for disposal.
- Potential remediation waste.
- Environmental media where natural attenuation or biodegradation or construction/evaluation of barriers is considered.

B.5.2 Spatial Boundaries

Spatial boundaries are the maximum lateral and vertical extent of expected contamination at each CAS. The spatial boundaries of CAS 25-41-03 are shown in Table B.5-1. Contamination found beyond these boundaries may indicate a flaw in the CSM and may require re-evaluation of the CSM before the investigation could continue. Corrective action site 25-41-03 is considered geographically independent, and intrusive activities are not intended to extend into the boundaries of neighboring CASs or existing URs from previously investigated CAUs.

Table B.5-1
Spatial Boundaries of CAS 25-41-03

CAS Identifier	CAS Description	Lateral Spatial Boundary	Vertical Spatial Boundary
25-41-03	EMAD Facility	25 ft beyond building footprint	15 ft bgs

B.5.3 Practical Constraints

Practical constraints, such as military activities, utilities, threatened or endangered animals and plants, unstable or steep terrain, and/or access restrictions, may affect the ability to investigate this site. The practical constraints associated with the CAI are summarized in Table B.5-2.

Table B.5-2
Practical Constraints for the CAU 114 Field Investigation

CAS	Practical Constraints
25-41-03 EMAD Facility	Military exercises; excavation access due to underground utilities; other access issues due to aboveground structures, limited working spaces, etc.
	Access to confined spaces (e.g., beneath turntables, various vaults, pits, manways).

B.5.4 Define the Sampling Units

The scale of decision making in Decision I is defined as the CAS. Any PSM detected at any location within the CAS or CAS component will cause the determination that the CAS is contaminated and needs further evaluation.

B.6.0 Step 5 - Develop the Analytic Approach

Step 5 of the DQO process specifies appropriate population parameters for making decisions, defines action levels, and generates an “If … then … else” decision rule that defines the conditions under which possible alternative actions will be chosen. This step also specifies the parameters that characterize the population of interest, specifies the FALs, and confirms that the analytical detection limits are capable of detecting FALs.

B.6.1 Population Parameters

For judgmental sampling results, the population parameter is the observed concentration of each contaminant from each individual analytical sample. Each sample result will be compared to the FALs to determine the appropriate resolution to Decision I. For Decision I, a single sample result that identifies a PSM would cause a determination that a PSM is present within the CAS.

B.6.2 Action Levels

The PALs presented in this section are to be used for site screening purposes. They are not intended to be used as cleanup action levels or FALs. However, they are useful in screening out contaminants that are not present in sufficient concentrations to warrant further evaluation and, therefore, streamline the consideration of remedial alternatives. The RBCA process used to establish FALs is described in the *Industrial Sites Project Establishment of Final Action Levels* (NNSA/NSO, 2006). This process conforms with NAC Section 445A.227, which lists the requirements for sites with soil contamination (NAC, 2008a). For the evaluation of corrective actions, NAC Section 445A.22705 (NAC, 2008b) requires the use of ASTM Method E1739 (ASTM, 1995) to “conduct an evaluation of the site, based on the risk it poses to public health and the environment, to determine the necessary remediation standards (i.e., FALs) or to establish that corrective action is not necessary.”

This RBCA process defines three tiers (or levels) of evaluation involving increasingly sophisticated analyses:

- Tier 1 evaluation - sample results from source areas (highest concentrations) are compared to action levels based on generic (non-site-specific) conditions (i.e., the PALs established in the SAFER Plan). The FALs may then be established as the Tier 1 action levels or the FALs may be calculated using a Tier 2 evaluation.

- Tier 2 evaluation - conducted by calculating Tier 2 SSTLs using site-specific information as inputs to the same or similar methodology used to calculate Tier 1 action levels. The Tier 2 SSTLs are then compared to individual sample results from reasonable points of exposure (as opposed to the source areas as is done in Tier 1) on a point-by-point basis. Total petroleum hydrocarbon concentrations will not be used for risk-based decisions under Tier 2 or Tier 3. Rather, the individual chemicals of concern will be compared to the SSTLs.

- Tier 3 evaluation - conducted by calculating Tier 3 SSTLs on the basis of more sophisticated risk analyses using methodologies described in Method E1739 that consider site-, pathway-, and receptor-specific parameters.

The comparison of laboratory results to FALs and the evaluation of potential corrective actions will be included in the investigation report. The FALs will be defined (along with the basis for their definition) in the investigation report.

B.6.2.1 Chemical PALs

Except as noted herein, the chemical PALs are defined as the EPA Region 9 Superfund preliminary RSLs for chemical contaminants in industrial soils (EPA, 2009). Background concentrations for RCRA metals and zinc will be used instead of RSLs when natural background concentrations exceed the RSL, as is often the case with arsenic on the NTS. Background is considered the mean plus two standard deviations of the mean for sediment samples collected by the Nevada Bureau of Mines and Geology throughout the Nevada Test and Training Range (formerly the Nellis Air Force Range) (NBMG, 1998; Moore, 1999). For detected chemical COPCs without established RSLs, the protocol used by the EPA Region 9 in establishing RSLs (or similar) will be used to establish PALs (EPA, 2009). If used, this process will be documented in the CR.

B.6.2.2 Total Petroleum Hydrocarbon PALs

The PAL for TPH is 100 mg/kg as listed in NAC 445A.2272 (NAC, 2008c).

B.6.2.3 Radionuclide PALs

The PALs for radiological contaminants are based on the NCRP Report No. 129 recommended screening limits for construction, commercial, industrial land-use scenarios (NCRP, 1999) scaled to 25-mrem/yr dose constraint (Murphy, 2004) and the generic guidelines for residual concentration of radionuclides in DOE Order 5400.5 (DOE, 1993). These PALs are based on the construction, commercial, and industrial land-use scenario provided in the guidance and are appropriate for the NTS based on future land use scenarios as presented in Section B.2.2.6.

B.6.3 Decision Rules

The decision rules applicable to both Decision I and Decision II are:

- If COC contamination is inconsistent with the CSM or extends beyond the spatial boundaries identified in Section B.5.2, then work will be suspended and the investigation strategy will be reconsidered, else the decision will be to continue sampling to define the extent.

The decision rules for Decision I are:

- If the population parameter of any COPC in the Decision I population of interest (defined in Section B.5.1) exceeds the corresponding PSM criteria, then that waste is identified as a PSM, and the PSM will be removed.
- If no PSM associated with a release from the CAS is detected, then further assessment of the CAS is not required, and the CAA of no further action will be selected. If a PSM associated with a release from the CAS is detected and removal is feasible, then clean close the site by removing the PSM. If the presence of PSM has been determined and removal is not feasible, then the remaining contamination will be closed under the alternative corrective action of closure in place.

The decision rules for Decision II are:

- If valid analytical results are available for the waste characterization samples defined in Section B.8.0, then the decision will be that sufficient information exists to characterize the IDW for disposal and determine potential remediation waste types, else collect additional waste characterization samples.

B.7.0 Step 6 - Specify Performance or Acceptance Criteria

Step 6 of the DQO process defines the decision hypotheses, specifies controls against false rejection and false acceptance decision errors, examines consequences of making incorrect decisions from the test, and places acceptable limits on the likelihood of making decision errors.

B.7.1 Decision Hypotheses

The baseline condition (i.e., null hypothesis) and alternative condition for Decision I are:

- Baseline condition – A PSM is present.
- Alternative condition – A PSM is not present.

Decisions and/or criteria have false negative or false positive errors associated with their determination. The impact of these decision errors and the methods that will be used to control these errors are discussed in the following subsections. In general terms, confidence in DQO decisions based on judgmental sampling results will be established qualitatively by:

- Developing and achieving concurrence of CSMs (based on process knowledge) by stakeholder participants during the DQO process.
- Conducting validity testing of CSMs based on investigation results.
- Evaluating data quality based on DQI parameters.

B.7.2 False Negative Decision Error

The false negative decision error would mean deciding that a PSM is not present when it actually is (Decision I). The potential consequence is an increased risk to human health and the environment.

B.7.2.1 False Negative Decision Error for Judgmental Sampling

In judgmental sampling, the selection of the number and location of samples is based on knowledge of the feature or condition under investigation and professional judgment (EPA, 2002). Judgmental sampling conclusions about the target population depend upon the validity and accuracy of professional judgment.

The false negative decision error (where consequences are more severe) for judgmental sampling designs is controlled by meeting these criteria:

- For Decision I, having a high degree of confidence that the sample locations selected will identify PSM if present anywhere within the CAS.
- Having a high degree of confidence that analyses conducted will be sufficient to detect any PSM present in the samples.
- Having a high degree of confidence that the dataset is of sufficient quality and completeness.

To satisfy the first criterion, Decision I samples must be collected in areas most likely to contain a PSM. The following characteristics must be considered to control decision errors for the first criterion:

- Source and location of release
- Chemical nature and fate properties
- Physical transport pathways and properties
- Hydrologic drivers

These characteristics were considered during the development of the CSMs and selection of sampling locations. The field-survey methods and biasing factors listed in Section B.4.2.1 will be used to further ensure that appropriate sampling locations are selected to meet these criteria. Radiological survey instruments and field-screening equipment will be calibrated and checked in accordance with the manufacturer's instructions and approved procedures. The investigation report will present an assessment on the DQI of representativeness that samples were collected from those locations that best represent the populations of interest as defined in Section B.5.1.

To satisfy the second criterion, Decision I samples will be analyzed for the chemical and radiological parameters listed in Section 3.2. The DQI of sensitivity will be assessed for all analytical results to ensure that all sample analyses had measurement sensitivities (detection limits) that were less than or equal to the corresponding FALs. If this criterion is not achieved, the affected data will be assessed (for usability and potential impacts on meeting site characterization objectives) in the investigation report.

To satisfy the third criterion, the entire dataset, as well as individual sample results, will be assessed against the DQIs of precision, accuracy, comparability, and completeness as defined in the Industrial

Sites QAPP (NNSA/NV, 2002) and in Section 7.2 of this SAFER Plan. The DQIs of precision and accuracy will be used to assess overall analytical method performance as well as the need to potentially "flag" (qualify) individual contaminant results when corresponding QC sample results are not within the established control limits for precision and accuracy. Data qualified as estimated for reasons of precision or accuracy may be considered to meet the constituent performance criteria based on an assessment of the data. The DQI of completeness will be assessed to ensure that all data needs identified in the DQO have been met. The DQI of comparability will be assessed to ensure that all analytical methods used are equivalent to standard EPA methods so that results will be comparable to regulatory action levels that have been established using those procedures. Strict adherence to established procedures and QA/QC protocol protects against false negative decision errors. Site-specific DQIs are discussed in more detail in Section 7.2 of this SAFER Plan.

To provide information for the assessment of the DQIs of precision and accuracy, the following QC samples will be collected as required by the Industrial Sites QAPP (NNSA/NV, 2002):

- Field duplicates (1 per 20 samples)
- Laboratory QC samples (1 per 20 samples)

B.7.3 False Positive Decision Error

The false positive decision error would mean deciding that a PSM is present when it is not, resulting in increased costs for unnecessary sampling and analysis.

False positive results are typically attributed to laboratory and/or sampling/handling errors that could cause cross contamination. To control against cross contamination, decontamination of sampling equipment will be conducted according to established and approved procedures and only clean sample containers will be used. To determine whether a false positive analytical result may have occurred, the following QC samples will be collected as required by the Industrial Sites QAPP (NNSA/NV, 2002):

- Trip blanks (1 per sample cooler containing VOC samples)
- Equipment blanks (1 per sampling event for each type of decontamination method)
- Source blanks (1 per uncharacterized lot of source water)
- Field blanks (minimum of 1 per CAS, additional if field conditions change)

B.8.0 Step 7 - Develop the Plan for Obtaining Data

Step 7 of the DQO process selects and documents a design that will yield data that will best achieve performance or acceptance criteria. Judgmental sampling schemes will be implemented to select sample locations and evaluate analytical results for CAU 114. Section B.8.1 contains general information about collecting Decision I samples under a judgmental sampling design. Section B.8.2 provides the specific sampling design for CAS 25-41-03.

B.8.1 Decision I Sampling

A judgmental sampling design will be implemented for CAU 114. Because individual sample results, rather than an average concentration, will be used to compare to the FALs, statistical methods to generate site characteristics will not be used. Adequate representativeness of the entire target population may not be a requirement to developing a sampling design. If good prior information is available on the target site of interest, then the sampling may be designed to collect samples only from areas known to have the highest concentration levels on the target site. If the observed concentrations from these samples are below PSM criteria, then a decision can be made that the site contains safe levels of the contaminant without the samples being truly representative of the entire area (EPA, 2006).

All sample locations will be selected to satisfy the DQI of representativeness in that samples collected from selected locations will best represent the populations of interest as defined in Section B.5.1. To meet this criterion for judgmentally sampled sites, a biased sampling strategy will be used for Decision I samples to target areas with the highest potential for contamination, if it is present anywhere in the CAS. Sample locations will be determined based on process knowledge, previously acquired data, or the field-survey methods and biasing factors listed in Section B.4.2.1. The Site Supervisor has the discretion to modify the judgmental sample locations, but only if the modified locations meet the decision needs and criteria stipulated in this DQO.

B.8.2 Sampling Design

This section discusses the specific sampling design for CAS 25-41-03. This CAS consists of the potential releases to soil associated with historic operations at Building 3900. Any potential releases identified during the field investigation that are associated with Building 3900 operations and support activities will be included in the scope of the CAI.

The Decision I sampling strategy at this CAS will involve the collection of PSM samples. Table B.8-1 lists the known or anticipated PSMs at Building 3900 and indicates which materials will be sampled and which will be assumed PSM. Samples will be collected from materials within Building 3900 that are suspected to contain COPCs and that may cause the future release of a COC to environmental media. Materials within Building 3900 that have been assumed to meet PSM criteria will be removed and disposed of without the need for environmental sampling. For the process water systems (chilled water, condenser water, heating hot water, potable cold water, potable hot water, process cold water, and process hot water), it is assumed that the fluids would not meet PSM criteria, and samples will not be required. It is also anticipated that concrete samples of floor and wall surfaces may be collected using core drilling techniques based on identified elevated radioactivity or other biasing factors. Samples of material removed during SAFER activities will be taken for waste characterization purposes, as such material is identified.

Table B.8-1
Known or Anticipated Potential Source Materials
(Page 1 of 2)

Potential Source[a]	Material	Contaminants[b]	Sample/Assumed
PCB-containing ballast capacitors	Ballast material	PCBs	Assumed
Excess chemicals	Chemicals	VOCs, SVOCs, RCRA Metals	Sample
HEPA filters	Filter paper	Radiological	Sample
Fluorescent light bulbs	Gases, RCRA Metals	RCRA Metals	Assumed
Freon	Gases	RCRA Metals	Assumed
Mercury vapor lights	Gases, RCRA Metals	RCRA Metals	Assumed
Sodium vapor lights	Gases	RCRA Metals	Assumed
Radiological check sources	Metals	Radiological	Sample
DU counterweights	Metals	Radiological	Assumed
Lead-containing fuses	Metals	RCRA Metals	Assumed
Lead-acid batteries	Metals	RCRA Metals	Assumed
Mercury-containing items	Metals	RCRA Metals	Assumed

Table B.8-1
Known or Anticipated Potential Source Materials
(Page 2 of 2)

Potential Source[a]	Material	Contaminants[b]	Sample/Assumed
Circuit boards	Metals	RCRA Metals, Radiological	Assumed
Lead-glass windows	Metals	RCRA Metals, Radiological	Assumed
Lead solids/shielding	Metals	RCRA Metals, Radiological	Assumed
Mineral oil	Oils	Radiological	Sample
Diesel fuel	Oils	VOCs, SVOCs, Radiological	Sample
Compressor, gear, and hydraulic oils	Oils	VOCs, SVOCs, PCBs, RCRA Metals, Radiological	Sample
Motor oil	Oils	VOCs, SVOCs, PCBs, RCRA Metals	Sample
Metallurgy Lab drains	Solid, liquid, sludge	Radiological, RCRA Metals, VOCs, SVOCs	Sample

[a]Other wastes may be identified during the CAI.
[b]The listed contaminants are the best available based on site history and process knowledge. Actual analytical suites will be determined in the field on a case-by-case basis based on process knowledge, field conditions, etc.

Note: Sample vs. assumed - Some PSMs will be assumed that a contaminant is present and be treated as such with no samples being collected or analyzed. Other PSMs will be sampled to determine whether and what contaminants are present.

The number and locations of Decision I samples to be collected at Building 3900 will be based on biasing factors identified based on radiological surveys and visual inspections of the interior of the building, as well as other biasing factors listed in Section B.4.2.1. Radiological surveys of Building 3900 surfaces (e.g., walls, flooring, HVAC systems) will be used to determine the extent of any remaining surface contamination and its potential to expose a receptor to a dose greater than 25 mrem/yr.

Potential pathways to environmental media from Building 3900 will also be determined by investigating any waste and drain systems (e.g., radioactive waste system, sanitary sewer system) associated with Building 3900. For any portions of waste or drain systems that were not previously investigated under another CAU, the investigation of that system may be incorporated into CAS 25-41-03 based on process knowledge.

B.9.0 References

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Appendix C

Nevada Division of Environmental Protection Comments

(6 Pages)

NEVADA ENVIRONMENTAL MANAGEMENT OPERATIONS ACTIVITY
DOCUMENT REVIEW SHEET

1. Document Title/Number: Streamline Approach for Environmental Restoration (SAFER) Plan for Corrective Action Unit 114: Area 25 EMAD Facility, Nevada National Security Site, Nevada, Revision 0, April 2021	2. Document Date: April 2021
3. Revision Number: 0	4. Originator/Organization: Navarro
5. Responsible EM Nevada Program Activity Lead: Kevin Cabble	6. Date Comments Due: May 2021
7. Review Criteria: Full	
8. Reviewer/Organization Phone No.: Chris Andres candres@ndep.nv.gov ; Nikita Lingenfelter nlingenfelter@ndep.nv.gov	9. Reviewer's Signature:

10. Comment Number/Location		11. Type[a]	12. Comment	13. Comment Response
1.	General Comment		The term "closure objectives" is used throughout the SAFER Plan. Please define in the text what the "closure objectives" are for CAU 114.	In Section 3.1 and in Section B.3.1, the Decision II statement was re-worded to: *Decision II: "Is sufficient information available to meet the closure objectives?" The closure objectives are defined as the following:* • *The volume of waste containing any PSM.* • *The information needed to characterize investigation-derived waste (IDW) for disposal.* • *The information needed to determine potential remediation waste types* An explicit statement that the scope of this SAFER does not cover soil contamination was added to the text in Section 3.2.5 as follows: *If evidence of contamination that is not consistent with the presented CSM is identified during CAI activities (such as soil contamination), NDEP will be notified, the situation will be reviewed, the CSM will be revised, the DQOs will be reassessed, and a recommendation will be made as to how best to proceed. In such cases, participants in the DQO process will be notified and given the opportunity to comment on and/or concur with the recommendation.*

[a]Comment Types: M = Mandatory, S = Suggested.
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2.	Executive Summary, Page ES-1, 2nd Paragraph, 4th to 6th Sentences		Perhaps the fourth sentence should be deleted as a final corrective action, whether no further action, clean closure, or closure-in-place, should be decided based on the results of the additional field investigation, as stated in the fifth and sixth sentences.	The term "no further corrective action" is used in the FFACO to mean that corrective actions are complete and sufficient to close the release under the FFACO. The term "no further action" is used in the FFACO to define a specific corrective action where the release site does not contain any contamination above action levels and does not require remediation.
3.	Executive Summary, Page ES-1, 2nd Paragraph, Last Sentence		Please add a timeline of when the closure report is anticipated to be submitted to the NDEP for review and approval (i.e., when SAFER activities will be completed).	Added the following text to the end of the paragraph: *The schedule for completion of the closure report will be established at the FFACO annual meeting.*

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10. Comment Number/Location	11. Type[a]	12. Comment	13. Comment Response
4. Executive Summary, Page ES-2, Last Paragraph, 3rd Sentence and Section 1.0, Introduction, 1st Paragraph, 2nd Sentence		Currently DOE Environmental Management is not a signatory to the FFACO as they were under the purview of the NNSA/NFO when the last modification of the FFACO was signed. This sentence will need to be reworded to reflect this historical fact.	Re-worded these sentences to: *…has been developed in accordance with the FFACO that was agreed to by the State of Nevada; DOE; and the U.S. Department of Defense.*
5. Section 1.2, Page 6, 3rd Paragraph, 1st Sentence		Please clarify if the clean closure corrective action includes the removal of structures.	Replaced the third sentence of this paragraph with the following text based on the CAU 572 SAFER: *The demolition of structures is planned barring any unforeseen circumstances (e.g., funding, re-utilization). When demolition takes place, it will be completed outside the FFACO process. If a UR is implemented in the CR under the FFACO due to PSM and it is feasible to remove the PSM during demolition activities, the CR will be modified under the FFACO process to document the corrective actions and remove/modify the UR.*

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6.	Section 1.4, Page 8, 2nd and 3rd Sentences		If some PSM does remain following the CAI and is removed during demolition activities, how can the final disposition of the equipment occur independent of the FF ACO (i.e., with it being contaminated)?	Replaced these two sentences with: *If PSM remains on the equipment following the CAI, it will be use restricted under the FFACO. If this PSM is removed during demolition activities, the removal will be conducted under the FFACO and the closure report will be modified to remove the use restriction. Final disposition of the material following PSM removal will occur independent of FFACO closure.*
7.	Section 2.1.3, Page 21, 2nd Paragraph, 4th and 5th Sentences		Present tense verbs are used in these two sentences in this section titled "Previous Investigations" whereas past tense is used in all the other sentences in this Section. Please clarify if the results described in these two sentences are indeed from past investigations or more recent sampling.	The present tense verbs are accurate to describe contamination that is currently present, not actions that are currently taking place. Changing these verbs to the past tense may give the mistaken impression that the contamination is no longer present.
8.	Section 2.1.3, Page 24, 2nd Paragraph, Last Sentence		It is suggested that the term "stakeholders" and the parenthesis around "EM Nevada Program and NDEP" be removed from this sentence as the EM Nevada Program is the responsible party and NDEP is the regulator and are the two agencies who will make the decision to remove any UR.	Changed the sentence to: *The potential to remove the other existing URs will be evaluated during the CAU 114 CAI and in consultation with NDEP.*

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9.	Section 2.4, Page 36, 1st Paragraph		Will any impacted soil not removed during the previous corrective action be removed during or after this CAI, thereby allowing the removal of the current UR?	Removal of contamination not associated with CAU 114 is not within the scope of this SAFER Plan. Any removal of URs will be conducted under the provisions of the FFACO.
10.	Section 3.1, Page 38, 2nd Paragraph		The NDEP requests a discussion be held to learn how the aspects of CAS 25-99-23 and CAS 25-33-05 are "sufficiently similar" to CAS 25-41-03.	Added the following text before the last sentence of this paragraph: *These two additional CASs also do not involve soil contamination and also have the potential to contain PSM (mainly lead shielding and radiological contamination) that is the same or similar to that found in the EMAD facility.*
11.	Section 3.1, Page 38, 4th Paragraph and Page B-3, Section B.2.0, 2nd Paragraph		The problem statements for CAU 114 in these two Sections are not the same. Please correct this discrepancy. Additionally, how do these problem statements account for the two additional CASs of this CAU? It is suggested that any necessary additional information could be included in an Addendum to Appendix B.	The problem statement was changed as follows to be consistent with Section B.2.0: "*Existing information on the nature and extent of potential contamination is insufficient to evaluate and confirm closure of CAS 25-41-03.*" This problem statement equally applies to the two additional CASs as some additional information is also required at these CASs to define the nature and extent of PSM. See the response to the previous comment.
12.	Section 3.2.3, Page 47, 1st Sentence		Please detail what the Judgmental Sample Design is for CAU 114.	Replaced the second sentence of Section 1.2 with: *This process starts with the initial CAI in which the appropriate target population(s) within each CAS component are defined in the DQO process (see Appendix B). The target populations of interest will be sampled using a judgmental sampling design defined as using biased sampling based on visual and radiological surveys.*

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13.	Section 4.4, Page 57, 2nd Paragraph, 2nd Bullet		Please describe what would make a corrective action not feasible and provide examples.	Removed "if feasible" from this sentence.
14.	Section 5.0, Page 59, 1st Paragraph, 1st Sentence		Remove "upon request." FFACO related reports/documents generated during ongoing field activities should always be provided to NDEP.	Replaced this sentence with: *"Supplemental reports and information (other than FFACO reports) generated during ongoing field activities will be provided to NDEP upon request."*
15.	Section 5.0, Page 59, Last Sentence		Please explain the basis of the last sentence.	Deleted this sentence.
16.	Section 6.2.3, Page 62, 11th Sentence		"RCRA-regulated hazardous waste" should be changed to "RCRA characteristic hazardous waste" as "RCRA-listed waste" is also regulated.	Deleted this sentence.
17.	Section B.6.2, Page B-19, 3rd Paragraph, 2nd Sentence		Remove "necessarily" from the sentence. The first sentence clearly states that PALs present in this section are to be used for screening purposes.	Removed the word "necessarily" from this sentence.

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