

Nevada
Environmental
Management
Operations Activity

DOE/NV--1556



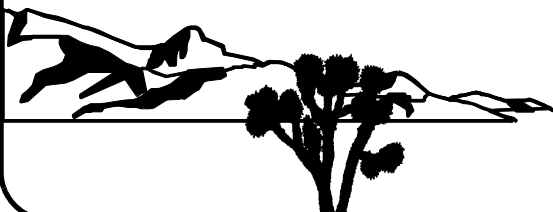
Closure Report for Corrective Action Unit 573: Alpha Contaminated Sites Nevada National Security Site, Nevada

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March 2017

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**CLOSURE REPORT FOR
CORRECTIVE ACTION UNIT 573:
ALPHA CONTAMINATED SITES
NEVADA NATIONAL SECURITY SITE, NEVADA**

U.S. Department of Energy, National Nuclear Security Administration
Nevada Field Office
Las Vegas, Nevada

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**CLOSURE REPORT FOR CORRECTIVE ACTION UNIT 573:
ALPHA CONTAMINATED SITES
NEVADA NATIONAL SECURITY SITE, NEVADA**

Approved by: /s/ Tiffany A. Lantow

Date: 03/27/2017

Tiffany A. Lantow
Soils Activity Lead

Approved by: /s/ Robert F. Boehlecke

Date: 03/28/2017

Robert F. Boehlecke
Environmental Management Operations Manager

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List of Acronyms and Abbreviations

General Acronyms and Abbreviations

ALARA	As low as reasonably achievable
bgs	Below ground surface
BMP	Best management practice
CA	Contamination area
CAA	Corrective action alternative
CADD	Corrective action decision document
CAI	Corrective action investigation
CAIP	Corrective action investigation plan
CAP	Corrective action plan
CAS	Corrective action site
CAU	Corrective action unit
CD	Certificate of Disposal
CFR	<i>Code of Federal Regulations</i>
cm	Centimeter
COC	Contaminant of concern
COPC	Contaminant of potential concern
cpm	Counts per minute
CR	Closure report
CSM	Conceptual site model
DOE	U.S. Department of Energy
DQA	Data quality assessment
DQI	Data quality indicator
DQO	Data quality objective

List of Acronyms and Abbreviations (Continued)

EPA	U.S. Environmental Protection Agency
FAL	Final action level
FFACO	<i>Federal Facility Agreement and Consent Order</i>
FIDLER	Field instrument for the detection of low-energy radiation
ft	Foot
ft ³	Cubic foot
gal	Gallon
GIS	Geographic Information Systems
GPS	Global Positioning System
GZ	Ground zero
HCA	High contamination area
IDW	Investigation-derived waste
LLW	Low-level waste
m	Meter
m ²	Square meter
m ³	Cubic meter
MDC	Minimum detectable concentration
MLLW	Mixed low-level waste
M&O	Management and operating
mrem/IA-yr	Millirem per Industrial Area year
mrem/OU-yr	Millirem per Occasional Use Area year
mrem/RW-yr	Millirem per Remote Work Area year
mrem/yr	Millirem per year
M&TE	Measuring and test equipment
N/A	Not applicable

List of Acronyms and Abbreviations (Continued)

NAC	<i>Nevada Administrative Code</i>
NAD	North American Datum
NDEP	Nevada Division of Environmental Protection
NIST	National Institute of Standards and Technology
NNSA/NFO	U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office
NNSS	Nevada National Security Site
NNSSWAC	Nevada National Security Site Waste Acceptance Criteria
OU	Occasional use
PCB	Polychlorinated biphenyl
pCi/g	Picocuries per gram
PPE	Personal protective equipment
PSM	Potential source material
QA	Quality assurance
QAP	Quality Assurance Plan
QC	Quality control
r^2	Coefficient of determination
RBCA	Risk-based corrective action
RCRA	<i>Resource Conservation and Recovery Act</i>
RRMG	Residual radioactive material guideline
RWMC	Radioactive waste management complex
TED	Total effective dose
TLD	Thermoluminescent dosimeter
TSDF	Treatment, storage, and disposal facility
UCL	Upper confidence limit

List of Acronyms and Abbreviations (Continued)

UR	Use restriction
UTM	Universal Transverse Mercator
yd ³	Cubic yard

Symbols for Elements and Compounds

Am	Americium
Cs	Cesium
Eu	Europium
Pu	Plutonium
Th	Thorium
U	Uranium

Executive Summary

This Closure Report (CR) presents information supporting the closure of Corrective Action Unit (CAU) 573: Alpha Contaminated Sites, Nevada National Security Site, Nevada. This CR complies with the requirements of the *Federal Facility Agreement and Consent Order* (FFACO) that was agreed to by the State of Nevada; U.S. Department of Energy (DOE), Environmental Management; U.S. Department of Defense; and DOE, Legacy Management. CAU 573 comprises the two corrective action sites (CASs) listed in [Table ES-1](#).

Table ES-1
CAU 573 CASs and Corrective Actions

CAS Number	CAS Description	Corrective Action
05-23-02	GMX Alpha Contaminated Area	Closure in Place
05-45-01	Atmospheric Test Site - Hamilton	Clean Closure

The purpose of this CR is to provide justification and documentation supporting the recommendation that no further corrective action is needed for CAU 573 based on the implementation of the corrective actions listed in [Table ES-1](#).

Corrective action activities were performed at Hamilton from May 25 through June 30, 2016; and at GMX from May 25 to October 27, 2016, as set forth in the *Corrective Action Decision Document* (CADD)/*Corrective Action Plan* (CAP) for *Corrective Action Unit 573: Alpha Contaminated Sites*; and in accordance with the *Soils Activity Quality Assurance Plan*, which establishes requirements, technical planning, and general quality practices.

Verification sample results were evaluated against data quality objective criteria developed by stakeholders that included representatives from the Nevada Division of Environmental Protection and the DOE, National Nuclear Security Administration Nevada Field Office (NNSA/NFO) during the corrective action alternative (CAA) meeting held on November 24, 2015. Radiological doses exceeding the final action level were assumed to be present within the high contamination areas associated with CAS 05-23-02, thus requiring corrective action. It was also assumed that radionuclides were present at levels that require corrective action within the soil/debris pile associated with CAS 05-45-01.

During the CAU 573 CAA meeting, the CAA of closure in place with a use restriction (UR) was selected by the stakeholders as the preferred corrective action of the high contamination areas at CAS 05-23-02 (GMX), which contain high levels of removable contamination; and the CAA of clean closure was selected by the stakeholders as preferred corrective action for the debris pile at CAS 05-45-01 (Hamilton).

The closure in place was accomplished by posting signs containing a warning label on the existing contamination area fence line; and recording the FFACO UR and administrative UR in the FFACO database, the NNSA/NFO CAU/CAS files, and the management and operating contractor Geographic Information Systems. The clean closure was accomplished by excavating the soil/debris pile, disposing of the contents at the Area 5 Radioactive Waste Management Complex, and collecting verification samples.

The corrective actions were implemented as stipulated in the CADD/CAP, and verification sample results confirm that the criteria for the completion of corrective actions have been met. Based on the implementation of these corrective actions, NNSA/NFO provides the following recommendations:

- No further corrective actions are necessary for CAU 573.
- The Nevada Division of Environmental Protection should issue a Notice of Completion to NNSA/NFO for closure of CAU 573.
- CAU 573 should be moved from Appendix III to Appendix IV of the FFACO.

1.0 Introduction

This Closure Report (CR) documents closure activities for Corrective Action Unit (CAU) 573, Alpha Contaminated Sites, located at the Nevada National Security Site (NNSS), Nevada, in accordance with the *Federal Facility Agreement and Consent Order* (FFACO) (1996, as amended) that was agreed to by the State of Nevada; U.S. Department of Energy (DOE), Environmental Management; U.S. Department of Defense; and DOE, Legacy Management. CAU 573 comprises the two corrective action sites (CASs) shown on [Figure 1-1](#) and listed below:

- 05-23-02, GMX Alpha Contaminated Area
- 05-45-01, Atmospheric Test Site - Hamilton

CAU 573 is located in the east (Hamilton) and northeast (GMX) portions of Area 5, as shown on [Figure 1-1](#). These two CASs include releases from 29 equation-of-state experiments (physical properties of materials at high temperature and pressure) and one weapons-related tower test. A detailed discussion of the history of this CAU is presented in the *Corrective Action Investigation Plan (CAIP) for Corrective Action Unit 573: Alpha Contaminated Sites* (NNSA/NFO, 2014a).

1.1 Purpose

The purpose of this CR is to provide documentation and justification that no further corrective action is needed for the closure of CAU 573 based on the implementation of corrective actions. This includes a description of closure activities that were performed and an evaluation of the verification data. The *Corrective Action Decision Document (CADD)/Corrective Action Plan (CAP) for Corrective Action Unit 573: Alpha Contaminated Sites* (NNSA/NFO, 2016b) provides additional information relating to the selection of corrective action alternatives (CAAs) and the reasoning behind their selection.

1.2 Scope

As presented in the CAU 573 CADD/CAP (NNSA/NFO, 2016b), the CAA of closure in place with a use restriction (UR) was selected by the stakeholders in the CAA meeting held on November 24, 2015, as the preferred corrective action for GMX. Clean closure was not selected due to the presence

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of high levels of removable contamination that would require significant radiological controls to protect workers from inhaling or ingesting airborne radioactive particles. Even if the site were clean closed, the area surrounding the high contamination areas (HCAs) would still be posted as a contamination area (CA). Therefore, the corrective action of closure in place with a UR was selected for GMX.

In addition to the corrective actions completed at GMX, another activity was implemented to address point source contamination (i.e., small particles of uranium and plutonium metal) identified in the CAIP (NNSA/NFO, 2014a) and the CADD/CAP (NNSA/NFO, 2016b). The removal and consolidation of the point sources was a conservative measure performed as a best management practice (BMP) to address material accountability and contamination control concerns. Because the point sources were determined to be below the action level (hot spot criterion defined in [Appendix I](#)), this was not considered a corrective action under the FFACO (1996, as amended). Removal and consolidation of the point sources is further discussed in [Sections 2.1.1](#) and [2.2](#).

As presented in the CADD/CAP (NNSA/NFO, 2016b), the CAA of clean closure was selected by the stakeholders in the CAA meeting held on November 24, 2015, as the preferred corrective action for the debris pile at Hamilton. Without dismantling the pile, it could not be determined during the corrective action investigation (CAI) whether the debris pile contained contaminants of concern (COCs). Thus, it was determined to assume that the pile contained COCs and to remove the pile as a clean closure. Clean closure at the Hamilton site was accomplished by implementing the corrective actions of removing the soil pile and collecting soil samples to demonstrate that contaminants were no longer present at levels that would cause a dose exceeding the final action level (FAL).

The closure activities were completed in accordance with the CADD/CAP and in accordance with the *Soils Activity Quality Assurance Plan* (QAP) (NNSA/NSO, 2012b), which establishes requirements, technical planning, and general quality practices. The verification sample results and the risk associated with site contamination were evaluated in accordance with the *Soils Risk-Based Corrective Action* (RBCA) *Evaluation Process* (NNSA/NFO, 2014b).

1.3 CR Contents

This CR is divided into the following sections and appendices:

- [Section 1.0](#), “Introduction,” summarizes the purpose, scope, and contents of this CR.
- [Section 2.0](#), “Closure Activities,” summarizes the closure activities, deviations from the CADD/CAP, the schedule, and the site conditions after completion of corrective actions.
- [Section 3.0](#), “Waste Disposition,” discusses the wastes generated and entered into an approved waste management system as a result of the corrective action.
- [Section 4.0](#), “Closure Verification Results,” describes verification activities and results.
- [Section 5.0](#), “Conclusions and Recommendations,” provides the conclusions and recommendations along with the rationale for their determination.
- [Section 6.0](#), “References,” provides a list of all referenced documents used in the preparation of this CR.
- [Appendix A](#), *DQOs as Developed in the CADD/CAP*, provides the DQOs as presented in Appendix F of the CAU 573 CADD/CAP.
- [Appendix B](#), *Closure Certification*, documents the specific closure activities completed for the CAU.
- [Appendix C](#), *As-Built Documentation*, identifies the as-built drawings for each CAS.
- [Appendix D](#), *Confirmation Sampling Test Results*, provides a description of the project objectives, field closure and sampling activities, and closure results.
- [Appendix E](#), *Waste Disposition Documentation*, documents disposal of items removed during closure activities.
- [Appendix F](#), *Modifications to the Post-Closure Plan*, documents any modifications to the Post-Closure Plan.
- [Appendix G](#), *Use Restrictions*, documents the URs.
- [Appendix H](#), *Sample Location Coordinates*, provides the coordinates of the sample locations.
- [Appendix I](#), *Radiological Hot Spot Criterion*, provides the development of site-specific hot spot criteria.
- [Appendix J](#), *Nevada Division of Environmental Protection (NDEP) Comments*, contains NDEP comments on the draft version of this document.

1.3.1 Applicable Programmatic Plans and Documents

All closure activities were performed in accordance with the following documents:

- CADD/CAP for CAU 573, Alpha Contaminated Sites (NNSA/NFO, 2016b)
- CAIP for CAU 573, Alpha Contaminated Sites (NNSA/NFO, 2014a)
- Soils QAP (NNSA/NSO, 2012b)
- Soils RBCA document (NNSA/NFO, 2014b)
- FFACO (1996, as amended)

1.3.2 Data Quality Objectives

This section contains a summary of the data quality objective (DQO) process that is presented in [Appendix A](#). The DQOs were developed to identify data needs, clearly define the intended use of the environmental data, and design a data collection program that will satisfy these purposes.

The problem statement for CAU 573 is as follows: “Existing information is insufficient to determine whether COCs are present after removal of the debris pile at Hamilton.” To address this problem, the resolution of the following decision statement is required:

- *“Do COCs remain in the soil beneath the debris pile following removal?”* For the judgmental sampling design, any contaminant associated with a release from the CAS that is remaining at levels that would cause a dose exceeding its corresponding FAL will be defined as a COC.

The presence of a COC or removable contamination that exceeds HCA criteria would require additional soil removal.

For the potential source material (PSM) element of the conceptual site model (CSM), an additional evaluation is made for the potential exposure to point sources of contamination. This evaluation (presented in [Appendix I](#)) considers the need for corrective action for small areas that may contain unacceptably high levels of residual radioactive material (i.e., hot spots) even though they do not cause a dose that exceeds the FAL (due to averaging over the 1,000-square-meter (m²) exposure area as prescribed in the Soils RBCA document [NNSA/NFO, 2014b]).

1.3.3 Data Quality Assessment Summary

The CAIP (NNSA/NFO, 2014a) contains the DQOs as agreed to by stakeholders before the field investigation. The DQO process ensures that the right type, quality, and quantity of data will be available to support the resolution of those decisions with an appropriate level of confidence. A data quality assessment (DQA) was conducted that evaluated the degree of acceptability and usability of the reported data in the decision-making process. This DQA is presented in [Section 4.1](#). Using both the DQO and DQA processes helps to ensure that DQO decisions are sound and defensible.

Based on this evaluation, the nature and extent of COCs at CAU 573 have been adequately identified to implement the corrective actions. Information generated during the investigation supports the CSM assumptions, and the data collected met the DQOs and support their intended use in the decision-making process.

2.0 Closure Activities

The CAU 573 CADD/CAP (NNSA/NFO, 2016b) identified the preferred corrective action as closure in place with a UR for GMX and clean closure for Hamilton. In order to supplement existing data and determine whether site closure objectives have been achieved, additional data were collected at CAU 573 as part of the closure activities. Results of verification sampling for individual CAU 573 CASs are presented in [Appendix D](#) of this document.

2.1 Description of Corrective Action Activities

2.1.1 CAS 05-23-02, GMX Alpha Contaminated Area

The corrective action of closure in place was implemented by establishing an FFACO UR for Corrective Action Boundaries A and B in the areas where removable contamination exceeds the HCA criteria (currently coincides with the HCA boundaries). To facilitate inspection and maintenance, UR signs were placed at locations designed to prevent inadvertent intrusion to the site (e.g., at the entrance to the CA and along the CA fence perimeter) in accordance with Section 5.1 of the CADD/CAP (NNSA/NFO, 2016b). The FFACO UR (see [Attachment G-1](#)) was recorded in the FFACO database, the NNSA/NFO CAU/CAS files, and the management and operating (M&O) contractor Geographic Information Systems (GIS).

Additional activities at GMX included the evaluation of hot spots of radioactivity associated with debris. [Figure 2-1](#) shows the locations of 12 hot spots with the highest radioactivity from the drive-over radiological survey as shown in the CAIP (NNSA/NFO, 2014a). The hot spot areas are very small and are individually shown at a larger scale in [Figure 2-1](#) to be visible.

A static field instrument for the detection of low-energy radiation (FIDLER) reading was taken at the hot spot location with the highest radioactivity. The static reading at this location was 670,000 counts per minute (cpm), which is much less than the hot spot criterion (900,000 cpm) presented in [Appendix I](#). Therefore, it was concluded that none of the hot spots exceeded the 25-millirem per Occasional Use Area year (mrem/OU-yr) hot spot FAL. However, debris and small quantities of associated soil (less than 0.05 cubic meter [m³]) associated with the 12 hot spots were removed as a BMP. [Figure 2-2](#) and [Table D.1-7](#) presents the results of the FIDLER survey after the hot spots were

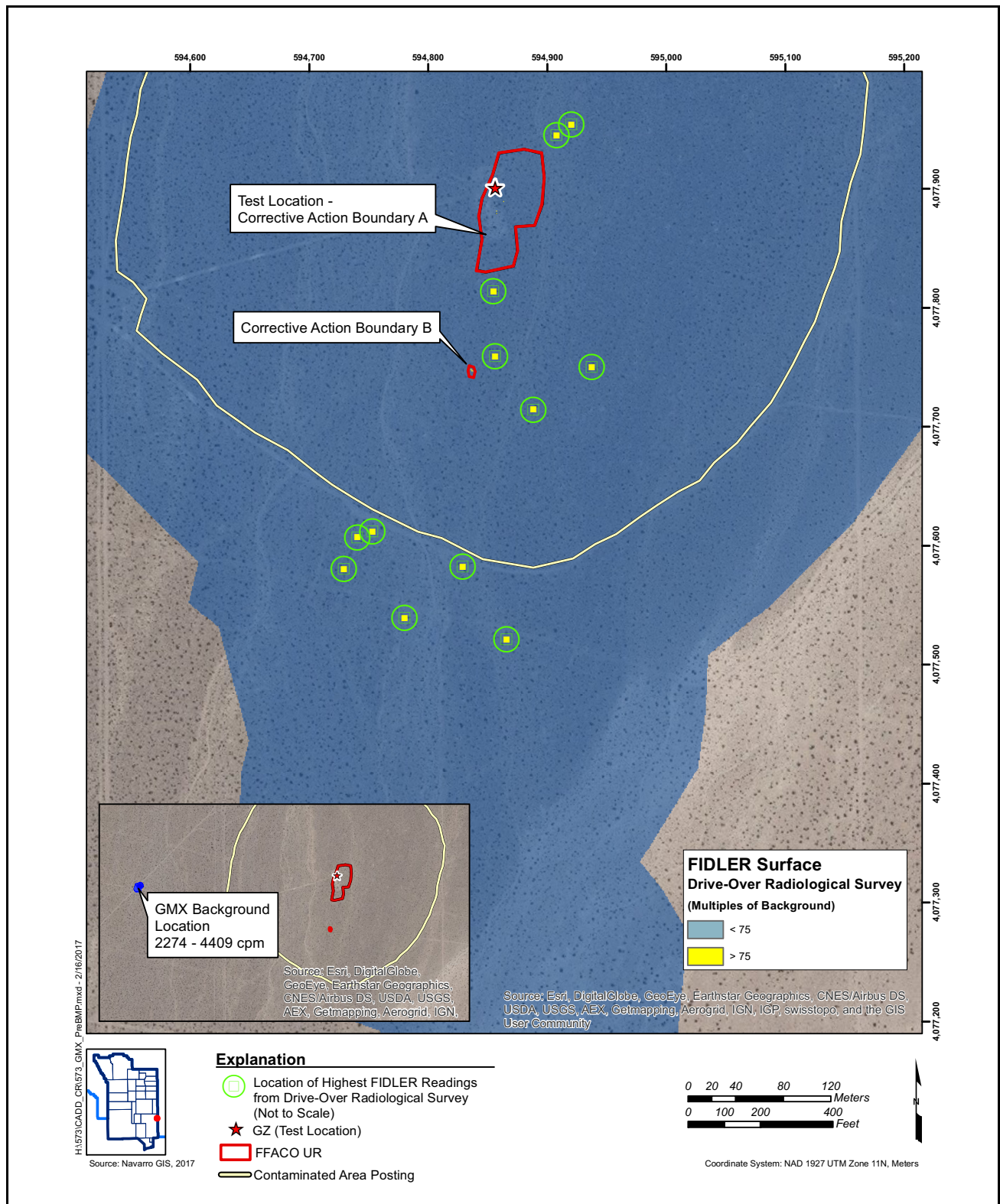


Figure 2-1
GMX Pre-BMP Hot Spots

removed. Note that radiation survey background values presented on different figures vary due to differences in cosmic, terrestrial, and radon radiation levels; different instrument efficiencies; and different voltage/gain adjustments on survey instruments.

These materials were relocated to Corrective Action Boundary A, which contains the test location (referred to as “ground zero” [GZ]), as this area is radiologically protected and already contains like materials. Although all activities for GMX were completed as prescribed in the CADD/CAP (NNSA/NFO, 2016b), the evaluation of hot spots was not presented in the CADD/CAP and is, therefore, presented in [Section 2.2](#) as a deviation.

2.1.2 CAS 05-45-01, Atmospheric Test Site - Hamilton

Corrective action activities were conducted at Hamilton from May 25 through June 30, 2016. This site consisted of a large soil and debris pile, and radioactive contaminants were assumed to be present within the pile at levels that would cause a dose above the FAL. Approximately 200 cubic yards (yd³) of soil and debris was excavated and disposed of at the Area 5 Radioactive Waste Management Complex (RWMC). [Figures 2-3](#) through [2-12](#) show the area before, during, and after the removal of the soil and debris pile.

A FIDLER radiation survey was conducted over the excavated area after the removal activities for the purpose of biasing the location of the verification sample plot. There is no previous terrestrial radiation survey of the pile area to compare to the post-excavation survey, as a pre-removal survey could not be safely conducted over the pile. The results of the post-excavation FIDLER survey are presented in [Figure 2-13](#). However, because the excavated area was slightly smaller than the size of the sample plot, the sample plot was centered over the excavated area.

This FIDLER survey covered the entire area as well as the area immediately surrounding the excavation. The survey tracks are either linear or spiral in nature, with parallel tracks used to ensure complete coverage. Positional resolution in the Global Positioning System (GPS) limits recording of the actual position to 1 meter (m). When the positional data are plotted in small scale (as in [Figure 2-13](#)), the parallel track nature of the survey is not readily apparent. This is the result of the survey GPS positional accuracy, not the actual survey conducted. The elevated readings outside

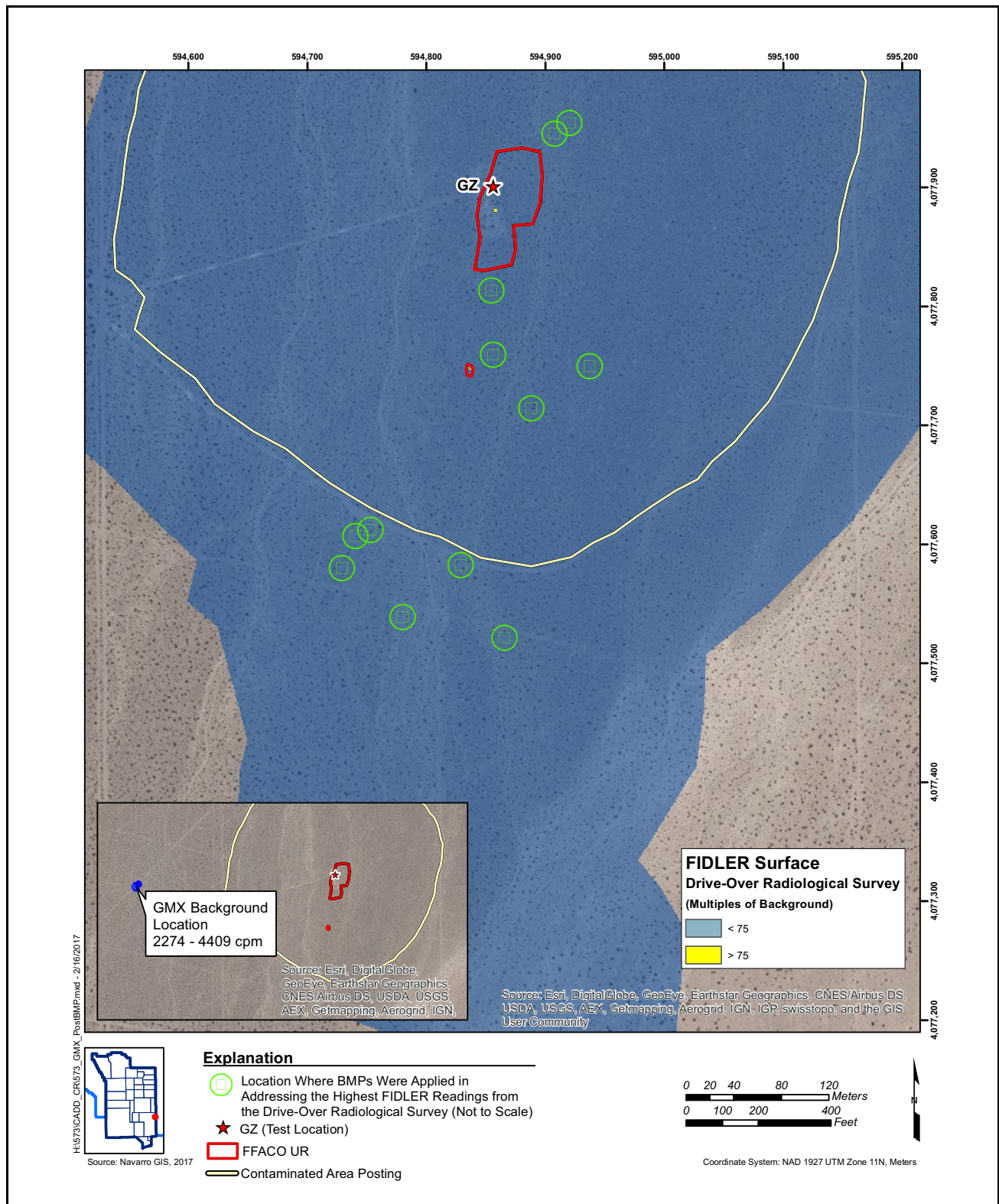


Figure 2-2
GMX Post-BMP Hot Spots



Figure 2-3
Hamilton Site at Beginning of Soil/Debris Pile Removal



Figure 2-4
Removal of Hamilton Soil/Debris Pile



Figure 2-5
Removal of Hamilton Soil/Debris Pile



Figure 2-6
Removal of Hamilton Soil/Debris Pile



Figure 2-7
Removal of Hamilton Soil/Debris Pile



Figure 2-8
Waste Packaging of Soil/Debris Pile Material



Figure 2-9
Loading of Waste Containers for Transport



Figure 2-10
Waste Management of Concrete Slab



Figure 2-11
Concrete Slab Wrapped and Loaded for Transport



Figure 2-12
Hamilton Site after Removal of Soil/Debris Pile

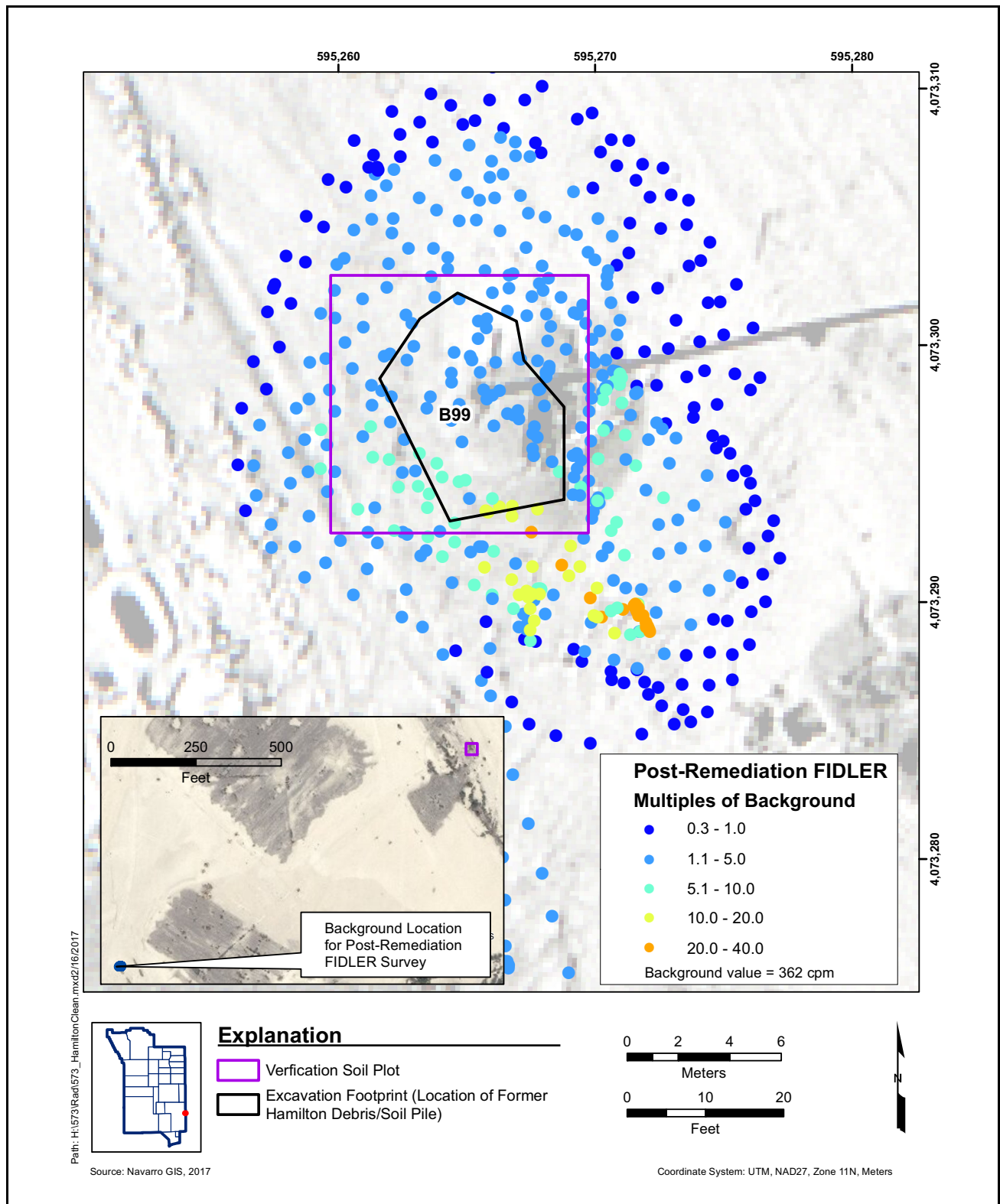


Figure 2-13
FIDLER Survey of Hamilton Site after Soil/Debris Pile Removal

the excavated area shown in [Figure 2-13](#) were evaluated in the CADD/CAP (NNSA/NFO, 2016b) and were shown to be below the FAL.

However, the FIDLER survey was not used to bias the location of the verification sample plot, as the excavation area was slightly smaller than the size of the sample plot. Therefore, the sample plot was centered over the excavation area. Four composite verification samples were collected from a soil plot at the location where the soil and debris pile had been located ([Figure 2-13](#)). Contents of a transformer ([Figure 2-14](#)) found in the soil pile were not sampled, as the transformer did not contain any liquid. Soil in the immediate area around the location where the transformer was found was inspected for signs of staining. As no staining or other biasing factors were observed, no additional samples were collected.



Figure 2-14
Transformer Recovered from Soil/Debris Pile at Hamilton

2.2 Deviations from CADD/CAP as Approved

The activities in the CADD/CAP (NNSA/NFO, 2016b) were implemented as planned. There were no deviations in the corrective actions or verification sampling specified in the CAU 573 CADD/CAP. An additional activity was implemented to address the hot spots of radioactivity identified in the CAU 573 CAIP (NNSA/NFO, 2014a) and the CAU 573 CADD/CAP (NNSA/NFO, 2016b).

Point source contamination, consisting of small particles of uranium and plutonium metal were identified at GMX in the CAU 573 CADD/CAP. While performing FIDLER surveys during closure activities in May/June 2016, additional point sources were identified outside the CA. At this time, project personnel elevated a concern due to potential material control issues associated with the point sources. After evaluation by additional subject matter experts, it was determined that several of the locations would require postings to comply with 10 *Code of Federal Regulations* (CFR) 835 requirements (CFR, 2016).

In September 2016, while workers were performing additional activities outside the GMX CA, removable radiological contamination exceeding the 10 CFR 835 criteria was discovered outside the posted area. Given the unusual circumstances (e.g., material control concerns, removable contamination), and to mitigate further concerns in regard to removable contamination in multiple locations outside the GMX CA, a determination was made to remove and consolidate the hot spot material within the existing test location HCA radiological posted area as a BMP.

In September/October 2016, elevated point sources (debris and small quantities of soil) were removed and relocated to the larger posted area around the GMX GZ. After the BMP was completed, a “hot spot criterion” was developed and approved for the CAU 414 CAIP (NNSA/NFO, 2016a). This was adapted for GMX debris to determine whether the hot spot removal would be considered a corrective action. As some of the drive-over survey values exceeded the limit of the FIDLER, the hot spot removal was initially considered to be a corrective action. Due to NDEP concerns, a revised hot spot evaluation approach was developed for GMX (see [Appendix I](#)). Based on static FIDLER data performed after the instruments were calibrated, the hot spots were demonstrated to be below corrective action levels (see [Table D.1-7](#)). As shown in [Section 2.1.1](#), none of the hot spots exceeded one-half of the hot spot criterion. Therefore, the removal activities were classified as a BMP.

2.3 Corrective Action Schedule as Completed

The Hamilton site closure activities, which consisted of the excavation and disposal of the contaminated soil pile within the CA, took place from May 25 through June 30, 2016. [Table 2-1](#) presents a summary of closure activity dates.

Table 2-1
Corrective Action Schedule for CAU 573, Hamilton Site

Date	Activity
May 25, 2016	Staged equipment.
May 26–June 2, 2016	M&O contractor staged clean soil at site.
June 8, 2016	Performed site walkdown and setup.
June 9, 2016	Built clean pad in CA; delivered waste containers to site.
June 13, 2016	Delivered and inspected waste containers.
June 14, 2016	Placed clean soil around pile.
June 15–23, 2016	Removed and segregated debris (including transformer) from pile; loaded waste containers; prepared and transported waste containers to landfill.
June 27, 2016	Prepared concrete slab for disposal.
June 28, 2016	Surveyed excavated area; laid out sample plot; collected soil sample.
June 29, 2016	Shipped concrete slab; cleaned up area; surveyed equipment.
June 30, 2016	Demobilized from site.

The GMX closure activities, which consisted of placing warning signs on the existing CA fence line, took place from May 25 to March 30, 2017. [Table 2-2](#) presents a summary of closure activity dates.

Table 2-2
Corrective Action Schedule for CAU 573, GMX Site

Date	Activity
May 25–June 6, 2016	Performed FIDLER drive-over survey outside CA.
June 6, 2016	Screened material outside CA.
June 7, 2016	Screened fragments inside CA.
June 8, 2016	Posted material outside CA.
October 24–27, 2016	Consolidated hot spot fragments to inside HCA.
March 2017	Placed UR signs.

2.4 *Site Plans/Survey Plat*

As-built drawings were not required for CAU 573 closure activities. UR maps are presented in [Attachment G-1](#).

3.0 Waste Disposition

This section addresses the characterization and management of remediation wastes. Waste management activities were conducted as specified in the CADD/CAP (NNSA/NFO, 2016b).

3.1 Generated Wastes

The wastes listed in [Table 3-1](#) were generated during closure activities at CAU 573. Wastes were segregated to the greatest extent possible, and waste minimization techniques were integrated into the field activities to reduce the amount of waste generated. Controls were in place to minimize the use of hazardous materials and to avoid the unnecessary generation of hazardous and/or mixed waste. Decontamination activities were planned and executed to minimize the volume of rinsate generated.

The amount, type, and source of waste placed into each container were recorded in waste management records that are maintained in the CAU 573 file.

Wastes generated during the corrective action activities were segregated into the following waste types:

- Mixed low-level radioactive waste (MLLW), consisting of radiologically contaminated elemental lead debris (lead bricks, lead plate, and lead-sheathed cable).
- Low-level radioactive waste (LLW), consisting of soil and debris, and a large concrete slab.
- Investigation-derived waste (IDW), which includes debris consisting of plastic sheeting, glass/plastic sample jars, personal protective equipment (PPE), sampling scoops, and disposable aluminum pans was generated during the investigation and remediation of the site.

In situ decontamination techniques were employed to eliminate decontamination waste.

A total of 13 drums of debris wastes and 17 bulk shipment containers of soil and debris were generated during the corrective action activities:

- One drum of MLLW was transferred to the M&O contractor for microencapsulation treatment and disposal at the Area 5 RWMC.

**Table 3-1
Waste Summary Table**

CAS	Waste Stream	Waste Characterization				Waste Disposition			
		Hazardous	Hydrocarbon	PCBs	Radioactive	Disposal Facility	Waste Volume	Disposal Date	Disposal Doc ^a
05-45-01	Lead Debris	Yes	No	No	Yes	Area 5 RWMC	1 × 10 gal	06/29/2015	CD
05-45-01	PPE/Debris	No	No	No	Yes	Area 5 RWMC	12 × 55 gal	03/31/2016 and 07/14/2016	CD
05-45-01	Soil/Debris	No	No	No	Yes	Area 5 RWMC	16 × 13.6 yd ³	06/21/2016 through 06/28/2016	CD
05-45-01	Concrete Slab	No	No	No	Yes	Area 5 RWMC	1 × 2.24 yd ³	06/29/2016	CD

^aCopies of waste disposal documents are located in [Appendix E](#) of this document.

CD = Certificate of Disposal

gal = Gallon

PCB = Polychlorinated biphenyl

- Twelve drums of PPE were generated. These drums were shipped as LLW for disposal at the Area 5 RWMC in accordance with requirements in the *Nevada National Security Site Waste Acceptance Criteria* (NNSSWAC) (NNSA/NFO, 2015).
- Sixteen supersack packages (each containing approximately 13.6 yd³ of soil/debris waste) were transported in 25-yd³ intermodal roll-off containers and disposed of as LLW at the Area 5 RWMC in accordance with NNSSWAC requirements (NNSA/NFO, 2015).
- One concrete slab was disposed of as LLW at the Area 5 RWMC in accordance with NNSSWACC requirements (NNSA/NFO, 2015).

3.2 Waste Characterization and Disposal

Waste characterization was based on process knowledge, radiological survey results, and analytical results of direct and/or associated samples. All generated wastes were characterized as containing low-level radioactivity attributed to residual soil adhering to the PPE and disposable sampling equipment. The radiological characterizations of each of the waste streams were based elevated levels of radionuclides in analytical results obtained from associated soil samples. These data were used to calculate the overall activity and activity concentration in each waste container. A brief description of the characterization information for each waste stream is provided below:

- The lead debris items were also characterized using process knowledge. Elemental lead identified in the debris items qualifies these as *Resource Conservation and Recovery Act* (RCRA)-regulated hazardous waste. As these waste items were characterized as containing low-level radioactivity, this waste stream was characterized as MLLW.
- The PPE and disposable sampling equipment were also characterized using process knowledge. Visual inspections for staining were conducted as the waste was generated to identify a potential for cross-contamination with hazardous and/or chemical contamination. Results of the visual inspection did not identify any staining. Therefore, the PPE and disposable sampling equipment waste stream was characterized as LLW.
- The bulk soil and debris waste generated at Hamilton were characterized using direct soil samples collected from the waste pile. The analytical results from these samples did not indicate any hydrocarbons, PCBs, or RCRA-regulated hazardous constituents above regulatory limits. The results indicated several radioisotopes exceeding the Table 4-2 limits of the NNSS Radiological Control Manual (NNSA/NSO, 2012a). Therefore, the waste was characterized as LLW.

- The concrete slab was also characterized using process knowledge. A visual inspection did not identify any staining that would indicate contamination from hydrocarbons, PCBs, and/or other RCRA-regulated hazardous constituents. As these waste items were characterized as containing low-level radioactivity, the waste was characterized as LLW and managed separately as a surface contaminated object.

The executed waste shipping and disposal documentation for CAU 573 are included in [Appendix E](#).

4.0 Closure Verification Results

All corrective actions were implemented as specified in the CADD/CAP (NNSA/NFO, 2016b). For the GMX site, the corrective action of closure in place was implemented by establishing an FFACO UR. No verification samples were required or collected at GMX.

For the Hamilton site, the corrective action of clean closure was implemented, and samples were collected after completion of corrective action activities to verify that site closure objectives had been achieved. A sample plot was established at location B99, and four samples were collected. Values for both the average total effective dose (TED) and the 95 percent upper confidence limit (UCL) of the TED for the Industrial Area, Remote Work Area, and Occasional Use Area exposure scenarios were calculated as described in the Soils RBCA document (NNSA/NFO, 2014b) and are summarized in [Table 4-1](#).

Table 4-1
Hamilton TED (mrem/yr^a)

Release	Location	Industrial Area		Remote Work Area		Occasional Use Area	
		Average TED	95% UCL of TED	Average TED	95% UCL of TED	Average TED	95% UCL of TED
05-45-01	B99	7.4	9.7	1.2	1.6	0.4	0.6

^a Doses presented here are a conservative estimate of maximum potential dose for decision-making purposes only and are not intended to represent actual doses to a receptor.

mrem/yr = Millirem per year

Data to calculate radiological dose were provided by the analysis of soil samples collected at the conclusion of the corrective action activity. All necessary CAU 573 sampling locations were accessible; and sampling activities at planned locations were not restricted by buildings, storage areas, active operations, or aboveground and underground utilities.

The analytical results are presented in [Appendix D](#). The closure objectives as presented in Section 5.4 of the CADD/CAP were achieved as indicated below:

- Radiological contamination at Hamilton is less than the FAL of the occasional use (OU) exposure scenario (i.e., the radiological dose is less than the FAL). The analytical results of samples collected from the verification sample plot did not exceed the FAL for radiological dose.
- An FFACO UR was established at GMX (see [Attachment G-1](#)). To facilitate inspection and maintenance, UR signs were placed at locations designed to prevent inadvertent intrusion to the site (e.g., at the entrance to the CA and along the CA fence perimeter) in accordance with Section 5.1 of the CADD/CAP (NNSA/NFO, 2016b).

Closure verification results consist of the analytical results from environmental samples that demonstrate that closure objectives were met. For the corrective action of clean closure at Hamilton, verification results demonstrate that contaminants no longer exist within the CAS in levels that would cause a dose greater than the FALs.

4.1 Data Quality Assessment

The DQA process is the scientific evaluation of the actual investigation results to determine whether the DQO criteria established in the CADD/CAP (NNSA/NFO, 2016b) were met and whether DQO decisions can be resolved at the desired level of confidence. The DQO process ensures that the right type, quality, and quantity of data will be available to support the resolution of those decisions at an appropriate level of confidence. Using both the DQO and DQA processes helps to ensure that DQO decisions are sound and defensible.

The DQA involves five steps that begin with a review of the DQOs and end with an answer to the DQO decisions. These steps are briefly summarized as follows:

1. *Review DQOs and Sampling Design.* Review the DQO process to provide context for analyzing the data. State the primary statistical hypotheses; confirm the limits on decision errors for committing false-negative (Type I) or false-positive (Type II) decision errors; and review any special features, potential problems, or any deviations to the sampling design.
2. *Conduct a Preliminary Data Review.* A preliminary data review should be performed by reviewing quality assurance (QA) reports and inspecting the data both numerically and graphically, validating and verifying the data to ensure that the measurement systems

performed in accordance with the criteria specified, and using the validated dataset to determine whether the quality of the data is satisfactory.

3. *Select the Test.* Select the test based on the population of interest, population parameter, and hypotheses. Identify the key underlying assumptions that could cause a change in one of the DQO decisions.
4. *Verify the Assumptions.* Perform tests of assumptions. If data are missing or censored, determine the impact on DQO decision error.
5. *Draw Conclusions from the Data.* Perform the calculations required for the test.

4.1.1 Review DQOs and Sampling Design

This section contains a review of the DQO process presented in [Appendix A](#). The DQO decision is presented with the DQO provisions to limit false-negative or false-positive decision errors. Special features, potential problems, or any deviations to the sampling design are also presented.

The FAL for radioactivity was established in Appendix D of the CADD/CAP (NNSA/NFO, 2016b) based on a dose limit of 25 mrem/yr over an annual exposure time of 80 hours (i.e., the Occasional Use Area exposure scenario). To be comparable to this action level, the CAU 573 investigation results are presented in terms of the dose a receptor would receive from site contamination under the Occasional Use Area (mrem/OU-yr) exposure scenario.

The chemical FALs are based on the U.S. Environmental Protection Agency (EPA) Regional Screening Levels for chemical contaminants in industrial soils (EPA, 2016). The chemical FALs were established in Appendix D of the CADD/CAP (NNSA/NFO, 2016b).

4.1.1.1 Decision I

The Decision I statement as presented in the CADD/CAP (NNSA/NFO, 2016b) is as follows: “Do COCs remain in the soil beneath the debris pile following removal?” Any contaminant that is present at levels that would cause a dose exceeding its corresponding FAL will be defined as a COC. A COC may also be defined as a contaminant that, in combination with other like contaminants, is determined to jointly pose an unacceptable risk based on a multiple contaminant analysis (NNSA/NFO, 2014b). If a COC is detected, then additional soil removal will be completed.

4.1.1.1.1 DQO Provisions To Limit False-Negative Decision Error

A false-negative decision error (when it is concluded that contamination exceeding FALs is not present when it actually is) was controlled by meeting the following criteria:

- 1a) For Decision I, having a high degree of confidence that sample locations selected will identify COCs if present anywhere within the corrective action boundary (judgmental sampling).
- 1b) Maintaining a false-negative decision error rate of 0.05 (probabilistic sampling).
- 2) Having a high degree of confidence that analyses conducted will be sufficient to detect any COCs present in the samples.
- 3) Having a high degree of confidence that the dataset is of sufficient quality and completeness.

Criterion 1a (Confidence Judgmental Sample Locations Identify COCs)

To satisfy this criterion:

- Samples must be collected in areas most likely to contain a COC.
- The analytical suite selected must be sufficient to identify any COCs present in the samples.

To satisfy the criterion that the sample must be collected in areas most likely to contain a COC, the judgmental sample location was selected at the highest radiological readings as detected during the FIDLER terrestrial radiological survey ([Figure 2-13](#)).

The analytical method was chosen during the DQO process as the analyses required to detect any of the contaminants of potential concern (COPCs) that were defined as the contaminants that could reasonably be expected at the site that could contribute to a dose or risk exceeding FALs. The analyses were identified based on the contaminants detected in CAI samples as reported in the CADD/CAP (NNSA/NFO, 2016b). This provides assurance that the analyses conducted for each sample has the capability of identifying any COPC present in the sample.

All samples were analyzed for isotopic americium (Am), isotopic plutonium (Pu), isotopic uranium (U), and gamma spectrometry.

Criterion 1b (Confidence in Probabilistic False-Negative Decision Error Rate)

Control of the false-negative decision error for the probabilistic samples was accomplished by ensuring that the samples are collected from unbiased locations.

Selection of the sample aliquot locations within a sample plot was accomplished using a random start, systematic triangular grid pattern for sample placement. This permitted that all given locations within the boundaries of the sample plot would have an equal probability of being chosen.

Criterion 2 (Confidence in Detecting COCs Present in Samples)

Sample results were assessed against the acceptance criterion for the data quality indicator (DQI) of sensitivity as defined in the Soils QAP (NNSA/NSO, 2012b). The sensitivity acceptance criterion for radionuclides is that all detection limits are less than their corresponding OU residual radioactive material guideline (RRMGs). All of the analytical result detection limits for every radionuclide were less than their corresponding RRMGs. Therefore, the DQI for sensitivity has been met for all contaminants, and no data were rejected due to sensitivity.

Criterion 3 (Confidence that Dataset is of Sufficient Quality and Complete)

To satisfy the third criterion, the dataset was assessed against the acceptance criteria for the DQIs of precision, accuracy, comparability, completeness, and representativeness, as defined in the Soils QAP (NNSA/NSO, 2012b). The individual DQI results are presented in the following subsections.

Precision

Precision was evaluated as described in the CAIP (NNSA/NFO, 2014a) and Section 4.2 of the Soils QAP (NNSA/NSO, 2012b). No results from the verification samples were qualified for precision. Therefore, the criterion for precision was met for all contaminants. The potential for a false-negative DQO decision error is negligible, and the results can be confidently used for decision making.

Accuracy

Accuracy was evaluated as described in the CAIP (NNSA/NFO, 2014a) and Section 4.2 of the Soils QAP (NNSA/NSO, 2012b). No results from the verification samples were qualified for accuracy

Therefore, the criterion for accuracy was met for all contaminants. The potential for a false-negative DQO decision error is negligible, and the results can be confidently used for decision making.

Representativeness

The DQO process as identified in the CAIP (NNSA/NFO, 2014a) was used to address sampling and analytical requirements for the verification samples. During this process, the location of the highest FIDLER survey values was selected to be representative of the population parameters identified in the DQO (the most likely location to contain COC contamination) (as described in Section F.8.0 of the CADD/CAP [NNSA/NFO, 2016b]). The sampling location identified in the Criterion 1a discussion met this criterion.

Special consideration is needed for americium and plutonium isotope activities related to representativeness. This is due to the nature of these contaminants in soil. These isotopes may be present in soil in the form of small particles that may or may not be captured in a small soil sample of 1 to 2 grams. As individual particles of these radionuclides can make a significant impact on analytical results, small soil samples taken from the same site can produce analytical results that are very different (i.e., poor accuracy). However, the americium and plutonium isotopes are co-located (e.g., Am-241 is a daughter product of Pu-241), and the relative activities between different samples from the same site (i.e., the ratio of americium to plutonium isotope activities) should be equal. Based on process knowledge and demonstrated by analytical results from previously sampled Soils Activity sites, the ratios between americium and plutonium isotopes in soil contamination from any given source is expected to be the same throughout the contaminant plume at any given time. Therefore, if the ratios are known and one of these isotopic activities is known, the activities of the other isotopes can be estimated.

Am-241 is reported by the gamma spectrometry method as well as the isotopic americium method. As the gamma spectrometry measurement is based on a much larger soil sample (usually 1 liter), the particle distribution problem discussed above is greatly diminished and the probability of the result being representative of the sampled site is much improved. Therefore, the ratios between the americium and plutonium isotopes were established using the isotopic analytical results and these ratios were used to infer activities of plutonium isotopes using the gamma spectrometry results for

Am-241. These inferred plutonium values are more representative of the sampled area than the isotopic results.

Based on the selection of the sample location and the use of americium and plutonium activities that are more representative of the sampled area, the analytical data acquired during the CAU 573 CAI are considered to adequately represent contaminant activities of the sampled population.

Comparability

Field sampling, as described in the CADD/CAP (NNSA/NFO, 2016b), was performed and documented in accordance with approved procedures that are comparable to standard industry practices. Approved analytical methods and procedures per DOE were used to analyze, report, and validate the data. These are comparable to other methods used not only in industry and government practices, but most importantly are comparable to other investigations conducted for the NNS. Therefore, CAU 573 datasets are considered comparable to other datasets generated using these same standardized DOE procedures, thereby meeting DQO requirements.

Also, standard, approved field and analytical methods ensured that data were appropriate for comparison to the investigation action levels specified in the CADD/CAP (NNSA/NFO, 2016b).

Completeness

The CAIP (NNSA/NFO, 2014a) defines acceptable criteria for completeness to be that the dataset is sufficiently complete to be able to make the DQO decisions. This is initially evaluated as 80 percent of release-specific analytes identified in the CADD/CAP having valid results. Rejected data (either qualified as rejected or data that failed the criterion of sensitivity) were not used in the resolution of DQO decisions and are not counted toward meeting the completeness acceptance criterion. All of the results from the verification samples were valid and usable for decision-making. Therefore, the completeness criteria was met.

4.1.1.1.2 DQO Provisions To Limit False-Positive Decision Error

The false-positive decision error was controlled by assessing the potential for false-positive analytical results. QA/quality control (QC) samples such as method blanks were used to determine whether a false-positive analytical result may have occurred. This provision is evaluated during the data

validation process and appropriate qualifications are applied to the data when applicable. There were no data qualifications that would indicate a potential false-positive analytical result.

Proper decontamination of sampling equipment also minimized the potential for cross contamination that could lead to a false-positive analytical result.

4.1.1.2 Alternative Actions to the Decision

If COCs are not detected in verification samples from the area of the removed soil and debris pile, further corrective action is not required. If COCs are detected, additional removal will be completed.

4.1.1.3 Sampling Design

The CADD/CAP (NNSA/NFO, 2016b) stipulated that the following sampling processes would be implemented:

- Sampling of a sample plot will be conducted by a combination of judgmental and probabilistic sampling approaches.

Result. The location of the plots were selected judgmentally, and sample aliquots were collected within the plot probabilistically as described in the CADD/CAP.

4.1.2 Conduct a Preliminary Data Review

A preliminary data review was conducted by reviewing QA reports and inspecting the data. The contract analytical laboratories generate a QA nonconformance report when data quality does not meet contractual requirements. All data received from the analytical laboratories met contractual requirements, and a QA nonconformance report was not generated. Data were validated and verified to ensure that the measurement systems performed in accordance with the criteria specified in the Soils QAP (NNSA/NSO, 2012b). The validated dataset quality was found to be satisfactory.

4.1.3 Select the Test and Identify Key Assumptions

The test for making DQO decisions for radiological contamination was the comparison of the TED to the FAL of 25 mrem/OU-yr.

The analytical and computational results for external and internal doses for the soil samples are presented in [Appendix D](#).

4.1.4 Verify the Assumptions

The key assumptions that could impact a DQO decision are listed in [Table 4-2](#).

**Table 4-2
Key Assumptions**

Exposure Scenario	Occasional Use Area
Affected Media	Surface soil
Location of Contamination/Release Points	Surface soil within the footprint of the excavated soil and debris pile.
Transport Mechanisms	None, as recently exposed soil below the soil and debris pile has not been previously subject to migration forces.
Preferential Pathways	None, as recently exposed soil below the soil and debris pile has not been previously subject to migration forces.
Lateral and Vertical Extent of Contamination	Contamination, if present, is expected to be contiguous to the former soil and debris pile and decrease with distance and depth from this source.
Groundwater Impacts	None.
Future Land Use	Research, Test, and Experiment Zone
Other DQO Assumptions	None.

The results of the investigation support the key assumptions identified in the CAU 573 DQOs and [Appendix D](#). All data collected during the corrective action supported the CSM, and no revisions to the CSM were necessary.

4.1.4.1 Other DQO Commitments

The CADD/CAP (NNSA/NFO, 2016b) made no further commitments.

4.1.5 Draw Conclusions from the Data

The DQO decision on the presence of COCs at the corrective action site was resolved based on the analytical results of samples collected at the sample plot locations. These results demonstrate that no

COCs are present at the corrective action site in levels that would cause a dose greater than the FALs and no corrective actions are necessary.

4.2 Use Restrictions

Corrective actions completed at Hamilton resulted in no remaining contamination that would require a UR.

Contamination is present at GMX at levels exceeding FALs and requires a UR. An FFACO UR (see [Attachment G-1](#)) was implemented based on the assumed potential to receive a dose exceeding 25 mrem/yr from the areas identified as exhibiting removable contamination at levels exceeding the criterion for an HCA (currently coincides with the HCA boundaries). This is based on the current land use, which is an assumed maximum exposure period of 80 hours per year. Activities that would cause a site worker to be exposed to site radiological contamination within the FFACO UR are restricted within the area defined by the coordinates listed in the UR and depicted in the figure attached to the UR without prior notification and acknowledgment of NDEP unless the activities are conducted under the provisions of 10 CFR Part 835 (CFR, 2016). The FFACO UR is recorded in the FFACO database, M&O contractor GIS, and the NNSA/NFO CAU/CAS files. To facilitate inspection and maintenance, UR signs were placed at locations designed to prevent inadvertent intrusion to the site (e.g., at the entrance to the CA and along the CA fence perimeter) in accordance with Section 5.1 of the CADD/CAP (NNSA/NFO, 2016b).

An administrative UR (see [Attachment G-1](#)) was also established to prevent inadvertent exposure of workers to radioactivity if a more intensive use of the site were to be considered in the future. As a BMP, this administrative UR was established based on the assumed potential to receive a dose exceeding 25 mrem/yr in the area identified as exhibiting removable contamination at levels exceeding the criterion for a CA. New activities that would cause a site worker to be exposed to site radiological contamination for a period of more than that of current land use (80 hours per year) are restricted within the areas defined by the coordinates listed in the administrative UR and depicted in the figure attached to the UR without prior notification and acknowledgment of NDEP unless the activities are conducted under the provisions of 10 CFR Part 835 (CFR, 2016). This administrative UR is recorded in the FFACO database, M&O contractor GIS, and the NNSA/NFO CAU/CAS files. No physical site controls are required for this administrative UR.

The Use Restriction Information form and figures showing the UR boundary for each CAS are included in [Attachment G-1](#). Post-closure requirements are summarized in [Section 5.2](#).

The corrective actions for CAU 573 are based on the assumption that activities on the NNSS will be limited to those that are industrial in nature and that the NNSS will maintain controlled access (i.e., restrict public access and residential use). Should the future land use of the NNSS change such that these assumptions are no longer valid, additional evaluation may be necessary.

4.3 FIDLER Data Quality

The Soils Activity uses FIDLER instruments to provide a measure of in situ radioactivity. The collected data are used in the following two distinct manners:

1. FIDLER data are used in an *absolute* manner when the numerical readings are used to compare to an action level. This is done to determine whether hot spots of radioactivity have the potential to provide a dose exceeding an action level. The FIDLER data collected for this purpose meet the definition of decision-making data in the Soils QAP (NNSA/NSO, 2012b).
2. FIDLER data are used in a *relative* manner to establish the relative spatial distribution of radioactivity (i.e., radiation plume isopleths). When used in this manner, the numerical values from the instrument have meaning only in relation to other readings. These data are used to identify the locations of the highest radioactivity and, when correlated to dose estimates, to estimate the spatial extent of dose at a particular level. The FIDLER data collected for this purpose meet the definition of decision-supporting data in the Soils QAP.

The Soils QAP, Section 2.5, states the following:

“Decisional data are directly compared to FALs. These data require the highest level of QA/QC in collection and measurement systems because the data are used to resolve primary decisions (i.e., rejecting or accepting the null hypothesis), and/or verifying closure standards have been met.

Environmental TLD and media analytical data are classified as decisional data. If other methods of collecting decisional data are identified, they will be addressed in the applicable FFACO report.”

It is assumed that when the FIDLER instrument is used for generating decisional data, it qualifies as measuring and test equipment (M&TE).

DOE G 414.1-2B, Admin Chg 2, *Quality Assurance Program Guide*, Section 4.8.3 “Control of Measuring and Test Equipment” (DOE, 2013) contains the following requirements for M&TE:

“Measuring and test equipment (M&TE) used for inspections, tests, monitoring, and data collection should be calibrated, maintained, and controlled using a documented process. M&TE should be checked before use to ensure that it is of the proper type, range, accuracy, and precision, and that it is uniquely identified and traceable to its calibration data.”

The Soils QAP, Section 1.11 (NNSA/NSO, 2012b), states the following:

“Participants must uniquely identify and control their M&TE, and establish a system of calibration and preventive maintenance to ensure proper operation. Reference standards of the correct type and range must be used for collecting data consistent with objectives.”

“Physical and chemical standards must have certifications traceable to NIST, EPA, or other nationally recognized agencies. Supporting documentation on reference standards and equipment must be maintained.”

The FIDLER instruments used in surveys at CAU 573 were calibrated using an Am-241 National Institute of Standards and Technology (NIST) traceable button source in a controlled environment to determine individual detector efficiencies. The FIDLER instruments were calibrated in the NNS M&O contractor’s radiation protection laboratory using standard operating procedures. Each FIDLER instrument was issued a calibration certificate containing the calibration data. The FIDLER instruments were further calibrated as defined in [Appendix I](#) and discussed in the Technical Basis Document *FIDLER Calculations: Converting Count Rates into Am-241 Soil Concentrations* (Navarro, 2017). This document also established the minimum detectable concentrations (MDCs) for each FIDLER instrument used for CAU 573 hot spot evaluations. The MDCs were much less than the hot spot criterion presented in [Appendix I](#).

Field procedures document the use of FIDLER instruments, including pre- and post-operational checks, used to collect measurements taken at CAUs. Data collected are transferred directly from the FIDLER to a connected GPS unit. After a survey is completed, the data from the GPS unit are transferred directly to the GIS database.

5.0 Conclusions and Recommendations

5.1 Conclusions

CAU 573 CAAs were implemented as follows:

- At CAS 05-23-02, GMX Alpha Contaminated Area, the corrective action decided upon by the stakeholders was closure in place. This was implemented by establishing a UR (see [Attachment G-1](#)) at the areas where removable contamination exceed the HCA criteria. Hot spot material exceeding the OU hot spot criterion for soil was consolidated into the source area as a BMP. No modifications to the decision or method of implementation were necessary.
- At CAS 05-45-01, Atmospheric Test Site - Hamilton, the corrective action decided upon by the stakeholders was clean closure. This was implemented by removing the soil/debris pile and collecting verification samples. No modifications to the decision or method of implementation were necessary.

As presented in the CADD/CAP (NNSA/NFO, 2016b), the CAA of closure in place with a UR was selected by the stakeholders in the CAA meeting held on November 24, 2015, as the preferred corrective action for GMX. Clean closure was not selected due to the presence of high levels of removable contamination that would require significant radiological controls to protect workers from inhaling or ingesting airborne radioactive particles. Even if the site were clean closed, the area surrounding the HCAs would still be posted as a CA. Therefore, the corrective action of closure in place with a UR was selected for GMX.

As presented in the CADD/CAP, the CAA of clean closure was selected by the stakeholders in the CAA meeting held on November 24, 2015, as the preferred corrective action for the debris pile at Hamilton. Without dismantling the pile, it could not be determined during the CAI whether the debris pile contained COCs. Thus, it was determined to assume that the pile contained COCs and to remove the pile as a clean closure.

5.2 Post-Closure Requirements

The FFACO UR implemented at CAS 05-23-02, GMX Alpha Contaminated Area, will protect site workers from inadvertent exposure. The FFACO UR is defined and shown in [Attachment G-1](#).

All URs are recorded in the FFACO database, the M&O contractor GIS, and the NNSA/NFO CAU/CAS files.

CAS 05-23-02, GMX Alpha Contaminated Area, requires post-closure inspections. Inspections will be performed annually to verify that the UR warning signs are in place and legible. Maintenance or repair needs that are identified will be completed before the following inspection and documented in the annual combined NNSS post-closure letter report submitted to NDEP.

The corrective action recommendations by the stakeholders for CAU 573 are based on the assumption that activities on the NNSS will be limited to those that are industrial in nature and that the NNSS will maintain controlled access (i.e., restrict public access and residential use). Should the future land use of the NNSS change such that these assumptions are no longer valid, additional evaluation may be necessary.

5.3 Recommendations

NNSA/NFO requests that NDEP issue a Notice of Completion for this CAU and approve transferring the CAU from Appendix III to Appendix IV of the FFACO. DOE, under its regulatory authority for management of radioactive waste materials associated with environmental remediation activities, approves these actions (USC, 2012).

6.0 References

CFR, see *Code of Federal Regulations*.

Code of Federal Regulations. 2016. Title 10 CFR, Part 835, “Occupational Radiation Protection.” Washington, DC: U.S. Government Printing Office.

DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.

FFACO, see *Federal Facility Agreement and Consent Order*.

Federal Facility Agreement and Consent Order. 1996 (as amended March 2010). Agreed to by the State of Nevada; U.S. Department of Energy, Environmental Management; U.S. Department of Defense; and U.S. Department of Energy, Legacy Management. Appendix VI, which contains the Soils Sites Strategy, was last modified June 2014, Revision No. 5.

Navarro GIS, see Navarro Geographic Information Systems.

NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office.

NNSA/NSO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office.

Navarro. 2017. Written communication. Subject: *FIDLER Calculations: Converting Count Rates into Am-241 Soil Concentrations*. Las Vegas, NV.

Navarro Geographic Information Systems. 2017. ESRI ArcGIS Software.

USC, see *United States Code*.

United States Code. 2012. Title 42 USC 2011 et seq., “Atomic Energy Act of 1954,” as amended. Washington, DC: U.S. Government Printing Office.

U.S. Department of Energy. 2013. *Quality Assurance Program Guide*, DOE Guide 414.1-2B, Admin Chg 2. Washington, DC: Office of Health, Safety and Security.

U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2012a. *Nevada National Security Site Radiological Control Manual*, DOE/NV/25946--801, Rev. 2. Prepared by Radiological Control Managers' Council. Las Vegas, NV.

- U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office. 2012b. *Soils Activity Quality Assurance Plan*, Rev. 0, DOE/NV--1478. Las Vegas, NV.
- U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2014a. *Corrective Action Investigation Plan for Corrective Action Unit 573: Alpha Contaminated Sites, Nevada National Security Site, Nevada*, Rev. 0, DOE/NV--1522. Las Vegas, NV.
- U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2014b. *Soils Risk-Based Corrective Action Evaluation Process*, Rev. 1, DOE/NV--1475-Rev. 1. Las Vegas, NV.
- U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2015. *Nevada National Security Site Waste Acceptance Criteria*, DOE/NV-325-Rev. 10a. Las Vegas, NV.
- U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2016a. *Corrective Action Investigation Plan for Corrective Action Unit 414: Clean Slate III Plutonium Dispersion (TTR) Tonopah Test Site, Nevada*, Rev. 1, DOE/NV--1550-REV 1. Las Vegas, NV.
- U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2016b. *Corrective Action Decision Document/Corrective Action Plan for Corrective Action Unit 573: Alpha Contaminated Sites, Nevada National Security Site, Nevada*, Rev. 0, DOE/NV--1541. Las Vegas, NV.
- U.S. Environmental Protection Agency. 2016. *Regional Screening Levels (RSLs)*. As accessed at <https://www.epa.gov/risk/regional-screening-levels-rsls> on 14 January.

Appendix A

DQOs as Developed in the CADD/CAP

Note 1: This appendix contains the DQOs as presented in Appendix F of the CADD/CAP. Therefore, cross references, acronyms, section headings, references, page numbers, header information, and other data in this appendix refer to the original document. The study groups used in the characterization phase are not used in the corrective action phase. Therefore, the term “study group” appears in this appendix but not in the remainder of the CR.

Note 2: For the GMX site, the corrective action of closure in place was implemented by establishing an FFACO UR. Therefore, the GMX site is not discussed in this appendix, as no verification samples were necessary.

Appendix F

Sampling and Analysis Plan

F.1.0 Sampling and Analysis Plan

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 573, Alpha Contaminated Sites. DQOs are designed to ensure that the data collected will provide sufficient and reliable information to identify, evaluate, and technically defend recommended corrective actions (i.e., no further action, closure in place, or clean closure).

The CAU 573 corrective action implementation is based on the DQOs agreed to and presented in the CAIP (NNSA/NFO, 2014) and as supplemented in this appendix to include verification decisions following the implementation of the corrective action of clean closure at the Hamilton debris pile. The seven steps of the DQO process presented in Sections F.2.0 through F.8.0 were developed in accordance with *Guidance on Systematic Planning Using the Data Quality Objectives Process* (EPA, 2006).

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.

F.2.0 Step 1 - State the Problem

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

F.2.1 Problem Statement

The problem statement for the clean closure of the Hamilton debris pile is as follows: “Existing sample information is insufficient to determine whether COCs are present after removal of the debris pile at Hamilton.”

F.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 a point in time. The CSM is a primary vehicle for communicating assumptions about release mechanisms, potential migration pathways, or specific constraints. The CSM describes the most probable scenario for current conditions at each site and defines the assumptions that are the basis for identifying appropriate sampling strategy and data collection methods. An accurate CSM is important as it serves as the basis for all subsequent inputs and decisions throughout the DQO process.

The CSM was developed for CAU 573 using information from the physical setting, 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 is presented in the CAU 573 CAIP (NNSA/NFO, 2014).

F.2.2.1 Release Sources

The potential release source specific to the implementation of corrective actions at CAU 573 is presented in the CSM as contamination that may be present in or beneath the debris pile (NNSA/NFO, 2014).

F.2.2.2 Potential Contaminants

The release-specific COPCs are defined as the contaminants reasonably expected at the site that could contribute to a dose or risk exceeding FALs based on the nature of the releases identified in Section 2.2.1. Soil and debris, which is radiologically contaminated as a result of the tower test, is contained within the debris pile. Additionally, lead PSM was found at multiple locations surrounding the debris pile; therefore, there is the potential for additional PSM to be present within the debris pile. These contaminants are potentially in concentrations that may cause an unacceptable risk to a site receptor.

F.2.2.3 Contaminant Characteristics

The contaminant characteristics of the radionuclides include, but are not limited to, solubility, density, and adsorption potential. Refer to Section A.2.2.3 of the CAIP (NNSA/NFO, 2014) for information on contaminant characteristics for CAU 573.

F.2.2.4 Site Characteristics

CAS 05-45-01 is located in Area 5 of the NNSS on the Frenchman dry lake bed. The area is very flat and is sparsely vegetated with native plants. Refer to Section A.2.2.4 of the CAIP (NNSA/NFO, 2014) for additional information.

F.2.2.5 Migration Pathways and Transport Mechanisms

The debris pile at CAS 05-45-01 is located on a dry lake bed. This provides the potential for a much greater lateral transport of contaminants compared to vertical flow.

F.2.2.6 Exposure Scenarios

Human receptors may be exposed to COPCs through oral ingestion or inhalation of, or dermal contact (absorption) with soil or debris due to inadvertent disturbance of these materials, or external irradiation by radioactive materials. As presented in Appendix D, the most appropriate exposure scenario for the CAU 573 CASs was conservatively established as the Occasional Use Area exposure scenario.

F.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 statements, and considers alternative outcomes or actions that can occur upon answering the questions.

F.3.1 Decision Statements

The Decision statement is as follows: “Do COCs remain in the soil beneath the debris pile following removal?”

F.3.2 Alternative Actions to the Decision

Once the debris pile is removed, if COCs are not detected, further corrective action is not required. If COCs are detected, additional soil removal will be completed.

F.4.0 Step 3 - Identify Information Inputs

Step 3 of the DQO process identifies the information needed, determines sources for information, and identifies methods that will allow reliable comparisons with corrective action criteria.

F.4.1 Information Needs

To resolve the DQO decision (determine whether COCs remain), soil samples will be collected and analyzed following these two criteria:

- Samples must be collected in areas most likely to contain a COC (judgmental sampling).
- The method must be sufficient to identify any COCs present.

F.4.2 Sources of Information

Information to satisfy the DQO decision will be generated by collecting and analyzing soil samples from the area of highest radiological readings in the general area of the debris pile.

F.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 survey/data collection, and defines the sampling units on which decisions or estimates will be made.

F.5.1 Target Populations of Interest

The population of interest to resolve the DQO decision (determine whether COCs from the debris pile remain) is the presence of PSM or a dose above FALs.

F.5.2 Spatial Boundaries

Spatial boundaries are the maximum lateral and vertical extent of expected contamination that can be supported by the CSM. The spatial boundaries are as follows:

- **Vertical.** 150 cm below original ground surface
- **Lateral.** The lateral extent of the debris pile

COCs found beyond these boundaries may indicate a flaw in the CSM and in earlier analytical results, and may require reevaluation of the CSM before the investigation can continue.

F.5.3 Practical Constraints

Practical constraints may be activities by other organizations at the NNSS, utilities, threatened or endangered animals and plants, unstable terrain, and/or access restrictions that may affect the ability to investigate this site. The only practical constraints that have been identified specific to CAU 573 are the presence of underground structures throughout the area and flooding due to rain events.

F.5.4 Define the Sampling Units

The scale of decision making refers to the smallest, most appropriate area or volume for which decisions will be made. The scale of decision making was defined as the Hamilton SG3.

F.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 a decision rule.

F.6.1 Population Parameters

Population parameters are the parameters compared to action levels. The population parameters are defined for judgmental and probabilistic sampling designs in the CAIP (NNSA/NFO, 2014).

F.6.2 Action Levels

The PALs for chemicals and radionuclides are discussed in Section A.6.2 of the CAIP (NNSA/NFO, 2014). The FALs for chemicals and radionuclides are established in Appendix D.

F.6.3 Decision Rules

The decision rules applicable to the DQO decision are as follows:

- If contamination levels are inconsistent with the CSM or extend beyond the spatial boundaries identified in Section F.5.2, then work will be suspended and the corrective action strategy will be reconsidered, else the decision will be to continue the corrective action.
- If the population parameter of any COPC in the population of interest (defined in Step 4) exceeds the corresponding action level, then additional corrective action will be implemented, else no further corrective action is needed.

F.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.

F.7.1 Decision Hypotheses

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

- **Baseline condition.** A COC is present.
- **Alternative condition.** A COC 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 the DQO decision will be established qualitatively by the following:

- Developing a CSM (based on process knowledge).
- Testing the validity of the CSM based on corrective action results.
- Evaluating the quality of data.

F.7.2 False-Negative Decision Error

The false-negative decision error would mean deciding that a COC is not present when it actually is. The potential consequence is an increased risk to human health and environment. Refer to Section A.7.2 of the CAIP (NNSA/NFO, 2014) for additional detail on false-negative decision errors.

F.7.3 False-Positive Decision Error

The false-positive decision error would mean deciding that a COC is present when it is not, resulting in increased costs for unnecessary corrective action activities. Refer to Section A.7.3 of the CAIP (NNSA/NFO, 2014) for additional detail on false-positive decision errors.

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

Step 7 of the DQO process selects and documents a design that will produce data that exceeds performance or acceptance criteria. A judgmental scheme will be implemented to select survey and sample locations at the Hamilton debris pile location. A probabilistic sampling scheme will be implemented to select sample locations within the sample plot and evaluate the analytical results. A soil sample plot will be established in the area containing the highest radiological readings as detected during the radiological survey.

F.9.0 References

EPA, see U.S. Environmental Protection Agency.

NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2014. *Corrective Action Investigation Plan for Corrective Action Unit 573: Alpha Contaminated Sites, Nevada National Security Site, Nevada*, Rev. 0, DOE/NV--1522. Las Vegas, NV.

U.S. Environmental Protection Agency. 2006. *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4, EPA/240/B-06/001. Washington, DC: Office of Environmental Information.

Appendix B

Closure Certification

B.1.0 Closure Certification

Certification of closure is required for permitted or interim status hazardous waste facilities, and is not applicable to CAU 573.

Appendix C

As-Built Documentation

C.1.0 As-Built Documentation

This appendix does not apply to CAU 573, because as-built drawings and documentation were not required.

Appendix D

Confirmation Sampling Test Results

D.1.0 Verification Results

To determine the potential dose remaining at the Hamilton site after closure activities were completed, a sample plot was sampled at the area with the highest FIDLER survey reading beneath where the soil/debris pile had been. A probabilistic sampling approach was implemented for collecting four composite samples from within the sample plot. Each composite sample consisted of soil collected from the surface to a depth of 5 centimeters (cm) at nine randomly located subsample locations within the plot. For each composite sample, the first location was selected randomly; the remaining eight subsample locations were established on a systematic triangular grid. The external dose used for the analysis was determined using the RRMGs as described in the Soils RBCA document (NNSA/NFO, 2014).

This appendix presents the analytical and computational results for the soil samples collected at Hamilton as verification sampling of completion of closure activities at the Hamilton site. The radiological results are reported as doses that are comparable to the dose-based FAL of 25 mrem/yr. The analytical results of the verification samples that were used to calculate doses are presented in [Table D.1-1](#). The calculations to convert the analytical results to dose are contained in the Soils RBCA document (NNSA/NFO, 2014). [Section D.1.4](#) presents the post removal FIDLER results from the 12 hot spots at the GMX site.

Table D.1-1
Results for Gamma-Emitting Radionuclides
Detected above MDCs in Verification Samples

Sample Location	Sample Number	COPCs (pCi/g)									
		Cs-137	Eu-152	Th-232	U-234	U-238	Am-241	Am-243	Pu-238 ^a	Pu-239/240 ^a	Pu-241 ^a
573B99	AA9B032	0.167	0.78	1.26	1.69	1.35	199	3.14	13.3	1,015.3	310.2
	AA9B033	0.241	0.75	1.5	1.67	--	115	1.93	7.7	586.8	179.3
	AA9B034	0.142	0.78	1.51	--	--	85	1.28	5.7	433.7	132.5
	AA9B035	0.134	0.69	1.41	2.2	--	120	1.7	8.0	612.3	187.0

^aInferred activity from Am-241 results and Pu to Am-241 ratio in accordance with the Soils RBCA and Section B.1.1.1.1 of the CAU 573 CADD/CAP (NNSA/NFO, 2016).

Cs = Cesium
Eu = Europium

pCi/g = Picocuries per gram
Th = Thorium

-- = Not detected above MDC

D.1.1 External Radiological Dose

In accordance with the verification sampling DQOs and the CAU 573 CADD/CAP (NNSA/NFO, 2016), external dose was calculated from verification sample analytical results. Thermoluminescent dosimeters (TLDs) were not used for calculating external dose because TED at the Hamilton site is predominantly from internal dose, and sufficient data are available to demonstrate a high correlation of RESRAD-derived external dose to TLD results. This has been shown at numerous locations where both TLD and soil samples have been collected (Figure D.1-1).

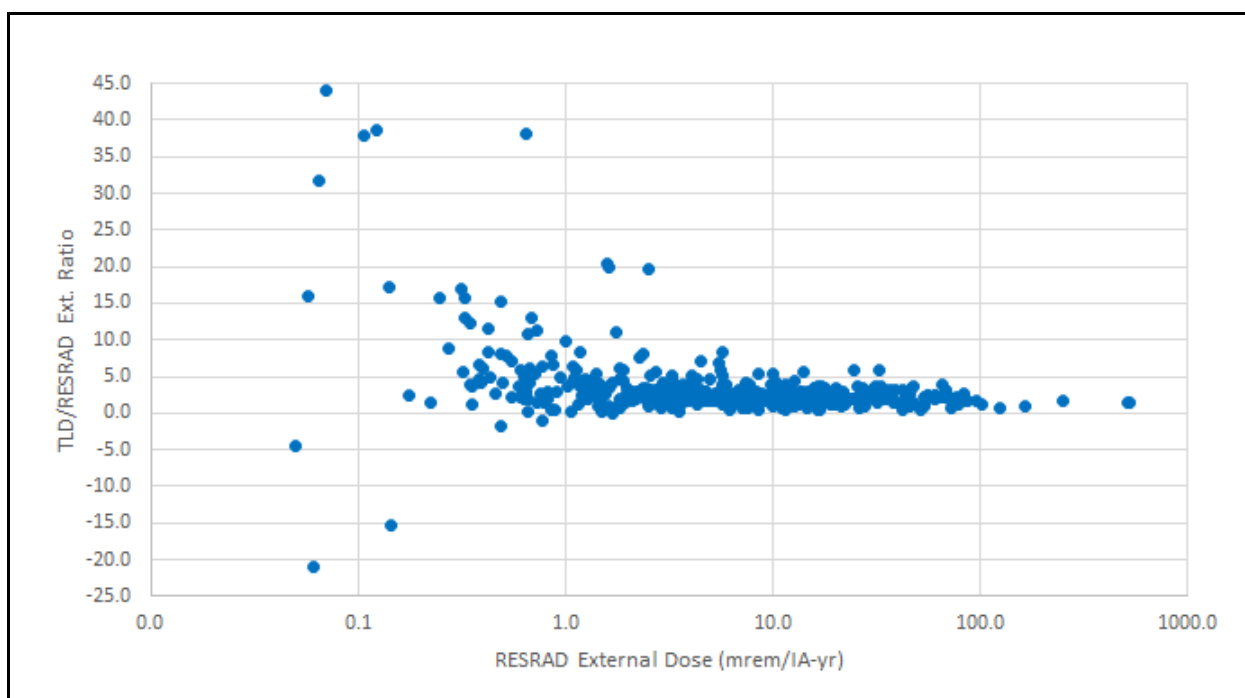


Figure D.1-1
Effect of Activity Level on TLD/RESRAD External Dose Ratio

Use of the TLD-equivalent external dose is conservative because the TLD external dose generally provides a higher external dose value. However, this relationship of TLD external dose to RESRAD-calculated external dose is not reliable at locations where dose is low (i.e., less than approximately 2 millirem per Industrial Area year [mrem/IA-yr]). Therefore, it is more reliable to use the central tendency of this relationship using all of the available data from the Soils Activity. This was done by calculating the slope of the regression line from the correlation of TLD external dose to RESRAD-calculated external dose. The resulting relationship is that the TLD external dose is 1.58 times higher than the RESRAD-calculated external dose. This relationship is then used as the

correction factor to adjust a RESRAD-calculated external dose to be equivalent to a TLD external dose value. The standard deviation and average external doses for each exposure scenario are presented in [Table D.1-2](#). [Table D.1-3](#) presents the 95 percent UCL of the external dose data.

Table D.1-2
External Dose Statistics for Each Exposure Scenario

Release	Location	Industrial Area Standard Deviation	Industrial Area Average (mrem/IA-yr)	Remote Work Area Standard Deviation	Remote Work Area Average (mrem/RW-yr)	Occasional Use Area Standard Deviation	Occasional Use Area Average (mrem/OU-yr)
05-45-01	B99	0.7	2.7	0.1	0.5	0.0	0.1

mrem/RW-yr = Millirem per Remote Work Area year

Table D.1-3
95% UCL External Dose for Each Exposure Scenario

Release	Location	Number of Samples	Minimum Sample Size (OU Scenario)	Industrial Area (mrem/IA-yr)	Remote Work Area (mrem/RW-yr)	Occasional Use Area (mrem/OU-yr)
05-45-01	B99	4	3	3.5	0.6	0.2

D.1.2 Internal Radiological Dose

Estimates for the internal dose that a receptor would receive at the Hamilton site were determined as described in the Soils RBCA document (NNSA/NFO, 2014). The standard deviation and average internal doses for each exposure scenario are presented in [Table D.1-4](#). The 95 percent UCL of the internal doses for each exposure scenario are presented in [Table D.1-5](#).

Table D.1-4
Internal Dose Statistics for Each Exposure Scenario

Release	Location	Industrial Area Standard Deviation	Industrial Area Average (mrem/IA-yr)	Remote Work Area Standard Deviation	Remote Work Area Average (mrem/RW-yr)	Occasional Use Area Standard Deviation	Occasional Use Area Average (mrem/OU-yr)
05-45-01	B99	1.8	4.7	0.3	0.8	0.1	0.3

Table D.1-5
95% UCL Internal Dose for Each Exposure Scenario

Release	Location	Number of Samples	Minimum Sample Size (OU Scenario)	Industrial Area (mrem/IA-yr)	Remote Work Area (mrem/RW-yr)	Occasional Use Area (mrem/OU-yr)
05-45-01	B99	4	3	6.8	1.1	0.4

D.1.3 Total Effective Dose

The TED was calculated by adding the external dose value and the internal dose value. Values for both the average TED and the 95 percent UCL of the TED for the Industrial Area, Remote Work Area, and Occasional Use Area exposure scenarios are presented in [Table D.1-6](#).

Table D.1-6
Hamilton TED (mrem/yr^a)

Release	Location	Industrial Area		Remote Work Area		Occasional Use Area	
		Average TED	95% UCL of TED	Average TED	95% UCL of TED	Average TED	95% UCL of TED
05-45-01	B99	7.4	10.3	1.2	1.7	0.4	0.6

^a Doses presented here are a conservative estimate of maximum potential dose for decision-making purposes only and are not intended to represent actual doses to a receptor.

D.1.4 Hot Spot FIDLER Data

Following removal of the elevated point sources (debris and small quantities of soil) at the GMX site, static FIDLER readings were collected from 12 hot spots with the highest radioactivity from the drive-over radiological survey. The location numbers and associated readings are presented in [Table D.1-7](#). [Figure D.1-2](#) presents the location of each hot spot.

Table D.1-7
GMX Hot Spot FIDLER Readings
(Page 1 of 2)

Location	Post-Removal Reading (cpm)
G5-1	3202
G6-1	2226
G7-2	3848

Table D.1-7
GMX Hot Spot FIDLER Readings
(Page 2 of 2)

Location	Post-Removal Reading (cpm)
G9-2	3547
F9-2	740
F8-2	610
G5-2	3392
F8-1	3382
G7-1	2985
F9-1	2414
H7-1	1177
G9-1	4967

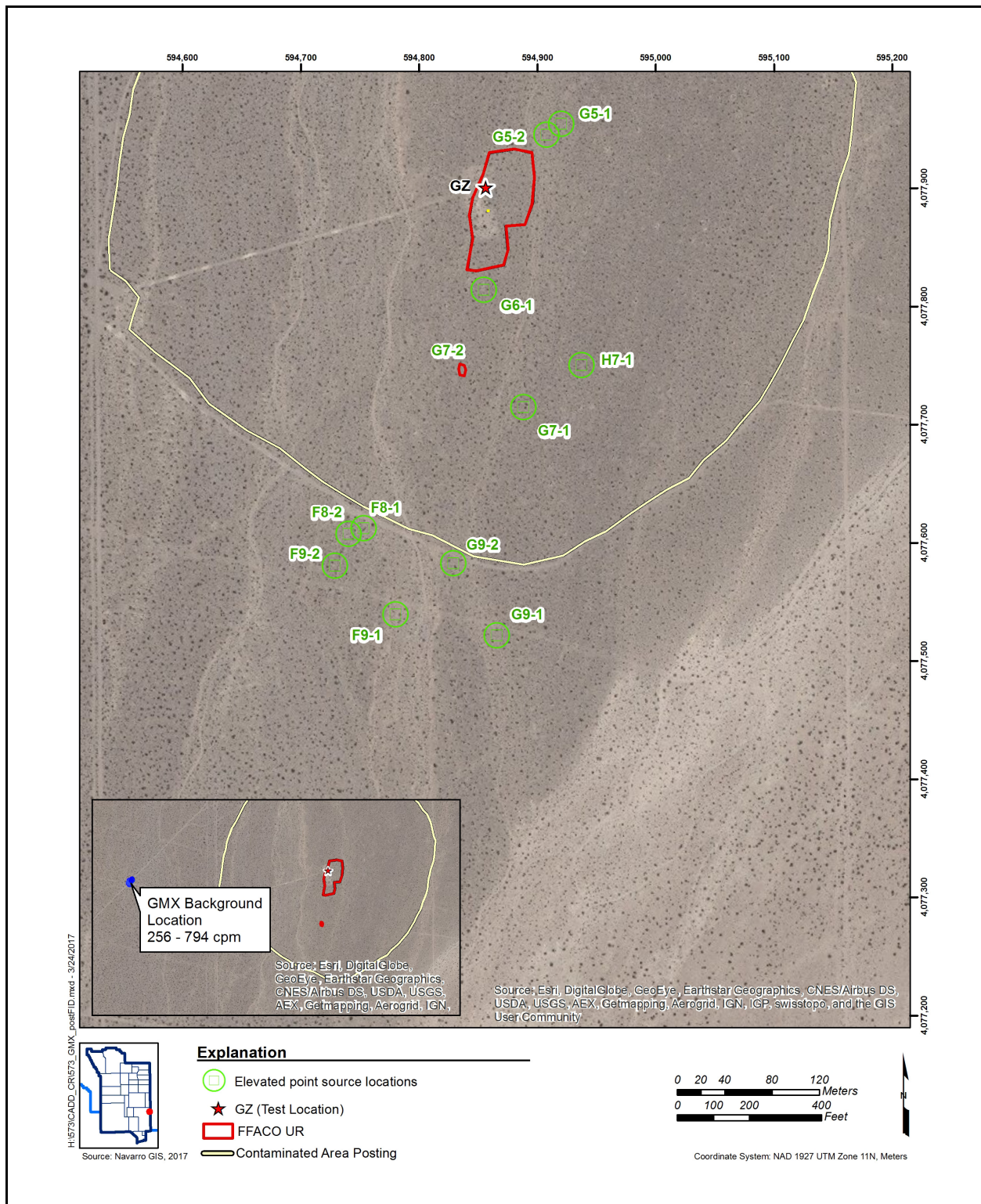


Figure D.1-2
Hot Spot Locations

D.2.0 References

NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2014. *Soils Risk-Based Corrective Action Evaluation Process*, Rev. 1, DOE/NV--1475-Rev. 1. Las Vegas, NV.

U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2016. *Corrective Action Decision Document/Corrective Action Plan for Corrective Action Unit 573: Alpha Contaminated Sites, Nevada National Security Site, Nevada*, Rev. 0, DOE/NV--1541. Las Vegas, NV.

Appendix E

Waste Disposition Documentation

(13 Pages)

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16002** with container numbers **573B02; 573B03; 573B04; 573B05; 573B06; 573B07; 573B08; and 573B09** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

<u>Mark Heser</u>	<u>Navarro</u>	<u>Waste Coordinator</u>
Shipped by	Organization	Title
<u>/s/ Mark Heser</u>		<u>3/31/16</u>
Signature		Date
<u>James B. Frick</u>	<u>Area 5 RWMC</u>	<u>Waste Specialist</u>
Received by	Organization	Title
<u>/s/ James B. Frick</u>		<u>03/31/2016</u>
Signature		Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16012** with container numbers **573B10; 573B11; 573B12; 573B13** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Hesar

Navarro

Waste Coordinator

Shipped by

Organization

Title

/s/ Mark Hesar

7/14/16

Signature

Date

Ed Takahashi

NSTe

Sr Scientist

Received by

Organization

Title

/s/ Ed Takahashi

JULY 14, 2016

Signature

Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16003** with container numbers **573H01 and 573H02** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Heser

Navarro

LL Waste Coordinator

Shipped by

Organization

Title

/s/ Mark Heser

Signature

6/21/16

Date

E. TAKAHASHI

NSTec

Sr Scientist

Received by

Organization

Title

/s/ Ed Takahashi

Signature

06/21/2016

Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16004** with container numbers **573H03** and **573H04** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Hesar

Navarro

LL Waste Coordinator

Shipped by

Organization

Title

/s/ Mark Hesar

6/21/16

Signature

Date

E. Takahashi

USTec

SR SCIENTIST

Received by

Organization

Title

/s/ Ed Takahashi

06/21/2016

Signature

Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16005** with container numbers **573H05** and **573H06** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Heser

Navarro

LL Waste Coordinator

Shipped by

Organization

Title

/s/ Mark Heser

Signature

6/22/16
Date

Robert H. Zion

Received by

RWMC

Organization

Waste Specialist

Title

/s/ Robert H. Zion

Signature

06/22/2016

Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16006** with container numbers **573H07 and 573H08** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Hesper

Navarro

LL Waste Coordinator

Shipped by

Organization

Title

/s/ Mark Hesper

Signature

6/22/16

Date

Robert H. Zion

Received by

NSTec / RWMC / NNSS

Organization

Waste Specialist

Title

/s/ Robert H. Zion

Signature

06/22/2016

Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16007** with container numbers **573H09** and **573H10** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Heser

Navarro

LL Waste Coordinator

Shipped by

Organization

Title

/s/ Mark Heser

Signature

6/23/16

Date

James B. Frick

NN SS Area 5

Waste Specialist

Received by

Organization

Title

/s/ James B. Frick

Signature

06/23/2016

Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16008** with container numbers **573H11** and **573H12** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Heser

Navarro

LL Waste Coordinator

Shipped by

Organization

Title

/s/ Mark Heser

Signature

6/27/16

Date

E. TAKAHASHI

NSTec

SR Scientist

Received by

Organization

Title

/s/ Ed Takahashi

Signature

06/27/2016

Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16009** with container numbers **573H13 and 573H14** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Hesar

Navarro

LL Waste Coordinator

Shipped by

Organization

Title

/s/ Mark Hesar

6/27/16

Signature

Date

E. Takahashi

NS Tec

Sr Scientist
06/27/2016
6/27/16

Received by

Organization

Title

/s/ Ed Takahashi

06/27/2016

Signature

Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-0000000006, Revision 16, shipment number **ITL16010** with container numbers **573H15** and **573H16** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Heser

Shipped by

Navarro

Organization

LL Waste Coordinator

Title

/s/ Mark Heser

Signature

6/28/16

Date

Robert H. Zion

Received by

RWMC

Organization

Waste Specialist

Title

/s/ Robert H. Zion

Signature

06/28/2016

Date

Certificate of Disposal

This is to certify that the Waste Stream No. LITN-000000006, Revision 16, shipment number **ITL16011** with container number **573C01** was shipped and received at the Nevada National Security Site Radioactive Waste Management Complex in Area 5 for disposal as stated below.

Mark Hesper

Navarro

LL Waste Coordinator

Shipped by

Organization

Title

/s/ Mark Hesper

6/29/16

Signature

Date

James B. Frick

NNSS

Waste Specialist

Received by

Organization

Title

/s/ James B. Frick

06/29/2016

Signature

Date

National Security Technologies LLC
Vision • Service • Partnership

H000-SK-15-0009

June 29, 2015

Stefan J. Duke
Waste Generator Services
National Security Technology
P.O. Box 98521
Las Vegas, NV 89193-8521

LEAD
Debris -
573 BØ1 packed
in this NSTec
container!

**Subject: CERTIFICATE OF DISPOSAL FOR MIXED LOW LEVEL WASTE; NON-RAD
CLASSIFIED HAZARDOUS WASTE/MATTER; NON-RAD CLASSIFIED
WASTE/MATTER AT THE NEVADA NATIONAL SECURITY SITE
RADIOACTIVE WASTE MANAGEMENT SITE (RWMS)**

Enclosed is the courtesy certificate acknowledging disposal of shipment DPM15008 in the Mixed Waste Disposal Unit, at the Nevada National Security Site RWMS.

If you have any questions, please contact me at 702-295-0146.

/s/ Scott W. Kranker

Scott W. Kranker, Program Manager
Environmental Management

LBG: saq

Enclosure: as stated

cc w/enc.

Correspondence Management
T. S. Belka, NSTec
J. T. Carilli, NNSA/NFO
C. J. Chalupka, NSTec
R. C. Denton, NSTec
L. B. Gregory, NSTec
M. Libidinsky, NNSA/NFO
K. M. Small, NNSA/NFO
K. C. Tanaka, NSTec
A. V. Tauber, Navarro
R. A. Wagner, NSTec

National Security Technologies, LLC

Vision – Service – Partnership

www.NSTec.com

P.O. Box 98521, Las Vegas, NV 89193-8521
2621 Losee Road, N. Las Vegas, NV 89030-4129

NSTec

Form

FRM-1929

CERTIFICATE OF DISPOSAL

(Courtesy Mixed Low Level; Non-Rad Classified Hazardous
Waste/Matter; Non-Rad Classified Waste/Matter)

10/30/14

Rev. 03

Page 1 of 1

National Security Technologies LLC
For U.S. Department of Energy
Waste Management
Nevada National Security Site - Zone 2
Mercury, NV 89023

EPA ID NV3890090001

This Certificate acknowledges that the following shipment(s) of Mixed Low Level Waste; Non-Rad Classified Hazardous Waste/Matter; Non-Rad Classified Waste/Matter have been disposed at the Nevada National Security Site Radioactive Waste Management Site.

Shipment Number	Uniform Hazardous Waste Manifest/Hazardous Material Bill of Lading Number	Date(s) of Disposal	Volume Ft ³ (m ³)	Disposal Process
DPM15008	000000015N42	06/25/2015	134.90 (3.82)	Landfill

This certification is provided as a courtesy to the waste generator for information purposes only.

/s/ Scott W. Kranker

Signature

7-6-15

Date

Program Manager, Environmental Management

Title

Instructions:

Shipment Number – enter shipment number from LWIS database.

Uniform Hazardous Waste Manifest Number – enter number from UHWM provided by generator OR

Hazardous Material Bill of Lading Number – enter Bill of Lading number.

Date of Disposal – enter date waste was placed in disposal cell.

Volume – enter shipment volume in cubic feet and equivalent cubic meters in parenthesis.

Disposal Process – enter Landfill.

Appendix F

Modifications to the Post-Closure Plan

F.1.0 Modifications to the Post-Closure Plan

This appendix does not apply to CAU 573, because the Post-Closure Plan as presented in the CAU 573 CADD/CAP is sufficient.

Appendix G

Use Restrictions

G.1.0 Use Restrictions

[Attachment G-1](#) of this appendix provides details of the UR and a figure of the UR boundaries.

Attachment G-1
Use Restrictions
(6 Pages)

Use Restriction Information

CAU Number/Description: CAU 573, Alpha Contaminated Sites

Applicable CAS Number/Description: CAS 05-23-02, GMX Alpha Contaminated Area

Contact (DOE AL/Activity): NNSA/NFO Soils Federal Activity Lead

FFACO Use Restriction Physical Description:

Surveyed Area (UTM, Zone 11, NAD 83, meters):

UR Points	Northing	Easting
Southeast Corner	4,078,038	594,869
	4,078,033	594,846
	4,078,034	594,838
	4,078,060	594,843
	4,078,080	594,840
	4,078,095	594,843
	4,078,115	594,852
	4,078,133	594,857
	4,078,136	594,878
	4,078,133	594,893
	4,078,112	594,895
	4,078,090	594,893
	4,078,072	594,887
	4,078,071	594,871
	4,078,051	594,873

Depth: Surface to 30 cm bgs

Surveyed Area (UTM, Zone 11, NAD 83, meters):

UR Points	Northing	Easting
Southeast Corner	4,077,944	594,836
	4,077,945	594,832
	4,077,950	594,831
	4,077,954	594,832
	4,077,953	594,836
	4,077,949	594,837

Depth: Surface to 30 cm bgs

Survey Source (GPS, GIS, etc.): GIS

Basis for FFACO UR(s):

Summary Statement: This FFACO use restriction (UR) is established based on the potential to receive a dose exceeding 25 mrem/yr from contamination that is present at this site. Based on the current land use which is an assumed maximum exposure period of 80 hours per year, the maximum calculated dose rate at this site was 2.6 mrem/yr. However, dose was not calculated for the HCAs but is assumed to exceed the action level of 25 mrem/yr based on the presence of removable contamination that exceeds the criteria for establishing an HCA. The maximum concentrations of the major radionuclides contributing to dose are presented in the contaminants table below. The analytical results and locations of all samples are presented in the CADD/CAP for CAU 573.

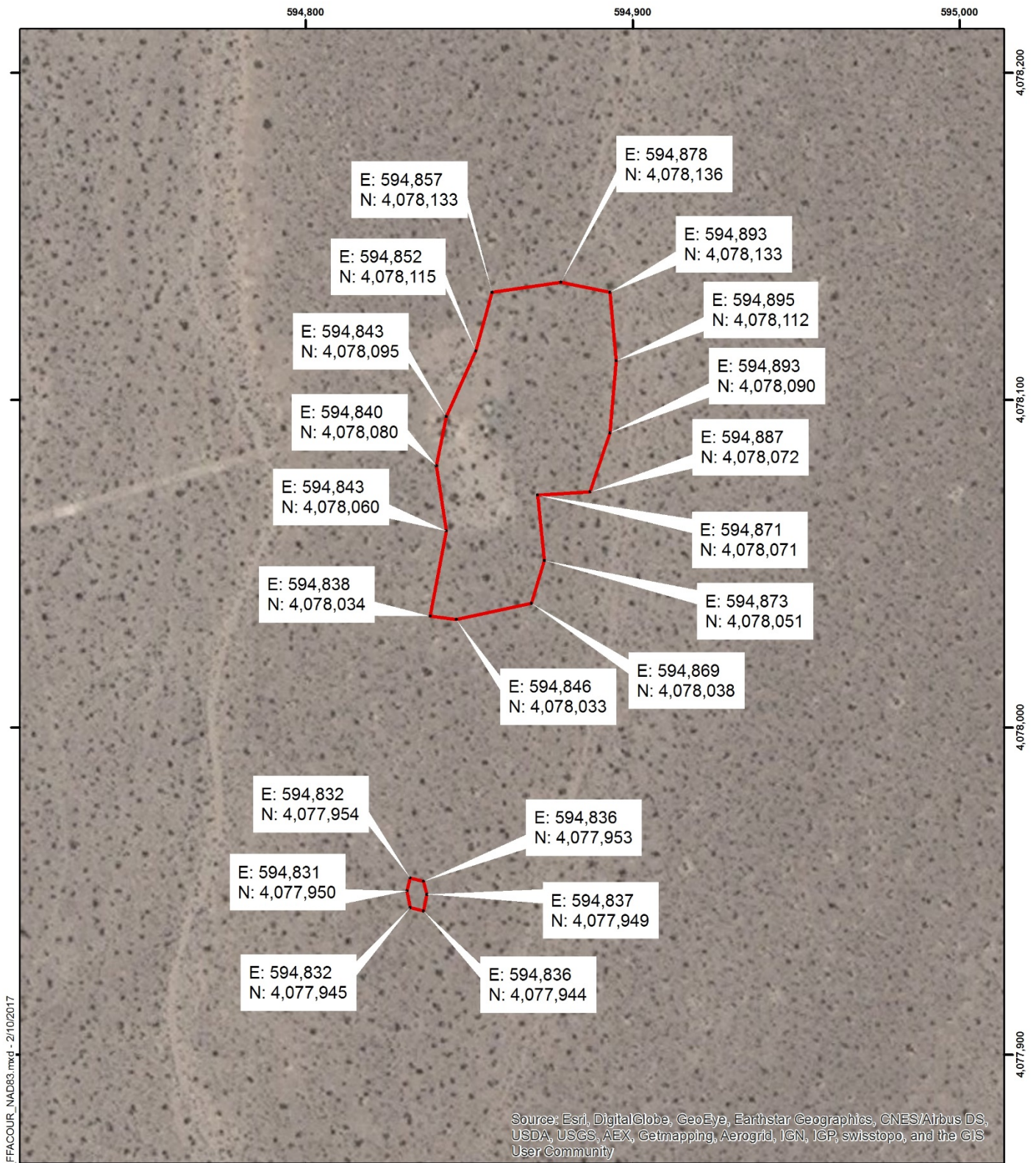
Use Restriction Information

Contaminants Table:

Maximum Concentration of Contaminants for CAU 573 CAS 05-23-02, GMX Alpha Contaminated Area			
Constituent	Maximum Concentration	Action Level	Units
Americium-241	1,210	39,000	pCi/g
Plutonium-239/240	6,900	68,600	pCi/g

Site Controls: Activities that would cause a site worker to be exposed to site radiological contamination for a period of more than that required to receive a dose of 25 mrem/yr (defined above) are restricted within the area defined by the coordinates listed above and depicted in the attached figure without prior notification and acknowledgement of NDEP unless the activities are conducted under the provisions of 10 CFR Part 835. The FFACO UR is recorded in the FFACO database, M&O Contractor GIS, and the NNSA Nevada Field Office CAU/CAS files. Warning signs were placed around the UR boundaries.

Use Restriction Information



H:\573\CADD_CR\573_CADD_FFACOUR_NAD83.mxd - 2/10/2017

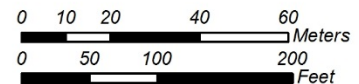


Source: Navarro GIS, 2017

**CAU 573, CAS 05-23-02
GMX Contamination Area
FFACO UR Boundary**

Explanation

FFACO UR



Coordinate System: NAD 1983 UTM Zone 11N, Meters

Use Restriction Information

Administrative Use Restriction Physical Description*:

Surveyed Area (UTM, Zone 11, NAD 83, meters):

UR Points	Northing	Easting
Southeast Corner	4,077,433	594,965
	4,077,375	594,799
	4,077,485	594,689
	4,077,878	594,671
	4,077,906	594,624
	4,077,979	594,549
	4,078,038	594,529
	4,078,203	594,551
	4,078,306	594,607
	4,078,406	594,689
	4,078,526	594,816
	4,078,518	594,870
	4,078,491	594,925
	4,078,413	595,031
	4,078,252	595,159
	4,078,236	595,222
	4,078,168	595,227
	4,078,135	595,170
	4,078,035	595,144
	4,077,939	595,101
	4,077,851	595,029
	4,077,786	594,919
	4,077,785	594,905

Depth: Surface to 30 cm bgs

Survey Source (GPS, GIS, etc.): GIS

*Coordinates for the Administrative Use Restriction exclude the area defined by the FFACO Use Restriction coordinates.

Basis for Administrative UR(s):

Summary Statement: This administrative use restriction (UR) is established based on the potential to receive a dose exceeding 25 mrem/yr from contamination that is present at this site if site usage were to exceed the current usage. This is based on the current land use which is an assumed maximum exposure period of 80 hours per year. Using the maximum calculated dose rate within this administrative UR, a worker could receive a 25-mrem dose in 758 hours of site exposure. The maximum concentrations of the major radionuclides contributing to dose are presented in the contaminants table below. The analytical results and locations of all samples are presented in the CADD/CAP for CAU 573.

Use Restriction Information

Contaminants Table:

Maximum Concentration of Contaminants for CAU 573 CAS 05-23-02, GMX Alpha Contaminated Area			
Constituent	Maximum Concentration	Action Level	Units
Americium-241	1,210	39,000	pCi/g
Plutonium-239/240	6,900	68,600	pCi/g

Site Controls: New activities that would cause a site worker to be exposed to site radiological contamination for a period of more than that of current land use (defined above) are restricted within the area defined by the coordinates listed above and depicted in the attached figure without prior notification and acknowledgment of NDEP unless the activities are conducted under the provisions of 10 CFR Part 835. This administrative UR is recorded in the FFACO database, M&O Contractor GIS, and the NNSA Nevada Field Office CAU/CAS files. No physical site controls are required for this administrative UR.

UR Maintenance Requirements (applies to both FFACO and Administrative UR(s) if Administrative UR exists):

Description: Warning signs for the FFACO UR will be inspected to ensure postings are in place, intact, and legible. Signs will be repaired or replaced as needed.

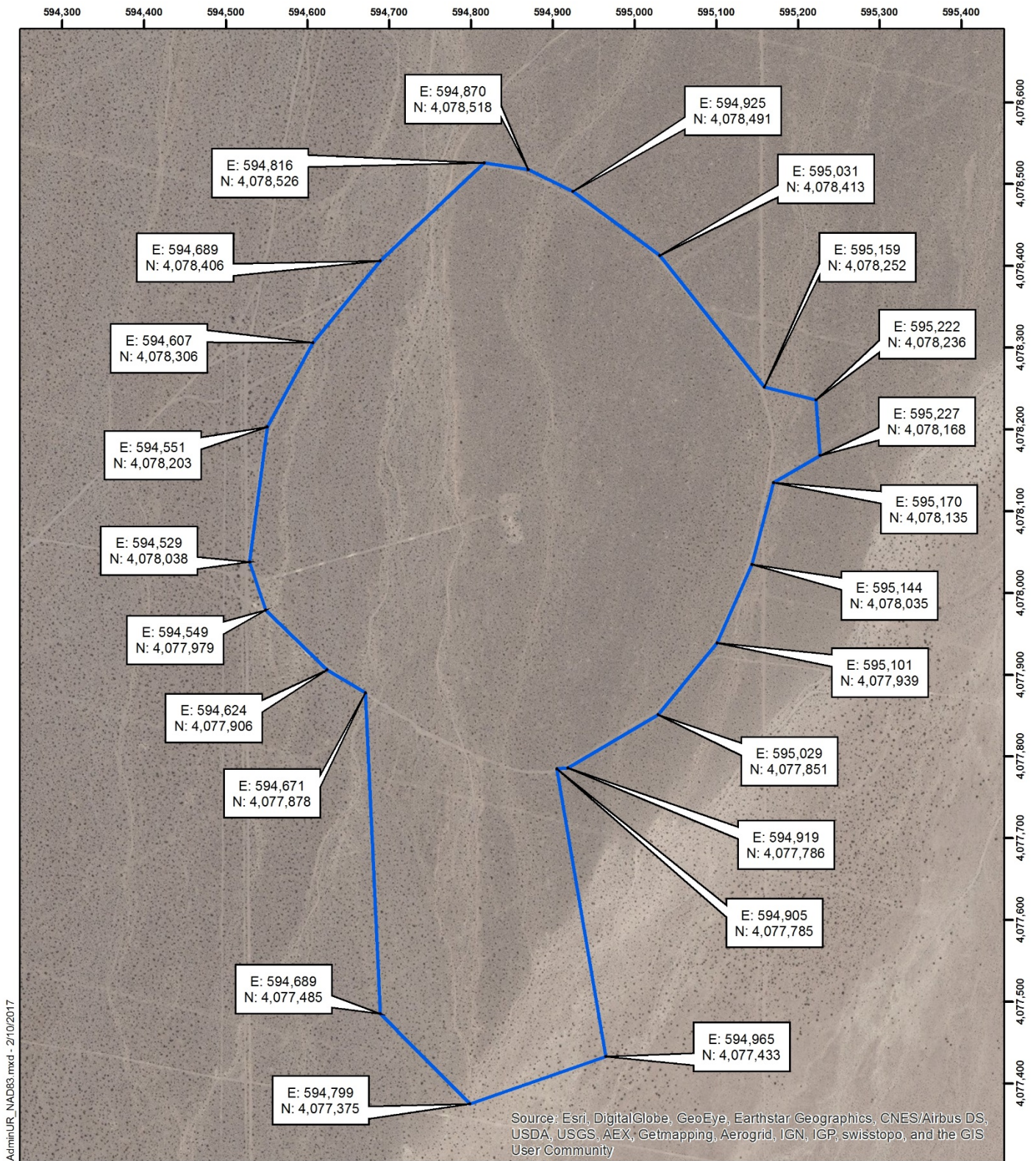
Inspection/Maintenance Frequency: Inspections of the FFACO UR will be conducted annually.

The future use of any land related to this Corrective Action Unit (CAU), as described by the above surveyed location, is restricted from any DOE or Air Force activity that may alter or modify the containment control as approved by the state and identified in the CAU CR or other CAU documentation unless appropriate concurrence is obtained in advance.

Comments: None

Submitted By: /s/ Tiffany A. Lantow **Date:** 02/21/2017

Use Restriction Information



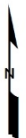
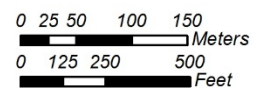
H:\573\CADD_CRIS73_CADD_AdminUR_NAD83.mxd - 2/10/2017



**CAU 573, CAS 05-23-02
GMX Contamination Area
Administrative UR Boundary**

Explanation

 Administrative UR



Source: Navarro GIS, 2017

Coordinate System: NAD 1983 UTM Zone 11N, Meters

Appendix H

Sample Location Coordinates

H.1.0 Sample Location Coordinates

The center of the verification sample plot at the Hamilton site was surveyed using a GPS instrument. The survey coordinates for this location are listed in [Table H.1-1](#).

Table H.1-1
Sample Plot/Location Coordinates for Hamilton^a

Easting ^b	Northing ^b	Sample Plot/Location
595,265	4073298	B99

^aAll coordinates listed are for the center of the plot

^bUTM Zone 11, NAD 1927 (U.S. Western) in meters.

Nine aliquot sample locations were established at the verification sample plot for each composite sample (4 composite samples, 36 aliquot sample locations) on a systematic triangular grid pattern based on a randomly generated origin. The sample aliquot locations for each composite sample are in a tabular format in terms of east and north distances from the southwest corner of the sample plot in [Table H.1-2](#).

Table H.1-2
Sample Plot Location Distance (Hamilton) in Meters
(Page 1 of 2)

Sample Plot B99		
Composite Number	Easting (Distance m)	Northing (Distance m)
B032	0.5	0.8
	4.1	0.8
	7.6	0.8
	2.3	3.9
	5.8	3.9
	9.4	3.9
	0.5	7.0
	4.1	7.0
	7.6	7.0

Table H.1-2
Sample Plot Location Distance (Hamilton) in Meters
(Page 2 of 2)

Sample Plot B99		
Composite Number	Easting (Distance m)	Northing (Distance m)
B033	0.5	1.6
	4.1	1.6
	7.7	1.6
	2.3	4.7
	5.9	4.7
	9.5	4.7
	0.5	7.8
	4.1	7.8
	7.7	7.8
B034	2.2	1.6
	5.8	1.6
	9.4	1.6
	0.4	4.7
	4.0	4.7
	7.6	4.7
	2.2	7.8
	5.8	7.8
	9.4	7.8
B035	0.9	2.8
	4.5	2.8
	8.1	2.8
	2.7	5.9
	6.3	5.9
	9.9	5.9
	0.9	9.0
	4.5	9.0
	8.1	9.0

Appendix I

Radiological Hot Spot Criterion

I.1.0 Radiological Hot Spot Criterion

I.1.1 Background

The radiological hot spot criterion was developed to address corrective action decisions for small areas that may contain unacceptably high activities of residual radioactive material (i.e., hot spots), even though the areas do not cause a dose that exceeds the area-based FAL. Hot spots may be identified by FIDLER surveys that detect radioactivity nominally above a value correlated to the FAL and anomalous to the surrounding area. This approach is based on the Hot Spot Criterion for Field Application in Section 3.3.2 of the *User's Manual for RESRAD Version 6* (Yu et al., 2001), which states the following:

“The derivation of remedial action criteria generally assumes homogeneous contamination of large areas (several hundred square meters or more), and the derived concentration guide is stated in terms of concentrations averaged over a 100-m² area. Because of this averaging process, hot spots can exist within these 100-m² areas that contain radionuclide concentrations significantly higher than the authorized limit. Therefore, the presence of hot spots could potentially pose a greater risk of exposure to individuals using the site than the risk associated with homogeneous contamination. To ensure that individuals are adequately protected and to ensure that the ALARA process is satisfied, the following hot spot criterion must be applied, along with the general criterion for homogeneous contamination.”

This approach is used by MARSSIM to comply with radiation protection requirements, and is fully evaluated and described in the *User's Manual for RESRAD Version 6* (Yu et al., 2001) and *Dose Modeling and Statistical Assessment of Hot Spots for Decommissioning Applications* (Abelquist, 2008). The hot spot RRMGs are based on the exact computations as the area-based RRMGs (based on an area of contamination of 1,000 m²) that have been used throughout the Soils Activity with the only exception being that the area of contamination was reduced to 1 m².

I.1.2 Hot Spot Criterion for Soil

This process produces a hot spot criterion that will conservatively protect potential receptors from an unacceptable dose due to a small area of elevated radioactive contamination (i.e., hot spot). The hot spot criterion is a FIDLER survey value expressed in terms of counts per minute (cpm) that corresponds to a dose of 25 mrem/yr calculated using the OU exposure scenario hot spot RRMGs. Hot spot RRMGs were developed using RESRAD by changing the area of contaminated zone

parameter to represent the area of the hot spot (i.e., 1 m²). To maintain conservatism in the process, the *User's Manual for RESRAD Version 6* stipulates that the minimum hot spot area to be used for development of the hot spot RRMGs will be 1 m² (Yu et al., 2001). When calculating the hot spot RRMGs, all other RESRAD parameters are not changed from those used to produce the area-based RRMGs in accordance with the Soils RBCA document (NNSA/NFO, 2014). The area-based RRMGs (based on 1,000 m²) and the resulting hot spot RRMGs (based on 1 m²) for the OU exposure scenario are presented in [Table I.1-1](#). Based on the average relative abundance of radionuclides at the GMX site, the calculated activities of each radionuclide that would result in a dose of 25 mrem/OU-yr are presented in [Table I.1-1](#) for both the area-based and hot spot RRMGs. Of the radionuclides present at the GMX site, Pu-239/240 and Am-241 provide more than 90 percent of TED. As Am-241 is the more readily detectable by field instrumentation, it was used to develop a FIDLER field screening criterion for hot spots based on an Am-241 activity of 112,876 pCi/g. To maintain conservatism in the process, the *User's Manual for RESRAD Version 6* stipulates that any hot spot exceeding 30 times the area-based FAL will be assumed to require corrective action (Yu et al., 2001). As 30 times the area-based Am-241 activity of 8,900 pCi/g is greater than the hot spot Am-241 activity of 112,876 pCi/g, this limit does not apply.

Table I.1-1
Hot Spot Contaminant Activities at 25 mrem/OU-yr

Contaminant	Area-Based			Hot Spot		
	RRMG (pCi/g)	Activity (pCi/g)	Dose (mrem/yr)	RRMG (pCi/g)	Activity (pCi/g)	Dose (mrem/yr)
Am-241	39,000	8,900	5.7	400,000	112,876	7.1
Am-243	4,410	125	0.7	59,800	1,590	0.7
Cs-137	1,630	12	0.2	24,800	152	0.2
Pu-238	74,900	680	0.2	1,030,000	8,624	0.2
Pu-239/240	68,600	47,910	17.5	947,000	607,634	16
Pu-241	3,360,000	14,287	0.1	45,600,000	181,200	0.1
Th-232	11,800	175	0.4	110,000	2,218	0.5
U-234	370,000	131	0.0	10,500,000	1,661	0.0
U-238	31,200	285	0.2	336,000	3,619	0.3
Total			25.0	Total		

The Am-241 hot spot limit of 112,876 pCi/g was applied to the GMX hot spots by converting the Am-241 activity into FIDLER count rates. This was achieved by calculating the FIDLER counts per minute (cpm) associated with the gamma emissions of Am-241 in terms of gamma disintegrations per minute (gamma dpm) per pCi/g. This required determining detector efficiencies for each FIDLER instrument and gamma attenuation rates through soil using an Am-241 button source in a controlled environment. This method was applied to the specific FIDLER instruments named Charlie and Nero.

1.1.3 Relationship between Gamma Disintegrations and FIDLER Counts

Efficiencies are used to convert gamma disintegrations of Am-241 per minute (dpm) to net counts per minute (net cpm) (gross cpm minus background cpm) from the FIDLER instruments. The efficiencies for the FIDLER detectors were determined by using an 11.03E6-pCi Am-241 button source that was centered 15 inches (in.) away from the face of the detector. This distance represents the approximate distance from the detector to the ground during radiation surveys.

$$efficiency (cpm/dpm) = \frac{net\ cpm}{4\pi\ gamma\ activity\ (dpm)} \quad Eq. 1$$

The 4π gamma activity is calculated by using the standard conversion of 2.22 total dpm per pCi and converting total dpm to gamma dpm by applying the 59.5 kiloelectron volt gamma yield of Am-241 (0.36) (the fraction of total Am-241 disintegrations that produce a gamma emission) as follows:

$$4\pi\ gamma\ dpm = 11,030,000\ pCi * \frac{2.22\ total\ dpm}{pCi} * \frac{0.36\ gamma\ dpm}{1\ total\ dpm} = 8.82E6 \quad Eq. 2$$

Using the 11.03E6-pCi Am-241 button source, the FIDLER instrument efficiencies are shown in [Table I.1-2](#).

The FIDLER instruments were calibrated on 06/23/2016. The differences in the efficiencies before and after this date are largely due to changes in the high voltage/gain at the time of calibration. The high voltage/gain settings resulted in pre-calibration readings that were much higher than post-calibration readings.

Table I.1-2
FIDLER Instrument Efficiencies

	Net cpm	Efficiency
Charlie before 06/23/2016	39,668	0.0045
Nero before 06/23/2016	43,194	0.0049
Charlie after 06/23/2016	8,891	0.00101
Nero after 06/23/2016	10,931	0.0012

However, using a single-point derived efficiency is unrealistic because the detector will detect gammas from its field of view, not just directly underneath the detector. For this reason, an integrated efficiency is needed. The integrated efficiency was determined by using an Am-241 button source at various offsets from the center of the detector and determining the efficiency of the source at each location. The efficiencies at each offset were weighted based on the portion of counts at the offset compared to the total counts recorded for all offsets. The weighted efficiencies at each offset were then summed to yield an integrated efficiency (Aleksen and Whicker, 2016; Farr et al., 2010).

$$\text{integrated efficiency} = \sum_{n=0}^{40 \text{ cm}} \left(\frac{(\text{net cpm}_n)}{\sum_{n=0}^{40 \text{ cm}} (\text{net cpm}_n)} \times \text{efficiency}_n \right) \quad \text{Eq. 3}$$

To calculate the integrated efficiency, the gross counts, background counts, and efficiency at a certain distance would need to be known. This was done for each detector. [Table I.1-3](#) contains the results for Charlie after 06/23/2016.

Table I.1-3
Example Efficiencies for Charlie after 06/23/2016

cm	Gross Counts	Net Counts	Fraction of Total Counts	Efficiency	Weighted Efficiency
	Gamma cpm		None		
0	9,014	8,891	50.6%	0.00101	0.00051
20	6,207	6,084	34.6%	0.00069	0.00024
40	2,735	2,612	14.9%	0.00030	0.00004
Sum		17,587		Sum	0.00079

The following explains the data contained in each of the table columns in [Table I.1-3](#):

- **cm.** The distance from the center of the detector in centimeters.
- **Gross Counts.** Gross counts at the distance listed in the row.
- **Net Counts.** Gross counts – background counts at the distance listed in the row.
- **Fraction of Total Counts.** The fraction of the total net counts at the listed distance.
- **Efficiency.** The efficiency at the listed distance.
- **Weighted Efficiency.** The “Efficiency” column multiplied by the “Fraction of Total Counts” column. The last row is the sum of all the weighted efficiencies and is the integrated efficiency for the detector.

This was done for each of the detectors resulting in the following integrated efficiencies:

- Charlie before 06/23/2016 = 0.0037 (cpm/dpm)
- Nero before 06/23/2016 = 0.0040 (cpm/dpm)
- Charlie after 06/23/2016 = 0.00079 (cpm/dpm)
- Nero after 06/23/2016 = 0.00099 (cpm/dpm)

The net cpm readings of the FIDLER instruments can be divided by these integrated efficiencies to convert the net cpm readings to gamma dpm.

1.1.3.1 Conversion of Gamma DPM to Am-241 Activity Concentration

The conversion of gamma dpm to an activity concentration in pCi/g can be calculated using the mass of Am-241-contaminated soil in the FIDLER field of view and the standard conversion of 2.22 dpm per pCi. It was experimentally determined that the FIDLER will detect about 97 percent of the normalized activity within a 100-cm radius of the FIDLER in a uniformly contaminated area. This means that 3 percent of the normalized activity is detected by the FIDLER from a distance greater than 100 cm. For the calculations, the assumption is made that the FIDLER has an effective field of view with a 100-cm radius. The mass of soil in the FIDLER field of view with a 1-in. (2.54-cm) thickness of was calculated as follows:

- Field of view area (100-cm radius) = $31,416 \text{ cm}^2$
- Volume of the field of view area (2.54-cm depth) = $79,796 \text{ cm}^3$
- Mass per $79,796 \text{ cm}^3$ of soil volume (1.6-g/cm^3 soil density) = $127,674 \text{ g}$

The following equation was used to determine the conversion factor from gamma dpm to Am-241 activity in pCi/g:

$$\frac{\text{gamma dpm}}{\text{pCi/g}} = \frac{2.22 \text{ total dpm}}{\text{pCi}} * \frac{0.36 \text{ gamma dpm}}{\text{total dpm}} * \frac{\text{Soil mass (g)}}{2.54 \text{ cm of depth}} * \text{depth (cm)} \quad \text{Eq. 4}$$

As shown in the following equation for a depth of contamination of 2.54 cm, this results in 102,037.3 gamma dpm for each pCi/g of Am-241.

$$\frac{\text{gamma dpm}}{\text{pCi/g}} = \frac{2.22 \text{ total dpm}}{\text{pCi}} * \frac{0.36 \text{ gamma dpm}}{\text{total dpm}} * \frac{127,674.3 \text{ g}}{2.54 \text{ cm}} * 2.54 \text{ cm} = 102,037.3 \quad \text{Eq. 5}$$

However, this relationship must be modified, as it does not account for attenuation of the gamma activity through the soil. Gamma emissions are attenuated exponentially in the desert soil. Some of the Am-241 gamma emissions are scattered and/or absorbed in the soil while others do not interact with the soil. An Am-241 button source was used to determine the attenuation coefficient of typical desert soil and the transmission fraction through various soil depths and offsets to 30 cm. The following equation is used for determining the transmission of photons through a target:

$$I_x = I_o e^{-\mu x} \quad \text{Eq. 6}$$

where

- I_x = the photons that do not interact with the soil
- I_o = the photons emitted from the source
- μ = the linear attenuation coefficient
- x = the thickness of the soil

The μ is determined by solving for μ in Equation 6. Experimentally, I_o is the gamma activity of the source, and I_x is the activity detected by the FIDLER. The distance from the source to the surface of the soil, x , is variable depending on the soil depth and the offset used. The distance from source to surface soil, x , was calculated for each soil thickness and offset. The average attenuation coefficient from a series of offsets and soil thicknesses was determined to be 0.6 cm^{-1} .

The transmission fraction is the portion of emitted gammas that could be detected after traveling through a soil thickness. This was determined by placing the source 15 in. away from the detector on

the surface of the soil (as well as offsets of 10, 20, and 30 cm) and recording the count rate. Then the source was placed underneath 1 in. of soil (still with the detector 15 in. away from the soil surface) and the count rate recorded (at offsets also). This process was repeated for a soil depth of 2 and 3 in. An integrated efficiency was determined (as discussed in the previous section) for the surface and each soil depth. The integrated efficiency for each soil depth was then compared to the integrated efficiency of the surface. The fraction of the integrated efficiency at soil depth to the integrated efficiency at the soil surface will be known as the transmission fraction. The two FIDLER detectors yielded results that were not distinguishably different. Therefore, the derived transmission fractions will be used for both instruments.

The integrated efficiency was determined for each soil depth using the Charlie detector. The transmission percentages for each soil depth were then calculated, as shown in [Table I.1-4](#).

**Table I.1-4
Transmission Percentages at Soil Depths**

Soil Depth	Transmission Percentage
Surface	100.0%
2.54 cm	17.5%
5.08 cm	4.4%
7.62 cm	1.2%

With the inclusion of a soil mass, the attenuation of the Am-241 gamma ray through the soil becomes an important factor in the estimation of soil concentration. The soil concentration can be better estimated by applying the corresponding transmission fraction to the gamma dpm to Am-241 activity (pCi/g) previously calculated.

$$\frac{dpm}{pCi/g} \text{ attenuated} = \frac{dpm}{pCi/g} * \frac{1}{F_t} \quad \text{Eq. 7}$$

Using a transmission fraction associated with the bottom of the contaminated soil layer would represent that all of the Am-241 contamination is at that depth and attenuated through an overlying layer of uncontaminated soil. Using a transmission fraction associated with the top of the contaminated soil layer would be more representative of site conditions, as the contamination is

concentrated at or near the surface and decreases rapidly with depth. However, to be conservative, it was determined to use a transmission fraction associated with a soil depth of one-half of the estimated total depth of contamination, even though this would result in an overestimation of Am-241 activities.

Using a total soil contamination depth of 5 cm, the corresponding transmission fraction would be 0.175. As shown in the following equation, this would result in 17,856.5 gamma dpm for each pCi/g of Am-241.

$$\frac{dpm}{pCi/g} \text{ attenuated} = \frac{102,037.3 \text{ gamma dpm}}{pCi/g} * 0.175 = 17,856.5 \quad Eq. 8$$

Putting the various equations together to get the relationship between the FIDLER net cpm readings and the Am-241 activity in pCi/g results in the following equation:

$$\frac{net \text{ cpm}}{pCi/g} = (Ew) * \left(\frac{dpm \text{ to } pCi}{conversion factor} \right) * \left(\frac{Am241}{gamma \text{ yield}} \right) * (soil \text{ mass}) * \left(\frac{transmission}{factor} \right) \quad Eq. 9$$

where

Ew = The integrated efficiency of the FIDLER instrument

Populating the non-FIDLER-specific parameters results in the following:

$$\frac{net \text{ cpm}}{pCi/g} = Ew \left(\frac{net \text{ cpm}}{gamma \text{ dpm}} \right) * \frac{2.22 \text{ total dpm}}{pCi} * \frac{0.36 \text{ gamma dpm}}{total \text{ dpm}} * 127,674.3 \text{ g} * 0.175 \quad Eq. 10$$

Consolidating terms results in the following conversion factor:

$$\frac{net \text{ cpm}}{pCi/g} = Ew \left(\frac{net \text{ cpm}}{gamma \text{ dpm}} \right) * \frac{17,856.5 \text{ gamma dpm}}{pCi/g} \quad Eq. 11$$

Applying the integrated efficiency of the Charlie FIDLER instrument (0.00079) to Equation 11 results in a conversion factor of 14.11. Applying the integrated efficiency of the Nero FIDLER instrument (0.00099) to Equation 11 results in a conversion factor of 17.68. Applying these conversion factors to the hot spot Am-241 activity of 112,876 pCi/g with results in hot spot criteria for the Charlie and Nero FIDLER instruments of 1.59E6 cpm and 2.0E6 cpm, respectively. However, as the FIDLER instruments cannot register a cpm value greater than 999,999, the hot spot criteria to

be used for both instruments will be conservatively set at 10 percent below the maximum reading or 900,000 cpm.

I.2.0 References

- Abelquist, E.W. 2008. *Dose Modeling and Statistical Assessment of Hot Spots for Decommissioning Applications*. University of Tennessee, Knoxville, Ph.D dissertation.
- Alecksan, T., and R. Whicker. 2016. "Scan MDCs for GPS-Based Gamma Radiation Surveys." In *Operational Radiation Safety*, Vol. 111(2): pp. S123–S132. McLean, VA: Health Physics Society.
- Farr, C.P., Alecksan, T.J., R.S. Heronimus, M.H. Simonds, D.R. Farrar, M.L. Miller, and K.R. Baker. 2010. "Recovery of Depleted Uranium Fragments from Soil." In *Operational Radiation Safety*, Vol. 98(2). McLean, VA: Health Physics Society.
- NNSA/NFO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office.
- U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office. 2014. *Soils Risk-Based Corrective Action Evaluation Process*, Rev. 1, DOE/NV--1475-Rev. 1. Las Vegas, NV.
- Yu, C., A.J. Zielen, J.-J. Cheng, D.J. LePoire, E. Gnanapragasam, S. Kamboj, J. Arnish, A. Wallo, III, W.A. Williams, and H. Peterson. 2001. *User's Manual for RESRAD Version 6*, ANL/EAD-4. Argonne, IL: Argonne National Laboratory, Environmental Assessment Division. (Version 7.0 released in April 2014.)

Appendix J

Nevada Division of Environmental Protection Comments

(20 Pages)

NEVADA ENVIRONMENTAL MANAGEMENT OPERATIONS ACTIVITY DOCUMENT REVIEW SHEET

1. Document Title/Number: Closure Report for Corrective Action Unit 573: Alpha Contaminated Sites, Nevada National Security Site, Nevada, Draft			2. Document Date: November 2016		
3. Revision Number: 0			4. Originator/Organization: Nevada Division of Environmental Protection		
5. Responsible DOE NNSA/NFO Activity Lead: T. Lantow			6. Date Comments Due: December 19, 2016		
7. Review Criteria:					
8. Reviewer/Organization Phone No.: NDEP			9. Reviewer's Signature:		
10. Comment Number/Location	11. Type ^a	12. Comment	13. Comment Response		
1. Section 1.0, pg. 1, para. 2		While a detailed discussion of the history of this CAU is not needed in this CR and reference to the CAIP is sufficient for such a history, there is no reason the third paragraph of Section 1.0 of the CADD/CAP cannot be repeated here to provide a very concise description of this CAU, especially given the content of Section 1.2 of this CR.	Revised as suggested; inserted the following at the beginning of the 2nd paragraph in Section 1.0: "CAU 573 is located in the east (Hamilton) and northeast (GMX) portions of Area 5 as shown on Figure 1-1. These two CASs include releases from 29 equation-of-state experiments (physical properties of materials at high temperature and pressure) and one weapons-related tower test."		

^aComment Types: M = Mandatory, S = Suggested.

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2.	1.1, pg. 1, para. 1		a) 2nd sentence: There is no verification data presented in this CR so NDEP cannot perform an evaluation that closure activities did indeed occur. See comments below for additional specific references to, and requests for, verification data. b) Last sentence: A short summary of the reason(s) for the selection of the corrective action alternatives should be included in this section, especially given the content of Section 1.2 of this CR. Section 4.0 of the CADD/CAP for CAU 573 contains the necessary information in a very concise manner. This will also address Comment No. 22, below.	a) Verification data were added to Appendix D, <i>Confirmation Sampling Test Results</i>. The verification data are presented in Table D.1-1. b) Deleted the last sentence of Section 1.1 and revised Section 1.2 with the following text: Section 1.2 Scope “As presented in the CAU 573 CADD/CAP (NNSA/NFO, 2016b), the CAA of closure in place with a use restriction (UR) was selected by the stakeholders in the CAA meeting held on November 24, 2015, as the preferred corrective action for GMX. Clean closure was not selected due to the presence of high levels of removable contamination that would require significant radiological controls to protect workers from inhaling or ingesting airborne radioactive particles. Even if the site were clean closed, the area surrounding the high contamination areas (HCAs) would still be posted as a contamination area (CA). Therefore, the corrective action of closure in place with a UR was selected for GMX. In addition to the corrective actions completed at GMX, another activity was implemented to address point source contamination (i.e., small particles of uranium and plutonium metal) identified in the CAIP (NNSA/NFO, 2014a) and the CADD/CAP (NNSA/NFO, 2016b). The removal and consolidation of the point sources was a conservative measure performed as a best management practice (BMP) to address material accountability and contamination control concerns. Because the point sources were determined to be below the action level (hot spot criterion defined in Appendix I), this was not considered a corrective action under the FFACO (1996, amended). Removal and consolidation of the point sources is further discussed in Sections 2.1.1 and 2.2. As presented in the CADD/CAP (NNSA/NFO, 2016b), the CAA of clean closure was selected by the stakeholders in the CAA meeting held on November 24, 2015, as the preferred corrective action for the debris pile at Hamilton. Without dismantling the pile, it could not be determined during the corrective action investigation (CAI) whether the debris pile contained contaminants of concern (COCs). Thus, it was determined to assume that the pile contained COCs and to remove the pile as a clean closure. Clean closure at the Hamilton site was accomplished by implementing the corrective actions of removing the soil pile and collecting soil samples to demonstrate that contaminants were no longer present at levels that would cause a dose exceeding the final action level (FAL). The closure activities were completed in accordance with the CADD/CAP and in accordance with the <i>Soils Activity Quality Assurance Plan</i> (QAP) (NNSA/NSO, 2012b), which establishes requirements, technical planning, and general quality practices. The verification sample results and the risk associated with site contamination were evaluated in accordance with the <i>Soils Risk-Based Corrective Action</i> (RBCA) <i>Evaluation Process</i> (NNSA/NFO, 2014b).”
3.	1.0, pg. 2, Fig. 1-1		Inset box: Identify the border between the NNSS and NTTR and place call outs on either side.	Added labels to figure as suggested.

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5. Responsible DOE NNSA/NFO Activity Lead: T. Lantow			6. Date Comments Due: December 19, 2016		
7. Review Criteria:					
8. Reviewer/Organization Phone No.: NDEP			9. Reviewer's Signature:		
10. Comment Number/Location	11. Type ^a	12. Comment	13. Comment Response		
4.	1.2, pg. 1,3, par. 1	a) The CAU 573 CADD/CAP does not address "hot spots" of radioactivity or the consolidation of them with debris into the source area. Discuss when and where these "hot spots" were identified and if appropriate notification and protective actions were made. b) What is the status of the revisions to the Soils Activity Quality Assurance Plan (QAP) (NNSA/NSO, 2012b) and the Soils Risk-Based Corrective Action (RBCA) Evaluation Process (NNSA/NFO, 2014b), given these two documents are cited extensively throughout this CR (and the previous CADD/CAP)? Additional comment received 2/28/17: c) Will the static Fiddler readings be added as a data set?	a) The removal and consolidation of hot spots were assumed to be corrective actions in the Draft Closure Report due to over-ranging of the FIDLER at several hot spot locations during the drive-over survey. After further evaluation, static FIDLER readings were used to show that all of the hot spots were well below the FIDLER hot spot action level, and the removal was determined to be a BMP. All corrective actions were completed as specified in the CADD/CAP, and the additional BMP activities associated with the hot spots (point sources) were added as deviations in Section 2.2. Also, explanatory text was added in the revised Section 1.2 shown in the response to Comment 2b. Revised Section 2.2 addresses when and where these "hot spots" were identified, and the notification and protective actions that were taken (see response to Comment 6). Changed the hot spot removal from "corrective action" to "BMP" throughout the document. b) All citations in the Closure Report refer to the current published versions of the QAP and the RBCA documents. The status of any revisions to these documents is outside the scope of this document and will be addressed in separate correspondence. No change to the document. c) Post FIDLER readings were added to Appendix D with a callout in Section 2.2.		
5.	2.0, pg. 6, para. 1	Last sentence: There are no results of verification sampling found in Appendix D. Please correct this oversight.	Verification data were added to Appendix D, <i>Confirmation Sampling Test Results</i>. The verification data are presented in Table D.1-1. Refer to Comment 2a.		

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10. Comment Number/Location	11. Type ^a	12. Comment	13. Comment Response		
6.	2.1.1, pg. 6, para. 1	1st sentence: The CAU 573 CADD/CAP does not address "hot spots" of radioactivity or the consolidation of them with debris into the source area. Discuss when and where these "hot spots" were identified and if appropriate notification and protective actions were made.	In order to address hot spots, Section 2.1.1 was rewritten. See the revised Section 2.1.1 in the Final document. In addition, Section 2.2 was replaced to further clarify the details associated with the disposition of the hot spots. See the revised Section 2.2 in the Final document.		
7.	2.1.1, pg. 6, para. 1	a) 2nd sentence: Figure 2-1 provides a table with "hot spot" names "Pre-Corrective Action MOB" and "Post Corrective Action MOB" values. Provide the average background CPM value, the background FIDLER survey location and how MOB values were calculated for multiple FIDLER instruments. b) In reviewing FIDLER survey maps presented in the CAU 573 CADD/CAP and CAIP, the background cpm values presented were provided as ranges. The CADD/CAP (Fig. A.4-1) presents a FIDLER background range of 2,510 – 4,241 cpm and the CAIP (Fig. 2-6) presents a FIDLER background range of 3910 – 4241 cpm. Figure 2-1 does not present a background range. Provide the background range and clarify the differences between the figures.	a) The background location was added to Figure 2-1. Also noted that the hot spot locations are not to scale on the figure. Added the following text to the 2nd paragraph of Section 2.1.1: "The hot spot areas are very small and are individually shown at a larger scale in Figure 2-1 to be visible." b) The background values for each survey were added to Figure 2-1. The following text was added to Section 2.1.1: "Note that radiation survey background values presented on different figures vary due to differences in cosmic, terrestrial, and radon radiation levels; different instrument efficiencies; and different voltage/gain adjustments on survey instruments."		

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8.	2.1.1 pg. 6, para. 1	a) Explain the phrase "over-ranging" of the instrument. b) Explain why FIDLER was appropriate to determine compliance with the OU hot spot criteria since the instrument range is below the action level criteria; assess whether the survey should have switched to an instrument appropriate for higher readings when "over-ranging" occurred. c) The CR does not address whether the hot spots were sampled to identify the total COC pCi/g concentration so a comparison could be made against the OU Hot Spot RRMGs. d) The last sentence uses the term, "relocated to the source area." Does this mean the same thing as "consolidation"? e) Using the term, "(i.e., the bunker area)" seems to imply there is more than one source area; clarify by showing the source area on the figure. Additional comment received 2/28/17: Has this been verified? Additional comment received 3/6/17: A static measurement with a FIDLER was taken at the location with the highest radioactivity. The value reported was 670,000 cpm (net or gross?), which is less than the hot spot criterion (1.59E6 cpm) presented in Appendix I. The hot spot material was not sampled. The revised section relies on FIDLER cpm values that are comparable to a hot spot criterion based on the activity of Am-241 in pCi/g. The hot spot criterion based on Am-241 is a single radionuclide soil concentration value. The CAU 573 CR identifies multiple radionuclide RRMGs. Since the hot spots were not sampled it is not clear as to how the isotopic ratios were determined so a comparison to a hot spot mixture could be performed to determine if the dose had been exceeded. Please reference equation 3.16 in	a) The term "over-ranging" was deleted in the revised Section 2.1.1. Refer to the revised Section 2.1.1 in the Final document. The revised section refers to a post-calibrated static FIDLER survey value that did not "over-range" the instrument. b) The FIDLER is widely accepted as the most appropriate survey instrument for surveying plutonium contamination. No change was made to the document. c) The hot spot material was not sampled. The revised section relies on FIDLER cpm values that are comparable to a hot spot criterion based on the activity of Am-241 in pCi/g. d) Yes, clarified in text that they were consolidated into the Test Location - Corrective Action Boundary A. e) Revised all terms to "Test Location - Corrective Action Boundary A." The FIDLER instrument calibrations were verified to a known Am-241 activity. The readings were not verified to a soil sample result as the hot spot criterion conservatively assumes a future state when the contamination is completely removed from the metal debris and resides in soil. As the contamination is not yet completely in the soil, a soil sample cannot be collected. The document specifies that the values are "readings" which are taken directly from the instrument (i.e., gross). Section I.1.2 states: "Based on the average relative abundance of radionuclides at the GMX site, the calculated activities of each radionuclide that would result in a dose of 25 mrem/OU-yr are presented in Table I.1-1 for both the area-based and hot spot RRMGs. Of the radionuclides present at the GMX site, Pu-239/240 and Am-241 provide more than 90 percent of TED. As Am-241 is the more readily detectable by field instrumentation, it was used to develop a FIDLER field screening criterion for hot spots based on an Am-241 activity of 112,876 pCi/g." The information for isotopic ratios of the multiple radionuclides is provided in Table I.1-1 based on all of the surface sample results (other than drainages) that were reported in the CAU 573 CADD/CAP.
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		ANL/EAD-4, User's Manual for RESRAD Version 6, July 2001			
9.	2.1.1 pg. 6, para. 1	a) 2nd sentence: state the criterion used to establish the placement (spacing, number, etc.) of the FFACO UR signs and if there were deviations. b) 4th sentence: While this statement is made in Section 4.0 of the NDEP-approved CADD/CAP, has a process for NDEP notification for evaluation and approval of activities within UR areas outside the scope of the UR been vetted and institutionalized? NDEP may not have sufficient resources to determine if any activity within the use restricted areas will result in a higher exposure than that of the most exposed site worker presented in the risk so this statement requires further discussion with Nevada Field Office personnel.		a) Added sign placement criteria in Section 2.1.1, Section 4.0, and Section 4.2: "To facilitate inspection and maintenance, UR signs were placed at locations designed to prevent inadvertent intrusion to the site (e.g., at the entrance to the CA and along the CA fence perimeter) in accordance with Section 5.1 of the CADD/CAP (NNSA/NFO, 2016b)." b) The 4th sentence of Section 2.1.1 was deleted from this section, as its purpose is to discuss closure activities only. This term "approval" in regard to evaluation of activities within UR areas has been revised throughout the document as follows: "....the UR without prior notification and acknowledgment of NDEP unless the activities are conducted under the provisions of 10 CFR Part 835 (CFR, 2016)."	

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10.	Fig 2-1, pg. 7	a) Add the location of the HCA to the Figure. It appears to be the same boundary as the "FFACO Use Restriction" but should probably be referred to as the HCA and not the FFACO Use Restriction (UR) on this Figure. b) Add the GMX GZ to the Figure. A smaller FFACO UR, south of the main FFACO UR area, is identified (and assumed to be an HCA) on Page 3 in Appendix G but is not clearly shown or discussed in Figure 2-1. Please ensure the two figures are comparable.	a and b) Clarified figure by labeling the GZ and the two corrective action boundaries as "Test Location - Corrective Action Boundary A" and "Corrective Action Boundary B." The multiple tests at GMX were conducted on or very near one test location (referred to as "GZ" on the figures). Added the GMX GZ test location to the figures. The following two sentences in Section 2.1.1 were modified to clarify the relationship between HCA boundaries and corrective action boundaries, and the definition of the term "GZ": "The corrective action of closure in place was implemented by establishing an FFACO UR for Corrective Action Boundaries A and B in the areas where removable contamination exceeds the HCA criteria (currently coincides with the HCA boundaries)." ... "These materials were relocated to Corrective Action Boundary A, which contains the test location (referred to as "ground zero" [GZ]), as this area is radiologically protected and already contains like materials."		

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11.	2.1.2, pg. 8, para. 1	a) 5th sentence: State the reason for the FIDLER survey. b) There is no comparison of the removal survey results to previous terrestrial radiation surveys conducted at Hamilton (i.e., pp. 16-20 CAU 573 DQO Presentation, April 2014). c) 7th sentence: The soil plot is apparently referred to as "Centroid" in Figure 2-12, with no explanation of the term. Clarify.	a) Revised and inserted the following text in Section 2.1.2 as follows: "A FIDLER radiation survey was conducted over the excavated area after the removal activities for the purpose of biasing the location of the verification sample plot. There is no previous terrestrial radiation survey of the pile area to compare to the post-excavation survey, as a pre-removal survey could not be safely conducted over the pile. The results of the post-excavation FIDLER survey are presented in Figure 2-13. However, because the excavated area was slightly smaller than the size of the sample plot, the sample plot was centered over the excavated area." b) See response to Comment 11a. The following sentence was added to Section 2.1.2: "There is no previous terrestrial radiation survey of the pile area to compare to the post-excavation survey, as a pre-removal survey could not be safely conducted over the pile." c) Figure 2-12 (now Figure 2-13) was revised to show that the sample plot was centered over and encompassed the excavated area.		

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10. Comment Number/Location	11. Type ^a	12. Comment	13. Comment Response		
12. Fig. 2-12, pg. 19		a) Identify the background location. b) In reviewing the FIDLER survey maps presented for Hamilton in the CADD/CAP and CAIP there appears to be an order of magnitude difference in the presented background CPM data. c) Clarify the difference in the stated FIDLER singular background value of 362 cpm with respect to the FIDLER background range of 2,273 – 3,806 cpm as provided in Figure A.6-3 of the CAU 573 CADD/CAP. d) The color coded FIDLER measurement points shown within remediated area are difficult to differentiate. Please enlarge the Soil Pile Removal confirmation Soil Plot.	a) The background location was added to the figure. b and c) The difference in the background numbers is discussed in the response to Comment 7b. d) The figure has been revised, and the soil plot has been enlarged for clarity.		
13. Section 4.0, pg. 26, para. 1		a) The CADD/CAP did not specify movement and consolidation of hot spots as a CAA remedy selection, rather only "establishing an FFACO UR around the two HCAs at the site". Explain this deviation from the NDEP-approved CADD/CAP. b) Identify in Figure 2-1 the location of the relocated hot spots.	a) The purpose of this section is to report verification sample results for the corrective action of clean closure. See the responses to Comments 4 and 6 for discussion of the hot spot removal actions. In addition, the 1 st paragraph of Section 4.0 has been replaced with the following: "All corrective actions were implemented as specified in the CADD/CAP (NNSA/NFO, 2016b). For the GMX site, the corrective action of closure in place was implemented by establishing an FFACO UR. No verification samples were required or collected at GMX." b) Changed text throughout the document to refer to the source area as "Corrective Action Boundary A" and labeled the "Test Location - Corrective Action Boundary A" in Figure 2-1.		

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5. Responsible DOE NNSA/NFO Activity Lead: T. Lantow			6. Date Comments Due: December 19, 2016		
7. Review Criteria:					
8. Reviewer/Organization Phone No.: NDEP			9. Reviewer's Signature:		
10. Comment Number/Location	11. Type ^a	12. Comment	13. Comment Response		
14. Section 4.0, pg. 26, Table 4-1		a) Include the analytical data and calculations for TED and 95% UCL of TED for IA, RW, and OU scenarios. These are key parameters that will allow NDEP to confirm the corrective action. NOTE: This is in agreement with (IAW) Section 1.4, 6th bullet of Appendix VI of the FFACO, "Closure Report (CR): A document that states that the completed corrective action was conducted in accordance with the approved CAP and provides to NDEP all necessary support data to confirm that the appropriate corrective action took place." b) Table 4-1: Is location "B99" shown on any Figure? If not, the location needs to be added to an appropriate Figure.	a) Added Table D.1-1 with verification sample analytical data and added the following reference to the RBCA document: "...were calculated as described in the Soils RBCA document (NNSA/NFO, 2014b)..." In keeping with past Soils documents, the standardized, repeatable calculations for dose are referenced as provided in the RBCA document. b) Added the location to Figure 2-12 (now Figure 2-13).		
15. Section 4.0, pg. 26, para. 3		1st sentence: Appendix D does not present any analytical results as stated in this section. Include all analytical results since these data support the corrective action (see comment 14 regarding presentation of necessary supporting data as required by the FFACO).	Added Table D.1-1 with verification sample analytical data.		

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16. Section 4.0, pg. 26, para. 3		a) 1st bullet: Section 1.2 states, "Clean closure at the Hamilton site was accomplished by implementing the corrective actions of removing the soils pile and collecting soil samples to demonstrate that contaminants were no longer present at concentrations above the final action level (FAL)." However, dose as presented in this CR, is a calculated/estimated quantity while concentration is a measured quantity. Clarify the Decision I criteria throughout the document: concentration or dose. b) 2nd bullet: State the criterion used to establish the placement (spacing, number, etc.) of the FFACO UR signs.	a) Changed "concentration" to "dose" or "activity" throughout the document b) Added sign placement criteria in Section 2.1.1, Section 4.0, and Section 4.2 (Refer to Comment 9a). Revised 2nd bullet in Section 4.0 to the following: "An FFACO UR was established at GMX (see Attachment G-1). To facilitate inspection and maintenance, UR signs were placed at locations designed to prevent inadvertent intrusion to the site (e.g., at the entrance to the CA and along the CA fence perimeter) in accordance with Section 5.1 of the CADD/CAP (NNSA/NFO, 2016b)."		
17. Section 4.0, pg. 26, para. 4		1st sentence: Include these data to confirm appropriate corrective actions took place.	Added Table D.1-1 with verification sample analytical data.		
18. Section 4.0, pg. 27, para. 1, 2		a) 1st sentence: This sentence is confusing as placed in this paragraph due to the singular data table being presented prior to this statement. Furthermore, a full summary is required of the verification data collected during the CA so a complete assessment could be performed to evaluate the CA. b) Paragraphs 1 and 2 seem introductory and should be placed near the beginning of Section 4.0.	a and b) Added Table D.1-1 with verification sample analytical data. Section 4.0 was revised for clarity; see revised text in the Final document.		

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19.	Section 4.1.1.1.1, pg. 29, par. 2		1st sentence: Figure 2-12 indicates highest FIDLER readings are located near the southern border of the previous debris pile and not within the confirmatory soil plot. Update the figure to show highest FIDLER readings were within the confirmatory soil plot or explain the apparent deviation from Criterion 1a. Additional Comment Received 2-28-17: Should GPS positional accuracy be a DQO element since UR and CA boundaries are often determined by them?		Figure 2-12 (now Figure 2-13) was revised to clarify that the sample plot encompassed the entire excavated area and the highest FIDLER readings. Inserted the following related text in Section 2.1.2: "However, because the excavated area was slightly smaller than the size of the sample plot, the sample plot was centered over the excavated area." "This FIDLER survey covered the entire area as well as the area immediately surrounding the excavation. The survey tracks are either linear or spiral in nature with parallel tracks used to ensure complete coverage. Positional resolution in the Global Positioning System (GPS) limits recording of the actual position to 1 meter (m). When the positional data are plotted in small scale (as in Figure 2-13), the parallel track nature of the survey is not readily apparent. This is the result of the survey GPS positional accuracy, not the actual survey conducted. The elevated readings outside the excavated area shown in Figure 2-13 were evaluated in the CADD/CAP (NNSA/NFO, 2016b) and were shown to be below the FAL." We agree that GPS accuracy could be included as a DQO consideration for sites where it is used as decision-supporting data in establishing UR and CA boundaries. This can be included in DQO as well as DQA discussions. GPS data were not used in establishing any boundaries for CAU 573.
20.	Section 4.2, pg. 36, para. 1		4th sentence: See Comment 9.b), above.		Deleted the word "approval" in regard to evaluation of activities within UR areas, and replaced with the following throughout the document: "....the UR without prior notification and acknowledgment of NDEP, unless the activities are conducted under the provisions of 10 CFR Part 835 (CFR, 2016)."

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21. Section 4.2, pg. 36, para. 1, 2		a) Clarify if the GMX FFACO UR boundary coincides with the existing HCA boundary. b) Add page references from Appendix G when the FFACO and URs are described in each paragraph. c) See Comment 9.b), above.	a) Revised the 2 nd sentence of the 2 nd paragraph as follows: "An FFACO UR (see Attachment G-1) was implemented based on the assumed potential to receive a dose exceeding 25 mrem/yr from the areas identified as exhibiting removable contamination at levels exceeding the criterion for an HCA (currently coincides with the HCA boundaries)." b) Added cross references to the UR Form in Attachment G-1 throughout the document. In keeping with past practices, the UR form is referenced in its entirety. c) The term "approval" in regard to evaluation of activities with UR areas has been revised throughout the document as follows: "...the UR without prior notification and acknowledgment of NDEP, unless the activities are conducted under the provisions of 10 CFR Part 835 (CFR, 2016)." Following the 2 nd bullet in Section 5.1, inserted a replication of the CAA explanatory text (also inserted similar text into Section 1.2), as follows: "As presented in the CADD/CAP (NNSA/NFO, 2016b), the CAA of closure in place with a UR was selected by the stakeholders in the CAA meeting held on November 24, 2015, as the preferred corrective action for GMX. Clean closure was not selected due to the presence of high levels of removable contamination that would require significant radiological controls to protect workers from inhaling or ingesting airborne radioactive particles. Even if the site were clean closed, the area surrounding the HCAs would still be posted as a CA. Therefore, the corrective action of closure in place with a UR was selected for GMX. As presented in the CADD/CAP, the CAA of clean closure was selected by the stakeholders in the CAA meeting held on November 24, 2015, as the preferred corrective action for the debris pile at Hamilton. Without dismantling the pile, it could not be determined during the CAI whether the debris pile contained COCs. Thus, it was determined to assume that the pile contained COCs and to remove the pile as a clean closure."		
22. Section 5.1, pg. 37, para. 1		Section 2.1.1 describes that GMX is known to have hot spots conservatively assumed to exceed hot spot criterion, while in Section 2.1.2, the Hamilton (Study Group 3 – debris pile) is "assumed" to have contaminants above the FAL. With this information, Close in Place was adopted for GMX while Clean Closure was selected for the Hamilton pile. As presented here, closure alternatives selected for each CAS could be construed as inconsistent by readers unfamiliar with the earlier process of selecting Corrective Action Alternatives. An additional brief explanation should be added about the selection rationale for two alternatives between the CASS.			

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23.	Section 5.2, pg. 37	The second and third sentences from the first paragraph of Section 4.0 of the CADD/CAP should be added to this Section as the last paragraph.	Add the following text to the end of Section 5.2: "The corrective action recommendations by the stakeholders for CAU 573 are based on the assumption that activities on the NNSS will be limited to those that are industrial in nature and that the NNSS will maintain controlled access (i.e., restrict public access and residential use). Should the future land use of the NNSS change such that these assumptions are no longer valid, additional evaluation may be necessary."		
24.	Appendix F	a) Appendix A Cover Sheet: There are no DQOs for the GMX CAS, for which corrective action is closure in place with URs. b) Section headings, page numbers and references within the text must be revised as Appendix A. c) F.2.1: does not include GMX. d) F.2.2.1: does not include GMX. e) F.2.2.4 & F.2.2.5: do not include GMX. f) F.3.2: does not include GMX. g) F.5.4: the term "Study Group" or "SG" was never "defined" in this CR. Its only other use is in the Executive Summary. If the term is going to be used it needs to be placed into context in the main document text, i.e., when discussing corrective actions taken (what, where, how) at each CAS. h) F.8.0: does not include GMX.	a) through h) The DQOs presented in Appendix A are taken verbatim from the approved CADD/CAP. The following notes were added to the cover page of Appendix A: "Note 1: This appendix contains the DQOs as presented in Appendix F of the CADD/CAP. Therefore, cross references, acronyms, section headings, references, page numbers, header information, and other data in this appendix refer to the original document. The study groups used in the characterization phase are not used in the corrective action phase. Therefore, the term "study group" appears in this appendix but not in the remainder of the CR. Note 2: For the GMX site, the corrective action of closure in place was implemented by establishing an FFACO UR. Therefore, the GMX site is not discussed in this appendix, as no verification samples were necessary"		

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25.	Section D.1.0, pg. D-1, para. 2	1st sentence: This appendix provides no analytical results for soil samples collected at Hamilton as verification sampling of completion of closure activities. The analytical results should be included so the conclusions in the CA can be confirmed.	Added Table D.1-1 with verification sample analytical data.		

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26. Section D.1.1, pg. D-1, D-2, para.1		a) 1st sentence: A justification for the use of modeling vs. direct TLD measurement is required, especially since a single direct measurement site would appear to be preferable. b) Since the CR does not provide sufficient data to determine that verification soil samples collected from beneath the soil/debris pile at Hamilton correspond to the highest FIDLER radiological readings as presented in Figure 2-12, the data presented in Table D.1-1 cannot be verified. The data and calculations to support Table D.1-1 should be provided. c) Table D.1-1: Is location B99 shown on any Figure?	a) Replaced Section D.1.1 to clarify that TLDs were not prescribed in the DQOs and to clarify the rationale for using a correction factor for TLD-equivalent external dose, as follows: "In accordance with the verification sampling DQOs and the CAU 573 CADD/CAP (NNSA/NFO, 2016), external dose was calculated from verification sample analytical results. Thermoluminescent dosimeters (TLDs) were not used for calculating external dose because TED at the Hamilton site is predominantly from internal dose, and sufficient data are available to demonstrate a high correlation of RESRAD-derived external dose to TLD results. This has been shown at numerous locations where both TLD and soil samples have been collected (Figure D.1-1). "Use of the TLD-equivalent external dose is conservative because the TLD external dose generally provides a higher external dose value. However, this relationship of TLD external dose to RESRAD-calculated external dose is not reliable at locations where dose is low (i.e., less than approximately 2 millirem per Industrial Area year [mrem/IA-yr]). Therefore, it is more reliable to use the central tendency of this relationship using all of the available data from the Soils Activity. This was done by calculating the slope of the regression line from the correlation of TLD external dose to RESRAD-calculated external dose. The resulting relationship is that the TLD external dose is 1.58 times higher than the RESRAD-calculated external dose. This relationship is then used as the correction factor to adjust a RESRAD-calculated external dose to be equivalent to a TLD external dose value. The standard deviation and average external doses for each exposure scenario are presented in Table D.1-2. Table D.1-3 presents the external dose data." b) Added Table D.1-1 with verification sample analytical data. c) Added location B99 to Figure 2-12 (now Figure 2-13).		

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27. Section D.1.2, pg. D-2, para. 1		a) Provide the data and calculations to support Table D.1-2. b) Table D.1-2: Is location B99 shown on any Figure?	a) Added Table D.1-1 with verification sample analytical data and a reference to RBCA document. b) Added location B99 to Figure 2-12 (now Figure 2-13).		
28. Section D.1.3, pg. D-2, para. 1		a) Provide the average internal dose and average external dose for each scenario so the Average TED values can be verified in Table D.1-3. b) Tables D.1-1 and D.1-2 show a "Number of Elements" column suggesting TLD deployment, but Sec. D.1.1 states no TLDs were placed. Clarify.	a) Added internal and external dose statistics for each scenario. Refer to revised Appendix D in the Final document. b) Number of Elements changed to "Number of Samples" as suggested		
29. Section F.1.0, pg. F-1, para. 1		What is meant by "the original Post-Closure Plan" as this site has not yet been closed? If there is indeed a Post-Closure Plan for this site, "was sufficient" should be "is sufficient."	For clarification, the text was revised to "...because the Post-Closure Plan as presented in the CAU 573 CADD/CAP is sufficient."		
30. Attachment G-1, pgs. 2, 5, para. 1		Under Site Controls : Has a process for NDEP notification and approval of activities that would cause a site worker to be exposed to site radiological contamination for a period of more than that required to receive a dose of 25 mrem/yr been vetted and institutionalized? NDEP may not have sufficient resources to determine if any activity within the use restricted areas will result in a higher dose so this statement requires further discussion with Nevada Field Office personnel.	Deleted the word "approval" in regard to evaluation of activities within UR areas, and replaced with the following: "....the UR without prior notification and acknowledgment of NDEP unless the activities are conducted under the provisions of 10 CFR Part 835."		

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31. Attachment G-1, pg. 4, para. 1		There are no concentrations provided in the "table below" for administrative UR, only the dose limit is provided. However, estimates presented in the CAIP, Feb 2016, show the following sample measurements (Ci): Am-241 at 0.20; Pu-238 at 0.028; Pu-239/240 at 1.4; Cs-137 at 0.026; Sr-90 at 0.015. Either provide a foot note (if allowed by UR format rules) to explain why dose limit is present rather than a concentration value, and/or include estimated concentrations from available data.	Replaced dose with the major contaminants and their maximum detected activities. Refer to revised Attachment G-1 in the Final document.		
32. Attachment G-1, pg. 5, para. 2		Under Description: Warning signs for the FFACO UR are to be inspected annually. Correct the text.	The frequency of the inspections is stated in the "Inspection/Maintenance Frequency" section as annual. No change to document.		
33. Section I.1.2, pg. I-1, para. 1		2nd sentence: The hot spot criterion expressed in terms of FIDLER MOB appears to meet the definition of decisional data IAW the Soils QAP because it is being used to verify closure. However, it has been previously stated that the NFO does not consider FIDLER to meet the definition of MTE, is used only in a qualitative, not quantitative manner as a field screening technique, and is never used for decision-making. Additionally, the CR contains no QA/QC requirements for MOB data. Clarify.	Agree that this use of the FIDLER qualifies it as decisional. A discussion of FIDLER data quality was added as Section 4.3. Refer to revised Section 4.3 and Appendix I in the Final document. Added the following text to Section 4.3: "This document also established the minimum detectable concentrations (MDCs) for each FIDLER instrument used for CAU 573 hot spot evaluations. The MDCs were much less than the hot spot criterion presented in Appendix I."		
34. Section I.1.2, pg. I-1, para. 1		4th sentence: OU Hot Spot RRMGs presented in Table I.1-1 appear to be quite high. In reviewing the CR, CADD/CAP, CAIP, Soils RBCA, and Soils QAP, there appears to be no comparison review of hot spot criterion for similar activities within the DOE complex (risk mitigation) or evaluation to ensure compliance with 10 CFR 20 and DOE O 458.1. Clarify.	Inserted the following text to the end of Section I.1.1: "This approach is used by MARSSIM to comply with radiation protection requirements, and is fully evaluated and described in the <i>User's Manual for RESRAD Version 6</i> (Yu et al., 2001) and <i>Dose Modeling and Statistical Assessment of Hot Spots for Decommissioning Applications</i> (Abelquist, 2008). The hot spot RRMGs are based on the exact computations as the area-based RRMGs (based on an area of contamination of 1,000 m²) that have been used throughout the Soils Activity with the only exception being that the area of contamination was reduced to 1 m²."		

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35. Section I.1.2, pg. I-3, para.1		a) Clarify which FIDLER data set was used to develop this correlation since the hot spot criteria is only applied at GMX and the CR does not provide any TED data for the GMX site. Identify the FIDLER data set used and the corresponding TED values. b) Linear regression with a 6-point sample size is not sufficient to offer a statistically valid correlation coefficient. RBCA (2014b) apparently does not identify any data quality objective for this correlation coefficient. Justify its use.	Based on NDEP concerns, the hot spot evaluation process was changed as presented in the attached revision of Appendix I.		
36. Figure I.1-1, pg. I-3		a) Define LCL (lower confidence limit) within the legend box. b) Retitle the figure to identify the data set (which CAS) was used to develop the correlation.	Based on NDEP concerns, the hot spot evaluation process was changed as presented in the attached revision of Appendix I.		
37. Section I.1.2, pg. I-3, last para.		1st sentence: This section is confusing since it appears that OU TED values were presented in the CAU 573 CADD/CAP; was this data not available to perform a direct calculation in lieu of scaling?	Based on NDEP concerns, the hot spot evaluation process was changed as presented in the attached revision of Appendix I.		

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38. Section I.1.2, Table I.1-2, pg. I-4, para. 2		a) It is unclear if or where these samples were collected during the CR stage because the sample identification numbers do not match any shown in this document or those shown in the CADD/CAP. b) Table I.1-2 is labeled as "IA Area Factor" yet the text states OU, clarify. c) The AF calculation is the ratio of the Area-Based TED to the Hot Spot TED. In reviewing the data presented in Table I.1-2, the Area Factor presented in the last column does not equate to the ratio of the data in the preceding columns. d) In reviewing the CAU 573 CADD/CAP, it appears sample data presented in the CR as Table I.1-2 is presented in Table A.3-7 of the CADD/CAP. However, it appears that the two tables have slightly different values for the IA TED. Clarify and explain the traceability and correlation between Table A.3-7 and Table I.1.2.	Based on NDEP concerns, the hot spot evaluation process was changed as presented in the attached revision of Appendix I.		
39. Throughout document			Several other editorial corrections were made.		

^aComment Types: M = Mandatory, S = Suggested.

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