ENERGYSOLUTIONS

LACBWR Radiological Characterization Survey Report for October and November 2014 Field Work
Genoa, Wisconsin

Project No. 313196 **Revision 0**

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Dairyland Power Cooperative

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- ☐ Title Change
- ☐ Revision
- ☐ Rewrite
- ☐ Cancellation

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List of Acronyms and Abbreviations

ALARA	As Low As Reasonably Achievable
AEC	U.S. Atomic Energy Commission
BWR	Boiling water reactor
Ci	Curie
COC	Chain-of-Custody
DAW	Dry Active Waste
DCGL	Derived Concentration Guideline Level
DPC	Dairyland Power Cooperative
DQA	Data Quality Assessment
DQO	Data Quality Objective
DRP	Discrete Radioactive Particle
FESW	Fuel Element Storage Well
FSS	Final Status Survey
G-3	Genoa Station #3
GPR	Ground Penetrating Radar
GPS	Global Positioning System
HASP	Health and Safety Plan
HSA	Historical Site Assessment
HTD	Hard-To-Detect
ISFSI	Independent Spent Fuel Storage Installation
JHA	Job Hazard Analysis
LACBWR	La Crosse Boiling Water Reactor
LBGR	Lower Bound of the Gray Region
LSE	LACBWR Site Enclosure Area
LTP	License Termination Plan
MARSAME	Multi-Agency Radiation Survey and Assessment of Materials and Equipment
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDA	Minimum detectable activity
MDC	Minimum detectable concentration
MWe	Megawatts electric
NIST	National Institute of Standards and Technology
NRC	United States Nuclear Regulatory Commission
NORM	Naturally Occurring Radioactive Material
pCi/g	PicoCuries per gram
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCA	Radiologically Controlled Area
ROC	Radionuclides of Concern
RPD	Relative Percent Difference
RPV	Reactor Pressure Vessel
RWP	Radiation Work Permit
TEDE	Total Effective Dose Equivalent
TRU	Transuranic
µCi/g	MicroCuries per gram
VSP	Visual Sample Plan

1.0 Introduction

This report documents the results of the radiological characterization performed at the Dairyland Power Cooperative (DPC) La Crosse Boiling Water Reactor (LACBWR) from October 9, 2014 thru November 15, 2014. The La Crosse Site Characterization Project will support License Termination Plan (LTP) development as well as future decommissioning operations. The La Crosse Boiling Water Reactor (LACBWR) was shut down in 1987. The 350-MWe fossil generating station, Genoa Station #3 (G-3), is also located on the same site. The LACBWR site is located approximately one (1) mile south of the Village of Genoa, WI, and approximately 19 miles south of the city of La Crosse, WI. Figure 1-1, "La Crosse Boiling Water Reactor Site" illustrates the location of the plant.

The approximate area of the licensed site is 163.5 acres and includes land areas to the north of LACBWR, which includes the site switchyard and the site of the former G-1 facility (removed in 1989); areas south of LACBWR, which includes the area with the existing operational G-3 facility as well as the coal pile area and land surrounding the Independent Spent Fuel Storage Installation (ISFSI); and a parcel of land to the east of Highway 35, across from LACBRW. Figure 1-1 illustrates the general layout of the site and surrounding areas.

The following buildings and structures are within the LACBWR site enclosure (LSE) fenced area:

- Reactor Building
- Turbine Building
- 1B Diesel Generator Building
- Waste Treatment Building
- Gas Storage Tank Vault
- Ventilation Stack
- LSA Storage Building
- Maintenance Eat Shack

Other LACBWR Buildings nearby, but outside the LSE, include:

- Administrative Building
- Warehouses Nos. 1, 2, and 3
- LACBWR Crib House

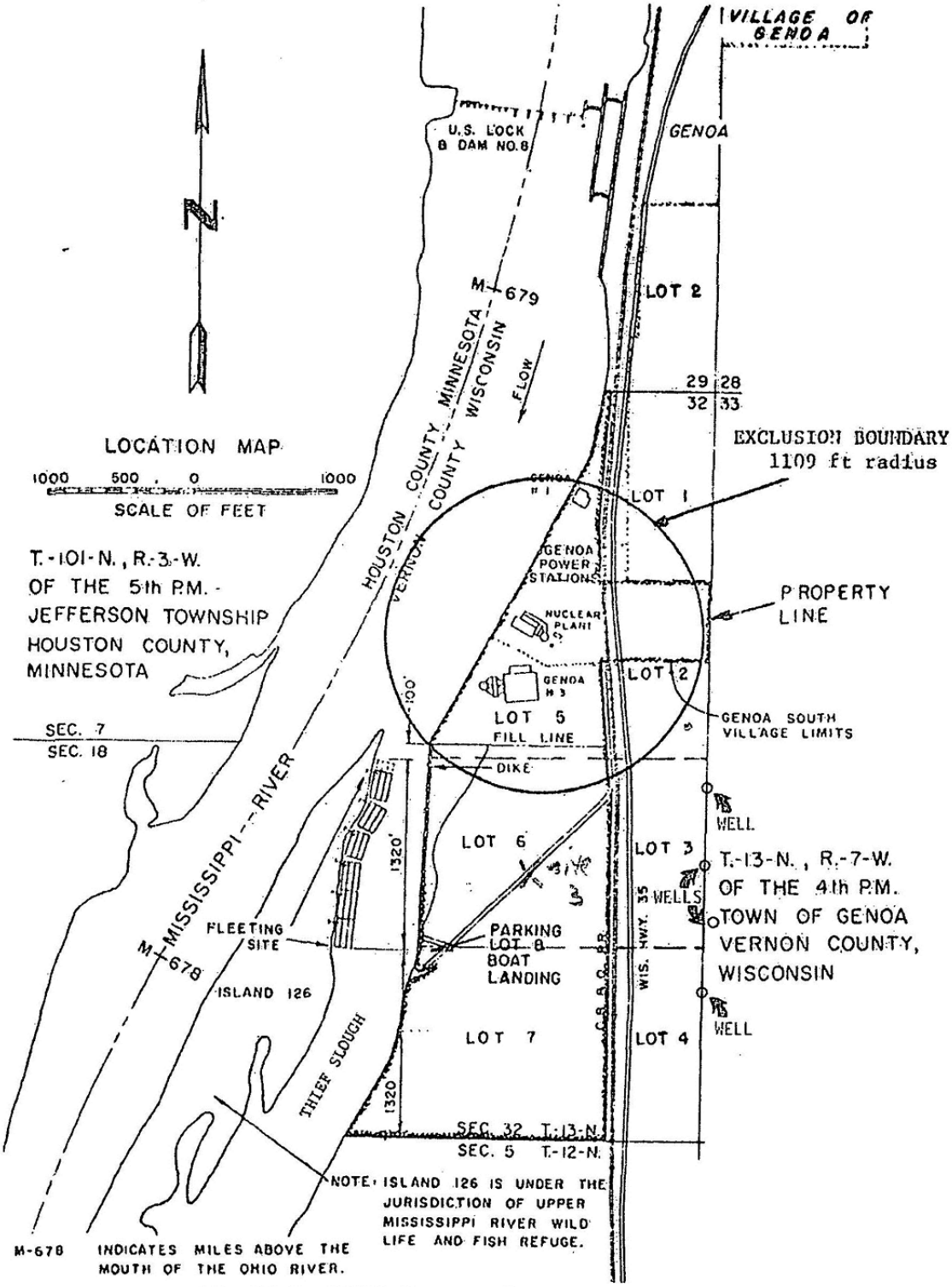
Figure 3-2 "LACBWR Site Buildings Map" illustrates the respective location of the aforementioned facilities and structures.

As part of its LTP scope for DPC, Energy*Solutions* reviewed current and historical facility and radiological information; and this information has been used in preparation of this report. With completion of this characterization effort, data will be available to:

- Determine the nature and extent of radiological contamination (e.g., radionuclides and ratios);
- Validate initial survey unit classifications;

- Support the development of Derived Concentration Guideline Levels (DCGLs) and completion of LTP Chapters 2 (Site Characterization), 5 (Final Radiation Surveys), and 6 (Compliance with the Radiological Criteria for License Termination),
- Support planning for unrestricted release surveys of materials in accordance with the guidance from NUREG-1575, Supplement 1, " Multi-Agency Radiation Survey and Assessment of Materials and Equipment Manual (MARSAME) [Reference 11-9]; and
- Assess various options for decontamination and demolition processes, and waste classification/segregation.

Figure 1-1 La Crosse Boiling Water Reactor Site



1.1. Definitions

Activity - Rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci).

Action Level – A derived media-specific, radionuclide-specific concentration or gross activity level of radioactivity that triggers a response, such as further measurements, investigation, or remediation, if exceeded.

Biased Measurements – Measurements performed at locations selected using professional judgment based on unusual appearance, location relative to known contamination areas, high potential for residual radioactivity or other general supplemental information.

Data Quality Objectives (DQO) – Qualitative and quantitative statements derived from the DQO process that clarify technical and quality objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions.

Derived Concentration Guideline Levels (DCGL) – A derived, radionuclide-specific activity concentration within a survey unit corresponding to the release criterion. DCGLs are derived from activity/dose relationships through various exposure pathway scenarios.

Final Radiation Survey – Measurements and sampling to describe the radiological conditions of a site, following completion of decontamination and remediation activities, if any, in preparation for release of a survey area or unit(s) from a site license.

Impacted Area – An area with a possibility of containing residual radioactivity from licensed activities in excess of natural background or fallout levels.

Minimum Detectable Activity (MDA) – The smallest amount of radioactive material in a sample that will yield a net count, above system background, that will be detected with a 95% probability with only 5% probability of falsely concluding that a blank observation represents a real signal. MDA depends upon the type of instrument, the counting geometry, and the radionuclide to be detected.

Minimum Detectable Concentration (MDC) – The MDC is the a priori activity level that a specific instrument and technique can be expected to detect 95% of the time. When stating the detection capability of an instrument this value should be used.

2.0 Site Summary

2.1. Site Information and History

The LACBWR is a 50 MWe BWR, which is owned and was operated by DPC. The plant is located on the east bank of the Mississippi River in Vernon County, Wisconsin, approximately one (1) mile south of the Village of Genoa, Wisconsin. The plant was one of a series of demonstration plants funded in part by the U.S. Atomic Energy Commission (AEC). The Allis-Chalmers Company was the original licensee; the AEC later sold the plant to DPC and provided them with a provisional operating license.

LACBWR achieved initial criticality on July 11, 1967, and was operated for approximately 19 years until it was permanently shut down by DPC on April 30, 1987. Final reactor defueling was completed on June 11, 1987. The DPC authority to operate LACBWR under Provisional Operating License DPR-45, pursuant to 10 CFR Part 50, was terminated by License Amendment No. 56, dated August 4, 1987; and a possess but not-operate status was granted by the U.S. Nuclear Regulatory Commission (NRC). The 333 irradiated fuel assemblies, which were in Fuel Element Storage Well (FESW), were placed into five (5) dry casks and transferred to the site's ISFSI by September 2012.

Limited dismantlement of shutdown and unused systems and waste disposal operations has been ongoing at LACBWR since 1994. Waste stored in the FESW and other Class B/C waste was shipped for disposal in June 2007. The Reactor Pressure Vessel (RPV) with head installed, internals intact, and 29 control rods in place was filled with concrete, removed from the Reactor Building, and shipped for disposal in June 2007. Other systems and components have been removed, including the spent fuel storage racks, Gaseous Waste Disposal System (except for the underground gas storage tanks); Condensate system and Feedwater heaters (except for the Condensate Storage Tank); and Component Cooling Water System pumps, heat exchangers, piping and components that were located in the Turbine Building.

The DPC "LACBWR Decommissioning Plan and Post-Shutdown Decommissioning Activities Report", March 12, 2014 [Reference 11-2] provides the latest information for the decommissioning activities conducted to date and the decommissioning planning for the plant.

2.2. Site Structures

The key LACBWR structures are summarized in Table 2-1 below and additional details are provided in the following subsections.

Table 2-1 Summary of LACBWR Structures

Structure	Dimensions[1]
Reactor Building	Height (internal) = 144 feet Diameter (inside) = 60 feet Extends 26'-6' below grade (grade elevation is 639 feet)
Turbine Building (and Turbine Office Building)	Turbine Building – 104.5'x 79 x 60' Turbine Office Building -110'x50'x45'
1B Diesel Generator Building (note: attached to SE corner of the TB)	L-shaped, with largest dimensions of 30'-10" by 37'-11" Height = 13 feet
Waste Treatment Building	42'x34'x20' Basement floor @ 630' elevation; has a 3-foot deep sump with 8-inch thick walls and bottom which extends to a depth of 626'-4"
Underground Gas Storage Tank Vault	29'-6" by 31-6" (outside dimensions) Basement floor @ 639' elevation; has a 22-foot deep sump @ elevation 617'
Ventilation Stack	Height = 350 feet
Low Specific Activity (LSA) Storage Building	80'x27'x15'
Crib House (LACBWR)	45'x35'x15'
Maintenance Eat Shack	40'x20'x15'
Warehouses	Various dimensions; Warehouse #1 – 100'x30'x 12' Warehouse #2 - 50'x40'x12' Warehouse #3 – 45' x 40'x12'
Administration Building	Length = 120 feet Width = 62 feet at widest dimension Height = 25 feet

1 – Information from DPC LACBWR Decommissioning Plan and Post-Shutdown Decommissioning Activities Report (D-Plan/PSDAR) Revision, March 2014 as well as site drawings.

2.2.1 Reactor Building

The Reactor Building structure is a steel shell and extends 26'-6" below grade level (grade elevation is 639'). The interior of the shell is lined with a 9-inch thick layer of concrete to an elevation of 727'-10". The Reactor Building is supported on a foundation consisting of 232 concrete-steel piles and a pile capping of concrete approximately 3 feet thick.

There are two airlocks at elevation 642'-9". The personal airlock connects the Reactor Building to the Turbine Building. The emergency airlock has two circular doors, both with 30-inch openings.

The majority of pipe penetrations leave the Reactor Building approximately 1 to 10 feet below grade level either at the northeast quadrant or at the northwest quadrant and enter the pipe tunnel which is connected to the Turbine Building, Ventilation Stack, Waste Treatment Building and the Underground Gas Storage Tank Vault. There is no external drain or processing piping in the subsurface soils associated with the Reactor Building.

A 45,000-gallon storage tank in the dome of the Reactor Building supplied water for the emergency core spray system and the building spray system. A 50-ton traveling bridge crane with a 5-ton auxiliary hoist is located in the upper part of the Reactor Building. The bridge completely spans the building and travels on circular tracks supported by columns around the inside of the building just below the hemispherical upper head.

The Reactor Building liquid waste system collects the liquid waste from the Reactor Building and stores this waste in two retention tanks (6,000 gallons each) located in the basement. Two separate sumps located in the Reactor Building basement pump to the two retention tanks in the Reactor Building. This system is still maintained operational.

The spent fuel has been removed but was previously stored underwater in racks in the bottom of the Fuel Element Storage Well (FESW) located adjacent to the reactor biological shielding in the Reactor Building.

2.2.2 Turbine Building (and Turbine Office Building)

The Turbine Building and Turbine Office Building is a combination metal and concrete structure with external drain piping located in the soils under the building foundation slab. The Turbine Building contained the steam turbine and generator, main condenser, electrical switchgear and other systems and equipment. A 30/5-ton capacity, remote-operated overhead electrical traveling crane spans the Turbine Building.

The Turbine Building liquid waste system collects liquid waste from the Turbine Building, the Waste Treatment Building, the Underground Gas Storage Tank Vault, and the tunnel area. This liquid waste is then stored in two storage tanks (3,000 gallons and 4,500 gallons) located in the tunnel between the Reactor Building and the Turbine Building. In addition, wasre water from three sumps located in the Turbine Building basement and the tunnel discharge to the Turbine Building waste water storage tanks. This system is still maintained operational.

The Turbine Office Building contained offices, the Control Room, locker room facilities, laboratory, shops, counting room, personnel change room, decontamination facilities,

heating, ventilation and air conditioning equipment, rest rooms, storeroom, and space for other plant services. In general, these areas were separated from power plant equipment spaces.

2.2.3 1B Diesel Generator Building

The 1B Diesel Generator Building is attached to the southeast corner of the Turbine Building and contains the Electrical Equipment Room, Diesel Generator Room, and an empty Battery Room. The building is constructed of concrete blocks and steam beams and braces. The drain system for this building is physically located in the soil beneath the building foundation.

2.2.4 Waste Treatment Building

The Waste Treatment Building (WTB) is a concrete structure with no external drain or processing piping in the subsurface soils. This building is located to the northeast of the Reactor Building. The building contains facilities and equipment for decontamination and the collection, processing, storage and disposal of low level solid radioactive waste. The grade floor of the WTB contains a shielded compartment which houses a 320 ft3 stainless steel spent resin receiving tank with associated resin receiving and transfer equipment. There is an adjacent shielded cubicle and two open cubicles. In the basement there is one sump which normally pumps to the Turbine Building waste water storage tanks.

The grade level contains two radioctive liquid waste filters, the spent resin liner level indication panel, and the spent resin liner final dewatering piping, container, and pumps. In an an above-grade area, there is a decontamination facility. Other areas contain a shower/wash/frisking area and temporary storage space for processed Dry Active Waste (DAW) containers.

2.2.5 Underground Gas Storage Tank Vault

The gas storage tank vault is an underground concrete structure with 14-feet high walls and 2-feet thick floors, walls, and ceiling. The vault is 3-feet below the grade elevation of 639’ and the sump area extends to a depth of 22 feet. All support systems have been removed except for two 1,600 ft3 tanks. The tanks remain in place along with the associated piping. The vault has one sump which normally discharges to the Turbine Building waste water storage tanks. There is no external drain or process piping in the subsurface soils.

2.2.6 Low Specific Activity (LSA) Storage Building

The LSA Storage Building is a sheet metal structure with a concrete floor which is located southwest of the Turbine Building. The facility does not contain drain or process piping. It is used to stored processed, packaged and sealed low level DAW and sealed low level activity components. No liquids are stored in this building.

2.2.7 Crib House (LACBWR)

The Crib House is a concrete and metal framed structure located on the bank of the Mississippi River to the west of the plant. River water was pumped through the intake structure to provide circulating water for the condenser as well as low- and high-pressure

service water. The Crib House contains the diesel-driven High Pressure Service Water pumps, Low Pressure Service Water pump, and the Circulating Water pumps. All water received from the Crib House was non-radioactive. No radioactive material wast stored in this structure.

2.2.8 Maintenance Eat Shack

The Maintenance Eat Shack is a sheet metal structure with a concrete slab. This building was used by workers inside the Radiologcically Controlled Area (RCA) as a common break area.

2.2.9 Warehouses

The three LACBWR Warehouses are located outside of the LSE to the north. The warehouses are adjacent to one another and are sheet metal structures with concrete floors. The warehouses were used for storage of LACBWR equipment and supplies as well as acting as a fab shop for the maintenance support group with carpentry, machine, and weld shop capability.

2.2.10 The LACBWR Administration Building

The LACBWR Administration Building is located outside of the LSE to the north. The facility historically has been used to house LACBWR administrative staff as well as for records storage. In addition the facility has served as an environmental and coal plant materials testing lab.

2.3. Noted Radionuclides and Site Conditions

Historical site information has been reviewed at the site, including early initial site characterization data compiled in the DPC document LAC-TR-138, Initial Site Characterization Survey for SAFSTOR (issued October 1995 and revised up to December 2009) [Reference 1Table 91-3]. In addition, Energy*Solutions* has drafted Technical Basis Document for Radionuclides of Concern During the Decommissioning of the La Crosse Boiling Water Reactor (July 2014)[Reference 11-4] which presents the expected radionuclides to be considered during characterization operations. The latest revision (March 2014) of the LACBWR Decommissioning Plan and Post-Shutdown Decommissioning also provided a synopsis of ongoing material and metal removal operations.

2.3.1 Sources of Radioactivity

The operation of a boiling water reactor for approximately 19 years resulted in the activation of various materials and the distribution of radioactive corrosion products throughout plant systems and structures. In addition, the reactor experienced fuel cladding failures early in its operational history. These fuel failures were severe enough to allow fission products to escape into the Fuel Element Storage Well and reactor coolant.

Assessments of radionuclide inventory in the reactor core, on plant system surfaces and internal locations conducted in January 1988 indicated that the primary radionuclides were fission and activation products such as Co-60, Fe-55, Cs-137 and Mn-54. A review of 10 CFR 61 analysis results for various metal and structural material waste streams from 1998 to 2010 indicated that following decay correction, the predominant

radionuclides to be expected would be Co-60 and Ni-63. Depending upon the type of sample, decay corrected Co-60 concentrations ranged from 6 to 45% of the total activity. Other radionuclides noted above 0.1% of the total activity in some of the samples were H-3, C-14, Fe-55, Ni-59, Cs-137, Eu-152, Pu-238, Pu-239/240, Am-241 and Pu-241. Additional liquid waste samples were obtained in July 2014 from various tanks and sumps. The analysis results from the majority of samples were dominated by the presence of Cs-137, ranging from 71% to 92% of the observed total activity.

DPC has performed a number of soil surveys since the plant shutdown in 1987. These have involved soil sampling operations performed within the LACBWR RCA (e.g. LACBWR Site Enclosure Area, LSE, the fenced in area), the licensed site boundary and outside the site boundary. While most of the soil survey campaigns have been limited in scope, a review of the six soil sampling operations conducted between 1987 and 2008 indicated that the primary contaminant in the surface soils was Cs-137. The last extensive soil sampling campaign conducted within the RCA was performed as part of an initial site characterization survey in 1995 and indicated that Cs-137 was present with a maximum observed concentration of 1.30 pCi/g.

The initial suite of Radionuclides of Concern (ROC) consists of 18 radionuclides with half-lives greater than 5 years, including gamma emitters, Hard-to-Detect (HTD) and Transuranic (TRU) alpha emitters. It was developed based upon the review of theoretical radionuclides noted in NUREG BWR studies, the specific engineering review of fuel inventory at LACBWR and other site-specific LACBWR sample results (e.g. the 10 CFR 61 reports, piping internal results, etc.). The list is shown in Table 2-2, "LACBWR Site-Specific Radionuclides of Concern." As site characterization progresses and additional survey and sample data is collected, this list will be reviewed and updated, if necessary.

Table 2-2–LACBWR Site-Specific Radionuclides of Concern

Radionuclide	Half Life (Years)
H-3	1.24E+01
C-14	5.73E+03
Fe-55	2.70E+00
Ni-59	7.50E+04
Co-60	5.27E+00
Ni-63	9.60E+01
Sr-90	2.91E+01
Nb-94	2.03E+04
Cs-137	3.00E+01
Eu-152	1.33E+01
Eu-154	8.80E+00
Np-237	2.14E+06
Pu-238	8.78E+01
Pu-239	2.41E+04
Pu-240	6.60E+03
Am-241	4.32E+02
Am-243	7.37E+03
Cm-243/244*	1.81E+01

*Listed half-life is the shortest half-life for the radionuclides in the pair

2.3.2 Preliminary Radionuclide Screening Criteria

As site specific DCGLs have not yet been established for the LACBWR decommissioning, alternative action levels were selected for characterization. The concentration values associated with the interim screening DCGLs presented in NUREG-1757 (Reference 11-5) and the NUREG/CR-5512, Volume 3 (Reference 11-6), using Table 6.91 (P_{crit}) for soils were used as the alternate action level when assessing the characterization of impacted open land or soil survey units. The preliminary criteria are presented in Table 2-3, "Characterization Action Levels for Soils."

Table 2-3–Characterization Action Levels for Soils

Radionuclide	(pCi/g)	Basis
H-3	110	NUREG-1757 Volume 2 Table H.2 Screening Criteria and concentration values found in NUREG/CR-5512 Volume 3, Residual Radioactive Contamination from Decommissioning Parameter Analysis, Table 6.91 (P_{crit} = 0.10) for soils.
C-14	12	
Fe-55	10,000	
Ni-59	5,500	
Co-60	3.8	
Ni-63	2,100	
Sr-90	1.7	
Nb-94	5.8	
Cs-137	11	
Eu-152	8.7	
Eu-154	8.0	
Np-237	0.09	
Pu-238	2.5	
Pu-239/240	2.3	
Am-241	2.1	
Am-243	2.0	
Cm-243	3.2	
Cm-244	4.2	

The characterization action levels for the LACBWR ROC represents the surface soil concentrations of individual radionuclides that would be deemed to be in compliance with the 25 mrem/year unrestricted release dose limit in 10 CFR 20.1402 [Reference 11-7]. If multiple ROC are present, then the dose contribution from each ROC is accounted for using a sum-of-fractions (SOF) calculation to ensure that the total dose from all ROC does not exceed the action level.

The Final Radiation Survey (FRS) of backfilled below grade structures remaining following decommissioning will consist of a Source Term Survey (STS), which will be conducted to demonstrate that the inventory of residual radioactivity in building basements is below a source term inventory commensurate with the dose criterion in 10 CFR 20.1402. Consequently, adjusted gross DCGL for direct measurements will not be used for the FRS of LACBWR backfilled structures. Some above grade structures will remain including the the Administration Building and LACBWR Crib House which will undergo either a MARSSIM Final Status Survey (FSS) or a MARSSAME free release survey. Therefore, the nuclide-specific gross screening value of 7,100 dpm/100 cm^2 total gross beta-gamma surface activity for Co-60 from NUREG-1757, Appendix H

was used to evaluate characaterization results. Use of the Co-60 screening value is appropriate and conservative as it is anticipated that the radionuclides distribution for surface contamination will be principally Co-60 and Cs-137 and the more conservative approach is to assume a distribution of 100% Co-60 as the screening value for Cs-137 is significantly greater. This action level will be used primarily to validate initial classifications of structures.

3.0 Characterization Plan Scope and Survey Units

3.1. Scope of Characterization Plan

Characterization is an initial step in the decommissioning process and requires a logical approach in obtaining the necessary data required for planning decommissioning activities. Radiological characterization provides a reliable database of information showing the quantity and type of radionuclides, their distribution, and their physical state as it applies to facilities and/or areas of the LACBWR Site. The characterization process also incorporates previously recorded survey data which includes scan and wipe measurements as well as soil sampling analyses to properly classify and define the radiological environment in each survey unit. Characterization survey results are used to:

- Determine the nature and extent of contamination (e.g., radionuclides and ratios) on the LACBWR Site open grounds areas including buried piping;
- Determine the nature and extent of any residual radioactivity in the Administration Building;
- Validate initial survey unit classifications;
- Support the development of Derived Concentration Guideline Levels (DCGLs) and completion of LTP Chapters 2 (Site Characterization), 5 (Final Radiation Surveys), and 6 (Compliance with the Radiological Criteria for License Termination);
- Support planning for unrestricted release surveys of materials in accordance with MARSAME guidance;
- Identify any additional radiological characterization activities that may be differed until after certain decommissioning or demolition activities are completed due to accessibity or safety concerns, and;
- Provide data to support the protection of workers, the general public, and the environment.

The survey of many inaccessible or not readily accessible structural surfaces that may remain has been deferred until later in the decommissioning process. The decision to defer the characterization of a structure was based on ALARA, safety considerations, and acquiring sufficient access to the structural surface of interest. The Reactor Building, Waste Treatment Building, Underground Gas Storage Tank Vault, Turbine Building, and interconnecting tunnel areas substructure areas which may remain following license termination but were not evaluated as part of this characterization scope.

The characterization surveys were designed and executed using the guidance provided in NUREG-1575, “Multi-Agency Radiation Survey and Site Investigation Manual”

(MARSSIM) [Reference 11-10] and NUREG-1757, Volume 2, Revision 1, "Consolidated Decommissioning Guidance, Characterization, Survey and Determination of Radiological Criteria," [Reference 11-5]. In addition, the guidance recommends development and use of a Quality Assurance Project Plan (QAPP) which describes policy, organization, functional activities, the Data Quality Objective (DQO) process, and measures necessary to achieve quality data [Reference 11-11]. Energy*Solutions* used subcontractor(s) to perform soil sampling and asphalt/concrete boring as described in the LACBWR Site Characterization Plan, as well as obtained the necessary radiological surveys with hand-held instrumentation. . Energy*Solutions* characterization procedures were used to implement characterization surveys. In addition, Energy*Solutions* complied with all relevant requirements in the LACBWR NRC Radioactive Material license, the LACBWR Radiation Protection, Health and Safety, and Work Control Program and associated technical specifications.

Using a combination of radiological scanning surveys, static measurements, samples for removable contamination, exposure rate measurements and sampling of various media, Energy*Solutions* characterized the radiological conditions of the LACBWR Site open grounds areas and the LACBWR Administration Building. A statistical basis was used for survey design and the DQOs of the survey were pre-defined to ensure sufficient reliable data was acquired to meet the survey objectives..

3.2. Initial Site Classification

Classification of survey units was initially based on historical information and available historical radiological survey data. Classifying a survey unit has a minimum of two stages: (1) initial classification and (2) final classification. Initial classification is performed at the time of identification of the survey unit using the information available. The LACBWR Site survey units and their current classifications are presented in Figure 3-1, "LACBWR Site Survey Unit Map," and Figure 3-2, "LACBWR Site Buildings Map." Note that for the purposes of this characterization project that no areas inside the LACBWR Site area, as defined by the Figure 3-1 "LACBWR Site Survey Unit Map," are considered non-impacted areas. A brief summary of the major findings and historical facts that are relevant to site characterization, as well as the initial classification of the survey units, are presented as follows.

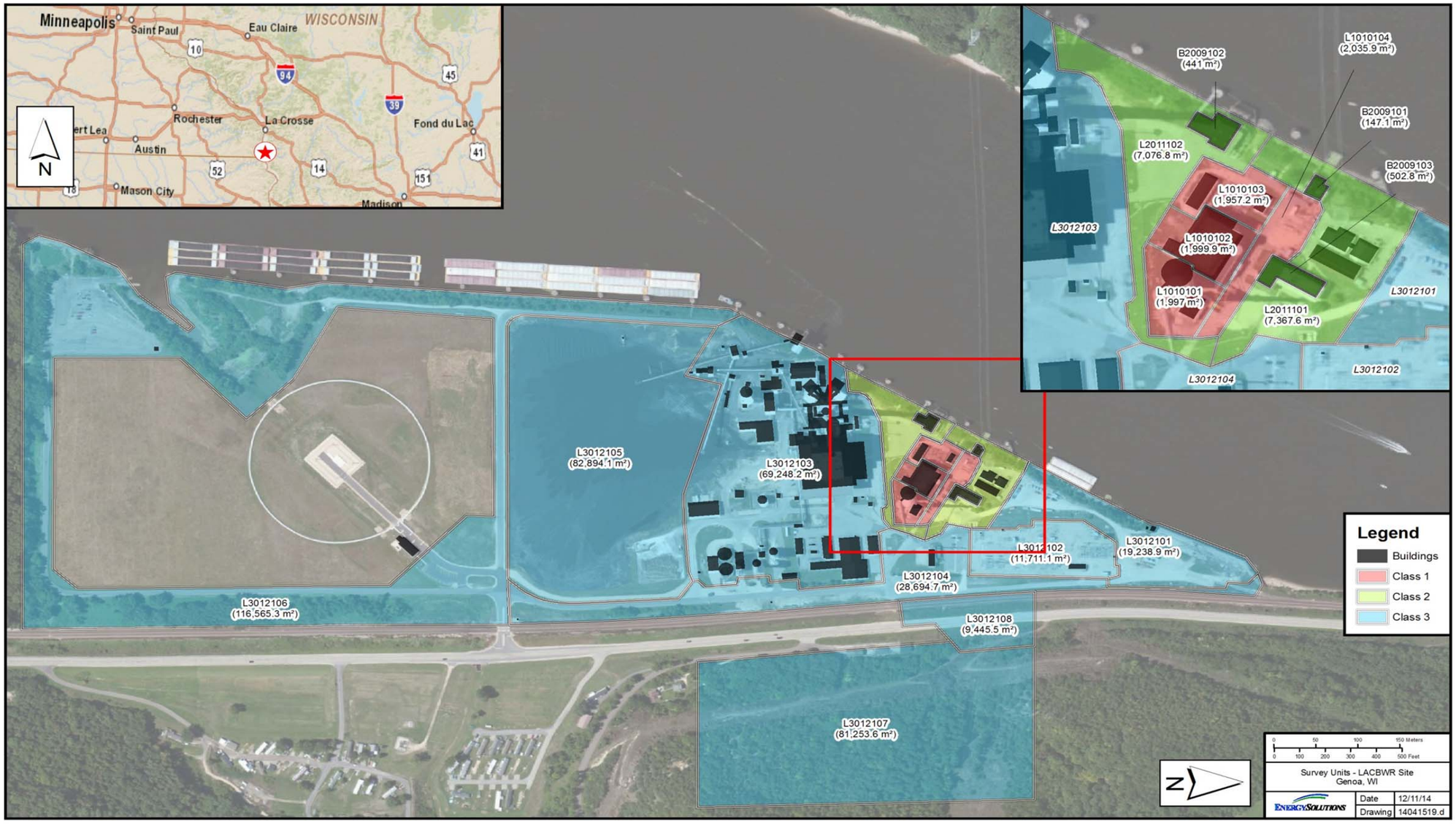
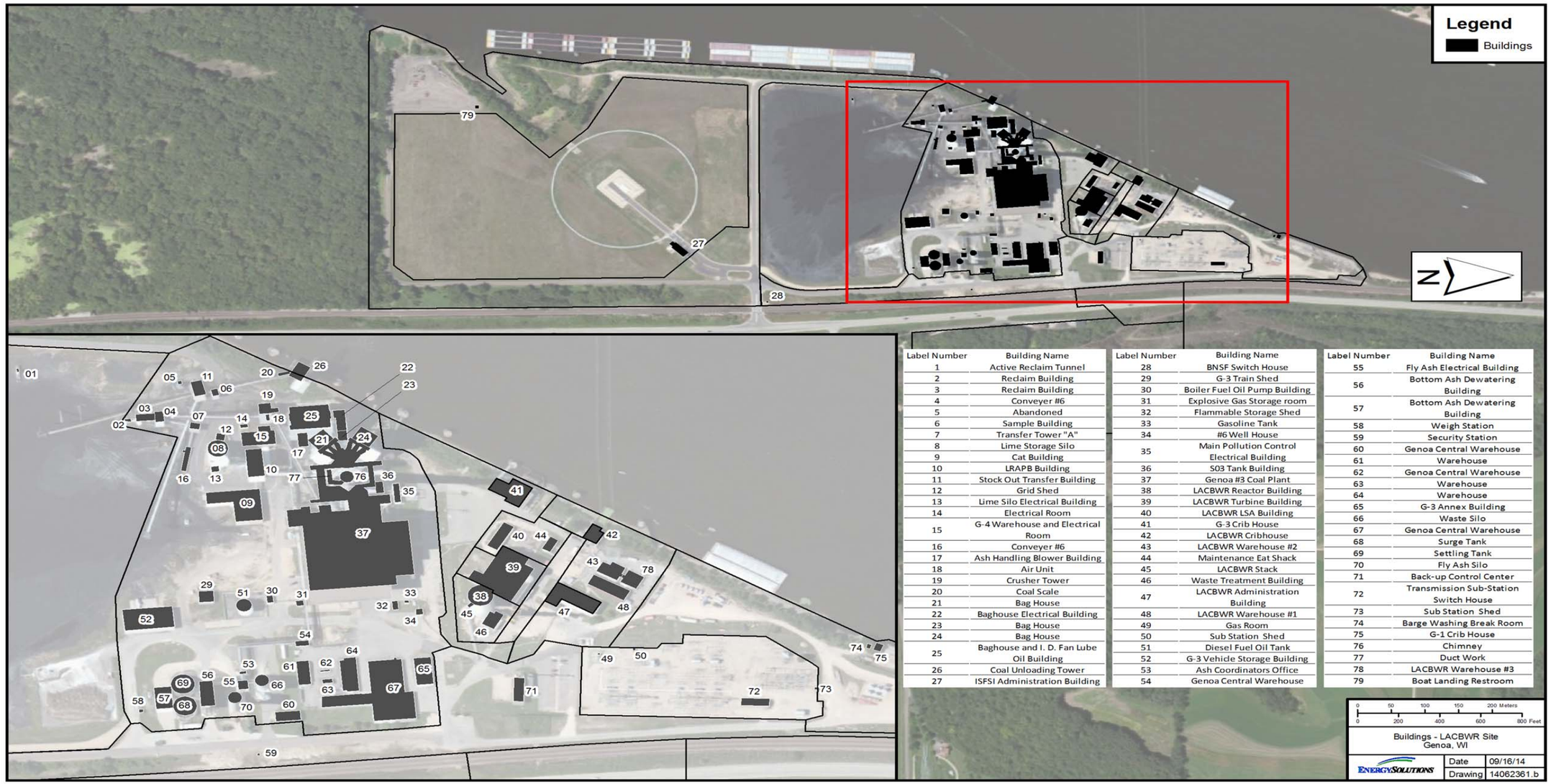


Figure 3-1 LACBWR Site Survey Unit Map



Label Number	Building Name
1	Active Reclaim Tunnel
2	Reclaim Building
3	Reclaim Building
4	Conveyer #6
5	Abandoned
6	Sample Building
7	Transfer Tower "A"
8	Lime Storage Silo
9	Cat Building
10	LRAPB Building
11	Stock Out Transfer Building
12	Grid Shed
13	Lime Silo Electrical Building
14	Electrical Room
15	G-4 Warehouse and Electrical Room
16	Conveyer #6
17	Ash Handling Blower Building
18	Air Unit
19	Crusher Tower
20	Coal Scale
21	Bag House
22	Baghouse Electrical Building
23	Bag House
24	Bag House
25	Baghouse and I. D. Fan Lube Oil Building
26	Coal Unloading Tower
27	ISFSI Administration Building

Label Number	Building Name
28	BNSF Switch House
29	G-3 Train Shed
30	Boiler Fuel Oil Pump Building
31	Explosive Gas Storage room
32	Flammable Storage Shed
33	Gasoline Tank
34	#6 Well House
35	Main Pollution Control Electrical Building
36	S03 Tank Building
37	Genoa #3 Coal Plant
38	LACBWR Reactor Building
39	LACBWR Turbine Building
40	LACBWR LSA Building
41	G-3 Crib House
42	LACBWR Cribhouse
43	LACBWR Warehouse #2
44	Maintenance Eat Shack
45	LACBWR Stack
46	Waste Treatment Building
47	LACBWR Administration Building
48	LACBWR Warehouse #1
49	Gas Room
50	Sub Station Shed
51	Diesel Fuel Oil Tank
52	G-3 Vehicle Storage Building
53	Ash Coordinators Office
54	Genoa Central Warehouse

Label Number	Building Name
55	Fly Ash Electrical Building
56	Bottom Ash Dewatering Building
57	Bottom Ash Dewatering Building
58	Weigh Station
59	Security Station
60	Genoa Central Warehouse
61	Warehouse
62	Genoa Central Warehouse
63	Warehouse
64	Warehouse
65	G-3 Annex Building
66	Waste Silo
67	Genoa Central Warehouse
68	Surge Tank
69	Settling Tank
70	Fly Ash Silo
71	Back-up Control Center
72	Transmission Sub-Station Switch House
73	Sub Station Shed
74	Barge Washing Break Room
75	G-1 Crib House
76	Chimney
77	Duct Work
78	LACBWR Warehouse #3
79	Boat Landing Restroom

Figure 3-2 LACBWR Site Buildings Map

3.2.1 Class 1 Structures

The following is a list of some of the major buildings that have been initially classified as impacted Class 1 structures in which, during operations; radioactive materials and wastes were routinely handled, transferred, and stored. These structures contained the: nuclear reactor, primary reactor systems, reactor support systems, nuclear fuel handling and storage systems, turbine and turbine operating related systems, and radioactive waste systems. A vast majority of the current radioactive material inventory at the LACBWR Site continues to be found in these structures:

- LACBWR Reactor Building
- Waste Treatment Building
- LACBWR Stack
- Off Gas Retention Vault
- LACBWR Turbine Building
- LSA Building

Throughout facility operations, these structures were either subjected to or at risk of spills of radioactive liquids, the spread of loose surface contamination, and airborne radioactive material. The current decommissioning approach for these structures involves the complete segmentation, removal, and disposal of all systems and structural surfaces as waste. With the exception of structural below-grade foundations and concrete structure in the Turbine Building that is candidate for the potential reuse of concrete as hard fill, no portion of these structures will remain at site closure to be subjected to FRS.

3.2.2 Class 2 Structures

The following is a list of some of the major buildings that have been initially classified as impacted Class 2 structures and are found on the LACBWR Site. Their primary function is to house the raw water feed systems, or to act as office and/or warehouse space.

- LACBWR Crib House
- G-3 Crib House
- LACBWR Administration Building
- Warehouses 1, 2, and 3

The primary reasons these facilities are classified as potentially impacted facilities are based on the fact that these facilities are in open land buffer areas around the RCA with the potential for contamination translocation due to personnel and equipment movements as well as surface water runoff from the RCA. Additionally, the LACBWR Administration Building used radioactive check sources with radiological instrumentation and, according to former employee recollections; the warehouses stored other nuclear power plant-used equipment in the 1970s before the equipment was shipped off site.

The current decommissioning approach calls for the G-3 Crib House, LACBWR Crib House, and LACBWR Administration Building to remain on site following FSS surveys and the Warehouses 1, 2,and 3 to be surveyed in place for free release and then demolished and the rubble removed from site for disposal as radiologically clean debris.

3.2.3 Class 3 Structures

The following is a list of some of the major buildings that have been initially classified as impacted Class 3 structures and are found on the LACBWR Site. Their primary function is to serve as primary electrical distribution from the LACBWR Site and as facilities associated with the operation of the G-3 Coal Plant. The balance of the facilities is presented on Table 3-1 "Survey Units for LACBWR Site Structures."

- G-3 Coal Plant
- G-3 Central Warehouse
- Back-Up Control Center
- G-3 Bag Houses

The initial Class 3 designation was assigned to ensure conservative characterization planning. It is anticipated that some or all of the structures initially designated as Class 3 may be reclassified as non-impacted in LACBWR LTP Chapter 2 based on the characterization results as supported by the HSA. All of these structures are outside of the LSE and the primary reason for the intial Class 3 designatation of these facilities is their location relative to the LACBWR Stack. Although not expected, it could not be ruled out without some supporting survey data that the routine airborne release during LACBWR operation did not affect these structures and land areas which were associated with LACBWR operation and are outside of the LSE.

The primary reasons these facilities are classified as potentially impacted facilities are based on the fact that these facilities may have historically been impacted by windborne transmigration of LACBWR stack released radioactivity due to predominant at-height meteorological conditions for the LACBWR Site and local area climatology.

The current decommissioning approach calls for all Class 3 structures on LACBWR Site to remain following decommissioning activities and required Class 3 FSS verifications.

Table 3-1 Survey Units for LACBWR Site Structures

Survey Area	Survey Area Description	Initial Classification
01	Reactor Building	Class 1
02	Waste Treatment Building	Class 1
03	LACBWR Ventilation Stack	Class 1
04	Off Gas Retention Tanks/Vault	Class 1
05	LACBWR Turbine Bldg./Turbine Office Bldg.	Class 1
06	LACBWR 1B Diesel Generator Structure	Class 1
07	Low Specific Activity Storage Building	Class 1
08	Maintenance Eat Shack	Class 1

Survey Area	Survey Area Description	Initial Classification
09	Outbuildings	Class 2/Class 3
Survey Unit: 101	LACBWR Crib House	Class 2
102	G-3 Crib House	Class 2
103	LACBWR Administration Building	Class 2
104	LACBWR Warehouse #1	Class 2
105	LACBWR Warehouse #2	Class 2
106	LACBWR Warehouse #3	Class 2
107	G-3 Reclaim Building	Class 3
108	G-3 Stock Out Transfer Building	Class 3
109	G-3 Coal Unloading Tower	Class 3
110	G-3 Transfer Tower A	Class 3
111	G-3 Electrical Room	Class 3
112	G-3 Crusher Tower	Class 3
113	G-3 Conveyor #6 (2)	Class 3
114	G-4 Warehouse and Electrical Room	Class 3
115	G-3 LRAPB Building	Class 3
116	G-3 Lime Silo Electrical Building	Class 3
117	G-3 CAT Building	Class 3
118	G-3 Coal Plant	Class 3
119	G-3 Vehicle Storage Building	Class 3
120	G-3 Train Shed	Class 3
121	G-3 Bottom Ash Dewatering Buildings	Class 3
122	G-3 Fly Ash Silo	Class 3
123	Genoa Central Warehouses (7)	Class 3
124	G-3 Annex Building	Class 3
125	G-3 Boiler Fuel Oil Pump Building	Class 3
126	G-3 Explosive Gas Storage Room	Class 3
127	G-3 Gas Room	Class 3
128	G-3 Sub Station Shed	Class 3
129	Genoa Back Up Control Center	Class 3
130	G-3 Transmission Sub Station Switch House	Class 3

Survey Area	Survey Area Description	Initial Classification
131	G-1 Crib House	Class 3
132	G-3 Sub Station Shed	Class 3
133	G-3 Lime Storage Silo	Class 3
134	G-3 Weigh Station	Class 3
135	Genoa Security Station	Class 3
136	Boat Landing Restroom	Class 3
137	BNSF Switch House	Class 3
138	G-3 Active Reclaim Buildings/ Tunnel	Class 3
139	G-3 Ash Coordinator's Office	Class 3
140	G-3 Bag Houses (5)	Class 3
141	G-3 Flammable Storage Shed	Class 3
142	#7 Well House	Class 3
143	Genoa Barge Washing Break Shack	Class 3
144	G-3 Coal Scale	Class 3
145	G-3 Sample Building	Class 3
146	G-3 Stock Out Transfer Building	Class 3
147	G-3 Grid Shed	Class 3
148	G-3 Ash handling Blower Building	Class 3
149	#6 Well House	Class 3
150	Main Pollution Control Electrical Building	Class 3
151	S03 Tank Building	Class 3
152	G-3 Fly Ash Electrical Building	Class 3
153	G-3 Waste Silo	Class 3
154	G-3 Surge Tank	Class 3
155	G-3 Settling Tank	Class 3

3.2.4 Class 1 Open Land Areas

Open land areas located inside the LACBWR LSE have been initially classified as impacted Class 1. The basis for this initial classification is due to either documented incidents of the contamination of surface or subsurface soil by radioactive material in these areas during facility operations or evidence demonstrating existing or likely soil contamination from past LSE area soil sampling studies. These incidents include the spills of radioactive liquids/resins and radioactive system leakage. The storage of radioactive packages and containers was also part of the operational history of the LSE area.

Based on an assessment of historical incidents and events, it is anticipated that the surface and subsurface soils in these areas may hold residual radioactive material in excess of the unrestricted release criteria and will require excavation and appropriate disposal. Table 3-1, "Survey Units for LACBWR Site Open Land Areas," presentss the open land survey units..

3.2.5 Class 2 Open Land Areas

The open land areas as shown on Figure 3-1 and identified as L2011102 and L2011101 have been initially classified as impacted Class 2. This classification is selected based on the fact that this survey unit is a buffer area around the RCA with the potential for contamination translocation due to personnel and equipment movements as well as surface water runoff from the RCA.

3.2.6 Class 3 Open Land Areas

The open land areas as shown on Figure 3-1 and identified as L3012101 thru L3012108 have been initially classified as Class 3. Historical information indicates that the presence of residual radioactivity in concentrations in excess of the unrestricted release criteria is not expected.

Table 3-2 Survey Units for LACBWR Site Open Land Areas

Survey Unit ID #	Survey Unit Description	Initial Classification	Approximate Survey Unit Area (m^2)
Survey Area 10	I/S LSE Open Land Areas		
L1010101	Area under and around The Reactor Building/Waste Treatment Building/Ventilation Stack/Off Gas Retention Tank Vaults	Class 1	1,997
L1010102	Area under and around the Turbine Building-Turbine Office Building/1B Diesel Generator Building	Class 1	2,000
L1010103	Area under and around The LSA Building/Maintenance Eat Shack/surrounding grounds	Class 1	1,957
L1010104	Grounds on the north end of LSE	Class 1	2,036
Survey Area 11	O/S LSE -Buffer Areas	Class 2	
L2011101	Areas under and around the LACBWR Three Warehouses/Administration Building/LACBWR Crib House	Class 2	7,368
L2011102	Areas under and around the G-3 Crib House/LACBWR Circ. Water Discharge Line/south of LSE fence	Class 2	7077
Survey Area 12	Areas O/S of Buffer Areas		
L3012101	North end of site and outside of switchyard	Class 3	19,239
L3012102	Switchyard	Class 3	11,711
L3012103	G-3 Coal Plant and related facilities area grounds	Class 3	69,248
L3012104	Grounds west of railroad right of way and east of survey units L3012101,L3012102,L3012103,L3012104, L3012105	Class 3	28,695
L3012105	Coal Pile area grounds	Class 3	82,894
L3012106	Capped ash impoundment ground area w/o ISFSI controlled area	Class 3	116,565
L3012107	Grounds across Highway 35 to east	Class 3	81,254
L3012108	Right of Ways -Hwy 35/Railroad	Class 3	9,446

3.3. Basis for Selection and Size of Initial Survey Units

A survey unit is a structure or portion of a structure or open land area that is surveyed, evaluated, and released as a single unit during FRS. Survey units have been delineated to physical areas with similar operational history or similar potential for residual radioactivity to the extent practical. If areas with more than one classification are combined into one survey

unit, then the entire survey unit will be given the more restrictive classification. Survey units may have relatively compact shapes and not have highly irregular shapes unless the unusual shape is appropriate for the site operational history or the site topography. Survey units of the same classification may be combined and reconfigured as necessary provided that eventual area remains appropriate for the classification.

For the characterization surveys, survey unit size will be determined based upon the specific area and the most efficient and practical size needed to bound the lateral and vertical extent of contamination identified in the area. In accordance with the guidance provided in NUREG-1575 (MARSSIM) Section 4.6 [Reference 11-10], the suggested physical area sizes for survey units for FRS are as noted in Table 3-3:

Table 3-3Recommended Survey Unit Sizes

Classification	Suggested Area
Class 1	
Structures	up to 100 m^2 floor area
Land Areas	up to 2,000 m^2
Class 2	
Structures	100 m^2 to 1,000 m^2
Land Areas	2,000 m^2 to 10,000 m^2
Class 3	
Structures	No Limit
Land Areas	No Limit

These areas are suggested because they give a reasonable sampling density and are consistent with most commonly used dose modeling codes. However, the size and shape of a particular survey unit may be adjusted to conform to the existing features of the particular site area and dose modeling specifics.

As previously stated, the current decommissioning approach for Class 1 structures calls for the complete segmentation, removal, and disposal of all impacted systems and structural surfaces. With the exception of structural below-grade foundations, and concrete structures that are candidates for the potential reuse of concrete as hard fill, no portion of these structures will remain at site closure to be subjected to FRS.

Survey units have not been established for buried piping. If the DQOs developed for the characterization of a structural or open land survey unit require the acquisition of radiological survey data on systems, then the survey will be designed and documented in the structural or open land survey unit in which it resides. If during the course of decommissioning the decision is made to subject a system to FRS, then a specific set of protocols and procedures will be developed and subjected to regulatory review; and DQOs will be developed which will be specific to that system as a unique survey unit.

An initial descriptive list of the survey areas and survey units is provided in Tables 3-1 and 3-2. It is expected that the conceptual boundaries of these survey units may be altered based on the actual conditions at the time of FRS survey design. This may be especially characteristic of the site structure survey areas within open land areas.

Although it is expected that the existing areas and conceptual survey units will require little modification with regard to classification, the characterization process is iterative. When information is obtained during the decommissioning process through characterization, the data will be assessed using the DQO process to verify that the initial classification is appropriate, to guide reclassification of the survey unit and/or to guide the design of subsequent surveys.

Changes from the initial survey units and site structure survey areas will be documented in the characterization sample plans and field logs.

4.0 Data Quality Objectives

4.1. Radiological Data Quality Objectives

The characterization surveys at LACBWR were designed to gather the appropriate data using the DQO process as outlined in NUREG-1575 (MARSSIM), Appendix D. This process is an integral part of the planning and design steps for the characterization survey. The DQO process involves a series of planning steps found to be effective in establishing criteria for data quality and developing survey plans. It is flexible such that the level of effort associated with planning a survey is based on the complexity of the survey and nature of the hazards. It is also iterative, allowing for the incorporation of new data and modification of the output of previous steps to act as input in subsequent steps.

The specific objectives for the characterization surveys were defined for each survey unit and addressed in the survey packages and survey and sampling instructions. To support further development of DCGLs and FRS planning, additional information is needed and the DQO process will ensure that appropriate, valid radiological data is obtained. Characterization data collection and evaluation included radiation exposure rates, direct surface contamination, removable surface contamination, volumetric contamination levels (for certain structural components and soil) and radionuclide analysis at on-site and off-site laboratories.

The seven steps of the DQO process are outlined in the following sections and described in more detail in the LACBWR Site Characterization Plan, PG-EO-313196-SV-PL-001 current revision [Reference 11-24].

4.1.1 Problem Identification

Based on previous operations at LACBWR and storage of radioactive materials it has been determined that radiological contamination exists and that the facility may require remediation in order to meet the criteria for unrestricted release, meeting the requirements of 10 CFR 20.1402, "*Radiological Criteria for Unrestricted Use"*[Reference 11-7]. Based upon this criteria, the site will be considered acceptable for unrestricted use if the residual radioactivity that is distinguishable from background radiation results in a Total Effective Dose Equivalent (TEDE) to an average member of

the critical group that does not exceed 25 mRem per year, including from groundwater sources of drinking water.

The problem associated with radiological characterization is to perform characterization inspections and surveys of sufficient quality and quantity to determine the nature, extent and range of radioactive contamination in each survey unit. According to Regulatory Guide 1.179, "*Standard Format and Content of License Termination Plans for Nuclear Power Reactors*"[Reference 11-12] the site characterization should be sufficiently detailed to allow the NRC to determine the extent and range of radiological contamination of structures, systems (including sewer systems, waste plumbing systems, floor drains, ventilation ducts, and piping and embedded piping), rubble, and paved parking lots (both on and beneath the site).

Characterization data is required to evaluate the radiological contaminants present and the extent of the radiological contamination for structures, systems, and open land areas which will remain following license termination. The data may be used to develop a conceptual site model for use in deriving site specific DCGLs. The data will also likely be useful in defining future measurement and sampling protocols that will be employed for remedial action surveys and FRS.

The approach for demonstrating that the site meets the criteria for unrestricted release will depend on some factors that have yet to be fully investigated including final DCGLs, the defined End State condition of the site at the time of the FRS, the statistical tests to be employed, etc. The approach for demonstrating that the site meets the criteria for free release will be discussed in detail in LTP Chapter 5 – Final Status Survey Plan and Chapter 6 – Compliance with the Radiological Criteria for License Termination.

4.1.2 Decision Identification

During radiological characterization, an important step in the DQO process is decision identification. This step consists of developing a decision statement, or in most cases, several decision statements, based on a principal study question (e.g. the state problem) and determining alternative actions that may be taken based on the answers. For each survey unit, each of the characterization objectives must be assessed with regards to their applicability to the end state of each specific survey unit. These objectives included:

- Providing a basis for the initial classification (e.g. Class 1, 2, 3 or non-impacted);
- Confirming the expected ROC and determining the relative distribution fractions;
- Providing a basis for surrogate relationships for HTD radionuclides;
- Providing a basis for the extent of remediation of surface and subsurface soils; and,
- Collecting data to support future planning of remediation, decontamination, and waste management operations.

4.1.3 Inputs to the Decision

This step in the DQO process identifies the types and quantity of information necessary to address the different decisions which are identified in the previous steps. The information required depends on the type of media under consideration (e.g. soil, sludge, concrete, asphalt, etc.) and the adequacy of existing data. If new data is need, then the type of measurement (e.g. scan measurement, direct measurement, and sampling) will be determined in the next step. Initial sources of information that has been utilized for determination of the necessary inputs include:

- Historical site information, including incidents and evidence of previous radioactive material storage;
- ROC assessments;
- Initial survey unit classification and basis;
- Action Levels associated with decision objectives;
- Instrumentation and MDA/MDC values;
- Laboratory counting and analytical requirements; and,
- Quality Control (QC) sample requirements.

4.1.4 Boundaries of the Study

This step of the DQO process typically includes identification of the target population and material of interest, the spacial boundaries, and other constraints for collecting the data (e.g. weather conditions and impact on personnel and instrumentation; physical obstacles or work interferences, etc.). The target population for characterization is scan, direct, or sample measurements from the survey unit. The media of interest is the type of materials that will be surveyed or sampled (e.g. soil, sludge, and sediment, asphalt, concrete). The spacial boundaries to be defined include the entire area of interest within survey units, including area dimensions and depth of soil, depth of concrete, etc.

The characterization surveys at LACBWR focused on Class 1 and 2 open land survey units, including paved and unpaved grounds as well as the Administration Building in the Class 2 survey unit. The focus for characterization in the Class 3 survey units was various paved and unpaved grounds that are adjacent to the Class 2 survey units.

4.1.5 Decision Rule

This step of the DQO process develops the binary type statement that presents a logical process for choosing among alternative actions. Making decisions is facilitated by the developing a clear statement using the "If…then…else" format. For characterization surveys, this process often involves selecting a workable Action Level (e.g. some level of contamination defined in dpm/100 cm^2 or pCi/g, typically associated with meeting a desired MDC) and developing a decision rule which involved comparison with the Action Level. Depending upon the objectives of a specific characterization survey task, there could be a number of decision statements.

One of the key evaluations did involve comparison of the surface measurements and soil sampling results from within the impacted areas to the preliminary criteria noted in Table

2-3. If radionuclides other than those shown in Table 2-1, are identified they will be compared with the default screening values in NUREG 1757, Volume 2, Appendix H [Reference 11-5].

When required, material specific background measurements or activity concentrations may be obtained to aid in the evaluation of material specific measurements and sample analysis results.

4.1.6 Limits on Decision Error

This step of the DQO process often involves statistical hypothesis testing and probabilistic sampling distributions to control decision errors during data analysis when characterization data is to be considered for FSS purposes. However, site characterization surveys are more of an exploratory nature versus the verification phase of the FSS. Therefore, decision errors are more subjective during the characterization process and the use of descriptive statistics is more appropriate.

The decision errors were limited by performing measurements, smears, and sampling activities in accordance with the LACBWR Site Characterization Plan [Reference 11-24] and the corresponding survey packages which specified the number of measurements and samples to be collected, the sample locations, the amount of sample to be collected, chain-of-custody requirements for each sample, sample preparation, the type of analyses, and the MDC for each of the analyses.

Split samples were collected to monitor the accuracy of the on-site laboratory, with designated QC samples also sent to a qualified, licensed off-site laboratory.

In addition to the samples specified in the survey package, additional biased measurements and samples, as dictated by the professional judgment of the Radiation Protection Supervisor (RPS) and/or the Project Health Physicist were collected to support the characterization of specific areas.

4.1.7 Design for Data Collection

The first six steps of the DQO process provide information that supports optimizing the plan for data collection. The final step is to use this information and establish an adequate survey design.

Both random and biased measurements and samples were collected as part of the Characterization Plan. Samples were located based at random pre-defined locations. The locations of biased samples and measurements were based in part on the results of gamma scans or direct readings performed in the area to be sampled and/or based on the judgment of the RPS or the Project Health Physicist.

The characterization surveys obtained complied with the LACBWR Site Characterization Plan for sufficient sensitivity, accuracy, reproducibility, and are well documented. Implementation of the LACBWR Site Characterization Plan and associated procedures, including the preparation of characterization survey packages ensured characterization survey quality.

To ensure data collection was optimized, all areas which were surveyed were also walked down as part of the characterization survey package development. Minimum data

requirements were defined, special situations identified, specific instructions provided, etc.

QC of instrumentation included efficiency checks, source checks, and background checks.

Where possible, the MDC for each measurement or sample was less than 50% of the Action Levels for the expected ROC.

Chain-of-Custody was maintained for all samples that were analyzed off-site. All collected samples were archived following analysis.

4.1.8 Project Organization

Energy*Solutions* established the LACBWR Characterization Project organization with sufficient management and technical resources to fulfill all project objectives and goals. The LACBWR Characterization Project organization is responsible for the execution of LACBWR Site characterization.

Characterization encompassed all survey and sampling activities related to the implementation of the Characterization Plan. The duties and responsibilities of key Energy*Solutions* managers as well as the various key positions within the characterization group as they pertained to the project implementation are described below. Responsibilities for each of the positions have been assigned to a designee as appropriate.

Project Manager

The EnergySolutions Project Manager reports to the EnergySolutions Director of Projects for:

- The overall responsibilities for all on site activities.
- The management of personnel assigned to the LACBWR Site Characterization Project.
- Ensuring all contractual obligations as they pertain to characterization is satisfied.
- The review and approval of project plans and procedures.
- All supporting documents that are subject to controlled distribution requirements are maintained properly.
- Ensure that activities conducted in accordance with the QAPP.
- Approving personnel access to characterization file cabinets and computer data bases.

Project Health Physicist (off site position)

The EnergySolutions Project Health Physicist reports to the EnergySolutions Project Manager and EnergySolutions Director of Health Physics & Radiological Engineering for:

- Development of and approval of characterization survey packages and sample plans.

- Development and approval of characterization plans and final reports.
- Resolving and documenting any survey design, instructions, or performance discrepancies.
- Perform data review, verification, and validation.

Radiological Protection Supervisor

The EnergySolutions Radiological Protection Supervisor reports to the EnergySolutions Project Manager and EnergySolutions Director of Health Physics & Radiological Engineering for:

- Control and implementation of survey packages and sample plans as received and to ensure that all quality objectives are met/documented.
- Coordination of area turnover and survey area preparation.
- Coordinate and schedule the Health Physics Technicians to support the schedule.
- Ensure all necessary instrumentation and other equipment is available to support survey activities.
- Maintain access controls over in process survey areas to ensure data integrity and staff safety
- Perform data review, verification, and validation.

Health Physics Technicians

The EnergySolutions and contractor Health Physics Technicians report directly to the EnergySolutions Radiological Protection Supervisor and are responsible for understanding and implementing the requirements of the surveys in the LACBWR Characterization Survey Plan. The technicians are responsible for the acquisition and documentation of survey data and collected samples.

Quality Engineer (off site position)

EnergySolutions Quality Engineer reports to the EnergySolutions Project Manager and ensures activities affecting quality are performed satisfactorily and to provide support as needed.

5.0 Radiological Instrumentation and Laboratory Analysis

5.1. Instrumentation

The selection and use of survey instrumentation ensured that their sensitivities were sufficient to detect the identified ROC at the desired MDC. Table 5-2 provides a list of the instruments used during the characterization survey.

The Ludlum Model 2350 Data Logger was used in combination with a gas flow proportional detector to obtain direct measurements of alpha and beta activity and for performing beta scans on surfaces. The Data Logger is a portable microprocessor computer-based counting instrument. The data logger is designed to operate with a wide variety of detectors. It was also used in combination with sodium iodide detectors for obtaining count rate or exposure rate measurements on soils.

The Ludlum Model 2360 Data Logger was used with the dual phosphor scintillation detectors to obtain direct measurements of alpha and beta activity and for performing beta scans on surfaces.

The Model 12 with 44-9 detector was used for beta scanning during field progress surveys, field counting of swipes, and to support equipment release surveys.

Analysis for removable alpha and beta activity was performed using the Ludlum Model 2929 alpha/beta or equivalent alpha/beta counter.

An on-site calibrated gamma spectroscopy system was used for soil, asphalt, sediment, and sludge/liquid sample analysis.

An off-site lab (Test America) was used to conduct gamma spectroscopy analyses of duplicate soil and/or asphalt samples as well as concrete and liquid/sludge analyses. The off-site lab also analyzed submitted soil, concrete, sediment, sludge/liquid samples for HTD and TRU radionuclides.

ROC

As presented in the Energy*Solutions* Technical Basis Document for the Radionuclides of Concern [Reference 11-4], the ROC remaining at the LACBWR Site are presented in Table 5-1. The table below lists the ROC, including half-lives, major radiations and intensities.

Table 5-1 Radionuclides of Concern

Radionuclide	Half Life (Years)	Major Radiations Energies and Intensities		
		Alpha	Beta (average)	Gamma
H-3	1.24E01		5.685 keV	
C-14	5.73E03		49.47 keV	
Fe-55	2.70E0			Low energy x-rays
Co-60	5.27E0		95.79 keV	1173 keV 100% 1332 keV 100%
Ni-59	7.50E04			Low energy x-rays
Ni-63	9.60 E01		17.13 keV	
Sr-90/Y-90	2.91 E01		195.8 keV /934.8keV	
Nb-94	2.03E04		145.9 keV	702 keV 100% 871 keV 100%
Cs-137	3.0E01		156.8 keV 94.6% 415.2 keV 5.4%	
Eu-152	1.33E01		300.8 keV	121.8 keV 28.4% 964 keV 14.4% 1085.8 keV 10% 1112 keV 13.3% 1407 keV 20.7% 344 keV 26.5% 778.9 keV 12.7%
Eu-154	8.80E0		225.4 keV	123.1 keV 40% 1274 keV 35.5%
Np-237	2.140E06	4.8 MeV (average)	70keV	35keV (average)
Pu-238	8.78E01	5500keV 72% 5460keV 28%		
Pu-239	2.41E4	5104 keV 11.5% 5142 keV 15.1% 5155 keV 73.3%		
Pu-240	6.60E03	5170keV 76% 5120keV 24%		
Am-241	4.32E02	5443 keV 13% 5486 keV 85%		59.5 keV 35.9%

Radionuclide	Half Life (Years)	Major Radiations Energies and Intensities		
Am-243	7.37E03	5280 keV 87% 5230 keV 12%		55 keV (average)
Cm-243/244	1.81E01 (shortest half-life)	5810keV 77% 5770 keV 23%		130keV (average)

Table 5-2 Survey Instrumentation

Detector Model [2]	Meter Model	Application	Nominal Detection Sensitivity	
			MDC_{scan} (dpm/100cm^2)	MDCdirect[1] (dpm/100cm^2)
Ludlum 44-9	Ludlum Model 3	β scan	1000-2000	N/A
Ludlum 43-68 β mode	Ludlum 2350-1	β direct & scan	1800-2000	600-700
Ludlum 43-68 α mode	Ludlum 2350-1	α direct	N/A	80-90
Ludlum 43-93 β mode Ludlum 43-89 β mode	Ludlum 2360	β direct & scan	1800-2000 2000-2200	800-900 800-900
Ludlum 43-93 α mode Ludlum 43-89 α mode	Ludlum 2360	α direct	N/A	90-100 90-100
Ludlum 44-10	Ludlum 2350-1	γ scan	3.5 pCi/g ^{60}Co 6.5 pCi/g ^{137}Cs	N/A
Ludlum 43-37	Ludlum 2350-1	β scan	2000-2200	N/A
Ludlum 43-10-1	Ludlum 2929	α and/or β smear analysis	N/A	α –14-15 β – 75-80
Gamma Spectroscopy System	N/A	γ Analysis	N/A	~0.10 pCi/g for Co-60 and Cs-137

1. Based on 1-minute count time and use of either Cs-137 energy max for surface efficiencies, $\in_{s,}$ as specified in International Standard, ISO 7503-1 [Reference 11-13].

2. Functional equivalent instrumentation may be used.

NOTE: Based on the current version of Energy*Solutions* Procedure CS-FO-PR-001, "Performance of Radiological Surveys" [Reference 11-14] and NUREG 1507 "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions" [Reference 11-15].

5.2. Calibration

The Data Loggers, associated detectors and all other portable instrumentation are calibrated on an annual basis using National Institute of Technology (NIST), traceable sources and calibration equipment. Procedures for calibration, maintenance, operation and quality control implement the appropriate guidance established in American National Standard Institute (ANSI) standards. Calibration typically includes:

- High voltage calibration
- Discriminator/threshold calibration
- Window calibration
- Alarm operation verification
- Scalar calibration verification

Detector calibration includes:

- Operating voltage determination
- Calibration constant determination
- Dead time correction determination

Calibration labels showing the instrument identification number, calibration date, and calibration due date were attached to all instruments. All instrumentation was inspected and source response checked daily before use to verify calibration status and proper operation. Control charts and/or source check criteria were established prior to the initial use of the instrument including the calculation of instrument efficiencies and surface efficiencies for portable instruments based on the requirements in the Energy*Solution*s procedure CS-FO-PR-001, "Performance of Radiological Surveys" [Reference 11-14].

The receipt, inspection, issue, control, and accountability of portable radiological instrumentation used for characterization or release surveys was performed in accordance with issue and control procedures as addressed in Section 5.0 of the LACBWR Site Characterization Project QAPP [Reference 11-11].

5.3. On-Site Sample Analysis

At the LACBWR site, a DPC Canberra gamma spectroscopy system with a High Purity Germanium (HPGe) detector was set up and calibrated to analyze soil, asphalt samples, sediment, and liquid/sludge type samples. The analysis library included Co-60, Cs-137, and other fission and activation products to ensure the ROC could be flagged, if present, during analysis. All samples collected were uniquely numbered and samples tracked through the analysis process. All soil, asphalt, and sediment samples were dried prior to analysis. Analytical results and daily QC runs of the gamma spectroscopy system were reviewed by system operator and the Radiological Protection Supervisor daily to ensure system was operating satisfactorily and that the Co-60 and Cs-137 MDCs were being maintained at </= to 0.1 pCi/g for soils and solids.

On-site sample types and quantities are discussed in greater detail in Chapter 7 of this document.

5.4. Off-Site Sample Analysis

A representative population of soil, concrete, sediment, and sludge/liquid samples was sent to an off-site lab for analysis for HTD and TRU analyses based on the ROC. In addition, a representative population of samples analyzed on-site by gamma spectroscopy was sent to the off-site lab for duplicate analysis by gamma spectroscopy. Off-site sample types and quantities are discussed in greater detail in Chapter 7 of this document.

All samples were uniquely numbered. All soil, asphalt, and sediment samples were dried prior to analysis excepting those samples for C-14 or tritium analysis. Offsite samples were tracked using chain of custody records, packing lists for transportation, laboratory verification of receipt, and laboratory tracking during analyses. A summary of lab methods used for analyses and MDCs met for those analyses is included in Table 5-3 Analytical Methods and Typical MDCs.

Table 5–3 Analytical Methods and Typical MDCs

Analysis	Technique	Soils Method/MDC(pCi/g)	Water Method/MDC(pCi/L)
Gamma Radionuclides	Gamma Spectroscopy	DOE EML HASL 300/<0.1	EPA Method 901.1/10.0
Isotopic Neptunium (Np-237)	Alpha Spectrometry	DOE EML HASL 300/<0.04	
Isotopic Plutonium (Pu-238/239/240)	Alpha Spectrometry	DOE EML HASL 300/<0.05	EML Pu-02 Modified/ 1.0
Isotopic Thorium (Th-228/230/232)	Alpha Spectrometry	DOE EML HASL 300/<0.05	
Isotopic Uranium (U-234/235/238)	Alpha Spectrometry	DOE EML HASL 300/<0.06	
Isotopic Curium (Cm-243/244)	Alpha Spectrometry	DOE EML HASL 300/<0.03	
Isotopic Americium (Am-241/243)	Alpha Spectrometry	DOE EML HASL 300/<0.04	
C-14	LSC	EPA EERF C-01/<5.0	ENIC Modified/50.0
Tritium	LSC	EPA 906.0/<10.0	EPA 906.0/300.0
Sr-90	GFPC	DOE EML HASL 300/<1.0	EICHROM Modified Method /2.0
Pu-241	LSC	DOE EML HASL 300/<10.0	EML Pu-01/50.0

Analysis	Technique	Soils Method/MDC(pCi/g)	Water Method/MDC(pCi/L)
Tc-99	LSC	DOE EML HASL 300/<2.0	EICHROM Tc-01/15.0
Gross Alpha and Beta	Gas Flow Proportional		EPA 900.0/5.0
Fe-55	LSC	DOE EML HASL 300/<10.0	EML Fe-01 Modified/100.0
Ni-63	LSC	DOE EML HASL 300 (SRW01)/<2.0	EML Ni-01 Modified/15.0
Ni-59	LSC	DOE EML HASL 300 (SRW01)/<50.0	EML Ni-01 Modified/100.0

6.0 Minimum Detectable Concentration

The MDC is dependent on count times, geometry, sample size, media type, detector efficiency, background, and for scanning, the scanning rate and the efficiency of the surveyor.

Typically, the MDCs for hand held instrument surveys were less than 50% of the Action Levels specified in Table 2-3. The desired MDCs were determined prior to analysis of soil, asphalt, concrete, sediment, and sludge/liquid samples and were included in the purchase order requirements for the offsite samples. The desired MDCs were verified as obtained on site during the review of the individual sample gamma spectroscopy results with the onsite equipment.

The equations used for calculating the MDC for direct measurements and smears are obtained from the formulas noted in procedure CS-FO-PR-001, “Performance of Radiological Surveys” [Reference 11-14].

7.0 Survey Design and Implementation

To facilitate characterization, the areas to be surveyed were divided into survey areas. Characterization surveys included beta scans, measurements for total alpha and total beta activity, smears for determining the presence of removable alpha and removable beta activity, gamma scans and exposure rate measurements. In addition, representative structural material, paved material (e.g. concrete and asphalt), and soil samples were collected for on-site analysis by gamma spectroscopy . Several samples were also sent to an off-site laboratory for HTD analysis. Both biased (judgmental) and random measurement locations were selected. The selection of random measurement locations were based on guidance from the Project Health Physicist and were pre-established using Wisconsin South state plane coordinates. The random sampling points were generated with the use of the Visual Sample Plan software. All measurement and sample locations were marked or otherwise identified.

The areas and materials surveyed and/or sampled in and around the LACBWR Site as part of the Energy*Solutions* characterization survey included:

- LACBWR Administration Building;
- Building concrete samples at locations of interest in the Turbine Building Tunnel;
- Surface and subsurface soils samples in all Class 1, 2, and 3 open land area survey units (survey unit L3012102 (switchyard) was not surveyed;
- Asphalt and concrete samples from roads and paved areas as well as the soil area directly below the asphalt to a one meter depth;
- Accessible representative roof surface areas at the Administration Building and the G-3 Coal Plant;
- Accessible facility drains and buried piping with an approach to get at depth samples above,alongside, and below the buried piping as found location;
- Septic drain fields; and
- A background radiation study of non-impacted soil with similar physical characteristics to the impacted soil at the LACBWR Site.

7.1. Survey Areas and Units

The survey areas and initial survey unit classifications were previously discussed in Section 3.0 – Characterization Plan Scope and Survey Units. Based upon available information, the entire LACBWR site was initially classified as “Impacted” and appropriate Class 1, 2, and 3 survey units were established for the overall land areas encompassing the site, including:

- Eight (8) Class 3 Survey Units,
- Five (5) Class 2 Survey Units, and,
- Four (4) Class 1 Survey Units.

The survey units for the land areas and associated building areas within them are limited in size to ensure adequate survey coverage. The size limits are specified in Table 7-1.

Table 7-1 Recommended Survey Unit Sizes

Survey Unit Classification	Type of Area	Size Limit (m^2)
Class 1	Building Surfaces	up to 100
	Land Areas	up to 2,000
Class 2	Building Surfaces	up to1,000
	Land Areas	up to 10,000
Class 3	Building Surfaces	No Limit
	Land Areas	No Limit

The level of scanning (beta or gamma, as appropriate, for the surfaces to be scanned) is driven by the classification of a survey unit. The area to be scanned in each survey unit was determined by the professional judgment of the Project Health Physicist during the survey design process. Based upon the review of historical and current radiological data at LACBWR and goals of the characterization surveys, Table 7-2 provides a list of the recommended scan coverage for the characterization surveys in Class 1 and Class 2 Areas.

Table 7-2 Scan Coverage

Survey Unit Classification	Recommended Characterization Scan Coverage for Open Land Areas
Class 1	Up to 25% scanning will be attempted based on background radiation conditions
Class 2	○ 25 to 50% ○ Concentrating on areas with an increased probability of exhibiting elevated activity (e.g. Class 1 boundaries, waste transfer areas, vehicle transit routes, etc.)
Class 3	No scanning surveys performed of open land areas

Attachment 7-1 provides a detailed listing of survey units, their preliminary classification as well as the estimated number and types of measurements established in the Characterization Survey Plan. For the Class 1, 2, and 3 survey units, the expected scan area percentage is identified and the anticipated number of samples to be collected for on-site gamma spectroscopy analysis, as well as the number of sanmples anticipated for QC purposes and offsite analysis for the presence of HTD and TRU radionuclides.

Note that the Reactor Building, Waste Treatment Building, Turbine Building, Underground Gas Storage Tank Vault, and interconnecting tunnels were excluded from the scope of the characterization survey as the current decommissioning approach calls for the removal and disposal of the above-grade portions of these buildings as radioactive waste. Tanks and sumps were also not part of the scope of the characterization survey as the tanks and sumps had been sampled earlier during a previous survey.

7.2. Survey Unit Preparation for Characterization

Preparations for performing characterization were implemented in all survey units as deemed appropriate and practical. Prior to performing characterization surveys on structural surfaces, survey units were cleared of all loose equipment and materials to the extent possible. All physical hazards in the survey unit were either identified and removed or marked as appropriate.

All measurement locations were marked on the building surface or equipment and a map or drawing was prepared to document the measurement location.

For open land survey units, reference coordinates were established using a Global Positioning System (GPS) coupled with a standard topographical grid coordinate system such as the North American Datum (NAD) system. Random sampling locations were generated using VSP in Class 3 and Class 2 open land survey units, asphalt in Class 1 survey units and Class 2 survey units and the selected locations were located using GPS and marked for survey. Biased sampling locations in Class 1 and Class 2 open land survey unit areas were located using GPS. All coordinates were logged and biased location was marked for survey and documented on survey maps.

ATTACHMENT 7-1 - Survey Unit Classification Table and Measurements and Samples for Characterization Survey

CLASS 1 Survey Units

Survey Unit/Description	MARSSIM Classification	Structure or Land Area	Gamma Exposure Measurements (Number)	Gamma Scan (Percent)	Beta Scan (Percent)	Direct Alpha/ Beta Measurements (Number)	Alpha/Beta Smears (Number)	H-3/C-14 Wipes (Number)	Sampling and On-Site and Off-Site Analysis*															
									Structural Samples		Soil Under Struct.		Paved Asphalt Samples		Soil Beneath Asphalt		Land Surface Samples		Land Subsurface Samples		Basin/Sewer/Sump Sludge/Sediment		Total Samples	
									On-Site	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site***	*On-Site*	*Off-Site***	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*
L110101																								
Land Area Only		Paved Area (as available)	N	N	N	N	N	N	N	N	N	N	N	N	N	N							0	0
		Land Area	N	Y (25%)	N	N	N	N	N	N	N	N	N	N	N	N	12 (15 cm)	2	18	2	N	N	30	4
Total Samples for Analysis																							**30**	**4**
L110102																								
Includes TB Tunnel and Grounds	**1**	TB Piping Tunnel	N	N	N	N	N	N	N	1	1	1	N	N	N	N	N	N	N	N	N	N	1	2
		Paved Area (as available)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0
		Land Area	N	Y (25%)	N	N	N	N	N	N	N	N	N	N	N	N	2 (15 cm)	1	6	1	N	N	8	2
L110103																								
Includes LSA Bldg; Transformer	**1**	Paved Area	N	N	N	N	N						10	1	10	1					2	1	22	3
		Land Area	N	Y (25%)	N	N	N										10 (15 cm)	1	10	1	(Sanitary samples)		20	2
Total Samples for Analysis																							**42**	**5**
L110104																								
North end of RCA grounds	1	Paved Area	N	N	Y(25%)	10 (tied to sample loc)	N						10	1	10	1							20	2
		Land Area	N	Y (25%)	N	N	N										10 (15 cm)	1	10	1			20	2
Total Samples for Analysis																							**40**	**4**

*NOTE: Off-site samples will be designated for QC and have gamma spectroscopy, HTD and TRU analysis performed

**NOTE: The paved materials (asphalt) and underlying soil will be asssessed on-site gamma spectroscopy only. The additional HTD and TRU analysis will only be performed if the on-site results indicate contamination above specified Action Levels and/or at the direction of the Project Health Physicist.

ATTACHMENT 7-1 - Survey Unit Classification Table and Measurements and Samples for Characterization Survey

CLASS 2 Survey Units

Survey Unit/Description	MARSSIM Classification	Structure or Land Area	Gamma Exposure Measurements (Number)	Gamma Scan (Percent)	Beta Scan (Percent)	Direct Alpha/ Beta Measurements (Number)	Alpha/Beta Smears (Number)	H-3/C-14 Wipes (Number)	*Sampling and On-Site and Off-Site Analysis**													
									Structural Samples		Soil Under Struct.		Paved Asphalt Samples		Soil Beneath Asphalt		Land Surface Samples		Land Subsurface Samples		Basin/Sewer/Sump Sludge/Sediment		Total Samples	
									On-Site	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site***	*On-Site*	*Off-Site***	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*
L211101																								
North area surrounding LACBWR	2																							
		Paved Area	N	N	Y (50%)-Random	6 (tied to sample loc)	N	N	N	N	N	N	6	1	6	1	N	N	N	N	N	N	12	2
		Land Area	13(tied to sample)	Y (50%)	N	N	N	N	N	N	N	N	N	N	N	N	13 (15 cm)	2	10	2	1 (stormwater line)	1	24	5
Total Samples for Analysis																							**36**	**7**
L211102																								
South area surrounding LACBWR	2	Paved Area	N	N	Y (50%)-Random	6 (tied to sample loc)	N	N	N	N	N	N	6	1	6	1	N	N	N	N			12	2
		Land Area	10(tied to sample)	Y (50%)	N	N	N	N	N	N	N	N	N	N	N	N	10 (15 cm)	1	1	1	N	N	11	2
Total Samples for Analysis																							**23**	**4**
B209103																								
Administration Building	2	Structure	N	N	Y (50%-Random)	22	9	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
NOTE: Administration Building Roof had surveys perfromed including:beta scans, direct alpa/beta measurements, and alpha/beta smears taken																								
Total Samples for Analysis																							**0**	**0**

***NOTE: Off-site samples will be designated for QC and have gamma spectroscopy, HTD and TRU analysis performed**
****NOTE: The paved materials (asphalt) and underlying soil will be asssessed on-site gamma spectroscopy only. The additional HTD and TRU analysis will only be performed if the on-site results indicate contamination above specified Action Levels and/or at the direction of the Project Health Physicist.**

ATTACHMENT 7-1 - Survey Unit Classification Table and Measurements and Samples for Characterization Survey

CLASS 3 Survey Units

Survey Unit/Description	MARSSIM Classification	Structure or Land Area	Gamma Exposure Measurements (Number)	Gamma Scan (Percent)	Beta Scan (Percent)	Direct Alpha/ Beta Measurements (Number)	Alpha/Beta Smears (Number)	H-3/C-14 Wipes (Number)	Structural Samples		Soil Under Struct.		Sampling and On-Site and Off-Site Analysis*											
													Paved Asphalt Samples		Soil Beneath Asphalt		Land Surface Samples		Land Subsurface Samples		Basin/Sewer/Sump Sludge/Sediment		Total Samples	
									On-Site	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site***	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*	*On-Site*	*Off-Site*
L312101		Concrete Area	N	N	N	3	3	N	N	N	N	N	N	3(concrete)	N	N	N	N	N	N	N	N	0	3
Area North of LACBWR	3	Land Area	3 (at sample loc)	N	N	N	N	N	N	N	N	N	N	N	N	N	3 (15 cm)	1	3 (1m deep)	1	1 (sanitary drain line)	1	7	3
Total Samples for Analysis																							**7**	**6**
L312102		Paved Area	*Note: Due to access and safety requirements working in a Switchyard area, no measurements or samples will be taken in this Survey Unit.*																					
Switchyard	3	Land Area																						
Total Samples for Analysis																							**0**	**0**
L312103		Paved Area	N	N	N	3 (tied to sample loc)	N	N	N	N	N	N	3	N	1	N	N	N	N	N	N	N	4	0
G-3 Plant and Grounds	3	Land Area	3 (at sample loc)	N	N	N	N	N	N	N	N	N	N	N	N	N	3 (15 cm)	1	3 (1m deep)	1	N	N	6	2
G-3 Bldg Roof*																								
c NOTE: Coal Plant Roof-Mid level had surveys perfromed including beta scans,direct alpha/beta measurements, and alpha/beta smears taken																								
Total Samples for Analysis																							**10**	**2**
L312104		Paved Area	N	N	N	3 (tied to sample loc)	N	N	N	N	N	N	3	N	1	N	N	N	N	N	N	N	4	0
Land strip/area East of LACBWR	3	Land Area	3 (at sample loc)	N	N	N	N	N	N	N	N	N	N	N	N	N	3 (15 cm)	1	3 (1m deep)	1	1 (basin sample)	2	7	4
Total Samples for Analysis																							**11**	**4**
L312105		Paved Area	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0
Coal pile area South of G-3	3	Land Area	3 (at sample loc)	N	N	N	N	N	N	N	N	N	N	N	N	N	3 (15 cm)	1	3 (1m deep)	1	1(coal)	1(coal)	7	3
Total Samples for Analysis																							**7**	**3**
L312106		Paved Area	N	N	N	3 (tied to sample loc)	N	N		N	N	N	3	N	1	N	N	N	N	N	N	N	4	0
Road/land strip by ISFSI	3	Land Area	3 (at sample loc)	N	N	N	N	N		N	N	N	N	N	N	N	3 (15 cm)	1	3 (1m deep)	1	N	N	6	2
Total Samples for Analysis																							**10**	**2**
L312107		Paved Area	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0
Hilly area E of Highway 35	3	Land Area	3 (at sample loc)	N	N	N	N	N	N	N	N	N	N	N	N	N	3 (15 cm)	1	3 (1m deep)	1	N	N	6	2
Total Samples for Analysis																							**6**	**2**
L312108		Paved Area	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	0	0
Strip immediately W of Highway 35	3	Land Area	3 (at sample loc)	N	N	N	N	N		N	N	N	N	N	N	N	3 (15 cm)	1	3 (1m deep)	1	N	N	6	2
		Gravel by Railroad							1														1	
Total Samples for Analysis																							**7**	**2**

***NOTE: Off-site samples will be designated for QC and have gamma spectroscopy, HTD and TRU analysis performed**
****NOTE: The paved materials (asphalt) and underlying soil will be asssessed on-site only. The additional HTD and TRU analysis will only be performed if the on-site results indicate contamination above specified Action Levels and/or at the direction of the Project Health Physicist.**
The concrete samples will all be sent off site for Gamma Spec and one selected sample will be analysed for HTD and TRU radionuclides.

7.3. Survey Package Development

A Characterization Survey Package was developed for each survey unit designated in Tables 3-1 and 3-2 in Section 3.0 – Characterization Plan Scope and Survey Units. Multiple survey plans were generated for several survey units to accommodate performing characterization in phases.

Specific survey instructions/work sheets were prepared for each survey unit detailing the survey requirements and providing instructions for completing the survey. The survey instructions described the number, type and location of scan and direct measurements, smears, and samples to be collected as well as the type of analyses to be performed. Direction was also provided for selection of instruments, count times, instrument modes, survey methods, required documentation, actions levels, investigation actions, background requirements and other appropriate instructions. In conjunction with the survey instructions, survey data forms, indicating desired measurements, were prepared to assist in survey documentation.

Each individual survey plan contained the following types of information:

- Detailed description of the survey unit,
- Photographs, maps, and/or drawings of the survey unit,
- A summary of the operational history pertinent to the survey unit and summary data from any previous radiological surveys if available,
- The specific DQO(s) for the survey unit,
- Types and number of survey measurements and/or samples prescribed for the survey,
- Specific survey instructions,
- Survey measurement and sample designation codes and locations,
- Quality Assurance (QA) measures in accordance with the QAPP requirements, and,
- Any pertinent information such as support from others, health and safety information and necessary Work Orders (e.g. for coring, drilling, access, lifting, etc.) and permits (e.g. Excavation Permit, Radiation Work Permit (RWP), etc.).

The survey packages were the primary method of controlling and tracking the survey results. Survey records, including the sample analysis results are maintained in the survey packages.

7.4. Survey Unit Walk Down

Survey plan development began with the performance of a walk down of the survey unit. During the walk down, details regarding the physical survey area were compiled such as the surfaces in the unit (wall, floor, ceiling, surface soils, etc.). Data from available operational surveys were reviewed and utilized as appropriate.

Significant health and safety concerns were identified, including any potential industrial hazards commonly found at a construction site, such as exposed electrical lines, excavations, enclosed work spaces, hazardous atmospheres, insects, unstable or sharp surfaces, hot and cold temperature extremes, tripping hazards, vehicle traffic, and working at heights.

Each hazard was evaluated to determine if the hazard could be eliminated, avoided, or minimized, as well as to determine if the need for additional outside support/expertise was necessary to complete further evaluation or mitigation.

7.5. Survey Design and Protocols

Characterization surveys were designed and performed in accordance with the LACBWR Site Characterization Survey Plan as well as the QAPP and applicable approved procedures (e.g. procedures CS-FO-PR-001, CS-FO-PR-002, CS-FO-PR-003, and CS-FO-PR-004[Reference 11-14, 11-16, 11-17 and 11-18] as well as the Energy*Solutions* instrument-specific operating procedures).

7.5.1 Graded Approach

The survey design incorporated a graded approach based upon the DQOs for the survey unit. For example, Class 1 open land survey units are expected to contain radiological contamination greater than the established action levels and in accordance with the expected decommissioning approach, a majority of the Class 1 structures (and systems) will be removed and disposed as radioactive waste. Therefore, the characterization surveys that were performed in Class 1 survey units were focused on bounding the contamination where contamination is known to exist. The survey design was based upon the number of measurements and samples required to identify the lateral and vertical extent of the contamination.

Areas classified as Class 2 or Class 3 were surveyed with a combination of random and biased survey measurement locations and scan areas. This supplemented what was currently known concerning the condition of the areas with respect to the presence or absence of radiological contamination.

There are two approaches that were used for survey design – biased and random. Biased survey designs use known information to select locations for direct measurements and/or samples. Random survey design selects direct measurement and/or sample locations at random or by using a systematic sampling design with a random start and is based on using pre-established survey units and georeferenced to Wisconsin South state plane coordinates. The random sampling points were generated with the use of VSP. A biased approach was considered when the characterization effort was designed to delineate the extent of an area that was expected to require remediation and/or had a known past contamination event or possibility for leaks. Alternately, a random approach was considered if the characterization effort was designed to verify the basis for classifying an area.

7.5.2 Number of Direct Measurements and/or Samples

The number of measurements and/or samples that were taken in each survey unit was based upon the LACBWR Site Characterization Plan as well as assessing the population size necessary to satisfy the specific DQOs for each survey unit.

For the characterization of impacted Class 1, 2 and 3 structures, the number of direct measurements and/or samples were based upon the DQOs (e.g. confirming extent of radiological contamination that may need remediation; obtaining additional radiological information to confirm the presence and ratios of ROC; etc.) and the professional

judgment of the Radiological Protection Supervisor and/or the Project Health Physicist. The number of locations selected was dependent upon existing radiological conditions and background levels, accessibility to structures, radiological/ALARA exposure, industrial hazard considerations, as well as other factors.

For the characterization of impacted Class 2 open land survey units (paved and unpaved), the minimum number of random direct measurements and/or samples taken were commensurate with the probability of the presence of residual radioactive contamination in the survey unit. The sample size selected was sufficiently robust to provide a statistically defensible mean and assessment of variability. A minimum number of direct and scanning measurements were performed in the Administration Building to verify that the facility contained no unsealed licensed- generated residual radioactivity greater than the action levels.

For impacted Class 3 open land survey units, sufficient random or biased measurements or samples were taken to assess the initial classification and determination that no licensed-generated residual radioactivity greater than the action levels reside in these areas.

7.5.3 Scan Coverage

Survey units were scanned in accordance with their classification using the recommended scan coverage guidance presented in Table 7-2. The area to be scanned in each survey unit was determined by the professional judgment of the Radiological Protection Supervisor and/or the Project Health Physicist during the survey design process, including information obtained on site ambient radiation conditions during the initial survey unit walk downs.

7.5.4 Direct Measurements

Direct measurements were performed to detect total levels of contamination on structural surfaces of buildings or on concrete or asphalt paved areas. These measurements were performed using ~100 cm^2 or greater scintillation or gas-flow proportional detectors.

Direct measurements were conducted by placing the detector very near the surface to be counted and acquiring data over a pre-determined time count time. A count time of one minute to two minutes was typically used for surface measurements and generally provided detection levels well below the designated investigation level or acceptable MDC.

Whenever possible, Health Physics Technicians monitored the audible response to identify locations of elevated activity that required further investigation and/or evaluation. Based on the direct measurements and the results of lab results for submitted asphalt and concrete samples no areas of elevated contamination were identified that needed to be marked for further investigation and potential decontamination.

7.5.5 Beta Surface Scans

Beta scans were performed over accessible surfaces, including, but not limited to: floors, roofs, asphalt paved areas. Floor monitors using large area gas-flow proportional detectors were used for asphalt, floor, and roof area surfaces. Smaller hand-held beta

scintillation and/or gas-flow proportional detectors (typically 100-126 cm^2) were also used for direct surveys of surfaces.

Beta scanning was performed with the detector positioned within 1 cm of the surface and with a scanning speed of one detector active window width per second. Scanning speed was calculated a priori to assure the MDC for scanning was appropriate for the stated objective of the survey.

Whenever possible, Health Physics Technicians monitored the audible response to identify locations of elevated activity that required further investigation and/or evaluation. One area of elevated contamination was identified on the second floor of the LACBWR Administration Building due to discovery of a single discrete radioactive particle. The survey requirements for the Administration Building were upgraded as described in Section 9.9 of this report.

7.5.6 Gamma Surface Scans

Gamma scans were performed over unpaved open land surfaces to identify locations of residual activity in surface soils. Sodium iodide (NaI) gamma scintillation detectors (2" x 2") were used for these scans.

Scanning was performed by moving the detector in a serpentine pattern, while advancing at a rate of about 0.5 m (20 inches) per second with the distance between the detector and the surface maintained at approximately four inches. Audible signals were monitored and locations of elevated levels were flagged for further investigation and/or sampling. Whenever possible, Health Physics Technicians monitored the audible response to identify locations of elevated activity that required further investigation and/or evaluation. No areas of elevated contamination were identified that needed to be marked for further investigation and potential decontamination.

7.5.7 Removable Surface Contamination

Removable beta and/or alpha contamination or smear surveys were performed to verify loose surface contamination was less than the designated investigation level. A smear for removable activity was usually taken at each direct measurement location on non-asphalt type surfaces. A 100 cm^2 surface area was wiped with a circular cloth or paper filter, using moderate pressure. Smears were analyzed for the presence of gross beta and/or gross alpha activity as appropriate. This was done using a dual channel scalar counting system.

7.5.8 Concrete and Asphalt Core Sampling

Concrete and asphalt core boring and sample collection were conducted to supplement the scans and direct measurements and provide information regarding the potential penetration of radiological contamination in structural surfaces and paved areas. Core bore sampling of concrete involved the use of a diamond bit core drill.

The concrete sample produced by the coring was typically broken up to allow for laboratory analysis purposes based on collecting a pre-determined core location. Direct measurements were performed on the top and bottom of the pucks to determine contamination intrusion depth and/or the activation of the material. Concrete pucks were

also pulverized and analyzed for radionuclide content. Asphalt samples were typically pulverized and analyzed.

7.5.9 Soil Sampling

Samples of soil were obtained from designed biased and random sample locations. Surface soil is defined as the top 15 cm (6-inch) layer of soil while subsurface soil is defined as soil below the top 15 cm layer in 1 meter increments. The depth of soil sampling required was defined in the survey packages and instructions.

Surface soil was collected using a split spoon sampling system or by using hand trowels. Subsurface soil was sampled by direct push sampling systems (e.g. GeoProbe methods) or in some cases manually using hand augers.

Subsurface soil sampling was performed as necessary to address the DQOs for the survey unit. Typically only one subsurface sample at a depth of one meter was required at a sampling location where both surface and subsurface samples were obtained. However, samples at additional depths were selected at sampling locations such as along discharge subsurface piping pathways, alongside facility structures and beneath the Turbine Building.

A sufficient amount of material was collected at each location based on the requested analyses; the amount of material needed was also defined by the requirement for split sampling and the volumes needed by on-site and off-site laboratories for the analysis objectives. Sample preparation included the removal of extraneous material and the homogenization and drying of the sample for analysis. It should be noted that drying was not performed on samples collected for C-14/H-3 analysis. Separate plastic containers were used for each sample and each container was accounted for throughout the sampling and analysis process. Samples were split when required in the survey instructions.

7.5.10 Background Measurements and Background Reference Materials

Assessments of background levels are necessary because it is necessary to verify that the background at LACBWR fell within nominal expected levels for soils,concrete, and asphalt.

The considerations for selecting background reference areas include:

- The background location should be representative of the survey unit location and,
- The background location should not be impacted from site operations.

Normally, background reference areas should be reasonably close to the decommissioning site to be representative. In addition, consideration should be given to the wind direction relative to the location of the selected area and the site. However, if no suitable off-site location can be identified, then an on-site area that is expected to be non-impacted can be used. Based upon the previous radiological results, the Project Health Physicist and the Radiation Protection Supervisor selected an area that seemed appropriate for obtaining background measurements in soils.

In addition, as some materials such as asphalt and concrete are expected to remain in the end-state condition of LACBWR, material background reference measurements were also

obtained on these types of materials. Construction materials may exhibit naturally occurring radioactive materials (NORM) with significant variability in concentration based on the origin and fabrication of the materials. Therefore, it was necessary to select on-site materials outside of the LSE area to confirm that they did not contain radionuclides of concern for further consideration and use as background reference materials. Concrete samples and direct measurements were taken in the Class 3 Survey Unit L3012101 (North of LACBWR) and direct measurements were taken of removed concrete structure from the LACBWR Crib House. Asphalt samples and direct measurements were collected and analyzed in the Class 3 Survey Unit L3012106 as a representative background condition for asphalt. Surface soil samples from L3012109, which is a small area of approximately 100 square meters of undisturbed non-drainage area in L3012108, were collected for use as background reference soils. Soil samples from L3012107 and L3012108 were also evaluated for use as background reference soils.

A series of scanning and direct measurements were made on the identified asphalt, concrete and/or soil areas with the same instruments and procedures that were implemented for the field characterization surveys. Surface and subsurface samples were also obtained from the potential background locations for asphalt and soil and first six inch samples taken of the concrete. The sample locations were indicated on a map of the background reference area. All measurements and sampling, including the specific number of measurements and samples, were performed in accordance with the survey guidance and instructions associated with the respective survey package.

7.6. Survey Implementation

When a survey package was approved and prior to implementation, the Radiological Protection Supervisor performed a pre-survey briefing with the Health Physics Technicians who performed the survey. During the briefing, the survey package and its specific survey instructions were reviewed. The following tasks were integral to survey implementation:

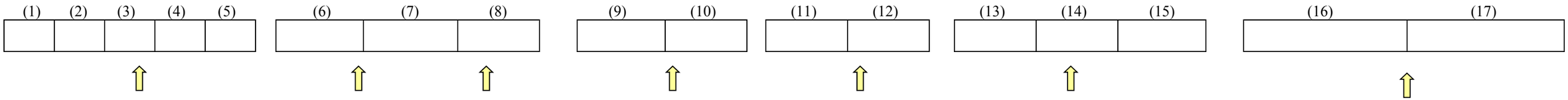
- Survey instrumentation set-up,
- Ensure proper instrument operation by performing source checks and background evaluations before and after each shift,
- Perform preliminary inspections of the survey unit to identify any additional specific survey instructions,
- Locate and mark all direct measurement and/or sample locations using the coordinates or directions provided in the survey instructions,
- Acquire survey data and analyze samples using appropriate calibrated instruments,
- Document survey measurements and sample analysis data,
- Ensure all requisite data is placed in survey package,
- Review survey results to identify any areas exceeding the action levels and,
- Review of the completed survey packages and allto ensure that all required surveys have been performed

-
- Review of the completed survey packages and all required surveys have been performed.

7.6.1 Survey/Sample Measurement Location Codes

Each characterization survey media sample collected was assigned a unique survey location code. Table 7-3 **Sample and Measurement Unique Identification Designation** presents the sample measurement unique identification designation system that was used to identify sample types and locations. Table 7-3 has been updated since the creation of the Characterization Plan [Reference 11-24] to add a surface type for "drain area" and a material type designation for carpet, plastic tile, and glazed tile. .

Table 7-3 Sample & Measurement Unique Identification Designation



Classification & Survey Area

1st digit indicates type of Survey Area
L = Open Land Area
B = Structural Survey Area
S = System

2nd digit indicates Classification
1 = Class 1
2 = Class 2
3 = Class 3
4 = Non-impacted
5 = Unassigned

3rd, 4th and 5th digits indicate the Survey Area Number

Survey Unit Number & Sequence Indicator

6th and 7th digits indicate the Survey Unit Number

The 8th digit indicates alphanumeric sequence (Sequence A-J) allows the survey unit to be divided into 10 smaller survey units. (Sequence K-Z) allows for up to 16 different survey instructions for a single survey unit.

Survey and Measurement Type

The 9th digit indicates the type of survey.
B = Background
S = Scoping
C = Characterization
R = Remedial Action
F = FSS
I = Investigation
V = Verification
Q = QA/QC

The 10th digit indicates the type of measurement.
B = Background
R = Random
S = Systematic
J = Judgmental or Biased
I = Investigation
V = Verification
Q = QA/QC

Surface Type

The 11th digit indicates the type of surface where the measurement was taken.
F = Floor
W = Wall
C = Ceiling
S = System
R = Roof
P = Paved Road
G = Ground
L = Water
D = Drain Area

The 12th digit indicates the material composition of the surface where the measurement was taken.
C = Concrete
M = Metal
W = Wood
B = Cinder Block
K = Brick
A = Asphalt
S = Soil
T = Tar
L = Liquid
R = Carpet
E = Plastic Tile
G = Glazed Tile

Sample or Measurement No.

The 13th, 14th and 15th digits indicate the alphanumeric measurement number Sequentially, 001 through 999

Media Type

The 16th and 17th digits indicate the type of media that was sampled.
SS = Surface Soil
SB = Subsurface Soil
SM = Sediment
WT = Water
LQ = Other liquids besides water
OL = Oil
CV = Volumetric Concrete
AV = Volumetric Asphalt
MT = Metal
PT = Paint
SW = Smear Sample
BD = Beta Direct
AD = Alpha Direct
GD = Direct Gamma measurement
BS = Beta Scan
GS = Gamma Scan
JS = Juncture Scan
JD = Juncture Direct
PS = Penetration Scan
PD = Penetration Direct

8.0 Quality Assurance and Quality Control

Energy*Solutions* possesses a USNRC-approved QA Program. The Energy*Solutions* QA Program meets the requirements of 10CFR50 Appendix B [Reference 11-20], ASME NQA-1[Reference 11-21], 10 CFR 71 Subpart H [Reference 11-22], and 10 CFR 72 subpart G [Reference 11-23]. All activities affecting quality were controlled by written plans and procedures, including the QAPP [Reference 11-11]. The following QA measures were incorporated into the characterization survey.

8.1. Selection of Personnel

All management and supervisory personnel involved with the acquisition of characterization data have experience in performing characterization surveys of nuclear or reactor facilities, and in the implementation of NUREG-1575 (MARSSIM). All persoonel were also made familiar with the requirements of the characterization survey plan, instrumentation to be used and all implementing procedures. All project personnel have received satisfactory and documented radiation worker training by the DPC Radiation Protection Manager prior to commencement of field characterization work..

8.2. Training

In addition to radiation worker training all on-site project personnel received site specific training that included applicable site emergency procedures and safety orientation. All site personnel reviewed all plans and procedures to be used in implementing the characterization survey. Acknowledgement sheets were used to document the review.

8.3. Written Plans and Procedures

All activities affecting quality were controlled by written plans and procedures. This included the LACBWR Site Characterization Plan, the project-specific QAPP and key implementing procedures such as the following:

- CS-FO-PR-001, Performance of Radiological Surveys,
- CS-FO-PR-002, Calibration and Maintenance of Radiological Survey Instruments,
- CS-FO-PR-003, Soil Surveys; Collection of Water, Sediment, Vegetation and Soil Samples; and Chain-of-Custody Procedure, and,
- CS-FO-PR-004, QA/QC of Portable Radiological Survey Instruments.

8.4. Survey Documentation

Hard copies of all survey results were maintained in survey packages. A separate survey package was maintained for each survey unit. As applicable, each measurement and sample result was identified by date, technician, instrument type and serial number, detector type and serial number, location code etc. All completed survey packages were reviewed by at least two individuals including the Radiation Protection Supervisor and the Project Health Physicist to ensure the package was complete and that the results adequately characterized the survey area. All off site lab results were reported in appropriate units and electronic

records of results were maintained on a dedicated internal SharePoint website with a hard copy of results kept with survey package records.

8.5. Chain-of-Custody

All samples sent off-site for analysis were accompanied by a chain-of-custody (COC) record to track the location of the sample and ensure that each sample received the appropriate analysis. Upon receipt of sample analysis results, the results were compared to the COC records to ensure all samples were analyzed and that the correct analyses were performed. All analyzed samples were archived for long term retention at a location on the LACBWR Site outside of the LSE boundary.

8.6. Data Validation

Characterization survey measurement and/or analysis results were reviewed to ensure that the survey was complete, fully documented, and technically acceptable. Validation ensured that the data set was comprised of qualified measurement results collected in accordance with the survey design, which accurately reflected the radiological status of the survey unit. The review criteria for data acceptability included the following items;

- Verifying compliance with survey instructions as specified in the survey package or noting the basis for any changes in implementation.
- Verification that the MDCs were appropriate for the instruments and techniques used to perform the survey.
- Verification that the instrument calibration was current and traceable to NIST standards.
- Verification that the field instruments were source checked with satisfactory results before and after use each day that the instrument was used to collect data or, if unsatisfactory, data obtained with that instrument since its previous acceptable performance check was evaluated for acceptability.
- Verification that the survey methods used to collect data was proper for the types of radiation involved and for the media being surveyed.
- Verification that the data set was comprised of qualified measurement results collected in accordance with the survey design, which accurately reflected the radiological status of the survey unit.
- Verification that the data has been properly recorded.

If the data review criteria was not met, then the Project Health Physicist was informed. The discrepancy was reviewed and the decision to accept or reject the data was documented in the survey package.

8.7. Data Evaluation and Review

Direct beta-gamma and alpha measurements and removable contamination samples collected during the characterization surveys were compared against the areas appropriate action level. Material sample analysis results were compared against the action levels for soils. If ROC were identified in soil at concentrations greater than MDC, then the sum of the fraction rule

was applied to the sample results. In Class 2 areas, sum of fractions results for ROCs exceeding 50% of the Table 2-3 criteria above lab MDCs were flagged. In Class 3 areas, sum of fraction for ROCs exceeding 10% of the Table 2-3 criteria above lab MDCs were flagged. Survey results that approached or exceeded the action level were evaluated and considered for additional investigation or possible reclassification. As applicable, the mean activity and the standard deviation were calculated for the survey population for the survey unit by surface or subsurface classification. Standard deviation results greater than 15% off the mean activity were evaluated. In addition Relative Percent Difference (RPD) calculations were performed of duplicate sample ROC results greater than MDC and any results greater than 50% evaluated. Also as per the QAPP Section 4.12, duplicate samples were used to determine the acceptability of the analyses by use of criteria in NRC Inspection Procedure No. 84750 "Radioactive Waste Treatment, and Effluent and Environmental Monitoring." Any results exceeding this analysis were evaluated.

At the completion of the surveys conducted in each survey unit, measurement results were assessed and evaluated according to the DQOs. Data evaluation utilized guidance from MARSSIM [Reference 11-10] and encompassed a review of the survey package data sheets, technician notes, on-site and offsite gamma spectroscopy analytical reports. There were no cases where the characterization plan survey package prescribed measurements and sampling did not adequately define the vertical and lateral extent of radiological contamination in the open land areas and as such no additional measurements and/or sampling was added to the characterization effort of the LACBWR open land areas. Once all DQOs had been achieved, the characterization was considered complete.

9.0 Characterization Survey Results

The on site characterization work was conducted at LACBWR beginning on October 9, 2014 and ending on November 15, 2014. The following is a summary by survey unit of the impacted area surveys and sample analysis results. Following the field work at LACBWR Site, it was determined that minor changes to the survey unit numbers were necessary. Consequently, the sample numbers shown in the results tables and figures are slightly different then the survey package and lab report information. The change made consisted of adding the digit "0" consistently to the survey area number portion of the sample number. Additionally, the sample and measurement number part of the unique identification designation had adequate digits added to establish three digits in the sample/measurement number part of the unique identification designation (See Table 7-3).

9.1. Overview of Characterization of Class 1 Open Land Survey Units and Concrete and Subsurface Soils in a Portion of the Turbine Building Tunnel.

The impacted Class 1 open land areas at LACBWR total approximately 6,045 square meters of surface area and are contained in the LACBWR LSE. The Class 1 impacted survey units were broken down into four survey units as shown in Figure 3-1. The inaccessible area of the Class 1 open land areas included the footprints of the buildings inside the LSE. An exception was the sub foundation samples taken in the Turbine Building Tunnel which were made accessible by concrete coring. This action was performed to provide the necessary data to assess the possible extent of a potential historical subsurface soil contamination event that occurred in the Turbine Building area.

Characterization inspections and surveys were performed of sufficient quantity and quality to quantify the potential volumetric contamination of accessible surface and subsurface soils in each open land survey unit. Limited soil information was obtained from below the structures due to interferences and inaccessibility. Survey techniques were employed to determine the lateral and vertical extent of any contamination identified and the radionuclide concentrations in the soil. A combination of random and biased survey locations were established in each survey unit in accordance with the survey package. The locations of biased measurements and/or samples were determined by the professional judgment of the Project Health Physicist and the Radiological Protection Supervisor working with DPC cognizant staff and ground-pentrating radar (GPR) contracted staff, in the case of locating underground buried piping.

Biased surveys and sampling were focused on locations that exhibited measurable radioactivity, discolored areas, buried pipe locations, actual and potential spill locations, or areas where the ground had been disturbed. The number of random based survey locations was based in part on area classification. Random class measurements were not required in open land Class 1 areas but were used on asphalt areas which had no past history of asphalt contamination. Each surface and subsurface soil sample as well as asphalt collected was analyzed by the on-site radiological laboratory by gamma spectroscopy for plant derived gamma emitting radionuclides and a subset of naturally occurring radionuclides. Count times were adjusted to achieve an MDC of equal to or less than 0.10 pCi/g for Cs-137 and Co-60. All samples were dried prior to analysis. Duplicate samples and concrete were collected by survey unit as per the LACBWR Characterization Plan [Reference 11-24] requirements and sent for offsite analysis to an Energy*Solutions* QA approved vendor lab for gamma spectroscopy, alpha spectroscopy, and HTD analyses

9.2. Survey Unit L1010101

Impacted Class 1 open land survey unit L1010101 is on the eastern end of the LACBWR LSE.

This open land area includes the Reactor Building, Waste Treatment Building, Stack Structure, Underground Gas Storage Tank Vault, and the associated below grade interconnecting tunnel areas. The size of the survey unit is approximately 1,997 square meters minus approximately 450 square meters of building and structure footprint. Inside the survey unit there is a past history of minor radiological surface contamination on the open grounds outside the footprint of the Waste Treatment Facility as discussed in the HSA. There is also little information on the Underground Gas Storage Tank Vault radiological conditions.

The survey design for this survey unit called for (10) biased land surface area soil samples and (10) subsurface soil samples taken at one meter depth at the same location as the surface area sample location in the area with previously identified surface contamination surrounding the Waste Treatment Facility area. Additionally, the survey design called for (2) biased soil sample locations at surface level and at intervals of 1, 2, 4, and 5 meters below grade on the south and west side of the Underground Gas Tank Storage Vault to evaluate the soil areas alongside and underneath the Vault for possible radiological contamination in line with groundwater movement direction of the LACBWR Site towards the Mississippi River. In

addition, duplicate samples were taken for offsite analysis of one surface sample with the highest gamma scan reading and another soil sample at the corresponding one meter location for the (10) biased land surface area soil samples around the Waste Treatment Facility. One duplicate surface soil sample with the highest gamma scan reading and one duplicate subsurface soil sample taken at the location with the highest subsurface on site gamma spectroscopy result in the area of the (2) biased sample locations of the Underground Gas Storage Tank Vault was also taken. All required (12) surface soils samples and the (18) subsurface soil samples were collected without issue. The survey plan also called for up to 25% gamma walkover survey of the open ground area of this survey unit. This was not performed as the nearby Reactor Building and Waste Treatment Building's ambient background radiation levels contributed to an elevated and varied significant background which precluded attempting to evaluate soil conditions with the walkover survey.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. There were no instances of the soil sample results either exceeding the sum of fractions rule from the Table 2-3 criteria or any single radionuclide exceeding 50% of an action level. The average Cs-137 surface soil sample result was 0.215 pCi/g with a high individual sample result of 1.07 pCi/g. The average Co-60 surface soil sample result was 0.08 pCi/g with a high individual sample result of 0.287 pCi/g. The average Cs-137 subsurface sample result was 0.065 pCi/g with a high individual sample result of 0.161 pCi/g. Co-60 was not positively detected at concentration greater than the instrument MDC in any subsurface soil sample. Acceptability testing of the duplicate soil samples' data in accordance with Section 4.12 of the QAPP did not reveal any lab data concerning the ROC requiring further evaluation.

Five surface soil sample, two subsurface soil samples and one concrete sample was sent for off-site analysis for HTD radionuclides. H-3, C-14, Fe-55, Np-237 and Am-243 was positively detected at concentrations greater than the instrument MDC but at concentrations less than their respective action level.

The following tables and figures are included with this survey unit:

- Table 9-1 and Table 9-2 show the summary of the surface and subsurface soil samples information and respective statistics.
- Figure 9-1 shows the location of the biased soil samples.
- Table 9-52 shows the offsite radioanalytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.
- Table 9-56 shows the soil sample numbers/depths for samples taken alongside the Underground Gas Storage Tank Vault

Table 9-1 L1010101 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L1010101-CJ-GS-001-SS	11/3/2014	570944.808	1642181.048	806.6	Dry			5.62E-02	3.18E-02	7.14E-03	2.62E-02
L1010101-CJ-GS-002-SS	11/4/2014	570956.705	1642201.377	652.4	Dry			7.91E-02	2.97E-01	2.07E-02	5.05E-02
L1010101-CJ-GS-003-SS	11/4/2014	570959.587	1642209.523	747.2	Dry			4.83E-02	9.97E-02	1.15E-02	3.43E-02
L1010101-CJ-GS-004-SS	11/4/2014	570921.323	1642245.418	757.6	Dry			5.45E-02	4.51E-02	8.53E-03	2.88E-02
L1010101-CJ-GS-005-SS	11/4/2014	570935.582	1642257.286	774.7	Dry			5.16E-02	6.79E-02	1.01E-02	3.83E-02
L1010101-CJ-GS-006-SS	11/4/2014	571009.079	1642241.110	766.5	Dry			5.64E-02	1.12E-01	1.19E-02	3.58E-02
L1010101-CJ-GS-007-SS	11/4/2014	571016.797	1642219.252	571.2	Dry	8.84E-02	1.16E-02	5.31E-02	1.07E+00	4.74E-02	7.40E-02
L1010101-CJ-GS-008-SS	11/4/2014	571020.062	1642198.718	687.4	Dry			5.41E-02	5.17E-02	9.66E-03	3.53E-02
L1010101-CJ-GS-009-SS	11/5/2014	571060.022	1642159.268	691.9	Dry			7.06E-02	2.02E-01	1.61E-02	3.46E-02
L1010101-CJ-GS-010-SS	11/5/2014	571045.158	1642132.913	747.1	Dry	2.87E-01	1.59E-02	4.62E-02	4.42E-01	2.47E-02	5.19E-02
L1010101-CJ-GS-011-SS	10/31/2014	570929.985	1642210.928	747.6	Dry			6.02E-02	5.87E-02	1.36E-02	4.89E-02
L1010101-CJ-GS-012-SS	10/31/2014	570946.715	1642203.950	752.5	Dry			5.86E-02	9.99E-02	1.54E-02	5.17E-02

	Co-60	Cs-137
# of Samples	12	12
# >Critical Level	2	12
Mean	8.04E-02 pCi/g	2.15E-01 pCi/g
Median	5.75E-02 pCi/g	9.98E-02 pCi/g
Max	2.87E-01 pCi/g	1.07E+00 pCi/g
Min	4.83E-02 pCi/g	3.18E-02 pCi/g
Standard Deviation	6.61E-02 pCi/g	2.96E-01 pCi/g

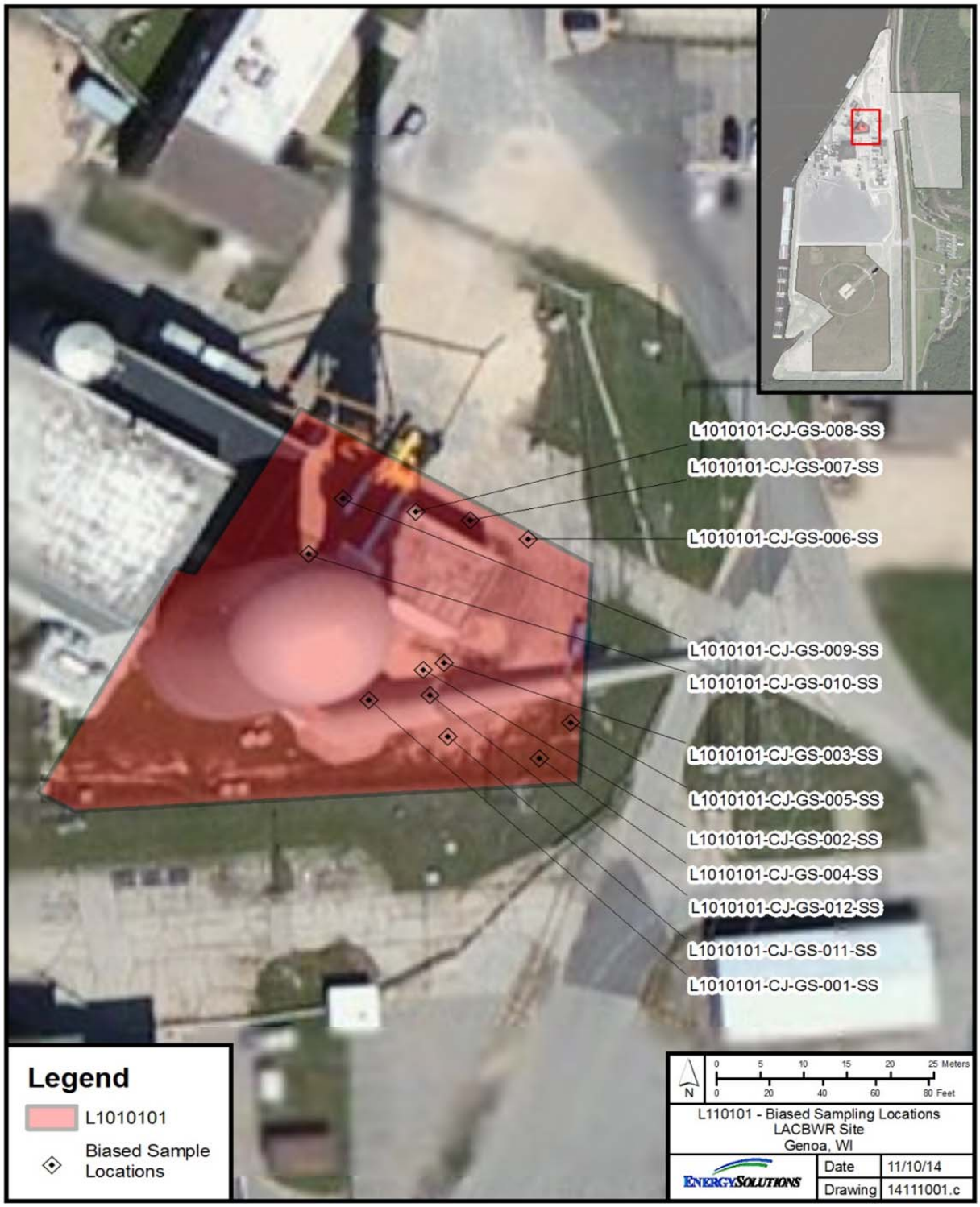
Table 9-2 L1010101 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L1010101-CJ-GS-001-SB	1	11/4/2014	570944.808	1642181.048	764.0	Dry			5.10E-02	1.50E-01	1.35E-02	6.76E-02
L1010101-CJ-GS-002-SB	1	11/4/2014	570956.705	1642201.377	832.9	Dry			5.30E-02	6.95E-02	1.02E-02	4.31E-02
L1010101-CJ-GS-003-SB	1	11/4/2014	570959.587	1642209.523	830.4	Dry			5.24E-02	9.39E-02	1.08E-02	3.84E-02
L1010101-CJ-GS-004-SB	1	11/4/2014	570921.323	1642245.418	774.3	Dry			5.97E-02	5.37E-02	9.36E-03	4.60E-02
L1010101-CJ-GS-005-SB	1	11/4/2014	570935.582	1642257.286	821.9	Dry			4.86E-02	3.82E-02	8.20E-03	4.38E-02
L1010101-CJ-GS-006-SB	1	11/5/2014	571009.079	1642241.110	852.1	Dry			5.32E-02	2.90E-02	7.32E-03	3.34E-02
L1010101-CJ-GS-007-SB	1	11/4/2014	571016.797	1642219.252	855.3	Dry			5.12E-02	8.11E-02	9.75E-03	3.52E-02
L1010101-CJ-GS-008-SB	1	11/5/2014	571020.062	1642198.718	792.1	Dry			5.45E-02	1.61E-01	1.34E-02	3.79E-02
L1010101-CJ-GS-009-SB	1	11/5/2014	571060.022	1642159.268	790.8	Dry			5.73E-02	4.13E-02	8.00E-03	3.68E-02
L1010101-CJ-GS-010-SB	1	11/5/2014	571045.158	1642132.913	808.9	Dry			4.77E-02	5.23E-02	8.47E-03	3.13E-02
L1010101-CJ-GS-011-SB	1	10/31/2014	570929.985	1642210.928	890.1	Dry			4.68E-02			5.37E-02
L1010101-CJ-GS-012-SB	3	10/31/2014	570929.985	1642210.928	867.8	Dry			5.22E-02			4.86E-02
L1010101-CJ-GS-013-SB	4	10/31/2014	570929.985	1642210.928	812.3	Dry			5.16E-01			5.34E-02
L1010101-CJ-GS-014-SB	5	10/31/2014	570929.985	1642210.928	850.7	Dry			5.04E-02			5.33E-02
L1010101-CJ-GS-015-SB	1	10/31/2014	570946.715	1642203.950	805.2	Dry			5.55E-02	3.19E-02	1.17E-02	4.76E-02
L1010101-CJ-GS-016-SB	2	10/31/2014	570946.715	1642203.950	857.7	Dry			5.04E-02	3.55E-02	1.16E-02	4.88E-02
L1010101-CJ-GS-017-SB	4	10/31/2014	570946.715	1642203.950	817.8	Dry			5.01E-02			5.71E-02
L1010101-CJ-GS-018-SB	5	10/31/2014	570946.715	1642203.950	800.8	Dry			5.47E-02			5.38E-02

	Co-60	Cs-137
# of Measurements	18	18
# >Critical Level	0	8
Mean	7.80E-02 pCi/g	6.65E-02 pCi/g
Median	5.23E-02 pCi/g	5.36E-02 pCi/g
Max	5.16E-01 pCi/g	1.61E-01 pCi/g
Min	4.68E-02 pCi/g	3.34E-02 pCi/g
Standard Deviation	1.09E-01 pCi/g	3.53E-02 pCi/g

Figure 9-1 L1010101 Biased Sampling Locations



9.3. Survey Unit L1010102

Impacted Class 1 open land survey unit L1010102 is on the central area of the LACBWR LSE.

This open land area includes the Turbine Building and Diesel Generator Building and associated below grade interconnecting tunnel areas. The size of the survey unit is approximately 2,000 square meters minus approximately1, 200 square meters of building and structure footprint. Inside the survey unit there is a past history of minor radiological surface contamination on the open grounds outside the footprint of the Turbine Building Truck Bay towards the inside LSE switch yard. This contamination was remediated. Additionally, there is a known area of minor radiological contamination that is underneath the west end of the Turbine Building due to a past drain pipe failure.

The survey design for this survey unit called for (2) biased land surface area soil samples and (8) subsurface soil samples taken at depths of 1,3,4, and 5 meters depth at the same locations as the surface area sample locations in an area directly alongside the footprint south of the southwest portion of the Turbine Building. This area was selected to evaluate the potential for any radiological contamination under the Turbine Building or any migration of residual radioactivity away from the sub foundation in the direction of groundwater flow towards the Mississippi River. One duplicate surface soil sample with the highest gamma scan reading and one duplicate subsurface soil sample was also taken at the location with the highest subsurface on site gamma spectroscopy result in the area of the (2) biased sample locations.

During the subsurface sampling operations, significant water was encountered before the 5 meter depth was reached in the drilling holes and drilling was aborted; therefore, the subsurface soil sample representing the 5-meter depth was not taken in both of the biased soil sample locations.

The survey design also called for up to 100% gamma walkover survey of the open ground area of this survey unit. This was not performed as the nearby LSA Storage Building to the west and the nearby survey unit L1010101 to the east had ambient background levels which contributed to an elevated and varied significant background which precluded attempting to evaluate soil conditions with the walkover survey.

In the Turbine Building Tunnel Area on the west end near the sump, the survey design called for (2) concrete core samples and sampling the soil under the floor following core removal. Due to the difficulties with subsurface concrete rebar and related structure interferences and lack of reliable GPR readings, only one (1) concrete core was collected for offsite sample analysis which is number L110102-CJ-FC-1-CV and one subfloor soil sample which is number L110102-CJ-GS-1-SB. In addition, one duplicate soil sample of the subfloor soil was taken for offsite analysis. The sampling was performed in an attempt to check for the possible lateral migration of the minor soil contamination likely due to a past drain pipe failure.

In the Turbine Building Truck Bay, the survey design called for the acquisition of (1) concrete core and (1) subslab soil sample taken in the area that would allow for the assessment of any possible lateral migration of the minor soil contamination likely due to a past drain pipe failure. The concrete core and the subfloor soil sample were not collected due

to the inability to develop reliable GPR information for the Turbine Building Truck Bay prevented the coring through the floor area.

In total, two (2) surface soil samples and seven (7) subsurface soil samples were collected in addition to one (1) concrete core from the Turbine Building Tunnel Area and its corresponding sub-floor soil sample.

A review of the onsite and offsite lab radioanalytical data and its quality characteristics was performed. There were no instances of the soil sample results either exceeding the sum of fractions rule from the Table 2-3 criteria or that any single radionuclide exceeded 50% of an action level.

No positive results for Cs-137 and Co-60 at concentration greater than the instrument MDC was obserbed in any surface or subsurface soil sample taken in this survey unit. The analysis of the concrete core sample did not identify any plant-derived radionuclide at concentrations greater than the instrument MDC. Direct TSC measurements taken on the removed concrete core for alpha and beta gamma were significantly less than the action level. Acceptability testing of the duplicate soil sample ROC data in accordance with Section 4.12 of the QAPP did not reveal any lab data requiring further evaluation.

One surface soil sample, three subsurface soil samples and one concrete sample was sent for off-site analysis for HTD radionuclides. H-3, Ni-63and Am-243 was positively detected at concentrations greater than the instrument MDC but at concentrations less than their respective action level.

The following tables and figures are included with this survey unit:

- Table 9-3 and Table 9-4 show the summary of the surface and subsurface soil samples information and respective statistics.
- Figure 9-2 shows the location of the biased soil samples
- Table 9-52 shows the offsite radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.
- Table 9-56 soil sample numbers/depths for samples taken alongside the south LACBWR Turbine Building foundation area.

Table 9-3 L1010102 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level(pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L1010102-CJ-GS-002-SS	10/30/2014	570989.709	1642007.360	862.5	Dry			4.44E-02			5.05E-02
L1010102-CJ-GS-003-SS	10/30/2014	570982.821	1642034.275	827.5	Dry			5.37E-02			4.96E-02

	Co-60		Cs-137	
# of Samples	2		2	
# >Critical Level	0		0	
Mean	4.91E-02	pCi/g	5.01E-02	pCi/g
Median	4.91E-02	pCi/g	5.01E-02	pCi/g
Max	5.37E-02	pCi/g	5.05E-02	pCi/g
Min	4.44E-02	pCi/g	4.96E-02	pCi/g
Standard Deviation	6.58E-03	pCi/g	6.36E-04	pCi/g

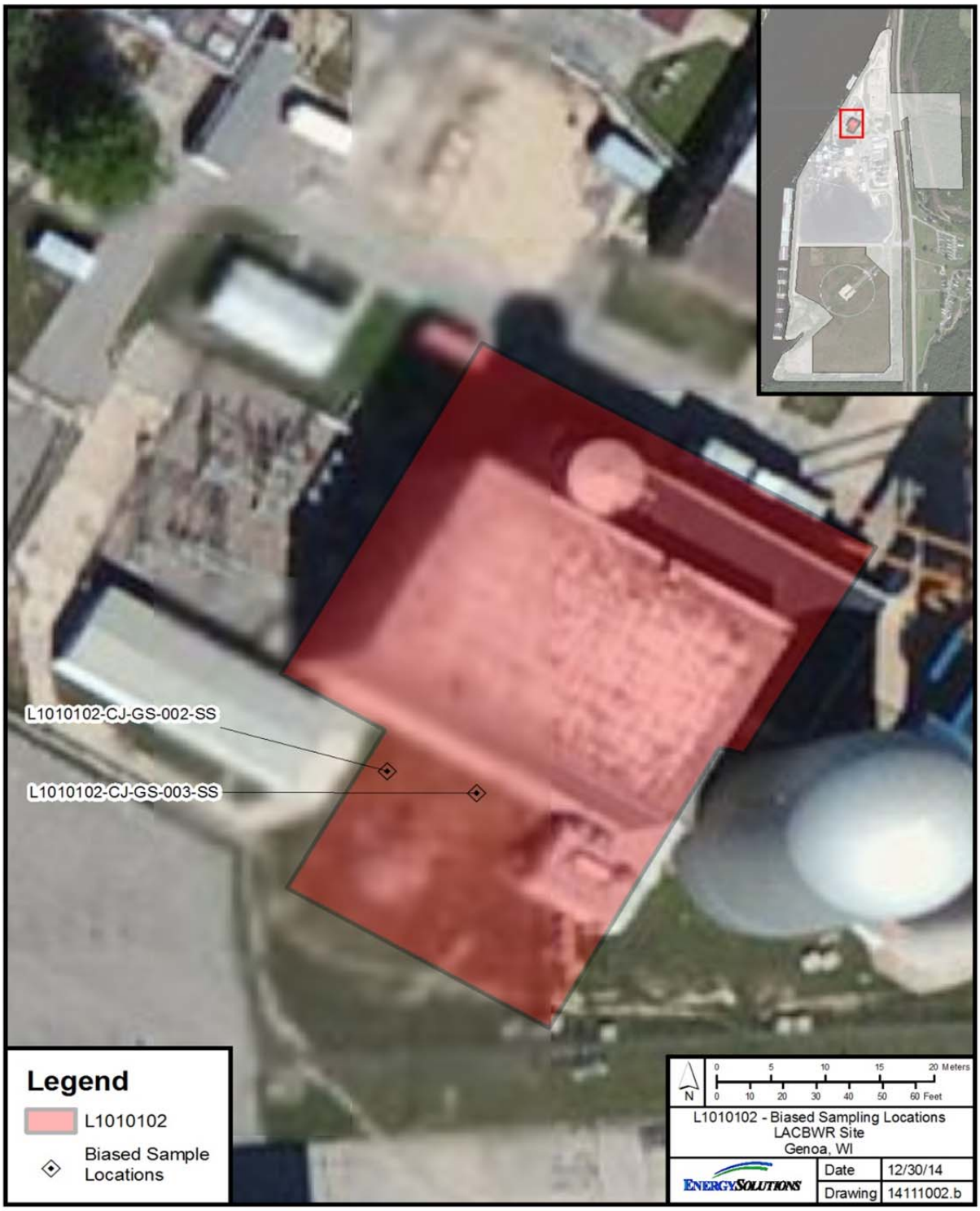
Table 9-4 L1010102 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L1010102-CJ-GS-001-SB	TB Tunnel	10/24/2014	N/A	N/A	819.5	Dry			5.67E-02			5.24E-02
L1010102-CJ-GS-007-SB	1	10/30/2014	570989.709	1642007.360	849.7	Dry			4.70E-02			4.88E-02
L1010102-CJ-GS-008-SB	3	10/30/2014	570989.709	1642007.360	845.8	Dry			4.48E-02			4.66E-02
L1010102-CJ-GS-009-SB	4	10/30/2014	570989.709	1642007.360	906.9	Dry			4.59E-02			4.35E-02
L1010102-CJ-GS-011-SB	1	10/30/2014	570982.821	1642034.275	785.7	Dry			4.54E-02			5.78E-02
L1010102-CJ-GS-012-SB	3	10/30/2014	570982.821	1642034.275	902.3	Dry			4.43E-02			4.94E-02
L1010102-CJ-GS-013-SB	4	10/30/2014	570982.821	1642034.275	871.0	Dry			4.31E-02			4.98E-02

	Co-60		Cs-137	
# of Measurements	7		7	
# >Critical Level	0		0	
Mean	4.67E-02	pCi/g	4.98E-02	pCi/g
Median	4.54E-02	pCi/g	4.94E-02	pCi/g
Max	5.67E-02	pCi/g	5.78E-02	pCi/g
Min	4.31E-02	pCi/g	4.35E-02	pCi/g
Standard Deviation	4.56E-03	pCi/g	4.51E-03	pCi/g

Figure 9-2 L1010102 Biased Sampling Locations



9.4. Survey Unit L1010103

Impacted Class 1 open land survey unit L1010103 is on the west and south end of the LACBWR LSE.

This open land area includes the LSA Storage Building, Maintenance Eat Shack, and the Inside LSE switchyard area. The size of the survey unit is approximately 1,957 square meters minus approximately 300 square meters of building and structure footprint. Inside this survey unit, there is a past history of minor radiological surface contamination on the open grounds outside the footprint of the Turbine Building Truck Bay into the inside LSE switch yard. Historical records indicte that this contamination was remediated.

The survey design for this survey unit focused on biased soil sampling near buried piping of interest at various depths as well as a continued investigation of potential migration of minor radioactive contamination from underneath the west end of the Turbine Building from a past event concerning damaged drain piping. The inside LSE switchyard was active at the time of the survey so samples in this area were not obtained for safety reasons. Representative soil samples were taken at depth at the locations of buried piping systems including:

- Combined Drain Discharge Piping,
- Circulating Water Discharge Piping, and,
- Circulating Water Intake Piping.

In each case, the buried piping was located by use of GPR and facility prints.

In accordance with the survey design, samples were collected as follows:

- Three (3) biased land surface area soil samples and nine (9) subsurface soil samples taken at 3, 4, and 5 meters depth at the surface area sample locations in the area of the Combined Drain Discharge Piping. Also one (1) duplicate was taken at the surface location with the highest gamma scan result and one (1) duplicate subsurface soil sample was also taken at the location with the highest subsurface on site gamma spectroscopy result in the area of the (3) biased sample locations.
- Two (2) biased land surface soil samples and eight (8) subsurface soil samples taken at 2, 3, 4 and 5 meters depth at the surface soil sample locations in the area of the Circulating Water Discharge Piping. Also one (1) duplicate was taken at the surface location with the highest gamma scan result and one (1) duplicate subsurface soil sample was also taken at the location with the highest subsurface on site gamma spectroscopy result in the area of the two (2) biased sample locations.
- Two (2) biased land surface soil samples and eight (8) subsurface soil samples taken at 2, 3, 4 and 5 meters depth at the same location as the surface soil samples in the area of the Circulating Water Intake Piping. Also one (1) duplicate was taken at the surface location with the highest gamma scan result and one (1) duplicate subsurface soil sample was also taken at the location with the highest subsurface on site gamma spectroscopy result in the area of the two (2) biased sample locations.

All soil samples were collected without issues. In total, seven (7) surface soil and 25 subsurface soils samples were collected.

One sediment sample from the sanitary solids tank that is located in this survey unit was collected for onsite gamma spectroscopy analysis and a duplicate sample taken for offsite analysis and identified as L1010103-CJ-SL-001-SM. The survey plan also called for up to 25% gamma walkover survey of the open ground area of this survey unit. This was not performed as the nearby LSA Storage Building and likely the Reactor Building and Waste Treatment Building background radiation levels contributed to an elevated and varied significant background which precluded attempting to evaluate soil conditions with the walkover survey.

A review of the onsite and offsite lab radioanalytical data and its quality characteristics was performed. There were no instances of the soil sample results or the sanitary solids tank exceeding the sum of fractions rule from the Table 2-3 criteria or that any single radionuclide exceeded 50% of an action level. The average Cs-137 surface soil sample result was 0.069 pCi/g with a high individual sample result of 0.161 pCi/g. Co-60 was not positively detected at concentrations greater than the MDC of the instrument in any surface soil sample. No positive results for Cs-137 and Co-60 at concentration greater than the instrument MDC was observed in any subsurface soil sample or sanitary sediment sample taken in this survey unit. Acceptability testing of the duplicates soil data in accordance with Section 4.12 of the QAPP did not reveal any lab data concerning the ROCs requiring further evaluation.

Three surface soil sample, six subsurface soil samples and two asphalt samples was sent for off-site analysis for HTD radionuclides. H-3, C-14, and Am-243 was positively detected at concentrations greater than the instrument MDC but at concentrations less than their respective action level.

The following tables and figures are included with this survey unit:

- Table 9-5 and Table 9-6 show the summary of the surface and subsurface soil samples information and respective statistics.
- Figure 9-3 shows the location of the biased soil samples and the sanitary solids tank sample.
- Table 9-52 shows the offsite Class 1 radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.
- Table 9-56 shows the buried piping soil sample locations and depths of samples taken alongside the Combined Drain Discharge, Circulating Water intake, and Circulating Water Discharge Piping.

Table 9-5 L1010103 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L1010103-CJ-GS-001-SS	10/28/2014	571070.283	1641948.204	837.9	Dry			4.81E-02			5.56E-02
L1010103-CJ-GS-002-SS	10/29/2014	571057.000	1641921.855	828.2	Dry			5.03E-02			5.35E-02
L1010103-CJ-GS-003-SS	10/29/2014	571049.105	1641890.944	875.5	Dry			4.83E-02			4.81E-02
L1010103-CJ-GS-004-SS	10/28/2014	571087.758	1641931.533	878.4	Dry			5.02E-02			4.95E-02
L1010103-CJ-GS-005-SS	10/29/2014	571071.669	1641902.866	844.4	Dry			5.01E-02			5.01E-02
L1010103-CJ-GS-006-SS	10/28/2014	571158.623	1641963.527	487.8	Dry			9.88E-02	1.61E-01	2.57E-02	9.02E-02
L1010103-CJ-GS-007-SS	10/28/2014	571119.861	1641973.419	632.1	Dry			6.79E-02	4.51E-02	1.71E-02	6.60E-02

	Co-60		Cs-137	
# of Samples	7		7	
# >Critical Level	0		1	
Mean	5.91E-02	pCi/g	6.91E-02	pCi/g
Median	5.02E-02	pCi/g	5.35E-02	pCi/g
Max	9.88E-02	pCi/g	1.61E-01	pCi/g
Min	4.81E-02	pCi/g	4.81E-02	pCi/g
Standard Deviation	1.88E-02	pCi/g	4.10E-02	pCi/g

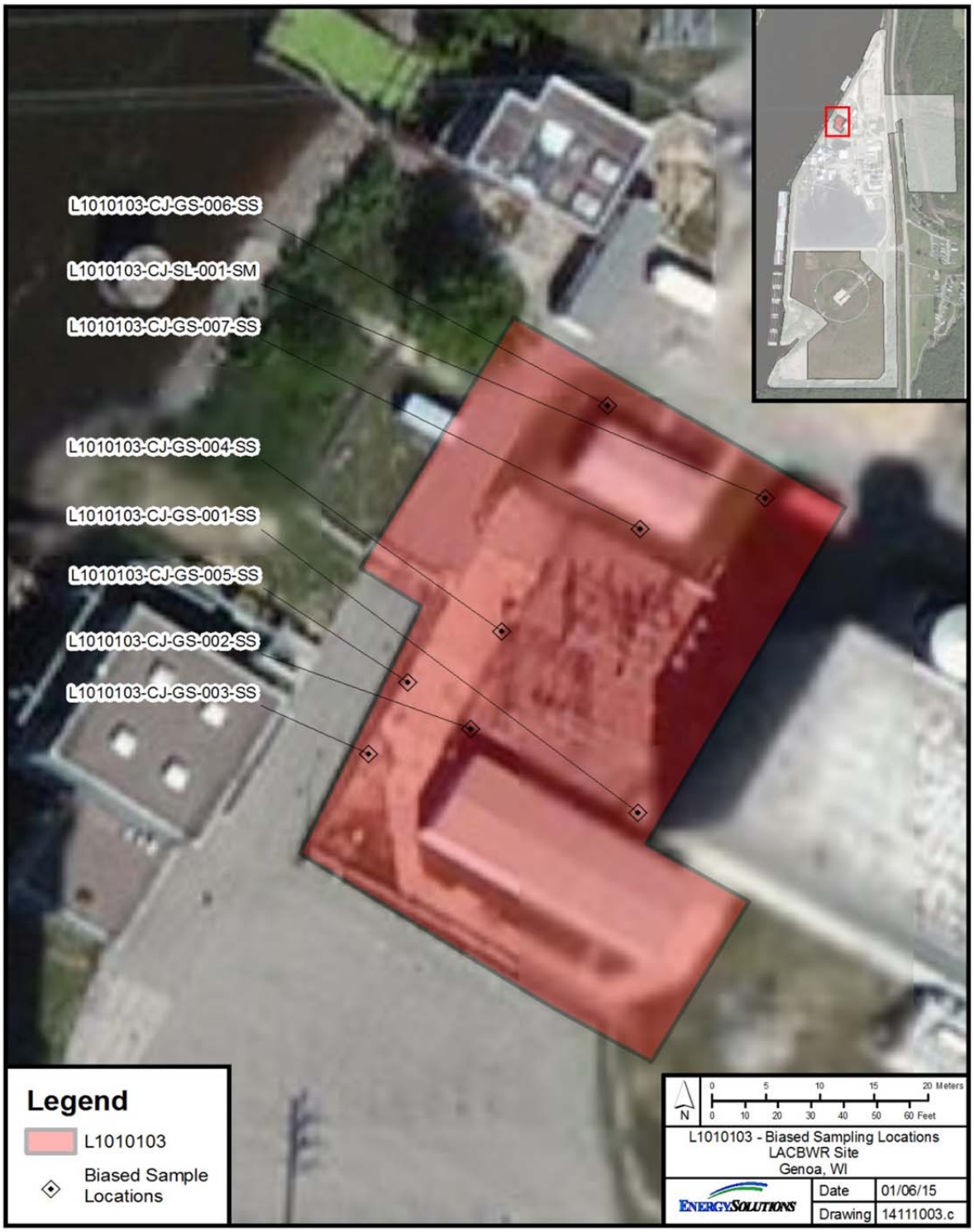
Table 9-6–L1010103 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L1010103-CJ-GS-001-SB	3	10/28/2014	571070.283	1641948.204	853.2	Dry			4.65E-02			4.80E-02
L1010103-CJ-GS-002-SB	4	10/28/2014	571070.283	1641948.204	867.3	Dry			4.29E-02			5.05E-02
L1010103-CJ-GS-003-SB	5	10/28/2014	571070.283	1641948.204	868.2	Dry			5.01E-02			4.82E-02
L1010103-CJ-GS-004-SB	3	10/29/2014	571057.000	1641921.855	876.2	Dry			4.60E-02			5.05E-02
L1010103-CJ-GS-005-SB	4	10/29/2014	571057.000	1641921.855	871.2	Dry			4.99E-02			4.95E-02
L1010103-CJ-GS-006-SB	5	10/29/2014	571057.000	1641921.855	846.8	Dry			4.64E-02			4.97E-02
L1010103-CJ-GS-007-SB	3	10/29/2014	571049.105	1641890.944	814.5	Dry			5.45E-02			5.37E-02
L1010103-CJ-GS-008-SB	4	10/29/2014	571049.105	1641890.944	836.1	Dry			4.90E-02			5.03E-02
L1010103-CJ-GS-009-SB	5	10/29/2014	571049.105	1641890.944	824.9	Dry			4.76E-02			5.04E-02
L1010103-CJ-GS-010-SB	2	10/28/2014	571087.758	1641931.533	822.8	Dry			4.61E-02			5.30E-02
L1010103-CJ-GS-011-SB	3	10/28/2014	571087.758	1641931.533	844.8	Dry			5.00E-02			4.80E-02
L1010103-CJ-GS-012-SB	4	10/28/2014	571087.758	1641931.533	894.3	Dry			4.12E-02			4.81E-02
L1010103-CJ-GS-013-SB	5	10/28/2014	571087.758	1641931.533	890.6	Dry			4.41E-02			4.68E-02
L1010103-CJ-GS-014-SB	2	10/29/2014	571071.669	1641902.866	834.7	Dry	2.28E-02	4.75E-03	2.54E-02			5.00E-02
L1010103-CJ-GS-015-SB	3	10/30/2014	571071.669	1641902.866	857.1	Dry			4.58E-02			5.05E-02
L1010103-CJ-GS-016-SB	4	10/30/2014	571071.669	1641902.866	876.1	Dry			4.93E-02			4.75E-02
L1010103-CJ-GS-017-SB	5	10/30/2014	571071.669	1641902.866	900.5	Dry			4.59E-02			4.52E-02
L1010103-CJ-GS-018-SB	2	10/27/2014	571158.623	1641963.527	858.4	Dry			4.81E-02			5.03E-02
L1010103-CJ-GS-019-SB	3	10/27/2014	571158.623	1641963.527	878.5	Dry			4.99E-02			4.32E-02
L1010103-CJ-GS-020-SB	4	10/27/2014	571158.623	1641963.527	899.1	Dry			4.74E-02			4.75E-02
L1010103-CJ-GS-021-SB	5	10/27/2014	571158.623	1641963.527	894.1	Dry			4.58E-02			4.23E-02
L1010103-CJ-GS-022-SB	2	10/27/2014	571119.861	1641973.419	879.4	Dry			4.66E-02			4.90E-02
L1010103-CJ-GS-023-SB	3	10/27/2014	571119.861	1641973.419	912.6	Dry			4.38E-02			4.60E-02
L1010103-CJ-GS-024-SB	4	10/28/2014	571119.861	1641973.419	883.5	Dry			4.04E-02			5.12E-02
L1010103-CJ-GS-025-SB	5	10/28/2014	571119.861	1641973.419	870.9	Dry			4.59E-02			4.73E-02

	Co-60		Cs-137	
# of Measurements	25		25	
# >Critical Level	0		0	
Mean	4.59E-02	pCi/g	4.87E-02	pCi/g
Median	4.64E-02	pCi/g	4.90E-02	pCi/g
Max	5.45E-02	pCi/g	5.37E-02	pCi/g
Min	2.54E-02	pCi/g	4.23E-02	pCi/g
Standard Deviation	5.25E-03	pCi/g	2.67E-03	pCi/g

Figure 9-3 L1010103 Biased Sampling Locations



9.5. Survey Unit L1010104

Impacted Class 1 open land survey unit L1010104 is on the northern end of the LACBWR LSE, spanning an area adjacent to the Waste Treatment Building, the Reactor Building, the Turbine Building and the LSE Inside Switchyard This open land area has no facilities or structures of significance located within the survey unit. The size of the survey unit is approximately 2,036 square meters. Inside the survey unit there was no past history of radiological surface contamination on the open grounds. This survey unit has an intact section of asphalt running from east to the west.

The survey design for this survey unit focused on collecting information on the asphalt in the survey unit and the soils underneath it. Additionally, one sample location was identified using GPR and maps to investigate soils alongside and underneath the Circulating Water Buried Pipe.

The survey design called for ten (10) random asphalt area samples and ten (10) subsurface soil samples taken under the asphalt at a depth of one meter depth at the same location as the surface area sample location. Additionally, the survey design called for one (1) biased soil sample location to be sampled below the asphalt and samples to be taken at intervals of 2, 4, 5, and 6 meters below grade alongside and underneath an identified section of the Circulating Water Intake Piping in this survey unit. In addition, duplicate samples were taken for offsite analysis of one surface asphalt sample with the highest beta-gamma direct reading and another soil sample at the corresponding one meter depth location.

All required soil samples were collected without issue.

The survey plan also called for up to 100% gamma walkover survey of the open ground area of this survey unit. This was not performed as the nearby Reactor Building, Waste Treatment Building, and LSA Storage Building ambient backgrounds contributed an elevated and varied significant background which precluded attempting to evaluate soil conditions with the walkover survey. In addition to the samples, the survey design called for a 25% beta scan of the intact asphalt area and beta/alpha direct measurements of the asphalt sample collection locations prior to sampling.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. There were no instances of the soil or asphalt sample results either exceeding the sum of fractions rule from the Table 2-3 soil criteria or that any single radionuclide exceeded 50% of its respective action level.

Cs-137 was positively detected at concentrations greater than the instrument MDC in 3 subsurface soil samples and 1 asphalt sample. No other plant-derived radionuclides were detected at concentrations greater than the instrument MDC in any other surface soil, subsurface soil or asphalt sample. Cs-137 was detected in the subsurface soil samples at an average concentration of 0.041 pCi/g with a maximum onserved concentration of 0.051 pCi/g in the subsurface soil samples. Cs-137 was detected in the asphalt samples at an average concentration of 0.041 pCi/g with a maximum onserved concentration of 0.048 pCi/g in the subsurface soil samples. Acceptability testing of the duplicate samples soil data in accordance with Section 4.12 of the QAPP did not reveal any lab data concerning the ROCs requiring further evaluation.

The asphalt beta –gamma scanning results ranged from MDC scan levels of 2,771 dpm/100cm^2 to a maximum of 3,095 dpm/100 cm^2. All direct beta-gamma readings were less than 50% of the action levels for surface measurements.

The following tables and figures are included with this survey unit:

- Table 9-7 and Table 9-8 show the summary of the surface and subsurface soil samples information and respective statistics.
- Table 9-9 shows the results of the asphalt sampling and respective statistics.
- Table 9-10 shows the direct survey results for asphalt.
- Figure 9-4 shows the location of the biased soil sample
- Figure 9-5 shows the asphalt and sub soil sampling locations.
- Table 9-52 shows the offsite radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.
- Table 9-56 shows the buried piping soil sampling location/depth of samples taken alongside the Circulating Water Intake Piping.

Table 9-7–L1010104 Surface Soil Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L1010104-CJ-GS-001-SS	10/24/2014	571174.998	1641963.536	876.5	Dry			4.52E-02			4.94E-02

	Co-60		Cs-137	
# of Samples	1		1	
# >Critical Level	0		0	
Mean	N/A	pCi/g	N/A	pCi/g
Median	N/A	pCi/g	N/A	pCi/g
Max	N/A	pCi/g	N/A	pCi/g
Min	N/A	pCi/g	N/A	pCi/g
Standard Deviation	N/A	pCi/g	N/A	pCi/g

Table 9-8–L1010104 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L1010104-CJ-GS-001-SB	2	10/27/2014	571174.998	1641963.536	946.9	Dry			4.76E-02			4.55E-02
L1010104-CJ-GS-002-SB	4	10/27/2014	571174.998	1641963.536	905.7	Dry			4.84E-02			4.66E-02
L1010104-CJ-GS-003-SB	5	10/27/2014	571174.998	1641963.536	857.2	Dry			4.74E-02			5.06E-02
L1010104-CJ-GS-004-SB	6	10/27/2014	571174.998	1641963.536	926.2	Dry			4.99E-02			4.50E-02
L1010104-CR-GS-001-SB	1	11/3/2014	571096.450	1642107.400	853.8	Dry			4.95E-02	3.52E-02	7.12E-03	3.36E-02
L1010104-CR-GS-002-SB	1	11/3/2014	571111.030	1642125.960	816.9	Dry			4.68E-02	2.59E-02	6.60E-03	3.35E-02
L1010104-CR-GS-003-SB	1	11/3/2014	571087.830	1642153.800	866.0	Dry			4.95E-02			5.12E-02
L1010104-CR-GS-004-SB	1	11/3/2014	571100.750	1642145.180	850.3	Dry			4.62E-02			4.95E-02
L1010104-CR-GS-005-SB	1	11/3/2014	571135.220	1642072.270	915.9	Dry			4.29E-02	2.46E-02	6.38E-03	2.75E-02
L1010104-CR-GS-006-SB	1	11/3/2014	571110.700	1642103.420	919.9	Dry			5.02E-02	3.66E-02	7.39E-03	2.90E-02
L1010104-CR-GS-007-SB	1	11/3/2014	571074.570	1642141.870	887.4	Dry			4.76E-02	2.02E-02	5.85E-03	3.17E-02
L1010104-CR-GS-008-SB	1	11/3/2014	571148.810	1642060.340	888.5	Dry			4.69E-02	3.99E-02	7.59E-03	3.17E-02
L1010104-CR-GS-009-SB	1	11/3/2014	571095.780	1642121.650	885.0	Dry			4.56E-02	2.17E-02	6.11E-03	2.73E-02
L1010104-CR-GS-010-SB	1	11/3/2014	571098.100	1642134.580	842.6	Dry			4.86E-02			4.77E-02

	Co-60		Cs-137	
# of Measurements	14		14	
# >Critical Level	0		3	
Mean	4.77E-02	pCi/g	4.06E-02	pCi/g
Median	4.76E-02	pCi/g	4.25E-02	pCi/g
Max	5.02E-02	pCi/g	5.12E-02	pCi/g
Min	4.29E-02	pCi/g	2.73E-02	pCi/g
Standard Deviation	1.96E-03	pCi/g	8.53E-03	pCi/g

Table 9-9–L1010104 Asphalt Sample Analysis

Asphalt Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L1010104-CR-PA-001-AV	10/22/2014	571096.450	1642107.400	879.9	Dry			5.41E-02	4.77E-02	1.24E-02	4.38E-02
L1010104-CR-PA-002-AV	10/22/2014	571111.030	1642125.960	801.5	Dry			5.43E-02			5.46E-02
L1010104-CR-PA-003-AV	10/23/2014	571087.830	1642153.800	746.6	Dry			5.95E-02			5.70E-02
L1010104-CR-PA-004-AV	10/23/2014	571100.750	1642145.180	835.0	Dry			4.87E-02			4.98E-02
L1010104-CR-PA-005-AV	10/23/2014	571135.220	1642072.270	803.2	Dry			5.26E-02			5.37E-02
L1010104-CR-PA-006-AV	10/23/2014	571110.700	1642103.420	816.1	Dry			5.33E-02			5.27E-02
L1010104-CR-PA-007-AV	10/23/2014	571074.570	1642141.870	766.7	Dry			5.47E-02			5.28E-02
L1010104-CR-PA-008-AV	10/23/2014	571148.810	1642060.340	733.6	Dry			6.18E-02			5.50E-02
L1010104-CR-PA-009-AV	10/31/2014	571095.780	1642121.650	903.5	Dry			4.15E-02			4.83E-02
L1010104-CR-PA-010-AV	11/3/2014	571098.100	1642134.580	956.4	Dry			4.80E-02	3.39E-02	6.92E-03	3.65E-02

	Co-60		Cs-137	
# of Measurements	10		10	
# >Critical Level	0		1	
Mean	5.29E-02	pCi/g	5.08E-02	pCi/g
Median	5.37E-02	pCi/g	5.28E-02	pCi/g
Max	6.18E-02	pCi/g	5.70E-02	pCi/g
Min	4.15E-02	pCi/g	3.65E-02	pCi/g
Standard Deviation	5.79E-03	pCi/g	5.85E-03	pCi/g

Table 9-10 L1010104 Asphalt Direct Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L1010104-CA-PA-001-AV	5.5	0.2	5.3	63.7	277.5	231	46.5	364.7
L1010104-CA-PA-002-AV	1	0.2	0.8	9.6	246.5	231	15.5	121.6
L1010104-CA-PA-003-AV	2.5	0.2	2.3	27.6	329	231	98	768.6
L1010104-CA-PA-004-AV	1	0.2	0.8	9.6	275.5	231	44.5	349
L1010104-CA-PA-005-AV	3	0.2	2.8	33.6	284	231	53	415.7
L1010104-CA-PA-006-AV	1	0.2	0.8	9.6	262.5	231	31.5	247.1
L1010104-CA-PA-007-AV	1	0.2	0.8	9.6	289	231	58	454.9
L1010104-CA-PA-008-AV	2	0.2	1.8	21.6	285	231	54	423.5
L1010104-CA-PA-009-AV	0.5	0.2	0.3	3.6	270	231	39	305.9
L1010104-CA-PA-010-AV	1	0.2	0.8	9.6	278.5	231	47.5	372.5
			Alpha MDA:	31.7			Beta MDA:	314.4

Figure 9-4 L1010104 Biased Sampling Location

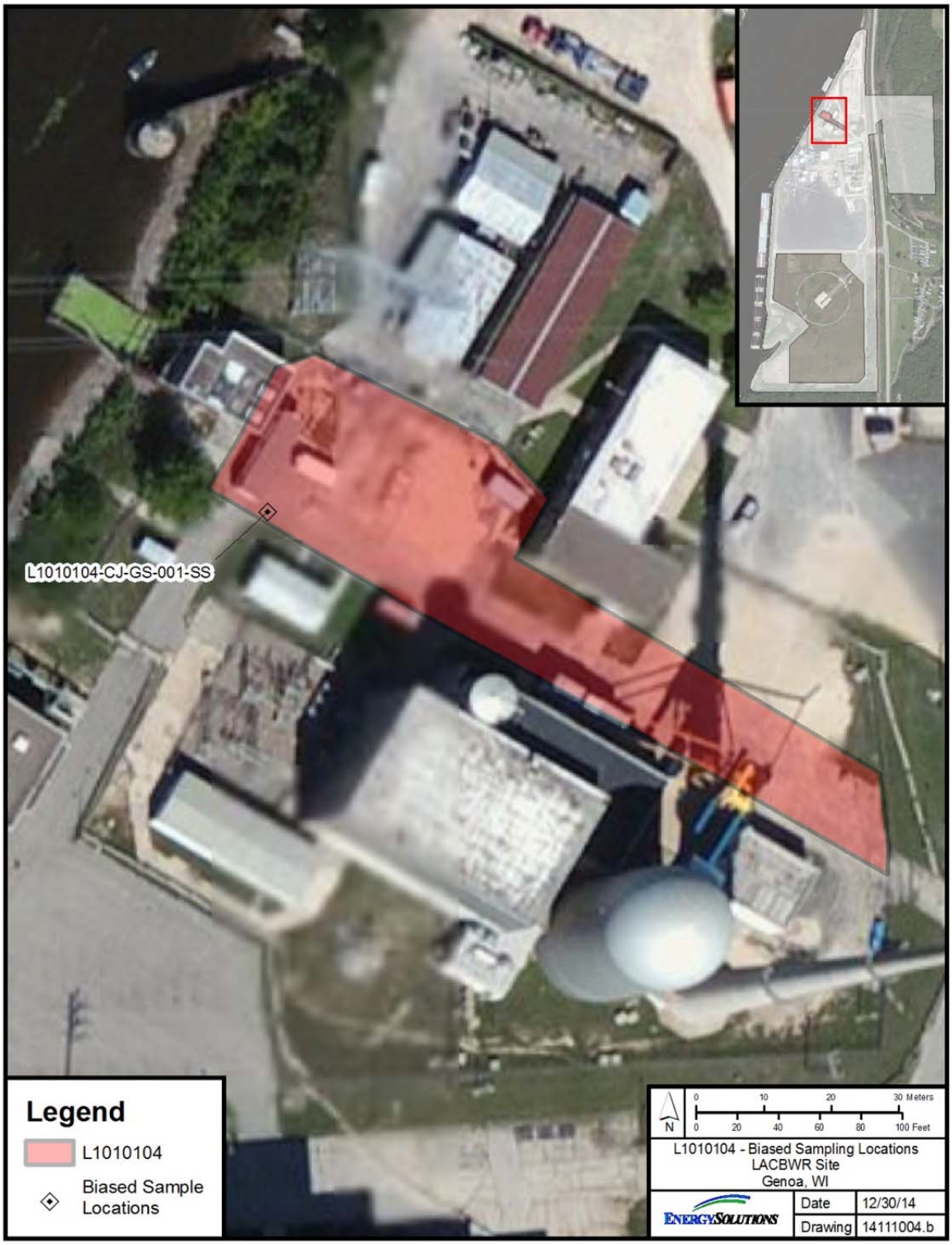
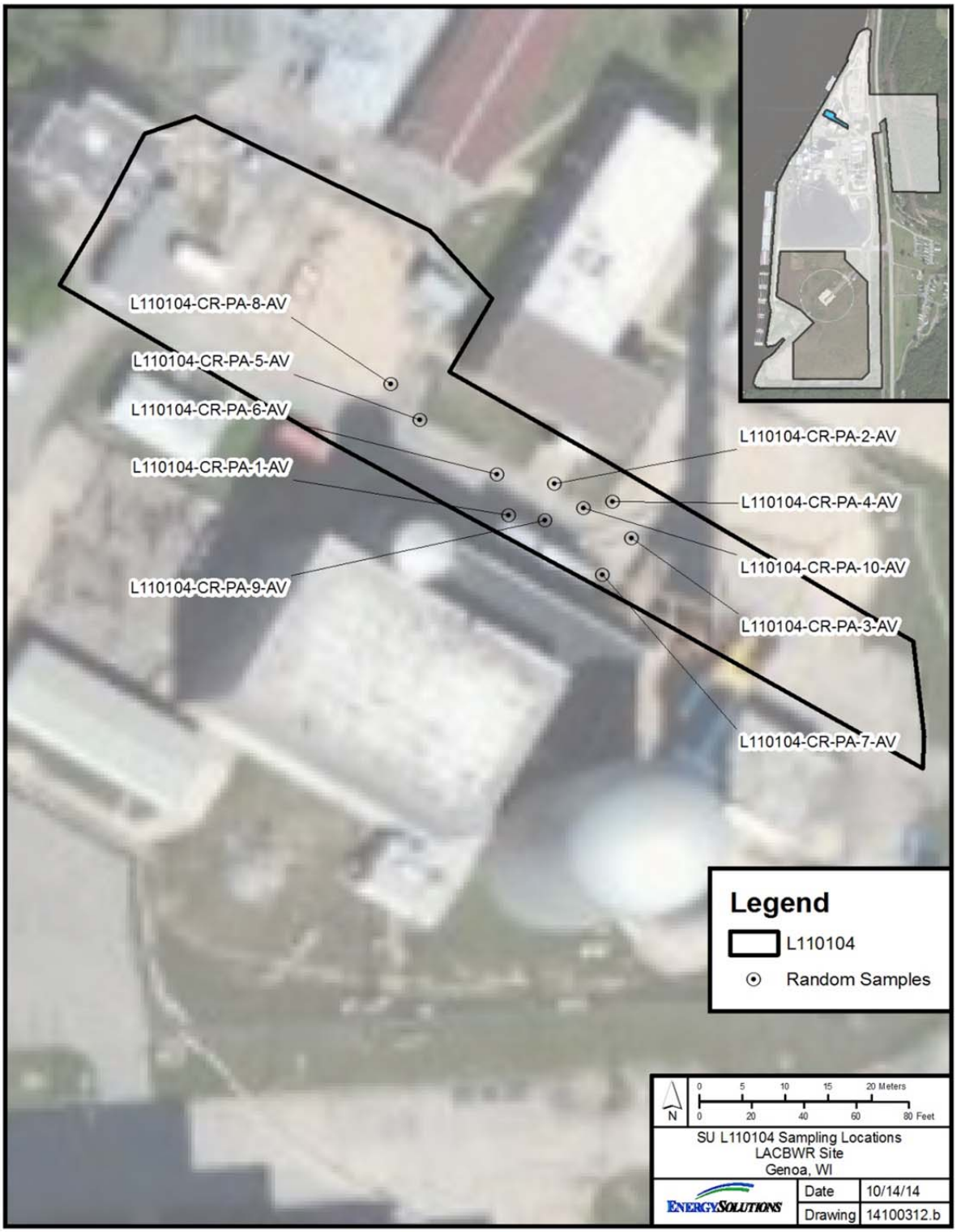


Figure 9-5 Random Sampling Locations



9.6. Overview of Characterization of Class 2 Open Land Survey Units and the LACBWR Administration Building

The impacted Class 2 open land areas at LACBWR total approximately 13,350 square meters of surface area and are located in the immediate area surrounding the LACBWR LSE. The Class 2 impacted open land survey units are broken down into two survey units in accordance with the illustration on Figure 3-1. There are no documented incidents of radioactive contamination migration from the LACBWR LSE into the Class 2 open land survey units however, the potential for contamination is based on their location adjacent to the LACBWR LSE, the presence of buried pipingand the presence of LACBWR support facilities located within these survey units.

Characterization inspections and surveys were performed of sufficient quantity and quality to quantify the potential volumetric contamination of surface and subsurface soils in each survey unit and to evaluate the radiological conditions of asphalt surfaces in the survey units. Survey techniques were employed to determine the lateral and vertical extent of any contamination identified and the radionuclide concentrations in the soil. A combination of random and biased survey locations were established in each survey unit in accordance with the survey package. The locations of biased measurements and/or samples were determined by the professional judgment of the Project Health Physicist and Radiological Protection Supervisor working with Dairyland Power cognizant staff and GPR contracted staff (as required, for locating underground buried piping). Consideration was given to locations that exhibited measurable radioactivity, discolored areas, and buried pipe locations, actual and potential spill locations, or areas where the ground had been disturbed.

Random soil samples were required in open land Class 2 areas on both soil and intact asphalt areas. The number of random based survey locations was based in part on area classification. Biased sampling locations included the locations of buried piping. Each collected surface soil,subsurface soil and asphalt sample was analyzed by the on-site radiological laboratory by gamma spectroscopy for plant derived ROC. Count times were adjusted to achieve an MDC of equal to or less than 0.10 pCi/g for Cs-137 and Co-60. All samples were dried prior to analysis. Duplicate samples were collected by survey unit as per LACBWR Characterization Plan [Reference 11-24] requirements and sent for offsite analysis to an Energy*Solutions* QA approved vendor lab for gamma spectroscopy and HTD analyses.

Direct alpha and beta gamma measurements were performed on asphalt areas prior to sampling. Additionally, 50% of the entire intact asphalt surface area was scanned using beta-gamma detectors. Gamma walkover scans were also performed on 50% of the accessible open land surface area.

There are no documented incidents of identified radioactive contamination, radioactive material spills or the use of unsealed radioactive sources in the LACBWR Administration Building. The facility has historically been used for office space, records storage, and housed an environmental lab to support the LACBWR and G-3 Coal Plant operations. The Administration Building was classified as a Class 2 structure due to its proximity to the LACBWR LSE and its previous occupancy by LACBWR facility workers.

9.7. Survey Unit L2011101

Impacted Class 2 open land survey unit L2011101 is located to the north and west of the LACBWR LSE fence.

The size of the survey unit is approximately 7,368 square meters. There are no documented incidents of radiological surface contamination pertaining to the soil and the three warehouses located in this survey unit. There are intact sections of asphalt outside of the entrance to the Administration Building and in the areas surrounding the three warehouses.

The survey design for this survey unit focused on:

- Collecting information on the asphalt in the survey unit and the soils underneath it. This was done by collecting six (6) random type asphalt samples and six (6) soil samples collected at one meter depth corresponding to the asphalt sampling locations. In addition one (1) duplicate asphalt sample was taken at the sampling location with the highest direct beta gamma reading and one (1) duplicate soil sample at one meter was taken where the duplicate asphalt sample was taken. Direct beta gamma and alpha measurements were taken on 50% of the accessible asphalt surfaces prior to sampling.
- Three (3) biased soil sampling locations were identified alongside and underneath the Storm Sewer Water Buried Pipe using GPR and maps to locate the pipe. Soil samples were taken at the surface and at intervals of 3, 4, and 5 meters below the surface. A duplicate soil sample was taken at the surface location with the highest gamma scan reading and a duplicate subsurface soil sample was taken at the location of the subsurface soil sample with the highest on site gamma spectroscopy activity. A representative sample of sediment was collected from an accessible storm sewer basin manhole located in front of the Administration Building for onsite analysis with a duplicate taken for offsite analysis.
- The survey design called for ten (10) random surface soil sample locations and one (1) subsurface soil sample at a depth of one meter depth at the same location as the surface area sample location with the highest gamma scan reading. One duplicate surface soil sample was taken at the location of the highest gamma scan result and a duplicate subsurface soil sample was taken at the location of the subsurface soil sample.

In summary, a total of thirteen (13) surface soil samples, six (6) asphalt samples, and sixteen (16) subsurface soil samples were taken without issue inside this survey unit.

- A gamma walkover survey was performed over 50% of the accessible open ground surface in the survey unit.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. All sample results were less than 50% of their applicable action level. Eight of thirteen surface soil samples exhibited Cs-137 concentrations greater than the instrument MDC. Cs-137 concentrations in surface soil samples averaged 0.090 pCi/g with a maximum observed concentration of 0.139 pCi/g. Cs-137 was positively detected at concentrations greater than the instrument MDC in 2 of the 16 subsurface soil samples and Co-60 was positively detected at concentrations greater than the instrument MDC in 1 of the 16 subsurface soil samples. Cs-137 concetrations averaged 0.050 pCi/g with a maximum concentration of 0.088 pCi/g in subsurface soils. The single sample with positive Co-60 showed a concentration of 0.112 pCi/g. Acceptability testing of the soil analysis results from the duplicate samples in accordance with Section 4.12 of the QAPP did not reveal any results

requiring further evaluation. The analysis of the sediment sample from the storm sewer basin indicated that the observed radionuclide concentrations was less than the applicable action level.

Two sediment samples, two surface soil samples, three subsurface soil samples and two asphalt samples was sent for off-site analysis for HTD radionuclides. H-3, Fe-55, Eu-155, Am-243 and Cm-243 was positively detected at concentrations greater than the instrument MDC but at concentrations less than 10% of their respective action level.

The beta –gamma scans of asphalt surfaces ranged from the MDC of 2,607 dpm/100cm^2 to a maximum of 2,748 dpm/100 cm^2. All direct beta-gamma survey results were well under 50% of the structural surface action levels. Given the satisfactory beta scan and beta direct readings in the asphalt survey coupled with the gamma spectroscopy results of the asphalt samples, the one slightly elevated alpha result was not investigated further as it was assumed to be contributed by the presence of naturally occurring radionuclides.

The results of the gamma scan walkover of 50% of the accessible surface soil area in the survey unit were less than 1.5 times the established scan background of 7,000-8,000 cpm. Elevated gamma scan readings at greater than 1.5 times the established background was noted when readings were taken within approximately ten feet of some LACBWR LSE fence. It was assumed that the elevated scan results were due to contribution to ambient radiation from radioactive materials and systems inside the LACBWR LSE.

The following tables and figures are included with this survey unit:

- Table 9-11 and Table 9-12 show the summary of the surface and subsurface soil sample information and respective statistics.
- Table 9-13 shows the results of the asphalt sampling and respective statistics.
- Table 9-14 shows the direct asphalt survey results.
- Figure 9-6 shows the location of the biased soil sample locations.
- Figure 9-7 shows the location of the random asphalt and soil sampling locations.
- Table 9-53 shows the offsite radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.
- Table 9-56 shows the buried piping soil sample locations/depth alongside the Storm Water Drain Piping

Table 9-11–L2011101 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L2011101-CJ-GS-001-SS	10/24/2014	571231.701	1642194.204	560.4	Dry			9.26E-02	6.05E-02	1.93E-02	8.37E-02
L2011101-CJ-GS-002-SS	10/24/2014	571306.287	1642179.285	616.1	Dry			7.16E-02	4.65E-02	1.82E-02	7.78E-02
L2011101-CJ-GS-003-SS	10/24/2014	571393.005	1642022.256	799.1	Dry			5.25E-02	3.45E-02	1.32E-02	5.05E-02
L2011101-CR-GS-001-SS	10/22/2014	571321.450	1641946.350	764.1	Dry			5.49E-02			5.97E-02
L2011101-CR-GS-002-SS	10/24/2014	571200.020	1641897.470	698.4	Dry			6.10E-02	1.09E-01	1.76E-02	5.94E-02
L2011101-CR-GS-003-SS	11/6/2014	571294.110	1641990.260	628.4	Dry			7.67E-02	1.21E-01	1.41E-02	5.90E-02
L2011101-CR-GS-004-SS	11/6/2014	571085.330	1642301.780	793.0	Dry			5.79E-02	4.06E-02	7.95E-03	3.96E-02
L2011101-CR-GS-005-SS	11/7/2014	571236.120	1642131.110	478.3	Dry			1.06E-01	9.95E-02	1.68E-02	8.32E-02
L2011101-CR-GS-006-SS	11/7/2014	571371.990	1642002.690	572.7	Dry			7.91E-02	1.39E-01	1.64E-02	5.80E-02
L2011101-CR-GS-007-SS	11/7/2014	571275.060	1641947.180	606.3	Dry			7.85E-02	1.06E-01	1.41E-02	6.04E-02
L2011101-CR-GS-008-SS	11/7/2014	571292.460	1642153.480	596.0	Dry			8.22E-02	1.07E-01	1.53E-02	5.83E-02
L2011101-CR-GS-009-SS	10/24/2014	571042.250	1642277.750	747.5	Dry			5.53E-02			5.77E-02
L2011101-CR-GS-010-SS	11/7/2014	571182.270	1641876.760	589.9	Dry			7.78E-02	1.15E-01	1.59E-02	5.78E-02

	Co-60		Cs-137	
# of Samples	13		13	
# >Critical Level	0		8	
Mean	7.28E-02	pCi/g	8.97E-02	pCi/g
Median	7.67E-02	pCi/g	9.95E-02	pCi/g
Max	1.06E-01	pCi/g	1.39E-01	pCi/g
Min	5.25E-02	pCi/g	4.06E-02	pCi/g
Standard Deviation	1.61E-02	pCi/g	3.05E-02	pCi/g

Table 9-12–L2011101 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L2011101-CJ-GS-002-SB	10/23/2014	571231.701	1642194.204	755.0	Dry			6.00E-02			5.70E-02
L2011101-CJ-GS-003-SB	10/23/2014	571231.701	1642194.204	895.2	Dry			5.03E-02			4.58E-02
L2011101-CJ-GS-004-SB	10/23/2014	571231.701	1642194.204	873.1	Dry			4.30E-02			4.73E-02
L2011101-CJ-GS-005-SB	10/24/2014	571306.287	1642179.285	884.6	Dry			4.28E-02			3.66E-02
L2011101-CJ-GS-006-SB	10/23/2014	571306.287	1642179.285	823.0	Dry			4.56E-02			4.01E-02
L2011101-CJ-GS-007-SB	10/23/2014	571306.287	1642179.285	857.6	Dry			4.03E-02			4.60E-02
L2011101-CJ-GS-008-SB	10/23/2014	571393.005	1642022.256	837.6	Dry			5.27E-02			5.54E-02
L2011101-CJ-GS-009-SB	10/24/2014	571393.005	1642022.256	879.6	Dry			4.18E-02			5.09E-02
L2011101-CJ-GS-010-SB	10/24/2014	571393.005	1642022.256	878.1	Dry			4.89E-02			4.82E-02
L2011101-CR-GS-001-SB	10/22/2014	571211.260	1642228.870	801.9	Dry			4.54E-02			5.50E-02
L2011101-CR-GS-002-SB	11/6/2014	571360.390	1642111.220	707.7	Dry			6.96E-02	2.42E-02	8.25E-03	4.15E-02
L2011101-CR-GS-003-SB	11/6/2014	571301.570	1642029.200	878.6	Dry			4.43E-02	3.97E-02	6.97E-03	2.78E-02
L2011101-CR-GS-004-SB	11/6/2014	571198.010	1642190.760	855.0	Dry			4.72E-02	3.12E-02	7.01E-03	3.37E-02
L2011101-CR-GS-005-SB	11/6/2014	571178.120	1642215.610	876.2	Dry			4.28E-02	8.82E-02	9.76E-03	4.04E-02
L2011101-CR-GS-006-SB	11/6/2014	571376.960	1642038.310	914.6	Dry	1.12E-01	9.45E-03	3.12E-02			5.25E-02
L2011101-CR-GS-007-SB	11/6/2014	571085.330	1642301.780	876.4	Dry			5.20E-02			4.94E-02

	Co-60		Cs-137	
# of Samples	16		16	
# >Critical Level	1		2	
Mean	5.24E-02	pCi/g	4.92E-02	pCi/g
Median	4.64E-02	pCi/g	4.78E-02	pCi/g
Max	1.12E-01	pCi/g	8.82E-02	pCi/g
Min	4.03E-02	pCi/g	3.37E-02	pCi/g
Standard Deviation	1.76E-02	pCi/g	1.25E-02	pCi/g

Table 9-13 L2011101 Asphalt Sample Analysis

Asphalt Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical level (pCi/g)
L2011101-CR-PA-001-AV	10/21/2014	571211.260	1642228.870	740.1	Dry			5.12E-02			5.31E-02
L2011101-CR-PA-002-AV	10/21/2014	571360.390	1642111.220	770.9	Dry			5.14E-02			5.31E-02
L2011101-CR-PA-003-AV	10/21/2014	571301.570	1642029.200	869.3	Dry			4.90E-02			4.95E-02
L2011101-CR-PA-004-AV	10/21/2014	571198.010	1642190.760	725.2	Dry			5.13E-02			5.43E-02
L2011101-CR-PA-005-AV	10/21/2014	571178.120	1642215.610	835.0	Dry			5.39E-02			4.78E-02
L2011101-CR-PA-006-AV	10/22/2014	571376.960	1642038.310	857.7	Dry			4.66E-02			4.67E-02

	Co-60		Cs-137	
# of Measurements	6		6	
# >Critical Level	0		0	
Mean	5.06E-02	pCi/g	5.08E-02	pCi/g
Median	5.13E-02	pCi/g	5.13E-02	pCi/g
Max	5.39E-02	pCi/g	5.43E-02	pCi/g
Min	4.66E-02	pCi/g	4.67E-02	pCi/g
Standard Deviation	2.49E-03	pCi/g	3.17E-03	pCi/g

Table 9-14 L2011101 Asphalt Direct Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L2011101-CR-PA-001-AV	3	0.5	2.5	32.3	117	88.5	28.5	267.6
L2011101-CR-PA-002-AV	2	0.5	1.5	19.4	129	88.5	40.5	380.3
L2011101-CR-PA-003-AV	9	0.5	8.5	109.7	150	88.5	61.5	577.5
L2011101-CR-PA-004-AV	4	0.5	3.5	45.2	141	88.5	52.5	493
L2011101-CR-PA-005-AV	2	0.5	1.5	19.4	107	88.5	18.5	173.7
L2011101-CR-PA-006-AV	2	0.5	1.5	19.4	136	88.5	47.5	446
			Alpha MDA:	75.5			Beta MDA:	381.4

Figure 9-6 L2011101 Biased Sampling Locations

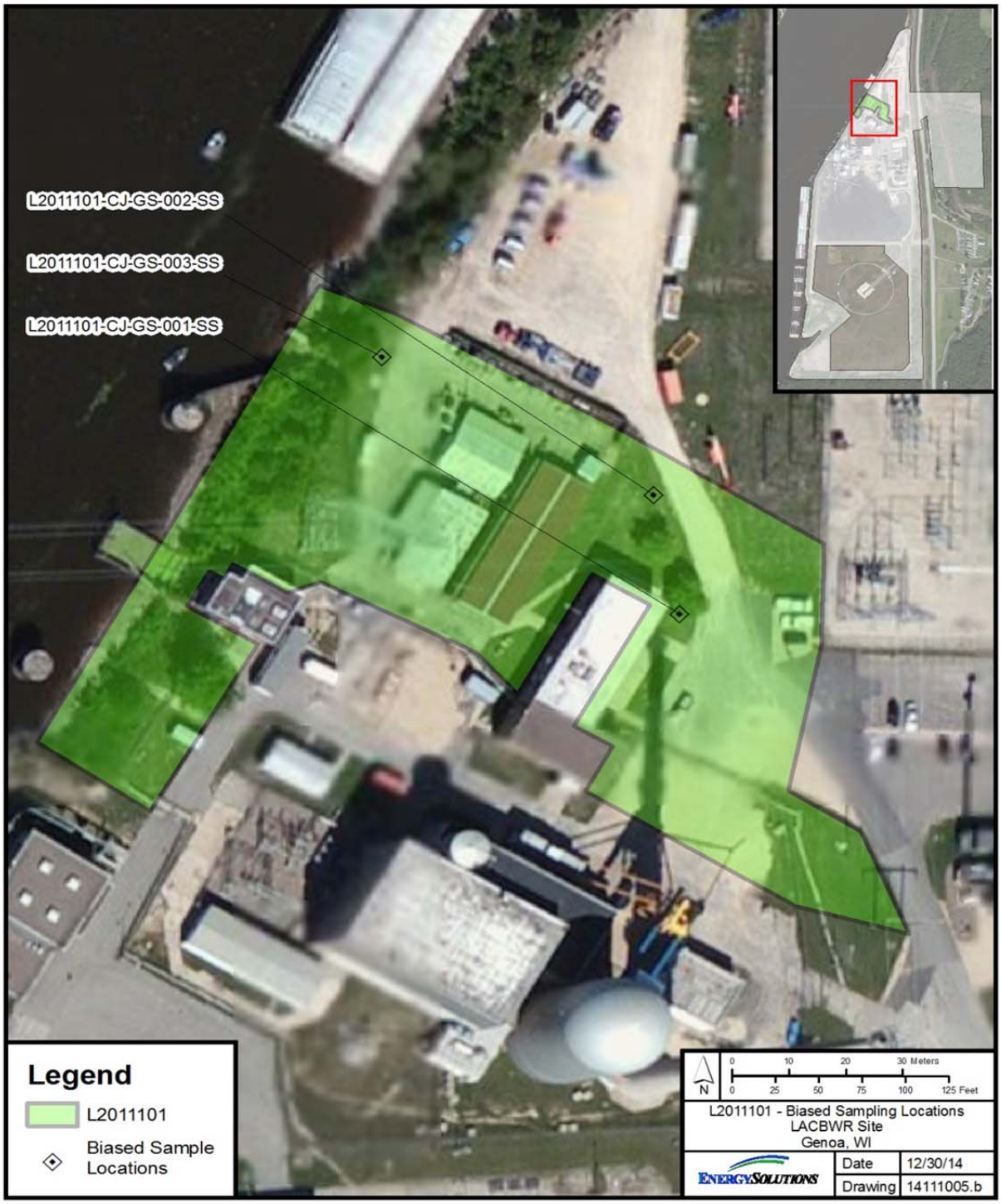
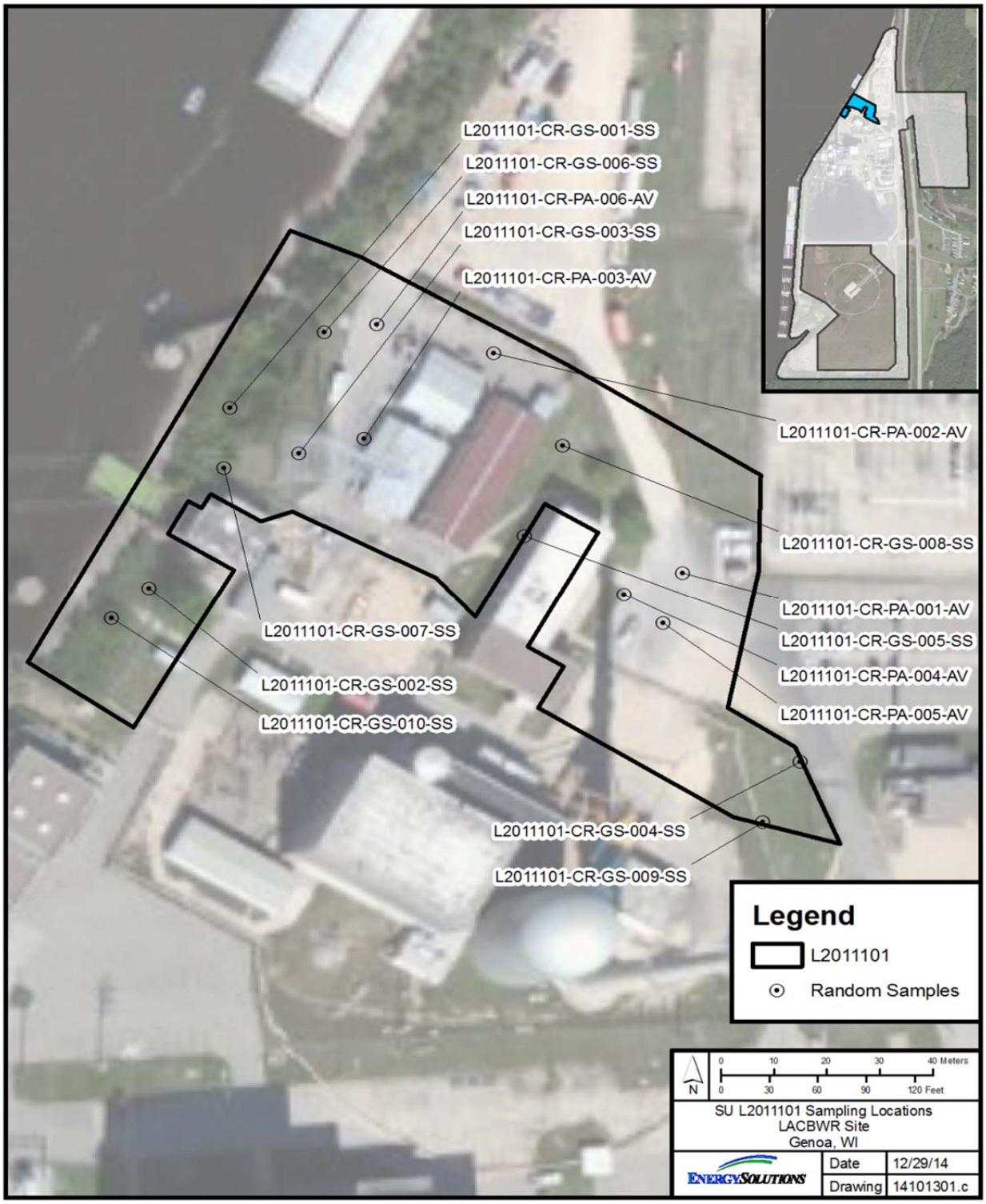


Figure 9-7 L2011101 Random Sampling Locations



9.8. Survey Unit L2011102

Impacted Class 2 open land survey unit L2011102 is located to the south and east of the LACBWR LSE fence.

The size of the survey unit is approximately 7,077 square meters. There are no documented incidents of radiological surface contamination pertaining to the soil in this survey unit. There are intact sections of asphalt south of the LACBWR LSE fence.

The survey design for this survey unit focused on:

- Collecting information on the asphalt in the survey unit and the soils underneath it. This was done by collecting six (6) random type asphalt samples and six (6) soil samples collected at one meter depth below the asphalt sampling location. In addition, one (1) duplicate asphalt sample was taken at the sampling location with the highest direct beta gamma reading and one (1) duplicate soil sample at one meter was taken where the duplicate asphalt sample was taken. Direct beta gamma and alpha measurements were taken on 50% of the accessible asphalt surfaces prior to sampling.
- The survey design required collecting soil samples adjacent to the buried Circulating Water Discharge Piping. However, the pipe was not successfully located. Based upon the inability to accurately locate the piping, along with the presence of a large number of other active buried piping in the area that supported the G-3 Coal Plant operations, these samples were not taken.
- The survey design called for ten (10) random surface soil sample locations and one (1) subsurface soil sample at a depth of one meter depth at the same location as the surface area sample location with the highest gamma scan reading. One duplicate surface soil sample was taken at the location of the highest gamma scan result and a duplicate subsurface soil sample was taken at the location of the subsurface soil sample.

In summary, a total of ten (10) surface soil samples, six (6) asphalt samples, and seven (7) subsurface soil samples were taken without issue inside this survey unit.

In addition, a gamma walkover survey was performed over 50% of the accessible open ground surface in the survey unit..

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. All sample results were less than 50% of their applicable action level. Cs-137 was positively identified at concentrations greater than the instrument MDC in five of the ten surface soil samples taken. Cs-137 concentrations averaged 0.065 pCi/g with a maximum observed concentration of 0.20 pCi/g in surface soils. Cs-137 was also identified in two of seven subsurface soil samples with an average observed concentration of 0.038 pCi/g and a maximum observed concentration of 0.052 pCi/g. Cs-137 was also positively identified in three of six asphalt samples with an average observed concentration of 0.048 pCi/g and a maximum observed concentration of 0.055 pCi/g. Co-60 was not positively identified at concentrations greater than the instrument MDC in any surface soil, subsurface soil or asphalt sample taken in this survey unit.

One surface soil sample, two subsurface soil samples and one asphalt sample was sent for off-site analysis for HTD radionuclides. H-3, C-14, Pu-238, Pu-239/240 and Am-241 was positively detected at concentrations greater than the instrument MDC but at concentrations less than 10% of their respective action level with the exception of C-14 detected in sample L2011102-QQ-GS-001-SB at a concentration of 1.56 pCi/g (action level 12 pCi/g).

Acceptability testing of the duplicates soil sample results in accordance with Section 4.12 of the QAPP did not reveal any lab data concerning the ROCs requiring further evaluation.

The beta –gamma scans of asphalt surfaces ranged from the MDC of 2,529 dpm/100cm^2 to a maximum of 2,582 dpm/100 cm^2. All direct beta-gamma survey results were well under 50% of the structural surface action levels. Given the satisfactory beta scan and beta direct readings in the asphalt survey coupled with the gamma spectroscopy results of the asphalt samples, the one slightly elevated alpha result was not investigated further as it was assumed to be contributed by the presence of naturally occurring radionuclides.

The results of the gamma scan walkover of 50% of the accessible surface soil area in the survey unit were less than 1.5 times the established scan background of 7,000-8,000 cpm. Elevated gamma scan readings at greater than 1.5 times the established background was noted when readings were taken within approximately ten feet of some LACBWR LSE fence. It was assumed that the elevated scan results were due to contribution to ambient radiation from radioactive materials and systems inside the LACBWR LSE.

The following tables and figures are included with this survey unit:

- Table 9-15 and Table 9-16 show the summary of the surface and subsurface soil sample information and respective statistics.
- Table 9-17 shows the results of the asphalt sampling and respective statistics.
- Table 9-18 shows the direct asphalt survey results.
- Figure 9-8 shows the location of the random asphalt and soil sampling locations.
- Table 9-53 shows the offsite radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.

Table 9-15–L2011102 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L2011102-CR-GS-001-SS	11/14/2014	570912.200	1642250.220	542.4	Dry			8.08E-02	2.00E-01	1.92E-02	5.80E-02
L2011102-CR-GS-002-SS	11/14/2014	570863.320	1641737.380	760.3	Dry			5.72E-02	3.48E-02	7.87E-03	3.94E-02
L2011102-CR-GS-003-SS	11/15/2014	570739.880	1641664.470	675.4	Dry			7.09E-02	2.96E-02	7.14E-03	3.03E-02
L2011102-CR-GS-004-SS	11/15/2014	570884.860	1642039.780	676.2	Dry			6.75E-02	6.04E-02	1.01E-02	3.30E-02
L2011102-CR-GS-005-SS	11/15/2014	570934.570	1641759.750	632.8	Dry			6.93E-02			7.06E-02
L2011102-CR-GS-006-SS	11/15/2014	570902.260	1641777.150	792.7	Dry			5.57E-02	3.59E-02	8.00E-03	3.37E-02
L2011102-CR-GS-007-SS	11/15/2014	570806.160	1641683.530	684.3	Dry			6.27E-02	4.73E-02	9.41E-03	4.36E-02
L2011102-CR-GS-008-SS	11/15/2014	571095.300	1641870.770	748.9	Dry			5.60E-02	5.25E-02	8.66E-03	3.11E-02
L2011102-CR-GS-009-SS	11/15/2014	570872.440	1642198.020	630.3	Dry			6.50E-02	5.54E-02	1.05E-02	5.11E-02
L2011102-CR-GS-010-SS	11/15/2014	570889.010	1641707.550	785.1	Dry			5.18E-02			5.57E-02

	Co-60		Cs-137	
# of Samples	10		10	
# >Critical Level	0		6	
Mean	6.37E-02	pCi/g	6.48E-02	pCi/g
Median	6.39E-02	pCi/g	5.40E-02	pCi/g
Max	8.08E-02	pCi/g	2.00E-01	pCi/g
Min	5.18E-02	pCi/g	3.03E-02	pCi/g
Standard Deviation	8.82E-03	pCi/g	4.90E-02	pCi/g

Table 9-16–L2011102 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L2011102-CR-GS-001-SB	1	11/14/2014	571016.590	1641838.460	846.9	Dry			4.64E-02	2.29E-02	7.01E-03	3.19E-02
L2011102-CR-GS-002-SB	1	11/14/2014	570942.860	1641911.360	865.1	Dry			5.10E-02	4.50E-02	7.43E-03	3.40E-02
L2011102-CR-GS-003-SB	1	11/14/2014	571029.850	1641866.630	833.8	Dry			5.14E-02	2.40E-02	5.78E-03	2.85E-02
L2011102-CR-GS-004-SB	1	11/14/2014	570881.550	1641956.930	848.4	Dry			4.83E-02			5.20E-02
L2011102-CR-GS-005-SB	1	11/14/2014	571058.020	1641881.540	881.3	Dry			4.22E-02	3.26E-02	7.07E-03	2.91E-02
L2011102-CR-GS-006-SB	1	11/14/2014	570912.200	1641837.630	874.9	Dry			4.68E-02	3.28E-02	7.44E-03	3.31E-02
L2011102-CR-GS-007-SB	1	11/15/2014	570872.440	1642198.020	796.3	Dry			5.50E-02	1.99E-02	6.70E-03	4.10E-02

	Co-60		Cs-137	
# of Measurements	7		7	
# >Critical Level	0		2	
Mean	4.87E-02	pCi/g	3.77E-02	pCi/g
Median	4.83E-02	pCi/g	3.31E-02	pCi/g
Max	5.50E-02	pCi/g	5.20E-02	pCi/g
Min	4.22E-02	pCi/g	2.85E-02	pCi/g
Standard Deviation	4.15E-03	pCi/g	8.51E-03	pCi/g

Table-9-17–L2011102 Asphalt Sample Analysis

Asphalt Sample Analysis

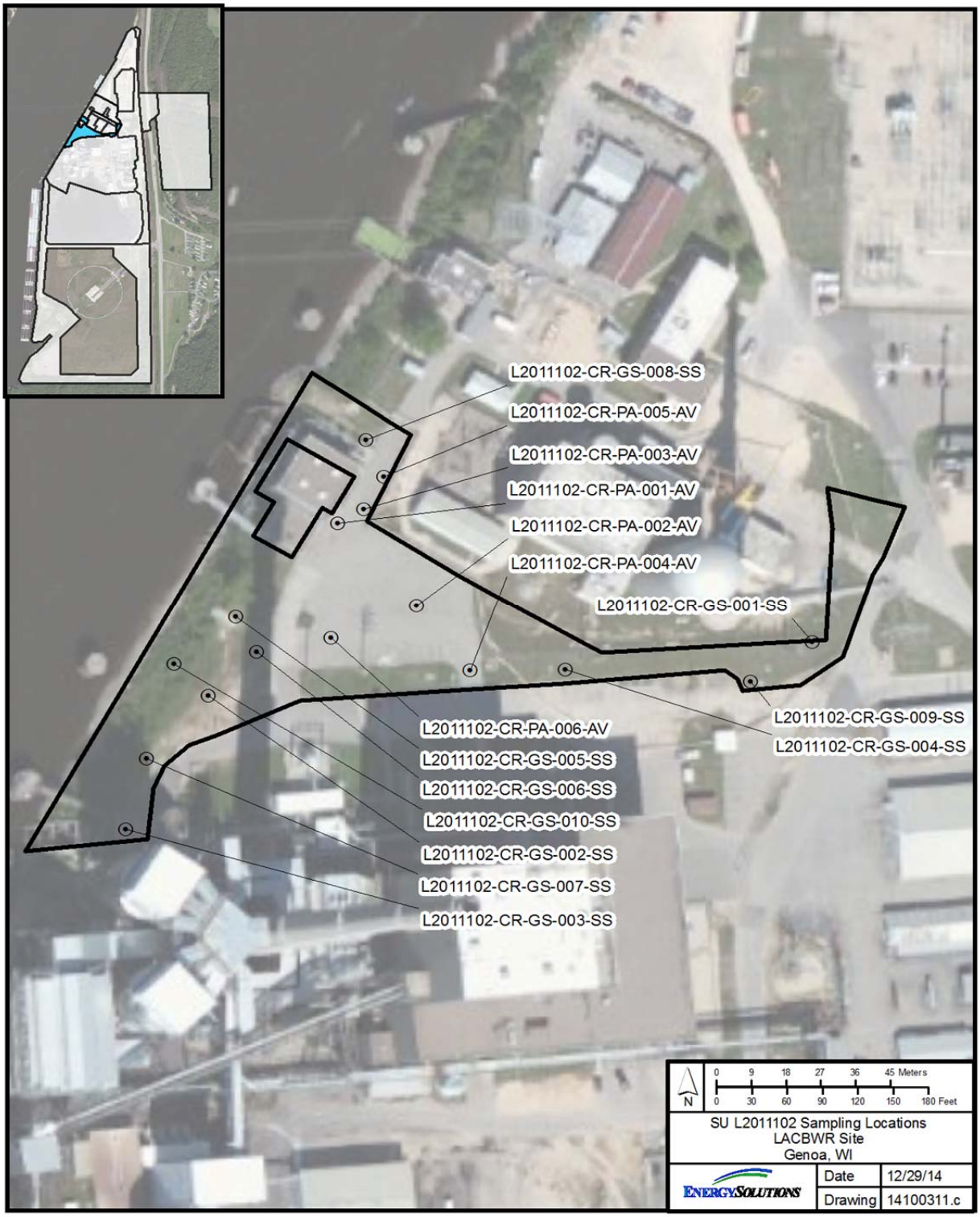
Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L2011102-CR-PA-001-AV	11/14/2014	571016.590	1641838.460	721.4	Dry			5.63E-02	5.05E-02	9.13E-03	3.35E-02
L2011102-CR-PA-002-AV	11/14/2014	570942.860	1641911.360	709.9	Dry			5.68E-02	1.95E-02	2.09E-03	3.41E-02
L2011102-CR-PA-003-AV	11/14/2014	571029.850	1641866.630	714.0	Dry			4.94E-02			5.52E-02
L2011102-CR-PA-004-AV	11/14/2014	570881.550	1641956.930	694.5	Dry			5.90E-02	4.56E-02	9.03E-03	3.64E-02
L2011102-CR-PA-005-AV	11/14/2014	571058.020	1641881.540	731.0	Dry			5.61E-02			5.26E-02
L2011102-CR-PA-006-AV	11/14/2014	570912.200	1641837.630	694.3	Dry			5.81E-02	5.14E-02	9.43E-03	3.35E-02

	Co-60		Cs-137	
# of Measurements	6		6	
# >Critical Level	0		3	
Mean	5.60E-02	pCi/g	4.82E-02	pCi/g
Median	5.66E-02	pCi/g	5.10E-02	pCi/g
Max	5.90E-02	pCi/g	5.52E-02	pCi/g
Min	4.94E-02	pCi/g	3.41E-02	pCi/g
Standard Deviation	3.40E-03	pCi/g	7.61E-03	pCi/g

Table 9-18 L2011102 Asphalt Direct Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L2011102-CR-PA-001-AV	4	0.6	3.4	42.9	177	116.5	60.5	530.7
L2011102-CR-PA-002-AV	5	0.6	4.4	55.3	196	116.5	79.5	697.4
L2011102-CR-PA-003-AV	5	0.6	4.4	55.3	209	116.5	92.5	811.4
L2011102-CR-PA-004-AV	1	0.6	0.4	5.6	177	116.5	60.5	530.7
L2011102-CR-PA-005-AV	4	0.6	3.4	42.9	188	116.5	71.5	627.2
L2011102-CR-PA-006-AV	9	0.6	8.4	105	179	116.5	62.5	548.2
			Alpha MDA:	68.3			Beta MDA:	343.0

Figure 9-8 L2011102 Random Sampling Locations



9.9. Survey Unit B2009103

Impacted Class 2 building LACBWR Administration Building survey unit B2009103 is located just to the north of the LACBWR LSE fence.

The size of the survey unit is approximately 503 square meters. As previously stated, there are no documented incidents of identified radioactive contamination, radioactive material spills or the use of unsealed radioactive sources in the LACBWR Administration Building.

The initial survey design for this survey unit did not call for in facility beta scanning or biased direct alpha,beta measurements(see Table 7-1) but following the discovery of a discrete particle on the second floor of the facility the following additional surveys were performed of the facility as well as the surveys described in Table 7-1:

- A beta scan on 50% of the accessible floor surfaces in hallways and rooms and the acquisition of biased direct alpha, beta and gamma measurements, with a focus on surface areas in rooms and hallways which were stained, discolored, or disturbed.
- A beta scan of 10% of the roof surface as well as the acquisition of six (6) random direct and removable contamination surveys for alpha and beta gamma contamination. The roof was surveyed to evaluate the potential for this large flat elevated open air surface to be potentially impacted by atmospheric dispersion of radioactive contamination from past LACBWR operations.
- The survey plan originally called for obtaining two (2) representative samples of sediments from drain lines in the facility. However, this was not accomplished as the cleanout areas of the drain systems were not readily accessible without excavation. As an alternative, floor and sink drains in the mechanical rooms, environmental lab, and a restroom were surveyed, with direct and removable contamination surveys for alpha and beta gamma.

The results of the beta scans of carpet, laminated wood, and 12’ by 12’ tile surfaces inside the structure ranged from 1,420 dpm/100 cm^2 to 2,710 dpm/100 cm^2 with an scan MDC of 2,000 dpm/100cm^2. The results of beta scans of glazed type tiles located on the first floor in and around the access control area ranged from 3,876 dpm/100 cm^2 to 4,915 dpm/100cm^2 with a scan MDC of 2,100dpm/100 cm^2. Gamma spectroscopy was performed on a non-impactedsample of the glazed tile and it exhibited a significant presence of uranium and thorium NORM. Additionally, during the beta scan survey of the second floor, a small elevated area was noted outside an office location on 12’ by 12’ tiles which were subsequently quantified with a hand held beta-gamma detector direct measurement to show contamination levels nearing 6,000 dpm/100 cm^2. The area and its control were turned over to the licensee for management.

The area of concern was verified to be a discrete radioactive particle (DRP) in the 12’ by 12’ tile that was removed by the license and verified by the onsite gamma spectroscopy unit to be an approximately 0.005 uCi discrete particle containing Cs-137. A total of ten (10) direct biased direct surveys were subsequently taken on the first and second floor laminated wood, carpet, and 12’ by 12’ tile areas. The results of the surveys showed all the beta- gamma direct and alpha direct results well below 50% of the action levels for structural surfaces. The two (2) direct beta-gamma and alpha measurements on the glazed tile results

demonstrated that the beta-gamma were less than 50% of the action levels for structural surfaces but were elevated at higher levels due to the presence of NORM. The elevated alpha on the glazed tile were due to the tile's content of natural thorium and uranium series radionuclides.

The scan survey results of 10% of the roof area indicated results ranging from 1,872 dpm/100cm^2 to 2,261 dpm/100 cm^2 with a scan MDC of 2,261 dpm/100 cm^2. The scan results demonstrated that the observed beta–gamma results were well below 50% of the action level. The direct alpha measuremtns were elevated with an average measurement of 112.5 dpm/100 cm^2 and a maximum measurement of 152.3 dpm/100 cm^2.

Direct and removable contamination surveys were performed onnine (9) sink and floor drains. The survey results indicated no residual radioactivity exceeding 50% of the structural surface action level.

The following tables and figures are included with this survey unit:

- Table 9-19 shows the results of the roof direct surveys.
- Table 9-20 shows the results of the removable contamination surveys.
- Table 9-21 shows the results of the glazed tile floor surveys.
- Table 9-22 and Table 9-23 show the results of the direct surveys inside the facility of the plastic tile floor areas and the results of the floor/sink drain areas respectively.
- Table 9-24 shows the results of the removable contamination surveys of the facility drains.
- Figure 9-9 shows the location of the direct surveys taken on the roof of the facility.
- Figures 9-10 and 9-11 show the locations of the direct surveys inside the facility of floor areas.
- Figure 9-12 and 9-13 show the location of the floor/sink drain areas respectively.

Table 9-19 B2009103 Admin Building Roof Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
B2009103-CR-RT-001-BD					149.5	108.3	41.2	386.9
B2009103-CR-RT-001-AD	13.5	1.7	11.8	152.3				
B2009103-CR-RT-002-BD					137.5	108.3	29.2	274.2
B2009103-CR-RT-002-AD	12	1.7	10.3	132.9				
B2009103-CR-RT-003-BD					122	108.3	13.7	128.6
B2009103-CR-RT-003-AD	7	1.7	5.3	68.4				
B2009103-CR-RT-004-BD					127	108.3	18.7	175.6
B2009103-CR-RT-004-AD	9.5	1.7	7.8	100.6				
B2009103-CR-RT-005-BD					157	108.3	48.7	457.3
B2009103-CR-RT-005-AD	9	1.7	7.3	94.2				
B2009103-CR-RT-006-BD					145	108.3	36.7	344.6
B2009103-CR-RT-006-AD	11.5	1.7	9.8	126.5				
			Alpha MDA:	34.5			Beta MDA:	136.5

Table 9-20 B2009103 Admin Building Roof Removable Survey Results

	Alpha Removable Contamination				Beta Removable Contamination			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
B2009103-CR-RT-001-SW	1.2	0.2	1	7.5	58.6	58	0.6	3.2
B2009103-CR-RT-002-SW	1.2	0.2	1	7.5	63	58	5	26.5
B2009103-CR-RT-003-SW	1.2	0.2	1	7.5	64.8	58	6.8	36
B2009103-CR-RT-004-SW	0.8	0.2	0.6	4.5	60.6	58	2.6	13.8
B2009103-CR-RT-005-SW	1.4	0.2	1.2	9.1	61.2	58	3.2	16.9
B2009103-CR-RT-006-SW	1.2	0.2	1	7.5	59	58	1	5.3
			Alpha MDA:	10.1			Beta MDA:	69.2

Table 9-21 B2009103 Admin Building Glazed Tile Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
B2009103-CJ-FG-001-BD					433.5	228	205.5	1929.6
B2009103-CJ-FG-001-AD	5	0.4	4.6	59.4				
B2009103-CJ-FG-002-BD					413.5	228	185.5	1741.8
B2009103-CJ-FG-002-AD	6	0.4	5.6	72.3				
			Alpha MDA:	39.3			Beta MDA:	358.7

Table 9-22 B2009103 Admin Building Plastic Tile Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
B2009103-CJ-FE-001-BD					305	190	115	1079.8
B2009103-CJ-FE-001-AD	0.5	0.9	-0.4	-5.2				
B2009103-CJ-FE-002-BD					283.5	190	93.5	877.9
B2009103-CJ-FE-002-AD	1.5	0.9	0.6	7.7				
B2009103-CJ-FE-003-BD					227	190	37	347.4
B2009103-CJ-FE-003-AD	2	0.9	1.1	14.2				
B2009103-CJ-FE-004-BD					260.5	190	70.5	662
B2009103-CJ-FE-004-AD	2	0.9	1.1	14.2				
B2009103-CJ-FE-005-BD					195	190	5	46.9
B2009103-CJ-FE-005-AD	0	0.9	-0.9	-11.6				
B2009103-CJ-FE-006-BD					171.5	190	-18.5	-173.7
B2009103-CJ-FE-006-AD	1	0.9	0.1	1.3				
B2009103-CJ-FE-007-BD					206	190	16	150.2
					Post Discrete Particle Removal for B2009103-CJ-FE-007-BD			
B2009103-CJ-FE-007-AD	0	0.9	-0.9	-11.6				
B2009103-CJ-FE-008-BD					213.5	190	23.5	220.7
B2009103-CJ-FE-008-AD	2.5	0.9	1.6	20.6				
B2009103-CJ-FE-009-BD					231.5	190	41.5	389.7
B2009103-CJ-FE-009-AD	0.5	0.9	-0.4	-5.2				
B2009103-CJ-FE-010-BD					226.5	190	36.5	342.7
B2009103-CJ-FE-010-AD	2.5	0.9	1.6	20.6				
B2009103-CJ-FE-011-BD					775	120	655	5743
					Pre Discrete Particle Removal for B2009103-CJ-FE-011-BD			
			Alpha MDA:	49.2			Beta MDA:	328.5

Table 9-23 B2009103 Admin Building Drain Area Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
B2009103-CJ-DM-001-BD					107.5	117	-9.5	-83.3
B2009103-CJ-DM-001-AD	0.5	0.6	-0.1	-1.2				
B2009103-CJ-DM-002-BD					145.5	117	28.5	250
B2009103-CJ-DM-002-AD	0	0.6	-0.6	-7.5				
B2009103-CJ-DM-003-BD					132	117	15	131.6
B2009103-CJ-DM-003-AD	0.5	0.6	-0.1	-1.2				
B2009103-CJ-DM-004-BD					112.5	117	-4.5	-39.5
B2009103-CJ-DM-004-AD	0	0.6	-0.6	-7.5				
B2009103-CJ-DM-005-BD					113.5	117	-3.5	-30.7
B2009103-CJ-DM-005-AD	1.5	0.6	0.9	11.2				
B2009103-CJ-DM-006-BD					113.5	117	-3.5	-30.7
B2009103-CJ-DM-006-AD	1.5	0.6	0.9	11.2				
B2009103-CJ-DM-007-BD					155	117	38	333.3
B2009103-CJ-DM-007-AD	3	0.6	2.4	29.8				
B2009103-CJ-DM-008-BD					117.5	117	0.5	4.4
B2009103-CJ-DM-008-AD	2	0.6	1.4	17.4				
B2009103-CJ-DM-009-BD					109.5	117	-7.5	-65.8
B2009103-CJ-DM-009-AD	0.5	0.6	-0.1	-1.2				
			Alpha MDA:	42.1			Beta MDA:	243.4

Table 9-24 B2009103 Admin Building Drain Area Removable Survey Results

	Alpha Removable Contamination				Beta Removable Contamination			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
B2009103-CJ-DM-001-SW	0.2	0.9	-0.7	-5.3	53.2	54.6	-1.4	-7.4
B2009103-CJ-DM-002-SW	0	0.9	-0.9	-6.8	58.8	54.6	4.2	22.2
B2009103-CJ-DM-003-SW	0.8	0.9	-0.1	-0.8	59.6	54.6	5	26.5
B2009103-CJ-DM-004-SW	NO SAMPLE				NO SAMPLE			
B2009103-CJ-DM-005-SW	0.2	0.9	-0.7	-5.3	59.4	54.6	4.8	25.4
B2009103-CJ-DM-006-SW	0.4	0.9	-0.5	-3.8	55.4	54.6	0.8	4.2
B2009103-CJ-DM-007-SW	0.2	0.9	-0.7	-5.3	56.4	54.6	1.8	9.5
B2009103-CJ-DM-008-SW	0	0.9	-0.9	-6.8	51.8	54.6	-2.8	-14.8
B2009103-CJ-DM-009-SW	0	0.9	-0.9	-6.8	51.2	54.6	-3.4	-18
			Alpha MDA:	16.3			Beta MDA:	67.2

Figure 9-9 B2009103 Admin Building Roof Sample Locations

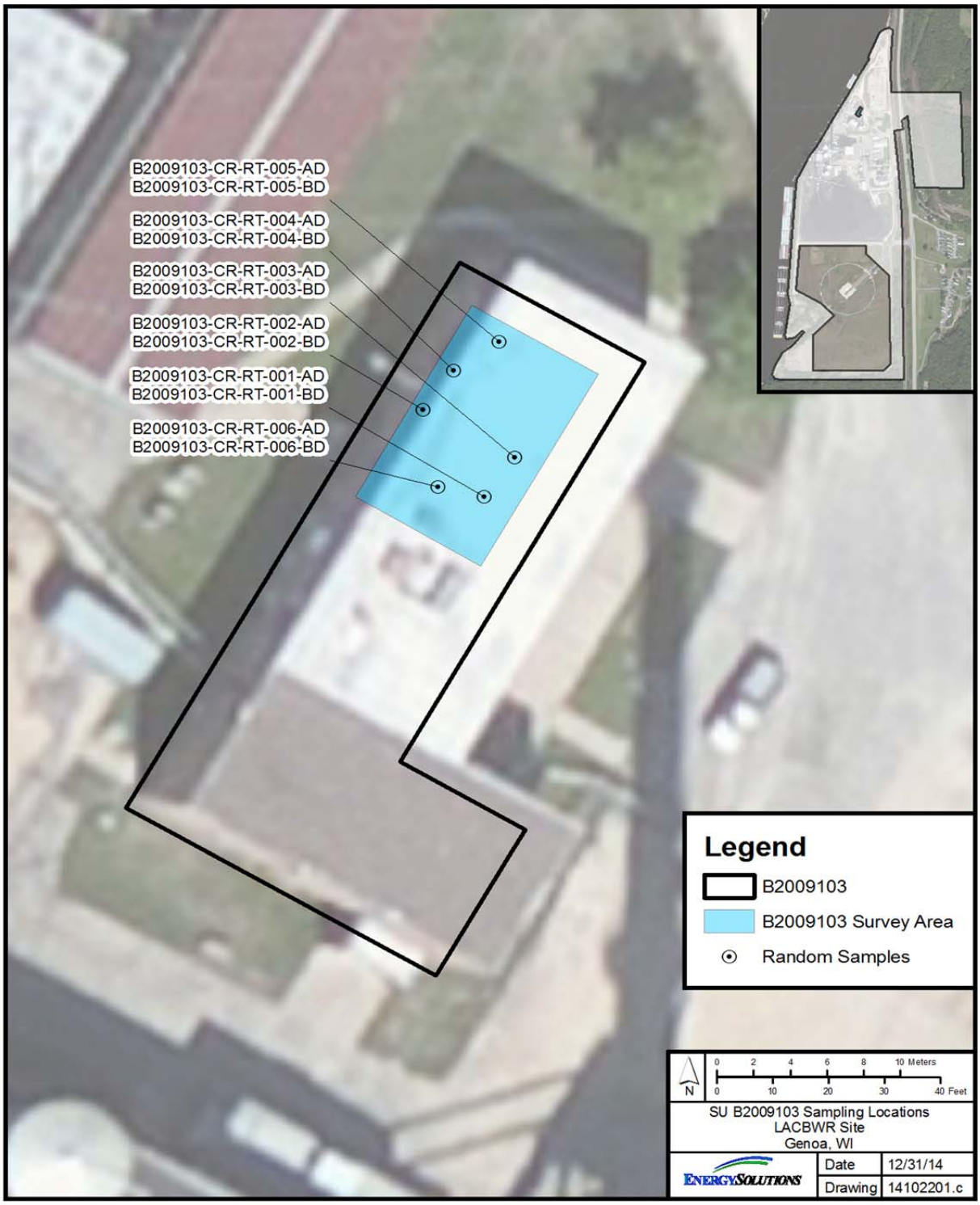


Figure 9-10 B2009103 Admin Building Direct Survey Locations First Floor

Glazed Tile

LABEL	SAMPLE NUMBER
1	B2009103-CJ-FG-001-BD
1	B2009103-CJ-FG-001-AD
2	B2009103-CJ-FG-002-BD
2	B2009103-CJ-FG-002-AD

Plastic Tile

LABEL	SAMPLE NUMBER
1	B2009103-CJ-FE-001-BD
1	B2009103-CJ-FE-001-AD
2	B2009103-CJ-FE-002-BD
2	B2009103-CJ-FE-002-AD
3	B2009103-CJ-FE-003-BD
3	B2009103-CJ-FE-003-AD
4	B2009103-CJ-FE-004-BD
4	B2009103-CJ-FE-004-AD
5	B2009103-CJ-FE-005-BD
5	B2009103-CJ-FE-005-AD
6	B2009103-CJ-FE-006-BD
6	B2009103-CJ-FE-006-AD

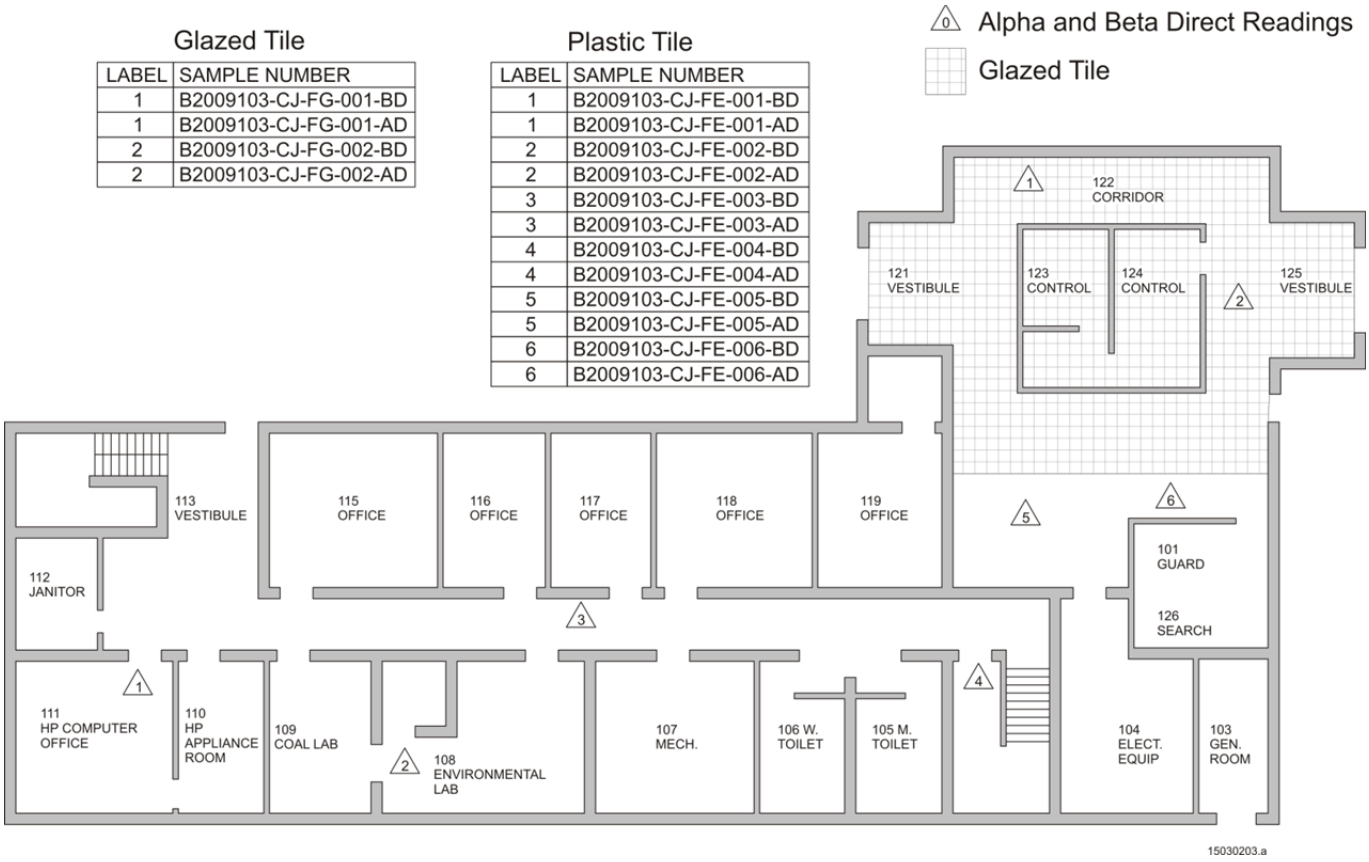


Figure 9-11 B2009103 Admin Building Direct Survey Locations Second Floor

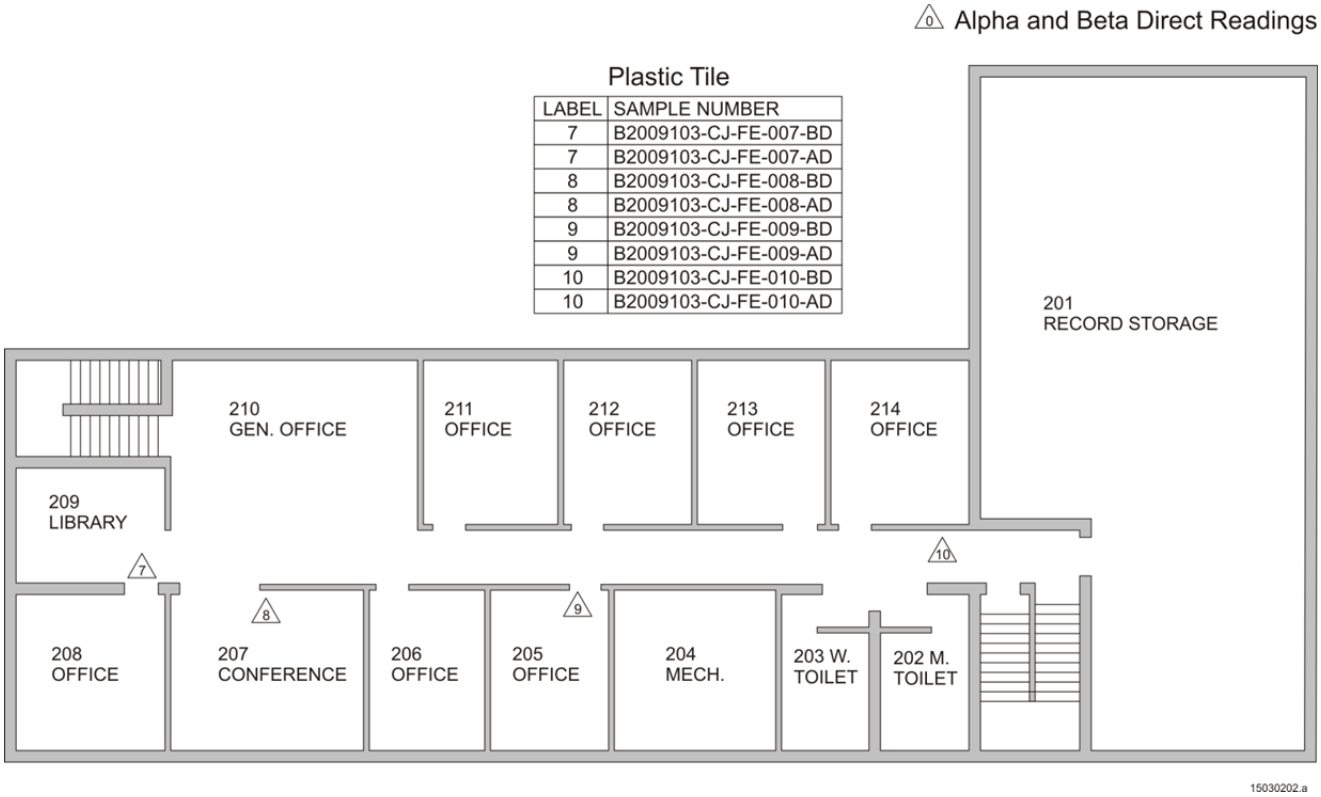


Figure 9-12 B2009103 Admin Building Direct Survey Locations Drain Area First Floor

LABEL	ROOM #	ROOM DESCRIPTION	SAMPLE NUMBER
1	Room 108	Environmental Lab Sink	B2009103-CJ-DM-001-SW
1	Room 108	Environmental Lab Sink	B2009103-CJ-DM-001-BD
1	Room 108	Environmental Lab Sink	B2009103-CJ-DM-001-AD
2	Room 108	Environmental Lab Sink Storage	B2009103-CJ-DM-002-SW
2	Room 108	Environmental Lab Sink Storage	B2009103-CJ-DM-002-BD
2	Room 108	Environmental Lab Sink Storage	B2009103-CJ-DM-002-AD
3	Room 108	Environmental Lab Hood	B2009103-CJ-DM-003-SW
3	Room 108	Environmental Lab Hood	B2009103-CJ-DM-003-BD
3	Room 108	Environmental Lab Hood	B2009103-CJ-DM-003-AD
4	Room 108	Environmental Lab Countertop	B2009103-CJ-DM-004-SW
4	Room 108	Environmental Lab Countertop	B2009103-CJ-DM-004-BD
4	Room 108	Environmental Lab Countertop	B2009103-CJ-DM-004-AD
5	Room 107	Mech. Room Floor Drain	B2009103-CJ-DM-005-SW
5	Room 107	Mech. Room Floor Drain	B2009103-CJ-DM-005-BD
5	Room 107	Mech. Room Floor Drain	B2009103-CJ-DM-005-AD
6	Room 107	Mech. Room Floor Wet Sink	B2009103-CJ-DM-006-SW
6	Room 107	Mech. Room Floor Wet Sink	B2009103-CJ-DM-006-BD
6	Room 107	Mech. Room Floor Wet Sink	B2009103-CJ-DM-006-AD

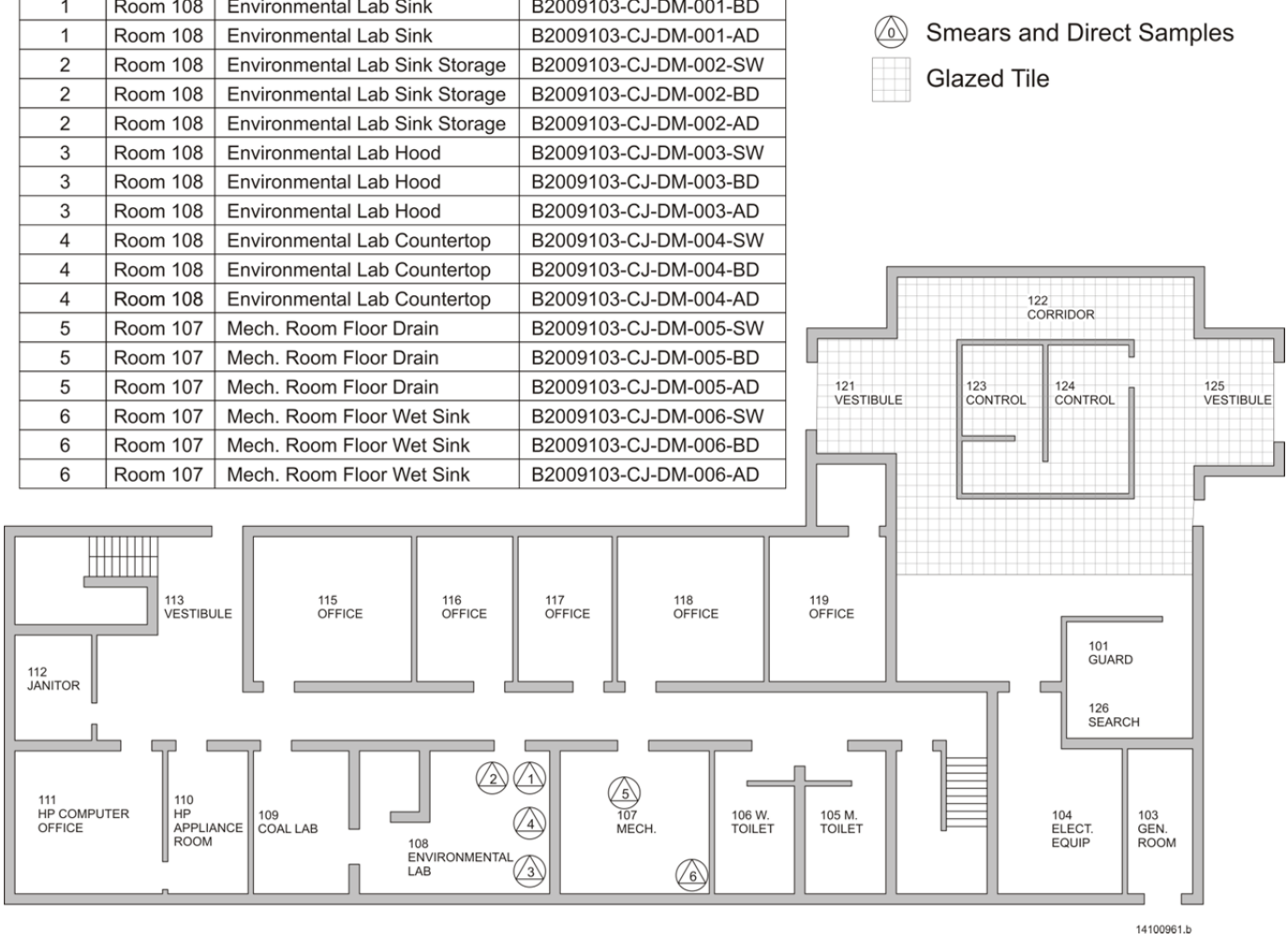
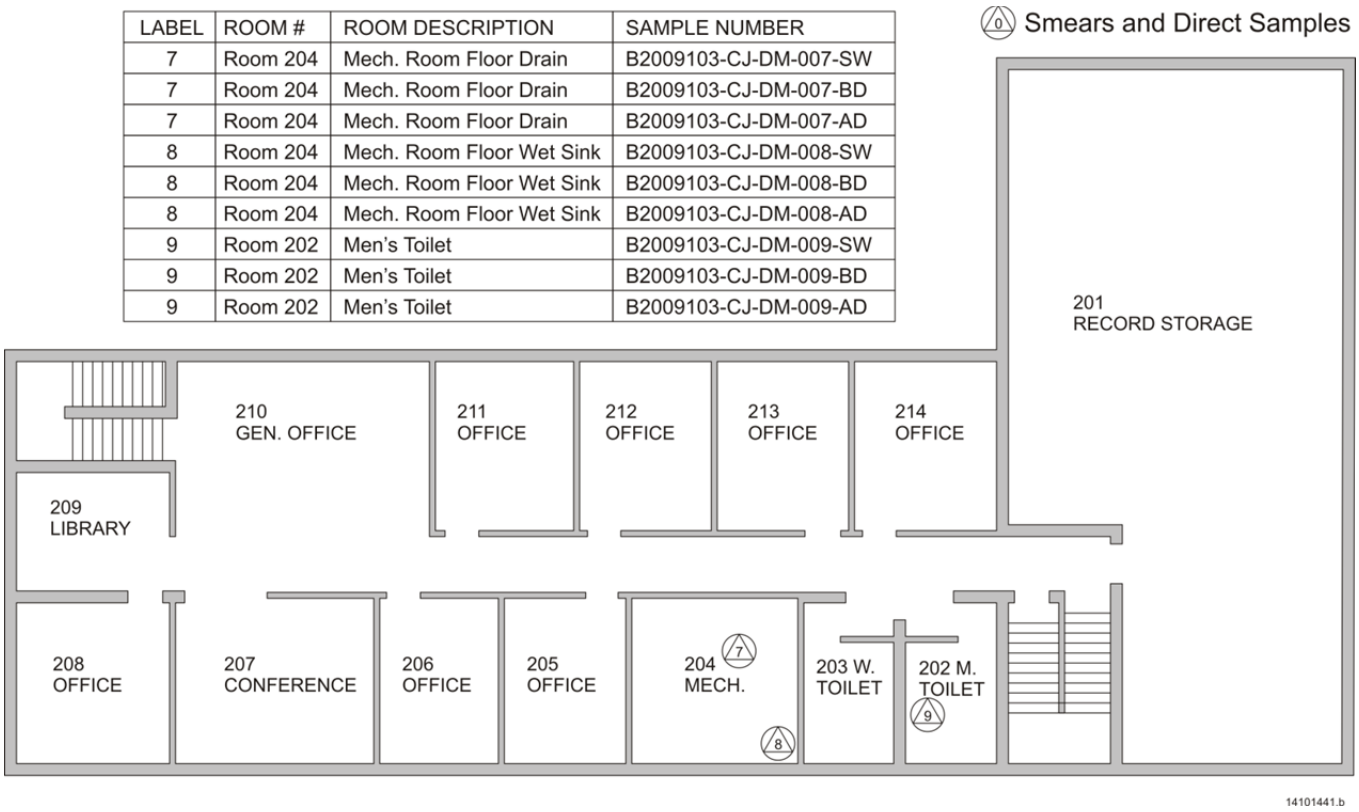


Figure 9-13 B2009103 Admin Building Direct Survey Locations Drain Area Second Floor

LABEL	ROOM #	ROOM DESCRIPTION	SAMPLE NUMBER
7	Room 204	Mech. Room Floor Drain	B2009103-CJ-DM-007-SW
7	Room 204	Mech. Room Floor Drain	B2009103-CJ-DM-007-BD
7	Room 204	Mech. Room Floor Drain	B2009103-CJ-DM-007-AD
8	Room 204	Mech. Room Floor Wet Sink	B2009103-CJ-DM-008-SW
8	Room 204	Mech. Room Floor Wet Sink	B2009103-CJ-DM-008-BD
8	Room 204	Mech. Room Floor Wet Sink	B2009103-CJ-DM-008-AD
9	Room 202	Men's Toilet	B2009103-CJ-DM-009-SW
9	Room 202	Men's Toilet	B2009103-CJ-DM-009-BD
9	Room 202	Men's Toilet	B2009103-CJ-DM-009-AD



9.10. Overview of Characterization of Class 3 Open Land Areas

The impacted Class 3 open land areas at LACBWR total approximately 419,052 square meters of surface area and are located as shown on Figure 3-1. There are no documented incidents of radioactive contamination, spills of radioactive material or use of unsealed radioactive sources in these Class 3 survey units. In addition, with the exception of survey unit L3012102 which contains the site switchyard, there is no history of using these open land areas to support LACBWR operations.

Characterization inspections and surveys were performed to validate the the Class 3 classification that these survey units did not contain any residual activity in excess of 10% of an action level. Random survey locations were established in each survey unit in accordance with the survey package for soils and, if present, intact asphalt and concrete areas. The locations of any biased measurements and/or samples to be collected during the performance of the characterization were determined by the professional judgment of the Project Health Physicist and Radiological Protection Supervisor. Consideration was given to locations that exhibited measurable radioactivity and/or stained or discolored areas.

Each surface soil, subsurface soil and asphalt sample was analyzed by the on-site radiological laboratory by gamma spectroscopy for plant derived gamma emitting radionuclides. Count times were adjusted to achieve an MDC of equal to or less than 0.10 pCi/g for Cs-137 and Co-60. All samples were dried prior to analysis. Duplicate samples and concrete samples were collected by survey unit as per LACBWR Characterization Plan [Reference 11-24] requirements and sent for offsite analysis to an Energy*Solutions* QA approved vendor lab for

In addition to material sampling, direct surveys for alpha and beta gamma were performed on asphalt surfaces.

Survey unit L3012102 was not surveyed during this characterization activity as the survey unit is the site switchyard which was active at the time of the survey operations and safety considerations prohibited surveys and sampling inside the switchyard.

9.11. Survey Unit L3012101

Impacted Class 3 open land survey unit L3012101 is located to the north of the LACBWR LSE fence.

The size of the survey unit is approximately 19,239 square meters. There are no documented incidents of radioactive contamination of soils in this survey unit. There is an intact section of concrete at the north end of the survey unit which was sampled and surveyed. Additionally, several sections of concrete that wereremoved from the LACBWR Crib House (survey unit B2009101) is currently located in this survey unit. These sections of concrete were also surveyed.

The survey design for this survey unit focused on:

- Collecting samples of the concrete in the survey unit. Three (3) concrete samples were collected from random locations for offsite analysis. Additionally, prior to concrete sampling, direct beta gamma and alpha measurements and removable contamination surveys were taken at each selected sample location.
- The survey design called for three (3) surface soil samples taken at random locations and three (3) subsurface soil samples taken at the same locations selected for surface soil samples to a depth on 1-meter. One duplicate surface soil sample was taken at the location of the highest gamma scan result and a duplicate subsurface soil sample was taken at the location of the subsurface soil sample.
- The sanitary sewer tank which serves the LACBWR Administration Building had one sample collected for onsite analysis by gamma spectroscopy and a duplicate taken for offsite analysis identified as L3012101-CJ-SL-001-SM and L3012101-QQ-SL-001-SM respectively.

In summary a total of three (3) surface soil samples, three (3) subsurface soil samples, three (3) concrete samples and (1) sanitary sewer sample were taken without issue inside this survey unit.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. The analysis of the surface and subsurface soil samples from location L3012101-QQ-GS-001 exceeded 10% of the action level for tritium levels in soil.

All three surface soil and subsurface soil samples were analyzed by the on-site gamma spectroscopy system. No positive results of Cs-137 and Co-60 weredetected in any soil sample taken in this survey unit. The three concrete samples, two of the three surface soil samples and one of the three subsurface soil samples were sent off-site for isotopic analysis. H-3, Fe-55, Ni-63 and Am-243 was positively identified at concentrations greater than the instrument MDC but at concentration less than the action level. H-3 was detected at concentrations of 18.4 pCi/g in sample L3012101-QQ-GS-001-SB and 15.5 pCi/g in sample

L3012101-QQ-GS-001-SS, which exceeds 10% of the action level for H-3 (110 pCi/g). Acceptability testing of the duplicate samples soil data in accordance with Section 4.1 of the QAPP did not reveal any lab data requiring further evaluation.

The direct beta-gamma measurements that were taken on the concrete were less than 50% of the action level for structural surfaces.The direct alpha measurments identified one location which was slightly elevated. The results of the removable contamination surveys for alpha and beta-gamma contamination results were all less than the instrument MDC.

The following tables and figures are included with this survey unit:

- Table 9-25 and Table 9-26 show the summary of the surface and subsurface soil sample information and respective statistics.
- Table 9-27 shows the results of the concrete sampling and respective statistics.
- Table 9-28 and Table 9-29 shows the direct concrete survey results and removable contamination results respectively for the three (3) random concrete sample locations as well as the measurements taken on the LACBWR Crib house numbered as L3012101-BB-FC-001-CV and L3012101-BB-FC- 002-CV.
- Figure 9-14 shows the location of the random concrete and soil sampling locations.
- Table 9-54 shows the offsite radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.

Table 9-25–L3012101 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012101-CR-GS-001-SS	10/20/2014	571333.940	1642209.260	574.2	Dry			7.74E-02	7.02E-02	1.94E-02	7.19E-02
L3012101-CR-GS-002-SS	10/20/2014	571565.090	1642109.020	716.3	Dry			5.81E-02			6.51E-02
L3012101-CR-GS-003-SS	10/20/2014	572296.650	1642491.780	495.4	Dry			7.58E-02	6.10E-02	2.20E-02	8.34E-02

	Co-60		Cs-137	
# of Samples	3		3	
# >Critical Level	0		0	
Mean	7.04E-02	pCi/g	7.35E-02	pCi/g
Median	7.58E-02	pCi/g	7.19E-02	pCi/g
Max	7.74E-02	pCi/g	8.34E-02	pCi/g
Min	5.81E-02	pCi/g	6.51E-02	pCi/g
Standard Deviation	1.07E-02	pCi/g	9.25E-03	pCi/g

Table 9-26 L3012101 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012101-CR-GS-001-SB	1	10/23/2014	571333.940	1642209.260	804.2	Dry			5.37E-02			5.17E-02
L3012101-CR-GS-002-SB	1	10/20/2014	571565.090	1642109.020	839.7	Dry			4.64E-02			5.15E-02
L3012101-CR-GS-003-SB	1	10/20/2014	572296.650	1642491.780	822.8	Dry			5.25E-02			5.05E-02

	Co-60		Cs-137	
# of Measurements	3		3	
# >Critical Level	0		0	
Mean	5.09E-02	pCi/g	5.12E-02	pCi/g
Median	5.25E-02	pCi/g	5.15E-02	pCi/g
Max	5.37E-02	pCi/g	5.17E-02	pCi/g
Min	4.64E-02	pCi/g	5.05E-02	pCi/g
Standard Deviation	3.91E-03	pCi/g	6.43E-04	pCi/g

Table 9-27 L3012101 Concrete Sample Analysis

Concrete Sample Analysis

Sample ID	Date	Location		Wet/Dry	Co-60			Cs-137		
		Northing	Easting		Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012101-CR-GC-001-CV	10/20/2014	571903.110	1642404.790	Dry	1.24E-03	8.34E-03	2.84E-02			2.64E-02
L3012101-CR-GC-002-CV	10/21/2014	571942.880	1642398.160	Dry	4.51E-03	1.92E-02	3.47E-02			3.33E-02
L3012101-CR-GC-003-CV	10/21/2014	571934.600	1642426.330	Dry	5.77E-03	1.36E-02	3.07E-02	6.14E-03	1.53E-02	2.65E-02

	Co-60		Cs-137	
# of Samples	3		3	
# >Critical level	0		0	
Mean	3.13E-02	pCi/g	2.87E-02	pCi/g
Median	3.07E-02	pCi/g	2.65E-02	pCi/g
Max	3.47E-02	pCi/g	3.33E-02	pCi/g
Min	2.84E-02	pCi/g	2.64E-02	pCi/g
Standard Deviation	3.19E-03	pCi/g	3.96E-03	pCi/g

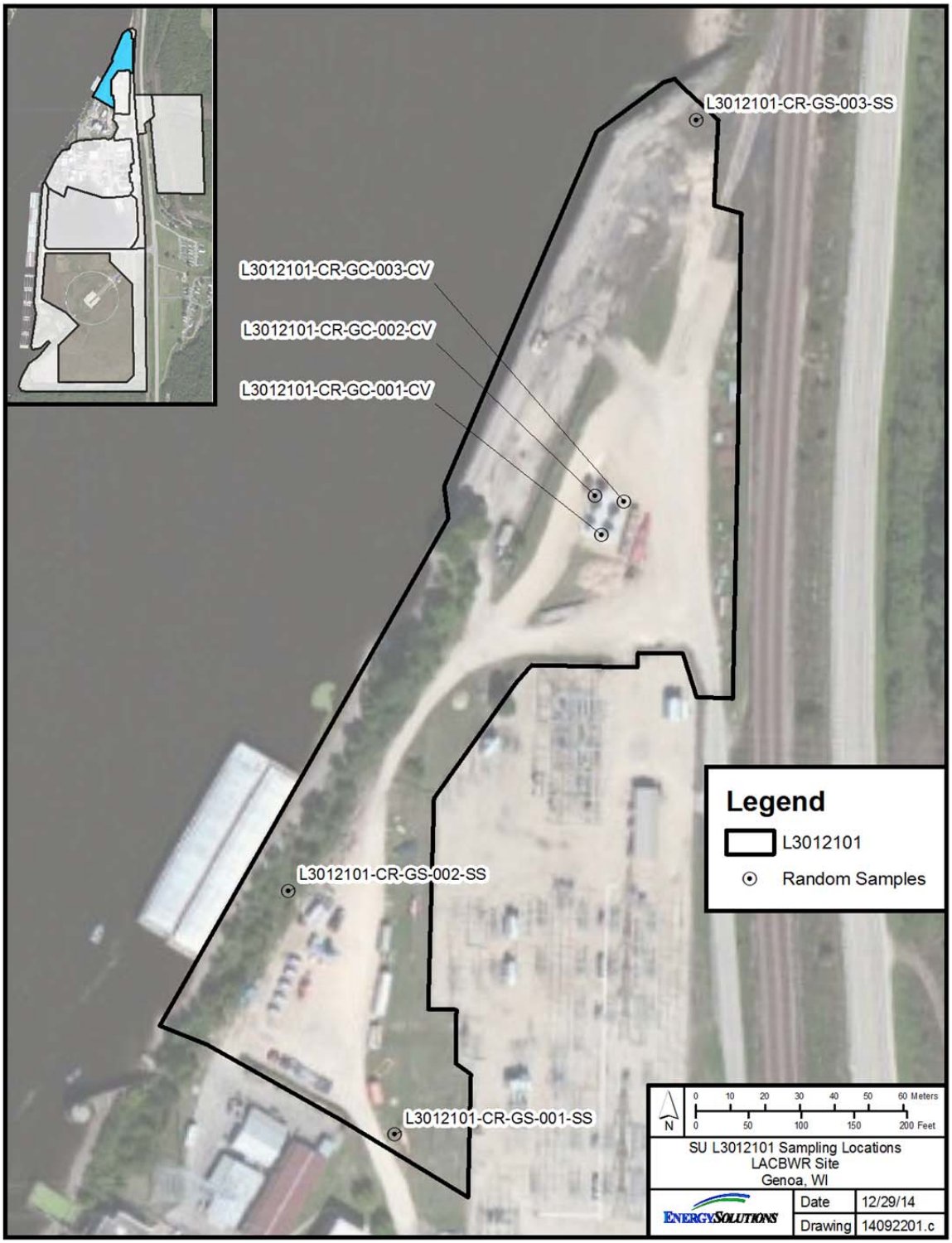
Table 9-28 L3012101 Concrete Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L3012101-CR-GC-001-CV	5	0.9	4.1	52.9	160	81.4	78.6	738
L3012101-CR-GC-002-CV	5	0.9	4.1	52.9	153.5	81.4	72.1	677
L3012101-CR-GC-003-CV	9	0.9	8.1	104.5	145.5	81.4	64.1	601.9
L3012101-BB-FC-001-CV	2.5	0.9	1.6	20.6	178	81.4	96.6	907
L3012101-BB-FC-002-CV	8	0.9	7.1	91.6	177	81.4	95.6	897.7
			Alpha MDA:	50.6			Beta MDA:	228.6

Table 9-29 L3012101 Concrete Removable Survey Results

	Alpha Removable Contamination				Beta Removable Contamination			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L3012101-CR-GC-001-SW	1.2	0.4	0.8	6	60	57.1	2.9	15.3
L3012101-CR-GC-002-SW	1	0.4	0.6	4.5	59.4	57.1	2.3	12.2
L3012101-CR-GC-003-SW	0.8	0.4	0.4	3	54.2	57.1	-2.9	-15.3
			Alpha MDA:	12.4			Beta MDA:	68.6

Figure 9-14 L3012101 Random Sample Locations



9.12. Survey Unit L3012103

Impacted Class 3 open land survey unit L3012103 is located to the south of the LACBWR.

The size of the survey unit is approximately 69,248 square meters but there are many facilities and structures inside this survey unit that are all tied to the G-3 Coal Plant operations. There are no documented incidents of radioactive contamination of soils in this survey unit. There is an intact section of asphalt in front of the G-3 Coal Plant which was

The survey design for this survey unit focused on:

- Collecting information on the asphalt in the survey unit. Three (3) asphalt samples were collected at random locations for analysis. Additionally, prior to asphalt sampling, direct beta gamma and alpha measurements were taken at each sample location. The sampling location with the highest beta gamma direct result also had a soil sample collected at a one meter depth at that location for onsite analysis.
- The survey design called for three (3) surface soil samples taken at random locations and three (3) subsurface soil samples taken at the same locations selected for surface soil samples to a depth on 1-meter. One duplicate surface soil sample was taken at the location of the highest gamma scan result and a duplicate subsurface soil sample was taken at the location of the subsurface soil sample.
- A scan using a beta-gamma detector of the Mid-Level Roof of the G-3 Coal Plant as well as six (6) direct alpha and beta-gamma measurments and removable contamination smear surveys at random locations on the roof surface. These surveys were performed to evaluate the large flat elevated open air surfaces located in the direction of typical metrology patterns of the site for atmospheric dispersion of radioactive contamination from past LACBWR operations.

In summary a total of three (3) surface soil samples, three (3) asphalt samples, and four (4) subsurface soil samples were taken without issue inside this survey unit.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. The results of all sample analysis were less than 10% of their respective action levels.

Of the three surface soil samples taken, only one identified Cs-137 at concentrations greater than the instrument MDC. The positive Cs-137 concentration was 0.071 pCi/g. Of the four subsurface soil samples taken, only one identified Cs-137 at concentrations greater than the instrument MDC. The positive Cs-137 concentration was 0.039 pCi/g. No other positive results of Cs-137 and Co-60 was detected in any other soil sample taken in this survey unit at concentrations greater than the instrument MDC. One concrete sample and one subsurface soil sample were sent off-site for isotopic analysis. H-3, C-14, Fe-55 and Eu-155 was positively identified at concentrations greater than the instrument MDC but at concentration less than the action level. Acceptability testing of the duplicate samples soil data in accordance with Section 4.1 of the QAPP did not reveal any lab data requiring further evaluation.

The results of the direct alpha and beta-gamma measurments taken on the asphalt wereless than 50% of action levels for structural surfaces.

The beta scan of the G-3 Coal Plant roof identified scan results ranging from 2,302 dpm/100 cm^2 to 2,816 dpm/100 cm^2 with a scan MDC of 2,816 dpm/100cm^2. The results of direct beta-gamma and alpha mesurements taken on the roof identified gross beta-gamma activity ranging from 1603 dpm/100cm2 to 2072 dpm/100cm2 and gross alpha measurments ranging from 142 dpm/100cm2 to 258 dpm/100cm2. While these levels as elevated, the beta-gamma results are less than 50% of the action level for structural surfaces.

The following tables and figures are included with this survey unit:

- Table 9-30 and Table 9-31 show the summary of the surface and subsurface soil sample information and respective statistics.
- Table 9-32 shows the results of the asphalt sampling and respective statistics.
- Table 9-33 shows the direct asphalt survey results.
- Table 9-34 and Table 9-35 show the results of the direct surveys and removable contamination surveys on the G-3 Coal Plant Roof and respective statistics.
- Figure 9-15 shows the location of the random asphalt and soil sampling locations.
- Figure 9-16 shows the location of the random direct readings on the G-3 Coal Plant Roof.
- Table 9-54 shows the offsite radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.

Table 9-30 L3012103 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical level (pCi/g)
L3012103-CR-GS-001-SS	11/10/2014	570160.170	1642339.040	619.9	Dry			7.82E-02			8.25E-02
L3012103-CR-GS-002-SS	11/10/2014	570501.510	1641478.240	569.0	Dry			7.54E-02			9.24E-02
L3012103-CR-GS-003-SS	11/11/2014	570684.610	1642527.940	751.1	Dry			5.71E-02	7.06E-02	1.04E-02	3.55E-02

	Co-60		Cs-137	
# of Samples	3		3	
# >Critical Level	0		1	
Mean	7.02E-02	pCi/g	8.18E-02	pCi/g
Median	7.54E-02	pCi/g	8.25E-02	pCi/g
Max	7.82E-02	pCi/g	9.24E-02	pCi/g
Min	5.71E-02	pCi/g	7.06E-02	pCi/g
Standard Deviation	1.15E-02	pCi/g	1.09E-02	pCi/g

Table 9-31–L3012103 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012103-CR-GS-001-SB	1	11/10/2014	570859.420	1642237.140	806.7	Dry			5.36E-02	3.38E-02	7.96E-03	3.68E-02
L3012103-CR-GS-002-SB	1	11/11/2014	570160.170	1642339.040	791.7	Dry			5.80E-02	3.92E-02	8.68E-03	3.44E-02
L3012103-CR-GS-003-SB	1	11/11/2014	570501.510	1641478.240	551.6	Dry			8.37E-02			8.08E-02
L3012103-CR-GS-004-SB	1	11/11/2014	570684.610	1642527.940	837.6	Dry			4.65E-02	3.24E-02	6.86E-03	3.60E-02

	Co-60		Cs-137	
# of Measurements	4		4	
# >Critical Level	0		1	
Mean	6.05E-02	pCi/g	4.82E-02	pCi/g
Median	5.58E-02	pCi/g	3.80E-02	pCi/g
Max	8.37E-02	pCi/g	8.08E-02	pCi/g
Min	4.65E-02	pCi/g	3.60E-02	pCi/g
Standard Deviation	1.62E-02	pCi/g	2.18E-02	pCi/g

Table 9-32 L3012103 Asphalt Sample Analysis

Asphalt Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level(pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012103-CR-PA-001-AV	11/10/2014	570866.870	1642025.040	797.5	Dry			5.26E-02			5.09E-02
L3012103-CR-PA-002-AV	11/10/2014	570859.420	1642237.140	742.1	Dry			5.25E-02			5.24E-02
L3012103-CR-PA-003-AV	11/10/2014	570801.420	1641731.760	778.2	Dry			5.51E-02	2.05E-02	6.37E-03	2.83E-02

	Co-60		Cs-137	
# of Measurements	3		3	
# >Critical Level	0		0	
Mean	5.34E-02	pCi/g	4.39E-02	pCi/g
Median	5.26E-02	pCi/g	5.09E-02	pCi/g
Max	5.51E-02	pCi/g	5.24E-02	pCi/g
Min	5.25E-02	pCi/g	2.83E-02	pCi/g
Standard Deviation	1.47E-03	pCi/g	1.35E-02	pCi/g

Table 9-33 L3012103 Asphalt Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L3012103-CR-PA-001-AV	4	1	3	38.7	153.5	74.4	79.1	742.7
L3012103-CR-PA-002-AV	1	1	0	0	131	74.4	56.6	531.5
L3012103-CR-PA-003-AV	2.5	1	1.5	19.4	113.5	74.4	39.1	367.1
			Alpha MDA:	52.2			Beta MDA:	219.1

Table 9-34 Coal Plant Roof Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L3012103-CR-RT-001-BD					306	85.3	220.7	2072.3
L3012103-CR-RT-001-AD	20.5	0.5	20	258.1				
L3012103-CR-RT-002-BD					262.5	85.3	177.2	1663.8
L3012103-CR-RT-002-AD	12	0.5	11.5	148.4				
L3012103-CR-RT-003-BD					258.5	85.3	173.2	1626.3
L3012103-CR-RT-003-AD	17.5	0.5	17	219.4				
L3012103-CR-RT-004-BD					301	85.3	215.7	2025.4
L3012103-CR-RT-004-AD	11.5	0.5	11	141.9				
L3012103-CR-RT-005-BD					269.5	85.3	184.2	1729.6
L3012103-CR-RT-005-AD	11.5	0.5	11	141.9				
L3012103-CR-RT-006-BD					256	85.3	170.7	1602.8
L3012103-CR-RT-006-AD	17	0.5	16.5	212.9				
			Alpha MDA:	42.6			Beta MDA:	233.7

Table 9-35 Coal Plant Roof Removable Survey Results

	Alpha Removable Contamination				Beta Removable Contamination			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L3012103-CR-RT-001-SW	0.6	0.3	0.3	2.6	51.6	58.2	-6.6	-34.7
L3012103-CR-RT-002-SW	0	0.3	-0.3	-1.9	65.2	58.2	7	37.3
L3012103-CR-RT-003-SW	0	0.3	-0.3	-1.9	50.8	58.2	-7.4	-38.9
L3012103-CR-RT-004-SW	0.2	0.3	-0.1	-0.4	57	58.2	-1.2	-6.1
L3012103-CR-RT-005-SW	0.6	0.3	0.3	2.6	55.4	58.2	-2.8	-14.6
L3012103-CR-RT-006-SW	0	0.3	-0.3	-1.9	56.6	58.2	-1.6	-8.2
			Alpha MDA:	10.7			Beta MDA:	69.2

Figure 9-15 L3012103 Random Sample Locations

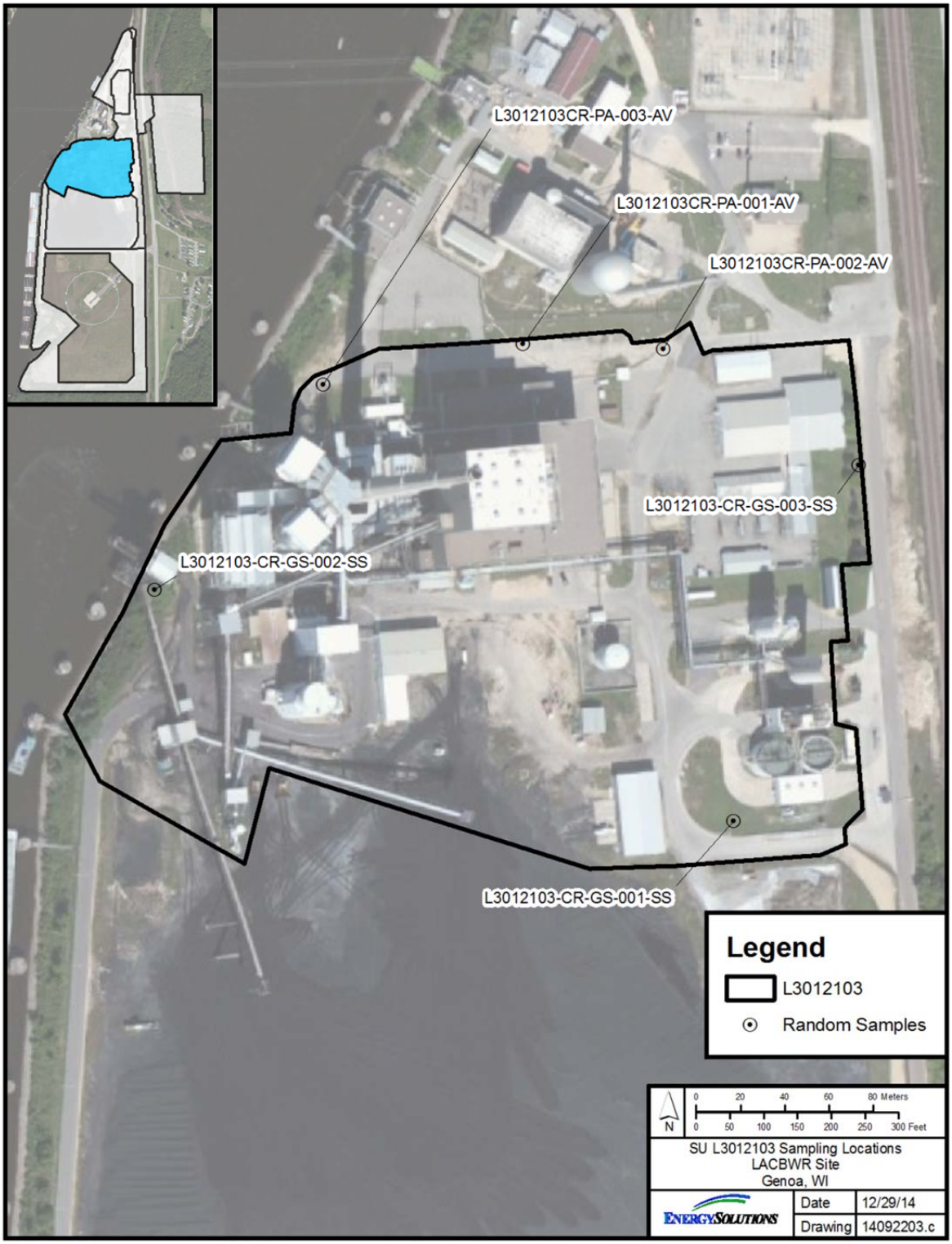
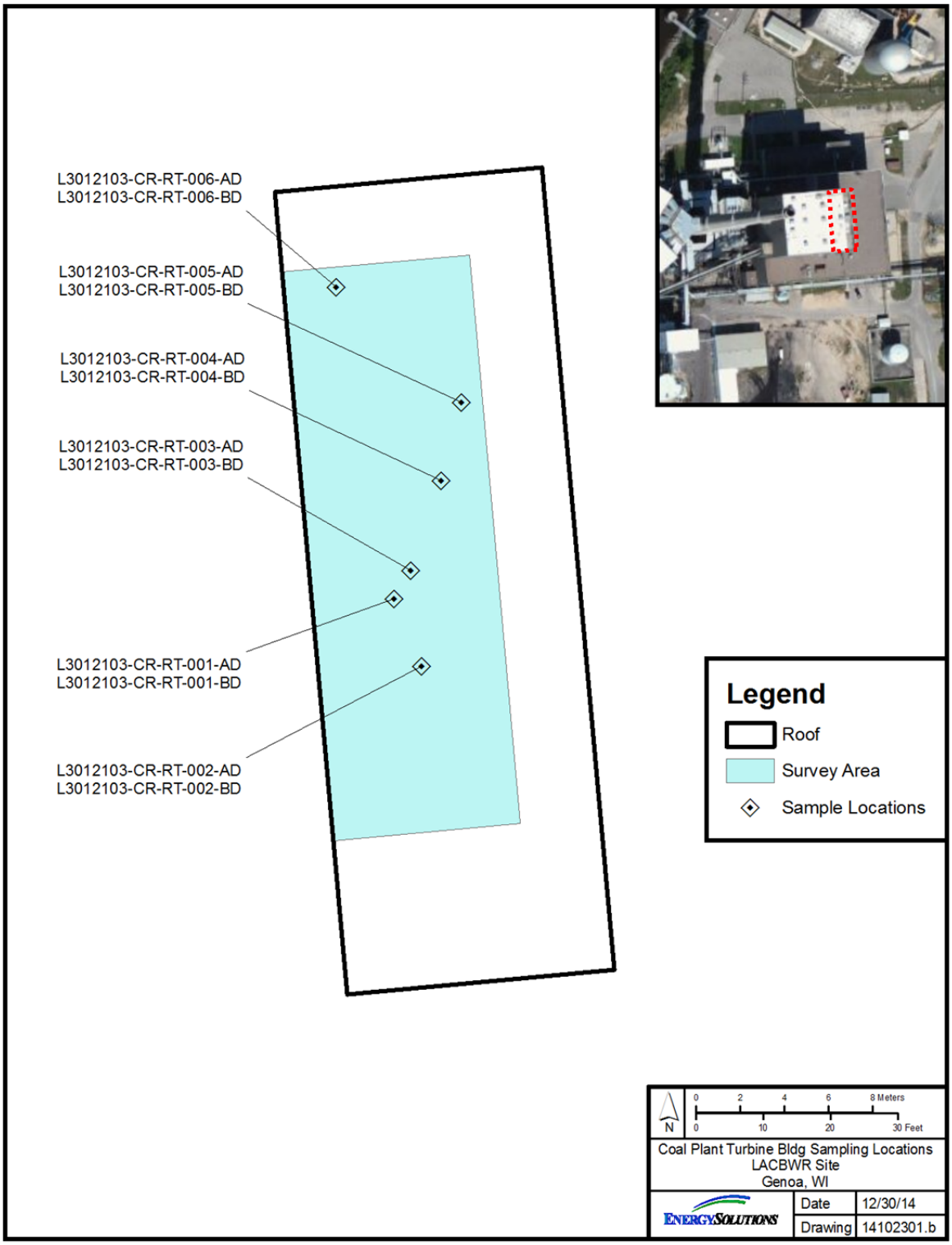


Figure 9-16 L3012103 Roof Sample Locations



9.13. Survey Unit L3012104

Impacted Class 3 open land survey unit L3012104 is located to the east of the LACBWR LSE fence.

The size of the survey unit is approximately 28,695 square meters. There are no documented incidents of radioactive contamination of soils in this survey unit. There is an intact section of asphalt which extends largely as part of the site access road from south to north through the survey unit which was sampled and surveyed.

The survey design for this survey unit focused on:

- Collecting information on the asphalt in the survey unit. Three (3) asphalt samples were collected at random locations for analysis. Additionally, prior to asphalt sampling, direct beta gamma and alpha measurements were taken at each sample location. The sampling location with the highest beta gamma direct result also had a soil sample collected at a one meter depth at that location for onsite analysis.
- The survey design called for three (3) surface soil samples taken at random locations and three (3) subsurface soil samples taken at the same locations selected for surface soil samples to a depth on 1-meter.One duplicate surface soil sample was taken at the location of the highest gamma scan result and a duplicate subsurface soil sample was taken at the location of the subsurface soil sample
- Collection of one (1) surface soil sample at the low point for the storm sewer basin. Two (2) duplicate samples were also collected for offsite analysis

In summary a total of (4) surface soil samples, (3) asphalt samples, and (4) subsurface soil samples were taken without issue inside this survey unit.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. The results of all sample analysis were less than 10% of their respective action levels.

Cs-137 was positively detected at concentrations greater than the instrument MDC in all surface soil samples taken. Cs-137 concentrations ranged from 0.14 pCi/g to 0.28 pCi/g. Cs-137 was also detected in the two sediment samples with concentrations ranging from 0.075 pCi/g to 0.089 pCi/g. Cs-137 was not detected at concentrations greater than the instrument MDC in any subsurface soil sample. Co-60 was not detected in any sample at a concentration greater than the instrument MDC.

Two sediment samples, a surface soil sample and a subsurface soil sample were sent off-site for isotopic analysis. H-3, Fe-55, Eu-155, Np-237, Pu-239/240 and Am-243 was positively identified at concentrations greater than the instrument MDC but at concentration less than the action level.

Acceptability testing of the duplicate samples soil data in accordance with Section 4.1 of the QAPP revealed one sample, L3012104-CR-GS-002SS, and its duplicate sample slightly elevated outside of its acceptable ratio of 1.66 with a ratio of 1.90. Due to the fact that the Cs-137 concentrations in question are quite low with values less than 0.30 pCi/g, it was determed thatno further evaluation was necessary.

The results of the direct alpha and beta-gamma measurments taken on the asphalt were less than 50% of action levels for structural surfaces.

The following tables and figures are included with this survey unit:

- Table 9-36 and Table 9-37 show the summary of the surface and subsurface soil sample information and respective statistics.
- Table 9-38 shows the results of the asphalt sampling and respective statistics.
- Table 9-39 shows the direct asphalt survey results.
- Figure 9-17 shows the location of the random asphalt and soil sampling locations.
- Figure 9-18 shows the biased location of the storm sewer basin soil samples.
- Table 9-54 shows the offsite Class 3 radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.

Table 9-36 L3012104 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012104-CR-GS-001-SS	11/13/2014	572254.400	1642514.620	526.3	Dry			7.75E-02	1.43E-01	1.68E-02	6.18E-02
L3012104-CR-GS-002-SS	11/13/2014	571096.160	1642537.820	621.5	Dry			6.70E-02	2.67E-01	2.05E-02	4.51E-02
L3012104-CR-GS-003-SS	11/13/2014	569565.100	1642640.550	743.9	Dry			5.33E-02	1.87E-01	5.60E-03	2.98E-02
L3012104-CR-GS-001-SM	11/6/2014	571095.041	1642520.730	648.3	Dry			6.37E-02	8.85E-02	1.29E-02	5.47E-02
L3012104-CR-GS-002-SM	11/6/2014	571095.041	1642520.730	771.7	Dry			5.56E-02	7.53E-02	9.97E-03	3.61E-02

	Co-60		Cs-137	
# of Samples	5		5	
# >Critical level	0		5	
Mean	6.34E-02	pCi/g	1.52E-01	pCi/g
Median	6.37E-02	pCi/g	1.43E-01	pCi/g
Max	7.75E-02	pCi/g	2.67E-01	pCi/g
Min	5.33E-02	pCi/g	7.53E-02	pCi/g
Standard Deviation	9.68E-03	pCi/g	7.82E-02	pCi/g

Table 9-37–L3012104 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012104-CR-GS-001-SB	1	11/13/2014	570585.810	1642552.730	795.0	Dry			9.98E-02			1.01E-01
L3012104-CR-GS-002-SB	1	11/13/2014	572254.400	1642514.620	893.6	Dry			4.55E-02			4.54E-02
L3012104-CR-GS-003-SB	1	11/13/2014	571096.160	1642537.820	677.1	Dry			6.52E-02			6.70E-02
L3012104-CR-GS-004-SB	1	11/13/2014	569565.100	1642640.550	459.6	Dry			7.93E-02	3.71E-02	1.13E-02	5.02E-02

	Co-60		Cs-137	
# of Measurements	4		4	
# >Critical Level	0		0	
Mean	7.25E-02	pCi/g	6.59E-02	pCi/g
Median	7.23E-02	pCi/g	5.86E-02	pCi/g
Max	9.98E-02	pCi/g	1.01E-01	pCi/g
Min	4.55E-02	pCi/g	4.54E-02	pCi/g
Standard Deviation	2.29E-02	pCi/g	2.52E-02	pCi/g

Table 9-38 L3012104 Asphalt Sample Analysis

Asphalt Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012104-CR-PA-001-AV	11/12/2014	569437.520	1642561.020	806.6	Dry			7.06E-02			7.88E-02
L3012104-CR-PA-002-AV	11/12/2014	570082.080	1642580.900	843.1	Dry			8.01E-02			7.57E-02
L3012104-CR-PA-003-AV	11/13/2014	570585.810	1642552.730	779.8	Dry			7.51E-02			7.72E-02

	Co-60		Cs-137	
# of Measurements	3		3	
# >Critical Level	0		0	
Mean	7.53E-02	pCi/g	7.72E-02	pCi/g
Median	7.51E-02	pCi/g	7.72E-02	pCi/g
Max	8.01E-02	pCi/g	7.88E-02	pCi/g
Min	7.06E-02	pCi/g	7.57E-02	pCi/g
Standard Deviation	4.75E-03	pCi/g	1.55E-03	pCi/g

Table 9-39 L3012104 Asphalt Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L3012104-CA-PA-001-AV	3	1.5	1.5	18.6	347	146.2	200.8	1763.2
L3012104-CA-PA-002-AV	1.5	1.5	0	0	311	146.2	164.8	1447.4
L3012104-CA-PA-003-AV	3	1.5	1.5	18.6	367	146.2	220.8	1938.6
			Alpha MDA:	57.4			Beta MDA:	282.2

Figure 9-17 L3012104 Random Sample Locations

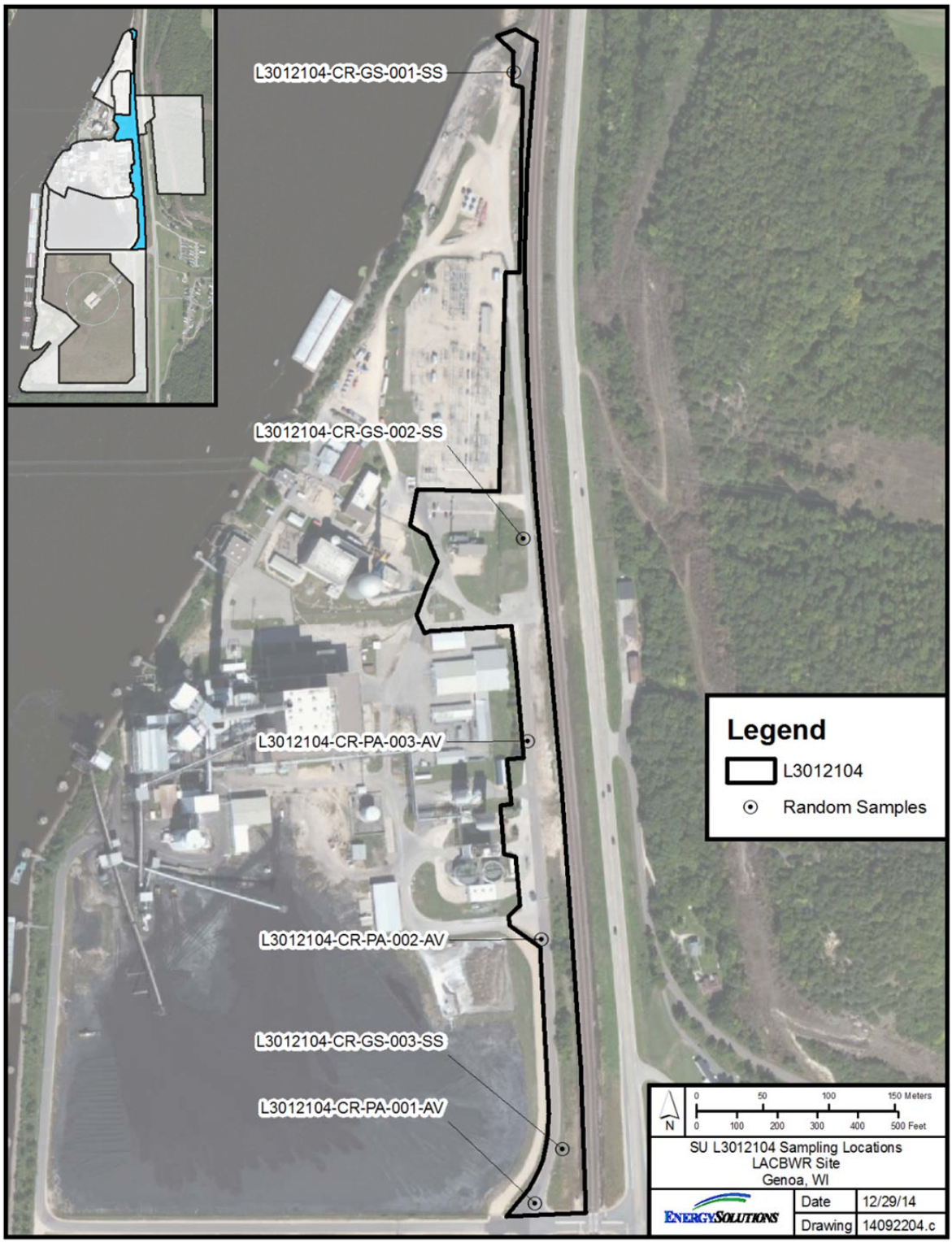
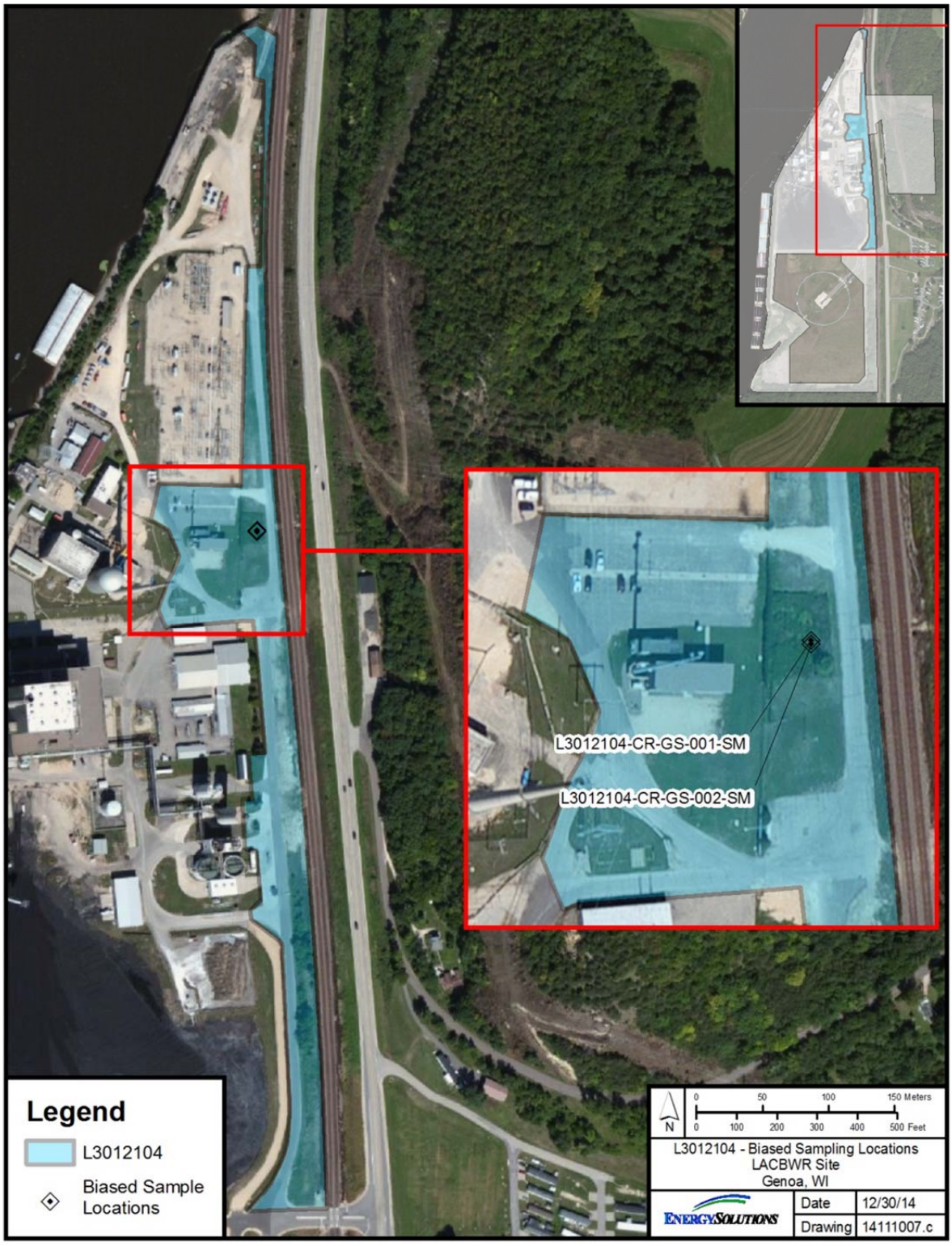


Figure 9-18 L3012104 Biased Sampling Locations



9.14. Survey Unit L3012105

Impacted Class 3 open land survey unit L3012105 is located to the south of the LACBWR LSE fence and primarily consists of the G-3 coal yard.

The size of the survey unit is approximately 82,894 square meters but a large percentage of this survey unit is typically covered with coal for the G-3 Coal Plant operations. There are no documented incidents of radioactive contamination of soils in this survey unit.

The survey design called for three (3) surface soil samples taken at random locations and three (3) subsurface soil samples taken at the same locations selected for surface soil samples to a depth on 1-meter. The locations selected were from the available soil areas at the boundaries around the coal pile. One duplicate surface soil sample was taken at the location of the highest gamma scan result and a duplicate subsurface soil sample was taken at the location of the sub surface soil sample.

In summary a total of (3) surface soil samples and (3) subsurface soil samples were taken without issue inside this survey unit.

One (1) sample of the coal pile was also collected for onsite gamma spectroscopy analysis and then sent off site for gamma spectroscopy comparative analysis.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. The results of all sample analysis were less than 10% of their respective action levels. In addition analysis of the sample taken from the coal pile did not contain any plant derived radionuclides.

Cs-137 was positively detected at concentrations greater than the instrument MDC one of the three surface soil samples taken. Cs-137 concentration in that sample measured 0.068 pCi/g. Cs-137 was not detected at concentrations greater than the instrument MDC in any subsurface soil sample. Co-60 was not detected in any sample at a concentration greater than the instrument MDC.

Two surface soil samples, a subsurface soil sample and the sample taken of the Coal Pile were sent off-site for isotopic analysis. Fe-55, Sr-90 and Am-243 was positively identified in the soil samples at concentrations greater than the instrument MDC but at concentration less than the action level. No ROC were positively detected in the sample from the Coal Pile.

Acceptability testing of the duplicate samples soil data in accordance with Section 4.1 of the QAPP revealed no cases of not meeting acceptance criteria.

The following tables and figures are included with this survey unit:

- Table 9-40 and Table 9-41 show the summary of the surface and subsurface soil sample information and respective statistics.
- Figure 9-19 shows the location of the random soil sampling locations.
- Table 9-54 shows the offsite Class 3 radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.

Table 9-40–L3012105 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012105-CR-GS-001-SS	11/7/2014	569855.110	1642528.810	624.0	Dry			7.22E-02	6.78E-02	1.22E-02	6.00E-02
L3012105-CR-GS-002-SS	11/7/2014	570130.170	1641421.940	720.4	Dry			5.69E-02			6.01E-02
L3012105-CR-GS-003-SS	11/7/2014	569411.040	1642269.490	465.8	Dry			8.44E-02	4.15E-02	9.89E-03	5.51E-02

	Co-60		Cs-137	
# of Samples	3		3	
# >Critical Level	0		1	
Mean	7.12E-02	pCi/g	6.10E-02	pCi/g
Median	7.22E-02	pCi/g	6.01E-02	pCi/g
Max	8.44E-02	pCi/g	6.78E-02	pCi/g
Min	5.69E-02	pCi/g	5.51E-02	pCi/g
Standard Deviation	1.38E-02	pCi/g	6.40E-03	pCi/g

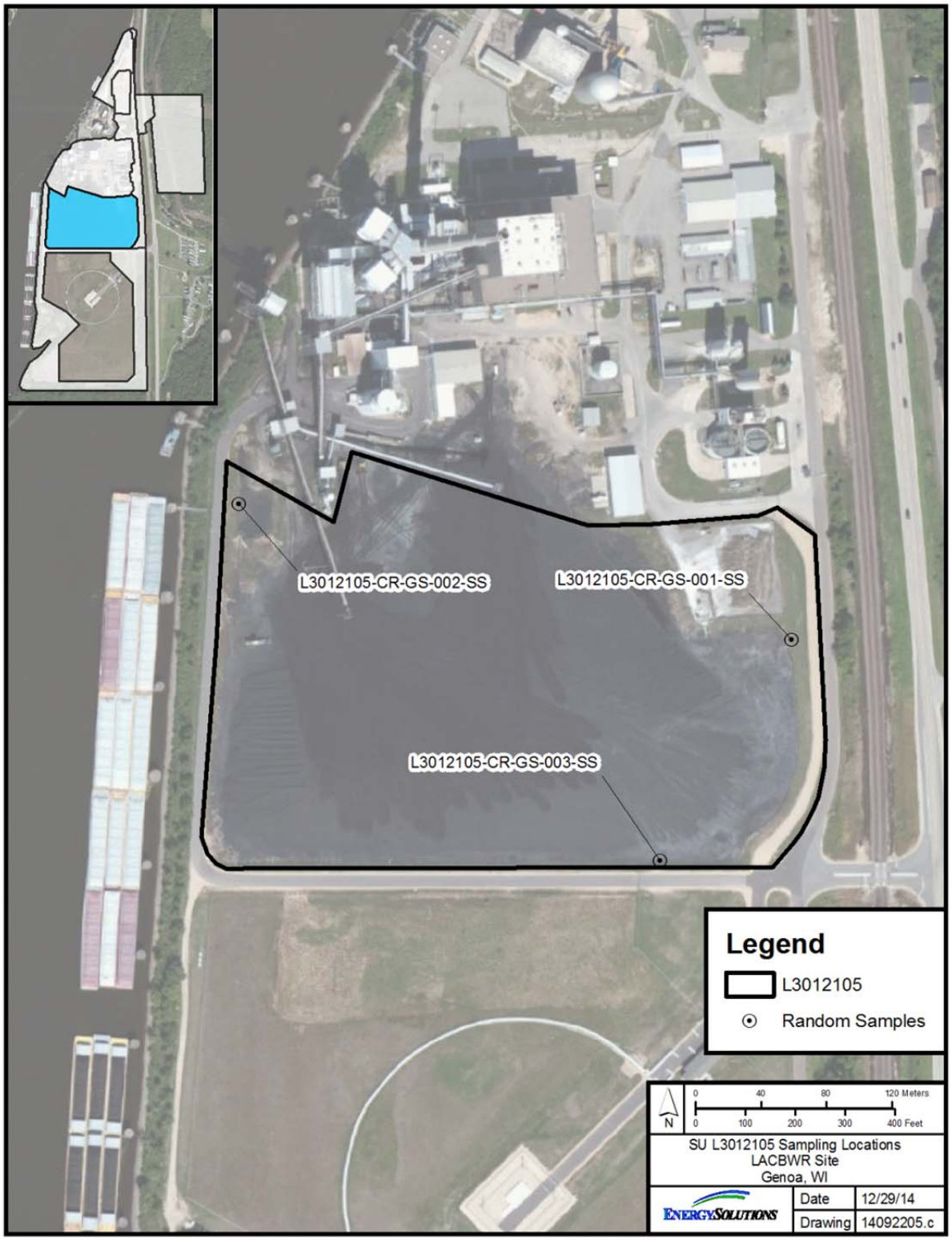
Table 9-41–L3012105 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012105-CR-GS-001-SB	1	11/7/2014	569855.110	1642528.810	643.4	Dry			6.81E-02	5.63E-02	1.06E-02	4.29E-02
L3012105-CR-GS-002-SB	1	11/7/2014	570130.170	1641421.940	835.3	Dry			5.17E-02	1.78E-02	6.29E-03	2.98E-02
L3012105-CR-GS-003-SB	1	11/7/2014	569411.040	1642269.490	705.7	Dry			6.34E-02	2.98E-02	7.91E-03	4.01E-02

	Co-60		Cs-137	
# of Measurements	3		3	
# >Critical Level	0		1	
Mean	6.11E-02	pCi/g	4.21E-02	pCi/g
Median	6.34E-02	pCi/g	4.01E-02	pCi/g
Max	6.81E-02	pCi/g	5.63E-02	pCi/g
Min	5.17E-02	pCi/g	2.98E-02	pCi/g
Standard Deviation	8.45E-03	pCi/g	1.34E-02	pCi/g

Figure 9-19 L3012105 Random Sample Locations



9.15. Survey Unit L3012106

Impacted Class 3 open land survey unit L3012106 is located to the south end of the LACBWR licensed site. The survey unit surrounds the ISFSI licensed area of the LACBWR Site.

The size of the survey unit is approximately 116,565 square meters. There are no documented incidents of radioactive contamination of soils in this survey unit. There is an intact sectionof asphalt which extends as part of the site access road to the boat landing area at the south end of the site which was sampled and surveyed.

The survey design for this survey unit focused on:

- Collecting information on the asphalt in the survey unit. Three (3) asphalt samples were collected at random locations for analysis. Additionally, prior to asphalt sampling, direct beta gamma and alpha measurements were taken of each sample location. The sampling location with the highest beta gamma direct result also had a soil sample collected at a one meter depth at that location for onsite analysis
- The survey design called for three (3) surface soil samples taken at random locations and three (3) subsurface soil samples taken at the same locations selected for surface soil samples to a depth on 1-meter. One (1) duplicate surface soil sample was taken at the location of the highest gamma scan result and a duplicate subsurface soil sample was taken at the location of the subsurface soil sample.

In summary a total of three (3) surface soil samples, three (3) asphalt samples, and four (4) subsurface soil samples were taken without issue inside this survey unit.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. The analysis of the subsurface soil sample from location L3012106-QJ-GS-001 exceeded 10% of the action level for tritium levels in soil.

All three surface soil and subsurface soil samples were analyzed by the on-site gamma spectroscopy system. Cs-137 was positively detected at concentrations greater than the instrument MDC two of the three surface soil samples taken. Cs-137 concentration in those two samples measured 0.12 pCi/g and 0.099 pCi/g respectively. Cs-137 was positively detected at concentrations greater than the instrument MDC two of the four subsurface soil samples taken. Cs-137 concentration in those two samples measured 0.054 pCi/g and 0.130 pCi/g respectively. Co-60 was not detected in any sample at a concentration greater than the instrument MDC. One surface and one subsurface soil sample was sent off-site for isotopic analysis. H-3, Fe-55, Ni-63, Eu-152, Eu-155 and Am-243 was positively identified at concentrations greater than the instrument MDC but at concentration less than the action level. H-3 was detected at concentrations of 14.2 pCi/g in sample L3012106-QJ-GS-001-SB which exceeds 10% of the action level for H-3 (110 pCi/g).

Acceptability testing of the duplicate sample soil data in accordance with Section 4.1 of the QAPP revealed no cases of not meeting acceptance criteria.

The direct beta-gamma measurments taken on the asphalt were less than 50% of the action levels for structural surfaces. The direct alpha measurements taken on the asphalt was slightly elevated. The area was resurveyed the following day and the elevated alpha

measurement was not reproduced. This investigation combined with the negative results of the gamma spectroscopy analysis of the sample of asphalt, no additional investigations were performed.

The following tables and figures are included with this survey unit:

- Table 9-42 and Table 9-43 show the summary of the surface and subsurface soil sample information and respective statistics.
- Table 9-44 shows the results of the asphalt sampling and respective statistics.
- Table 9-45 and Table 9-46 (L3012106-CR-PA-003-AV area investigation) show the direct asphalt survey results.
- Figure 9-20 shows the location of the random asphalt and soil sampling locations.
- Table 9-54 shows the offsite radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.

Table 9-42 L3012106 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012106-CR-GS-001-SS	11/13/2014	568251.690	1641425.180	562.6	Dry			8.95E-02	1.21E-01	1.58E-02	7.32E-02
L3012106-CR-GS-002-SS	11/13/2014	567726.420	1642679.520	564.2	Dry			8.44E-02	9.94E-02	1.45E-02	6.07E-02
L3012106-CR-GS-003-SS	11/13/2014	569930.220	1641297.590	665.4	Dry			7.20E-02			7.85E-02

	Co-60		Cs-137	
# of Samples	3		3	
# >Critical level	0		2	
Mean	8.20E-02	pCi/g	9.96E-02	pCi/g
Median	8.44E-02	pCi/g	9.94E-02	pCi/g
Max	8.95E-02	pCi/g	1.21E-01	pCi/g
Min	7.20E-02	pCi/g	7.85E-02	pCi/g
Standard Deviation	9.00E-03	pCi/g	2.13E-02	pCi/g

Table 9-43 L3012106 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012106-CR-GS-001-SB	1	11/13/2014	567593.860	1641660.470	626.4	Dry			7.04E-02	5.35E-02	1.14E-02	5.04E-02
L3012106-CR-GS-002-SB	1	11/13/2014	568251.690	1641425.180	543.9	Dry			9.54E-02	1.30E-01	1.70E-02	6.28E-02
L3012106-CR-GS-003-SB	1	11/14/2014	567726.420	1642679.520	770.1	Dry			5.61E-02			5.97E-02
L3012106-CR-GS-004-SB	1	11/14/2014	569930.220	1641297.590	714.3	Dry			1.02E-01			1.08E-01

	Co-60		Cs-137	
# of Measurements	4		4	
# >Critical Level	0		2	
Mean	8.10E-02	pCi/g	8.78E-02	pCi/g
Median	8.29E-02	pCi/g	8.39E-02	pCi/g
Max	1.02E-01	pCi/g	1.30E-01	pCi/g
Min	5.61E-02	pCi/g	5.35E-02	pCi/g
Standard Deviation	2.15E-02	pCi/g	3.72E-02	pCi/g

Table 9-44 L3012106 Asphalt Sample Analysis

Asphalt Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012106-CR-PA-001-AV	11/13/2014	568251.690	1642566.840	698.3	Dry			8.22E-02			8.36E-02
L3012106-CR-PA-002-AV	11/13/2014	567593.860	1641660.470	829.4	Dry			6.47E-02	2.19E-02	7.38E-03	4.00E-02
L3012106-CR-PA-003-AV	11/13/2014	569250.850	1642546.960	784.1	Dry			4.65E-02			4.94E-02

	Co-60		Cs-137	
# of Measurements	3		3	
# >Critical Level	0		0	
Mean	6.45E-02	pCi/g	5.77E-02	pCi/g
Median	6.47E-02	pCi/g	4.94E-02	pCi/g
Max	8.22E-02	pCi/g	8.36E-02	pCi/g
Min	4.65E-02	pCi/g	4.00E-02	pCi/g
Standard Deviation	1.79E-02	pCi/g	2.29E-02	pCi/g

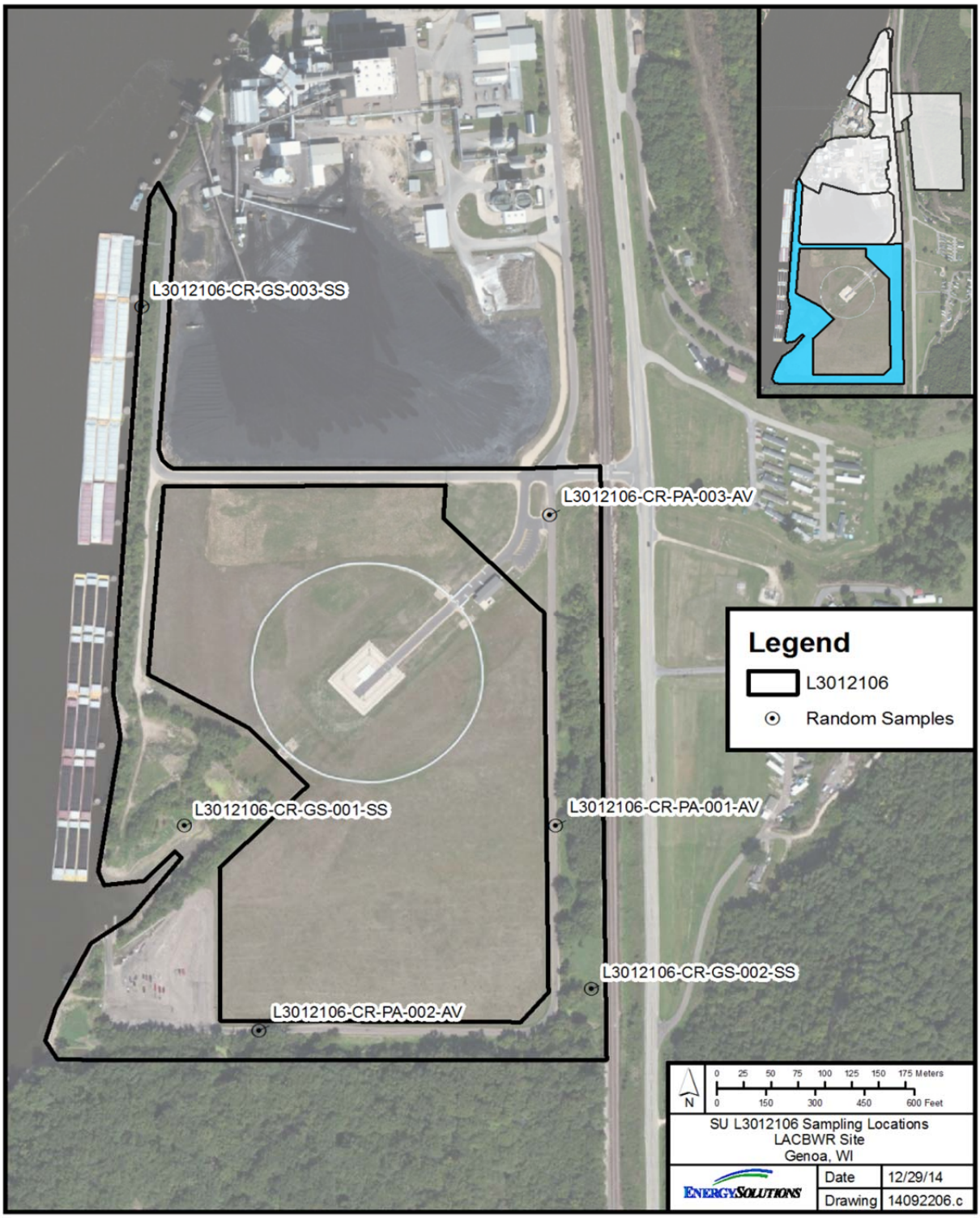
Table 9-45 L3012106 Asphalt Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
L3012106-CR-PA-001-AV	3.5	0.9	2.6	33.5	296.5	135.8	160.7	1516.4
L3012106-CR-PA-002-AV	2	0.9	1.1	14.2	279	135.8	143.2	1352.1
L3012106-CR-PA-003-AV	10.5	0.9	9.6	123.9	147.5	135.8	11.7	117.4
			Alpha MDA:	50.6			Beta MDA:	291.6

Table 9-46 Asphalt Location L3012106-CR-PA-003-AV Direct Survey Results

	Alpha Directs				Beta Directs			
Sample Number	gross cpm	background cpm	net cpm	dpm/100cm^2	gross cpm	background cpm	net cpm	dpm/100cm^2
CORE	1.5	0.6	0.9	11.6	144	167	-23	-216
ON CORE HOLE	3	0.6	2.4	31	120	167	-47	-441.3
1 FT NORTH	2	0.6	1.4	18.1	108.5	167	-58.5	-549.3
1 FT SOUTH	5.5	0.6	4.9	63.2	118.5	168	-49.5	-464.8
1 FT EAST	3.5	0.6	2.9	37.4	120	169	-49	-460.1
1 FT WEST	6	0.6	5.4	69.7	112.5	170	-57.5	-539.9
			Alpha MDA:	44.8			Beta MDA:	322.1

Figure 9-20 L3012106 Random Sample Locations



9.16. Survey Unit L3012107

Impacted Class 3 open land survey unit L3012107 is located across Highway 35 to the east of the LACBWR Site.

The size of the survey unit is approximately 81,254 square meters. There are no documented incidents of radioactive contamination of soils in this survey unit.

The survey design called for three (3) surface soil samples taken at random locations and three (3) subsurface soil samples taken at the same locations selected for surface soil samples to a depth on 1-meter. One duplicate surface soil sample was taken at the location of the highest gamma scan result and a duplicate subsurface soil sample was taken at the location of the sub surface soil sample.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. The results of all sample analysis were less than 10% of their respective action levels.

All three surface soil and subsurface soil samples were analyzed by the on-site gamma spectroscopy system. Cs-137 was positively detected at concentrations greater than the instrument MDC all three surface soil samples taken. Cs-137 concentration in those three samples measured 0.065, 0.263 pCi/g and 0.463 pCi/g respectively. Cs-137 was positively detected at concentrations greater than the instrument MDC two of the three subsurface soil samples taken. Cs-137 concentration in those two samples measured 0.091 pCi/g and 0.056 pCi/g respectively. Co-60 was not detected in any sample at a concentration greater than the instrument MDC. One surface and one subsurface soil sample was sent off-site for isotopic analysis. H-3, Fe-55 and Cm-243 was positively identified at concentrations greater than the instrument MDC but at concentration less than the action level.

Acceptability testing of the duplicate samples soil data in accordance with Section 4.1 of the QAPP revealed one case with the surface soil sample L2012107-QJ-GS-001 and its duplicate sample that did not meet its acceptance test on the upper bound of 2.0 with an acceptable ratio of 3.77. Due to the fact that the Cs-137 activities values were less than 0.25 pCi/g,no further evaluation was conducted.

The following tables and figures are included with this survey unit:

- Table 9-47 and Table 9-48 show the summary of the surface and subsurface soil sample information and respective statistics.
- Figure 9-21 shows the location of the random soil sampling locations.
- Table 9-54 shows the offsite radio analytical data.
- Table 9-55 shows the location relationship of the duplicate sample for offsite analysis was taken.

Table 9-47–L3012107 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012107-CR-GS-001-SS	11/10/2014	570947.280	1642846.690	595.6	Dry			7.20E-02	6.49E-02	1.19E-02	4.73E-02
L3012107-CR-GS-002-SS	11/10/2014	571385.550	1643213.710	606.2	Dry			8.89E-02	2.63E-01	2.01E-02	5.86E-02
L3012107-CR-GS-003-SS	11/10/2014	570260.450	1643027.300	594.5	Dry			7.87E-02	4.63E-01	2.76E-02	6.21E-02

	Co-60		Cs-137	
# of Samples	3		3	
# >Critical Level	0		2	
Mean	7.99E-02	pCi/g	2.64E-01	pCi/g
Median	7.87E-02	pCi/g	2.63E-01	pCi/g
Max	8.89E-02	pCi/g	4.63E-01	pCi/g
Min	7.20E-02	pCi/g	6.49E-02	pCi/g
Standard Deviation	8.51E-03	pCi/g	1.99E-01	pCi/g

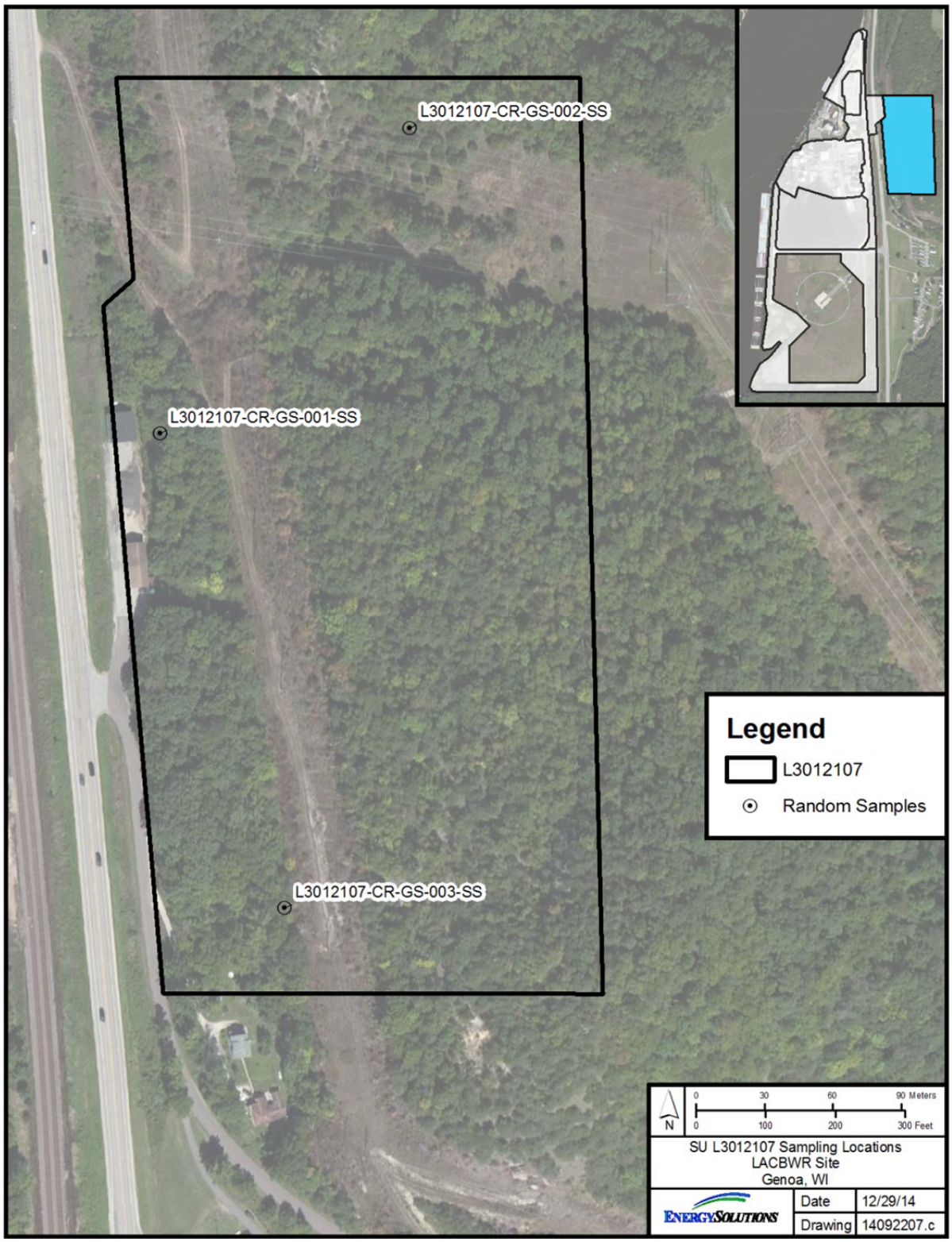
Table 9-48 L3012107 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012107-CR-GS-001-SB	11/10/2014	570947.280	1642846.690	693.2	Dry			6.79E-02			5.68E-02
L3012107-CR-GS-002-SB	11/10/2014	571385.550	1643213.710	581.9	Dry			1.06E-01	9.05E-02	1.59E-02	7.08E-02
L3012107-CR-GS-003-SB	11/10/2014	570260.450	1643027.300	706.9	Dry			6.93E-02	5.60E-02	1.12E-02	5.22E-02

	Co-60		Cs-137	
# of Measurements	3		3	
# >Critical Level	0		2	
Mean	8.11E-02	pCi/g	6.78E-02	pCi/g
Median	6.93E-02	pCi/g	5.68E-02	pCi/g
Max	1.06E-01	pCi/g	9.05E-02	pCi/g
Min	6.79E-02	pCi/g	5.60E-02	pCi/g
Standard Deviation	2.16E-02	pCi/g	1.97E-02	pCi/g

Figure 9-21 L3012107 Random Sample Locations



9.17. Survey Unit L3012108

Impacted Class 3 open land survey unit L3012108 is located east of the survey unit L3012104 in a land strip that includes the railroad track areas as well as an area of land across the Highway 35 to the east of the LACBWR Site.

The size of the survey unit is approximately 9,446 square meters. There are no documented incidents of radioactive contamination of soils in this survey unit.

The survey design called for three (3) surface soil samples taken at random locations and three (3) subsurface soil samples taken at the same locations selected for surface soil samples to a depth on 1-meter. One duplicate surface soil sample was taken at the location of the highest gamma scan result and a duplicate subsurface soil sample was taken at the location of the subsurface soil sample.

A representative sample of rail road bed gravel was also taken for onsite gamma spectroscopy analysis and gamma scan readings were taken of areas in the rail road bed gravels area to evaluate the gravel for any significant difference than the LACBWR Site gamma scan background average of 7,000-8,000 cpm.

In summary a total of three (3) surface soil samples and three (3) subsurface soil samples and one (1) railroad bed gravel sample were taken without issue inside this survey unit.

A review of the onsite and offsite lab radio analytical data and its quality characteristics was performed. The results of all sample analysis were less than 10% of their respective action levels. No plant derived ROC was detected in the sample of the railroad bed gravel.

All three surface soil and subsurface soil samples were analyzed by the on-site gamma spectroscopy system. Cs-137 was positively detected at concentrations greater than the instrument MDC two of the three surface soil samples taken. Cs-137 concentration in those two samples measured 0.156 pCi/g and 0.108 pCi/g respectively. Cs-137 was positively detected at concentrations greater than the instrument MDC two of the three subsurface soil samples taken. Cs-137 concentration in those two samples measured 0.409 pCi/g and 0.067 pCi/g respectively. Co-60 was not detected in any sample at a concentration greater than the instrument MDC. One surface and one subsurface soil sample was sent off-site for isotopic analysis. H-3, Ni-63 and Am-243 was positively identified at concentrations greater than the instrument MDC but at concentration less than the action level.

Acceptability testing of the duplicate samples soil data in accordance with Section 4.1 of the QAPP revealed no cases of not meeting the acceptance testing.

The railroad bed gravels sample had elevated natural uranium and thorium series nuclides identified in the gamma spectroscopy results with no plant derived radionuclides. The gamma scan readings in the area of the gravels conducted as a walkover type survey averaged 7,000-8,500 cpm; these results were not significantly different than the background levels for areas outside the LSE but within the LACBWR licensed area.

The following tables and figures are included with this survey unit:

- Table 9-49 and Table 9-50 show the summary of the surface and subsurface soil sample information and respective statistics.

- Figure 9-22 shows the location of the random soil sampling locations.
- Table 9-54 shows the offsite Class 3 radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.

Table 9-49 L3012108 Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012108-CR-GS-001-SS	11/5/2014	571440.940	1642733.340	599.1	Dry			9.47E-02			9.29E-02
L3012108-CR-GS-002-SS	11/5/2014	571168.860	1642788.360	653.0	Dry			7.54E-02	1.56E-01	1.62E-02	4.76E-02
L3012108-CR-GS-003-SS	11/5/2014	571343.180	1642605.090	720.8	Dry			6.83E-02	1.08E-01	1.29E-02	4.91E-02

	Co-60		Cs-137	
# of Samples	3		3	
# >Critical level	0		2	
Mean	7.95E-02	pCi/g	1.19E-01	pCi/g
Median	7.54E-02	pCi/g	1.08E-01	pCi/g
Max	9.47E-02	pCi/g	1.56E-01	pCi/g
Min	6.83E-02	pCi/g	9.29E-02	pCi/g
Standard Deviation	1.37E-02	pCi/g	3.29E-02	pCi/g

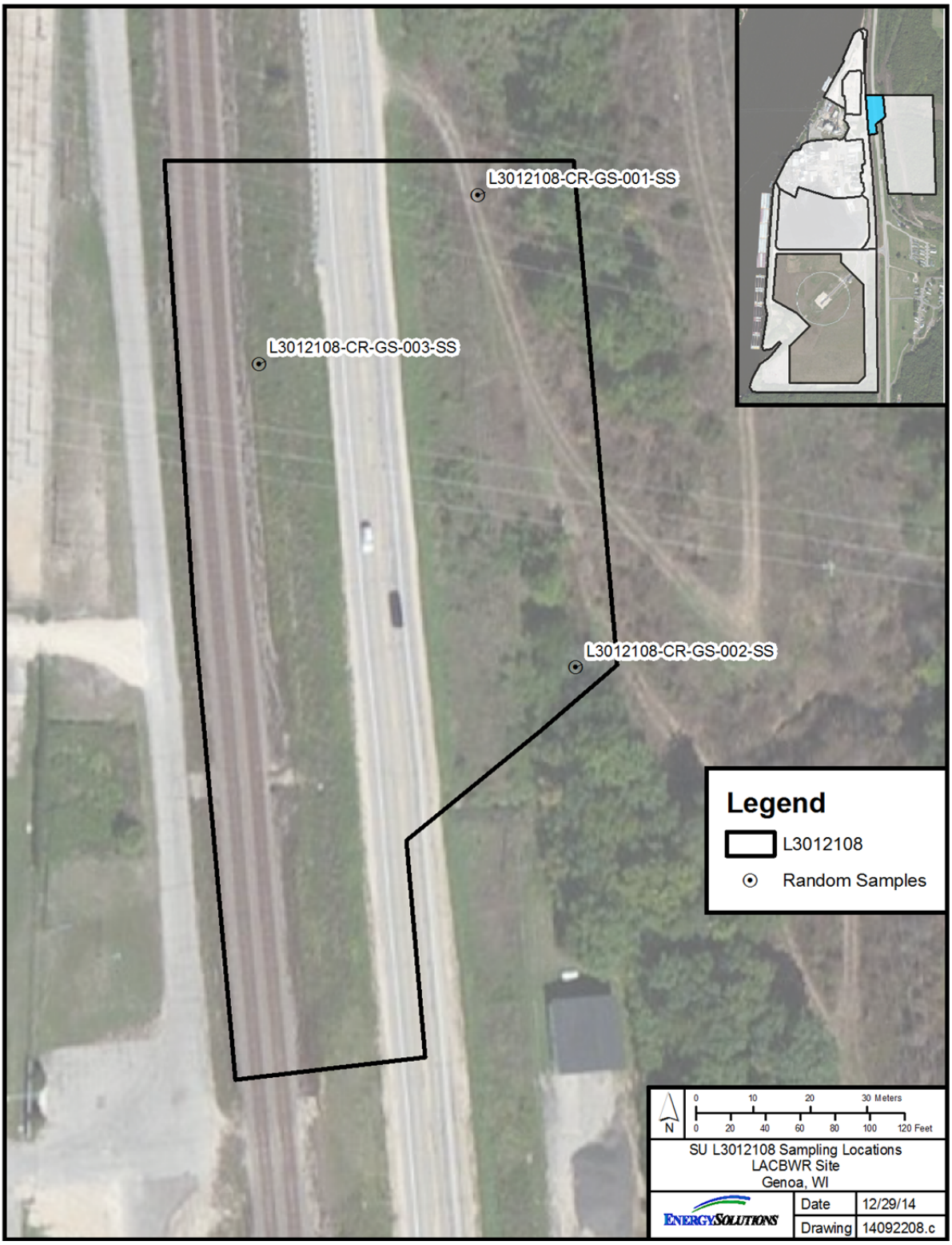
Table 9-50 L3012108 Subsurface Soil Analysis

Subsurface Soil Sample Analysis

Sample ID	Sample Depth (meters)	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
			Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)
L3012108-CR-GS-001-SB	1	11/5/2014	571440.940	1642733.340	619.2	Dry			1.07E-01			9.09E-02
L3012108-CR-GS-002-SB	1	11/5/2014	571168.860	1642788.360	528.2	Dry			9.22E-02	4.09E-01	2.79E-02	6.61E-02
L3012108-CR-GS-003-SB	1	11/5/2014	571343.180	1642605.090	740.5	Dry			6.00E-02	6.73E-02	1.03E-02	4.43E-02

	Co-60		Cs-137	
# of Measurements	3		3	
# >Critical Level	0		2	
Mean	8.64E-02	pCi/g	1.89E-01	pCi/g
Median	9.22E-02	pCi/g	9.09E-02	pCi/g
Max	1.07E-01	pCi/g	4.09E-01	pCi/g
Min	6.00E-02	pCi/g	6.73E-02	pCi/g
Standard Deviation	2.40E-02	pCi/g	1.91E-01	pCi/g

Figure 9-22 L3012108 Random Sample Locations



9.18. Survey Unit L3012109

Impacted Class 3 open land survey unit L3012109 is located inside of the survey unit L3012108 in a vegetated area with minimal disturbance east of Highway 35.

The size of the survey unit is approximately 100 square meters. Inside the survey unit there was no past known history of radiological surface contamination on the open grounds. This particular survey unit surface soil was being evaluated as an area for possible use as the soil background area for the LACBWR LTP as it is a minimally disturbed area close to the site with similar soil characteristics. The area also has no past use tied to the LACBWR operation and is not in directly in any area of concern tied to normal metrology for air dispersion patterns.

This survey involved the collection of fifteen (15) surface soil samples at random locations.

A review of the onsite lab radio analytical data was performed. There were no instances of the soil sample results exceeding 10% of the action levels.

The Cs-137 surface soil sample average result was 0.160 pCi/g with a high of 0.268 pCi/g. Co-60 was not detected in concentrations greater than the instrument MDC.

The following tables and figures are included with this survey unit:

- Table 9-51 shows the summary of the surface soil sample information and respective statistics.
- Figure 9-23 shows the location of the random soil sampling locations.
- Table 9-54 shows the offsite radio analytical data.
- Table 9-55 shows the location relationship of where the duplicate sample for offsite analysis was taken.

Table 9-51 Background Area Surface Soil Analysis

Surface Soil Sample Analysis

Sample ID	Date	Location		Weight (g)	Wet/Dry	Co-60			Cs-137		
		Northing	Easting			Activity (pCi/g)	1σ (pCi/g)	Critical Level (pCi/g)	Activity (pCi/g)	1σ (pCi/g)	Critical level (pCi/g)
L3012109-BB-GS-001-SS	11/11/2014	571212.730	1642792.960	539.5	Dry			1.01E-01	1.86E-01	2.01E-02	7.96E-02
L3012109-BB-GS-002-SS	11/11/2014	571230.500	1642808.780	573.5	Dry			9.89E-02	1.58E-01	1.79E-02	6.86E-02
L3012109-BB-GS-003-SS	11/11/2014	571248.350	1642789.130	590.9	Dry			8.29E-02	1.07E-01	1.42E-02	6.42E-02
L3012109-BB-GS-004-SS	11/11/2014	571218.850	1642804.850	588.0	Dry			8.69E-02	1.61E-01	1.72E-02	6.31E-02
L3012109-BB-GS-005-SS	11/12/2014	571236.320	1642796.850	557.6	Dry			8.69E-02	2.68E-01	2.18E-02	7.37-02
L3012109-BB-GS-006-SS	11/12/2014	571209.090	1642787.140	550.4	Dry			8.23E-02	1.69E-01	1.78E-02	7.29E-02
L3012109-BB-GS-007-SS	11/12/2014	571226.810	1642802.620	648.7	Dry			7.96E-02	1.12E-01	1.42E-02	5.50E-02
L3012109-BB-GS-008-SS	11/12/2014	571244.280	1642795.000	600.5	Dry			7.69E-02	2.10E-01	1.90E-02	6.66E-02
L3012109-BB-GS-009-SS	11/12/2014	571214.920	1642810.770	582.6	Dry			8.08E-02	2.29E-01	1.99E-02	5.06E-02
L3012109-BB-GS-010-SS	11/12/2014	571232.780	1642791.270	582.5	Dry			8.64E-02	5.85E-02	1.14E-02	4.71E-02
L3012109-BB-GS-011-SS	11/12/2014	571220.840	1642799.030	525.4	Dry			9.27E-02	1.73E-01	1.82E-02	8.09E-02
L3012109-BB-GS-012-SS	11/12/2014	571210.840	1642799.180	596.0	Dry			8.66E-02	2.46E-01	1.98E-02	6.66E-02
L3012109-BB-GS-013-SS	11/12/2014	571228.460	1642791.510	607.6	Dry			8.15E-02	1.15E-01	1.47E-02	4.96E-02
L3012109-BB-GS-014-SS	11/12/2014	571216.810	1642787.380	596.8	Dry			8.12E-02	1.21E-01	1.58E-02	6.45E-02
L3012109-BB-GS-015-SS	11/12/2014	571234.720	1642802.820	538.9	Dry			9.86E-02	2.07E-01	1.95E-02	6.63E-02
L3012109-BQ-GS-016-SS	11/12/2014	571226.810	1642802.620	646.1	Dry			8.03E-02	9.46E-02	1.38E-02	5.89E-02
L3012109-BQ-GS-017-SS	11/12/2014	571248.350	1642709.130	530.2	Dry			9.09E-02	9.78E-02	1.41E-02	6.91E-02

	Co-60		Cs-137	
# of Samples	17		17	
# >Critical Level	0		17	
Mean	8.67E-02	pCi/g	1.60E-01	pCi/g
Median	8.64E-02	pCi/g	1.61E-01	pCi/g
Max	1.01E-01	pCi/g	2.68E-01	pCi/g
Min	7.69E-02	pCi/g	5.85E-02	pCi/g
Standard Deviation	7.34E-03	pCi/g	5.95E-02	pCi/g

Figure 9-23 Background Area Surface Soil Sampling Locations

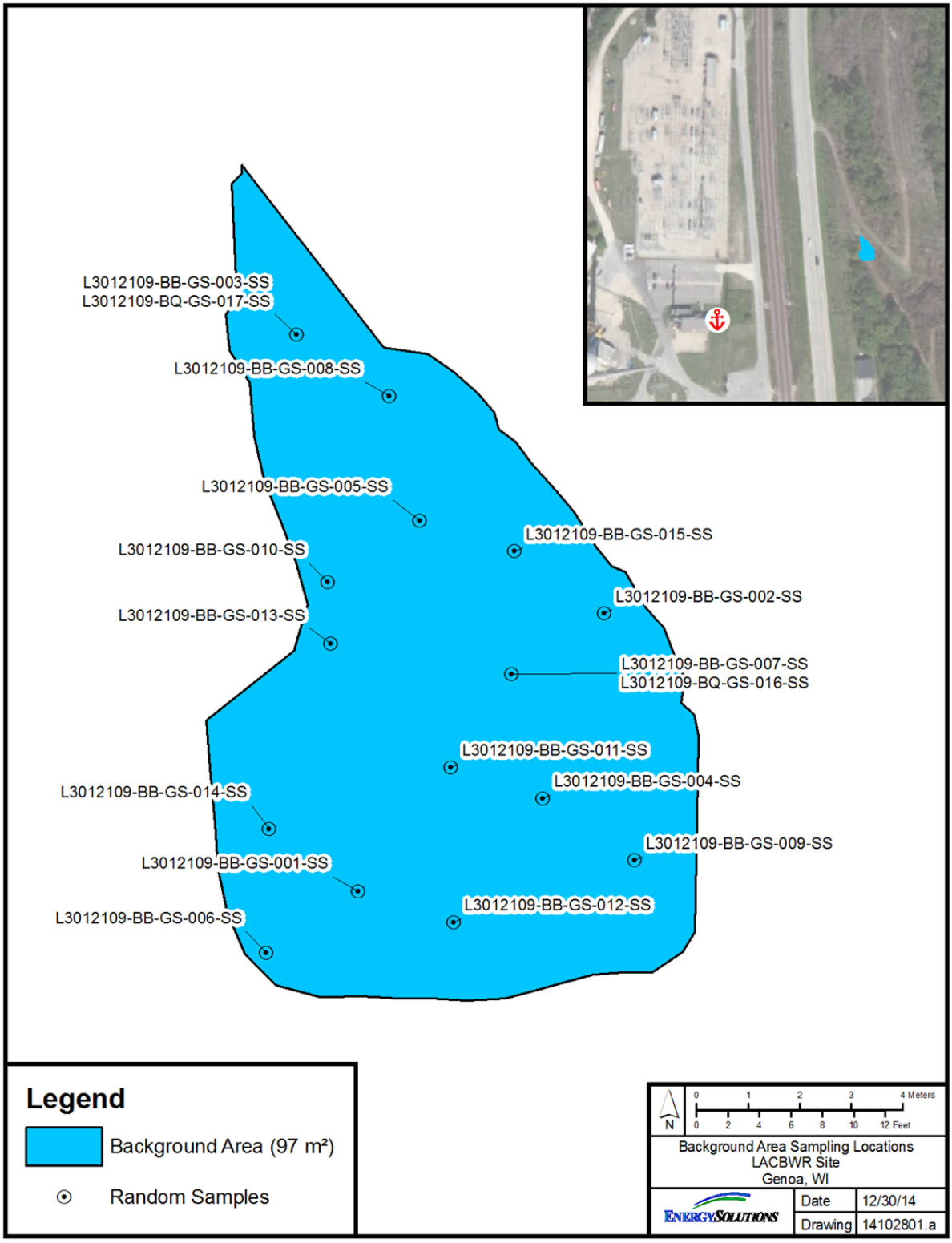


Table 9-52 Class 1 Off-Site Lab Analysis Results

Class 1

Radionuclide	H-3	C-14	Fe-55	Ni-59	Co-60	Ni-63	Sr-90	Nb-94	Tc-99	Cs-137	Pm-147	Eu-152	Eu-154	Eu-155	Np-237	Pu-238	Pu-239/240	Pu-241	Am-241	Am-243	Cm-243/244
L1010101-CJ-GS-002-SS					2.39E-02			1.96E-02		*2.33E-01*		5.63E-02	1.61E-01	6.58E-02					5.83E-02		
L1010101-CJ-GS-009-SS					*4.00E-02*			1.96E-02		*1.85E-01*		5.55E-02	1.81E-01	4.99E-02					4.24E-02		
L1010101-CJ-GS-010-SS					*2.86E-01*			2.53E-02		*4.13E-01*		6.16E-02	2.47E-01	5.71E-02					5.14E-02		
L1010101-QJ-GS-001-SB	3.64E-01	*8.96E-01*	*2.43E+00*	1.85E+00	2.35E-02	3.04E+00	3.35E-01	1.53E-02	5.79E-01	1.95E-02	8.00E-01	4.98E-02	1.43E-01	4.42E-02	1.91E-02	4.55E-02	2.26E-02	1.97E+00	1.50E-02	2.34E-02	2.13E-02
L1010101-QJ-GS-001-SS	*4.41E-01*	6.76E-01	2.19E+00	1.90E+00	1.78E-02	3.04E+00	4.40E-01	1.15E-02	5.87E-01	*1.47E-01*	3.17E+00	3.40E-02	1.12E-01	4.35E-02	*1.21E-02*	3.88E-02	2.27E-02	1.83E+00	1.57E-02	*2.11E-02*	1.93E-02
L1010101-QJ-GS-002-SB	3.77E-01	6.79E-01	2.15E+00	1.75E+00	1.72E-02	2.93E+00	3.38E-01	1.12E-02	6.20E-01	*1.49E-01*	7.72E-01	3.97E-02	1.09E-01	4.02E-02	1.92E-02	4.13E-02	2.17E-02	1.95E+00	1.74E-02	*2.91E-02*	1.36E-02
L1010101-QJ-GS-002-SS	*1.38E+00*	6.77E-01	*4.19E+00*	2.01E+00	1.51E-02	3.32E+00	3.57E-01	1.03E-02	5.21E-01	*5.87E-02*	9.78E-01	3.25E-02	9.56E-02	3.59E-02	1.57E-02	4.03E-02	1.56E-02	2.09E+00	1.98E-02	1.73E-02	2.24E-02
L1010102-CJ-FC-001-CV	*1.71E+00*	7.27E-01	1.65E+00	2.63E+00	*1.06E-01*	3.92E+00	2.92E-01	2.23E-02	5.36E-01	*3.52E-01*	1.29E+00	6.06E-02	2.39E-01	6.23E-02	2.90E-02	4.05E-02	2.78E-02	2.49E+00	1.83E-02	1.93E-02	2.07E-02
L1010102-CJ-GS-013-SB					3.02E-02			1.59E-02		2.06E-02		4.36E-02	1.70E-01	4.06E-02					3.62E-02		
L1010102-QJ-GS-001-SB	*8.74E+00*	7.26E-01	2.12E+00	2.62E+00	1.48E-02	*4.00E+00*	3.10E-01	1.12E-02	5.39E-01	1.19E-02	9.61E-01	3.04E-02	1.01E-01	2.75E-02	2.80E-02	3.99E-02	2.55E-02	2.78E+00	1.47E-02	2.02E-02	2.09E-02
L1010102-QJ-GS-001-SS					2.17E-02			1.53E-02		1.75E-02		3.56E-02	1.13E-01	4.21E-02					3.89E-02		
L1010102-QJ-GS-002-SB	*2.47E+01*	7.15E-01	2.23E+00	2.76E+00	2.05E-02	3.92E+00	3.16E-01	1.43E-02	5.37E-01	1.59E-02	7.22E-01	4.28E-02	1.39E-01	4.17E-02	3.23E-02	4.23E-02	2.85E-02	2.66E+00	1.47E-02	*2.06E-02*	1.80E-02
L1010103-CJ-GS-002-SB					1.08E-02			1.70E-02		2.08E-02		4.44E-02	1.81E-01	4.57E-02					4.40E-02		
L1010103-QJ-SL-001-SM	3.54E-01	*4.53E-01*	6.89E-01	7.11E-01	*1.36E-01*	1.09E+00	1.32E-01	1.83E-02	4.32E-01	*1.36E-01*	3.60E-01	5.40E-02	1.99E-01	4.86E-02	1.84E-02	1.45E-02	1.45E-02	8.67E-01	7.92E-03	1.93E-02	7.76E-03
L1010103-QJ-GS-001-SB	*3.26E+00*	7.15E-01	1.83E+00	2.85E+00	1.65E-02	4.24E+00	3.33E-01	1.07E-02	6.06E-01	1.51E-02	7.40E-01	3.61E-02	1.17E-01	3.86E-02	2.59E-02	2.92E-02	1.65E-02	1.43E+00	*9.14E-03*	*2.43E-02*	5.37E-03
L1010103-QJ-GS-001-SS					2.54E-02			1.52E-02		1.99E-02		4.56E-02	1.74E-01	4.65E-02					4.26E-02		
L1010103-QJ-GS-002-SB	*6.49E-01*	7.02E-01	2.10E+00	2.62E+00	1.43E-02	3.71E+00	3.25E-01	1.20E-02	6.45E-01	1.24E-02	8.38E-01	2.94E-02	1.03E-01	3.41E-02	1.95E-02	3.40E-02	2.36E-02	2.57E+00	1.83E-02	2.38E-02	1.44E-02
L1010103-QJ-GS-002-SS					1.94E-02			1.66E-02		1.71E-02		4.02E-02	1.39E-01	4.52E-02					2.41E-02		
L1010103-QJ-GS-003-SB	*6.54E-01*	7.17E-01	2.34E+00	2.63E+00	1.22E-02	3.66E+00	3.00E-01	8.65E-03	5.57E-01	1.13E-02	7.13E-01	2.93E-02	9.17E-02	3.44E-02	4.02E-02	2.75E-02	2.75E-02	2.47E+00	1.78E-02	*2.22E-02*	5.47E-03
L1010103-QJ-GS-003-SS					2.34E-02			1.93E-02		*9.12E-02*		5.73E-02	1.86E-01	6.33E-02					5.19E-02		
L1010104-CJ-GS-003-SB					1.52E-02			8.18E-03		1.31E-02		3.16E-02	7.77E-02	3.64E-02					3.44E-02		
L1010104-CR-PA-007-AV					2.14E-02			1.40E-02		1.59E-02		4.23E-02	1.41E-01	4.41E-02					3.98E-02		
L1010104-QQ-PA-001-AV					2.47E-02			2.48E-02		2.82E-02		5.75E-02	2.18E-01	6.05E-02					4.99E-02		
L1010104-QR-GS-001-SB					1.74E-02			1.13E-02		1.20E-02		3.79E-02	1.32E-01	3.15E-02					3.19E-02		

LEGEND
SS= surface soil
SB=subsurface soil
AV=Asphalt
CV= Concrete

L1010103-SM = sanitary solids
L2011101-SM= sediment
L3012101-SM=sanitary solids
L3012104-SM=soils

NOTES:
Bold = MDA
Italicized= activity result>MDA

Table 9-53 Class 2 Off-Site Lab Analysis Results

Class 2

Radionuclide	H-3	C-14	Fe-55	Ni-59	Co-60	Ni-63	Sr-90	Nb-94	Tc-99	Cs-137	Pm-147	Eu-152	Eu-154	Eu-155	Np-237	Pu-238	Pu-239/240	Pu-241	Am-241	Am-243	Cm-243/244
L2011101-CJ-GS-001-SM					*9.60E-02*			1.14E-02		*1.37E-01*		4.05E-02	9.81E-02	3.25E-02					3.13E-02		
L2011101-CR-PA-003-AV					2.33E-02			1.60E-02		1.67E-02		3.90E-02	1.31E-01	3.86E-02					3.75E-02		
L2011101-QJ-GS-001-SB	5.18E-01	7.27E-01	2.29E+00	2.66E+00	1.61E-02	4.03E+00	2.73E-01	1.42E-02	6.43E-01	1.47E-02	7.05E-01	3.34E-02	1.08E-01	3.98E-02	2.19E-02	2.80E-02	2.45E-02	2.47E+00	1.54E-02	*2.24E-02*	1.89E-02
L2011101-QJ-GS-001-SM	*2.04E+00*	7.07E-01	2.24E+00	2.95E+00	*4.86E-02*	4.14E+00	5.23E-01	1.82E-02	5.85E-01	*1.07E-01*	6.15E-01	4.78E-02	1.78E-01	4.92E-02	2.63E-02	4.48E-02	2.11E-02	3.10E+00	3.68E-02	3.60E-02	*3.40E-02*
L2011101-QJ-GS-001-SS					1.16E-02			1.97E-02		*8.03E-02*		5.95E-02	1.88E-01	*9.13E-02*					4.18E-02		
L2011101-QQ-GS-001-SB					1.73E-02			1.21E-02		1.30E-02		3.95E-02	1.27E-01	3.72E-02					3.07E-02		
L2011101-QQ-GS-001-SS	5.67E-01	7.26E-01	2.59E+00	2.60E+00	3.46E-02	3.72E+00	2.55E-01	3.45E-02	5.32E-01	*1.03E-01*	7.79E-01	9.65E-02	2.05E-01	*1.02E-01*	2.30E-02	3.66E-02	2.36E-02	2.80E+00	1.94E-02	1.48E-02	1.52E-02
L2011101-QQ-GS-002-SB	*2.50E+00*	7.31E-01	*1.94E+00*	2.68E+00	1.74E-02	3.87E+00	3.14E-01	1.40E-02	6.16E-01	1.60E-02	6.97E-01	3.66E-02	1.19E-01	4.12E-02	1.90E-02	3.89E-02	1.62E-02	2.92E+00	2.02E-02	*2.77E-02*	1.58E-02
L2011101-QQ-PA-001-AV					2.20E-02			1.48E-02		1.53E-02		4.63E-02	1.35E-01	4.16E-02					4.04E-02		
L2011102-QQ-GS-001-SB	*1.37E+00*	*1.56E+00*	2.26E+00	3.04E+00	7.47E-03	4.39E+00	2.91E-01	1.79E-02	5.37E-01	2.10E-02	6.72E-01	4.38E-02	1.73E-01	5.47E-02	3.14E-02	2.56E-02	1.83E-02	2.68E+00	2.92E-02	*2.84E-02*	2.44E-02
L2011102-QQ-GS-001-SS	5.33E-01	7.13E-01	2.33E+00	2.82E+00	1.90E-02	4.30E+00	3.61E-01	1.35E-02	5.95E-01	1.40E-02	7.72E-01	3.93E-02	1.11E-01	4.53E-02	1.68E-02	3.55E-02	2.58E-02	2.88E+00	2.59E-02	3.42E-02	2.10E-02
L2011102-QQ-GS-002-SB	5.25E-01	7.02E-01	3.89E+00	2.88E+00	3.14E-02	3.95E+00	3.27E-01	1.63E-02	5.68E-01	1.81E-02	7.17E-01	5.16E-02	1.83E-01	5.10E-02	2.20E-02	*2.79E-02*	*1.99E-02*	1.71E+00	*9.61E-03*	2.80E-02	5.65E-03
L2011102-QQ-PA-001-AV					2.70E-02			1.72E-02		1.78E-02		5.05E-02	1.42E-01	3.83E-02					3.60E-02		

LEGEND
SS= surface soil
SB=subsurface soil
AV=Asphalt
CV= Concrete

NOTES:
Bold = MDA
Italicized= activity result>MDA

L1010103-SM = sanitary solids
L2011101-SM= sediment
L3012101-SM=sanitary solids
L3012104-SM=soils

Table 9-54 Class 3 Off-Site Lab Analysis Results

Class 3

Radionuclide	H-3	C-14	Fe-55	Ni-59	Co-60	Ni-63	Sr-90	Nb-94	Tc-99	Cs-137	Pm-147	Eu-152	Eu-154	Eu-155	Np-237	Pu-238	Pu-239/240	Pu-241	Am-241	Am-243	Cm-243/244
L3012101-CR-GC-001-CV					2.84E-02			3.01E-02		2.64E-02		4.27E-02	2.21E-01	5.91E-02					5.30E-02		
L3012101-CR-GC-002-CV					3.47E-02			2.64E-02		3.33E-02		6.24E-02	2.71E-01	5.59E-02					5.52E-02		
L3012101-CR-GC-003-CV		6.69E-01	2.18E+00	2.02E+00	3.07E-02	3.59E+00	3.74E-01	2.66E-02	5.21E-01	2.65E-02	1.48E+00	5.57E-02	2.49E-01	6.88E-02	2.48E-02	4.58E-02	1.81E-02	1.69E+00	1.86E-02	2.13E-02	5.71E-03
L3012101-CR-GS-003-SS					2.49E-02			1.74E-02		*1.13E-01*		5.19E-02	1.57E-01	5.87E-02					5.22E-02		
L3012101-QQ-GS-001-SB	*1.84E+01*	7.17E-01	2.39E+00	2.87E+00	1.64E-02	*5.64E+00*	3.09E-01	1.37E-02	5.50E-01	1.48E-02	8.99E-01	3.62E-02	1.28E-01	3.56E-02	3.86E-02	3.47E-02	2.24E-02	2.59E+00	2.34E-02	*2.87E-02*	2.65E-02
L3012101-QQ-GS-001-SS	*1.55E+01*	7.08E-01	*2.33E+00*	2.66E+00	2.01E-02	3.89E+00	2.95E-01	1.66E-02	6.03E-01	*5.86E-02*	1.09E+00	4.67E-02	1.16E-01	5.42E-02	2.83E-02	2.82E-02	2.17E-02	2.64E+00	1.87E-02	*2.10E-02*	5.75E-03
L3012101-QQ-SL-001-SM	3.64E-01	3.42E-01	*2.71E+00*	7.39E-01	2.20E-02	*1.09E+00*	1.52E-01	1.74E-02	3.60E-01	1.97E-02	3.33E-01	4.19E-02	1.53E-01	3.38E-02	9.24E-03	1.55E-02	1.32E-02	7.97E-01	9.32E-03	*8.79E-03*	1.05E-02
L3012103-QJ-GS-001-SB	*4.39E+00*	*1.23E+00*	*3.43E+00*	1.47E+00	2.56E-02	2.14E+00	3.21E-01	1.79E-02	8.20E-01	2.43E-02	7.14E-01	7.06E-02	1.90E-01	*9.54E-02*	2.47E-02	4.62E-02	1.46E-02	1.73E+00	3.19E-02	2.17E-02	9.79E-03
L3012103-QJ-GS-001-SS	*3.57E+00*	6.71E-01	*2.79E+00*	1.87E+00	2.72E-02	3.38E+00	3.91E-01	2.17E-02	6.28E-01	1.81E-02	8.47E-01	5.97E-02	1.67E-01	*9.58E-02*	2.38E-02	3.99E-02	2.10E-02	1.65E+00	2.50E-02	2.35E-02	1.91E-02
L3012104-CR-GS-002-SM					1.49E-02			1.25E-02		*6.56E-02*		3.50E-02	1.28E-01	4.66E-02					3.63E-02		
L3012104-QJ-GS-001-SB	*2.16E+00*	6.70E-01	*1.95E+00*	1.75E+00	2.05E-02	3.06E+00	3.25E-01	1.77E-02	4.69E-01	2.50E-02	8.18E-01	5.33E-02	1.60E-01	5.41E-02	2.15E-02	2.70E-02	2.07E-02	1.61E+00	1.62E-02	1.83E-02	1.59E-02
L3012104-QJ-GS-001-SM	*2.89E+00*	6.72E-01	*2.72E+00*	1.99E+00	3.74E-02	3.50E+00	2.98E-01	2.03E-02	6.51E-01	*9.36E-02*	8.18E-01	7.38E-02	2.17E-01	7.09E-02	*5.85E-03*	3.11E-02	*1.65E-02*	1.56E+00	1.56E-02	*1.64E-02*	1.53E-02
L3012104-QJ-GS-001-SS	*2.19E+00*	6.76E-01	*4.24E+00*	1.88E+00	2.91E-02	3.30E+00	3.29E-01	2.02E-02	6.31E-01	*1.38E-01*	6.67E-01	6.81E-02	1.81E-01	*7.96E-02*	*1.99E-02*	4.33E-02	2.56E-02	1.58E+00	1.86E-02	*1.91E-02*	2.11E-02
L3012105-Genoa Coal Pile					1.82E-02			2.18E-02		1.89E-02		5.20E-02	1.52E-01	4.75E-02					4.07E-02		
L3012105-CR-GS-002-SS	5.33E-01	6.75E-01	*2.13E+00*	1.73E+00	2.47E-02	2.95E+00	*2.89E-01*	1.56E-02	5.87E-01	1.81E-02	6.98E-01	5.10E-02	1.37E-01	5.61E-02	2.30E-02	3.57E-02	2.86E-02	1.67E+00	1.84E-02	*2.49E-02*	5.65E-03
L3012105-QJ-GS-001-SB					2.64E-02			2.03E-02		2.29E-02		4.85E-02	1.66E-01	5.49E-02					4.77E-02		
L3012105-QJ-GS-001-SS					3.02E-02			1.97E-02		2.84E-02		7.22E-02	1.99E-01	7.40E-02					6.06E-02		
L3012106-QJ-GS-001-SB	*1.46E+01*	7.13E-01	2.30E+00	2.37E+00	3.73E-02	*3.95E+00*	3.48E-01	2.98E-02	6.11E-01	*3.19E-01*	1.50E+00	*1.15E-01*	2.23E-01	*8.02E-02*	3.50E-02	3.59E-02	1.44E-02	2.55E+00	1.85E-02	*3.44E-02*	5.66E-03
L3012106-QJ-GS-001-SS	*8.13E-01*	7.13E-01	*3.55E+00*	2.56E+00	3.74E-02	3.58E+00	3.38E-01	2.84E-02	6.16E-01	*9.55E-02*	8.26E-01	7.92E-02	2.32E-01	*1.12E-01*	2.65E-02	4.40E-02	2.59E-02	2.74E+00	2.50E-02	*1.31E-02*	1.91E-02
L3012107-QJ-GS-001-SB					1.89E-02			1.33E-02		2.06E-02		4.47E-02	1.15E-01	3.84E-02					3.35E-02		
L3012107-QJ-GS-001-SS	*1.42E+00*	7.19E-01	*3.61E+00*	2.80E+00	2.54E-02	3.94E+00	2.93E-01	1.87E-02	5.93E-01	*1.84E-02*	1.45E+00	4.91E-02	1.56E-01	4.82E-02	3.96E-02	2.13E-02	2.37E-02	2.58E+00	2.01E-02	3.53E-02	*6.16E-03*
L3012108-QJ-GS-001-SB	*2.35E+00*	7.05E-01	1.92E+00	3.11E+00	1.78E-02	4.44E+00	2.78E-01	1.55E-02	6.04E-01	*3.29E-02*	1.31E+00	4.11E-02	1.28E-01	4.35E-02	3.00E-02	2.58E-02	2.13E-02	2.67E+00	1.69E-02	*3.56E-02*	1.66E-02
L3012108-QJ-GS-001-SS	*6.49E+00*	7.28E-01	2.26E+00	3.20E+00	2.96E-02	*4.71E+00*	2.71E-01	1.98E-02	5.76E-01	*1.82E-01*	7.70E-01	5.94E-02	1.76E-01	6.03E-02	1.96E-02	2.75E-02	2.93E-02	2.74E+00	1.51E-02	2.38E-02	1.48E-02

LEGEND
SS= surface soil
SB=subsurface soil
AV=Asphalt
CV= Concrete

L1010103-SM = sanitary solids
L2011101-SM= sediment
L3012101-SM=sanitary solids
L3012104-SM=soils

NOTES:
Bold = MDA
Italicized= activity result>MDA

Table 9-55 Split Sample Location Table

Split Sample Location Table	
Split QC Sample	**Site Sample Location**
L2011102-QQ-PA-001-AV	L2011102-CR-PA-003-AV
L2011102-QQ-GS-001-SB	L2011102-CR-GS-003-SB
L2011102-QQ-GS-001-SS	L2011102-CR-GS-009-SS
L2011102-QQ-GS-002-SB	L2011102-CR-GS-007-SB
L2011101-QQ-GS-002-SB	L2011101-CR-GS-007-SB
L2011101-QQ-GS-001-SS	L2011101-CR-GS-004-SS
L2011101-QJ-GS-001-SS	L2011101-CJ-GS-001-SS
L2011101-QQ-GS-001-SB	L2011101-CR-GS-003-SB
L2011101-QJ-GS-001-SB	L2011101-CJ-GS-002-SB
L2011101-QQ-PA-001-AV	L2011101-CR-PA-003-AV
L2011101-QJ-GS-001-SM	L2011101-CJ-GS-001-SM
L1010104-QR-GS-001-SB	L1010104-CR-GS-003-SB
L1010104-QQ-PA-001-AV	L1010104-CR-PA-003-AV
L3012103-QJ-GS-001-SB	L3012103-CR-GS-003-SB
L3012103-QJ-GS-001-SS	L3012103-CR-GS-002-SS
L3012105-QJ-GS-001-SB	L3012105-CR-GS-002-SB
L3012105-QJ-GS-001-SS	L3012105-CR-GS-002-SS
L3012104-QJ-GS-001-SS	L3012104-CR-GS-002-SS
L3012104-QJ-GS-001-SB	L3012104-CR-GS-003-SB
L3012104-QJ-GS-001-SM	L3012104-CR-GS-001-SM
L3012101-QQ-SL-001-SM	L3012101-CJ-SL-001-SM
L1010103-QJ-SL-001-SM	L1010103-CJ-SL-001-SM
L1010101-QJ-GS-002-SS	L1010101-CJ-GS-011-SS
L1010101-QJ-GS-001-SB	L1010101-CJ-GS-008-SB
L1010101-QJ-GS-002-SB	L1010101-CJ-GS-014-SB
L1010101-QJ-GS-001-SS	L1010101-CJ-GS-008-SS
L1010103-QJ-GS-003-SS	L1010103-CJ-GS-007-SS
L1010103-QJ-GS-001-SS	L1010103-CJ-GS-003-SS
L1010103-QJ-GS-002-SS	L1010103-CJ-GS-004-SS
L1010103-QJ-GS-002-SB	L1010103-CJ-GS-012-SB
L1010103-QJ-GS-001-SB	L1010103-CJ-GS-009-SB
L1010103-QJ-GS-003-SB	L1010103-CJ-GS-023-SB
L1010102-QJ-GS-001-SB	L1010102-CJ-GS-001-SB
L1010102-QJ-GS-001-SS	L1010102-CJ-GS-002-SS
L1010102-QJ-GS-002-SB	L1010102-CJ-GS-009-SB
L3012101-QQ-GS-001-SS	L3012101-CR-GS-001-SS
L3012101-QQ-GS-001-SB	L3012101-CR-GS-001-SB
L3012108-QJ-GS-001-SS	L3012108-CR-GS-003-SS
L3012108-QJ-GS-001-SB	L3012108-CR-GS-003-SB
L3012106-QJ-GS-001-SS	L3012106-CR-GS-002-SS
L3012106-QJ-GS-001-SB	L3012106-CR-GS-003-SB
L3012107-QJ-CR-001-SS	L3012107-CR-GS-001-SS
L3012107-QJ-CR-001-SB	L3012107-CR-GS-001-SB

Table 9-56 Buried Piping Related Sample Locations and Depths

Buried Piping Related Sample Locations and Depths

Underground Gas Storage Tank Vault	
Sample ID	**Sample Depth (meters)**
L1010101-CJ-GS-011-SS	Surface
L1010101-CJ-GS-011-SB	1
L1010101-CJ-GS-012-SB	2
L1010101-CJ-GS-013-SB	4
L1010101-CJ-GS-014-SB	5
L1010101-CJ-GS-012-SS	Surface
L1010101-CJ-GS-015-SB	1
L1010101-CJ-GS-016-SB	2
L1010101-CJ-GS-017-SB	4
L1010101-CJ-GS-018-SB	5
Turbine Building South Foundation Area	
Sample ID	**Sample Depth (meters)**
L1010102-CJ-GS-002-SS	Surface
L1010102-CJ-GS-007-SB	1
L1010102-CJ-GS-008-SB	3
L1010102-CJ-GS-009-SB	4
L1010102-CJ-GS-003-SS	Surface
L1010102-CJ-GS-011-SB	1
L1010102-CJ-GS-012-SB	3
L1010102-CJ-GS-013-SB	4
Combined Drain Discharge Piping Area	
Sample ID	**Sample Depth (meters)**
L1010103-CJ-GS-001-SS	Surface
L1010103-CJ-GS-001-SB	3
L1010103-CJ-GS-002-SB	4
L1010103-CJ-GS-003-SB	5
L1010103-CJ-GS-002-SS	Surface
L1010103-CJ-GS-004-SB	3
L1010103-CJ-GS-005-SB	4
L1010103-CJ-GS-006-SB	5
L1010103-CJ-GS-003-SS	Surface
L1010103-CJ-GS-007-SB	3
L1010103-CJ-GS-008-SB	4
L1010103-CJ-GS-009-SB	5
Circulating Water Discharge Piping Area	
Sample ID	**Sample Depth (meters)**
L1010103-CJ-GS-004-SS	Surface
L1010103-CJ-GS-010-SB	2
L1010103-CJ-GS-011-SB	3
L1010103-CJ-GS-012-SB	4
L1010103-CJ-GS-013-SB	5
L1010103-CJ-GS-005-SS	Surface
L1010103-CJ-GS-014-SB	2
L1010103-CJ-GS-015-SB	3
L1010103-CJ-GS-016-SB	4
L1010103-CJ-GS-017-SB	5

Circulating Water Intake Piping Area	
Sample ID	**Sample Depth (meters)**
L1010103-CJ-GS-006-SS	Surface
L1010103-CJ-GS-018-SB	2
L1010103-CJ-GS-019-SB	3
L1010103-CJ-GS-020-SB	4
L1010103-CJ-GS-021-SB	5
L1010103-CJ-GS-007-SS	Surface
L1010103-CJ-GS-022-SB	2
L1010103-CJ-GS-023-SB	3
L1010103-CJ-GS-024-SB	4
L1010103-CJ-GS-025-SB	5
L1010104-CJ-GS-001-SS	Surface
L1010104-CJ-GS-001-SB	2
L1010104-CJ-GS-002-SB	4
L1010104-CJ-GS-003-SB	5
L1010104-CJ-GS-004-SB	6
Storm Water Drain Piping Area	
Sample ID	**Sample Depth (meters)**
L2011101-CJ-GS-001-SS	Surface
L2011101-CJ-GS-002-SB	3
L2011101-CJ-GS-003-SB	4
L2011101-CJ-GS-004-SB	5
L2011101-CJ-GS-002-SS	Surface
L2011101-CJ-GS-005-SB	3
L2011101-CJ-GS-006-SB	4
L2011101-CJ-GS-007-SB	5
L2011101-CJ-GS-003-SS	Surface
L2011101-CJ-GS-008-SB	3
L2011101-CJ-GS-009-SB	4
L2011101-CJ-GS-010-SB	5

10.0SUMMARY AND CONCLUSIONS

10.1. Impacted Class 3 Survey Units

There are eight Class 3 open land survey units. All of the survey units lie outside of the LACBWR LSE area but are inside the purview of the LACBWR licensed area for license termination purposes. The total area of the Class 3 open land survey units is 419,052 square meters minus a significant amount of area due to G-3 Coal Plant facilities and the coal yard in L3012103 and L3012105 respectively. A total of (38) surface soil samples, (23) subsurface soil samples to a depth of one meter, (9) asphalt samples, (3) concrete samples, (2) sediment samples,and (1) sanitary tank solids sample were taken and analyzed from the Class 3 areas with a prescribed subgroup of duplicate samples sent to an offsite lab for analysis.

Asphalt and concrete areas had direct measurements taken for alpha and beta at random locations. In addition a section of the G-3 Coal Plant Roof had a beta scan and random type beta-gamma and alpha direct measurements and removable contamination surveys taken.

Of the samples taken the results include:

- Thirty (32) of the surface soil samples were greater than the instrument MDC for Cs-137 with the highest result being 0.463 pCi/g.
- None of the surface soil samples were greater than the instrument MDC for Co-60.
- Seven (7) of the subsurface soil samples were greater than the instrument MDC for Cs-137 with the highest result being 0.409 pCi/g.
- None of the subsurface samples for Co-60 were greater than the instrument MDC.
- The only other ROC noted was Tritium (H-3) which exceeded the MDC on twelve (12) of the submitted duplicate soil samples sent to the offsite lab ranging from 0.813-18.4 pCi/g with the highest results being approximately 15% of the Table 2-3 Criteria for Tritium in Soils.
- The sanitary solids tank results for Cs-137 was above instrument MDC at 0.0554 pCi/g.
- None of the asphalt samples were greater than instrument MDC.
- The intact asphalt and concrete survey results for beta-gamma direct measurements were all less than the Table 2-3 criteria for surface measurements as were the concrete removable contamination surveys.
- None of the concrete samples ROCs were greater than instrument MDC.

The G-3 Plant Roof beta–gamma measurements for scan, directs, and removable contamination as well as alpha removable contamination were all well less than the Table 2-3 criteria for surface measurements.

Based on the results of the characterization surveys performed in the Class 3 open land areas coupled with the existing information presented in the LACBWR LTP [Reference 11-1]

strong evidence is provided to qualify that the Class 3 open land areas have minimal plant-derived radioactivity present. Other than for tritium concentration in soil in three cases in the Class 3 analytical data being greater than 10% DCGL for tritium all soil sample results were less than 10% of the DCGL after subtracting sample background activity. The open land areas were appropriately and conservatively classified as Class 3 and did not meet the criteria for Class 2 classification. The historical data in the HSA, noted Cs-137 background levels around the site, coupled with the data in this report leads to a preliminary observation that soil remediation activities may be minimal or not required at all during the decommissioning work in the Class 3 areas.

10.2. Impacted Class 2 Survey Units

There are two Class 2 open land survey units and three Class 2 buildings included in the LACBWR LTP. A total of approximately 13, 350 square meters resides as open land area. All of the Class 2 area and buildings lie outside of the LACBWR LSE fence line.

A total of twenty-three (23) surface soil samples, twelve (12) asphalt samples, and twenty-three (23) subsurface samples were taken and analyzed from the Class 2 open land areas with a prescribed subgroup of duplicate samples sent to an offsite lab for analysis. Subsurface soil samples included fourteen (14) at one meter depth and three (3) each were also taken at 3, 4, and 5 meters depth as well to evaluate a buried storm sewer pipe. In addition, samples were taken of an accessible storm sewer basin manhole area to sample sediment just inside of the LACBWR LSE fence line next to the LACBWR Administration Building. Asphalt areas had a 50% beta scan and direct measurements taken for alpha and beta at random locations. A 50% gamma scan walkover of soil areas was also performed.

Of the samples taken the results include:

- Twelve (14) of the surface soil samples were greater than the instrument MDC for Cs-137 with the highest result being 0.200 pCi/g.
- None of the surface soil samples were greater than the instrument MDC for Co-60.
- Four (4) of the subsurface soil samples were greater than the instrument MDC for Cs-137 with the highest result being 0.088 pCi/g.
- One of the sub- surface soil samples were greater than the instrument MDC for Co-60 at 0.112 pCi/g.
- The only other ROC noted was tritium exceeded the MDC on three (3) of the submitted duplicate soil samples sent to the offsite lab with the range being from 1.3-2.5 pCi/g.
- Three (3) of the asphalt samples were greater than the instrument MDC for Cs-137 with the highest result being 0.0514 pCi/g.
- The intact asphalt survey results for beta-gamma scans and direct measurements were all well less than the Table 2-3 criteria for surface measurements.
- The results of the gamma scan walkover survey of soil areas were all less than 1.5 times the average background established for the LACBWR Site.

- The results of the storm sewer drain sample [L2011101-QJ-GS-001-SM] which were greater than instrument MDC included: 0.0625 pCi/g Co-60, 0.114 pCi/g Cs-137, and 2.04 pCi/g tritium.

Based on the results of the characterization surveys performed in the Class 2 open land areas coupled with the existing information presented in the HSA strong evidence is provided to qualify that the Class 2 open land areas have minimal plant-derived radioactivity present and at levels less than 25 % of the preliminary DCGLs. The Class 2 areas were classified correctly and did not meet the criteria for Class 1 designation. The historical data in Chapter 2 of the LTP coupled with the soil data in this report leads to a preliminary observation that soil remediation activities may be minimal during the decommissioning work in the Class 2 areas.

The LACBWR Administration Building also had surveys performed inside the facility and on the roof. Surveys performed included beta scans of floor and roof areas and beta-gamma and alpha directs and removable contamination surveys of floor areas drain areas, and roof areas of the facility. The results of the beta-gamma scans, beta direct readings, and beta and alpha removable contamination surveys were all well less than Table 2-3 criteria for surfaces with the alpha direct surveys all less than Table 2-3 criteria for inside facility surfaces as well. The only outlier discovered during the facility surveys was a discrete radioactive particle of Cs-137 with minor activity located inside the facility on the second floor hallway north end. This discrete particle was removed and dispositioned on site during the course of the on site characterization work by DPC staff and follow-up surveys within and around the Administration Building did not discover any other hot particles.

10.3. Impacted Class 1 Survey Units

There are four Class 1 open land survey units. All of the survey units lie inside of the LACBWR LSE area. The total area of the Class 1 open land survey units is approximately 6,045 square meters. A total of twenty-two (22) surface soil samples, sixty-four (64) subsurface soil samples at varying depths to six meters in depth, ten (10) asphalt samples, and one (1) sanitary tank solids sample were taken and analyzed from the Class 1 areas with a prescribed subgroup of duplicate samples sent to an offsite lab for analysis. In addition beta scans and direct surveys of beta-gamma/ alpha were performed at random locations on the intact asphalt survey unit in L1010104.

Of the samples taken the results include:

- Thirteen (13) of the surface soil samples were greater than the instrument MDC for Cs-137 with the highest result of 1.07 pCi/g.
- Two (2) of the surface soil samples were greater than the instrument MDC for Co-60 with the highest result being 0.287 pCi/g.
- Ten (10) of the subsurface soil samples were greater than the instrument MDC for Cs-137 with the highest result being 0.161 pCi/g.
- None of the subsurface samples for Co-60 were greater than the instrument MDC.
- The only other ROC noted was tritium which exceeded the MDC on eight (8) of the submitted duplicate soil samples sent to the offsite lab with a range of 0.44-24.7

pCi/g and the highest result being approximately 22% of the Table 2-3 Criteria for Soils.

- The sanitary solids tank results for Cs-137 was above instrument MDC at 0.136 pCi/g for Cs-137 as well as 0.136 pCi/g for Co-60.
- One (1) of the asphalt samples were greater than instrument MDC for Cs-137 with the highest at 0.0477 pCi/g.
- The asphalt beta–gamma measurements for scans and beta-gamma/alpha directs, were all less than the Table 2-3 criteria for surfaces.

Based on the results of the characterization surveys performed in the Class 1 open land areas coupled with the existing information presented in the HSA strong evidence is provided to qualify that the Class 1 open land areas are classified properly given the future planned decommissioning work and the nearby location of the Class 1 LACBWR Facilities. The maximum plant-derived radioactivity sample results were at levels less than 25 % of the preliminary DCGLs.

11.0 References

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11.18. Energy*Solutions* CS-FO-PR-004, "QA/QC of portable Radiological Survey Instruments"

11.19. Pacific Northwest National Laboratory software, "Visual Sample Plan", VSP Version 7.0

11.20. U.S. Nuclear Regulatory Commission 10 CFR 50, Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants"

11.21. American Society of Mechanical Engineers, ASME, NQA-1: Quality Assurance Requirements for Nuclear Facilities Applications"

11.22. U.S. Nuclear Regulatory Commission 10 CFR 71, Subpart H, "Quality Assurance"

11.23. U.S. Nuclear Regulatory Commission 10 CFR 72, Subpart G, "Quality Assurance"

11.24. EnergySolutions PG-EO-313196-SV-PL-001, "Characterization Survey Plan for the La Crosse Boiling Water Reactor"

11.25. LACBWR Historical Site Assessment