Energy*Solutions*, Inc.
Technical Support Document

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La Crosse Boiling Water Reactor Historical Site Assessment

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TABLE OF CONTENTS

1. PURPOSE OF THE HISTORICAL SITE ASSESSMENT 1-1

2. PROPERTY IDENTIFICATION 2-2
2.1. Site Location and Physical Characteristics 2-2
2.1.1. Licensee Information 2-2
2.1.2. Site Information 2-3
2.1.3. Topography 2-3
2.1.4. Regional Geology 2-3
2.1.5. Site Geology and Stratigraphy 2-4
2.2. Environmental Setting 2-4
2.2.1. Demography 2-4
2.2.1.1. Site Location and Description 2-4
2.2.1.2. Population 2-4
2.2.1.3. Site Access, Land and Water Use 2-5
2.2.2. Meteorology 2-5
2.2.3. Surface Water Hydrology 2-5
2.2.4. Hydrogeology 2-6

3. HISTORICAL SITE ASSESSMENT METHODOLOGY 3-19
3.1. Approach and Rationale 3-19
3.2. Boundaries of Site 3-19
3.3. Documents Reviewed 3-19
3.3.1. Licenses and Permits 3-20
3.3.1.1. CAPR-5 and DPRA-5 3-20
3.3.1.2. DPRA-6 3-20
3.3.1.3. DPR-45 3-20
3.3.1.4. Environmental Permits 3-22
3.3.2. Operating Records and Existing Radiation Data 3-23
3.3.2.1. Liquid Release Incidents 3-23
3.3.2.2. Aerial Survey 3-28
3.3.2.3. Soil Survey Campaigns 3-28
3.3.2.4. State of Wisconsin Radiological Surveys 3-30
3.3.3. Environmental Monitoring Data 3-32
3.3.3.1. Air Effluent 3-32
3.3.3.2. Liquid Effluent 3-38
3.3.4. Groundwater Monitoring 3-41
3.3.4.1. LACBWR Groundwater Monitoring History 3-41
3.3.4.2. On-Site Well Construction Details 3-42
3.3.4.3. Off-Site Well Construction Details 3-42
3.3.5. Historical and 2012 thru 2013 Hydrogeological Investigation 3-42
3.4. Property Inspections 3-44
3.5. Personnel Interviews 3-44
3.6. Historical Construction Photograph Review 3-45

4. HISTORY AND CURRENT USAGE 4-1
4.1. Historical Use 4-1
4.1.1. Description of Operations Impacting Site Radiological Status 4-1
4.1.2. History of Releases 4-2
4.1.2.1. Introduction 4-2

4.1.2.2. Radioactive Airborne Effluent Releases 4-3
4.1.2.3. Planned Radioactive Liquid Effluent Releases 4-3
4.1.2.4. Noted Liquid Radioactive Release Events 4-3
4.2. Current Use 4-3
4.3. Adjacent Land Usage 4-4
4.3.1. Onsite Land Use 4-4
4.3.2. Offsite Land Use 4-4

5. FINDINGS 5-1
5.1. Review of LACBWR Records 5-1
5.2. Basis for Site Classification 5-1
5.3. Impacted Area Assessments 5-2
5.3.1. Initial Impacted Area Assessment 5-2
5.4. Potential Contaminants 5-3
5.4.1. Radionuclides of Concern at LACBWR 5-3
5.4.1.1. Industry Documents Review 5-3
5.4.1.2. Discounting Insignificant Radionuclides 5-4
5.4.1.3. Review of Other Documents and Data 5-13
5.5. Potentially Contaminated Areas 5-15
5.5.1. Impacted Areas 5-16
5.6. Impacted Area Assessments 5-16
5.6.1. Non-Impacted Areas 5-16
5.7. Potentially Contaminated Media 5-16
5.7.1. Surface Soil 5-16
5.7.2. Surface Water 5-17
5.7.3. Groundwater 5-17
5.8. Environmental Concerns 5-17

6. CONCLUSIONS 6-1

7. REFERENCES 7-1

LIST OF TABLES

Table 3-1 Environmental Permits at the DPC Genoa Site 3-22
Table 3-2 Outfall Silt Sampling Results 3-24
Table 3-3 Wastewater Tank Overflow events 3-25
Table 3-4 Soil Samples Beneath Turbine Building Floor 3-27
Table 3-5 Summary of Soil Sampling Data 3-29
Table 3-6 Summary of Sate of Wisconsin Environmental Monitoring 3-31
Table 3-7 Operational Air Effluent Releases 3-34
Table 3-8 Operational Liquid Effluent Releases 3-39
Table 3-9 Well Point Data 3-41
Table 3-10 Technical Rationale for Monitoring Well Locations 3-42
Table 3-11 Personnel Observations Summary 3-45
Table 5-1 LACBWR Site-Specific Radionuclides of Concern 5-3
Table 5-2 Initial Radionuclides based on NUREG/CR-3474 5-4
Table 5-3 NUREG/CR-3424 Radionuclides and Activity Fractions 5-6
Table 5-4 List of Radionuclides Considered for Discounting 5-7
Table 5-5 Radionuclides Considered for Discounting Assessed by DandD Code 5-8
Table 5-6 Non-Discounted Radionuclides Assessed by DandD Code 5-10
Table 5-7 Review of NUREG/CR3474 Radionuclides for Residential Scenario 5-11
Table 5-8 Review of NUREG/CR3474 Radionuclides for Building Occupancy Scenario 5-12
Table 5-9 Dose Considerations for Radionuclides Not Supported by DandD Code 5-13
Table 5-10 Additional Radionuclides Identified in NUREG/CR-3474 5-14
Table 5-11 Other Sources Reviewed for Development of Radionuclides of Concern 5-15

LIST OF FIGURES

Figure 2-1 LACBWR Site Regional Location 2-7
Figure 2-2 LACBWR Site Location 2-8
Figure 2-3 LACBWR Licensed Site Area 2-9
Figure 2-4 LACBWR Site Topographic Map 2-10
Figure 2-5 LACBWR Site Structures 2-11
Figure 2-6 LACBWR Site Drainage and Sewerage Map 2-12
Figure 2-7 LACBWR Site Stratigraphy 2-13
Figure 2-8 Shallow Aquifer Groundwater Contours November 2012 2-14
Figure 2-9 Deep Aquifer Groundwater Contours November 2012 2-15
Figure 2-10 Shallow Aquifer Groundwater Contours June 2013 2-16
Figure 2-11 Deep Aquifer Groundwater Contours June 2013 2-17
Figure 2-12 LACBWR Site Groundwater Wells 2-18
Figure 5-1 LACBWR Site Survey Unit Map 5-18

LIST OF ACRONYMS AND ABBREVIATIONS

AMSL	Above Mean Sea Level
DCGLs	Derived Concentration Guideline Values
DPC	Dairyland Power Cooperative
FESW	Fuel Element Storage Well
FRS	Final Radiation Survey
FSS	Final Status Survey
GPH	Gallons Per Hour
HSA	Historical Site Assessment
LACBWR	La Crosse Boiling Water Reactor
LSA	Low Specific Activity
LSE	LACBWR Site Exclusion area or LACBWR Security Enclosure (the RCA)
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MARSAME	Multi-Agency Radiation Survey and Assessment of Materials and Equipment
MYBP	Million Years Before Present
MWe	Megawatt Electric
POA	Provisional Operating Authority
POL	Provisional Operating License
RCA	Radiologically Controlled Area
SEP	Systematic Evaluation Program
USACE	U.S. Army Corps of Engineers
WDNR	Wisconsin Department of Natural Resources

1. PURPOSE OF THE HISTORICAL SITE ASSESSMENT

This HSA is a detailed investigation intended to collect existing information regarding the radiological condition of the site and its surroundings. The HSA focused on historical events and routine operational processes that may have resulted in the contamination of plant systems, onsite buildings, and surface and subsurface soils within the La Crosse Boiling Water Reactor (LACBWR) Radiologically Controlled Areas (RCAs) as well as structures, open land areas and subsurface soils outside of the RCA but within the LACBWR Licensed Site. The scope of this HSA included potential contamination from radioactive materials, hazardous materials, and other regulated materials. The objectives of this HSA were to:

- Identify potential, likely, or known sources of radioactive and chemical contaminants based on existing or derived information.
- Distinguish portions of the site that may need further action from those that pose little or no threat to human health.
- Provide an assessment of the likelihood of contaminant migration.
- Provide information useful to subsequent continuing characterization surveys.
- Provide an initial classification of areas and structures as non-impacted or impacted
- Provide a graded initial classification for impacted soils and structures in accordance with MARSSIM guidance.
- Delineate initial survey unit boundaries and areas based upon the initial classification.

2. PROPERTY IDENTIFICATION

The La Crosse Boiling Water Reactor (LACBWR) is a 50 Megawatt Electric (MWe) BWR that is owned by Dairyland Power Cooperative (DPC). This unit, also known as Genoa 2, is located on the DPC Genoa site on the east shore of the Mississippi River south of the Village of Genoa, Vernon County, Wisconsin with an address of:

Dairyland Power Cooperative LACBWR
S4601 State Road 35
Genoa, WI. 54632-8846

The LACBWR and one fossil-fueled steam plant are located on 163.5 acres in Section 32, Town 13N, Range 7W, which is owned in fee by DPC. Figure 2-1 LACBWR Site Regional Location and Figure 2-2 LACBWR Site Location)depict the site's regional location and nearby communities. A summary of the legal description of the acquisition of property that in total makes up the LACBWR Site licensed acreage owned by Dairyland Power Cooperative is included in Appendix A.

The NRC Docket Number for the site is 50-409 and for the Independent Spent Fuel Storage Installation (ISFSI) is 72-046. LACBWR has been shut down since 1987 and is currently undergoing decommissioning. The spent nuclear fuel stored in the LACBWR ISFSI will be maintained under an amended Part 50 license.

2.1. Site Location and Physical Characteristics

LACBWR is located in southwestern Wisconsin, in Vernon County, on the eastern shore of the Mississippi River, about 1 mile south of the Village of Genoa, WI and approximately 19 miles south of the city of La Crosse, WI. Figure 2-1 depicts the site location regionally and in relation to the town of La Crosse, WI. Figure 2-2 depicts the LACBWR site locally and in relation to the village of Genoa, WI, including nearby prominent features such as highways, rivers and lakes. The geophysical coordinates for LACBWR are longitude 91°, 13', 53.35"W and latitude 43°, 33', 36.22"N. The site is located above the mouth of the Ohio River at mile 678.6 on the Mississippi River. The reactor is approximately 300 feet east of the Mississippi River and 475 feet west of the BNSF railroad right of way. The reactor stands on filled land at a grade elevation of 639 feet Above Mean Sea Level (AMSL) per NUREG-0191, *Environmental Statement related to Operation of the La Crosse Boiling Water Reactor* [Reference 7.1].

The licensed site comprises a total of 163.5 acres, which is owned and controlled by DPC, with LACBWR comprising only 1.5 acres [Reference 7.2]. Figure 2-3 LACBWR Licensed Site Area depicts the land parcels that were joined to comprise the LACBWR licensed site. The site is accessed by an access road on the south side of the plant, off of Highway 35. Other prominent features on the site include:

- the land north of the LACBWR plant, including the site switchyard and the site of the former G-1 coal (and later oil) fueled power plant (removed in 1989),
- an area directly south of LACBWR with an operational 350-MWe fossil generating station (Genoa Station #3) approximately 175 feet from the LACBWR plant,
- an area south of Genoa #3 where the ISFSI is located, and
- a parcel of land to the east of Highway 35, across from LACBWR.

The site is bordered on the north by the Mississippi River and a narrow strip of land between the Mississippi River and Highway 35. The U.S. Lock & Dam No. 8 is located approximately 0.6 miles upstream, managed by the U.S. Army Corps of Engineers (USACE), Rock Island District. The site is bordered on the west by the Mississippi River and on the east by Highway 35. A Burlington Northern-Santa Fe rail line, located between the site and Highway 35 carries commercial freight along the eastern portion of the site; there is no passenger service on this rail line. The site is bordered to the south by a segment of the Upper Mississippi River National Wildlife & Fish Refuge Pool 9 area. Further south, approximately 2.4 miles from LACBWR, is the Genoa National Fish Hatchery, which raises endangered mussels, brook trout and sturgeon.

2.1.1. Licensee Information

The La Crosse BWR license history consists of three time periods. The first period is from 1962 to 1969, when the facility was owned by Allis-Chalmers and licensed by the AEC. The license numbers associated with this phase are

Construction Authorization 5 (docket number 115-5), issued March 29, 1963, authorizing construction of LACBWR, and Provisional Operating Authority DPRA-5, issued July 3, 1967, for start-up testing and initial operation. The second period is from October 31, 1969, to August 28, 1973, when the facility was owned by DPC and licensed by the AEC under Provisional Operating Authority DPRA-6. The third period is from August 28, 1973, to the present and represents the period where the facility was owned by DPC and operated under AEC/NRC 10 CFR 50 Operating License DPR-45. This period includes power operations to 1987, permanent shutdown for decommissioning in 1987, and ISFSI construction and spent fuel off-load completed in 2012. Licensing history is discussed in detail in Section 3.3.1.

2.1.2. Site Information

The LACBWR Site is relatively flat from the railroad tracks on the east to the riprap that borders the Mississippi River on the west. In preparation for building of the LACBWR, the site was prepared by dredging sands from the Mississippi River to the low-lying areas of the land and grading. Approximately 27 acres of the site were formed by filling in river edge and low forest areas with material dredged from the Mississippi River. The LACBWR Site has been studied in the past in areas that contribute to understanding the groundwater qualities, including the geology, hydrology, topography, and hydrogeology.

A contour map of the site is provided as Figure 2-4 LACBWR Site Topographic Map. Names and locations of site structures are presented in Figure 2-5 LACBWR Site Structures. Locations of Site Storm drains and Sewerage are presented in Figure 2-6 LACBWR Site Drainage and Sewerage Map.

2.1.3. Topography

The LACBWR Site is located between two valleys on either side of the bluff east of Highway 35 (Figure 2-2). The first valley drains north toward Genoa and the second valley drains to an area south of the site. The two valleys limit the area that contributes runoff across the site and only the precipitation that falls on the bluff and a small upland area across from the site contribute to storm water surface flow. Drainage upgradient of the site is channeled along the highway and railroad into a recharge swale. A small amount of other drainage from the railroad right-of-way and nearby hills is channeled to the river via three underground culverts. These culverts cross the property discharging to the Mississippi River [Reference 7.3].

2.1.4. Regional Geology

LACBWR is located within the Wisconsin Driftless section of the Central Lowland physiographic province. The Wisconsin Driftless section was not glaciated during the Pleistocene Epoch and is characterized by flat lying naturally dissected sedimentary rocks of early Paleozoic age. Moderate to strong relief has been produced on the unglaciated landscape, which has been modified by a mantle of loess and glacial outwash in the larger valleys of the area. Maximum relief in the region is about 1,000 feet.

Bedrock in the site region consists of Pre-Cambrian crystalline rocks exposed at the crest of the Wisconsin Dome by early Paleozoic (Cambrian and Ordovician, 572 Million Years Before Present (MYBP) sedimentary strata. Basement rocks in the site vicinity are of granitic composition. The Paleozoic rocks are 1,200-1,300 feet thick in the site vicinity and consist of dolomites, sandstones and shales. About 600 feet of this sequence is exposed along the bluffs on both sides of the Mississippi river in the plant vicinity. Prior to the Pleistocene Epoch (more than 2 MYBP) the river had carved a gorge as much as 150 to 210 feet deeper than can be seen today. It was buried by post-glacial sediment.

The site is located within the Central Stable Region tectonic province. The Central Stable Region consists of a vast area of large circular uplifts and sedimentary basins, and broad synclines and arches. Major structural features include the Wisconsin Dome and Arch, Lake Superior syncline, Forest City basin, Michigan Basin, and Illinois Basin. These structures were formed during the Late Pre-Cambrian and Early Paleozoic eras (more than 435 MYBP).

Major uplift and down-warping also occurred during the late Paleozoic era (330 MYBP to 240 MYBP). Some minor tilting occurred during and following the Pleistocene glaciations (2 MYBP to 0.001 MYBP). The site is located on the southwest flank of the Wisconsin Dome and the western flank of the Wisconsin Arch, a southward

projection of the Wisconsin Dome. For this reason, sedimentary strata in the vicinity dip less than 20 feet per mile to the southwest.

Many faults have been mapped in the site region. None of these faults are considered to be capable according to 10 CFR 100, Appendix A. Per the US NRC, "There are no geologic conditions in the site vicinity that represent hazard to the facility. . Additionally, the area is one of relatively low seismicity. Therefore, capable faulting does not need to be considered in the analysis of this site" [Reference 7.4].

Seismic activity (magnitudes ranging from 3.5 to 5.4) that has been noted between 1975 and 2008 occurred over 180 miles from the site and did not impact plant operations [Reference 7.5].

2.1.5. Site Geology and Stratigraphy

The site geology consists primarily of fill materials (fine sands and silts) underlain by fine to medium sands with some soils containing higher percentages of coarse sands and gravels. Bedrock is encountered at approximately 130 feet below ground surface (bgs). Generally, the local geology is described as approximately 15 feet of hydraulic fill overlying 100 to 130 feet of glacial outwash and fluvial deposits on the east flood plain of the Mississippi River Valley [Reference 7.3].

These unconsolidated deposits are underlain by flat lying sandstone and shales of the Dreshbach Group (Upper Cambrian). The Dreshbach Group is then underlain by dense Precambrian crystalline rocks encountered at approximately 650 feet below ground surface (bgs) [Reference 7.4]. At the LACBWR Site, the bedrock surface is encountered at an elevation of approximately 509 feet MSL near the Reactor Building, which is at an elevation of 639 feet MSL and then slopes to approximately 501 feet MSL near the river shoreline. A typical cross section showing the hydraulic fill and underlying local geology is presented in Figure 2-7 LACBWR Site Stratigraphy [Reference 7.3].

A more detailed description of the primary soil types encountered in soil borings is provided below:

- 0 to 20 feet bgs - Hydraulic Fill – Fill sands are encountered from approximately 14 to 20 feet bgs and described as light brown to brown, fine to medium sands with occasional fine gravel.
- 20 to 30 feet bgs - Brown to grey, fine to medium sands underlie the fill, with average thickness of 7 to 28 feet. The average base depth of these sands is 20 feet bgs.
- 30 to 100 feet bgs - Brown, fine to medium sand that also has zones of coarse sand and fine gravel below the finer sands and are generally encountered from 30 to 100 feet bgs.
- 100 to 115 feet bgs - Brown fine to medium sand and fine to medium gravels.
- 115 to 135 feet bgs - Brown fine to medium sand with trace silt, occasional zones [Reference 7.3].

2.2. Environmental Setting

2.2.1. Demography

2.2.1.1. Site Location and Description

The site location and description were discussed in section 2.1. The 163.5 acre site is located in Vernon County, Wisconsin, in the Mississippi River Valley, with the reactor building 300 feet from the east bank of the Mississippi River. 27 acres of the site were formed by filling in river edge and low forest areas with material dredged from the Mississippi River. The site is relatively flat with the reactor facilities standing at elevations ranging from 636 to 642 feet AMSL bounded by the railroad tracks to the east and the riprap on the shore of the Mississippi River to the west. The geology consists primarily of fill materials (fine sands and silts) underlain by fine to medium sands with some soils containing higher percentages of coarse sands and gravels. Bedrock is encountered at approximately 130 feet below ground surface [Reference 7.3].

2.2.1.2. Population

The U.S. Census Bureau, "American Community Survey" (ACS) report provides the most reliable census data for nearby Wisconsin villages and cities and Vernon County [Reference 7.7]. The estimated total population in 2013 was 258 for the Village of Genoa, located 1 mile north of LACBWR; 744 for Stoddard, located 7 miles N of the

plant; 51,522 for La Crosse, the largest Wisconsin city near the plant, located 17 miles N; and 30,329 for Vernon County. There are also numerous small towns west of the plant across the Mississippi River, including Reno township, MN (population 397), located 3 miles northwest, and New Albin, IA (population 513), located 5 miles southwest.

2.2.1.3. Site Access, Land and Water Use

The LACBWR property is located in the far western portion of Vernon County on the east bank of the Mississippi River. Although the site area is 163.5 acres, it is relatively isolated as it is bounded by the Mississippi River to the west, a rail line to the east, USACE property to the north, and a wildlife and fish refuge to the south. The site includes G-3, a coal-fired 350 MWe electric power station completed in 1969, which is also owned and operated by DPC [Reference 7.8]. This station is located to the south, adjacent to the LACBWR facilities. The closest town is Genoa, WI. It includes an elementary school and is located approximately 1 mile to the northeast of the site. There are no residences within 2,000 feet of any LACBWR structure.

The area of the Mississippi River adjacent to the site is used for recreational purposes (boating and fresh water fishing) and commercial barge and ship traffic (e.g. barges of coal are delivered to the G-3 station located south of the LACBWR plant). There is a public boat landing on the site, located approximately 4,000 feet south of the plant. There is a portion (Pool 9) of the Upper Mississippi River National Wildlife & Fish Refuge just south of the site which has limited access for hunting, fishing and recreational activities (U.S. Fish & Wildlife Service, "Internet Information Site", [Reference 7.9]). Further south are public land areas and the Genoa National Fish Hatchery. Lock and Dam No. 8, located on the Mississippi River at mile 679.2, is approximately 0.6 miles north of the site. The dam is a 110 feet wide, 600 feet long lock and dam structure owned and operated by the USACE (U.S. Army Corps of Engineers, "Internet Information Site", [Reference 7.10]). This facility also allows public access to an observation platform, open from dawn to dusk during the months of April through November. The State of Wisconsin also maintains a highway wayside off State Highway 35 approximately ½ mile north of the LACBWR site, across from Lock and Dam No. 8.

2.2.2. Meteorology

The La Crosse Municipal Airport located in the town of La Crosse and the US USACE Lock 8 Dam in Genoa maintain long standing active weather stations that monitor and archive standard weather related information in the La Crosse – Genoa region of the Mississippi River. Collected data includes: wind speed and direction, temperature, and precipitation [References 7.10 and 7.11].

Temperatures in the La Crosse region are typical of the continental climate with the extremes being more marked because of the river valley location of the LACBWR Site. Average temperatures range from 20 °F in the three months of the winter season to 72 °F in the summer season. A record maximum temperature of 108 °F was recorded in July of both 1936 and 1995. The record low was -43 °F in January of 1873.

Monthly precipitation averages in the area ranges from three to five inches per month in the spring and summer seasons and one to three inches per month for the rest of the year.

The bluffs of the Mississippi River Valley channel the winds at the LACBWR Site. Airport data shows prevailing southerly winds for seven months of the year with prevailing north to northwest winds for the months of November through March. Predominant winds at the LACBWR Site where the river valley runs north-south are from the north and south. Monthly average wind speeds are typically 6-10 mph. Wind rose data is available on the U.S. Department of Agriculture National Resources Conservation Service Climate website for La Crosse, WI [Reference 7.12].

2.2.3. Surface Water Hydrology

The LACBWR site is in the Mississippi River valley. In the vicinity of the site, the valley is deeply cut into highly dissected uplands. From La Crosse to Prairie du Chien, approximately 40 miles south, the valley varies between 2.5 and 4.5 miles in width. The valley walls rise sharply 500 to 600 feet from river level.

There is little or no agricultural use of the river valley floor which consists primarily of marshy land, islands between river channels and extensions of low lying flood plain cut by ponds, sloughs and meandering river

channels. Numerous short, steep-sided valleys have been cut into the upland tributary streams and intercept the main river valley. Both walls of the main channel are wooded. The flat upland areas and some of the tributary valleys are cultivated.

The main channel of the river varies greatly in width above and below the site. A series of dams are operated by the USACE for navigational purposes. Above Dam No. 8 (about 0.75 mile north of the site) the river is nearly four miles wide. Below the site, the river is relatively narrow for a distance of 20 miles, then gradually widens as the river approaches Dam No. 9, 33 miles south of the site.

Part of the licensed area (27 acres) is on a filled in area south of the original Genoa-1 steam plant. Therefore, drainage at the site has been established. One valley drains to the north and one to the south, so that only precipitation that falls on the bluff adjacent to the site and on a small portion of the upland area contributes to runoff directly across the site. This runoff is presently channeled along the highway and railroad to prevent interference with traffic. No problems of flash floods have occurred at the site.

For a distance of 40 miles downstream of the site, virtually all municipal water supplies for cities and towns along the river are obtained from ground water. On the basis of readily available published records, the nearest major city using river water for direct human consumption is Davenport, Iowa, about 195 miles downstream. The nearest use of river water for industrial purposes, excluding the adjacent fossil plant, is the steam-power plant in Lansing, Iowa, about 15 miles downstream. River water at the Lansing plant is used for condenser cooling. There are no other known users of river water for industrial purposes between LACBWR site and Prairie du Chien, 40 miles downriver.

2.2.4. Hydrogeology

Regionally, groundwater flows in a westerly direction from the bluffs on the east towards the river. Closer to the shore, groundwater may also have a flow component that parallels the river. Under typical river stage, groundwater gradients near the river are slightly upward; however, the vertical gradient reverses during flood stages. The geological and historic river stage data compared to water table elevations measure in LACBWR Site monitoring wells demonstrates that the shallow aquifer is in direct hydraulic communication with the river and the river stage impacts the water table elevation [Reference 7.3].

Groundwater beneath the site is first encountered at depths ranging from approximately 15 to 25 feet bgs and the water table aquifer is in strong hydraulic communication with the adjacent Mississippi River. Groundwater in the shallow deposits and fill material flows towards the west and discharges into the Mississippi River. The deeper groundwater is also likely to flow towards the west but then may turn and flow parallel to the river. Because the potential releases of radiological or chemical constituents would occur at or near the surface, the releases would likely be confined to the shallow system [Reference 7.3]. Onsite shallow and deep aquifer gradients during periods of high and low river elevation are presented in Figure 2-8 Shallow Aquifer Groundwater Contours November 2012, Figure 2-9 Deep Aquifer Groundwater Contours November 2012, Figure 2-10 Shallow Aquifer Groundwater Contours June 2013, and Figure 2-11 Deep Aquifer Groundwater Contours June 2013.

Groundwater characterization efforts have been enhanced through the installation of 10 groundwater monitoring wells (5 pairs) within the LACBWR RCA in November 2012 and the collection of groundwater sampling in 2013. As discussed in the latest LACBWR D-Plan/PSDAR [Reference 7.4], the most likely areas of interest where radionuclides could have been released to soils and groundwater include the Turbine Building waste water collection system and the Underground Gas Storage Tank Vault and piping. The 2013 groundwater sample analysis indicated no radionuclides detected above background; however, the soils and groundwater directly below these areas have not yet been evaluated or characterized. Groundwater monitoring wells locations are depicted in Figure 2-12 LACBWR Site Groundwater Wells.

Figure 2-1 LACBWR Site Regional Location

Figure 2-2 LACBWR Site Location

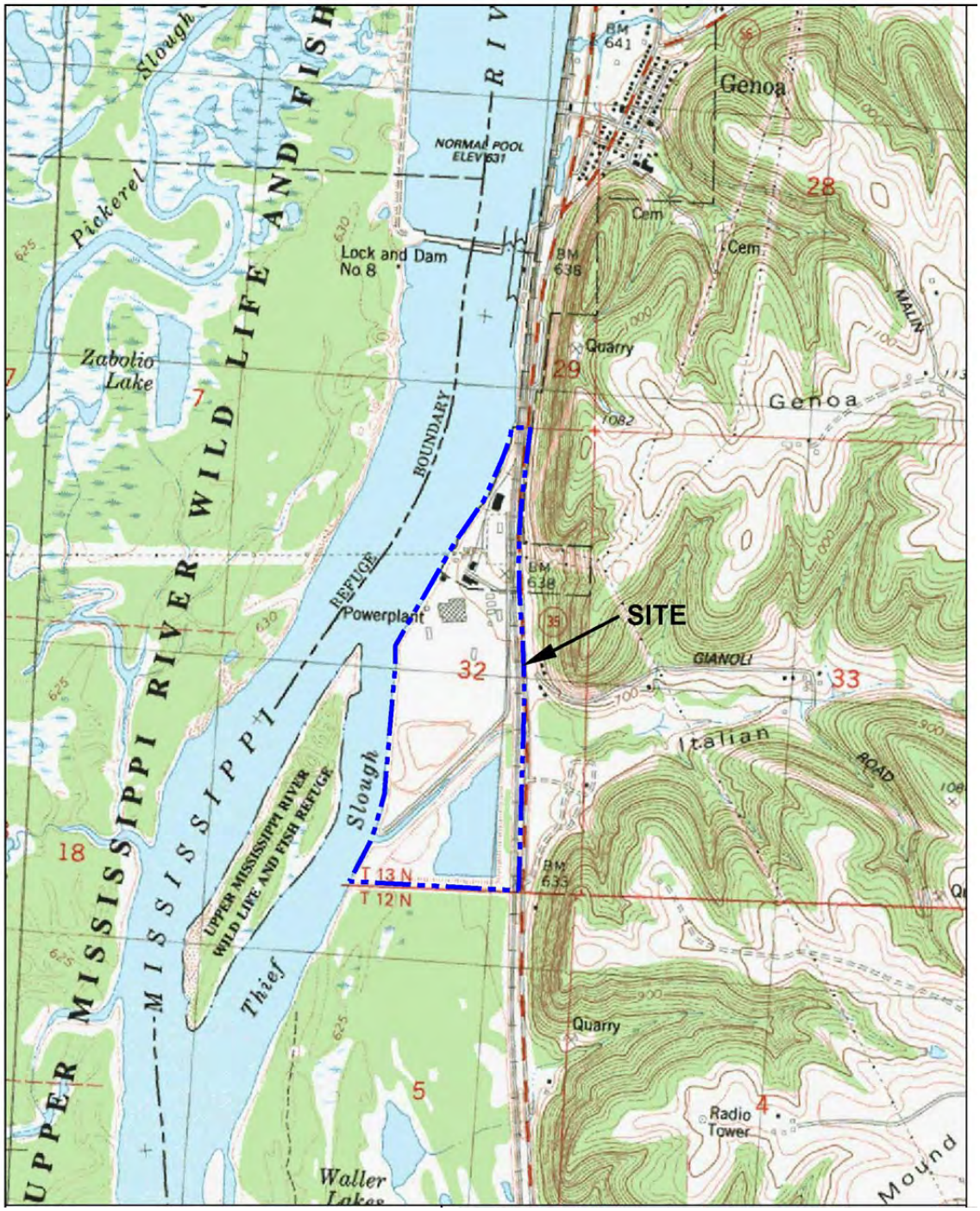


Figure 2-3 LACBWR Licensed Site Area

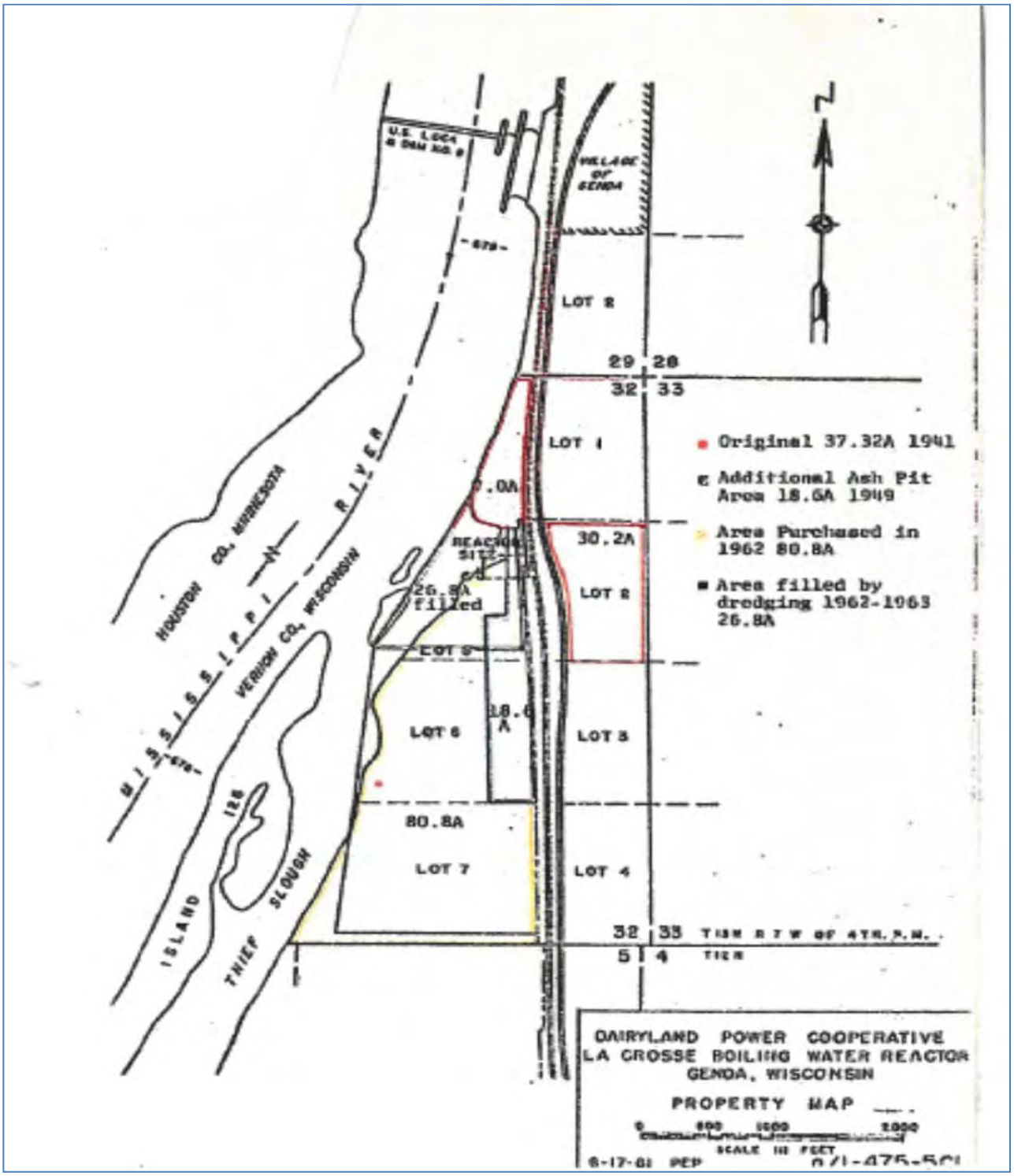


Figure 2-4 LACBWR Site Topographic Map

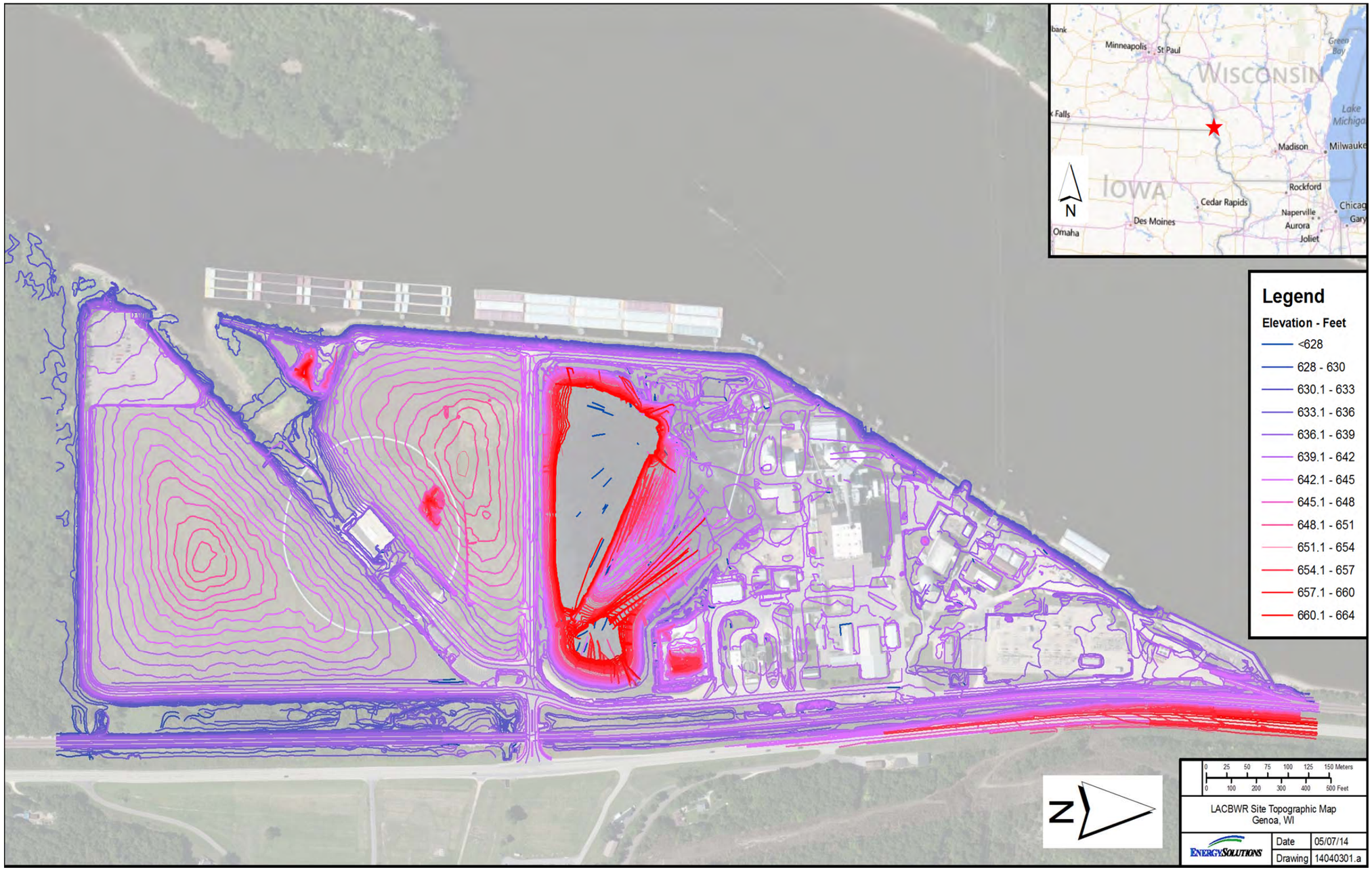
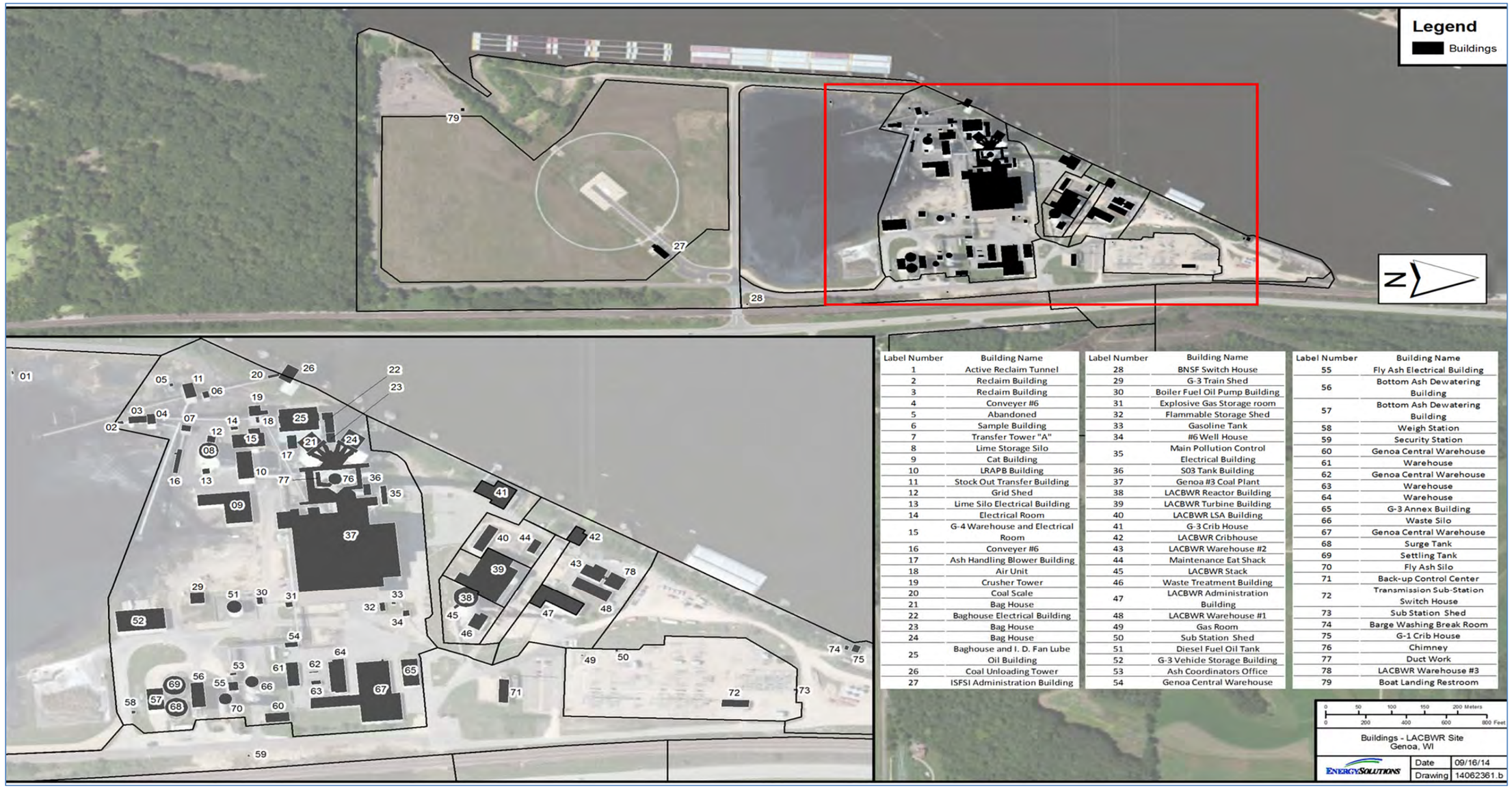


Figure 2-5 LACBWR Site Structures



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 2-6 LACBWR Site Drainage and Sewerage Map

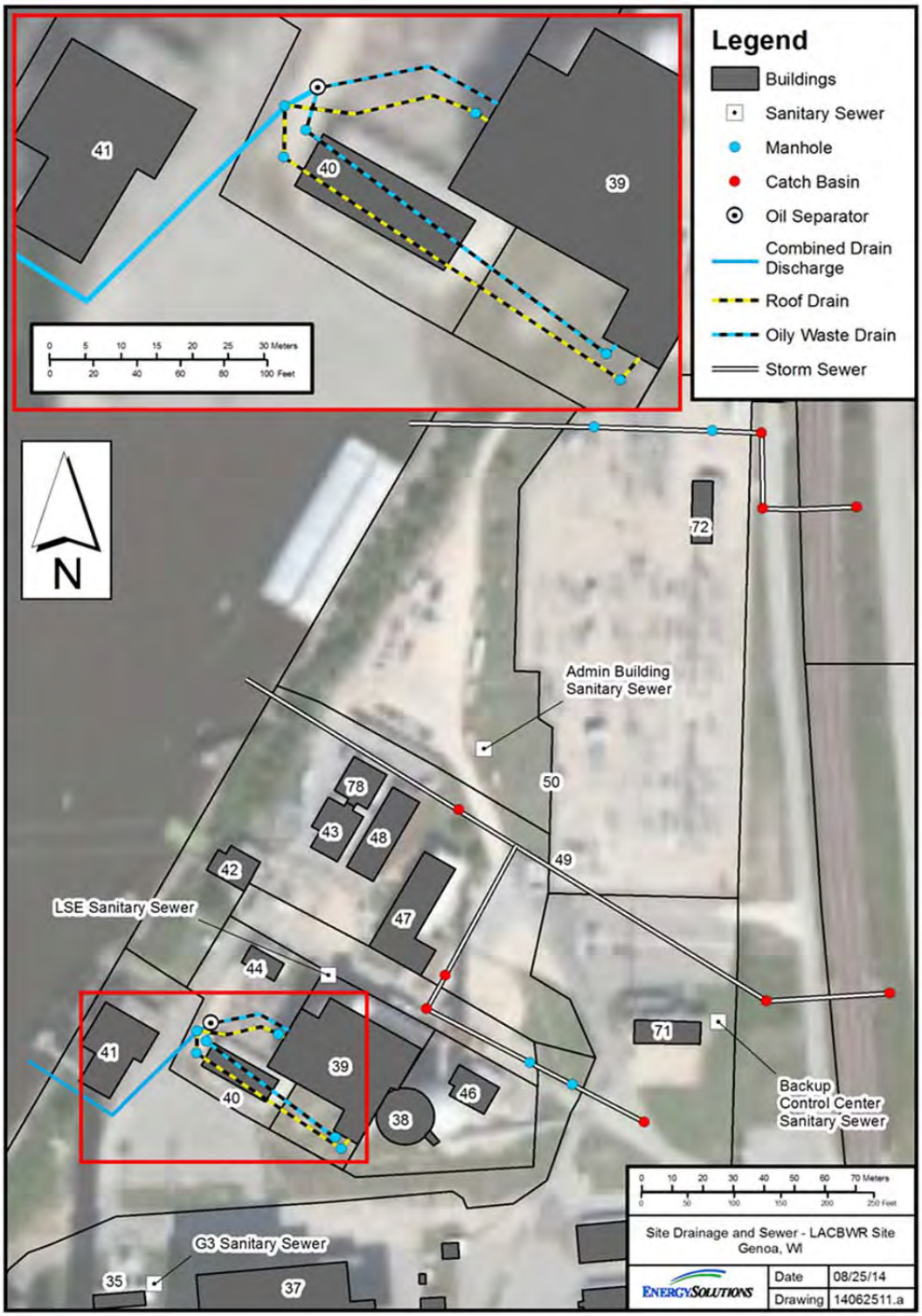


Figure 2-7 LACBWR Site Stratigraphy

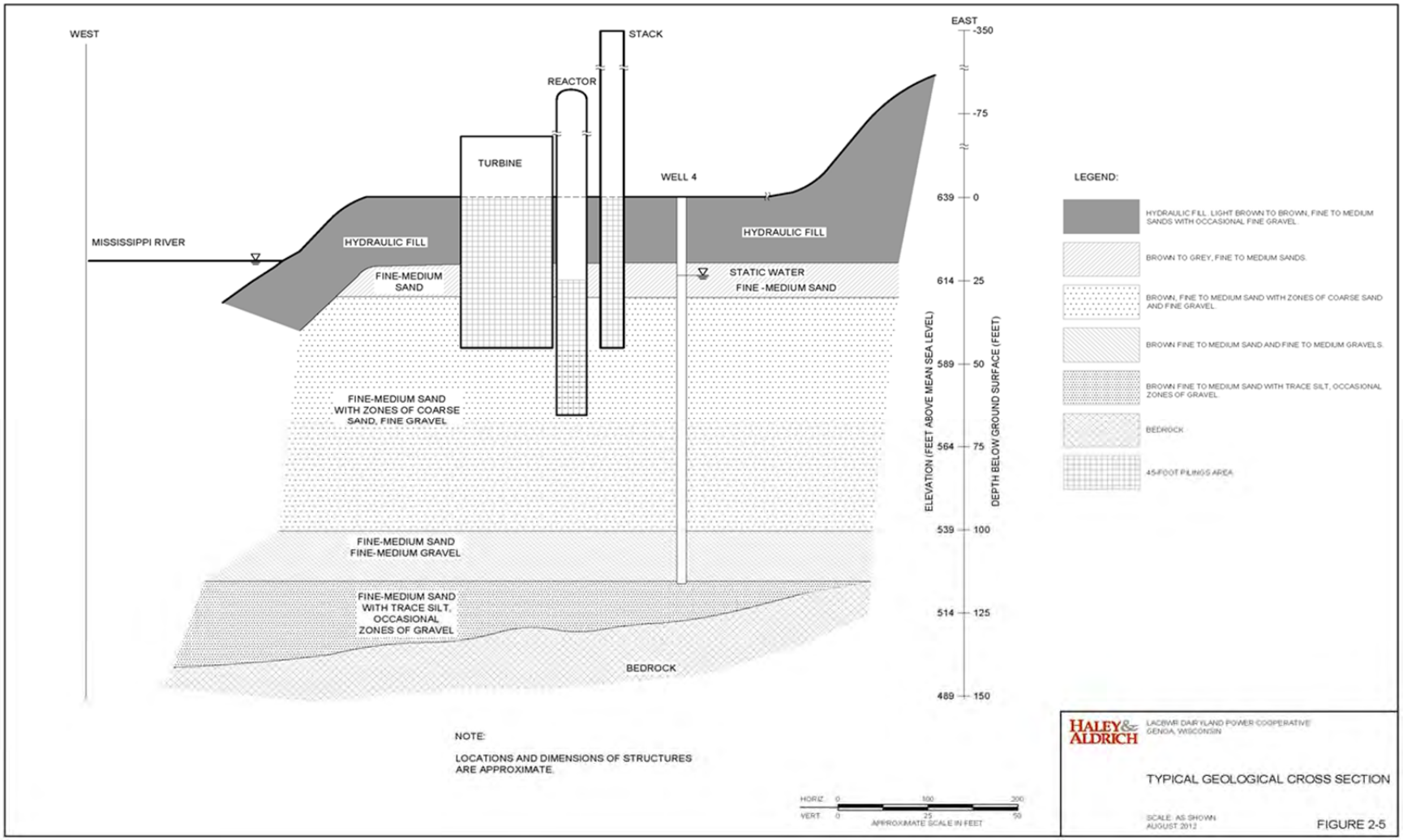


Figure 2-8 Shallow Aquifer Groundwater Contours November 2012

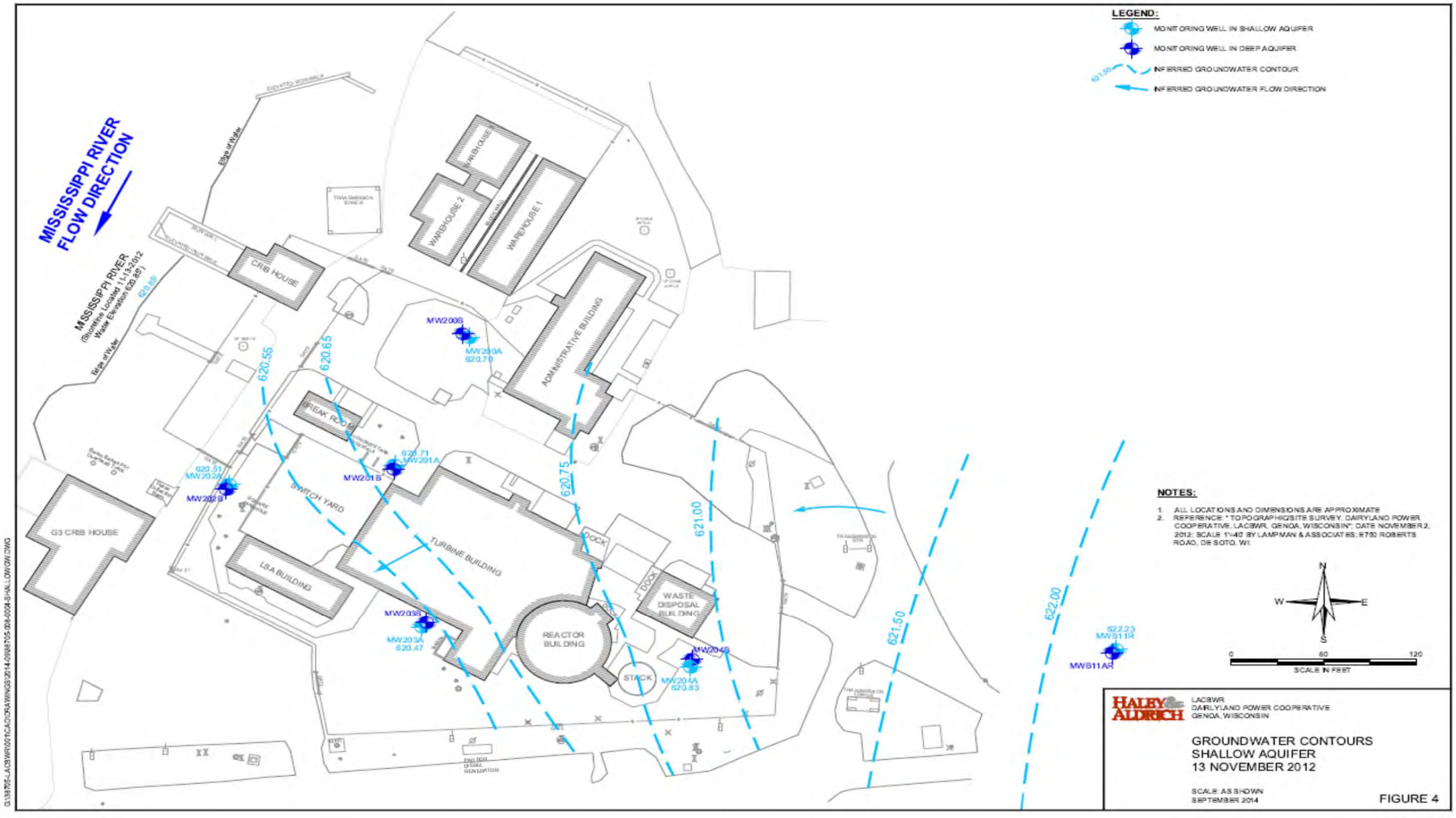


Figure 2-9 Deep Aquifer Groundwater Contours November 2012

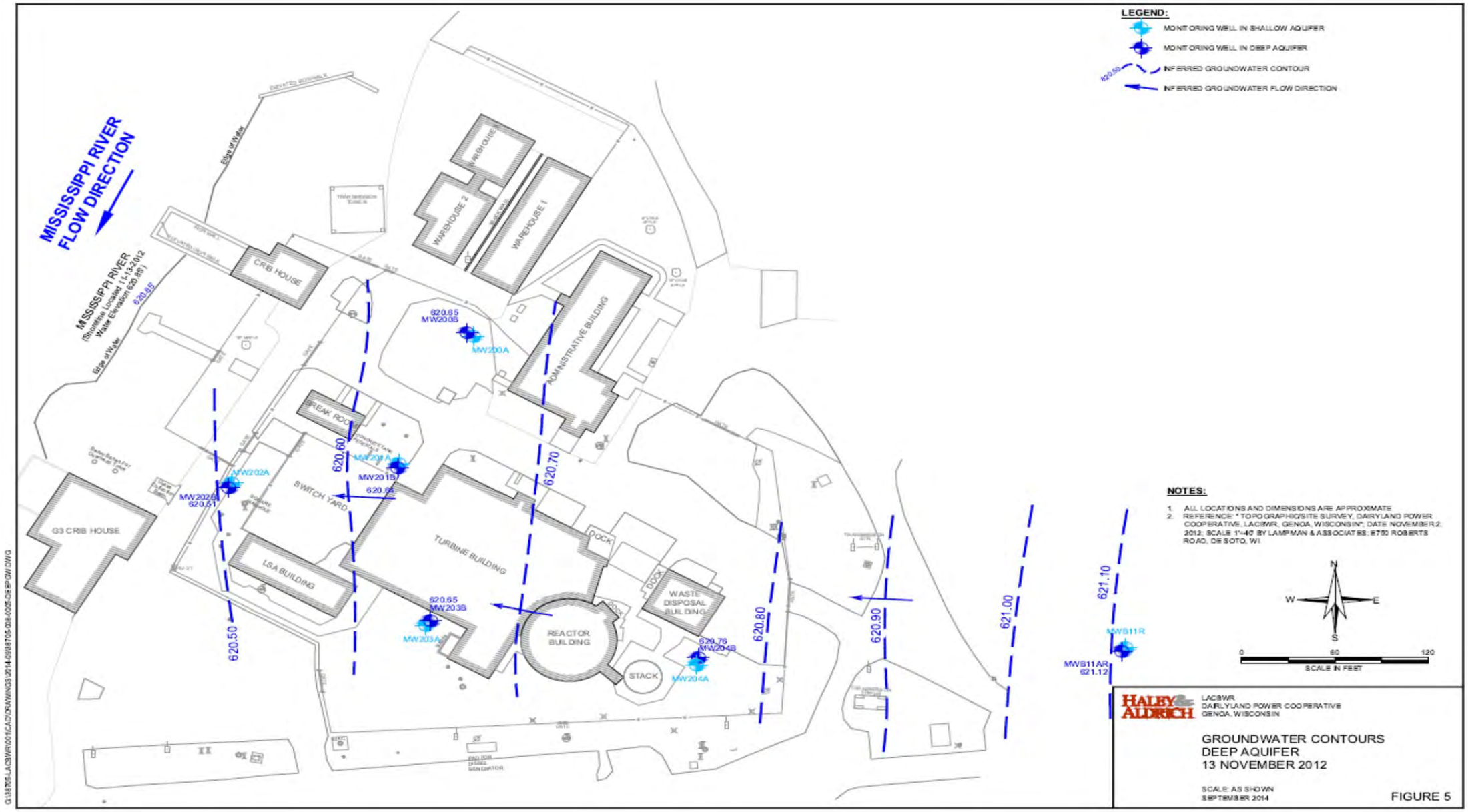


Figure 2-10 Shallow Aquifer Groundwater Contours June 2013

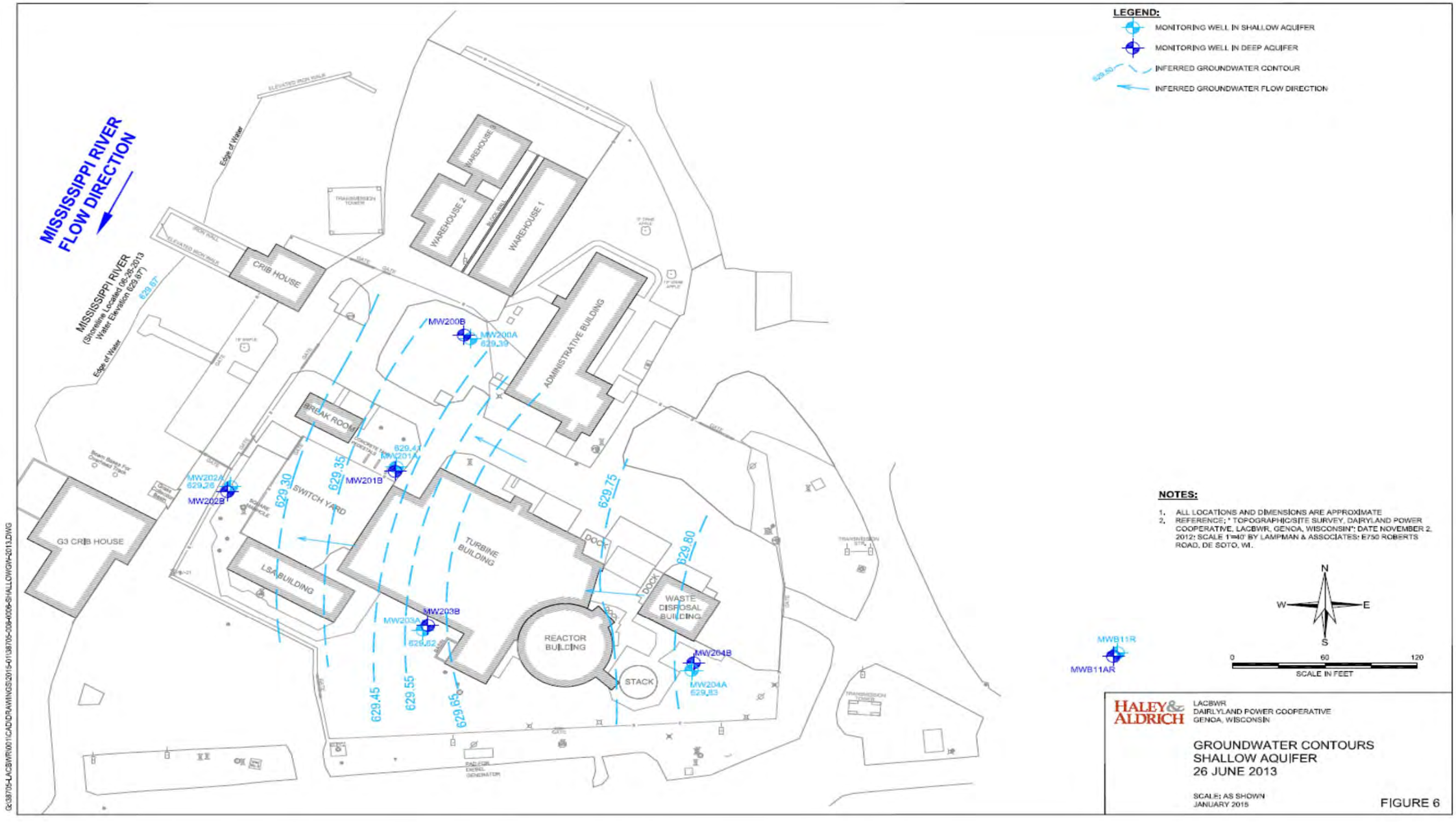


Figure 2-11 Deep Aquifer Groundwater Contours June 2013

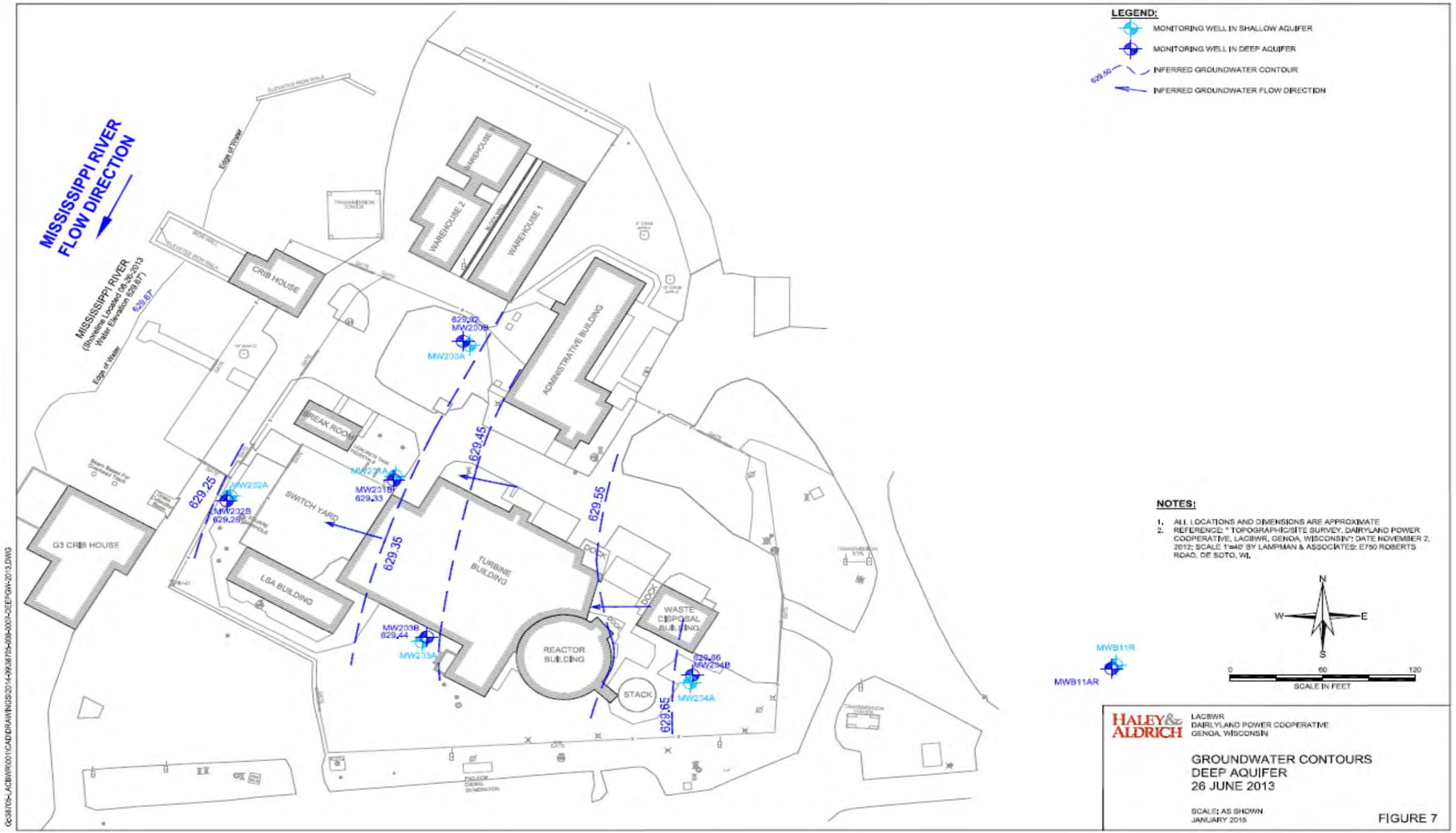


Figure 2-12 LACBWR Site Groundwater Wells

3. HISTORICAL SITE ASSESSMENT METHODOLOGY

The methodology used for the LACBWR Historical Site Assessment (HSA) and subsequent definition of survey units is that found in NUREG 1575, Multi-Agency Site Survey and Investigation Manual (MARSSIM). LACBWR, being a NRC licensee, has much of the HSA-related information within its records management system used to maintain its records throughout its operational and post shutdown history. Records were reviewed to document those events and circumstances during the history of the facility that contributed or may have contributed to the contamination of the site above background levels.

3.1. Approach and Rationale

The HSA included a detailed records search and personnel interview processes performed to identify events that posed a significant probability of impacting the hazardous materials or radiological status of the site's structures, infrastructure, or environment that would be pertinent to the license termination plan and the Multi-Agency Radiation Survey and Assessment of Materials and Equipment (MARSAME) process for the release of site structures, materials and equipment. This review included systems, structures and area contamination from system or personnel failures resulting in airborne releases, liquid spills or releases, or loss of control over solid material management which may impact site structures, components, or environmental media.

Each event identified that posed a realistic potential to impact the site was further investigated. This investigation focused on the scope of contaminant, sampling and analysis, remedial actions taken to mitigate the situation, and any post-remedial action sampling, survey, and analysis to validate the success of the remedial actions.

Also included in the research associated with the development of the HSA were:

- Relevant excerpts from written reports and correspondences;
- Personnel interviews, including the use of questionnaires, of current, former, and retired plant personnel to confirm events and identify undocumented events; and
- Site inspections utilizing historical site maps, photographs, and diagrams to identify, locate, confirm, and document areas of concern.

Information from this research was used in the HSA development, including the compilation of data, evaluation of results, documentation of findings, and the identification of Impacted and Non-Impacted Areas and associated Survey Units.

3.2. Boundaries of Site

The site boundary description is discussed in Section 2.1, "Site Location and Physical Characteristics." Figure 2-3, "LACBWR Site" as presented in Exhibit B of Reference 7.2 depicts the LACBWR licensed site. The fenced area of the ISFSI Facility as located in Lot 7 of the site is excluded from the scope of this license termination plan as the release of the ISFSI Pad Facility area will be at a later date following disposition of the spent nuclear fuel stored there.

3.3. Documents Reviewed

During the HSA research, the records reviewed included:

- Licenses and Permits
- Operational Review Committee (ORC) Meeting Minutes
- Safety Review Committee (SRC) Meeting Minutes
- Licensee Event Reports (LER) Summaries
- Site Initiated Incident Reports (IR)
- Operator Logs including Reactor Operator and Health Physics entries
- Annual Environmental Monitoring Reports
- Environmental investigations performed by independent entities
- Regulatory actions concerning the site
- Documentation from interviews conducted with retired/separated site personnel

- Health Physics surveys and sampling results associated with identified events
- Site inspection and surveillance type documents associated with identified events
- Radiological and environmental survey documents
- Quality Control/Quality Assurance finding type documents

3.3.1. Licenses and Permits

The La Crosse BWR AEC/NRC license history consists of three time periods. The first period is from 1962 to 1969, when the facility was owned by Allis-Chalmers and licensed by the AEC. The license numbers associated with this phase are Construction Authorization 5 (docket number 115-5), issued March 29, 1963, authorizing construction of LACBWR, and Provisional Operating Authority DPRA-5 issued July 3, 1967 for start-up testing and initial operation. The second period is from October 31, 1969, to August 28, 1973, when the facility was owned by DPC and licensed by the AEC under Provisional Operating Authority DPRA-6. The third period is from August 28, 1973, to the present and represents the period where the facility was owned by DPC and operated under AEC/NRC 10 CFR 50 Operating License DPR-45. This period includes power operations to 1987, permanent shutdown for decommissioning in 1987, and ISFSI construction and spent fuel off-load completed in 2012.

3.3.1.1. CAPR-5 and DPRA-5

Allis-Chalmers Atomic Energy Division and the Atomic Energy Commission (AEC) entered into a contract, AT (11-1) -850, on June 6, 1962, to construct a second-round demonstration nuclear power plant. Under this contract, Allis-Chalmers had the responsibility for the design, fabrication, construction, and startup of the reactor. Allis-Chalmers retained Sargent & Lundy Engineers as architect-engineers for the project and the Maxon Construction Company as constructors. DPC furnished the plant site and all equipment, facilities and services necessary for a complete and operable nuclear plant. DPC and the AEC entered into a contract, AT (11-1)-851, on June 6, 1962, to buy steam from the nuclear power plant to operate a turbine-generator for production of electricity.

On November 5, 1962, Allis-Chalmers applied for Construction Authorization. The AEC issued Construction Authorization, CAPR-5, on March 29, 1963.

On August 3, 1965, Allis-Chalmers applied for an Operating Authorization; amendments to the application continued through March 8, 1967. The last modification to the contract AT (1 1-1)-850 was No. 8, dated June 16, 1967. The AEC issued Provisional Operating Authorization (POA) No. DPRA-5 to Allis-Chalmers on July 3, 1967.

3.3.1.2. DPRA-6

DPC applied for an Operating Authorization on October 4, 1967. POA No. DPRA-6 was issued to DPC on October 31, 1969, under Docket No. 115-5.

License No. DPRA-6 had a total of 15 changes from May 21, 1969, to August 28, 1973. DPC applied to the AEC to convert POA No. DPRA-6 to a 10 CFR Part 50 Provisional Operating License on May 22, 1972.

3.3.1.3. DPR-45

Change 12 to DPRA-6 converted it from a POA pursuant to 10 CFR Part 115, docket 115-5, to a Provisional Operating License (POL) DPR-45, docket 50-409, under 10 CFR 50. The AEC issued this change on August 28, 1973.

DPC applied to the AEC to convert POL No. DPR-45 to a full-term facility operating license on October 9, 1974. The 40-year term would expire on March 28, 2003.

In 1977, the Systematic Evaluation Program (SEP) was initiated by the Nuclear Regulatory Commission (NRC) to review the designs of older operating nuclear power plants, including LACBWR, in order to reconfirm and document their safety. The purpose of the review was to provide: (1) an assessment of the significance of differences between current technical positions on safety issues and those that existed when a particular plant was licensed, (2) a basis for deciding on how these differences should be resolved in an integrated plant review, and (3) a

documented evaluation of plant safety. The conversion of the provisional operating license to a full-term operating license was tied to the completion of the SEP safety assessment.

The Integrated Plant Safety Assessment for LACBWR was issued as NUREG-0827 in June 1983. Addendum 1 to NUREG-0827 was released in August 1986. DPC performed a consequence study to evaluate wind, tornado and seismic events. The study was accepted by the NRC in letters dated September 9, 1986, and April 6, 1987.

DPC provided a schedule for completion of items necessary for safe shutdown during a seismic, wind or tornado event on December 11, 1986. Work on scheduled items had been terminated due to the plant shutdown.

On April 24, 1987, the decision was made by the DPC Board of Directors to permanently shut down LACBWR. The official announcement to the public of this decision was made on April 27, 1987; and LACBWR was permanently shut down on April 30, 1987.

The licensee's authority to operate Facility License No. DPR-45, pursuant to 10 CFR Part 50, was terminated by license Amendment No. 56, dated August 4, 1987, and a possession-only status was granted. The decommissioning alternative of SAFSTOR was chosen.

The NRC directed the licensee to decommission the facility in its Decommissioning Order dated August 7, 1991. The Decommissioning Order was modified September 15**,** 1994, by Confirmatory Order to allow the licensee to make changes in the facility or procedures as described in the Safety Analysis Report and to conduct tests or experiments not described in the Safety Analysis Report, without prior NRC approval, if a plant-specific safety and environmental review procedure containing similar requirements as specified in 10 CFR 50.59 was applied.

License Amendment No. 66, issued with the Decommissioning Order and also dated August 7, 1991, provided evaluation and approval of the proposed Decommissioning Plan, proposed SAFSTOR Technical Specifications, and license renewal to accommodate the proposed SAFSTOR period until March 29, 2031.

The Initial Site Characterization Survey for SAFSTOR was completed and published October 1995 and is attached to the Decommissioning Plan.

License Amendment No. 69, containing the current Technical Specifications, was issued April 11, 1997. This amendment revised the body of the license and the Appendix A Technical Specifications. The changes to the license and Technical Specifications were structured to reflect the permanently defueled and shutdown status of the plant. These changes deleted all requirements for emergency electrical power systems and maintenance of containment integrity.

The SAFSTOR Decommissioning Plan is considered the post-shutdown decommissioning activities report (PSDAR). The PSDAR public meeting was held on May 13, 1998. Review of and revisions to this Decommissioning Plan, the Security Plan, the Emergency Plan, the Quality Assurance Program Description, the Offsite Dose Calculation Manual and other material continue at intervals as required.

NAC International submitted an amendment request for the NAC-MPC dry cask storage system to incorporate the LACBWR spent fuel as allowable contents. The NRC approved the amendment with an effective date of October 4, 2010.

All of the spent nuclear fuel was transferred from the Fuel Element Storage Well (FESW) to dry cask storage at the on-site Independent Spent Fuel Storage Installation (ISFSI) as of September19, 2012.

July 31, 2013, DPC received amendment 72, which revised license and Technical Specification as a result of the completion of the transfer of the spent fuel to dry cask storage.

On March 12, 2014, DPC submitted LACBWR Decommissioning Plan and Post-Shutdown Decommissioning Activities Report (D-Plan/PSDAR) Revision to USNRC. DPC continues conducting dismantlement and decommissioning activities of the reactor site.

License No. DPR-45 has had 72 Amendments to date. A brief description of all changes and amendments to date are listed below in Appendix B, the License Amendment History.

At no time in LACBWR Site history was either a radioactive material/waste landfill or incinerator operated on the site property. There are no on-site radioactive waste disposal locations.

3.3.1.4. Environmental Permits

DPC holds a number of additional environmental permits at the Genoa Site. These permits are summarized in Table 3-1, below.

Table 3-1 Environmental Permits at the DPC Genoa Site

Location	Title	Permit Number	Issuing Agency	Permit Coverage Location
Genoa 3	Drinking Water Testing at G-3	No Permit Number	Per NR-809 Vernon County	G-3
LACBWR	Drinking Water Testing at LACBWR	No Permit Number	Per NR-809 Vernon County	LACBWR
Genoa 3	G-3 Bottom Ash Storage Plan	No Permit Number	Wisconsin Department of Natural Resources	G-3 Bottom Ash Pad Near Bottom Ash Dewatering Bins
Genoa 3	Genoa Barge Fleeting Permit	IP-WC-2011-63-03151	Wisconsin Department of Natural Resources	Genoa Site
Genoa 3	Genoa Landfill License and Closure Plan	01747	Wisconsin Department of Natural Resources	South of G-3 Plant and Coal Pile
Genoa Site	Genoa Site Air Pollution Control Operation Permit	663020930	Wisconsin Department of Natural Resources	Genoa Site
Genoa Site	Genoa Site Bulkhead Lease/Permit	WDNR Docket Number 2-WP-1589	Wisconsin Department of Natural Resources	Genoa Site
Genoa Site	Pit and Trench Dewatering General WPDES Permit for G-3	WI-0049344-3	Wisconsin Department of Natural Resources	G-3

Location	Title	Permit Number	Issuing Agency	Permit Coverage Location
Genoa Site	TIER-II Industrial Storm Water General Permit (WPDES) for G-3 and LACBWR	WI-S067857-3	Wisconsin Department of Natural Resources	Genoa Plant Site
Genoa 3	USA v. DPC/Sierra Club v. DPC Consent Decree Genoa	12-cv-462/10-cv-30-bbc	United States	G-3
Genoa 3	Vessel General Permit (VGP) for Discharges Incidental to the Normal Operation of Vessels (VGP), NPDES	No Permit Number	Environmental Protection Agency	Genoa Barge Fleeting Area
Genoa Site	Wastewater (WPDES) Permit for G-3 and LACBWR	WI-0003239-8-0	Wisconsin Department of Natural Resources	For G-3 and LACBWR Plants

3.3.2. Operating Records and Existing Radiation Data

Radiological surveys and environmental monitoring of the LACBWR site as well as off-site locations have been ongoing since the start of plant operations in 1967. A review of available historical radiological information associated with soil, surrounding environs, and groundwater was conducted and the results are summarized in this section.

3.3.2.1. Liquid Release Incidents

The historical review indicated that between 1967 and 1987, there were several instances of noted system leakages, radiological spills, and radioactive liquid effluent releases with the potential to impact the site that occurred at LACBWR. Spills within facility structures and floors were surveyed and decontaminated. When overflows spread outside buildings, any contaminated material released to paved areas or soil was remediated. Waste water tank releases which were not grab sampled, but were fixed-process monitored prior to discharge to the Mississippi River, were investigated, assessed and determined to be within allowable limits.

Noted radiological releases, which had the potential to impact the site, included the following:

3.3.2.1.1. Leakage from the Fuel Element Storage Well

An initial site characterization report conducted by DPC, LAC-TR-138 indicated that the stainless steel liner in the Fuel Element Storage Well (FESW) had a history of leakage [Reference 7.13]. From the date of initial service in 1967 until 1980, the leakage increased from approximately 2 gallons per hour (gph) to just over 14 gph. In 1980, epoxy was injected behind the liner and the leakage was reduced to approximately 2 gph. In 1993, the FESW pump seals were discovered to be defective and were replaced, which reduced the leakage to approximately 1 gph. FESW leakage then stabilized over the years to an average of approximately 21 gallons per day. The spent nuclear fuel was

completely removed from the FESW and transferred to an on-site ISFSI by September 2012. It is believed that all FESW leakage was subsequently contained within the Reactor Building's 1.16-inch thick carbon steel shell.

3.3.2.1.2. Release of Resin Regeneration Waste Liquids to the Discharge Point

The release of resin regeneration waste liquids to the Mississippi River was summarized in the Haley & Aldrich hydrogeological report contracted by DPC [Reference 7.3]. The plant was designed for the regeneration of full-flow resin beds. During early operations of the plant in the 1970s, routine resin bed regeneration activities contributed to spent resin fines being part of the routine controlled and monitored liquid waste releases to the circulating water discharge line to the Mississippi River discharge point. Mid-run backwashes and regeneration of the resins with release to the Mississippi River were stopped in July 1973.

In late February 1994, DPC contracted Environmental Marine Services to conduct a sampling survey to determine the extent of the radioactive contamination in the outfall area [References 7.14 and 7.15]. This included sampling of the area beyond the riprap, about 60 feet from the river's edge, as no sample could be readily obtained from the riprap area. Silt samples were taken at various locations at the outfall and downstream, and plant-derived radionuclides (Co-60, Cs-137) were noted in these samples. The sample results are provided in Table 3-2 and decay corrected to January 1, 2015.

Table 3-2 Outfall Silt Sampling Results

Sample ID	Location Relative to Outfall	Original Co-60 activity (pCi/g) (2/16/1994)	Decay Corrected Co-60 activity (pCi/g) (1/1/2015)	Original Cs-137 activity (pCi/g) (2/16/1994)	Decay Corrected Cs-137 activity (pCi/g) (1/1/2015)
1-60'	60' from shoreline	1.07E+0	6.83E-2	1.98E+0	1.22E+0
2-70'	70' from shoreline	1.26E+0	8.04E-2	2.22E+0	1.37E+0
3-80'	80' from shoreline	1.33E+0	8.49E-2	2.23E+0	1.38E+0
4-90'	90' from shoreline	8.13E-1	5.19E-2	1.87E+0	1.15E+0
5-100'	100' from shoreline	2.16E-1	1.38E-2	3.62E-1	2.23E-1
6-110'	110' from shoreline	8.23E-2	5.25E-3	1.27E-1	7.84E-2
7-120'	120' downstream from outfall	8.96E-3	5.72E-4	2.14E-2	1.32E-2
8-130'	130' downstream from outfall	Not Detected	---	7.22E-3	4.46E-3
9-140'	140' downstream from outfall	Not Detected	---	2.01E-2	1.24E-2
10-150'	150' downstream from outfall	9.33E-3	5.95E-4	2.26E-2	1.40E-2

The hydrogeological contractor, Haley & Aldrich, Inc., which was retained by DPC to develop a hydrogeological conceptual site model for the site, assessed the releases and 1994 results in its August 2012 report submitted to DPC and arrived at the following conclusions [Reference 7.3]

Based on the surveys, there are no unacceptable dose levels associated with the resins and most of the materials have been dispersed within the riprap matrix and have decayed since their release in the early 1970s. The resins that were historically released via the circulating water do not pose an unacceptable risk to the environment. The areas at the outfall and downstream have been surveyed and no additional characterization or remediation is warranted.

3.3.2.1.3. Overflow of Waste Water Tanks into the Turbine Building or Discharged into the Mississippi River Without Sampling

A review of historical event reports disclosed numerous instances of the overflow of the 3,000-gallon and the 4,500-gallon waste water tanks, with contamination spread to other parts of the Turbine Building and/or to the Mississippi River. These are listed in Table 3-3.

Table 3-3 Wastewater Tank Overflow events

Report No./Reportable	Event Date	Summary
Licensee Event Report No. 79-15 (Reportable)	August 22, 1979	2,483 gallons from the 1B Retention Tank were inadvertently pumped to the Mississippi River instead of the 4,500 gallon Waste Tank. The pumping was terminated after discovery. The tank was sampled and it was determined that no radiological release limits were approached or exceeded. The liquid discharge all went through the fixed process monitor without alarm conditions.
LACBWR Incident Report No. DPC-80-102 (Not Reportable)	December 6, 1980	Overflow of 4,500-gallon waste tank; approximately 0.5 gallons spread to Reactor Feed Pump area and into Machine Shop. Samples taken of West Turbine Building sump indicated no release to the environment. Flooded area had contamination levels of 15,000 – 40,000 dpm/100 cm^2 and the area was decontaminated and released.
LACBWR Incident Report No. DPC-80-106 (Not Reportable)	December 15, 1980	Overflow of 4,500-gallon waste tank; sump pumps in Turbine Building basement tunnel. The tunnel area was subsequently decontaminated.
LACBWR Incident Report No. DPC-81-10 (Not Reportable)	January 30, 1981	Overflow of 4,500-gallon waste tank and water spread into the laundry room. Surveys of the water that came up through the drains read > 10 mR/hr and surveys of the sediment that came through the drains read 30 mR/hr. The waste and sediment were pushed back into the drain and the area was decontaminated.
Licensee Event Report No. 85-06 (Reportable)	April 10, 1985	Failure to isolate the 3,000-gallon waste tank allowed for additional water (approximately 550 gallons) from the Turbine Building drain system, primarily from the laundry area, to be discharged to the Mississippi River without sampling prior to release. The liquid waste was fixed process monitored during the release and since the indicated activity did not exceed the alarm set point, the activity of the water was within allowable limits.
Licensee Event Report No. 86-004	January 13, 1986	During a discharge of the 3,000-gallon waste tank, it was determined that the contents of the 4,500-gallon waste tank were also being discharged to the Mississippi River without sampling prior to release. The liquid waste was monitored during the release and since the indicated

Report No./Reportable	Event Date	Summary
(Reportable)		activity did not exceed the alarm set point, the activity of the water was within allowable limits. The contents of the tank were sampled and analyzed following this incident and determined to be releasable at the dilution rate used.
Licensee Event Report No. 86-012 (Reportable)	April 9, 1986	During a discharge of the 4,500-gallon waste tank, it was determined that water (approximately 875 gallons) from the 3,000-gallon waste tank had overflowed into the 4,500-gallon tank. The water was mainly ground water which was seeping into the Turbine Building tunnel due to high Mississippi River water level. The 3,000-gallon tank contents had not been sampled prior to release to the Mississippi River. However, since the indicated activity did not exceed the alarm set point on the fixed process monitor, the activity of the water was within allowable limits. Additionally, the contents of the tank were sampled and analyzed following this incident and determined to be releasable at the dilution rate used.
Licensee Event Report No. 86-014 (Reportable)	April 18, 1986	During a discharge of the 3,000-gallon tank, it was determined that water (approximately 2,445 gallons) was also discharged to the Mississippi River without sampling. However, since the indicated activity did not exceed the alarm set point on the fixed process monitor, the activity of the water was within allowable limits. Additionally, the contents of the tank were sampled and analyzed following this incident and determined to be releasable at the dilution rate used.

3.3.2.1.4. Turbine Building Floor Drain System Piping Potential Degradation and Leaks to Soil

In late 1980, DPC conducted an investigation of the Turbine Building floor drain system, after grouting operations to fill void spaces under the building, due to a concern that drain liquids may have entered the underlying soil. This investigation was summarized in a Licensee Event Report to the NRC, LER 80-12 [Reference 7.16] and is described below.

In the late 1970s, it was determined that there were some minor voids beneath the Turbine Building floor, mainly in the northeast area below the laundry operations. Subsequently, grout material was injected under slight pressure to fill the voids beneath the floor. On November 7, 1980, it was verified that grout material had entered some of the drain piping and blocked the piping. Because it could not be determined that the blocked drain piping was sealed completely by the grout, the potential existed for leakage of drain water into the soil beneath the Turbine Building floor.

An initial soil sample down to 2 feet under the Turbine Building, near the No. 3 Feedwater Heater, was taken on November 24, 1980, and determined to be slightly contaminated. The soil activity was discovered within the first foot of soil, with 9 pCi/g at the 0-6” depth (6 pCi/g Co-60; 2 pCi/g Cs-137) and 0.5 pCi/g at the 6-12” depth (0.47 pCi/g Co-60; 0.07 pCi/g Cs-137). Another core soil sample was taken outside the Turbine Building about 25 feet from the south Turbine Building wall. Soil was sampled down to 3 feet, and all results were less than the MDA (~ 0.4 pCi/g). Another hole was also drilled in the Turbine Building floor near the No. 3 Feedwater Heater, about 8 feet from the first location which had indicated subsoil activity. Subsurface soil samples were taken down to 3 feet from this new location, and sample analysis showed no results above the MDA.

Water samples were also taken from two potable water wells: the Genoa-3 North Well (No. 4 well, deep well south of LACBWR), and the LACBWR No. 3 Well (deep well east of LACBWR). These samples indicated minimal

activity as their water radioactivity concentrations were well within the activity of the shallow river well in the vicinity of the plant as well as the activity levels associated with LACBWR's standard environmental water sampling program.

Based on the other soil and water activity results and the fact that there was a high ratio of Co-60 to Cs-137 (indicating that the subsoil contamination occurred recently), it was concluded that the initial discovered contamination was not due to long-term leakage of the Turbine Building drain piping, but recent activity which resulted from drill cutting water, post-drilling rinse water and floor cleaning water which had entered the hole.

As the majority of the low levels of contamination detected in the subsurface soil in this November 24, 1980, discovery were from Co-60, it would have significantly decayed over the years. Table 3-4provides the results from 1980 decay corrected to January 1, 2015, for the radionuclides noted in 1980.

Table 3-4 Soil Samples Beneath Turbine Building Floor

Depth of Sampled Subsoil	Original Co-60 activity (pCi/g) (11/24/1980)	Decay Corrected Co-60 activity (pCi/g) (1/1/2015)	Original Cs-137 activity (pCi/g) (11/24/1980)	Decay Corrected Cs-137 activity (pCi/g) (1/1/2015)
0-6"	6.0E+0	6.8E-2	2.0E+0	9.1E-1
6-12"	4.7E-1	5.3E-3	7.0E-2	3.2E-2

The decayed activity levels for these radionuclides are well below NRC screening DCGLs and indicate that subsurface contamination from the introduced activity in the Turbine Building core drilling hole near the No. 3 Feedwater Heater is most likely not a concern for soil remediation.

While the soils and groundwater beneath the Turbine Building are not likely to exceed screening DCGLs, further evaluation and determination of additional characterization efforts post-Turbine Building demolition will be warranted to confirm this initial assessment.

3.3.2.1.5. Release of Radioactively Contaminated Water from the Turbine Building to the Environment

The most significant release event at LACBWR impacting the environment is considered to be the event which occurred on July 2, 1982, when the resin sluice water sight flow bulls eye ruptured, resulting in the release of approximately 25 gallons of condensate water to an unrestricted area. This event was noted in a DPC Licensee Event Report [Reference 7.17] and also discussed in the LACBWR Initial Site Characterization Report [Reference 7.13].

Approximately 1,200 gallons of water were released to the Turbine Building floor, and an estimated 1,125 gallons were recovered by the waste water tanks. About 20 gallons entered the ground in the radiologically controlled area outside the west turbine hall door; and, at the turbine hall truck bay door, an estimated 30 gallons were recovered by the oil separator overflow sump. It was estimated that the remaining 25 gallons were discharged to an unrestricted area. The total of 25 gallons of contaminated water was estimated to have entered the environment through the combined drain discharge line to the Mississippi River as well as thru leakage from the overflow sump into the ground. The total number of Curies discharged to the river was estimated to be approximately 5E-5 Ci and the discharged water concentration was estimated to be 0.05% MPCW, with no consequences to the public.

The contaminated ground was removed over a 3-square foot area by the west Turbine Building door and a 2-square yard area by the Truck Bay door. The soil was placed in waste storage barrels and disposed of offsite.

3.3.2.1.6. Release of Reactor Coolant Water to Reactor Building Basement

In July 1983, there was a seal water injection leak at the 1A Forced Circulation Pump (FCP) which resulted in a spill of approximately 15,000 gallons of reactor coolant water to the Reactor Building basement floor areas [Reference 7.18]. The areas were decontaminated and the water sampled and released per normal procedures.

3.3.2.1.7. Reuse of Potentially Contaminated Control Rod Drive (CRD) Oil on Roads

There is the potential for environmental impact by the reuse of Control Rod Drive (CRD) oil on-site, as discussed in the Haley & Aldrich Hydrogeological Report [Reference 7.3]. Based on historical accounts from former employees, in the early 1970s, oils from the CRDs within the Reactor Building were recycled by spraying on the dirt roads for dust suppression, including areas near the former boat ramp. Because these oils came from the Reactor Building, they could have been radiologically contaminated. The historical accounts suggest that this oil use occurred just after startup; therefore, it is unclear if the oil was radiologically contaminated. Because the oils were reportedly used as dust suppressants, areas within the road, adjacent swales and areas around the boat ramp may have been impacted. However, at the time of this practice, procedures were in place that would prevent the release and reuse of any radiologically impacted materials. Additionally, a portion of the impacted area is where the current ISFSI pad is located. Prior to construction of the pad, a radiological survey of the ground was conducted with the collection of soil samples, and no plant-related contaminants were detected above the MDA of the on-site gamma spectroscopy equipment.

Therefore, it is unlikely that the areas where the CRD oil was spread were radiologically impacted. However, further evaluation and possible additional characterization may be conducted to confirm this assumption.

3.3.2.2. Aerial Survey

EG&G conducted aerial surveys of the area surrounding LACBWR [References 7.19 and 7.20] in July 1968 for the U.S. Atomic Energy Commission (AEC) and June 1976 for the U.S. Nuclear Regulatory Commission (NRC). These surveys were made as part of a continuing nationwide Aerial Radiological Measuring System (ARMS) program started in 1958 to monitor radiation levels surrounding facilities producing or using radioactive materials.

The aerial survey performed in 1968 was the first survey of the La Crosse area since the startup of the plant in 1967. EG&G utilized ARMS system equipment consisting of an array of NaI (Tl) scintillation detectors in flights at an altitude of 300 to 500 feet above ground level and covering an area of 625 square miles. The exposure rates, including cosmic ray contributions, were in the 4 to 10 µR/hour range. The radionuclides detected were K-40, Pb-214, Bi-214, and Tl-208, consistent with normal terrestrial background radionuclides. It was concluded that no significant results were detected that could be attributed to reactor operations.

Another ARMS survey was performed by EG&G in June 1976 and covered an area of 829 square miles. The calculated exposure rates ranged from 7 to 10 µR/hour and were consistent with soil sample analysis results from samples taken at two off-site locations west and northeast of the plant. The detected radionuclides were again the usual terrestrial background radionuclides (K-40, Bi-214, and Tl-208).

3.3.2.3. Soil Survey Campaigns

DPC has performed a number of soil surveys since the plant shutdown in 1987. These have involved soil sampling operations performed within the LACBWR Radiologically Controlled Area (RCA) (e.g. LACBWR Site Enclosure Area, LSE), the licensed site boundary and outside the site boundary. The soil survey and sampling information is summarized in Table 3-5 on the following pages.

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 at low levels. The last extensive soil sample campaign conducted within the RCA was performed as part of an initial site characterization survey in 1995 [Reference 7.13] and indicated that Cs-137 was present at levels up to 1.30 pCi/g. Appendix E provides the tabulated soil data for the information summarized in Table 3-5.

Table 3-5 Summary of Soil Sampling Data

Survey Campaign/Timeframe	Samples[1] Within RCA (LACBWR Site Enclosure Area - LSE)	Samples[1] Within Site Boundary	Samples[1] Outside Site Boundary
SAFSTOR Ground Sampling Initial Site (September 1987)	10 samples total: Co-60 activity *Range from ≤ MDA to 7.27 pCi/g. *Highest (7.27 pCi/g) was noted NE of Waste Treatment Building *Average of reported Co-60 activity was 1.23 pCi/g Cs-137 activity *Range from ≤ MDA to 14.34 pCi/g *Highest (14.34 pCi/g) was noted NE of Waste Treatment Building *Average of reported Cs-137 activity was 2.00 pCi/g	10 samples total: Co-60 activity *Range from ≤ MDA to 0.32 pCi/g *Average of reported Co-60 activity was 0.24 pCi/g Cs-137 activity *Range 0.02 to 0.70 pCi/g * Highest (0.70 pCi/g) was noted NE of the electrical switchyard, W of Highway 35 *Average Cs-137 activity was 0.18 pCi/g	1 sample taken. This sample across Highway 35, Northeast from plant indicated 0.71 pCi/g Cs-137
Initial Site Soil Sampling (August 1992 – January 1993)	8 samples total, all taken SW side of the plant Co-60 activity *3 of 8 samples showed activity *Range from ≤ MDA to 0.09 pCi/g *Average of reported Co-60 activity was 0.06 pCi/g Cs-137 activity *All samples showed minor concentrations of Cs-137 *Range from 0.04 to 0.12 pCi/g *Average Cs-137 activity was 0.10 pCi/g	0 samples taken	12 off-site samples were taken. Co-60 activity *Activity levels were less than or equal to MDA(range of 0.012-0.016 pCi/g) Cs-137 activity *Range from 0.04 to 0.67 pCi/g *Highest activity was 0.67 pCi/g at area SE of Stoddard, WI *Average was 0.25 pCi/g

Initial Site Characterization Survey (August – September 1995)	69 samples total: Co-60 activity *Range from ≤ MDA (range from 0.003-0.006 pCi/g) to 0.77 pCi/g; majority of samples were ≤ MDA *Highest (0.77 pCi/g) was noted SE of Waste Treatment Building Cs-137 activity *Range from 0.01 to 1.30 pCi/g *Highest activity levels were areas SE of Waste Treatment Building (0.98 pCi/g) and NE of Waste Treatment Building (1.30 pCi/g) *Average was 0.15 pCi/g	6 samples taken Co-60 activity *Activity was ≤ MDA (0.003 to 0.006 pCi/g) Cs-137 activity *Range from 0.02 to 0.15 pCi/g *Highest activity (0.15 pCi/g) was N of Administration Building	5 samples taken Co-60 activity *Activity was ≤ MDA (0.003 to 0.006 pCi/g) Cs-137 activity *Range from 0.04 to 0.38 pCi/g *Highest activity noted was 0.38 pCi/g at location 3.3 miles S of boat landing at Bad Axe River *Average was 0.18 pCi/g
Soil Survey– East of Plant (July 2008)		8 samples were taken for consideration of construction of a Back Up Control Center east of the plant. Cs-137 noted in all samples; range from 0.06 to 0.10 pCi/g; average was 0.08 pCi/g	
Soil Survey – South of Plant (September 2008)		2 samples were taken in area considered for new parts storage building S of the Central Warehouse Cs-137 was noted at 0.08 and 0.12 pCi/g	
ISFSI Site Soil Collection (April – August 2009)		83 samples taken pre-ISFSI construction in area of ISFSI facility Review of 17 of these samples indicated average Cs-137 concentration of 0.01 pCi/g. NORM radionuclides identified included K-40, Tl-208, Bi-212, Pb-212, Bi-214, Pb-214, Ra-226, Ac-228 and Th-234	

Note: 1- Samples taken within top 6 inches (15 cm) of soil.

3.3.2.4. State of Wisconsin Radiological Surveys

The State of Wisconsin has been performing environmental radioactivity surveys, including soil sampling at off-site locations, since 1965. The State of Wisconsin sampling program has included samples of air, penetrating gamma

radiation (Thermoluminescent Dosimeters, TLD), precipitation, surface water, well waters, fish, shoreline sediment, bottom sediments, soil and vegetation at selected locations around LACBWR.

In 1973, DPC performed a review of the Wisconsin Environmental Reports from 1965 to 1972 in response to U.S. Atomic Energy Commission (AEC) questions, including an inquiry regarding possible cumulative radioactivity buildup in the environment [Reference 7.21]. DPC stated that "the best data which is presently available in determining if there is buildup of radioactivity in the environment surrounding LACBWR is the soil data available from State of Wisconsin's Environmental Reports from 1965-1972." DPC concluded that "there does not appear to be any particular pattern to the radioactivity that could be described as a cumulative buildup."

Upon shutdown of LACBWR in 1987, the Wisconsin environmental radioactivity monitoring program was modified in June 1988. These modifications included the elimination of precipitation, shoreline sediment and well water samples as well as a reduction in vegetation, soil and some surface water sampling. Other minor modifications were made in 1998, 1999 and 2000. Selected State of Wisconsin environmental reports were reviewed from the past 20 years.

A summary of the discussions and conclusions from the latest (2013) State of Wisconsin, Department of Health Services (DHS) report [Reference 7.22] is noted in Table 3-6.

Table 3-6 Summary of Sate of Wisconsin Environmental Monitoring

Type of Sample	Location(s)	Summary of Results
Air Particulate	LAC-2, Lock & Dam #8, 0.6 miles N of LACBWR	The gross beta activities were not different from gross beta activities in other WI environmental monitoring programs. With no significant differences, an increase in gross beta activity attributable to the LACBWR facility is not evident. Small amounts of Be-7 were detected on the filter composites; however this is a naturally occurring radionuclide produced through nuclear reactions between cosmic rays and nuclei in the atmosphere. Overall, influence by the LACBWR facility on air quality is not evident from air particulate analysis.
Ambient Gamma Radiation	6 TLD locations at off-site locations around LACBWR	Ambient gamma radiation data obtained from TLDs for 2012 from the WI DHS network comparable for all sites. Significant differences in exposure were not noticed at different distances from the LACBWR facility. The individual quarterly TLD readings among the 6 TLDs and 4 quarters ranged from 12.2 to 19.9 mR. The average quarterly exposure from the four sites located within Wisconsin was 15.7 $\pm$ 2.3 mR. The average quarterly exposure for 2012 is at background levels and is comparable to other areas within Wisconsin. Influence by the LACBWR facility is not evident from air ambient gamma radiation analysis.
Fish	LAC-3, Discharge channel, 0.1 miles WSW of LACBWR	The fish samples showed no unusual activities. Naturally occurring K-40 was reported in all samples. All other radionuclides were below their respective Lower Limit of Detection (LLD). Influence by the LACBWR facility is not evident from fish sample analysis.

Type of Sample	Location(s)	Summary of Results
Bottom Sediments	LAC-2, Lock & Dam #8, 0.6 miles N of LACBWR LAC-3, Discharge channel, 0.1 miles WSW of LACBWR LAC-4, Boat launch area, 0.7 miles SSW of LACBWR	The naturally occurring radionuclide K-40 was detected in all samples. Also, small amounts of Cs-137 (0.02 – 0.200 pCi/g) were detected in bottom sediment samples taken at sites LAC-3 and LAC-4. The reported activities for Cs-137 can be attributed past effluent discharges from the LACBWR facility and have also been detected in previous years. Naturally occurring radionuclides from the U-238 and Th-232 decay series are also commonly detected but have not been quantified or reported.
Surface Water	LAC-2, Lock & Dam #8, 0.6 miles N of LACBWR LAC-3, Discharge channel, 0.1 miles WSW of LACBWR	The surface water samples showed no unusual activities. All detected activities are at background levels and are comparable to data from previous years. The surface water samples uniformly show activities below state or federal standards. Influence by the LACBWR facility is not evident from surface water sample analysis.
Vegetation	LAC-5, Highway 35 parking lot, 0.6 miles NNE of LACBWR LAC-6, Boat launch access road, 0.7 miles S of LACBWR	Analysis of the vegetation samples showed no unusual activities. The gamma isotopic analysis detected only small amounts of naturally occurring K-40 and Be-7. Influence by the LACBWR facility is not evident from vegetation sample analysis.
Soil	LAC-5, Highway 35 parking lot, 0.6 miles NNE of LACBWR LAC-6, Boat launch access road, 0.7 miles S of LACBWR	Analysis of the soil samples showed no unusual activities. The naturally occurring radionuclide K-40 was detected in all samples. The reported activities (e.g. 0.160 $\pm$ 0.040 pCi/g at LAC-5 location) of Cs-137 were also detected in previous years and can be attributed to residual fallout from previous atmospheric nuclear weapons tests. Naturally occurring radionuclides from the U-238 and Th-232 decay series are commonly detected but have not been quantified or reported. Influence by the LACBWR facility is not evident from soil sample analysis.

3.3.3. Environmental Monitoring Data

LACBWR, as part of routine operations and later, SAFSTOR and DECON operations, released radioactive effluents into the environment. In addition to stack sampling (for airborne effluents) and waste tanks (for liquid effluents), a comprehensive Radiological Environmental Monitoring Program (REMP) was implemented to ensure that the radionuclide releases did not result in radiation exposures to the surrounding population which exceeded the established limits.

3.3.3.1. Air Effluent

The gaseous radioactive waste treatment and plant ventilation systems consisted of process equipment and instrumentation for the collection, processing, storage and monitoring of potentially radioactive gaseous wastes discharged from the plant. The main sources of gaseous waste were the effluents from the main condenser air ejector, the mechanical vacuum pump, the turbine gland seal exhaust, and the ventilation systems of the Reactor Building, the Turbine Building and the Waste Treatment Building. In early 1978, modifications were made to the off-gas system to allow for additional delay in the storage tanks and to provide downstream HEPA/charcoal filtration prior to discharge to the environment.

During power operations, radioactive material released to the atmosphere in gaseous effluents included fission product and activation gases, halogens (primarily iodine), tritium contained in water vapor, and particulate material, including fission products and activated corrosion products.

Airborne effluents released from LACBWR during operation were continuously-elevated release point-type releases from the plant's stack. The plant's concrete, 350-foot-high stack, situated east of the Reactor Building, allowed for airborne releases at an elevated height and also incorporated methods to continuously sample the airborne effluents being released. Stack monitors were installed to continuously sample the stack emissions and detect particulate and gaseous activity released to the stack.

The airborne concentrations were limited to specific Curie Release Rates, defined in the plant's Technical Specifications, and based on the Maximum Permissible Concentration (MPC) of the mixture of radionuclides being discharged. Airborne gaseous effluents, including gaseous halogen concentrations, were determined by gamma analysis on a Germanium Lithium (Ge-Li) detector of samples from various flow paths. Airborne particulate and particulate halogen (radioiodine nuclide) releases were determined by performing gamma spectroscopy analysis on a Ge-Li detector of weekly samples of stack discharges on glass fiber filter paper and charcoal cartridge adsorbents. Tritium releases were determined by taking a grab sample of the stack effluent and analyzing the distillate of the condensed water vapor by liquid scintillation spectrometry.

There were a few occasions where the release rates exceeded Technical Specifications. One event was noted in an LACBWR Incident Report, DPC 72-10, dated August 18, 1972. On August 18, 1972, the reactor was ramping up (64 percent power) and the stack released I-131 at rate of 0.987 µCi/second in excess of the Technical Specification limit of 0.51 µCi/sec. Off-gas was shifted to storage and fuel elements were surveyed to look for leaking fuel elements. The plant was shut down on August 19, 1972. Just prior to shutdown, airborne activity started to rise in the tunnel and Turbine Building. This was due to the failure of the waste compressor; however, the off-gas released went directly to the stack. It was verified that it did not exceed any radioactive release rates.

Once the plant permanently ceased operations in April 1987, the stack releases of fission and activation gases and iodine radionuclides dropped to immeasurable levels; and only particulate activity and tritium were noted during the subsequent SAFSTOR and DECON operations.

On September 9, 2011, DPC determined that that the plant's ventilation configuration was not in compliance with LACBWR Off-Site Dose Calculation Manual (ODCM), Section 3.3.1, which requires particulate filtration of Reactor Building exhaust air. DPC reported the condition to the NRC [Reference 7.23] and initiated a root cause analysis. The root cause analysis [Reference 7.24] identified that in November 1995 the main airlock doors were unlocked and opened and subsequent 50.59 screening process and other documents changes (e.g. ODCM, D-Plan, Reactor Building Operating Procedure) did not note the ODCM requirement for filtration of Reactor Building air prior to discharge. Therefore, there were occasions when the Reactor Building air was not filtered prior to discharge to the stack. The Root Cause Analysis involved a review of the Annual Radioactive Effluent Reports for 1990 to 2010. The annual doses to the public were well below 10 CFR 20 and 40 CFR 190 limits and lower in the 1995 to 2010 timeframe than the lowest doses calculated between 1990 and 1995. The gaseous effluent release data for the 1995 to 2010 time period showed that bypassing the filtration units did not have a measurable effect on doses to the public and it was concluded that the effect of operating without filtration was insignificant.

With the removal of spent fuel from the plant in 2012, no fission gases remained; and monitoring for fission and activation gases was discontinued in 2013.

Overall, the review of historical gaseous effluents has shown that there were no abnormal releases of radioactivity in gaseous effluents. The gaseous effluent releases did not exceed the concentration limits of 10 CFR Part 20, Table 2, Column 1, or the dose limits of 10 CFR 50, Appendix I and 40 CFR Part 190.

Based on a review of available information, Table 3-7 provides a summary of historical airborne radioactive releases from LACBWR.

Table 3-7 Operational Air Effluent Releases

Plant Stage/ Year(s)	Airborne Releases and Notes	Document(s) Referenced
Operations/1969	Early operations; 4.83E+2 Curies (Ci) released; Kr-87 primary isotope; I-131 not detectable	Dairyland Power Cooperative DPC-ED-3, Environmental Report, La Crosse Boiling Water Reactor – Full-Term Operating License Stage, September, 1972
Operations/1970	Early operations; 6.70E+2 Ci released; Kr-87 primary isotope; I-131 not detectable	DPC-ED-3
Operations/ July-September, 1970	3rd Quarter Report noted that off-gas releases were 2.87E+2 Ci and particulate releases were 5.75 Ci. Alpha radioactivity was negligible.	John Madgett (DPC) letter to Kenneth Dunbar (US AEC), "Contract No AT(11-1)-851 – Form AEC-298, Radioactive Waste Management Report", dated October 14, 1970
Operations/1970-1971	Off-gas releases averaged about 4.95E+1 µCi/sec during the period of June 1970 to April 1971. The majority of the activity released was N-13 with a 10-minute half-life. These releases are less than 1% of the applicable 10 CFR 20 standards and AECM 0524 (Atomic Energy Commission Manual, Chapter 0524, "Standards for Radiation Protection). A determination of the radioactive isotopic components of the off-gas was initiated in April 1971. The previous such resolution was made in August 1969.	U.S. Atomic Energy Commission, Chicago Operations Office, "Health Protection Survey Report, La Crosse Boiling Water Reactor, La Crosse, Wisconsin, April 28-30, 1971"
Operations/1971	Early operations; 5.29E+2 Ci released; Xe-135 and Xe-138 primary isotopes; I-131 not detectable; total particulate measured at 5.73E-1 µCi/sec	DPC-ED-3
Operations/ Jan – June 1972	Early operations; 8.87E+3 Ci released; Xe-135 and Xe-135m primary isotopes, I-131 detected at 1.12E-2 µCi/sec; increase in release expected since the core fuel is reaching end of its life	DPC-ED-3
Operations/1972	Total of 3.06E+4 Ci released; Xe-135 and Xe-135m and Xe-138 were the primary isotopes; I-131 concentration rate release was 2.1E-2 µCi/sec. Total particulate release rate was 2.53 µCi/sec.	Environmental Report Supplement [to DPC-ED-3] for La Crosse Boiling Water Reactor, dated June 15, 1973

Plant Stage/ Year(s)	Airborne Releases and Notes	Document(s) Referenced
Operations/1972	Total gaseous tritium released was 2.65E+1 Ci	John Madgett, Gen Mgr, DPC letter to Robert Reid, Director of Nuclear Reactor Regulation, NRC "Dairyland Power Cooperative La Crosse Boiling Water Reactor (LACBWR) Provisional Operating License No. DPR-45 Information to Meet Requirements of Sec. V.B. of Appendix I to 10 CFR 50], November 17,1976.
Operations/1974	Airborne effluents released in 1974: • Total Noble Gases: 4.91E+4 Ci • Total I-131: 3.27E-2 Ci • Total Halogens (including I-131): 6.33E-2 Ci • Total Particulates: 6.50E+1 Ci • Total Tritium: 1.83E+1 Ci	DPC Radioactive Effluent Report, 1974
Operations/1975	Airborne effluents released in 1975: • Total Noble Gases: 5.71E+4 Ci • Total I-131: 8.73E-2 Ci • Total Halogens (including I-131): 1.32E-1 Ci • Total Particulates: 7.92E+1 Ci • Total Tritium: 1.67E+1 Ci	DPC Radioactive Effluent Report, 1975
Operations/1976	No Data Available	
Operations/1977	Summary of Airborne Effluents, including corrected value for Total Particulates • Total Noble Gases: 4.25E+4 Ci • Total I-131: 1.56E-1 Ci • Total Halogens (including I-131): 2.49E-1 Ci • Total Particulates (half-lives > 8 day) 1.08E-2 Ci • Total Tritium: 8.74 Ci	DPC Radioactive Effluent Report, 1976
Operations/1978 - 1979	NRC staff evaluation of the releases in gaseous effluents for 1978 and 1979 calculated releases to be approximately: • 1.42E+5 Ci/yr of Noble Gases • 3.1E-2 Ci/yr of I-131 • 3.2E-3 Ci/yr of Particulates • 1.0E+1 Ci/yr ofTritium The FES also noted that "the DPC Radioactive	US NRC Final Environmental Statement Related to Operation of the La Crosse Boiling Water Reactor, Dairyland Power Cooperative, Docket No. 50-409, NUREG-0191, April 1980 (FES)

Plant Stage/ Year(s)	Airborne Releases and Notes	Document(s) Referenced
	Effluent Report for 1979 shows that during normal plant operation early in the current fuel cycle (late summer 1979) with the off gas system fully operative, the measured radioactivity release rate at the stack (essentially noble gases) averaged 325 curies per month." Based on the NRC staff's evaluation of the radioactivity in gaseous effluents from LACBWR, the annual gamma and beta doses at or beyond the site boundary were less that the limits of Appendix I to 10 CFR Part 50. Evaluation of the releases of radioiodine and particulates in gaseous effluents, the annual dose or dose commitment to any organ of the maximum exposed individual was less than the limits of Appendix I to 10 CFR Part 50.	
Operations/1980	• Noble Gases: 5.67E+3 Ci • Total Halogens (including I-131: 7.25E-3 Ci) • Total Particulates (with half-lives > 8 days): 5.92E-3 Ci • Tritium: 8.41 Ci	DPC Radioactive Effluent Report, 1980
Operations/1981	• Noble Gases: 5.03E+3 Ci • Total Halogens (including I-131): 9.54E-3 Ci • Total Particulates (with half-lives > 8 days): 7.38E-3 Ci • Tritium: 2.34E+1 Ci	DPC Radioactive Effluent Report, 1981
Operations/1982	• Noble Gases: 4.26E+3 Ci • Total Halogens (including I-131): 6.39E-3 Ci • Total Particulates (with half-lives > 8 days): 1.96E-3 Ci • Tritium: 1.70E+1 Ci	DPC Radioactive Effluent Report, 1982
Operations/1983	Total effluent releases tabulated for 1983: • Noble Gases: 7.08E+3 Ci • I-131: 6.17E-3Ci • Particulates: 4.9E-3 Ci • Tritium: 2.3E+1 Ci	DPC Operational Radiological Parameters memo, 1984

Plant Stage/ Year(s)	Airborne Releases and Notes	Document(s) Referenced
Operations/1984	Standard report, but also provided summary tables and Ci totals for effluent releases in 1984: • Fission & Activation Gases: 1.09E+4 Ci • Total I-131: 3.98E-3 Ci • Particulates (with half-lives > 8 days) 2.91E-3 Ci • Tritium: 4.25E+1 Ci Xe-135 was the primary fission gas released. No abnormal releases were noted.	DPC Radioactive Effluent Report, 1984
Operations/1985	Total effluent releases in 1985: • Fission & Activation Gases: 8.58E+3 Ci • Total I-131: 4.94E-3 Ci • Particulates (with half-lives > 8 days) 2.59E-3 Ci • Tritium: 3.48E+1 Ci Xenon and Krypton radionuclides were the primary fission gases released.	DPC Radioactive Effluent Report, 1985
Operations/1986	Total effluent releases in 1986: • Fission & Activation Gases: 3.53E+3 Ci • Total I-131: 3.54E-3 Ci • Particulates (with half-lives > 8 days) 5.43E-4 Ci • Tritium: 1.21E+1 Ci Xenon and Krypton radionuclides were the primary fission gases released.	DPC Radioactive Effluent Report, 1986
Operations/ January – April 30, 1987 SAFSTOR May to December 1987	Total effluent releases in 1987: • Fission & Activation Gases: 3.53E+3 Ci • Total I-131: 3.54E-3 Ci • Particulates (with half-lives > 8 days) 5.43E-4 Ci • Tritium:1.21E+1 Ci Xenon and Krypton radionuclides were the primary fission gases released. Note: there were no Fission & Activation gas releases or I-131 releases in the 3rd & 4th Quarters of 1987.	DPC Radioactive Effluent Report, 1987

3.3.3.2. Liquid Effluent

The liquid radioactive waste treatment system consists of process equipment and instrumentation for the collection, processing, and monitoring of potentially radioactive liquid wastes discharged from the plant. The Reactor Building collection subsystem collects the equipment drains, floor drains and primary purification system resin sluice water in two 6,000-gallon retention tanks. The Turbine Building collection subsystem collects condensate leakage, sluice water from condensate demineralizer system resins, hot change room and laboratory drains, floor drains and process drains as well as the Waste Treatment Building drains into the 3,000-gallon or 4,500-gallon waste water storage tanks located in the basement tunnel structure within the eastern portion of the Turbine Building. After final plant shutdown in April 1987, liquid waste from the Turbine Building waste water tanks were routinely transferred to the Reactor Building 6,000-gallon tanks and then batch released as the tanks were filled.

Liquid wastes from the Reactor Building and Turbine Building tanks are handled and released on a batch basis. Prior to release of any liquid wastes, grab samples are analyzed to determine the type and amount of radioactivity in the batch. Dependent upon the results of the analysis, the wastes are either released under controlled conditions to the Mississippi River or retained for processing through the radioactive waste demineralizer. The processed waste water is discharged directly to the Mississippi River after passing through fixed-process-type radiation detectors in the discharge line.

All planned radioactive waste liquid discharges were collected via the floor drains and then batch released into the circulating water line for discharge into the Mississippi River once it was determined that the radioactivity met release limits. LACBWR liquid effluent release limitations for liquid effluent releases are those concentrations specified in 10 CFR 20 Appendix B, Table 2, Column 2. For alpha emitting radionuclides, the concentration is limited to a total activity concentration of 4.9E-9 µCi/ml, based upon an actual alpha emitting radionuclide analysis performed on a representative water sample. The average diluted concentrations (in µCi/ml) per quarter are based on dilution with the combination of LACBWR and Genoa Station No. 3 condenser cooling water flow prior to discharge to the Mississippi River. No credit is taken for further dilution in the mixing zone of the Mississippi River. In addition, it was verified that liquid releases also met the dose commitment requirements to a member of the public in accordance with 10 CFR 50, Appendix I.

Table 3-8 provides a listing of the historical routine planned liquid effluent releases. Based upon a review of the available radioactive effluent reports and other sources of effluent release data, these releases were within 10 CFR 20, 10 CFR 50, Appendix I, and 40 CFR Part 190 limits. Releases early in plant operations were dominated by Co-58 (70%) and other identified radionuclides were Na-24, Cr-51, Man-54, Fe-59, Cu-64, Zn-65 and Co-60. After plant shutdown in 1987, the predominant radionuclide in the liquid releases is now Cs-137 (~75%) with smaller amounts of Fe-55, Co-60, and Sr-90.

Table 3-8 Operational Liquid Effluent Releases

Plant Stage/ Year(s)	Radioactive Liquid Effluent Releases and Notes	Document(s) Referenced
Operations/1969	The liquid effluents are released under monitored conditions. In 1969, 8.5 Curies of corrosion product activity was released which corresponded to an average discharge rate of 3.5E-8 µCi/ml. The releases are always less than 10% of the applicable Radiation Concentration Guide (RCG). These releases are made after an adequate decay of the short-lived radioactive material has elapsed. The current method is by controlled dilution with the condenser cooling water.	LAC-95 Memo, Thomas Steele (DPC) to Terrence Lynch (Stout State University), dated October 21, 1970
Operations/1969	Gross Beta Activity Released (excluding Tritium): 8.52 Ci; the volume average concentration at the outfall equated to 0.11% of the RCG. Tritium Released: 2.48E+1 Ci; the volume average concentration at the outfall equated to 0.003% of the RCG.	Environmental Report Supplement for La Crosse Boiling Water Reactor, DPC-ED-3, dated June 15, 1973
Operations/1970	Gross Beta Activity Released (excluding Tritium): 6.41 Ci Tritium Released: 19.8 Ci	Supplement to DPC-ED-3
Operations/1971	Gross Beta Activity Released (excluding Tritium): 17.06 Ci Tritium Released: 9.14E+1 Ci	Supplement to DPC-ED-3
Operations/1972	Gross Beta Activity Released (excluding Tritium): 4.85E+1 Ci Tritium Released: 1.21E+2 Ci	Supplement to DPC-ED-3
Operations/1973	The release of radionuclides in the liquid effluents has been reduced by the elimination of regeneration of the full flow demineralizers.	DPC-ED-3
Operations/1973	Gross Radioactivity (β, γ): 3.69E+1 Ci Tritium: 1.03E+2 Ci Dissolved Noble Gases: < 6.1E-1 Ci Gross Alpha Radioactivity: < 9.0E-4 Ci	DPC Radioactive Effluent Report, 1973
Operations/1974	Gross Radioactivity (β, γ): 1.31E+1 Ci Tritium: 1.15E+2 Ci Dissolved Noble Gases: < 8.3E-2 Ci Gross Alpha Radioactivity: < 4.1E-4 Ci	DPC Radioactive Effluent Report, 1974
Operations/1975	Gross Radioactivity (β, γ): 1.40E+1 Ci Tritium: 1.27E+2 Ci Dissolved Noble Gases: <4.07E-1 Ci Gross Alpha Radioactivity: 9.58E-4 Ci	DPC Radioactive Effluent Report, 1975
Operations/1976	No Data Available	

Plant Stage/ Year(s)	Radioactive Liquid Effluent Releases and Notes	Document(s) Referenced
Operations/1977	Total Mixed Fission & Activation Products: 2.13E+1 Ci Tritium: 4.86E+1 Ci Dissolved Noble Gases: 1.71E-1 Ci	J. Madgett (General Manager, DPC) letter to Richard Muranaka, Chief, Office of Management Information & Program Control (NRC), "Dairyland Power Cooperative La Crosse Boiling Water Reactor (LACBWR) Provisional Operating License No. DPR-45 Summary of Radioactive Effluents Released from LACBWR– DRAFT COPY OF DATA, dated September 18, 1978
Operations/1978	Gross Radioactivity (β, γ): 3.06E-1 Ci Tritium: 1.47 Ci Dissolved Noble Gases: 1.25E-2 Ci Gross Alpha Radioactivity: 6.42E-4 Ci	DPC Radioactive Effluent Report, 1978
Operations/1979	No Data Available	
Operations/1980	Fission & Activation Products: 2.13 Ci Tritium: 7.20E+1 Ci Dissolved Noble Gases: 3.88E-2 Ci Gross Alpha Radioactivity: 2.98E-3	DPC Radioactive Effluent Report, 1980
Operations/1981	Gross Radioactivity (β, γ): 2.26E-1 Ci Tritium: 7.74E+1 Ci Dissolved Noble Gases: 1.57E-2 Ci Gross Alpha Radioactivity: 1.47E-3 Ci	DPC Radioactive Effluent Report, 1981
Operations/1982	Gross Radioactivity (β, γ): 5.83 Ci Tritium: 5.92E+1 Ci Dissolved Noble Gases: 1.11E-1 Ci Gross Alpha Radioactivity: 5.24E-3 Ci	DPC Radioactive Effluent Report, 1982
Operations/1983	Fission & Activation Products: 3.75 Ci Tritium: 1.24E+2 Ci	DPC Radiological Operational Parameters, 1984
Operations/1984	Fission & Activation Products: 3.26 Ci Tritium: 1.25E+2 Ci Dissolved & Entrained Gases: 1.08E-1 Ci Gross Alpha Radioactivity: 3.63E-3 Ci	DPC Radioactive Effluent Report, 1984 (and corrected data, submitted March 20, 1985)
Operations/1985	Fission & Activation Products: 1.84 Ci Tritium: 1.28E+2 Ci Dissolved & Entrained Gases: 6.65E-2 Ci Gross Alpha Radioactivity: 6.14E-3 Ci	DPC Radioactive Effluent Report, 1985

Plant Stage/ Year(s)	Radioactive Liquid Effluent Releases and Notes	Document(s) Referenced
Operations/1986	Fission & Activation Products: 5.00 Ci Tritium: 5.75E+1 Ci Dissolved & Entrained Gases: 2.19E-1 Ci Gross Alpha Radioactivity: 2.61E-3 Ci	DPC Radioactive Effluent Report, 1986
Operations/ January – April 30, 1987 SAFSTOR May to December 1987	Fission & Activation Products: 1.16 Ci Tritium: 4.66E+1 Ci Dissolved & Entrained Gases: 1.61E-3 Ci Gross Alpha Radioactivity: 3.51E-3 Ci	DPC Radioactive Effluent Report, 1987

3.3.4. Groundwater Monitoring

3.3.4.1. LACBWR Groundwater Monitoring History

During the operational history of the LACBWR, the Potable Wells # 3 and # 4 and #5 were at times routinely monitored for gross beta activity (Figure 2-12 LACBWR Site Groundwater Wells). The LACBWR Virgin Water Storage Tank (Demineralized Well Water Storage) was also monitored more frequently for gross beta activity. Typical gross beta activity levels reported for the potable wells sampling was less than or equal to MDA values of 3E-08 to 9E-08 µCi/ml. The Virgin Water Storage Tank also typically reported gross beta activity levels of less than or equal to MDA values of 3E-08 to 9E-08 µCi/ml, with the highest result noted as 1.15 E-07µCi/ml. However, water in the Virgin Water Storage Tank water was well water run through a demineralizer, consequently a direct comparison with the potable well water gross beta activity levels is not possible. Additionally, for a brief period of time, a well point was located inside the LACBWR RCA (Figure 2-12). The well point, which was located down gradient of the Turbine Building below grade suspected broken floor drains, was monitored one time on May 3, 1983, with the sample being analyzed using gamma spectroscopy to support the study of the suspect broken floor drains (see Section 3.3.2.1, Liquid Release Incidents, for details). This well point has since been abandoned. The well point gamma spec sample mixed fission product and mixed activation product results reported included in Table 3-9:

Table 3-9 Well Point Data

Radionuclide	Activity 5/06/1983 pCi/L	Decayed Activity 1/1/2015 pCi/L
Co-60	508	7.9
Cs-137	21.7	10.5
Co-57	6.4	<0.1
Mn-54	63.4	<0.1
Ce-141	18.9	<0.1
Nb-95	21.4	<0.1

Chemical data exists for Potable Wells 3 and 4 and 5, which is part of the Site Groundwater Wells (Figure 2-12) [Reference 7.25]. The data set contains an abbreviated set of parameters that were used to determine if there was an impact on groundwater quality and are conducted as required per Wisconsin Administrative Code for potable water wells. The analyses include contaminants identified as potential groundwater quality issues in the State of Wisconsin by the U.S. Geological Survey [Reference 7.26] and include some metals, cations and anions, and organics. Review of the data for the wells indicates relatively clean groundwater, free of contaminants above drinking water limits with a pH between 7.0 and 7.5, alkalinity of approximately 300 mg/L (relatively hard water), nitrate levels well below drinking water limits of 10 MG/L, and no detectable organics. Nothing in the chemical

data is indicative of conditions that would significantly enhance or retard contaminant transport, if radionuclides were found to be present in the vadose zone or in the saturated zone beneath the site.

3.3.4.2. On-Site Well Construction Details

The following Appendix H, LACBWR Site Wells is a presentation of details of the construction of the LACBWR Site ground water monitoring wells and potable water wells.

3.3.4.3. Off-Site Well Construction Details

The following Appendix I, Off-Site Wells presents the locations of off -LACBWR Site property potable water wells located within one mile of the LACBWR RCA. Note that all listed wells are located to the east (i.e., upgradient) of the Mississippi River and the LACBWR Site.

3.3.5. Historical and 2012 thru 2013 Hydrogeological Investigation

Starting in late 2012, a field investigation was conducted to collect site-specific data documenting site hydrogeological conditions and to refine the conceptualized site model of those conditions. Five pairs of monitoring wells (MW-200A/B through MW-204A/B) were installed in early November 2012 as part of this hydrogeological investigation and soil cuttings collected during drilling of the deeper well in the pair and retained for later geotechnical analyses (Figure 2-12 LACBWR Site Groundwater Wells). The shallow well in the pair was located approximately five feet from the deeper well. The monitoring wells in this network were installed down gradient of the most likely areas where potential releases could have occurred based on the historical information review and are described in Table 3-10. Note that the MW-203A/B Pair is located within 3 to 4 feet of the former well point location.

Table 3-10 Technical Rationale for Monitoring Well Locations

Well Identification	Location	Termination Criteria	Data Objective
MW-200A/B	The well pair located within the footprint of the former 20,000 gallon above ground storage tank.	The shallow well was installed to intercept the water table during normal river stage (non-flooding conditions), the deeper well was screened from 20 to 30 feet below the water table.	To collect data cross-gradient from the main buildings/structures to better characterize groundwater flow directions.
MW-201A/B	The well pair located west of the turbine building floor drains, in the area of the resin fluid release, as well as the septic dry well and switchyard.	The shallow well was installed to intercept the water table during normal river stage (non-flooding conditions), the deeper well was screened from 20 to 30 feet below the water table.	The characterize groundwater quality downgradient and northwest of the turbine building, the resin liquid release area, and the dry well. Data were also collected to better characterize site hydrogeology.
MW-202A/B	Located west of the turbine building floor drains, and downgradient of the switchyard.	The shallow well was installed to intercept the water table during normal river stage (non-flooding conditions), the deeper well was screened from 20 to 30 feet below the water table.	To characterize groundwater quality downgradient and southwest side of the turbine building, and the switchyard. Data were also collected to better characterize site hydrogeology.
MW-203A/B	Located near and downgradient of the Emergency Diesel Generator tanks.	The shallow well was installed to intercept the water table during normal river stage (non-flooding	To characterize groundwater to the south of the turbine building and to provide spatial distribution to better

Well Identification	Location	Termination Criteria	Data Objective
		conditions), the deeper well was screened from 20 to 30 feet below the water table.	characterize groundwater flow directions.
MW-204A/B	Located downgradient of the gas storage tank vault.	The shallow well was installed to intercept the water table during normal river stage (non-flooding conditions), the deeper well was screened from 20 to 30 feet below the water table.	To characterize groundwater quality downgradient of the gas storage tank vault. Data were also collected to better characterize hydrogeology with this well providing additional spatial distribution to evaluate groundwater flow directions.

Hollow stem augers were used to create boreholes that were of sufficient diameter to install a well casing. The "A" designated wells were screened from approximately 15 to 25 ft bgs; the "B" designated wells were screened from approximately 45 to 55 ft bgs. Monitoring wells were installed in compliance with WDNR regulations. Each well was then developed by surging and purging methods and allowed to equilibrate for at least 14 days prior to sampling. The well construction details are presented in Appendix J [Reference 7.27].

The paired wells were installed in order that the shallow wells generally intersected the water table and the deeper wells were installed at depths approximately 20 to 30 feet below the shallow wells. It should be noted that with the large fluctuation in groundwater levels, this was not always achieved. The wells were installed during a "dryer" period; therefore, during times of high river stage, the top of screened interval of the shallow well is submerged. The vertical separation between the shallow and deeper wells provided data to evaluate vertical gradients across the site [Reference 7.27].

Groundwater elevation data were collected from each well and used to contour groundwater flow in the shallow and deeper portions of the aquifer. Based on the estimated contours, the groundwater flows from the east to the west and discharges into the adjacent Mississippi River. Groundwater contours from each of the two sampling rounds for the shallow and deep aquifer are presented in (Figure 2-8 through Figure 2-11) [Reference 7.27]. In addition to collecting groundwater data to evaluate flow direction, a series of hydraulic conductivity tests, referred to as slug tests or falling/rising head tests, were completed at each well to collect data to estimate the hydraulic conductivity.

A minimum of two rising and falling head slug tests was conducted at each of the new wells. Data were evaluated using the Bouwer and Rice method [Reference 7.28]. Because of the water loss to the vadose zone for the shallow wells that intercepted the water table, falling head data were not used in the average hydraulic conductivity calculations. The average shallow aquifer hydraulic conductivity is approximately 313 feet per day. The average deep aquifer hydraulic conductivity is approximately 429 feet per day. This evaluation is in agreement with the historical data on the LACBWR Site [Reference 7.27].

Based on the interpreted groundwater contours and the hydraulic conductivity data, the groundwater velocity at the LACBWR Site ranges from 0.005 to 0.073 feet per day in the shallow aquifer. The groundwater velocity for the deeper water bearing zone ranges from 0.009 to 0.030 feet per day, indicating that there is a difference in hydrogeologic properties between the shallow and deeper zones. These differences may be attributed to the installation of the pilings during construction as well as subsurface barriers or structures (i.e., the Reactor Building).

The shallow aquifer groundwater appears to have lower groundwater gradients below the buildings and steeper groundwater gradients outside the buildings. The data indicates that the shallow aquifer has slower velocities and groundwater movement below the turbine building and faster groundwater movement outside and around the turbine building, suggesting some interference of the subsurface pilings associated with the building. Groundwater velocity data for the deep aquifer indicate less variability and lack the influence of subsurface disturbances. The horizontal gradient of the water table ranges from 0.004 to 0.005 ft/ft in the shallow aquifer and 0.001 to 0.002 ft/ft in the deeper aquifer. Vertical groundwater gradients also vary and are impacted by the river stage. Generally, there is an

upward groundwater gradient, as expected, during the low river stages with a downward gradient during times of extremely high water. Vertical gradients are small and range from 0.015 ft/ft in the downward direction to 0.028 ft/ft in the upward direction [Reference 7.27]. This evaluation is in agreement with the historical data on the LACBWR Site

3.4. Property Inspections

The LACBWR site is currently continuously occupied by Dairyland Power Cooperative (DPC) personnel performing monitoring, surveillance and maintenance at LACBWR facilities under an approved Decommissioning Plan. Energy*Solutions* and DPC have made several property inspections on site during the course of the development of this HSA with staff cognizant of site characterization and license termination plan development to identify site features and events of interest significant to the HSA development and DPC current and past staff interviews.

These inspections have included review of physical features such as visual inspection of remaining structures, systems and components including site buildings, and material storage areas. Underground systems such as storm drains and sewerage systems were also inspected where accessible.

In addition to visual observations of facilities and conditions, limited radiological surveys were performed in advance of formal characterization to identify ambient gamma radiation levels (e.g., radiation level surrounding the Independent Spent Fuel Storage Installation (ISFSI)

3.5. Personnel Interviews

Between 2010 and 2011, current and former LACBWR staff were interviewed, from which, approximately (40) recollections of interest were logged from the individuals contacted in the HSA questionnaire program [Reference 7.29]. These individuals represented retired/separated former site personnel whom worked at LACBWR during its operational years. The personnel survey was a standard questionnaire completed voluntarily by retired/separated staff (see Appendix C for a copy of the questionnaire).

With few exceptions, the personnel observations documented on the questionnaire were corroborated either by logged memories of other questionnaire completers, current on-site working staff that had LACBWR operational period experience, or by documentation discovered during the records search.

Table 3-11 presents a brief summary of the personnel survey questionnaire results showing the number of observations recorded for the various general areas identified on the survey questionnaire.

Table 3-11 Personnel Observations Summary

General Area of Observation	Number of Observations
Surface and Subsurface Soil Disturbances for Construction/Maintenance	10
Possible Soil Radiological Contamination Issue	4
Circulating Water Outfall Radiological Incidents Associated with Discharges	3
Small Fires or Explosions On Site But Contained in Off Gas Facilities	3
Non-Radiological Hazardous Materials/Chemicals	20

3.6. Historical Construction Photograph Review

Collections of historical construction photographs and aerial views were reviewed to assess their contribution to this HSA. A selection of construction photographs and aerial photos is included as Appendix D.

Of particular note is the construction of the intake structure supporting the G-3 fossil plant. During the course of the HSA it was determined that the G-3 intake structure was constructed prior to LACBWR initial criticality. The G-3 intake structure was located at the spot originally planned for LACBWR circulating water system outfall. As part of the construction of the G-3 crib house and circulating water systems, the LACBWR circulating water system including radioactive waste discharge was tied in to the G-3 circulating water discharge line. This occurred prior to LACBWR initial criticality in 1967.

4. HISTORY AND CURRENT USAGE

4.1. Historical Use

4.1.1. Description of Operations Impacting Site Radiological Status

Normal plant operations were expected to result in contamination in certain areas inside the facilities and these areas were designed to contain such material. However, early in the plant life, certain events and conditions resulted in radioactive material being deposited in other locations. Review of the operational history of the site drew heavily on the plant incident reports and associated LER (Licensee Event Reports) and ORC (Operations Review Committee) meeting minutes.

The following principal event circumstances, listed in chronological order, contributed to the residual contamination that needs to be addressed during decommissioning.

- The stainless steel liner in the Fuel Element Storage Well (FESW) had a history of leakage of cooling water to the Reactor Building Floor Areas. Leakage may have occurred in a timeframe from the date of initial service in 1967 until September 2012 when the spent nuclear fuel was completely removed from FESW and transferred to the on-site ISFSI.
- September, 1977- Removable alpha contamination noted during decontamination efforts surrounding a Forced Circulation Pump (FCP) corrective maintenance activity involving a steam cleaning tank in the Reactor Building 701' elevation area. [ORC sub-committee meeting,, September 27, 1977]
- November 5, 1980- Partial blockage of drain lines under Turbine Building noted with the potential for leakage of drain water into the soil under the Turbine Building. [DPC-80-84 Incident Report. ORC-80-71, ORC-80-75, ORC-80-87, ORC-80-97].
- November 24, 1980- Slight amount of radioactive contamination found in soil under the Turbine Building. [DPC-80-93 Incident Report. ORC-80-71, ORC-80-75, ORC-80-87, ORC-80-97, LER 80-12].
- December 6, 1980- Overflow of a Turbine Building Waste Water Tank, with 0.5 gallon spread to the Turbine Building Floor. [DPC-80-102 Incident Report. ORC-80-71, ORC-80-75, ORC-80-87, ORC-80-97].
- December 15, 1980-Overflow of a Turbine Building Waste Water Tank into Turbine Building Basement Tunnel. [DPC-80-106 Incident Report].
- January 30, 1981- A Turbine Building Waste Water Tank overflowed with water spread into the laundry room. [DPC-81-10 Incident Report].
- May 31, 1982- Spent Resin Liner overflow- Lid Broke. Operations were in the process of transferring resins from #1 service tank to spent resin liner. The resins had just finished going over, when the tank began overflowing through overflow line to sump. The order was given to shut water off, but it was too late. Water and some resins overflowed into spent resin liner room and into basement. [DPC-82-51 Incident Report].
- July 02, 1982- Liquid radioactive release; 1,200 gallons of condensate water was released from a sight flow bullseye rupture to the Turbine Building floor, and approximately 20 gallons entered the ground outside the Turbine Building door and Truck Bay door and 25 gallons were discharged to an unrestricted area. [DPC-82-58 Incident Report, LER 82-016].
- July 16, 1983- Seal Water Injection System leak at 1A FCP caused leakage of approximately 15,000 gallons of reactor coolant to Reactor Building basement floor areas. [LER 83-07).

While there were periodic instances of accidental waste water tank discharges into the Mississippi River, assessments of these events indicated no radiological impact. These events are summarized within Section 3.3.2.1 – Liquid Effluents and Table 3-8 Operational Liquid Effluent Releases.

4.1.2. History of Releases

4.1.2.1. Introduction

LACBWR, as part of routine operations and later, SAFSTOR and DECON operations, released radioactive effluents into the environment. In addition to stack sampling (for airborne effluents) and waste tanks (for liquid effluents), a comprehensive Radiological Environmental Monitoring Program (REMP) was implemented to ensure that the radionuclide releases did not result in radiation exposures to the surrounding population which exceeded the established limits.

The objective of this historical records search process was the identification of those events posing a significant probability of impacting the radiological status or hazardous material status of LACBWR site land areas and structures. These included system, structure, or area contamination from system failures resulting in airborne releases, liquid spills or releases.

LACBWR historical information reviewed included:

- Operations Review Committee (ORC) and health physics files;
- employee interview information from November 2011 and later discussions in 2013-2014;
- radiological incident reports; pre-operational survey data; spill reports; operational survey results; and
- annual effluent and environmental monitoring records.

Special emphasis was placed on obtaining and reviewing the Annual Radioactive Effluent Reports (focused on gaseous and liquid releases) which were submitted to the NRC (or its predecessor, the U.S. Atomic Energy Commission) during LACBWR operations since 1967, including reports covering the periods of SAFSTOR and decommissioning activities after the plant shutdown in 1987. Available sampling results associated with soil and groundwater within or around the plant site were also reviewed.

The historical review indicated that between 1967 and 1987, there were several instances of noted system leakages, radiological spills, and radioactive liquid effluent releases with the potential to impact the site that occurred at LACBWR. These included the following:

- Leakage from the stainless steel liner in the Fuel Element Storage Well (FESW) of FESW cooling water (1967-2012);
- Routine releases of resin regeneration waste liquids to the circulating water discharge line (1967 – 1973);
- Overflow of waste water tanks into the Turbine Building (1979-1986);
- Release of potentially contaminated liquids, without grab sampling, from the Turbine Building 3,000-gallon or 4,500-gallon waste water tanks through the normal effluent release pathway to the Mississippi River (1980-1986);
- Turbine Building subgrade grouting operation and discovery of grout in floor drain system (1980);
- Release of radioactively contaminated condensate water from Turbine Building to the environment (1982); and,
- Reuse of potentially contaminated Control Rod Drive (CRD) oil for dust suppression on the licensed site roads (1970s).

Additional details on these releases are provided in Section 3.3.2.1, Liquid Release Incidents. Spills within facility structures and floors were surveyed and decontaminated. When overflows spread outside buildings, any contaminated material released to paved areas or soil was remediated. Waste water tank releases which were not grab sampled, but were fixed-process monitored prior to discharge to the Mississippi River, were investigated, assessed and determined to be within allowable limits.

The routine planned radioactive gaseous and liquid effluent releases during operation of the plant did not exceed the concentration limits of 10 CFR Part 20, Table 2, Columns 1 and 2 [Reference 7.30]; the dose limits of 10 CFR 50, Appendix I [Reference 7.31]; or the fuel cycle dose limits of 40 CFR Part 190 [Reference 7.32].

Between 1967 and 2014, there were also some documented incidents involving the unplanned spill or release of chemicals and/or potentially hazardous liquids to the environment. These incidents ranged from spills of acids and caustics used in the plant's various systems to the spill of diesel and fuel oil from systems and storage tanks. A majority of the incidents occurred inside impacted buildings. These spills were controlled and remediated in accordance with the station policies and procedures associated with the identification, control and remediation of hazardous material releases.

4.1.2.2. Radioactive Airborne Effluent Releases

Details of historical radioactive airborne effluent releases are provided in Section 3.3.3.1 above.

4.1.2.3. Planned Radioactive Liquid Effluent Releases

Details of historical Planned Radioactive Liquid Effluent releases are provided in Section 3.3.3.2above.

4.1.2.4. Noted Liquid Radioactive Release Events

Details of radioactive liquid release events which had the potential to impact the site are provided in Section 3.3.2.1 above.

4.2. Current Use

Current site use includes a variety of industrial and recreational activities. At the north end of the site, barge washing operations associated with unloading coal barges used to supply coal to the Genoa 3 powerplant are conducted. East of the LACBWR administration building a switchyard is located which inter connects eastern and western portions of the DPC distribution system. Just south of the switchyard and adjacent parking lot is a backup dispatching center used to control of generation and distribution of power throughout the DPC if the primary dispatching center is unavailable.

Immediately south of the LACBWR site is the Genoa 3 generating station and office building. This includes ancillary supporting systems and facilities such as coal barge unloading, chemical storage and ash handling. Located to the south of the Genoa 3 powerplant are closed ash pits associated with prior fossil fuel operations and the LACBWR ISFSI.

At the southern-most portion of the site is a recreational boat ramp for use by local residents. There are no camping facilities located at the boat ramp.

The LACBWR decommissioning project is located and executed within the boundary of the existing LACBWR licensed property previously used for power generation; all work is expected to be conducted within the LSE footprint. Some onsite roads have been refurbished. No barge slips are being constructed. The existing rail line supported the operation of the facility. The onsite rail line will be modified and refurbished with a rail spur to support decommissioning activities. Containers will be unloaded and loaded onsite. Onsite activities such as vehicle parking and equipment/container laydown, storage, staging and waste loading are and continue to occur in a manner similar to when the facility was operational.

Several structures such as the Switchyard, Administration Building, Crib House as well as all roadways and rail lines, will remain at license termination. Subsurface basement structures, including piping and tunnels, below the 636 foot elevation will be radiologically assessed and remediated, as necessary. All other systems, components as well as all structures above the 636 foot elevation will be removed during the decommissioning process and disposed of as a waste stream.

4.3. Adjacent Land Usage

4.3.1. Onsite Land Use

Only areas within the existing site licensed boundary are used to support current SAFESTOR and ISFSI operations. Decommissioning and license termination activities (such as temporary storage and staging areas for remediation and demolition equipment, waste containers, etc.) will also occur within the Licensed Site Area. Of the 163.5 acre site, about 1.5 acres are located within the fence-enclosed LSE. Appropriate isolation and control measures will be instituted to prevent the spread of contamination from the LSE area to the adjacent LACBWR property as well as offsite areas during decommissioning activities. These measures will also be monitored to ensure their effectiveness.

4.3.2. Offsite Land Use

Land in the vicinity of the LACBWR site is predominantly rural and undeveloped. Of the area within a five-mile radius, approximately one third is water and bottomlands included in the Upper Mississippi River National Wildlife & Fish Refuge. WDNR has designated the La Crosse-Bad Axe River Basin Watershed as a Geographic Management Unit (GMU) and Vernon County has established a *"Land & Water Resource Management Plan"* [Reference 7.33], addressing land use, water quality and protection of the environment within this GMU. Approximately 36% of the La Crosse-Bad Axe basin land use is agricultural and over 50% of the land is forested. There is an increasing shift of some of the agricultural land to recreational land use, similar to other parts of rural Wisconsin.

The closest municipality to the LACBWR site is the village of Genoa, approximately 1 mile north of the site, across from the north-south running Highway 35. This small rural community with a population of 258 consists of various residences, farms, and a few retail businesses in the valley below the eastern bluff. Decommissioning activities are not being performed in any land areas adjacent to the site or near the Refuge at the southern boundary of the site.

LACBWR is located on the shores of the Mississippi River. The Mississippi River and its Thief Slough tributary extends along the LACBWR site for 3,000 feet from north to south. The predominant water usage during the operation of LACBWR was the use of water from the Mississippi River as condensate cooling water for turbine systems. With the plant shut down and fuel removed from the reactor, the cooling water system is currently not being used and water is not drawn from the Mississippi River for any decommissioning activities. Water pulled from onsite wells will support decommissioning tasks and this water will continue to be processed onsite and discharged in accordance with the site's national and state discharge permits.

For a distance of 40 miles downstream of the site, virtually all municipal water supplies for towns and cities along the Mississippi River are obtained from ground water. The nearest use of river water for industrial purposes, excluding the adjacent G-3 fossil plant, is the coal-fired plant in Lansing, Iowa, about 15 miles downstream of the site. There are no other known users of river water for industrial purposes between the LACBWR site and Prairie du Chien, WI, 40 miles downstream.

The LACBWR site has its own potable water supply, provided through three ground water wells at the site. Potable water use during decommissioning operations is not expected to be significantly greater than the potable water use during plant power operations. Sanitary wastes are collected in a solids holding tank and pumped by a local state permitted sanitary wastes hauler. This includes a sanitary holding tank that services the Administration Building and a sanitary holding tank that services the LSE Turbine Building. Storm water runoff is diverted directly to the Mississippi River at outfalls. DPC periodically monitors release areas for oil sheen and discoloration. Roof drains are either discharged to the ground area surrounding the facility thru downspouts or through a piped discharge to the Mississippi River..

5. FINDINGS

5.1. Review of LACBWR Records

The records review encompassed 46 years of historical plant records, including operational, safety, licensing, regulatory, and environmental and health physics documents. A list of operational events with the potential for radiological or hazardous material impacts to the site from this review was compiled. These events are discussed in Section 3.3.2 Operating Records and Existing Radiation Data and Section 3.3.3 Environmental Monitoring Data. In addition to the records review, site walk downs and discussions with current LACBWR staff were conducted to determine the present radiological condition of the site. Similar efforts were also performed for evaluation of potential non-radiological site contaminants.

5.2. Basis for Site Classification

The LACBWR Radiological Controlled Area (RCA) (also called the LACBWR Site Exclusion area or LSE), encompasses the major buildings, including the Reactor Building, Turbine Building and Waste Treatment Building and other structures. It is approximately 1.5 acres of the total LACBWR 163.5-acre licensed site area owned and controlled by DPC. During the planning process for the ISFSI, DPC and the NRC reconfirmed the total NRC-licensed site area under License DPR-45 to be considered for demonstrating compliance with the license termination release criteria. [Reference 7.2]

The LACBWR Initial Site Characterization Survey report [Reference 7.13] identified failed fuel and the potential for fission products to enter and impact a number of systems. As a result of routine BWR operations as well as failed fuel leaks, systems in the Reactor Building and Turbine Building were radiologically impacted, including the forced circulation, primary purification, condensate, Fuel Element Storage Well (FESW) cooling water, and others. Waste tank overflows and equipment leaks during operations also periodically contributed to the spread of radioactive contamination.

Intermittent dismantlement operations and equipment and component removal at LACBWR have been ongoing since 1994. The reactor vessel was removed in 2007, and more extensive component removal started in late 2012 with a focus on removal of metallic waste. Key buildings and structures within the RCA that will be demolished include the Reactor Building, Turbine Building, Waste Treatment Building, Low Specific Activity (LSA) Building, Underground Gas Storage Tank Vault, and the Ventilation Stack. Their remaining sub-structural and ground areas will be subject to Final Radiation Surveys (FRS) after decontamination and remediation operations are completed.

Review of existing radiological data included routine health physics surveys as well as various soil sampling campaigns conducted inside and outside the RCA since plant shutdown in 1987. The DPC soil surveys which provided radiological data used to determine the preliminary site classification include:

- SAFSTOR Ground Sampling Initial Site, September, 1987
- Initial Site Soil Sampling, August, 1992, to January, 1993
- Initial Site Characterization Survey, August to September, 1995
- Survey East of Plant, July, 2008
- Survey South of Plant, September, 2008
- ISFSI Site Soil Collection, April to August, 2009

These soil survey and sampling efforts involved obtaining soil samples from the ground surface to a depth of 6”. Subsurface soil sampling below 6” has not been performed.

Groundwater characterization efforts have been enhanced through the installation of 10 groundwater monitoring wells (5 pairs) within the LACBWR RCA in November 2012 and the collection of groundwater sampling in 2013. As discussed in the latest LACBWR D-Plan/PSDAR [Reference 7.4], the most likely areas of interest where radionuclides could have been released to soils and groundwater include the Turbine Building waste collection system and the Underground Gas Storage Tank Vault and piping. The 2013 groundwater sample analysis indicated

no radionuclides detected above background; however, the soils and groundwater directly below these areas have not yet been evaluated or characterized.

5.3. Impacted Area Assessments

The impacted area assessments in Appendices F and G include a description, key elements of the history, contaminated media involved/continued investigation needed, and current known range of radiological conditions within the specific impacted survey units. The summary also includes a current decommissioning status and a general description of the work remaining to be done. A survey area classification is assigned to each impacted area assessed based on MARSSIM guidelines which are stated as:

Class 1 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiological surveys). Note that areas containing contamination in excess of the DCGL prior to remediation should be classified as Class 1 areas.

Class 2 Areas: These areas have a potential for radioactive contamination or known contamination but are not expected to exceed the DCGL.

Class 3 Areas: Any impacted areas that are not expected to contain any residual radioactivity or are expected to contain levels of residual radioactivity at a small fraction of the DCGL based on site operating history and previous radiological surveys.

The classifications have been assigned based on historical activities performed in the area and are substantiated for the most part either by records, scoping-type survey data available or anticipated conditions based on location from the operational reactor and its supporting operational systems. Note that the entire site as bounded by the radioactive materials license [Reference 7.2] and [Reference 7.34] is considered impacted.

The LACBWR Site Survey Unit Map, LACBWR Site Buildings Map, and LACBWR Site Drainage and Sewerage Map are shown as Figure 5-1, Figure 2-5, and Figure 2-6, respectively.

5.3.1. Initial Impacted Area Assessment

Classification of the LACBWR site into MARSSIM survey unit areas meeting the requirements of NUREG-1575 [Reference 7.35] for Impacted Area classification was based on the results of historical operations and current radiological conditions review. Figure 5-1 LACBWR Site Survey Unit Map depicts the initially defined Class 1, 2, and 3 Survey Units. In general, the classification depicts:

- Class 1 – The Class 1 Survey Areas (L1010101, L1010102, L1010103, and L1010104) encompass the areas with the major impacted buildings and structures, including the Reactor Building, Turbine Building, Waste Treatment Building, LSA Building and Ventilation Stack, as well as the immediate surrounding ground areas. This also includes the Main Transformer Substation.
- Class 2 – The Class 2 Survey Areas (L2011101, L2011102, B2009101, B2009102, and B2009103) consist of building areas and grounds surrounding the Class 1 Survey Units. These Survey Units include areas with buildings such as the Administration Building, LACBWR Intake Structure, Genoa 3 (G-3) Fossil Station Intake Structure, and Warehouse Buildings.
- Class 3 – The classification of the remaining LACBWR Licensed Site Area is as Class 3 Survey Units (L3012101, L3012102, L3012103, L3012104, L3012105, L3012106, L3012107, and L3012108) including the grounds areas within the electrical switchyard, around the G-3 Fossil Station, the former G-3 ash ponds and areas around the current ISFSI pad and facility, and the owned area across Highway 35 including the railroad and road right of ways. It does not include the ISFSI facility area which will be decommissioned at a future date after the spent nuclear fuel is transferred off-site. While these areas are considered to have a low potential for being impacted and containing any residual radioactivity, there is limited DQO-based systematic surveys or sampling to currently justify a Non-Impacted classification and therefore, a decision was made to conservatively classify them as Class 3 areas.

Appendices F and G provide details of the impacted area assessments of these buildings, structures and open land areas inside and outside the RCA.

5.4. Potential Contaminants

5.4.1. Radionuclides of Concern at LACBWR

The LACBWR site-specific radionuclides of concern are shown in Table 5-1 below. This listing was developed based upon a review of theoretical radionuclides from NUREG BWR and PWR studies, the specific nuclear engineering review of fuel inventory at LACBWR, and other site-specific LACBWR sample results (e.g. 10 CFR 61 reports, piping internals sample analysis, etc.). The approach to develop this list is detailed in the Radionuclides of Concern Technical Basis Document [Reference 7.36] and is summarized in the following sections. This list represents the preliminary radionuclides that should be considered during development of site characterization plans, DCGLs, and Final Status Surveys at LACBWR.

Table 5-1 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

5.4.1.1. Industry Documents Review

For the development of the suite of potential radionuclides of concern, several nuclear industry guidance documents were reviewed, including NUREG/CR-3474 [Reference 7.37] and NUREG/CR-4289 [Reference 7.38]. NUREG/CR-3474 provides tables of theoretical activation products for both pressurized water reactors (PWR) and boiling water reactors (BWR) based on typical materials of construction, anticipated impurities, assumed neutron flux, etc. An initial list of radionuclides, as shown in Table 5-2, was developed by listing those radionuclides noted in both Table 5.14, “Activity Inventory of BWR Internals at Shutdown (Total Ci),” and Table 5.15, “Inventories of PWR and BWR Vessel Walls at Shutdown (Total Ci).” of NUREG/CR-3474[Reference 7.37] The radionuclides with half-lives of less than two years were also noted, as these radionuclides would not be expected to be observed since the final shutdown of the LACBWR reactor in April 1987 and are candidate radionuclides to be removed from the Radionuclides of Concern suite.

Table 5-2 Initial Radionuclides based on NUREG/CR-3474

Radionuclide	Half Life (Years)	Half Life < 2 Years
H-3	1.24E+01	
C-14	5.73E+03	
Cl-36	3.01E+05	
Ar-39	2.69E+02	
Ca-41	1.40E+05	
Mn-53	3.70E+06	
Mn-54	8.56E-01	Yes
Fe-55	2.70E+00	
Ni-59	7.50E+04	
Co-60	5.27E+00	
Ni-63	9.60E+01	
Zn-65	6.69E-01	Yes
Se-79	6.50E+04	
Kr-81	2.10E+05	
Kr-85	1.07E+01	
Sr-90	2.91E+01	
Nb-92m	2.78E-02	Yes
Zr-93	1.53E+06	
Mo-93	3.50E+03	
Nb-94	2.03E+04	
Tc-99	2.13E+05	
Ag-108m	4.18E+02	
Sn-121m	5.50E+01	
I-129	1.57E+07	
Ba-133	1.07E+01	
Cs-134	2.06E+00	
Cs-135	2.30E+06	
Cs-137	3.00E+01	
Pm-145	1.77E+01	
Sm-146	1.00E+08	
Sm-151	9.00E+01	
Eu-152	1.33E+01	
Eu-154	8.80E+00	
Eu-155	4.96E+00	
Tb-158	1.50E+02	
Ho-166m	1.20E+03	
Hf-178m	3.10E+01	
Pb-205	1.43E+07	
U-233	1.58E+05	
Pu-239/240	2.41E+04	

5.4.1.2. Discounting Insignificant Radionuclides

Since Table 5-2 includes trace elements that would not likely be found at LACBWR due to their low abundance, an evaluation of radionuclides that may be discounted as being of low potential importance was performed. The total inventory for each radionuclide was determined from activity inventories provided in Table 5.14 and Table 5.15 of NUREG/CR-3474. From this information, the percentage of total inventory for each radionuclide (decayed to

January 1, 2015) was calculated. The January 1, 2015, date represents a near-term date when Characterization and/or Final Status Survey operations and data assessments are expected to be occurring. The results of this evaluation are provided in Table 5-3.

Table 5-3 NUREG/CR-3424 Radionuclides and Activity Fractions

Table 2.3.2-3 - Review of NUREG/CR-3474 Radionuclides and Total Activity Fractions

Radionuclide	Shroud Activity (Ci)	Vessel Cladding Activity (Ci)	Vessel Walls Activity (Ci)	Total Activity (Ci)* (shutdown 4/30/87)	Percent of All Radionuclide Activity	Activity Decayed** (to 1/1/2015)	Percent of All Radionuclide Activity	Less Than 0.1%? (<1E-1 Percent)
H-3	1.83E+02	1.40E-02	6.10E-02	1.83E+02	1.24E-02	3.86E+01	4.86E-02	**Yes*** **
C-14	1.03E+02	2.80E-03	1.20E-02	1.03E+02	6.99E-03	1.03E+02	1.30E-01	No
Cl-36	2.24E+00	5.70E-05	1.43E-04	2.24E+00	1.52E-04	2.24E+00	2.82E-03	**Yes**
Ar-39	<2.67E-01	<3.00E-05	<1.10E-03	2.68E-01	1.82E-05	2.50E-01	3.15E-04	**Yes**
Ca-41	2.00E-02	5.20E-07	2.00E-06	2.00E-02	1.36E-06	2.00E-02	2.52E-05	**Yes**
Mn-53	6.50E-03	8.00E-07	1.00E-05	6.51E-03	4.42E-07	6.51E-03	8.19E-06	**Yes**
Mn-54	1.17E+04	1.14E+00	1.27E+01	1.17E+04	7.95E-01	2.11E-06	2.65E-09	**Yes**
Fe-55	9.29E+05	2.36E+01	1.14E+02	9.29E+05	6.31E+01	8.21E+02	1.03E+00	No
Ni-59	6.04E+02	1.80E-02	8.00E-02	6.04E+02	4.10E-02	6.04E+02	7.60E-01	No
Co-60	4.50E+05	1.38E+01	9.55E+01	4.50E+05	3.05E+01	1.18E+04	1.48E+01	No
Ni-63	8.01E+04	2.30E+00	9.55E+00	8.01E+04	5.44E+00	6.61E+04	8.32E+01	No
Zn-65	1.55E+03	4.10E-02	2.90E-02	1.55E+03	1.05E-01	5.41E-10	6.81E-13	Yes
Se-79	1.40E-03	9.80E-08	1.00E-06	1.40E-03	9.51E-08	1.40E-03	1.76E-06	Yes
Kr-81	<2.24E0-04	<5.40E-12	<3.04E-11	2.24E-04	1.52E-08	2.24E-04	2.82E-07	Yes
Kr-85	<8.15E-01	<5.00E-06	<2.20E-05	8.15E-01	5.53E-05	1.37E-01	1.72E-04	Yes
Sr-90	<2.11E+00	<1.40E-05	<6.10E-05	2.11E+00	1.43E-04	1.08E+00	1.36E-03	**Yes*** **
Nb-92m	6.33E-07	2.20E-10	2.90E-09	6.36E-07	4.32E-11	0.00E+00	0.00E+00	Yes
Zr-93	1.41E-04	6.90E-09	8.10E-08	1.41E-04	9.57E-09	1.41E-04	1.77E-07	Yes
Mo-93	1.08E+00	4.40E-05	7.96E-04	1.08E+00	7.33E-05	1.07E+00	1.35E-03	Yes
Nb-94	8.86E-01	2.80E-05	7.20E-05	8.86E-01	6.01E-05	8.85E-01	1.11E-03	**Yes*** **
Tc-99	2.10E-01	9.00E-06	1.59E-04	2.10E-01	1.43E-05	2.10E-01	2.64E-04	Yes
Ag-108m	<2.18E-01	<9.00E-06	<7.80E-05	2.18E-01	1.48E-05	2.08E-01	2.62E-04	Yes
Sn-121m	1.07E-02	1.00E-06	1.40E-05	1.07E-02	7.27E-07	6.90E-03	8.68E-06	Yes
I-129	<5.90E-07	<4.40E-12	1.88E-12	5.90E-07	4.00E-11	5.90E-07	7.42E-10	Yes
Ba-133	<1.00E+01	<3.50E-04	<2.20E-03	1.00E+01	6.79E-04	1.61E+00	2.03E-03	Yes
Cs-134	<3.37E+01	<9.80E-04	<3.50E-03	3.37E+01	2.29E-03	3.10E-03	3.90E-06	Yes
Cs-135	<3.80E-04	<3.67E-10	<2.46E-09	3.80E-04	2.58E-08	3.80E-04	4.78E-07	Yes
Cs-137	<2.11E+00	<2.00E-05	<1.38E-04	2.11E+00	1.43E-04	1.12E+00	1.41E-03	**Yes*** **
Pm-145	<4.40E-03	<1.30E-07	<9.41E-08	4.40E-03	2.99E-07	1.50E-03	1.89E-06	Yes
Sm-146	4.07E-10	4.50E-14	6.20E-13	4.08E-10	2.77E-14	4.08E-10	5.13E-13	Yes
Sm-151	5.30E-02	1.80E-05	1.45E-04	5.32E-02	3.61E-06	4.30E-02	5.41E-05	Yes
Eu-152	3.09E-07	3.85E-03	1.70E-02	2.09E-02	1.41E-06	5.10E-03	1.09E-02	**Yes*** **
Eu-154	1.28E+01	4.60E-04	4.50E-03	1.28E+01	8.69E-04	1.37E+00	1.72E-03	**Yes*** **
Eu-155	5.06E+00	1.70E-05	1.88E-04	5.06E+00	3.43E-04	9.00E-02	1.13E-04	Yes
Tb-158	5.30E-03	6.31E-07	8.00E-06	5.31E-03	3.60E-07	4.80E-03	6.04E-06	Yes
Ho-166m	3.93E-01	1.10E-05	1.59E-04	3.93E-01	2.67E-05	3.87E-01	4.87E-04	Yes
Hf-178m	<5.20E-01	<4.30E-05	<7.09E-04	5.21E-01	3.53E-05	2.81E-01	3.54E-04	Yes
Pb-205	4.00E-06	2.58E-10	3.04E-09	4.00E-06	2.72E-10	4.00E-06	5.03E-09	Yes
U-233	<2.25E-03	<1.30E-07	<2.00E-06	2.25E-03	1.53E-07	2.25E-03	2.83E-06	Yes
Pu-239	<3.80E-02	<3.00E-06	<6.80E-05	3.81E-02	2.58E-06	3.81E-02	4.79E-05	**Yes*** **
			Totals:	1.47E+06	1.00E+02	7.95E+04	1.00E+02	

*Assumes same inventory of radionuclides exist at LACBWR at time of the plant's shutdown on 4/30/87
**Decay calculations were performed using the Oak Ridge National Laboratory's Center for Radiation Protection Knowledge online Decay Calculator
***Radionuclides meet the criteria of contributing less than 0.1% of the total activity but cannot be discounted because they have other methods of production in addition to activation of reactor components and/or have been observed in 10 CFR 61 waste stream analysis or site characterization samples.
10 CFR 61 analysis at LACBWR has identified H-3, Sr-90, Cs-137, Eu-152, Eu-154, and Pu-239. In addition, Cs-137 has been observed in soil samples

Based on the evaluation conducted on the NUREG/CR-3474 activation product radionuclides, the following radionuclides, listed in Table 5-4 were identified which contributed to less than 0.1% of the total decayed activity in Table 5-2 and could be considered as for discounting:

Table 5-4 List of Radionuclides Considered for Discounting

Discounted Radionuclides				
Cl-36	Ar-39	Ca-41	Mn-53	Mn-54
Zn-65	Se-79	Kr-81	Kr-85	Nb-92m
Zr-93	Mo-93	Tc-99	Ag-108m	Sn-121m
I-129	Ba-133	Cs-134	Cs-135	Pm-145
Sm-146	Sm-151	Eu-155	Tb-158	Ho-166m
Hf-178m	Pb-205	U-233		

Several additional radionuclides met the criteria of contributing less than 0.1% of the total activity, but could not be discounted because they have other methods of production in addition to activation of reactor components and/or have been observed in 10 CFR Part 61 waste stream analyses or in other site samples. These radionuclides include H-3, Sr-90, Nb-94, Cs-137, Eu-152, Eu-154 and Pu-239.

The radionuclides listed in Table 5-4 could be discounted provided that the potential dose contributed by the sum of the discounted radionuclides does not exceed 1% of the total calculated dose for the remaining, non-discounted radionuclides. In order to evaluate compliance with these criteria, dose calculations were performed using the NRC-developed computer code DandD, Version 2.1. This is a code developed by the NRC as a screening tool to support decommissioning and license termination evaluations.

The DandD code was used with the NRC determined default parameters and non-discounted radionuclide and discounted radionuclide inputs to provide conservative screening results for assessment of the relative dose impact of the discounted radionuclides. Input concentrations for each radionuclide used in the Residential scenario were their percent of total activity from Table 5-3 input as concentration in pCi/g. Input concentrations for each radionuclide used in the Building Occupancy scenario were 1,000 times their percent of total activity from Table 5-3 input as surface contamination in dpm/100 cm^2.

The DandD code cannot be used for all radionuclides, but was used to calculate the doses associated with potential discounted radionuclides and non-discounted radionuclides as noted in Table 5-5 and Table 5-6.

Table 5-5 Radionuclides Considered for Discounting Assessed by DandD Code

Radionuclides from NUREG/CR-3474	Supported by DandD Code?	Input Value for DandD Code Residential Scenario (in pCi/g)	Input Value for DandD Code Occupancy Scenario (in dpm/100 cm^2)
Cl-36	Yes	2.82E-3	2.82E0
Ar-39	No	N/A	N/A
Ca-41	Yes	2.52E-5	2.52E-2
Mn-53	No	N/A	N/A
Mn-54	Yes	2.65E-9	2.65E-6
Zn-65	Yes	6.81E-13	6.81E-10
Se-79	Yes	1.76E-6	1.76E-3
Kr-81	No	N/A	N/A
Kr-85	No	N/A	N/A
Nb-92m	No	N/A	N/A
Zr-93	Yes	1.77E-7	1.77E-4
Mo-93	Yes	1.35E-3	1.35E0
Tc-99	Yes	2.64E-4	2.64E-1
Ag-108m	No	N/A	N/A
Sn-121m	Yes	8.68E-6	8.68E-3
I-129	Yes	7.42E-10	7.42E-7
Ba-133	No	N/A	N/A
Cs-134	Yes	3.90E-6	3.90E-3
Cs-135	Yes	4.78E-7	4.78E-4
Pm-145	No	N/A	N/A
Sm-146	No	N/A	N/A
Sm-151	Yes	5.41E-5	5.41E-2

Radionuclides from NUREG/CR-3474	Supported by DandD Code?	Input Value for DandD Code Residential Scenario (in pCi/g)	Input Value for DandD Code Occupancy Scenario (in dpm/100 cm^2)
Eu-155	Yes	1.13E-4	1.13E-1
Tb-158	No	N/A	N/A
Ho-166m	Yes	4.87E-4	4.87E-1
Hf-178m	No	N/A	N/A
Pb-205	No	N/A	N/A
U-233	Yes	2.83E-6	2.83E-3

Table 5-6 Non-Discounted Radionuclides Assessed by DandD Code

Radionuclides from NUREG/CR-3474	Supported by DandD Code?	Input Value for DandD Code Residential Scenario (in pCi/g)	Input Value for DandD Code Occupancy Scenario (in dpm/100 cm^2)
H-3	Yes	4.86E-2	4.86E+1
C-14	Yes	1.30E-1	1.30E+2
Fe-55	Yes	1.03E0	1.03E+3
Ni-59	Yes	7.60E-1	7.60E+2
Co-60	Yes	1.48E+1	1.48E+4
Ni-63	Yes	8.32E+1	8.32E+4
Sr-90	Yes	1.36E-3	1.36E0
Nb-94	Yes	1.11E-3	1.11E0
Cs-137	Yes	1.41E-3	1.41E0
Eu-152	Yes	1.09E-2	1.09E+1
Eu-154	Yes	1.72E-3	1.72E0
Pu-239	Yes	4.79E-5	4.79E-2

The calculated total dose from the discounted NUREG/CR-3474 radionuclides represents only 0.24% of the total calculated dose from the non-discounted radionuclides when the dose information is reviewed from the DandD code runs for the residential scenario, as shown in Table 5-7. The calculated total dose from the discounted NUREG/CR-3474 radionuclides represents only 0.006% of the total calculated dose from the non-discounted radionuclides when the dose information is reviewed from the DandD code runs for the occupancy scenario, as shown in Table 5-8. The summary reports for the DandD inputs and calculations are included in the Radionuclides of Concern Technical Basis Document. [Reference 7.36]

The DandD code does not support the following radionuclides and could not calculate their dose contribution: Ar-39, Mn-53, Kr-81, Kr-85, Nb-92m, Ag-108m, Ba-133, Pm-145, Sm-146, Tb-158, Hf-178m, and Pb-205. The activity represented by the radionuclides not supported by the DandD code is calculated to be only 3.14E-3% of the total activity of the radionuclides presented in NUREG/CR-3474. Of these radionuclides, Ar-39, Kr-81 and Kr-85 are noble gases; and it is highly unlikely that they would still be present in soil and on structural surfaces. Therefore, it is appropriate to discount Ar-39, Kr-81 and Kr-85. Due to its very short half-life (10.13d), Nb-92m is also not expected to be present and is also discounted.

Table 5-7 Review of NUREG/CR3474 Radionuclides for Residential Scenario

Not Discounted Radionuclide	All Pathways Dose (mrem)	Discounted Radionuclide	All Pathways Dose (mrem)
H-3	1.77E-02	Cl-36	2.32E-01
C-14	8.15E-02	Ca-41	1.08E-05
Fe-55	2.49E-03	Mn-54	4.65E-09
Ni-59	1.86E-03	Zr-65	1.73E-12
Co-60	9.90E+01	Se-79	2.46E-07
Ni-63	5.57E-01	Zr-93	1.02E-06
Sr-90	2.88E-02	Mo-93	1.50E-04
Nb-94	4.80E-03	Tc-99	4.03E-04
Cs-137	3.24E-03	Sn-121m	1.20E-07
Eu-152	3.14E-02	I-129	1.03E-08
Eu-154	5.37E-03	Cs-134	1.75E-05
Pu-239	5.36E-04	Cs-135	5.94E-08
Total dose (mrem)	**9.97E+01**	Sm-151	7.79E-08
		Eu-155	9.95E-06
		Ho-166m	2.19E-03
		U-233	3.53E-06
		Total dose (mrem)	**2.35E-01**
		Non-Discounted Dose %	**2.35E-01**

Table 5-8 Review of NUREG/CR3474 Radionuclides for Building Occupancy Scenario

Not Discounted Radionuclide	All Pathways Dose (mrem)	Discounted Radionuclide	All Pathways Dose (mrem)
H-3	1.07E-05	Cl-36	1.60E-04
C-14	9.63E-04	Ca-41	1.18E-07
Fe-55	6.44E-03	Mn-54	2.10E-09
Ni-59	5.07E-03	Zn-65	3.57E-13
Co-60	5.34E+01	Se-79	5.90E-08
Ni-63	1.30E+00	Zr-93	2.56E-06
Sr-90	4.38E-03	Mo-93	1.03E-04
Nb-94	3.48E-03	Tc-99	5.70E-06
Cs-137	1.27E-03	Sn-121m	9.33E-11
Eu-152	2.21E-02	I-129	5.71E-10
Eu-154	3.88E-03	Cs-134	7.70E-06
Pu-239	4.91E-02	Cs-135	9.11E-09
Total dose (mrem)	**5.48E+01**	Sm-151	3.87E-06
		Eu-155	1.93E-05
		Ho-166m	2.06E-03
		U-233	9.13E-04
		Total dose (mrem)	**3.28E-03**
		% of Non-Discounted Dose	**5.98E-03**

The potential dose contribution from the remaining radionuclides not supported by the DandD code was evaluated by comparison of the inhalation and ingestion exposure-to-dose conversion factors (DCFs) contained in Federal Guidance Report No. 11, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion and Ingestion" [Reference 7.38]. Weighted DCFs were calculated for each discounted radionuclide and summed for both inhalation and ingestion DCFs. These totals were then compared to the sum of the weighted DCFs for the two most abundant radionuclides noted in the NUREG/CR-3474 listing: Co-60 and Ni-63. This resulted in a total of 9.33E-3% for inhalation DCFs and 3.66E-3% for ingestion DCFs. The calculations to demonstrate these results are provided in Table 5-9. As a result, it is appropriate to discount all of the radionuclides not supported by the DandD code.

Table 5-9 Dose Considerations for Radionuclides Not Supported by DandD Code

Radionuclide	Percent Total	Inhalation			Ingestion		
		DCF*	Weighted DCF	% Total Weighted DCF	DCF*	Weighted DCF	% Total Weighted DCF
Mn-53	8.19E-06	1.35E-10	1.11E-15	1.17E-07	2.92E-11	2.39E-16	1.98E-07
Ag-108m	2.62E-04	7.66E-08	2.01E-11	2.12E-03	2.06E-09	5.40E-13	4.47E-04
Ba-133	2.03E-03	2.11E-09	4.28E-12	4.54E-04	9.19E-10	1.87E-12	1.55E-03
Pm-145	1.89E-06	8.23E-09	1.56E-14	1.65E-06	1.28E-10	2.42E-16	2.00E-07
Sm-146	5.13E-13	2.23E-05	1.14E-17	1.21E-09	5.51E-08	2.83E-20	2.34E-11
Tb-158	6.04E-06	6.91E-08	4.17E-13	4.42E-05	1.19E-09	7.19E-15	5.95E-06
Hf-178m	3.54E-04	1.79E-07	6.34E-11	6.71E-03	5.68E-09	2.01E-12	1.67E-03
Pb-205	5.03E-09	1.06E-09	5.33E-18	5.65E-10	4.41E-10	2.22E-18	1.84E-09
			Total: 9.	**33E-03**		**Total: 3**	**.66E-03**
Predominant Radionuclides							
Co-60	1.48E+01	5.91E-08	8.75E-07		7.28E-09	1.08E-07	
Ni-63	8.32E+01	8.39E-10	6.98E-08		1.56E-10	1.30E-08	
		Total:	9.44E-07		**Total:**	1.21E-07	

*DCF values from Federal Guidance Report No. 11 in units of Committed Effective Dose Equivalent per Unit Intake (Sv/Bq).

5.4.1.3. Review of Other Documents and Data

A review of another nuclear industry guidance document, NUREG/CR-4289, which addressed fission and activation products present in seven representative nuclear power plants, both BWRs and PWRs, was conducted. The referenced BWRs included another Allis Chalmers BWR (the 66 MWe Pathfinder reactor) as well as the Dresden-1 and Monticello BWRs. Radionuclides with half lives of two or more years identified in NUREG/CR-4289 as being present in BWRs were compared with the list of radionuclides in NUREG/CR-3474. Based on the overall review, the following additional radionuclides (as shown in Table 5-10) were considered for addition to the suite of potential radionuclides of concern at LACBWR. As noted, based on their short half lives, some of the listed radionuclides were discounted from further consideration.

Table 5-10 Additional Radionuclides Identified in NUREG/CR-3474

Radionuclide	Half Life (Years)	Notes
Ru-106	1.01E+00	Half life < 2 years, so discounted
Ce-144	7.80E-01	Half life < 2 years, so discounted
Np-237	2.14E+06	
Pu-238	8.77E+01	
Am-241	4.32E+02	
Cm-242	4.47E-01	Half life < 2 years, so discounted
Am-243	7.38E+03	
Cm-243/244	1.81E+01	Noted half life is the shortest half-life for the radionuclides in the pair

Other documents that were reviewed to support the development of the Radionuclides of Concern technical basis document and confirmation of radionuclides for inclusion consisted of the following:

- Spent Fuel Radionuclide Inventory as noted in the 1995 LACBWR Initial Site Characterization Survey for SAFSTOR [Reference 7.13].
- Other Studies and Radiological Data in the 1995 LACBWR Initial Site Characterization Survey for SAFSTOR [Reference 7.13].
- Representative 10 CFR 61 Sample Data [Reference 7.40].
- Memos documenting the presence of Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM) [References 7.41 and 7.42].

The review of these documents and impacts to the development of the radionuclides of concern suite are summarized in Table 5-11. The Radionuclides of Concern at LACBWR, as previously presented in Table 5-1, were determined from a review of both industry and LACBWR documents. Reference 7.36 provides the more detailed Technical Basis Document that supports the Radionuclides of Concern discussion in this section.

Table 5-11 Other Sources Reviewed for Development of Radionuclides of Concern

Radiological Data	Summary of Impact to Radionuclides of Concern Listing
Spent Fuel Radionuclide Inventory	A review of the spent fuel assembly radionuclides as studied and identified by Dairyland Power Cooperative in 1995 was conducted to identify those radionuclides expected to be greater than 1% of the total spent fuel radionuclide activity, when decay corrected to January 1, 2015. The key radionuclides noted and confirmed to be in the radionuclides of concern suite were: Cs-137, Am-241, Sr-90, Pu-241 and Ni-63.
10 CFR 61 Sample Data	10 CFR 61 sample analytical results from 6 different samples taken from 1998 to 2010) were reviewed and radionuclide activity, after decay correction to January 1, 2015, indicated that the predominant radionuclides would be Co-60 and Ni-63. Other radionuclides that were noted above 0.1% of the expected activity for some of the samples included H-3, C-14, Fe-55, Ni-59, Sr-90, Cs-137, Eu-152, Pu-238, Pu-239/240, Am-241 and Pu-241. The Am-241 activities were also calculated to increase with the in-growth from the concurrent Pu-241 concentrations. This confirmed that these radionuclides should be in the radionuclides of concern suite.
Radiological Studies for Initial Site Characterization	The LAC-TR-138 Initial Site Characterization Report (Ref. 7.11) also addressed radiological data associated with the following: o Core Internal/Reactor Radionuclide Inventory o Plant Loose Surface Radionuclide Inventory o Plant Systems Internal Radionuclide Inventory o Reactor Biological Shield Activation Survey o Circulating Cooling Water Outfall Radionuclide Inventory o Site Soil Contamination Determination Survey Regarding the Core Internal/Reactor Radionuclide Inventory, it was noted that reactor vessel and its components, as well as the Fuel Element Storage Well were processed, packaged and disposed of by 2007. The other inventories and studies indicated the predominant presence of Cs-137 and Co-60 which would be expected to be present in 2015 due to their longer half-lives versus radionuclides such as Fe-55 and Mn-54 with shorter half-lives. Eu-152 was expected to still be present in activated concrete sections at LACBWR. A review of these inventory and survey data did not indicate the presence of any new radionuclides to be added to the radionuclides of concern suite.
Documented TENORM Radionuclides	A review of some Dairyland Power Cooperative correspondence summarizing survey results indicated that the nearby Genoa 3 Fossil Station likely contributes to the presence of Technologically Enhanced Naturally Occurring Radioactive Materials (TENORM), with radionuclides such as K-40, Bi-214, Pb-212, Pb-214, Bi-212, Fr-223, Ra-223, Ra-224, Ac-228, Th-227, and Th-234, and Ra-226 to the environment within the LACBWR site licensed area. While these radionuclides could impact gross radiation measurements in some locations, the radionuclides are not LACBWR plant-derived radionuclides and will not be added to the radionuclides of concern suite.

5.5. Potentially Contaminated Areas

Identification of Impacted and non-Impacted areas is hampered by limited radiological survey data outside the LSE. Known impacted areas include soils and structures within the LSE, as well as, the ISFSI area which will continue to store spent fuel after the LACBWR facility is decommissioned. Assessments on a survey unit basis are contained in Appendix F for buildings, structures, and open land areas inside the RCA and Appendix G for buildings, structures and open land areas outside the RCA.

5.5.1. Impacted Areas

Due to the limited amount of radiological surveillance data available, the entire 163.5 acres site was initially conservatively considered as impacted area. This initial assessment could be revised to non-impacted based on the results of additional site scoping and characterization surveys. Based on historical operations and information presently available, and subsequent to additional scoping and characterization surveys, that impacted areas will limited to the LSE and a small surrounding buffer area.

5.6. Impacted Area Assessments

The summary assessments in Appendices F and G include a description, key elements of the history, contaminated media involved/continued investigation needed, and current known range of radiological conditions within the specific impacted survey unit. The summary also includes a current decommissioning status and a general description of the work remaining to be done in that respective survey unit. A survey area classification is assigned to each impacted area assessed based on MARSSIM guidelines which are stated as:

Class 1 Areas: Areas that have, or had prior to remediation, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiological surveys). Note that areas containing contamination in excess of the DCGL prior to remediation should be classified as Class 1 areas.

Class 2 Areas: These areas have a potential for radioactive contamination or known contamination but are not expected to exceed the DCGL.

Class 3 Areas: Any impacted areas that are not expected to contain any residual radioactivity or are expected to contain levels of residual radioactivity at a small fraction of the DCGL based on site operating history and previous radiological surveys.

The classifications have been assigned based on historical activities performed in the area and are substantiated for the most part either by records, scoping-type survey data available or anticipated conditions based on location from the operational reactor and its supporting operational systems. Note that at this time, the entire site as bounded by the radioactive materials license [Reference 7.2] and [Reference 7.34] is considered impacted for purposes of this HSA; however, individual survey units may be reclassified as Non-Impacted based on additional characterization data.

The LACBWR Site Survey Unit Map and LACBWR Site Structures are provided in Figure 5-1and Figure 2-5, respectively.

5.6.1. Non-Impacted Areas

As a result of this HSA the entire 163.5 acre site is considered as an impacted area, however this is subject to revision based on the results of additional scoping surveys and characterization data. In particular, portions of the site located east of Highway 35 and the BNSF right of way, as well as the boat launch area and a majority of the Genoa 3 facility including northern portions of the site associated with barge washing operations, are likely to be reclassified as non-impacted when additional radiological survey data is obtained.

5.7. Potentially Contaminated Media

Potentially contaminated media at the LACBWR site includes surface and sub-surface soils located within the LACBWR LSE. This includes soils located below the Turbine and Waste Treatment Building, as well as soils adjacent to tunnels connecting the Turbine Building and Waste Treatment Building.

5.7.1. Surface Soil

Potentially contaminated surface soils are limited to those survey units within the LSE. Subsurface Soil and Media

Subsurface soils and media that warrant additional investigation include soil located below the Turbine Building, Waste Treatment Building and associated tunnels. Soils along the circulating water discharge line between LACBWR and the Mississippi River should also be investigated.

Other sub-surface media that warrant investigation are the concrete foundations and pilings beneath the Turbine Building, Waste Treatment Building, Waste Gas Vaults and Reactor Building. These will be investigated as part of site characterization.

5.7.2. Surface Water

Other than the Mississippi River, there are no surface waters located at the LACBWR site.

5.7.3. Groundwater

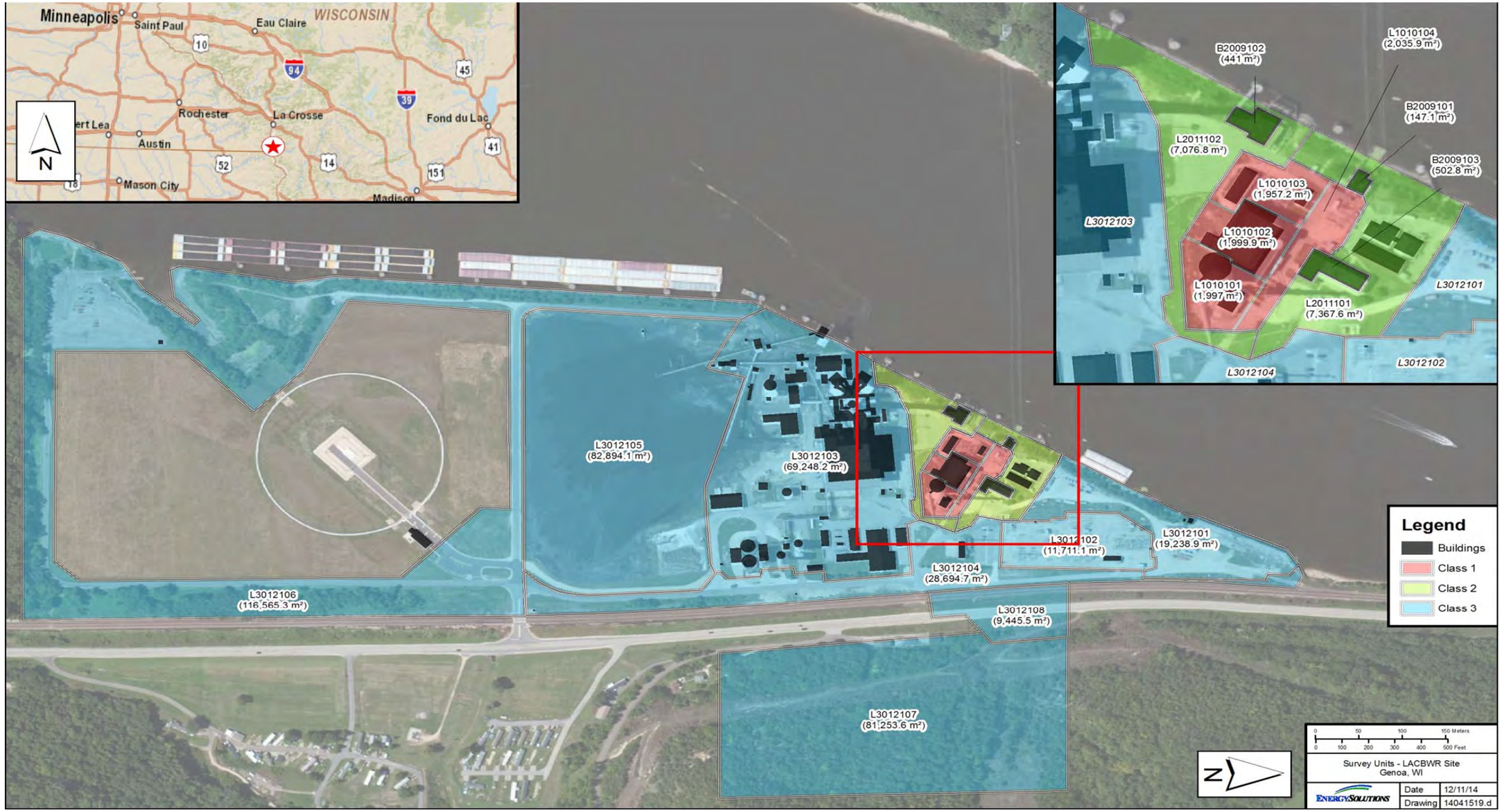
Groundwater at the LACBWR site is shallow, approximately 20 feet below grade, and is in direct communication with the Mississippi River. A series of 10 paired monitoring wells has been installed immediately around the LACBWR facility. To date these there is no indication of radiological contamination in these wells or in deep site wells used for potable water supply.

Historically a well point installed adjacent to the Turbine Building indicated low levels of contamination in the 1980's showed low levels of licensed radioactive material during one sampling event. The well point, which was located down gradient of the Turbine Building below the elevation of suspected broken floor drains, was monitored one time on May 3, 1983, with the sample being analyzed using gamma spectroscopy to support the study of the suspect broken floor drains. The well was subsequently abandoned. Samples from monitoring wells recently installed nearby have not indicated the presence of any detectable radioactivity.

5.8. Environmental Concerns

Environmental concerns at the facility are consistent with the materials of construction and construction practices in use at the time the facility was constructed. Hazards include the presence of asbestos throughout the facility, lead based paints and potential for PCBs in soil around transformers and in paint.

Figure 5-1 LACBWR Site Survey Unit Map



6. CONCLUSIONS

A detailed HSA was performed of the LACBWR licensed site to collect existing information regarding the radiological condition of the site and its surroundings. The HSA focused on historical events and routine operational processes that may have resulted in the contamination of plant systems, onsite buildings, and surface and subsurface soils within the LACBWR RCAs as well as structures, open land areas and subsurface soils outside of the RCA but within the LACBWR Licensed Site. The scope of this HSA included potential contamination from radioactive materials, hazardous materials, and other regulated materials. The objectives of this HSA were to:

- Identify potential, likely, or known sources of radioactive and chemical contaminants based on existing or derived information.
- Distinguish portions of the site that may need further action from those that pose little or no threat to human health.
- Provide an assessment of the likelihood of contaminant migration.
- Provide information useful to subsequent continuing characterization surveys.
- Provide an initial classification of areas and structures as non-impacted or impacted
- Provide a graded initial classification for impacted soils and structures in accordance with MARSSIM guidance.
- Delineate initial survey unit boundaries and areas based upon the initial classification.

The principal findings of this HSA were :

- classifying buildings, soils and open land areas within the LACBWR LSE as Class 1 areas,
- identifying a buffer around the LSE consisting of MARSSIM Class 2 areas, and
- classifying all remaining licensed site areas as MARSSIM Class 3 pending the results of additional scoping and characterization surveys.

Subsequent to additional scoping and characterization surveys being performed and consistent with those results areas outside the LSE, excluding the ISFSI, may be appropriately classified as non-impacted.

Additional finding include:

- there is no indication of any significant contamination in any soils systems or structures outside the LSE
- there is no indication of the presence of licensed radioactive material in the Genoa 3 powerplant footprint,
- there is no indication of groundwater contamination at the site.

7. REFERENCES

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7.4 Dairyland Power Cooperative, "LACBWR Decommissioning Plan and Post-Shutdown Decommissioning Activities Report (D-Plan/PSDAR) Revision – March 2014", March 12, 2014

7.5 http://www.city-data.com/city/Genoa-Wisconsin.html

7.6 Dames & Moore, 1973. Geotechnical Investigation of Geology, Seismology, and Liquefaction Potential, La Crosse Boiling Water Reactor (LACBWR) near Genoa, Vernon County, Wisconsin, for Gulf United Nuclear Fuels Corporation, October 1973.

7.7 U.S. Census Bureau, "American Community Survey", – 2009-2013 (5-year data sets)

7.8 Dairyland Power Cooperative, http://www.dairynet.com/energy_resources/genoa.php

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7.10 U.S. Army Corps of Engineers, http://www.mvp.usace.army.mil/Missions/Navigation/LocksDams/LockDam8.aspx

7.11 Weather Underground website: http://www.wunderground.com/us/wi/la-crosse

7.12 U.S. Department of Agriculture National Resources Conservation Service Climate website for La Crosse, WI http://www.wcc.nrcs.usda.gov/ftpref/downloads/climate/windrose/wisconsin/la_crosse/

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7.18 Licensee Event Report No. 83-07, dated October 3, 1983

7.19 EGG-1183-1584, "Radiological Survey of the Area Surrounding The La Crosse Boiling Water Reactor, Genoa, Wisconsin, Date of Survey: July 1968, report", dated April 11, 1973

7.20 EGG-1183-1720, "An Aerial Radiological Survey of the Area Surrounding the La Crosse Boiling Water Reactor Site, Genoa, Wisconsin, Date of Survey: June 1976", report dated October 1977

7.21 Dairyland Power Cooperative, "La Crosse Boiling Water Reactor Environmental Report Comments and Responses (Answer to AEC Letter of March 8, 1973), July 10, 1973

7.22 Dairyland Power Cooperative, La Crosse Boiling Water Reactor (LACBWR) Annual Radioactive Effluent Report and Radiological Environmental Monitoring Reports, 1971- 2013

7.23 Dairyland Power Cooperative letter LAC-1419 to NRC, "Non-Compliance with Offsite Dose Calculation Manual (ODCM) Requirement, October 7, 2011

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7.26 USGS, Protecting Wisconsin's Groundwater Through Comprehensive Planning, 2007.

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7.28 Bouwer & Rice, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfirmed Aquifers with Completely or Partially Penetrating Wells, Water Resources Research, Volume 12, No. 3, pp 423-428, Bouwer, H., and Rice, R.C., June 1976.

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7.32 40 CFR 190, Environmental Radiation Protection Standards for Nuclear Power Operations

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7.39 Federal Guidance Report No. 11, EPA-520/1-88-020, “Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion”, 1988

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7.41 Memo, “Contamination of Restricted Area on 9/5/85”, Larry Nelson, Dairyland Power Cooperative, September 9, 1985

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7.44 Dairyland Power Cooperative, “Environmental Report Supplement for La Crosse Boiling Water Reactor”, DPC-ED-3, June 15, 1973

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Appendix A
Legal Descriptions of Parcels Forming the LACBWR Site

DAIRYLAND POWER COOPERATIVE

GENOA SITE

PROPERTY AND LEGAL DESCRIPTIONS

Parcel 2

All that part of Government Lot 1 in Section 32, T13N, R7W, Vernon County, Wisconsin, lying West of the centerline of State Trunk Highway #35, as said highway is now located and between said centerline of said highway and the centerline of the main channel of the Mississippi River, subject, however, to the right of public travel on the afore-mentioned State Trunk Highway #35, to the right of way of the Chicago, Burlington and Quincy Railroad Company, as said right of way is now located and to applicable governmental laws and regulations relating to the said Mississippi River and the use of the channel thereof for the purposes of navigation. Further subject to subsequent highway conveyances.

Grantor: Tri-State Power Cooperative

Grantee: Dairyland Power Cooperative

Deed and Bill of Sale dated December 16, 1941, and recorded March 11, 1942, as Document Number 173742 in Volume 105 of Deeds on Page 621 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 2-1 (reference to prior Tri-State title)

All that portion of the N½-N½ of Government Lot 1, lying West of the centerline of State Trunk Highway No. 35, as said highway is now located, and between such centerline of said highway and the centerline of the main channels of the Mississippi River, all in Section 32, T13N, R7W, Town of Genoa, Vernon County, Wisconsin, subject to public highway, the right of way of the CB&Q RR Co., and governmental laws and regulations relating to said Mississippi River and use of the channel thereof for purposes of navigation.

Grantor: John Britting and Ana Britting

Grantee: Tri-State Power Cooperative

Quitclaim Deed dated August 10, 1939, and recorded January 26,, 1940, as Document Number 168888 in Volume 96 of Deeds on Page 148 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 2-3 (reference to prior Tri-State title)

All that portion of the N½ of Government Lot 1 in Section 32, T13N, R7W, Vernon County, Wisconsin, lying West of the East right of way line of State Trunk Highway No. 35, as said highway is now located, and between said East line of said highway right of way and the centerline of the main channel of the Mississippi River (subject to public highway, the right of way of the CB&Q RR Co., and governmental laws and regulations relating to said Mississippi River and use of the channel thereof for purposes of navigation).

Grantor: George Ott, et al.

Grantee: Tri-State Power Cooperative

Warranty Deed and Easement dated March 16, 1940, and recorded March 21, 1940, as Document Number 169337 in Volume 97 of Deeds on Page 484 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 2-4 (reference to prior Tri-State title)

All that part of the S¾ of Government Lot 1, lying West of the centerline of State Trunk Highway No. 35, as said highway is now located, and between said centerline of said highway and the centerline of the main channel of the Mississippi River, all in Section 32, T13N, R7W, in the Town of Genoa, Vernon County, Wisconsin (subject to public highway, the right of way of the CB&Q RR Co., and governmental laws and regulations relating to said Mississippi River and use of the channel thereof for purposes of navigation).

Grantor: Margaret Trussoni, et al.

Grantee: Tri-State Power Cooperative

Warranty Deed and Easement dated March 19, 1940, and recorded March 21, 1940, as Document Number 169335 in Volume 97 of Deeds on Page 482 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 2.5 (reference to prior Tri-State title)

All that part of Government Lot 1 and the North 530 feet of Government Lot 2, Section 32, T13N, R7W, Vernon County, Wisconsin, lying westwardly of a line 50 feet normally and radially distant westwardly of and parallel to the centerline of the most westwardly and southbound main track of said Railroad Company as said track is now located over, through, across and beyond said Lots 1 and 2; also, any and all right, title and interest of the grantor in and to that part of said Government Lot 2 lying westwardly of a line 100 feet normally and radially distant westwardly of the center line of the most eastwardly or northbound main track of said Railroad Company.

Grantor: Chicago, Burlington and Quincy Railroad Company

Grantee: Tri-State Power Cooperative

Quitclaim Deed dated November 16, 1940, and recorded December 17, 1940, as Document Number 170933 in Volume 105 of Deeds on Page 99 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 2.6 (reference to prior Tri-State title)

(Tract 1) – All that portion of Government Lot a and what is now surveyed as Government Lot 5 in Section 32, T13N,, R7W, Vernon County, Wisconsin, lying between a line parallel to and 20 feet West from the centerline of the West tracks of the CB&Q RR Company, as said tracks are now located, and the centerline of the main channel of the Mississippi River.

(Tract 2) – All that portion of Government Lot 2 and what is now surveyed as Government Lot 5 in Section 32, T13N, R7W, Vernon County, Wisconsin, bounded as follows: On the North by the North line of said Government Lot 2 as extended to the center line of the main channel of the Mississippi River; on the East by a line parallel to and 20 feet West from the center line of the West tracks of the C.B. and Q. RR Company as said West tracks are now located; on the South by an easterly and westerly line perpendicular to the center line of said tracks and extending westerly to the center line of the main channel of the Mississippi River, which South boundary of this tract is located along the southerly line of the private right of way and crossing as now used for ingress to and egress from Government Lot 5 to and from State Trunk Highway 35 and over the tracks of said railroad, said southerly line being located 530 feet, more or less,

southerly of the North line of said Government Lot 2 as measured along the center line of said railroad r/w; on the West by the centerline of the main channel of the Mississippi River.

(Tract 3) – All that part of Government Lot 2 in Section 32, T13N, R7W, Vernon County, Wisconsin, lying westerly of the westerly r/w line of the CB&Q RR Company as said r/w is now located (which westerly r/w line at said location is parallel to and 100 feet westerly from the easterly track of said railroad as said easterly track is now located) and South of the South boundary of Tract 2, above described.

Grantor: Chicago, Burlington and Quincy Railroad Company

Grantee: Tri-State Power Cooperative

Quitclaim Deed. No references.

Parcel 3

All that part of Government Lot 2 of Section 32, T13N, R7W, Vernon County, Wisconsin, containing 30.32 acres according to the government survey thereof excepting, however, that portion thereof heretofore conveyed to Frank Ghelfi and Margaret Ghelfi, his wife, by deed dated January 8, 1940 and recorded January 31, 1940 in Volume 100 of Deeds on Page 62 in the office of the Register of Deeds of Vernon County, said excepted portion containing 2½ acres.

Grantor: Tri-State Power Cooperative

Grantee: Dairyland Power Cooperative

Deed and Bill of Sale dated December 16, 1941, and recorded March 11, 1942, as Document Number 173742 in Volume 105 of Deeds on Page 621 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 3-2 (reference to prior Tri-State title)

All of Government Lot 2 of Section 32, T13N, R7W, Vernon County, Wisconsin, containing 30.32 acres according to the government survey thereof excepting, however, that portion thereof heretofore sold to Alexander Tollack and to Frank Ghelfi and now owned by Frank Ghelfi, described as that part of said Government Lot 2 bounded on the West by the centerline of State Trunk Highway No. 35 as now located, and the North by the North line of said Government Lot 2 and on the South and East by the northerly line of the dry ditch which runs from a point on said Highway located 393.8’ South of the North line of said Lot 2, northeasterly to a point on the North line of said Government Lot 2 located approximately 560 feet east of the point of beginning, said excepted parcel owned and occupied by said Ghelfi containing approximately 2½ acres more or less.

Grantor: Aloysius Malin and Kathryn Malin

Grantee: Tri-State Power Cooperative

Warranty Deed and Easement dated January 9, 1940, and recorded January 31, 1940, as Document Number 168926 in Volume 97 of Deeds on Page 403 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 3.3 (reference to prior Tri-State title)

All that part of Government Lot 1 and the North 530 feet of Government Lot 2, Section 32, T13N, R7W, Vernon County, Wisconsin, lying westwardly of a line 50 feet normally and radially distant westwardly of and parallel to the centerline of the most westwardly and southbound main track of said Railroad Company

as said track is now located over, through, across and beyond said Lots 1 and 2; also, any and all right, title and interest of the grantor in and to that part of said Government Lot 2 lying westwardly of a line 100 feet normally and radially distant westwardly of the center line of the most eastwardly or northbound main track of said Railroad Company.

Grantor: Chicago, Burlington and Quincy Railroad Company

Grantee: Tri-State Power Cooperative

Quitclaim Deed dated November 16, 1940, and recorded December 17, 1940, as Document Number 170933 in Volume 105 of Deeds on Page 99 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 4

All that part of the Government Lot 5, Section 32, T13N, R7W, Vernon County, Wisconsin, lying North of a line extended due West from a point approximately 530 feet South of the North line of Government Lot 2, said parcel containing all that part of said Government Lot 5 lying North of the southerly edge of the highway which runs easterly and westerly through said Lot 5, across the tracks of CB&Q RR Co. in Lot 2 at a point approximately 530 feet South of the North line of said Government Lot 2.

Grantor: Tri-State Power Cooperative

Grantee: Dairyland Power Cooperative

Deed and Bill of Sale dated December 16, 1941, and recorded March 11, 1942, as Document Number 173742 in Volume 105 of Deeds on Page 621 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 5

All that part of Government Lot 2 (sometimes referred to as the SE¼-NE¼) of Section 32. T13N, R7W, Vernon County, Wisconsin, described as follows: Beginning at a point where the North line of said Government Lot 2 intersects the centerline of State Trunk Highway No. 35, as now located; thence southerly along the centerline of said highway to a point where the centerline of said highway intersects the northerly line as extended of the dry ditch which runs northeasterly from said highway, which point 393.8 feet, more or less, south of the point of beginning; thence running in a general northeasterly direction along the northerly edge of said dry ditch to a point where said northerly edge of said dry ditch intersects the North line of said Government Lot 2, which point is approximately 560 feet East of the point of beginning; (subject to public highway, the right of way of the CB&Q RR Co., and governmental laws and regulations relating to said Mississippi River and use of the channel thereof for purposes of navigation).

Grantor: Frank Ghelfi, et ux.

Grantee: Dairyland Power Cooperative

Warranty Deed dated November 25, 1946, and recorded May 6, 1947, as Document Number 188668 in Volume 111 of Deeds on Page 443 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 6.1

All that part of Government Lot 5 in Section 32, T13N, R7W, Vernon County, Wisconsin which lies East of a line running parallel to and 85 feet westerly from the westerly r/w line of the CB&Q RR Co., said westerly r/w line being a line parallel to and 50 feet West of the centerline of the West of southbound track of said railroad, and which lies North of the centerline extended of the private right of way crossing at right angles to the tracks of said CB&Q RR

Co. and serving the properties of the parties to this conveyance as well as the property of George Blask. Said southern boundary of the land herein conveyed at its point of intersection with the westerly r/w line of said CB&Q RR Co. is located 921.35 feet West and 1854.6 feet South (on a course parallel with the westerly line of said railroad r/w) or the northeast corner of said Section 32.

Grantor: Ralph B. Engh, et ux.

Grantee: Dairyland Power Cooperative

Warranty Deed dated August 25, 1949, and recorded August 31, 1949, as Document Number 194970 in Volume 116 of Deeds, Page 447 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 6.2

That part of Government Lot 5, Section 32, T13N, R7W, Vernon County, Wisconsin, described in that certain warranty deed from James Morris and Catherine Morris, his wife to Ralph Engh, dated May 25, 1943, and recorded in the office of the Register of Deeds for Vernon County, Wisconsin on July 8, 1944, in Volume 106 of Deeds, Page 446 as Instrument No. 176892, as follows:

That part of Government Lot 5, located generally West of the North ½ of Government Lot 2 in Section 32, T13N, R7W, Vernon County, Wisconsin: From a point on Mississippi River bank at southern limit of the riprap embankment wall of the rock dike of Tri-State Power Cooperative (now Dairyland Power Cooperative), easterly along a line parallel with said dike wall or a distance of approximately 103 feet, the point where the wall turns southerly; thence continuing southerly and parallel along the western limit of the riprap embankment wall of the highway of Tri-State Power Cooperative (now Dairyland Power Cooperative) to the intersection of the private highway running westerly from a grade crossing over the tracks of the CB&Q RR Co. for a distance of 357 feet; thence due West to the bank of the Mississippi River or a distance of approximately 270 feet; thence northeasterly to northerly along the waterfront bank of the Mississippi River to the original starting point at the aforesaid southern limit of the riprap embankment wall of the rock dike, or a distance of approximately 360 feet; excepting warranty deed dated August 25, 1949, and recorded in the office of the Register of Deeds for Vernon County, Wisconsin in Volume 116 of Deeds, Page 447, as follows:

All that part of Government Lot 5 in Section 32, T13N, R7W, Vernon County, Wisconsin, which lies East of a line running parallel to and 85 feet westerly from the westerly r/w line of the CB&Q RR Co., said westerly r/w line being a line parallel to and 50 feet West of the centerline of the West of southbound track of said railroad, and which lies North of the centerline extended of the private right of way crossing at right angles to the tracks of said CB&Q RR Co. and serving the properties of the parties to this conveyance as well as the property of George Blask. Said southern boundary of the land herein conveyed at its point of intersection with the westerly r/w line of said CB&Q RR Co. is located 921.35 feet West and 1854.6 feet South (on a course parallel with the westerly line of said railroad r/w) or the northeast corner of said Section 32.

Grantor: Ralph B. Engh, et ux.

Grantee: Dairyland Power Cooperative

Warranty Deed dated March 22, 1963, and recorded April 10, 1963, as Document Number 226681 in Volume 145 of Deeds, Page 538 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 7.1

Parcel A - All that part of Government Lot 5 and 2 of Section 32, T13N, R7W, Vernon County, Wisconsin, described as follows: Beginning at a point in Government Lot 2 where the centerline of the East and West private road grade crossing the tracks of the CB&Q RR Co. to enter said Government Lot 5 intersects the westerly r/w line of said railroad (which point bears 921.35 feet West and 1854.6 feet South on a line parallel with the West r/w line

of said railroad from the NE corner of said Section 32; thence S80°54'W 116 feet; thence S05°57'W 259 feet; thence S82°17W 157 feet; thence S02°40'E 423 feet to the South line of said Government Lot 5; thence East along the South line of said lot and along the South line of Government Lot 2 to the westerly r/w line of the CB&Q RR Co.; thence N07°20'W in said Government Lot 2 and along the westerly r/w line of said railroad 724 feet to the point of beginning.

Parcel B – All that part of Government Lot 6, Section 32, T13N, R7W, Vernon County, Wisconsin, lying easterly of the prolongation and extension of the West line of Parcel A above described through said Government Lot 6 to the South Line thereof.

Grantor: George Blask

Grantee: Dairyland Power Cooperative

Warranty Deed dated August 31, 1949, and recorded September 1, 1949, as Document Number 194988 in Volume 116 of Deeds, Page 448 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 7.2

All of Government Lots 5, 6, and 7 of Section 32, T13N, R7W, Vernon County, Wisconsin, containing in all 87.6 acres according to the government survey thereof, excepting there from such parts thereof as were owned by Dairyland Power Cooperative prior to May 15, 1962, and described in the following instruments of conveyance:

(1) Warranty Deed in Volume 116 of Deeds on Page 447 in the office of the Register of Deeds, Vernon County, Wisconsin;

(2) Warranty Deed in Volume 116 of Deeds on Page 448 in the office of the Register of Deeds, Vernon County, Wisconsin;

And further excepting that part of Government Lot 5 as described in Warranty Deed in Volume 106 of Deeds, Page 446 in the office of the Register of Deeds, Vernon County, Wisconsin.

Grantor: George Blask, et al.

Grantee: Dairyland Power Cooperative

Warranty Deed dated September 12, 1963, and recorded as Document Number 225624 in Volume 144 of Deeds, Page 694 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 8

All that Part of Government Lot 3, Section 32, T13N, R7W, Vernon County, Wisconsin, which lies West of the westerly r/w line of the CB&Q RR Co.; said westerly r/w line being parallel to and 225 feet westerly of the centerline of the West of the southbound track.

Grantor: Catherine Trussoni, et al.

Grantee: Dairyland Power Cooperative

Quitclaim Deed dated September 30, 1949, and recorded September 30, 1949, as Document Number 195177 in Volume 116 of Deeds, Page 472 in the office of the Register of Deeds, Vernon County, Wisconsin.

Grantor: John B. Trussoni

Grantee: Dairyland Power Cooperative

Quitclaim Deed dated September 23, 1949, and recorded September 30, 1949, as Document Number 195178 in Volume 116 of Deeds, Page 473 in the office of the Register of Deeds, Vernon County, Wisconsin.

Parcel 9

All that part of a 450 foot strip of land extending in a north-south direction across Lot 3 in Section 32, T13N, R7W, Vernon County, Wisconsin, lying westerly of a line 100 feet normally and radially distant westerly of the centerline of the most westerly or eastbound main track of said CB&Q RR Co., said 450 foot strip having been acquired from Mary Granoli by warranty deed dated October 15, 1885, filed for record in Book 18 at page 598 of the records of Vernon County, Wisconsin.

Grantor: Chicago, Burlington and Quincy Railroad Company

Grantee: Dairyland Power Cooperative

Quitclaim Deed dated March 26, 1951 (unrecorded).

Submerged Lands Lease

That part of the Mississippi River adjacent to Government Lots 1, 5, 6 and 7, of Section 32, Township 13 North, Range 7 West, Vernon County, Wisconsin, lying easterly of the following described general line: Beginning at a point on the South line of said Government Lot 7 located approximately 2340 feet West of the northeasterly corner of Section 5, T12N, R7W of the 4th P.M., thence N05°20’E for a distance of approximately 2740 feet to a point on the southerly end of a small island lying between the North end of Island 126 and the aforementioned Government Lot 5; thence N28°40’E for a distance of approximately 1770 feet to join the existing steel bulkhead on the shoreline of Government Lot 1 of said Section 32. The net area between the above described line and the exiting shoreline is approximately 15.3 acres.

Lessor: State of Wisconsin Board of Commissioners of Public Lands
Lessee: Dairyland Power Cooperative

1.1. Submerged Land Lease dated July 18, 2012, with a 50-year term (unrecorded). Map attached for reference.

Appendix B
LACBWR License Amendment History

License No.	Amendment / Change No.	Date of Issuance	Description of Change/Amendment
DPRA-6	Change # 1	May 11, 1970	Technical Specifications Changes
DPRA-6	Change # 2	April 28, 1970	Extension of expiration date of Provisional Operating Authorization No. DPRA-6 from April 30, 1971, to August 31, 1972, for the La Crosse Boiling Water Reactor.
DPRA- 6	Change # 3	October 14, 1971	Change to Technical Specifications section 3.3.2 in its entirety. Respirator equipment and Assigned Protection Factors.
DPRA -6	Change # 4	December 13, 1971	Request to perform test 240, "Reactor Pressure Control System"' to optimize system response with the objective that main coolant circulation and feed water pumps automatically follow steam demand up to a 1.5 MWe per minute rate of change.
DPRA-6	Change # 5	February 29, 1972	Incorporated requirements for the planned five- and ten-year inspection program for the reactor vessel, piping, valves and pumps into the Technical Specifications. A maximum allowable primary coolant leakage rate was also added to the Technical Specifications.
DPRA-6	Change # 6	July 12 , 1972	Change to Technical Specifications for LACBWR plant organization.
DPRA-6	Change # 7	October 11, 1972	Change to Technical Specifications to increase the overpower scram set points from 115% to 120% of rated power.
DPRA-6	Change # 8	December 1, 1972	Change to Technical Specifications that would reduce the required frequency of containment leakage tests.
DPRA-6	Change # 9	November 29, 1972	Change to Technical Specifications to permit operation of the facility using Core II fuel bundles that contain 3.92 W/O enriched uranium 235 in place of original Core I fuel bundles that were 3.63 W/O enriched uranium 235.

License No.	Amendment / Change No.	Date of Issuance	Description of Change/Amendment
DPRA-6	Change # 10	March 26, 1973	Request that the annual tests for proper operation of the LACBWR forced circulation system controls and automatically operated valves be delayed approximately two days to coincide with our planned refueling outage scheduled to begin on April 1, 1873.
DPRA-6	Change # 11	May 11, 1973	Change to Technical Specification section for respirator protection. Change in protection factor from 500 to 100.
DPRA-6	Change # 12	October 31, 1969	Change added section 3.5 to Technical Specification "Records and Reporting Requirements." Change in License DPRA-6 to DPR-45.
DPR-45	Change # 13	October 18, 1973	Change in Technical Specification to allow for change in plant organization.
DPR-45	Change # 14	December 5, 1973	Change in Technical Specifications to read to require inspection of the most exposed control rod or other control rod with a comparatively high exposure. Inspection of "the most exposed control rod' was the old requirement.
DPR-45	Change # 15	March 29, 1974	Change in Technical Specification. Change relates to the composition of the Safety Review Committee (SRC).
DPR-45	Amendment 1/ Change # 16	May 5, 1975	This amendment allows the high-pressure core spray pumps to be removed from the service for maintenance under specified conditions when the reactor is shut down. This Amendment includes change No. 16 to Technical Specifications.
DPR-45	Amendment 2/ Change # 17	August 8, 1975	This amendment changes the trip points in the Technical Specifications which provide automatic shut off of the high-pressure core spray pumps at a reactor high-water level equal to or less than 19 inches. This amendment includes Change No. 17 to the Technical Specifications.
DPR-45	Amendment 3/ Change # 18	December 23, 1975	This amendment includes Change No. 18 to the Technical Specifications and is in partial response to request dated November 25, 1974. The amendment incorporates into the LACBWR Technical Specifications changes to the Administration Controls.

License No.	Amendment / Change No.	Date of Issuance	Description of Change/Amendment
DPR-45	Amendment 4	March 18, 1976	This amendment consists of a change to the Technical Specifications in response to the application dated September 5, 1975, as amended September 24, 1975, and staff discussions. This amendment requires that the containment building be isolated during certain spent fuel handling activities.
DPR-45	Amendment 5	April 5, 1976	This amendment adds interim surveillance requirements to the Technical Specifications for the La Crosse Boiling Water Reactor pending completion and acceptance of certain modifications to the facility to assure that it will withstand the consequences of postulated ruptures in the high-energy fluid piping outside containment without loss of capability to achieve and maintain safe shutdown of the facility.
DPR-45	Amendment 6	August 12, 1976	This amendment added provisions in the Technical Specifications for operations of LACBWR with a second emergency on-site power supply and associated modifications.
DPR -45	Amendment 7	November 3, 1976	This amendment removes an interim surveillance requirement to volumetrically examine and periodically visually inspect welds and high- stress areas on the high-pressure portion of the feed water line outside containment.
DPR- 45	Amendment 8	January 19, 1977	This amendment establishes new pressure-temperature operating limits for the LACBWR to assure conformance with 10 CFR Part 50, Appendix G, “Fracture Toughness Requirements.”
DPR -45	Amendment 9	December 29, 1977	This amendment eliminates the requirement for an Annual Operating Report while retaining the requirement to report personnel occupational exposure data.
DPR-45	Amendment 10	February 28, 1978	This amendment implements the Technical Specification for fire protection.
DPR-45	Amendment 11	April 18, 1978	The amendment (1) modifies the Technical Specifications for the operation of the LACBWR with a core configuration of 32 Exxon Type III new fuel assemblies and 40 Allis-Chalmers Type II irradiated fuel assemblies; (2) adds provisions in the TS for an off-gas and coolant activity monitoring program and limiting conditions for operation which will assure the appropriate corrective action will be taken in the event of excessive fuel failures; (3) increases the surveillance on the control rods and drives; (4) adds provision in the TS for operations of the LACBWR with a second completely redundant and independent 120 volt A.C. non-interruptible bus and a diverse parameter (containment pressure) for actuation of the High Pressure Core Spray System; and (5) provides for minor changes in the TS which include rearrangement of sections, addition of definitions, and numbering off pages to accommodate the Standard Technical Specifications format.
DPR-45	Amendment 12	March 13, 1978	This amendment removes the interim surveillance requirements to volumetrically examine and periodically visually inspect welds and high stress areas on the main steam line in the pipe tunnel and steam bypass line outside the containment.

License No.	Amendment / Change No.	Date of Issuance	Description of Change/Amendment
DPR-45	Amendment 13	June 12, 1978	This amendment changes the Technical Specifications for the LACBWR by revising the Reference transition Temperature for the LACBWR to assure conformance with 10 CFR Part 50, Appendix G, "Fracture Toughness Requirements."
DPR-45	Amendment 14	October 11, 1978	This amendment deletes the requirement for operable fire detectors in the Reactor Containment Building during the performance of the containment integrated leak rate test.
DPR-45	Amendment 15	May 16, 1979	This amendment incorporates the "Modified Amended Physical Security Plan for the La Crosse Boiling Water Reactor," into License No, DPR-45.
DPR-45	Amendment 16	May 25, 1979	This amendment modifies the Technical Specifications for the operation of the LACBWR in fuel cycle 6 by (1) adding core power distribution limits for Allis-Chalmers Type I fuel assemblies, and (2) changing the limits for off-gas emission rates to account for cleanup of tramp activity during operation.
DPR -45	Amendment 17	July 27, 1979	This amendment adds a license condition relating to the completion of facility modifications to improve the fire protection program.
DPR-45	Amendment 18	February 4, 1980	This amendment approves the design concept of the crash pad and revises the provisions of the Technical Specifications to allow increase in the capacity of the spent fuel storage pool from 134 to 440 fuel assemblies.
DPR-45	Amendment 19	February 4, 1980	This amendment adds new, more restrictive limits for reactor coolant and off-gas radioactivity to compensate for the increasing the maximum allowable average fuel assembly exposure by 600 MWD/MTU. This limit applies to LACBWR fuel cycle 6 which would permit continued reactor operations while the new spent fuel racks are being installed in the Fuel Storage Well.
DPR-45	Amendment 20	May 13, 1980	This amendment allows a second extension to the current Cycle 6 operation by changing the fuel depletion limit on the lead fuel from 15,600 MWD/MTU for all fuel assemblies to 15,600 MWD/ MTU for any non-peripheral fuel assembly.
DPR-45	Amendment 21	September 25, 1980	This amendment modifies License DPR-45 to include a requirement to maintain a Safeguards Contingency Plan to be fully implemented, in accordance with 10 CFR 73.40(b), within 30 days of this approval by the Commission.
DPR-45	Amendment 22	January 16, 1981	This amendment modifies the provisions of the Technical Specifications to incorporate Recirculation Pump Trip (RPT) System requirements.
DPR-45	Amendment 23	February 4, 1981	This amendment modifies the Technical Specifications to reflect changes in the management structure and facility staff, which involves replacing the existing Section 3.0 with the Standard technical Specifications Section 6.0, "Administration Controls."

License No.	Amendment / Change No.	Date of Issuance	Description of Change/Amendment
DPR-45	Amendment 24	February 25, 1981	This amendment adds new requirements to the LACBWR Technical Specifications to specify limiting conditions for operations and surveillance requirements for the (1) Emergency Service Water Supply System and (2) Primary Coolant Systems Pressure Isolation Valves.
DPR-45	Amendment 25	October 23, 1981	This amendment modifies the Technical Specifications to incorporate changes resulting from Lessons Learned as a result of the accident at TMI-2. It also revises the standards used to determine equipment operability.
DPR-45	Amendment 26	November 6, 1981	This amendment allows an increase in the maximum fuel exposure limit for fuel assemblies not on the periphery of core from 15,600 MWD/MTU to 16,800 MWD/MTU.
DPR-45	Amendment 27	November 20, 1981	This amendment consists of changes to the Technical Specifications in response to submittal of October 26, 1981.
DPR-45	Amendment 28	March 11, 1982	This amendment modifies the Technical Specifications to reflect changes in the allowable maximum average exposure of a fuel assembly not on the periphery of the core for Cycle 7.
DPR-45	Amendment 29	July 30, 1982	This amendment consists of changes to the Technical Specifications in response to submittals of May 19, 1981, and September 24, 1981.
DPR-45	Amendment 30	December 6, 1982	This amendment modifies License No. DPR-45 to include a requirement to maintain a Guard Training and Qualification Plan to be fully implemented in accordance with 10 CFR 73.55 (b) (4) and Appendix B to 10 CFR 73 within 60 days after this approval. All security personnel shall be qualified within two years of this approval.
DPR-45	Amendment 31	December 14, 1982	This amendment approves revisions to the Physical Security Plan and the Safeguards Contingency Plan, which incorporate upgrading information to satisfy the requirement of 10 CFR Section 73.55 and Appendix C to 10 CFR Part 73.
DPR-45	Amendment 32	March 14, 1983	This amendment changes the Technical Specification to require an audit of Emergency Preparedness Programs and the Safeguards Contingency Plan (Security Plan) at a frequency of at least once per twelve (12) months.
DPR-45	Amendment 33	April 15, 1983	This amendment approves modifications to the Technical Specifications pertaining to the required frequency of certain surveillance tests to preclude requiring the plant to shut down from power operations to perform certain routine surveillance tests.

License No.	Amendment / Change No.	Date of Issuance	Description of Change/Amendment
DPR-45	Amendment 34	October 14, 1983	This amendment modifies the Appendix A Technical Specifications by (1) incorporation of additional limitations to protect against degraded grid voltage and pipe cracking and new requirements to facilitate fire protection and in-service inspections, (2) revision of existing provisions reflecting changes in plant organization and other administrative changes not affecting safety, (3) revision of the existing provisions on electrical power systems to be consistent with the STS format, and (4) modifications of the fuel inventory and fuel change-out requirements of the Emergency Service Water Supply Systems (ESWSS) engines.
DPR-45	Amendment 35	December 12, 1983	This amendment modifies the Appendix A Technical Specifications by adding requirements for quarterly testing of containment ventilation (purge) valves to detect excessive degradation of the resilient seats.
DPR-45	Amendment 36	October 18, 1984	This amendment modifies the Appendix A Technical Specifications by incorporating Radiological Effluent Technical Specifications (RETS) by making administration changes to clarify actions to be taken when a nuclear instrumentation channel becomes inoperable and by correcting a clerical error made in License Amendment 34.
DPR-45	Amendment 37	November 30, 1984	This amendment modifies the Appendix A Technical Specifications by incorporating requirements resulting from the review of TMI Action Plan (NUREG-0737) Items II.B.3 - Post-Accident Sampling, II.F.1.1. - Noble Gas Effluent Monitors, II.F.1.2 - Sampling and Analysis of Plant Effluents, II.F.1.3 - Containment High Range Radiation Monitor, II.F.1.4 - Containment Pressure Monitor, II.F.1.5 - Containment Water Level Monitor, and II.F.1.6 - Containment Hydrogen Monitor.
DPR-45	Amendment 38	January 8, 1985	This amendment modifies the Appendix A Technical Specifications by adding requirements which restrict overtime of certain plant personnel and also requires reporting of all indicated operations of primary system safety valves for pressure relief purposes.
DPR-45	Amendment 39	March 22, 1985	This amendment consists of rewording of existing requirements and changes to the transition temperature curve in Section 4.2.2.4 of the LACBWR Technical Specifications.
DPR-45	Amendment 40	April 23, 1985	This amendment modifies the Appendix A Technical Specifications to change the acceptance criteria for Type B and Type C leak testing and to implement a more conservative method of back-correcting Type A leak test results when local leakage DPR-45 is discovered and repaired. Certain other minor administrative changes related to Type C leak testing are also included.
DPR-45	Amendment 41	May 28, 1985	This amendment approves changes to the Technical Specifications relating to the exclusion area, coolant water purity limits and containment airlock door seals.

License No.	Amendment / Change No.	Date of Issuance	Description of Change/Amendment
DPR-45	Amendment 42	June 5, 1985	This amendment modifies certain conditions of the license to remove specific quantity limitations for radioactive byproducts, source, or special nuclear material used at LACBWR facility for sample analysis or instrument calibration.
DPR-45	Amendment 43	June 7, 1985	This amendment revises technical specifications regarding reactor coolant systems safety valves to incorporate new requirements for operability and surveillance testing.
DPR-45	Amendment 44	October 8, 1985	This amendment adds a new paragraph 4.2.23 to the Technical Specifications to require the Demineralized Virgin Water Tank to be operable with a minimum water level of 1 foot. In addition, the amendment adds a surveillance requirement to verify the minimum water level in the tank at least once per 7 days and adds a basis for the above requirements.
DPR-45	Amendment 45	January 6, 1986	This amendment adds a new paragraph 4.1.6 to the Technical Specifications to require the plant, if it is in condition 1,2 or 3 and the Mississippi River level adjacent to the plant reaches 639.2 feet and is predicted to exceed 640 feet, to commence reactor shutdown and be in condition 4 prior to the river level exceeding 640 feet.
DPR-45	Amendment 46	March 25, 1986	This amendment would increase the maximum average exposure of any fuel assembly not on the periphery of the core from 16,800 MWD/MTU to 18,000 MWD/MTU.
DPR-45	Amendment 47	March 27, 1986	This amendment modifies the Technical Specifications (TS) to allow the use of control rods of the ASEA-ATOM plate design or the current Allis Chalmers tube sheath design. This amendment also deletes the requirement to go-gage control rods in Section 4.2.4.10 of the TS.
DPR-45	Amendment 48	April 14. 1986	This amendment modifies Section 4.2.3 and Section 2.6 of the Technical Specifications describing the replacement and modification of the 1C Non-Interruptible Bus.
DPR-45	Amendment 49	July 15, 1986	This amendment changes the functional testing frequency for the installed radiation monitors from every 2 weeks to quarterly and the calibration frequency from each refueling outage to at least once per 18 months.
DPR-45	Amendment 50	July 15, 1986	This amendment revises the wording of the Technical Specifications regarding Reactor Coolant Chemistry to help ensure the plant personnel will uniformly interpret necessary actions to be taken.
DPR-45	Amendment 51	July 30, 1986	This amendment involves the consolidation and clarification of operability and surveillance requirements for the ECCS.
DPR-45	Amendment 52	September 2, 1986	This amendment transfers design technical specification Section 2.6, electrical power supply, to the bases of operability technical specification Section 4.2.3, electrical power systems.

License No.	Amendment / Change No.	Date of Issuance	Description of Change/Amendment
DPR-45	Amendment 53	September 5, 1986	This amendment changes the Technical Specification by adding operational requirements on the Containment Building ventilation isolation inlet and exhaust dampers. In addition, a typographical error made on page 29b as issued in Amendment 50 has been corrected.
DPR-45	Amendment 54	September 10, 1986	This amendment updates the La Crosse BWR Facility Organization Chart, Figure 6.2.2-1 of Technical Specifications.
DPR-45	Amendment 55	April 8, 1987	This amendment authorizes changes to the Appendix A Technical Specifications (TS) pertaining to (1) new reporting requirements of 10 CFR 50.73 and (2) addition of details to the requirements of the reports required for diesel generator failures.
DPR-45	Amendment 56	August 4, 1987	This amendment modifies License No. DPR-45 to possess-but-not-operate status.
DPR-45	Amendment 57	September 15, 1987	This amendment is for the deletion of Technical Specification requirements for ISI and Nuclear Instrumentation.
DPR-45	Amendment 58	January 4, 1988	This amendment grants exemption from 10 CFR Part 50, Appendix R, Section III.H., is granted with respect to fire brigade requirements.
DPR-45	Amendment 59	March 15, 1988	This amendment grants exemption from 10 CFR 50.54 (o) and 10 CFR 50, Appendix J requirements to perform Type A Containment Building Integrated Leak Rate Tests pursuant to 10 CFR 50.12 (a) (2) (11).
DPR-45	Amendment 60	April 11, 1988	This amendment revises the Technical Specifications in response to application of November 12, 1987.
DPR-45	Amendment 61	May 19, 1988	This amendment revised the Physical Security Plan.
DPR-45	Amendment 62	May 31, 1988	This amendment revises the Technical Specifications in response to application of September 30, 1987.
DPR-45	Amendment 63	August 18, 1988	This amendment revised Provisional License No. DPR-45 to full-term, possession-only license that expires on March 29, 2003.
DPR-45	Amendment 64	December 22, 1988	This amendment revises the Technical Specifications in partial response to application of December 21, 1987.
DPR-45	Amendment 65	April 26, 1989	This amendment revises the Technical Specifications in partial response to application of December 21, 1987.
DPR-45	Amendment 66	August 7, 1991	Order to Authorize Decommissioning and Changes in Technical Specification contained in Appendix A.
DPR-45	Amendment 67	January 13, 1993	This amendment revises the Technical Specification (TS) by deleting the requirements the Radioactive Effluent Release Report be submitted on a semi-annual basis and adds the requirement to the TS that the Radioactive Effluent Release Report be submitted annually in accordance with the revised 10 CFR Part 50.36a. In addition, this amendment eliminates the collection and reporting of hourly meteorological data.

License No.	Amendment / Change No.	Date of Issuance	Description of Change/Amendment
DPR-45	Amendment 68	September 27, 1994	This amendment revises the Technical Specifications in response to application of November 5, 1993.
DPR-45	Amendment 69	April 11, 1997	This amendment revises both the body of the License and the Appendix A Technical Specifications (TS) to the License. These changes to the License and TS are structured to reflect the permanently defueled and shutdown status of the plant. This amendment also removes the fire protection requirements, radiological effluent controls for the emergency and security plans from the Technical Specifications to licensee controlled documents.
DPR-45	Amendment 70	April 3, 2006	This amendment revises the LACBWR Technical Specification to allow waste processing components of fixtures to be handled over the Fuel Element Storage Well (FESW), limiting the weight of such items to 50 tons (the weight of the heavy load drop found acceptable in the cask drop analysis performed for the LACBWR FESW).
DPR-45	Amendment 71	April 6, 2011	This amendment addresses typographical error identified on Technical Specification pages 2-1 and 4/5-2.
DPR-45	Amendment 72	July 31, 2013	This amendment revises the LACBWR License and Technical Specification as a result of the completion of the transfer of the spent fuel to dry cask storage.
DPR-45	Amendment 73	September 8, 2014	This amendment revises the current emergency plan requirements for the LACBWR Facility.

Appendix C
Personnel Interview Questionnaire

La Crosse Boiling Water Reactor
Historical Site Assessment Questionnaire

2010

The following questionnaire is the basis of hazard identification and documentation at the La Crosse Boiling Water Reactor. The intent of this form is to collect any relevant historical information related to LACBWR regarding the operating period including on-site waste disposal, environmental concerns or any other issues that could be used to classify the site appropriately. This information should include any suspected location(s) of radioactive or hazardous waste spill or dumping sites (radioactive or other). Answers to the questions should be from personal knowledge whenever practicable.

To assist personnel in locating areas of concern, information should be placed on maps of the site or any other relevant location(s).

Location described if different than LACBWR site area: _____

Person Completing Questionnaire: _____

_____ **Date:** _____

DIRECTIONS (Attach additional sheets, use supplied maps or use the back of this document as necessary.)

General Background

1) During what time period did you work at LACBWR? _____

2) What major projects did you participate in? _____

3) What was your specific function on these projects? _____

4) Do you know of anyone else who should receive a questionnaire (Please provide an address or phone number if known)? _____

5) What were your job titles (s) and work descriptions while at LACBWR? _____

36

La Crosse Boiling Water Reactor
Historical Site Assessment Questionnaire
2010

Surface & Subsurface Soils

6) Do you know of any soil contamination areas resulting from plant operation? NO_____YES_____
If yes, note all locations suspected of having contaminated soil, and at what depth you suspect the contamination exists. Include any locations within or immediately under or adjacent to asphalt or concrete materials. _____

_____

_____

7) Do you know of any known radiological releases resulting from plant operation or the cleanup? NO___ YES ___
If yes, list timeframe (month/year) and describe any known releases of radioactive material (solid, liquid or gas), or other hazardous materials (PCBs, oil spills, etc.) onto surface soil. What documents or other sources could provide additional information? Were there any follow-up reports or documentation? If so, where might they be located? _____

_____

_____

8) Do you know of any plant related radioactive or hazardous materials storage areas other than those identified on the site map? NO _____ YES _____
If yes, were radioactive or hazardous materials stored above ground within the Site Area? This includes any properly controlled materials (including waste shipments and contents). List timeframe (month/year) of incident(s). _____

_____

_____

9) Do you know if surface soil was re-graded or moved elsewhere for fill or construction purposes? NO_____YES_____
If yes, list timeframe (month/year) and where was it moved or stored? _____

_____

_____

10) Do you know of any fires or explosions that occurred on the site? NO_____ YES _____
If yes, list timeframe (month/year) and describe any events noted. _____

_____

11) Do you know of any ground water contamination without an identifiable source? NO_____ YES _____
If yes, list timeframe (month/year) and describe any events noted._____

La Crosse Boiling Water Reactor
Historical Site Assessment Questionnaire
2010

12) Do you know of areas where excavations have taken place after site startup? NO_____ YES _____

If yes, list timeframe (month/year) and describe any areas. _____

_____

13) Are you aware of subsurface tanks, piping (including sewer lines) or components not shown on the plant drawings? NO_____ YES _____

If yes, where are their locations? Do you have any ideas regarding content? _____

_____

Surface & Ground Water

14) Do you know of any instances where radioactive materials or hazardous materials could have entered pathways to surface or ground water? NO_____ YES _____

If yes, list timeframe (month/year) and describe any instances noted._____

_____

15) Do you know of any instances where installed site engineering controls (such as berms, external tanks, dikes etc.) have failed, potentially allowing radioactive or other hazardous materials to enter a pathway toward the environment? NO_____ YES _____

If yes, list timeframe (month/year) and describe any instances. _____

_____

16) Do you know of instances where radioactive materials or other materials could have entered the environment through ground water? NO_____ YES _____

If yes, list timeframe (month/year) and describe any instances._____

_____

_____

Air

17) Do you know of any instances where radioactive or other hazardous materials were (or could have been) released to the environment? NO_____ YES _____

If yes, list timeframe (month/year) and describe any instances. _____

_____

_____

Historical Site Assessment Questionnaire

2010

18) Do you know of instances where installed site engineering controls (such as plant internal tanks, external tanks, radioactive waste systems etc.) have failed, potentially allowing radioactive or other hazardous materials to enter a pathway to the environment? NO_____ YES _____

If yes, list timeframe (month/year) and describe any instances. _____

19) Do you know of instances where approved radioactive or hazardous airborne releases occurred which subsequently contaminated ground or liquid effluent pathways? NO_____ YES _____

If yes, list timeframe (month/year) and describe any instances. _____

Structures

20) Do you know of any existing structures (permanent or temporary) other than the reactor bldg, turbine building and waste treatment bldg that are potentially contaminated with radioactive and/or hazardous materials?

NO_____ YES _____

If yes, were there any known efforts to fix the contaminants via painting, etc. List timeframe of any efforts.

_____

21) Do you know of structures or locations (permanent or temporary) other than those identified on the site map, that were used for storage of radioactive materials and/or hazardous materials? (this includes temporary storage of properly controlled materials such as packages for waste disposal). NO_____ YES _____

If yes, list timeframe (month/year) and describe any instances. _____

22) Are any structures (permanent or temporary) constructed on potentially contaminated grounds?

NO_____ YES _____

If yes, describe._____

23) Do you know of any structures (permanent or temporary) that share any liquid drainage systems with previously contaminated structures? NO_____ YES _____

If yes, describe._____

24) Do you know of any structures that may have been decontaminated or were suspected of being contaminated?

NO_____ YES _____

If yes, list timeframe (month/year) and describe any instances. _____

39

La Crosse Boiling Water Reactor
Historical Site Assessment Questionnaire
2010

Other Potential Hazards/Concerns

25) Were there any examples of known PCBs present at LACBWR? (in addition to use in transformers, PCBs historically have been used in other electrical components and have been a component in certain paints as well as used as lubricants for cable pulling). NO_____ YES _____

If yes, list timeframe (month/year) and describe any examples. _____

_____

26) Do you know of any examples where lead based paint was used or stored in the facility? NO_____ YES _____

If yes, list timeframe (month/year) and describe any examples. _____

27) Do you know of any examples where potentially friable asbestos was used or stored in the facility? (in addition to insulation, asbestos was sometimes used in brake linings, as gasket material, various building materials (wallboard, roofing material, etc.) or as an additive to epoxy). NO_____ YES _____

If yes, list timeframe (month/year) and describe any examples. _____

_____

28) Do you know of other information that can be used to qualify and/or quantify radioactive and non-radioactive hazards within the facility? NO_____ YES _____

If yes, who additionally can provide more details or where can this information be found? _____

_____

29) Did the site ever dispose of or incinerate radioactive materials onsite? NO_____ YES _____

If yes, list timeframe (month/year) and is there evidence of such activities? _____

_____

30) Do you know of any instances of off-site disposal of radioactive materials or hazardous wastes other than at a licensed facility? NO_____ YES _____

If yes, list timeframe (month/year) and describe any instances. _____

_____

40

La Crosse Boiling Water Reactor
Historical Site Assessment Questionnaire
2010

31) Do you know of any off-site activities that could have caused a release of hazardous or radioactive materials?

NO_____ YES _____

If yes, list timeframe (month/year) and describe any activities. _____

_____

32) Are there any other issues not previously addressed that should be considered with respect to the LACBWR site area? If so, list timeframe (month/year) and describe any issues. NO_____ YES _____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

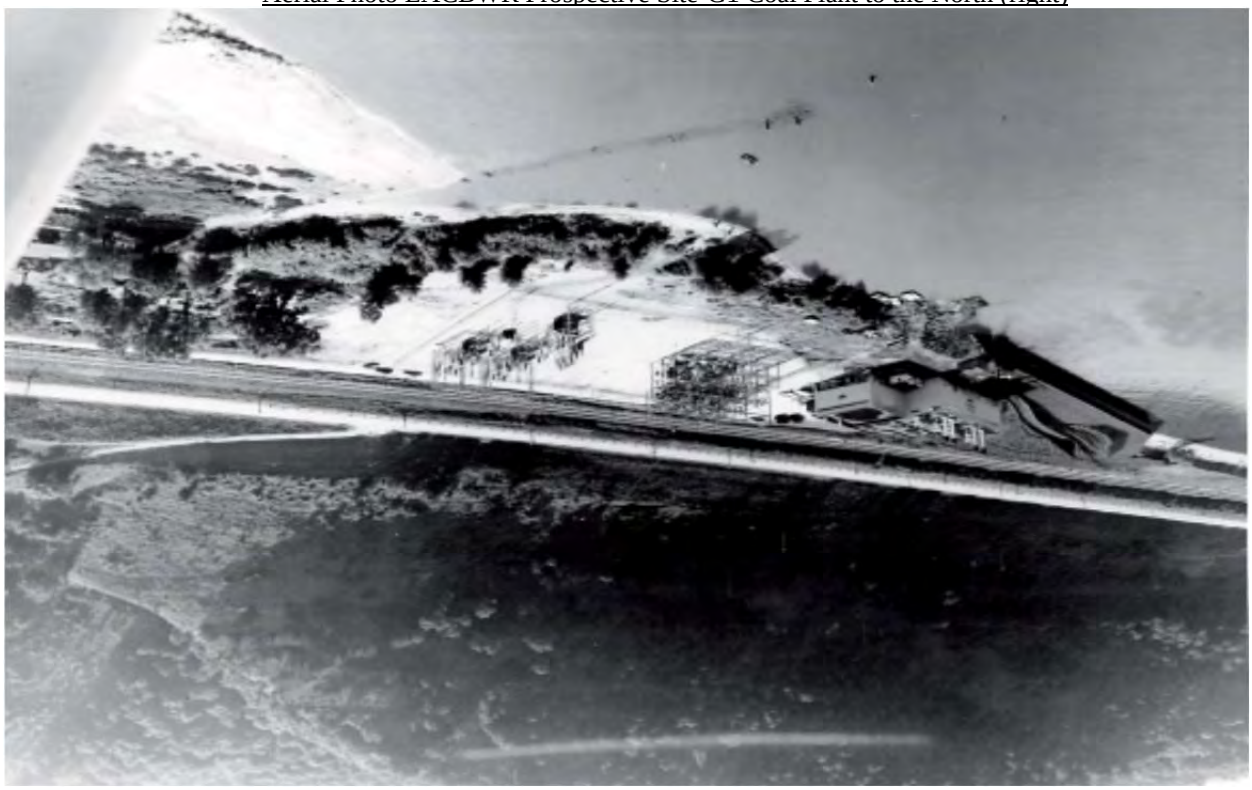
_____

_____

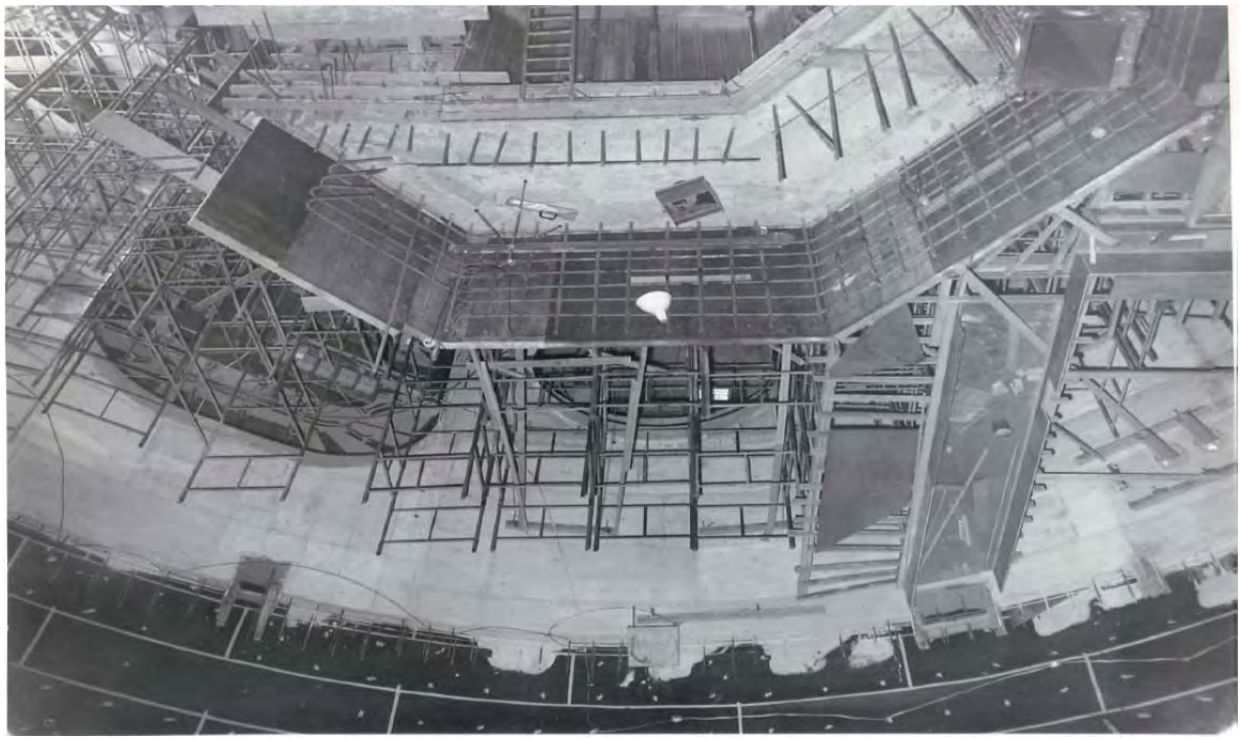
Appendix D
Site Construction and Aerial Photographs

1962 Aerial Photo of LACBWR Prospective Site

Aerial Photo LACBWR Prospective Site-G1 Coal Plant to the North (right)

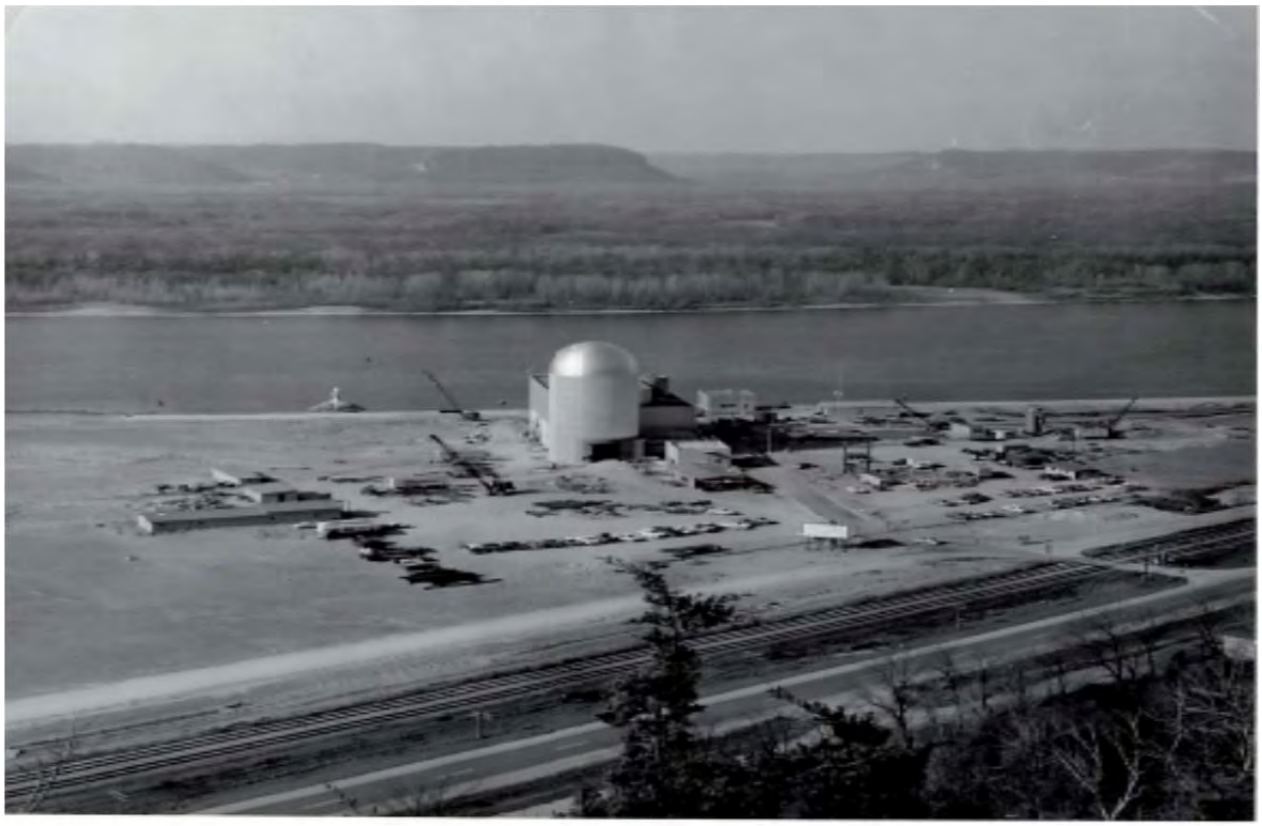


Reactor Building Construction—Looking North, July 1964



Radioactive Waste Building, October 1964

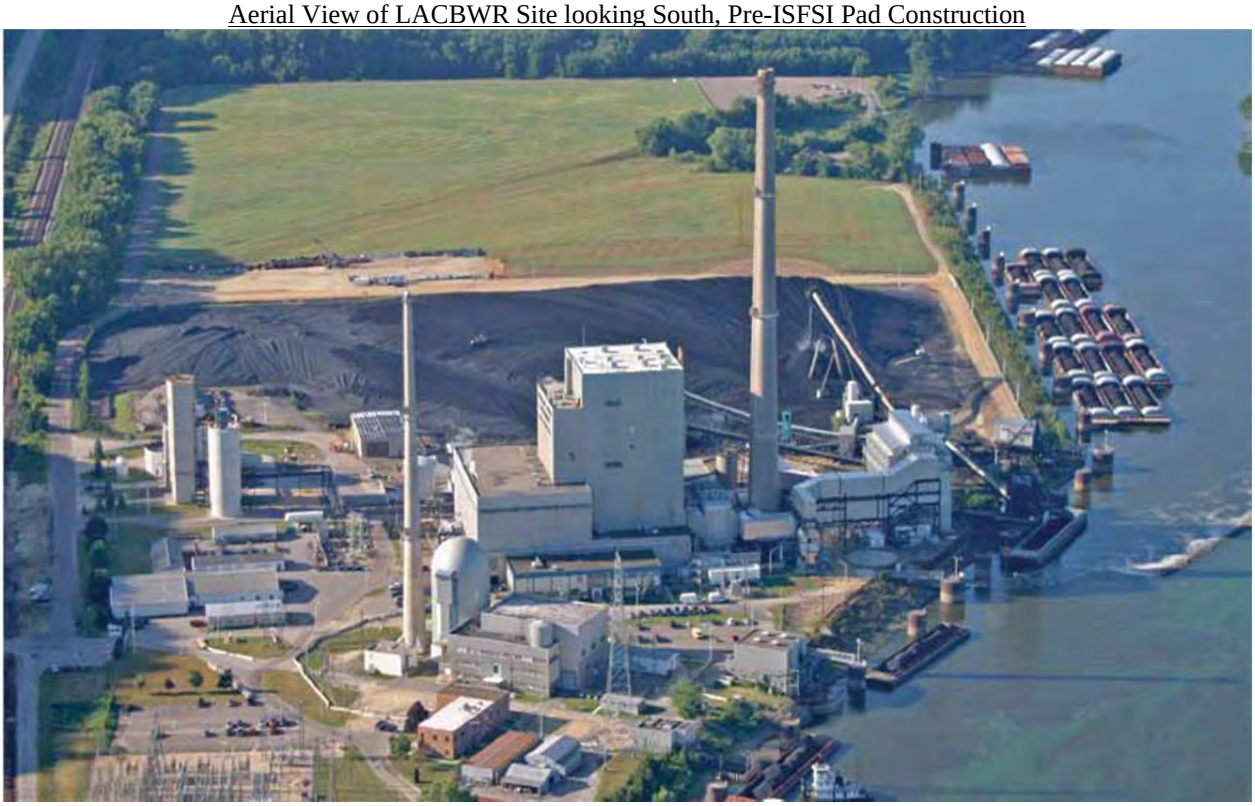
View from Bluff to East of LACBWR Construction, November 1964



LACBWR Site Looking North, March 1966

Aerial Photo, LACBWR Site, August 1967

Aerial View of LACBWR Site looking South, Pre-ISFSI Pad Construction



Appendix E
Historic LACBWR Soil Survey Data

Ground Sample Survey – September, 1987
(Activity in pCi/kg; NR = Not Reported)
(First Sample @ 2", Second Sample 4-8" depth)

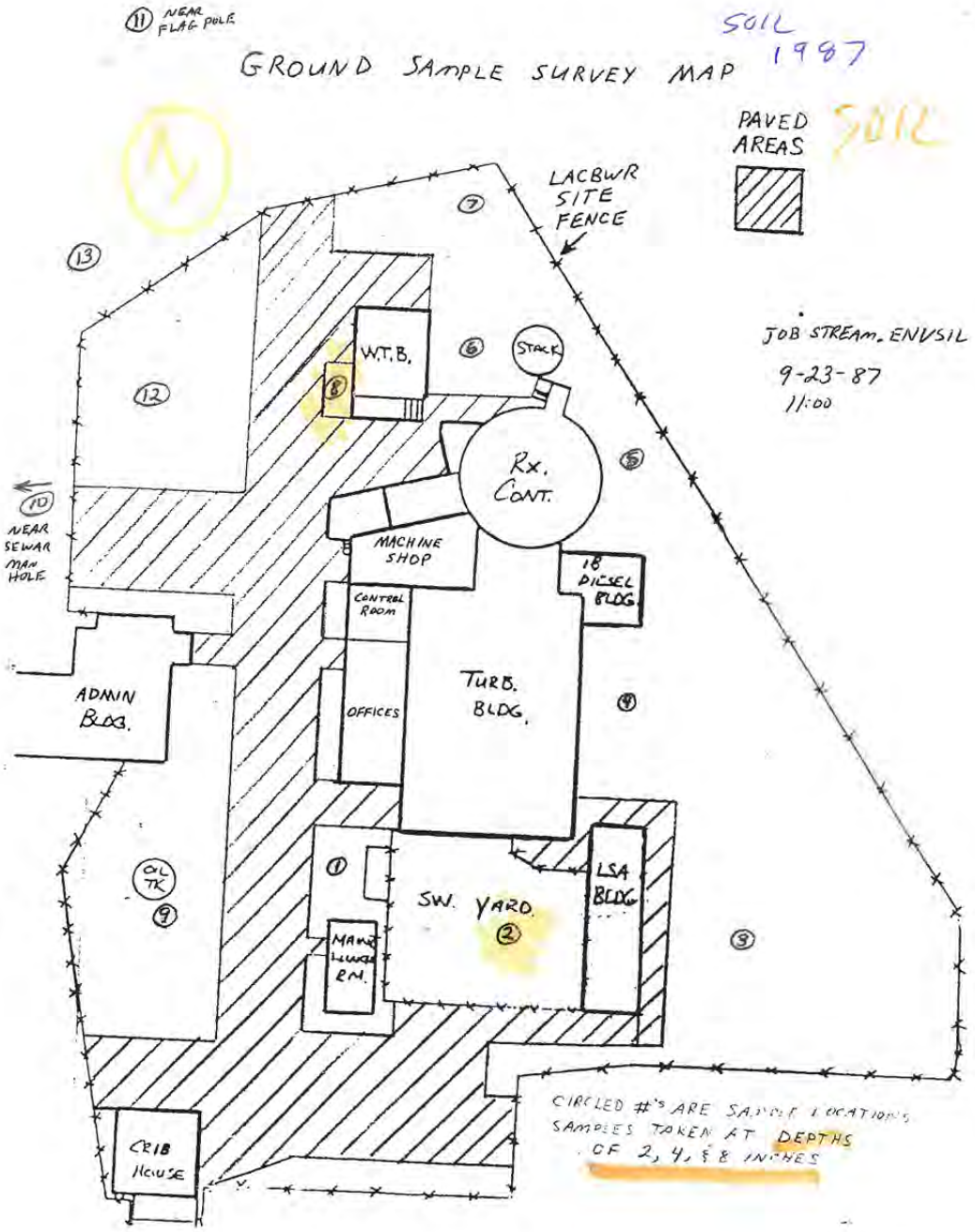
Location	Co-60	Cs-137	Mn-54	CS-134	Co-57	Ce-141	Ce-144	Co-58
1-1	481.8 ± 22.1	256.0 ± 18.4						
1-2	437.9 ± 22.7	248.9 ± 20.8	19.2 ± 6.8					
2-1	1,400 ± 61.9	1,654 ± 62.0						
2-2	1,201 ± 31.8	3,151 ± 40.6		60.2 ± 17.5				
3-1	NR	NR						
3-2	NR	NR						
4-1	37.4 ± 9.4	35.1 ± 10.9			9.4 ± 3.2		44.1 ± 23.9	
4-2	15.9 ± 10.4	NR						
5-1	30.0 ± 12.7	52.0 ± 15.1						
5-2	NR	45.0 ± 14.3	16.2 ± 5.0					
6-1	755.6 ± 30.2	746.4 ± 28.6	30.5 ± 9.0					
6-2	57.1 ± 16.4	74.4 ± 17.0						19.5 ± 5.7
7-1	56.2 ± 18.7	21.5 ± 14.7	27.9 ± 8.1					
7-2	NR	NR						
8-1	7,267 ± 80.1	14,340 ± 91.4		149.6 ± 28.0				
8-2	3,390 ± 54.7	11,170 ± 76.6	25.0 ± 10.9	97.0 ± 21.2		35.4 ± 14.8		

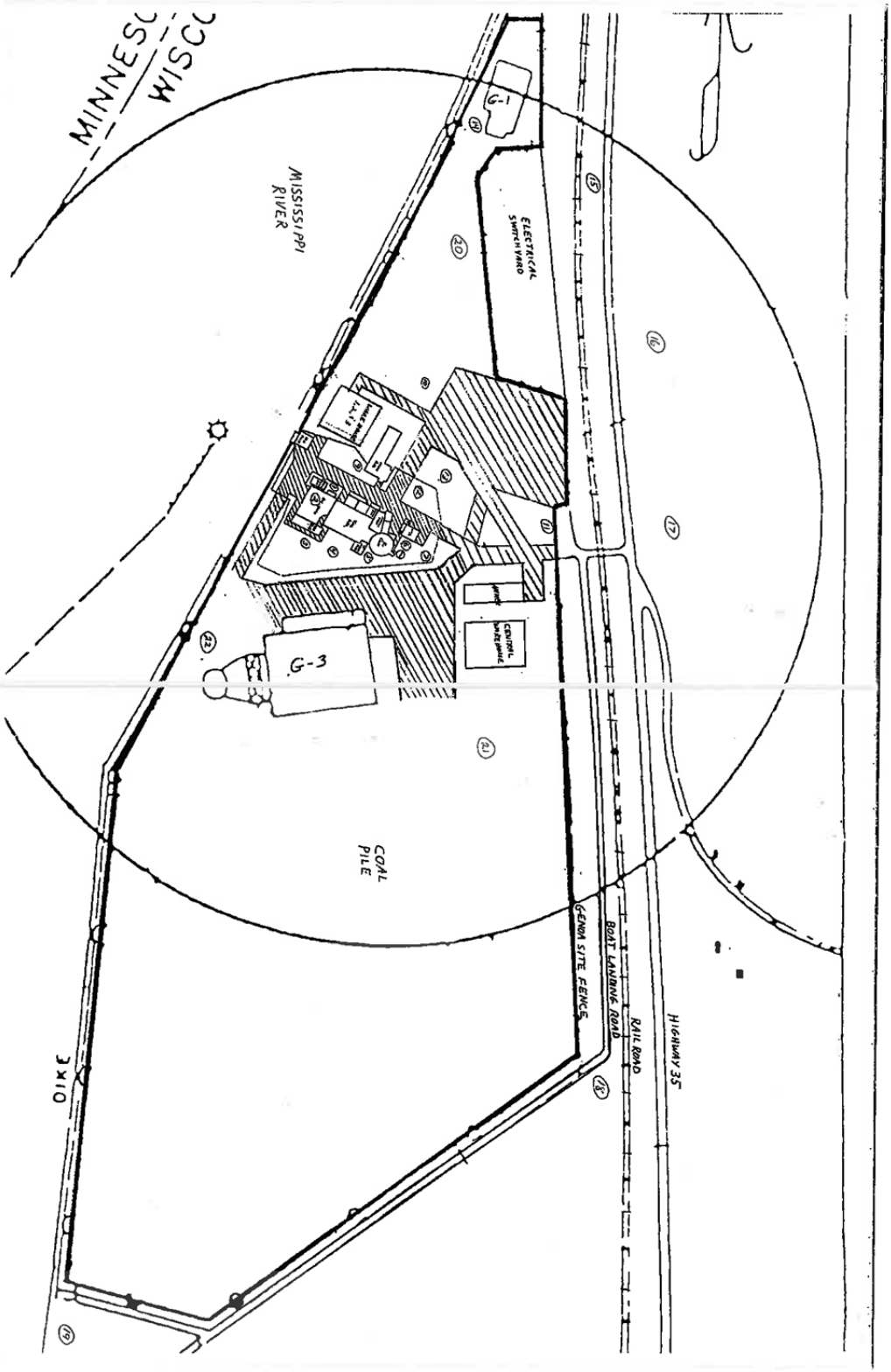
Ground Sample Survey – September, 1987
(Activity in pCi/kg; NR = Not Reported)
(First Sample @ 2", Second Sample 4-8" depth)

Location	Co-60	Cs-137	Mn-54	CS-134	Co-57	Ce-141	Ce-144	Co-58
9-1	789.1 ± 25.6	574.8 ± 24.1						
9-2	59.2 ± 15.8	368.1 ± 21.7				21.4 ± 8.7		
10-1	316.2 ± 19.6	150.4 ± 11.8						
10-2	53.4 ± 15.9	111.8 ± 12.0	21.3 ± 6.8					
11-1	178.5 ± 11.3	341.2 ± 15.7						
11-2	76.2 ± 8.6	478.1 ± 16.8	12.0 ± 4.3					
12-1	227.9 ± 19.7	292.0 ± 24.0			13.0 ± 4.6			
12-2	NR	134.0 ± 15.8						
13-1	240.1 ± 18.7	64.7 ± 22.1	25.2 ± 7.8					
13-2	49.0 ± 15.5	47.2 ± 18.3	32.5 ± 8.6					
14-1	NR	41.6 ± 12.9						
14-2	NR	96.3 ± 12.8						
15-1	NR	698.1 ± 24.3						
15-2	NR	585.0 ± 23.0			10.8 ± 4.9			

Ground Sample Survey – September, 1987
(Activity in pCi/kg; NR = Not Reported)
(First Sample @ 2", Second Sample 4-8" depth)

Location	Co-60	Cs-137	Mn-54	CS-134	Co-57	Ce-141	Ce-144	Co-58
16-1	NR	705.7 ± 23.6						
16-2	NR	38.2 ± 16.5						
17-1	NR	376.1 ± 19.8			7 3 ± 4.3			
17-2	NR	256.1 ± 17.1						
18-1	NR	20.0 ± 15.4						
18-2	NR	25.4 ± 15.1						
19-1	235 7 ± 22.2	114.0 ± 16.0						
19-2	66.5 ± 14.2	NR						
20-1	NR	46.9 ± 12.1						
20-2	NR	NR						
21-1	NR	46.6 ± 11.3						
21-2	NR	10.3 ± 9.6						
22-1	NR	NR						
22-2	NR	22.2 ± 13.9						


GROUND SAMPLE SURVEY MAP
SOIL 1987
PAVED AREAS
SOIL
LACBWR SITE FENCE
JOB STREAM. ENVSIL
9-23-87
11:00
W.T.B.
STACK
Rx. CONT.
MACHINE SHOP
18 DIESEL BLDG.
CONTROL ROOM
TURB. BLDG.
OFFICES
ADMIN BLDG.
NEAR SEWAR MAN HOLE
NEAR FLAG POLE
SW. YARD
LSA BLDG.
OIL TK
CRIB HOUSE
CIRCLED #'S ARE SAMPLE LOCATIONS
SAMPLES TAKEN AT DEPTHS OF 2, 4, & 8 INCHES


MINNESO
WISCO
MISSISSIPPI RIVER
ELECTRICAL SWITCH YARD
G-1
G-3
CENTRAL WAREHOUSE
COAL PILE
DIKE
GENOA SITE FENCE
BOAT LANDING ROAD
RAIL ROAD
HIGHWAY 35

On-Site (LSE) LACBWR Soil Survey, Aug. 1992 – Jan. 1993
(Activity in pCi/kg; NR = Not Reported)
(First sample @ surface, second sample @ 6" depth)

Location	Cs-137	Co-60
1-1	43.3 26.1 45.3 38.2 (Avg.)	NR
1-2	45.8 45.5 45.6 45.6 (Avg.)	NR
2-1	78.0 70.5 59.1 69.2 (Avg.)	NR
2-2	115 110 108 111 (Avg.)	NR
3-1	99.5 101.0 87.6 96.0 (Avg.)	49.1 53.0 48.8 50.3 (Avg.)
3-2	112 103 103 106 (Avg.)	50.1 40.4 41.1 43.9 (Avg.)
4-1	101.0 104.0 96.1 100.4 (Avg.)	33.5 28.5 31.0 (Avg.)
4-2	90.0 77.1 76.3 81.0 (Avg.)	NR
5-1	150 137 162 150 (Avg.)	136 157 138 144 (Avg.)
5-2	84.9 79.5 47.1 87.2 (Avg.)	35.1 34.7 31.2 33.7 (Avg.)

On-Site (LSE) LACBWR Soil Survey, Aug. 1992 – Jan. 1993
(Activity in pCi/kg; NR = Not Reported)
(First sample @ surface, second sample @ 6" depth)

Location	Cs-137	Co-60
6-1	79.5 86.2 86.9 84.2 (Avg.)	47.7 53.7 39.5 47.0 (Avg.)
6-2	88 100 93.5 94.0 (Avg.)	13.6 22.7 20.2 18.8 (Avg.)
7-1	123 140 128 130 (Avg.)	NR
7-2	106 117 115 113 (Avg.)	18.8
8-1	123 131 135 130 (Avg.)	NR
8-2	104 105 101 103 (Avg.)	NR

Legend
Historical Surface Soil Samples
Current LSE Fence
1-1
1-2
1-3
1-4
1-5
1-6
1-7
1-8
0 10 20 30 Meters
0 20 40 60 80 100 Feet
Historical Surface Soil Survey
LACBWR Site
Genoa, WI
ENERGYSOLUTIONS
Date 01/19/15
Drawing 15011901.a

Soil Background (Off-Site) Survey, Aug. 1992- Jan. 1993
(Activity in pCi/kg; NR = Not Reported)

Location	Cs-137	Co-60
SE on County M, La Crosse, WI	231 233 220 228 (Avg.)	NR
SE of Stoddard, WI	662 676 675 671 (Avg.)	NR
SE on County K, La Crosse, WI	444 448 445 446 (Avg.)	NR
A. Hansen's Property, S of La Crosse, WI	139 133 117 129 (Avg.)	NR
Gianoli Road, Genoa, WI	97.8 113.0 79.9 96.9 (Avg.)	NR
Pedretti Farm, N of Genoa, WI	36.7 36.6 45.5 39.6 (Avg.)	NR
By Radio Tower, NE of Genoa, WI	75.1 66.3 52.8 64.7 (Avg.)	24.7
Mellen, WI	601 574 573 583 (Avg.)	15.7
Trailer Court, E of Hwy 35, Genoa, WI	137 125 128 130 (Avg.)	NR
0.5 Miles N of Victory, WI	502 515 544 520 (Avg.)	NR
0.25 Miles N of DeSoto, WI	35.0 37.7 51.3 41.3 (Avg.)	NR

Initial Site Characterization Soil Survey – August-September, 1995
(Activity in pCi/kg[1]; samples taken within top 6" depth)

Sample Location[2]	Co-60	Cs-137
1	10.5	106
2	34.8	81.6
3	2.89	126
4	16.7	78.5
5	4.77	92.1
6	8.76	80.2
7	< MDA	51
8	< MDA	12.2
9	<MDA	23.2
10	<MDA	38.9
11	<MDA	71
12	<MDA	93.3
13	767	983
14	100	312
15	5.79	58.9
16	<MDA	22.5
17	<MDA	15
18	<MDA	14.4
19	<MDA	43.5
20	<MDA	44.2
21	<MDA	72.6
22	<MDA	55.6

Initial Site Characterization Soil Survey – August-September, 1995
(Activity in pCi/kg[1]; samples taken within top 6" depth)

Sample #	Co-60	Cs-137
23	<MDA	45.5
24	<MDA	67.9
25	7.36	31
26	10.7	28.7
27	13.9	58.4
28	<MDA	78.7
29	<MDA	74.1
30	<MDA	68.3
31	<MDA	64.2
32	<MDA	27.7
33	31.2	129
34	<MDA	171
35	<MDA	91.7
36	<MDA	61
37	40.9	124
38	<MDA	44.6
39	<MDA	130
40	<MDA	49
41	<MDA	74.9
42	<MDA	55.6
43	20.7	211
44	9.1	145

Initial Site Characterization Soil Survey – August-September, 1995
(Activity in pCi/kg[1]; samples taken within top 6" depth)

Sample #	Co-60	Cs-137
45	36.5	310
46	19.6	197
47	85.1	177
48	12	158
49	56.4	329
50	23.8	99
51	19.3	192
52	17.4	353
53	6.22	291
54	8.64	150
55	19.1	307
56	113	213
57	28.9	367
58	27	109
59	12.8	84.7
60	<MDA	30.7
61	48.5	137
62	76.9	206
63	28.3	226
64	<MDA	200
65	<MDA	122
66	26.7	66.8

Initial Site Characterization Soil Survey – August-September, 1995
(Activity in pCi/kg[1]; samples taken within top 6" depth)

Sample #	Co-60	Cs-137
67	19.2	185
68	276	1,300
69	44.8	252
70	<MDA	77.3
71	<MDA	25.5
72	<MDA	149
73	<MDA	38.2
74	<MDA	76.3
75	<MDA	17.2
76 (3.3 miles S of the plant, @ boat landing along the Bad Axe River)	22.7	381
77 (Pedretti Farm substation, E of the plant, N of Genoa, WI)	<MDA	227
78 (By Radio Tower, NE of plant, Genoa, WI)	<MDA	35
79 (Junction County O & County K roads, WI)	<MDA	188
80 (Junction of Rte 162 & County O, East of Stoddard, WI)	<MDA	66.5

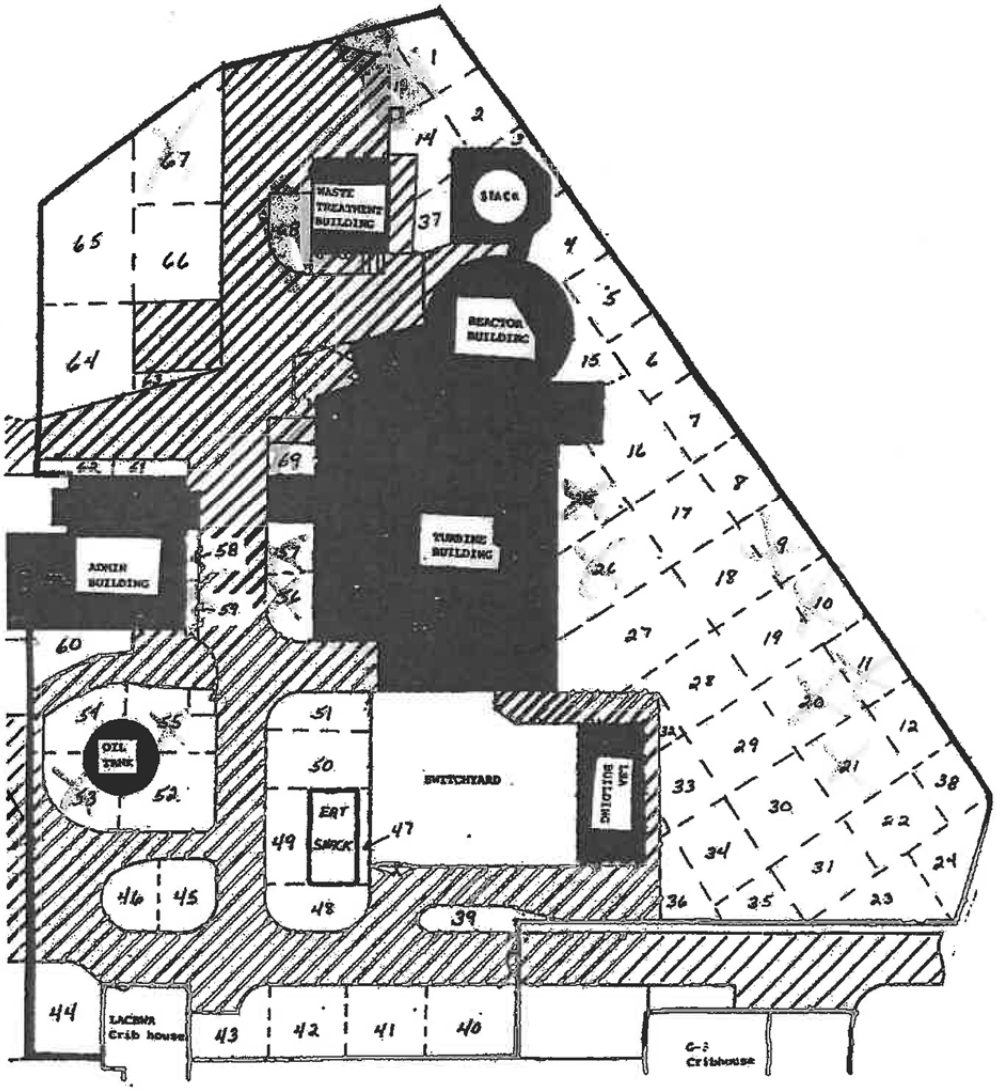
Notes:

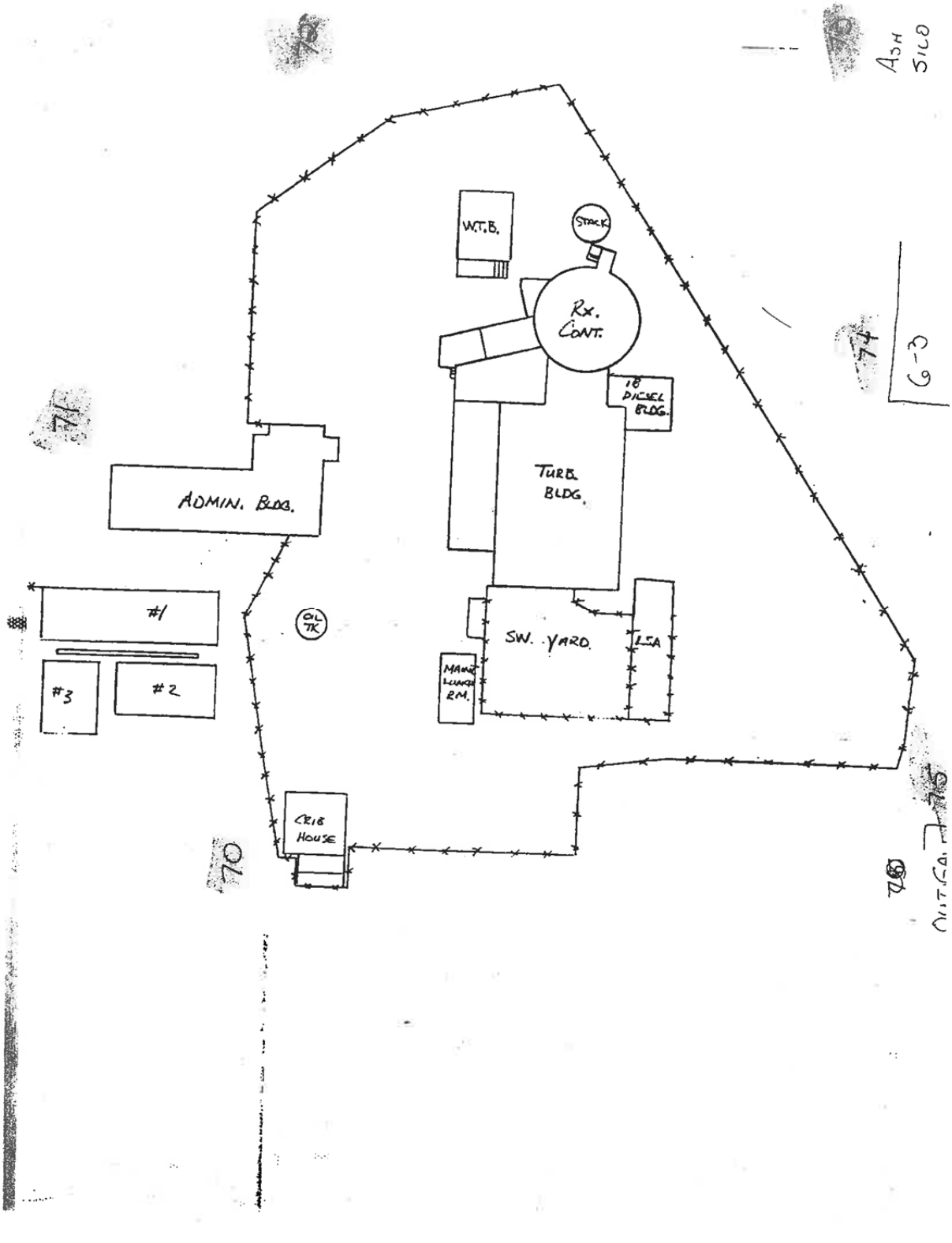
1 – Data obtained from Dairyland Power Cooperative LAC-TR-138, "Initial Site Characterization Survey for SAFSTOR", October 1995 (relevant excerpt follows) and DPC soil sample notes

2 - Sample locations 1 through 69 were collected within the LACBWR Site Exclusion (LSE) area; samples 70 through 75 were taken within the Owner Controlled Area licensed property; and samples 76 through 80 were taken at off-site locations as noted.

LAC-TR-138
PAGE 22

SITE SOIL SAMPLING GRID MAP




ASH SILO
W.T.B.
STACK
RX. CONT.
1B DIESEL BLDG.
TURB. BLDG.
ADMIN. BLDG.
#1
#2
#3
OIL TK
SW. YARD
LSA
MAIN LUNCH RM.
CRIB HOUSE
G-3

Excerpt from LAC-TR-138, Page 19

4.7 Initial Site Soil Contamination Determination Survey

In accordance with NUREG/CR-5849 "Manual for Conducting Radiological Surveys in Support of License Termination" an initial site soil survey was performed during August - September 1995. The LACBWR affected area (area within the LSE fence) was marked out into 10 m_2 areas for sample location identification. No samples were taken under surface coverings such as blacktop. After gridding of the area was complete one surface soil sample was collected from the top 15 cm of the soil in each grid location. Each sample collected was approximately 1 - 2 kg.

LAC-TR-138
PAGE 20

Grass, rocks, sticks and foreign objects were removed from each sample to the degree practical. Each sample was then dried and placed in a disposable marinelli container for gamma analysis. All samples were allowed to sit for at least 72 hours to reduce the affect of any short lived natural decay chains. All samples were then counted for 3 hours on the ENV HPGE. The following is a listing of activity found in these samples. No natural occurring isotope is listed. The actual sample gamma scans are being kept for further review if needed. All sample locations can be found using their corresponding number using the enclosed site grid map.

NOTE: All activity values are in ρCi/kg

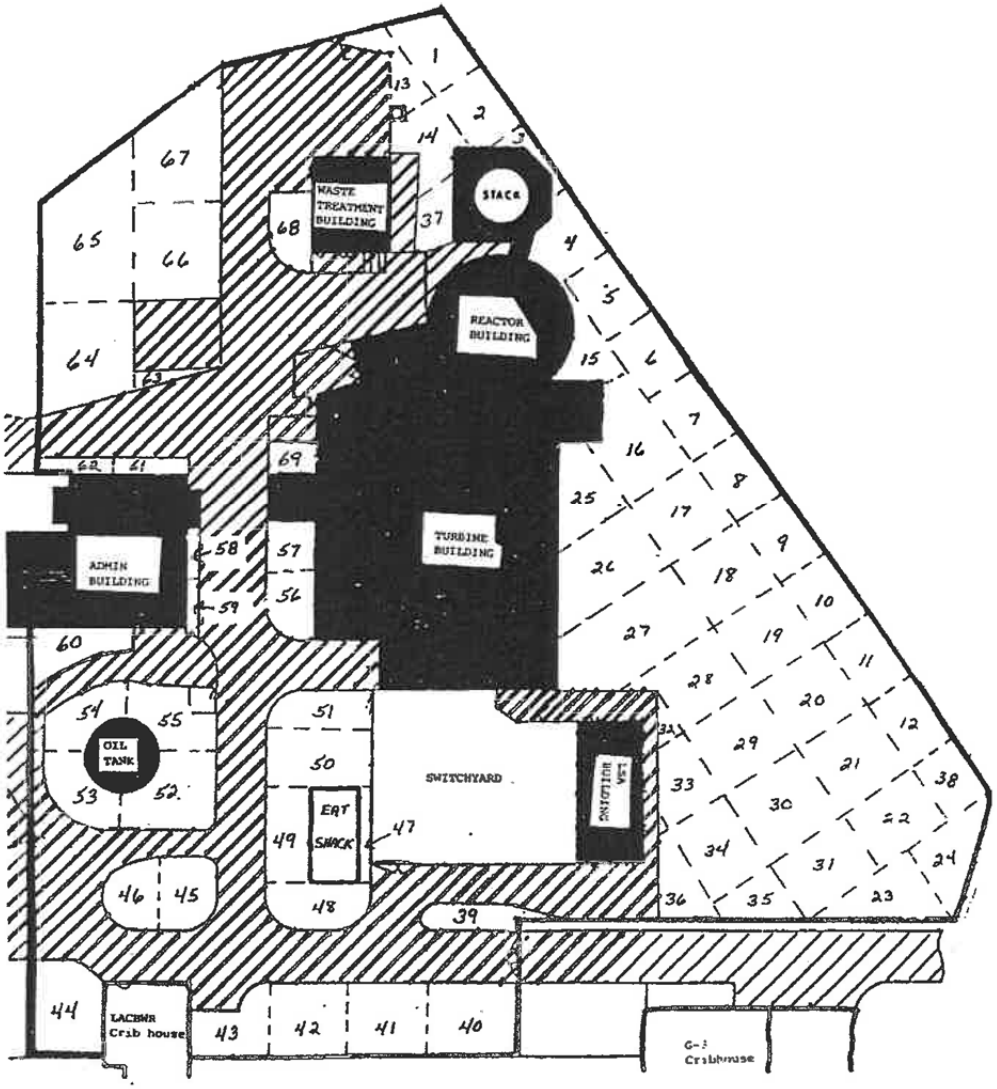
Sample Grid #	Co-60	Cs-137	Sample Grid #	Co-60	Cs-137	Eu-155
1	10.5	106	27	13.9	58.4	
2	34.8	81.6	28	<MDA	78.7	
3	2.9	126	29	<MDA	74.1	
4	16.7	78.5	30	<MDA	68.3	
5	4.8	92.1	31	<MDA	64.2	
6	8.8	80.2	32	<MDA	27.7	
7	<MDA	51	33	31.2	129	
8	<MDA	12.2	34	<MDA	171	
9	<MDA	23.2	35	<MDA	91.7	53.5
10	<MDA	38.9	36	<MDA	61	20.3
11	<MDA	71	37	40.9	124	40.4
12	<MDA	93.3	38	<MDA	44.6	
13	767	983	39	<MDA	130	
14	100	312	40	<MDA	49	
15	5.8	58.9	41	<MDA	74.9	
16	<MDA	22.5	42	<MDA	55.6	
17	<MDA	15	43	20.7	211	
18	<MDA	14.4	44	9.1	145	
19	<MDA	43.5	45	36.5	310	
20	<MDA	44.2	46	19.5	197	30.8
21	<MDA	72.6	47	85.1	177	27.7
22	<MDA	55.6	48	12	158	
23	<MDA	45.5	49	56.4	329	
24	<MDA	67.9	50	23.8	99	
25	7.4	31	51	19.3	192	33.4
26	10.7	28.7	52	17.4	353	11.9

LAC-TR-138
PAGE 21

Sample Grid #	Co-60	Cs-137	Eu-155
53	6.2	291	23
54	8.6	150	
55	19.1	307	11.4
56	11.3	213	40
57	28.9	367	56.9
58	27	109	
59	12.8	84.7	32.8
60	<MDA	30.7	
61	48.5	137	
62	76.9	206	
63	28.3	226	
64	<MDA	200	
65	<MDA	122	
66	26.7	66.8	
67	19.2	185	27.3
68	276	1,300	52.2
69	44.8	252	26

LAC-TR-138
PAGE 22

SITE SOIL SAMPLING GRID MAP



The unaffected area around LACBWR but within the owner controlled area was also checked. These samples were taken and analyzed as the samples taken from the affected area. The following results were obtained.

Location	Co-60	Cs-137
Area W of #2 warehouse	<MDA	77.3
Area S of parking lot	<MDA	25.5
Area N of LACBWR admin building	<MDA	149
Area by G-3 ash silo	<MDA	38.2
Area outside G-3 offices	<MDA	76.3
Area by G-3 outfall	<MDA	17.2

All results are in ρCi/kg

To determine potential background Cs-137 levels for the area surrounding LACBWR several soil samples were taken at various locations outside the owner control area. These samples were collected and analyzed as per NUREG/CR-5849 as all the other samples. The following results were obtained.

Location	Co-60	Cs-137
3.3 miles S @ boat landing along the Bad Axe River	22.7	381
Pedretti Farm Substation E of plant	<MDA	227
Radio Tower NE of plant	<MDA	35.00
Junction of Cty Hwy O and K	<MDA	188.00
E of Stoddard @ Junction of Cty Hwy O and 162	<MDA	66.5

NOTE: All activities are in ρCi/kg

Soil Survey East of LACBWR – July, 2008
(Activity in pCi/kg; samples collected at 6" depth)

Sample Location	Cs-137
A1	68
A2	75
A3	69
A4	55
B1	79
B2	86
B3	72
C1	98

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LWR-FILE:
D-2

MEMORANDUM

TO: Decommissioning File

FROM: Larry L. Nelson

DATE: July 23, 2008

SUBJECT: Site Soil Contamination Determination Survey

During May 2008 LACBWR was informed that the area east of the plant was to be used for the construction of a new communications building. This area is considered within the license boundary but has been previously categorized as an unaffected area from plant operations. It was determined by plant staff that a soil survey of this area be performed in accordance with NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Terminations." This area was marked out into a maximum of 50 foot-squared section for sample locations and identifications.

No samples were taken under surface coverings such as blacktop. After sectioning of the area was complete one surface soil sample was collected from the top 15 cm of the soil in each grid location. Each sample collected was approximately 1-2 kg.

Grass, rocks, sticks and foreign objects were removed from each sample to the degree practical. Each sample was then dried and placed in a disposable marinelli container for gamma analysis. All samples were allowed to sit for at least 72 hours to reduce the affect of any short lived natural decay chains. All samples were then counted for 6 hours on the ENV/HPGE. The following is a listing of activity found in these samples. No natural occurring isotope is listed. The actual sample gamma scans are being kept for further review if needed. All sample locations can be found using their corresponding number using the enclosed site grid map.

NOTE: All activity values are in pCi/kg

Sample Location	Cs-137
A1	68
A2	75
A3	69
A4	55
B1	79
B2	86
B3	72
C1	98

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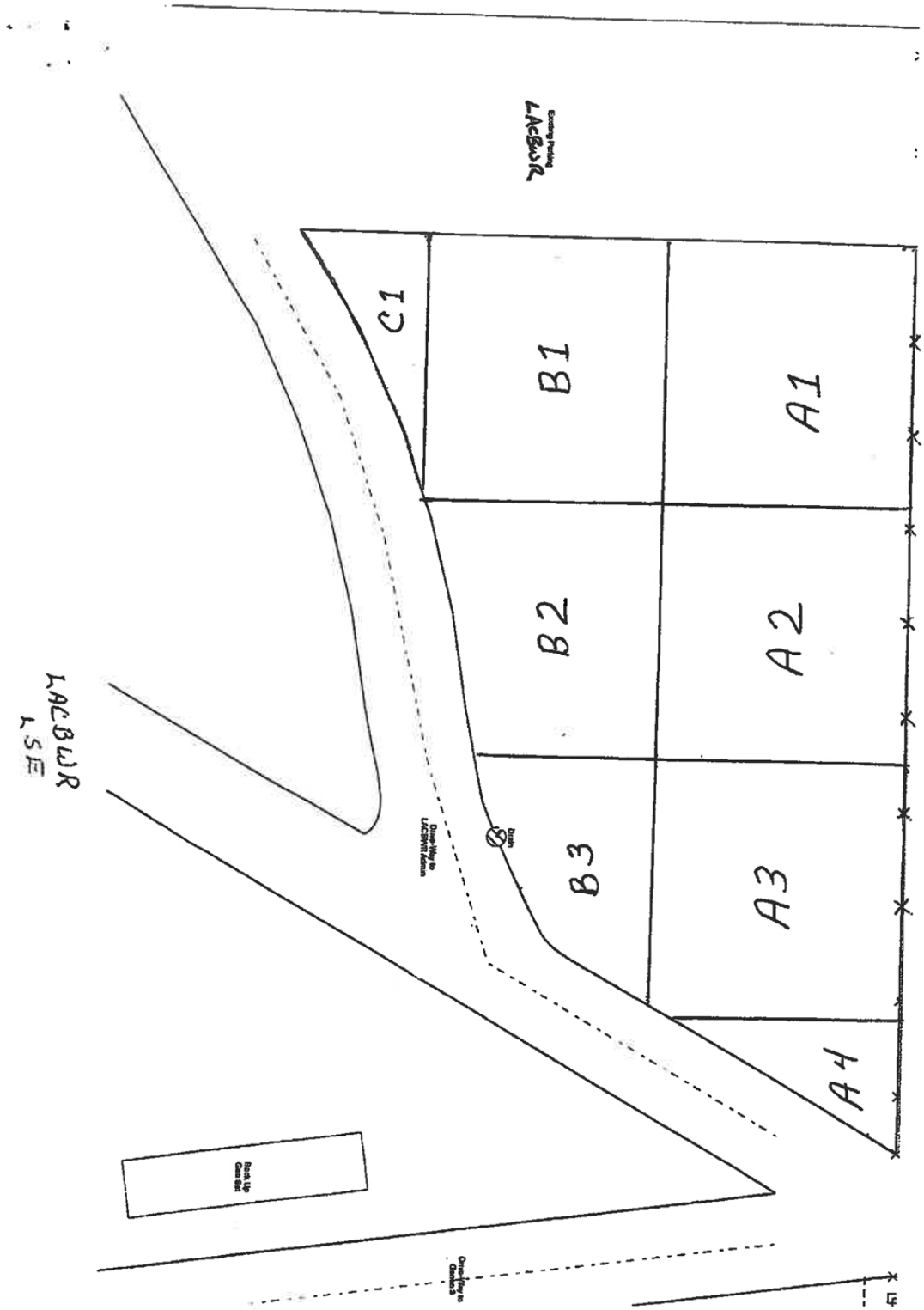
Memo to File: Decommissioning
Page 2
07/23/08

Background soil samples were taken in 1995 as part of the "Limited Site Characterization Survey for SAFSTOR", (LAC-TR-138). Cs-137 concentration found in the sampled area lie within the background levels.

LLN: two

cc: File Decommissioning
Roger Christians
QA
Mike Brasel


A1
A2
A3
A4
B1
B2
B3
C1
LACBWR
LSE

Soil Survey South of LACBWR – October, 2008
(Activity in pCi/kg; samples collected at 6" depth)

Sample Location	Cs-137
1	81
2	166

Soil Survey at ISFSI Area – April - August, 2009
(Cross-section of samples; activity in pCi/kg; samples collected at 6" depth)

Sample Location	Cs-137
S-5	10.30
I-9	5.67
I-14	9.78
S-19	6.02
S-20	3.55
S-35	NR
S-37	8.92
S-39	1.38
S-41	1.94
S-42	8.10
S-48	4.79
S-56	12.89
S-60	13.15
S-69	7.53
S-71	22.52
S-80	29.13
S-83	23.90

Appendix F
Impacted Area Assessments
Buildings, Structures, and Open Land Areas Inside the RCA

Survey Unit L1010101

Description:
This survey unit includes the land areas of the Reactor Building, Waste Treatment Building, Ventilation Stack, and Off Gas Retention Tanks Vault including areas under and around the facilities. This survey unit encompasses 1,997 m^2 and is depicted on the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The facilities within this survey unit were all used in the operation or support of the LACBWR nuclear steam system. The radionuclides present in the facilities will be similar and tied to the reactor operation with variations of contamination levels based on past use of systems and processes. Sections 3.3.2, 4.1.1, and 4.1.2 discuss past unplanned incidents that have impacted this survey unit area and have been part of the classification evaluation for this survey unit.

Contamination:
Media: Reinforced Concrete, Steel, Asphalt, Surface and Subsurface Soils

Continued Investigation Activities:
Will evaluate below grade reinforced concrete, asphalt, surface and subsurface soils, groundwater

Current Radiological Conditions Summary (Except Grounds Around Buildings Soils Dates in Brackets):

Reactor Building

Area	Radiation (mR/hr Closed Window)- General Area	Beta Gamma Removable General Area (dpm/100cm^2)	Alpha Removable General Area (dpm/100cm^2)
Basement General Area	5-60	<1000-3000	</=MDA(20) to 30
Forced Circulation Pump (FCP) Cubicles	30-80	<1000-2000	</=MDA(20) to 30
Lower Control Rod Drive (CRD)Area	2-15	<1000-2000	</= MDA (20) to 30
Liquid Waste Retention Tanks Space	5-90	<1000	</= MDA(20) to 30
Grade Level	<1-15	<1000	</= MDA (20)
Nuclear Instruments Platform	1-10	<1000	</= MDA (20)
Fuel Element Storage Well (FESW)-Post Decon and Painting	25-80	<1000-24,000	</=MDA (20) to 510
Mezzanine Level	<1-3	<1000	</=MDA (20)
701 Foot Level O/S Bioshield	<1-6	<1000-35,000	</=MDA (20) to 70
Lower Cavity Thermal Shield Ring-I/S Bioshield	60-180	N/A	N/A

Waste Treatment Building

Area	Radiation (mR/hr Closed Window)- General Area	Beta Gamma Removable General Area (dpm/100cm^2)	Alpha Removable General Area (dpm/100cm^2)
Basement Excluding Resin Tank Room	<1-7	<1000-5000	</=MDA(22) to 40
Spent Resin Tank Room	20-700	<1000-4000	25-35
Sump Area	15-25	<1000-5000	</= MDA(22) to 40
Grade Level	<1-5	<1000	</=MDA(20)

Grounds Around Buildings

Area	Radiation (µR/hr) General Area	Surface Soil Activity Concentration Co-60 (pCi/g)	Surface Soil Activity Concentration Cs-137 (pCi/g)
Reactor Building	17-20 with high area of 2mR/hr on South End of Facility	</= 0.5 [1995]	</= 0.5 [1995]
Waste Treatment Building	18-134	</= 0.5 to 7.3[1987]	</= 0.5 to 14.3[1987]
Ventilation Stack	15-25	</= 0.5 to 0.75[1987]	</= 0.5 to 0.75[1987]
Off Gas Retention Tank Vault	15-25	</= 0.5[1995]	</= 0.5[1995]

Decommissioning/Decontamination Activities:

Activities Performed to Date:

Reactor Building

The following major equipment/components have been removed from the LACBWR Site except the spent nuclear fuel which has been loaded into dry storage casks and relocated to the on-site Independent Spent Fuel Storage Installation (ISFSI) located at the South Side of the LACBWR Site:

- Reactor Pressure Vessel and all internals including hardware
- Bioshield Cooling System except coils embedded in concrete
- Spent Fuel Storage Racks and Related Components

- Refueling Bridge
- System Shutdown Condenser
- Fuel Element Storage Well (FESW) decontaminated and painted
- CRD Operating Mechanisms
- In addition all systems have been drained.

Planned Decommissioning Activities:

Reactor Building

The reactor building structure is enclosed inside a steel shell. There is no external drain or process piping in the subsurface soils associated with this building. The entire building structure inside the external steel shell, including any process related equipment or related components, will be managed as low-level radioactive waste and removed from site. Below the steel external structure, the concrete will be removed to three feet below grade as low-level radioactive waste and then the concrete will be presented for Final Status Surveys (FSS) following any required remedial actions. Surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Waste Treatment Building

The Waste Treatment Building is a concrete structure with no external drain or process piping in the subsurface soils. Following removal of facility components and equipment as radioactive waste, the structure will be managed as low-level radioactive waste down to three feet below grade and all waste removed from site. Once at three feet below grade, the remaining concrete will be presented for final status survey following any required remedial actions. Surface and subsurface soils will be presented for final status surveys following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Ventilation Stack

The Stack is a steel lined concrete structure approximately 350 feet tall. The entire structure, including its associated fixed equipment, will be removed from the site as low-level radioactive waste. The supporting concrete base will be removed as radioactive waste from site down to three feet and then the remaining concrete will be presented for FSS following any required remedial actions. Surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Underground Gas Storage Tank Vault

The two underground gas storage tanks will be removed from site as radioactive waste along with the tank vault concrete down to three feet below grade. There is no external drain or process piping in the subsurface soils. The remaining concrete will be presented for FSS following any required remedial action. Surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Grounds Around Facilities

The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste. All buried piping encountered will be removed and managed as radioactive waste except the piping and valving associated with the fire protection system which will remain in place and be released in accordance with the FSS program requirements. All asphalt and concrete greater than three feet below grade will be evaluated for release by the MARSAME program with the concrete reused on site as backfill after size reduction and removal of rebar from the concrete and the asphalt being

sent off site as clean material to a recycler or an authorized industrial type landfill. The MARSAME program will be developed using the principles of not releasing concrete or asphalt unless indistinguishable from background after correcting for representative background activity levels of the respective concrete or asphalt matrix and verifying within developed critical levels associated with the appropriate minimum detectable concentrations (MDCs). All concrete and asphalt that does not pass the MARSAME program requirements will be managed as low-level radioactive waste.

Classification Status:
Based upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff, Survey Unit L1010101 is identified as a MARSSIM Class 1 Area.

Survey Unit L1010102

Description:
This survey unit includes the land area under and around the Turbine Building/Turbine Office Building and 1B Diesel Generator Building as well as the I/S RCA Underground Sanitary System. This survey unit encompasses 1,999 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The Turbine Building/Turbine Office Building was used for operation or support of the LACBWR nuclear steam system. The radionuclides present in the facility will be similar and tied to the reactor operation with variations of contamination levels based on past use of systems and processes. The 1B Diesel Generator Building was used for support of the LACBWR nuclear steam system on a demand basis. The underground sanitary system is the sanitary system for inside the RCA area use. The sanitary system consists of a solids tank and seepage pit which ultimately drains back into the Turbine Building waste water tanks for processing. Sections 3.3.2, 4.1.1, and 4.1.2 discuss past unplanned incidents that have impacted this survey unit area and have been part of the classification evaluation for this survey unit.

Contamination:
Media: Reinforced Concrete, Asphalt, Drywall, Tile, Carpeting, Steel, Surface and Subsurface Soils

Continued Investigation Activities:
Will evaluate below grade reinforced concrete, asphalt, surface and subsurface soils, and groundwater.

Current Radiological Conditions Summary (Except Grounds Around Buildings; Soil Dates in Parentheses):

Turbine Building and Turbine Office Building

Area	Radiation General Area	Beta Gamma Removable (dpm/100cm^2) General Area	Alpha Removable (dpm/100cm^2) General Area
Machine Shop	10-15 µR/hr	<1000	</=MDA(20-22)
Count Room/Instrument Lab	6-16 µR/hr	<1000	</=MDA (20-23)
Locker Rooms/Showers	10-18 µR/hr	<1000	</=MDA (20-23)
Piping Tunnel	<1 to 6 mR/hr	<1000-3100	</= MDA(20-23)
Electrical Penetration Room	<0.1 to 0.5 mR/hr	<1000	</=MDA (20-23)
Feed Water Heater Area/Condenser Area	<1-3 mR/hr	<1000	</= MDA (20-23)
Full Flow Demineralizer Area	<1-2 mR/hr	<1000	</= MDA (20-23)
Grade Floor Level	25-300 µR/hr	<1000	</=MDA (20-23)
Mezzanine Level	0.1 to 2 mR/hr	<1000	</=MDA (20-23)
Diesel Generator Room	5-10 µR/hr	<1000	</=MDA (20-23)

Grounds Around Buildings

Area	Radiation (µR/hr) General Area	Surface Soil Activity Concentration Co-60 (pCi/g)	Surface Soil Activity Concentration Cs-137 (pCi/g)
Turbine Building	12-20 with high area of 100 on South East Corner area of facility	</= 0.5 [1995]	</= 0.5[1995]

Decommissioning/Decontamination Activities
Activities Performed to Date:
Turbine Building

The following major equipment/components have been removed from the LACBWR Site:

- Reactor Feed Water Pumps and piping
- Generator
- Steam Turbine and related piping/valves
- Feedwater Heaters
- Both Diesel Generators Removed

Planned Decommissioning Activities:

Turbine Building and Turbine Office Building

The Turbine Building and Turbine Office building is a combination metal and concrete structure with external drains piping in the subsurface soils. Following removal of facility components and equipment as low-level radioactive waste, the structure will be split for management of the structure removal down to three feet below grade. The concrete from the top deck down to the grade level concrete will be surveyed per the requirements of the MARSAME program and subsequently released for use on site as fill material following size reduction and removal of the rebar from the concrete. The MARSAME program will be developed using the principles of not releasing concrete unless indistinguishable from background after correcting for background activity levels of the concrete matrix and verifying within developed critical levels associated with the appropriate minimum detectable concentrations (MDCs). The balance of the structure will be managed as low-level radioactive waste down to three feet below grade. The remaining concrete three feet below grade will be presented for FSS following any required remedial actions. Any concrete not passing the MARSAME program requirements will be disposed of as low-level radioactive waste. Surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

1B Diesel Generator Structure

The Diesel Generator Structure is a concrete structure with external drain piping in the subsurface soils. The concrete structure will be surveyed per the requirements of the MARSAME program and subsequently released for use on site as fill material following size reduction and removal of rebar from the concrete. The MARSAME program will be developed using the principles of not releasing concrete unless indistinguishable from background after correcting for background activity levels of a representative concrete matrix and verifying within developed critical levels associated with the appropriate minimum detectable concentrations (MDCs). The structure will all be removed down to three feet below grade. Once at three feet below grade, the remaining concrete will be presented for FSS following any required remedial actions. All concrete that does not pass the MARSAME program requirements will be managed as low-level radioactive waste. Surface

and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Underground Sanitary System

The entire sanitary system including solids tank, seepage pit, and associated piping will be managed as low-level radioactive waste. The associated surface and subsurface soils will be presented for FSS surveys following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Grounds Around Facilities

The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste. All Buried piping will be managed as radioactive waste except the fire protection system piping/valves which will remain in place and be released in accordance with the FSS program requirements. Asphalt and concrete will be evaluated for release by the MARSAME program with the concrete reused on site as backfill after size reduction and removal of the rebar from the concrete. The asphalt will be sent off site as clean material to a recycler or an authorized industrial type landfill. The MARSAME program will be developed using the principles of not releasing concrete or asphalt unless indistinguishable from background after correcting for representative background activity levels of the respective concrete or asphalt matrix and verifying within developed critical levels associated with the appropriate minimum detectable concentrations(MDCs). All concrete and asphalt that does not pass the MARSAME program requirements will be managed as low-level radioactive waste.

Classification Status**:**
Based upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff, Survey Unit L1010102 is identified as a MARSSIM Class 1 Area.

Survey Unit L1010103

Description:
This survey unit includes the land area under and around the Low Specific Activity (LSA) Storage Building, Maintenance Eat Shack, and Main Transformer Substation. This survey unit encompasses 1,957 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The Main Transformer Substation was used to support the LACBWR nuclear steam system. The LSA Building was used for storage of packaged radioactive wastes/materials as well as storage of radiologically controlled equipment/components. The Maintenance Eat Shack was used by workers inside the RCA as a common break area where personnel could eat and drink. Sections 3.3.2, 4.1.1, and 4.1.2 discuss past unplanned incidents that have impacted this survey unit area and have been part of the classification evaluation for this survey unit.

Contamination:
Media: Reinforced Concrete, Asphalt, Steel, Surface and Subsurface Soils

Continued Investigation Activities:
Will evaluate below grade reinforced concrete, asphalt, surface and sub surface soils, and groundwater.

Current Radiological Conditions Summary (except soils with dates in parentheses):

Area	Radiation General Area	Beta Gamma Removable **(dpm/100cm^2)** General Area	Alpha Removable **(dpm/100cm^2)** **G**eneral Area
LSA Building	<1-14 mR/hr	<1000	</=MDA (20-23)
Maintenance Break Building	21-50 µR/hr	</=MDA (145-160)	</= MDA (20-23)
Main Transformer/Sub Station	20-30 µR/hr	<1000	</=MDA (20-23)

Grounds Areas

Radiation General Area	Surface Soil Activity Concentration Cs-137 pCi/g	Surface Soil Activity Concentration Co-60 pCi/g
20-40 uR/hr	</= 0.5 [1995]	</= 0.5 [1995]

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:

LSA Building

The LSA Building is a sheet metal structure with a concrete floor. The facility does not contain drain or process piping. The stored packaged radioactive wastes/materials as well as stored radiologically controlled equipment/components will be managed as low-level radioactive waste. The facility structure down to three feet below grade will be managed as low-level radioactive waste. The remaining concrete three feet below grade--if existing--will be presented for final status survey following any required remedial actions. Surface and subsurface soils will be presented for final status surveys following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Main Transformer/Substation

The switchyard consists of an above ground network of metal components which together make up the switch gear, and the entire network of components is placed and secured to a concrete pad. The network of components and the concrete down to three feet below grade will be managed as low-level radioactive waste. The remaining concrete three feet below grade--if existing--will be presented for final status survey following any required remedial actions. Surface and subsurface soils will be presented for final status surveys following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Maintenance Eat Shack

The building is a sheet metal structure with a concrete base. The structure will be surveyed per the requirements of the MARSAME program and subsequently released for off-site disposal as clean waste except the concrete, which will be reused on site after size reduction and removal of rebar in the concrete. The MARSAME program will be developed using the principles of not releasing building components unless indistinguishable from background after correcting for background activity levels of representative structural material matrices and verifying within developed critical levels associated with the appropriate minimum detectable concentrations (MDCs). Structure materials not able to pass the MARSAME program requirements will be disposed of as low-level radioactive waste. Surface and subsurface soils will be presented for final

status surveys following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Grounds Around Facilities

The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

All buried piping will be managed as radioactive waste except the fire protection system piping/valves which will remain in place and will be released in accordance with the FSS program requirements. Asphalt and concrete will be evaluated for release by the MARSAME program with the concrete reused on site as backfill following size reduction and removal of the rebar from the concrete and the asphalt being sent off site as clean material to a recycler or an authorized industrial type landfill. The MARSAME program will be developed using the principles of not releasing concrete or asphalt unless indistinguishable from background after correcting for representative background activity levels of the respective concrete or asphalt matrix and verifying within developed critical levels associated with the appropriate minimum detectable concentrations(MDCs). All concrete and asphalt that does not pass the MARSAME program requirements will be managed as low-level radioactive waste.

Classification Status**:**
Based upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff, Survey Unit L1010103 is identified as a MARSSIM Class 1 Area.

Survey Unit L1010104

Description:
This survey unit includes the north end of the RCA grounds up to and including the asphalt road that traverses the RCA yard from east to west. This survey unit encompasses 1,766 m^2 and is depicted by the LACBWR Site Survey Units May and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
This area of the site was largely used for access and egress from the RCA, as well as temporary storage of items. Sections 3.3.2, 4.1.1, and 4.1.2 discuss past unplanned incidents that have impacted this survey unit area and have been part of the classification evaluation for this survey unit.
Contamination:

Media: Concrete, Asphalt, Surface and Subsurface Soils
Continued Investigation Activities:

- Will evaluate concrete, asphalt, surface and subsurface soils, and groundwater.

Current Radiological Conditions Summary (except soils with dates in parentheses):
Grounds Areas

Radiation General Area	Surface Soil Activity Concentration Cs-137 pCi/g	Surface Soil Activity Concentration Co-60 pCi/g
10-30 µR/hr	</= 0.5-0.6 [1987]	</= 0.5-0.8 [1995]

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:

Grounds Around Facilities

The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste. All buried piping will be managed as radioactive waste except the fire protection system piping/valves which will remain in place and be released in accordance with the FSS program requirements. Asphalt and concrete will be evaluated for release by the MARSAME program with the concrete reused on site as backfill after size reduction and removal of the rebar from the concrete and the asphalt being sent off site as clean material to a recycler or an authorized industrial type landfill. The MARSAME program will be developed using the principles of not releasing concrete or asphalt unless indistinguishable from background after correcting for representative background activity levels of the respective concrete or asphalt matrix and verifying within developed critical levels associated with the appropriate minimum detectable concentrations(MDCs). All concrete and asphalt that does not pass the MARSAME program requirements will be managed as low-level radioactive waste.

Classification Status:
Based upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff, Survey Unit L1010104 is identified as a MARSSIM Class 1 Area.

Appendix G
Impacted Area Assessments
Buildings, Structures and Open Land Areas Outside the RCA

Survey Unit L2011101

Description:
This survey unit includes the grounds under and around the three warehouses designated as Warehouse #1, #2, and #3, as well as the buffer area grounds around the RCA to the West and North. This survey unit also includes the underground sanitary system that services the Administration Building. This survey unit encompasses 7,930 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The three warehouses were used for site storage of needed materials, components, and equipment for the LACBWR. The warehouses were not used for storage of any radioactive materials other than possible storage of other nuclear power plant equipment in the early 1970s before it was shipped off site.

Potential for Contamination:

Media: Concrete, Asphalt, Steel, Surface and Subsurface Soils
Continued Investigation Activities:

- Will evaluate the concrete, asphalt, surface and subsurface soils, as well as groundwater.

Current Radiological Conditions Summary:

• Area	Radiation General Area (µR/hr)	Beta Gamma Removable • (dpm/100cm^2) • General Area	Alpha Removable (dpm/100cm^2) General Area
Warehouse #1	• 7-10	• </=MDA(145-160)	</=MDA (20-23)
Warehouse #2	• 15-20	• </=MDA (145-160)	</= MDA (20-23)
Warehouse #3	• 7-15	• </=MDA (145-160)	</=MDA (20-23)

Grounds Around Buildings (Note--Year of Sampling Event in Parentheses)

• Area	• Surface Soil Activity Concentration • Co-60 (pCi/g)	Surface Soil Activity Concentration • Cs-137 (pCi/g)
West of Warehouse #2	</=MDA of 0.003 [1995]	• 0.077 [1995]
North of Admin Building	</=MDA of 0.005 [1995]	• 0.149 [1995]
North of Admin Building	• 0.316 [1987]	• 0.150 [1987]

Decommissioning/Decontamination Activities:

Activities Performed to Date:
None to date

Planned Decommissioning Activities:
Three Warehouses

The buildings are a sheet metal structure with a concrete base. The structure will be surveyed per the requirements of the MARSAME program following removal of loose equipment/materials and, in the case of the concrete, reused on site after size reduction and removal of the rebar from the concrete. All structure materials will be subsequently released for off-site disposal as clean waste. The MARSAME program will be developed using the principles of not releasing building components unless indistinguishable from background after correcting for background activity levels of representative structural material matrices and verifying within developed critical levels associated with the appropriate minimum detectable concentrations (MDCs). Any concrete or structural materials not passing the MARSAME program requirements will be disposed of as low-level radioactive waste.

Underground Sanitary System

The entire sanitary system including solids tank and laterals will be FSS surveyed for continued use on site with the Administration Building. The associated surface and subsurface soils will be presented for FSS surveys following any required remedial actions. Soils and sanitary system structure not able to pass FSS requirements will be managed as low-level radioactive waste.

Grounds Around Facilities
The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste. The fire protection system piping/valves will remain in place with the catch basin storm sewer system and will be released in accordance with the FSS program requirements. Asphalt and concrete will be evaluated for release by the MARSAME program with the concrete reused on site as backfill following size reduction and removal of the rebar from the concrete and the asphalt sent off site as clean material to a recycler or an authorized industrial-type landfill. The MARSAME program will be developed using the principles of not releasing concrete or asphalt unless indistinguishable from background after correcting for representative background activity levels of the respective concrete or asphalt matrix and verifying within developed critical levels associated with the appropriate minimum detectable concentrations (MDCs). All concrete and asphalt that does not pass the MARSAME program requirements will be managed as low-level radioactive waste.
Classification Status**:** Survey Unit L2011101 is identified as a MARSSIM Class 2 Area.
This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also 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.

Survey Unit L2011102

Description:
This survey unit includes the buffer area grounds around the RCA to the South and East as well as the grounds in the area of the LACBWR Underground Circulating Water Discharge Pipe to the seal well located in the Mississippi River. This survey unit encompasses 7,084 m2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.
History of Use of Area:

The area is all located outside of the LACBWR RCA fence and was not historically used for LACBWR operations other than the area was used for LACBWR construction as a lay-down area and currently contains the LACBWR Circulating Water Discharge Pipe to the seal well and the combined drain discharge pipe. Sections 3.3.2, 4.1.1, and 4.1.2 discuss past unplanned incidents that have impacted this survey unit area and have been part of the classification evaluation for this survey unit.

Potential for Contamination:
Media: Asphalt, Steel, Surface and Subsurface Soils

Continued Investigation Activities:
Will evaluate asphalt, surface and subsurface soils, as well as groundwater.

Current Radiological Conditions Summary:

Grounds Around Buildings (Note--Year of Sampling Event in Parentheses)

Area	Surface Soil Activity Concentration Co-60 (pCi/g)	Surface Soil Activity Concentration Cs-137 (pCi/g)
By Circulating Water Outfall	</=MDA of 0.004 [1995]	0.017 [1995]
By Circulating Water Outfall		0.022 [1987]

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:
The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low level radioactive waste. The fire protection system piping/valves will remain in place and will be released in accordance with the FSS program requirements. The asphalt will remain in place and be surveyed for FSS. Any asphalt that does not pass the FSS program requirements will be disposed of as low-level radioactive waste. The LACBWR Circulating Water Discharge Pipe to the seal well area and the combined discharge drain pipe will be removed as low-level radioactive waste. The soils removed to obtain access to the LACBWR Circulating Water Discharge Pipe and the combined discharge pipe will be presented for FSS following any required remedial action.

Classification Status**:**
Survey L2011102 is identified as a MARSSIM Class 2 Area.
This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also 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.

Survey Unit B2009101

Description:
This survey unit includes the LACBWR Circulating Water Intake Structure (LACBWR Crib House), which is a concrete and metal framed structure.
This survey unit encompasses 147 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The Circulating Water Intake Structure area is located at the west end of the LACBWR RCA fence and was used for LACBWR operations providing circulating water for the condenser as well as low- and high-pressure service water on a pressurized demand basis. All provided water from the Circulating Water Intake Structure was radiologically clean water, and radioactive material was not stored in this structure.

Current Radiological Conditions Summary:

Area	Radiation General Area (µR/hr)	Beta Gamma Removable **(dpm/100cm^2)** General Area	Alpha Removable **(dpm/100cm^2)** General Area
Intake Structure	7-12	</=MDA(140-160)	</=MDA (22-24)

Potential for Contamination:
Media: Reinforced Concrete and Steel Structure.

Continued Investigation Activities:

None

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:
Perform FSS surveys after removal of any unnecessary equipment from the LACBWR Circulating Water Intake Structure. Any concrete or structural materials not passing the FSS program requirements will be disposed of as low-level radioactive waste. The LACBWR Circulating Water Intake Structure will be left intact to support G-3 Coal Plant Operations.
Classification Status**:** Survey Unit B2009101 is identified as a MARSSIM Class 2 Area.
This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also 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.

Survey Unit B2009103

Description:
This survey unit includes the Administration Building, which is a two-story metal and brick structure located directly north of the LACBWR RCA. This survey unit encompasses 503 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.
History of Use of Area:

The Administration Building is used as an office building for staff and records and also has lab capability to perform both environmental analyses of LACBWR media tied to routine environmental reporting and for G-3 Coal Plant process testing requirements. Additionally, the facility also has equipment used to conduct whole-body counting.

Potential for Contamination:
Media: Brick, Steel, Drywall, Tile, and Carpeting.

Continued Investigation Activities:

None

Current Radiological Conditions Summary:

Area	Radiation General Area (µR/hr)	Beta Gamma Removable **(dpm/100cm^2)** **G**eneral Area	Alpha Removable **(dpm/100cm^2)** General Area
Administration Building	10-25	</=MDA(145-160)	</=MDA (20-24)

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:

Perform FSS surveys after removal of any unnecessary equipment from the Administration Building. Any structural or facility materials not passing the FSS program requirements will be disposed of as low- level radioactive waste. The Administration Building will be left intact to support future Dairyland Power Cooperative needs.

Classification Status**:**
Survey Unit B2009103 is identified as a MARSSIM Class 2 Area.
This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also 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 the use of sealed and similar contained sources in the facility for environmental lab equipment checkouts coupled with environmental sample counting activities.

Survey Unit B2009102

Description:
This survey unit includes the G-3 Coal Plant Circulating Water Intake and Chlorinating Structure (G-3 Crib House), which is a concrete and metal framed-type structure. This survey unit encompasses 441 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The G-3 Circulating Water Intake Structure area is located at the west end of the LACBWR Licensed Property and was built to support the G-3 Coal Plant operations. All water provided from the G-3 Circulating Water Intake Structure is radiologically clean water, and radioactive material was not stored in this structure. The G-3 Circulating Water Intake Structure area was not used for LACBWR operations.

Potential for Contamination:
Media: Reinforced Concrete and Steel Structure

Continued Investigation Activities:
None

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:
Perform FSS surveys after removal of any unnecessary equipment from the G-3 Intake Structure. Any concrete or structural materials not passing the FSS program requirements will be disposed of as low-level radioactive waste. The G-3Circulating Water Structure will be left intact to support G-3 Coal Plant Operations.

Classification Status**:**
Survey Unit B2009102 is identified as a MARSSIM Class 2 Area.
This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also selected based on the fact that this survey unit has the potential for contamination translocation due to personnel and equipment movements as well as surface water runoff from the RCA.

Survey Unit L3012101

Description:

This survey unit includes the current coal barge washing area and several lay-down areas for site equipment and materials tied to G-3 Coal Plant operations and are located on the north end of the LACBWR Site. This survey unit encompasses 19,239 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The area is all located outside of the LACBWR RCA fence and away from the associated buffer areas and was not historically used for or part of LACBWR operations. The area in this survey unit originally was used for the siting of the G-1 Coal/Fuel Oil Plant as well as the retired coal ash impoundment area to the south of the G-1 Coal Plant.

Potential for Contamination:
Media: Piled Asphalt, Piled Concrete, Steel, Loose Equipment and Materials, Surface and Subsurface Soils

Continued Investigation Activities:
None Planned

Current Radiological Conditions Summary:

Grounds (Note--Year of Sampling Event in Parentheses)

Area	Surface Soil Activity Concentration Co-60 (pCi/g)	Surface Soil Activity Concentration Cs-137 (pCi/g)
North End of Survey Unit		0.096 [1987]
Middle of Survey Unit		0.047 [1987]
South End of Survey Unit	0.32[1987]	0.150 [1987]

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:
The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste. The piled asphalt and piled concrete will be surveyed per the requirements of the MARSAME program and, in the case of the concrete, reused on site after size reduction after removal of rebar from the concrete. All other asphalt will be subsequently released for off-site disposal as clean waste to a recycler or an authorized industrial type landfill. The MARSAME program will be developed using the principles of not releasing materials unless indistinguishable from background after correcting for background activity levels of representative concrete and asphalt material matrices and verifying within developed critical levels associated with the appropriate minimum detectable concentrations (MDCs). Any concrete or asphalt materials not passing the MARSAME program requirements will be disposed of as low-level radioactive waste.

Classification Status**:**
Survey Unit L3012101 is identified as a MARSSIM Class 3 Area.
This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also selected based on the fact that this survey unit is outside the buffer area to the RCA with low potential for contamination translocation due to personnel and equipment movements or surface water runoff from the RCA. This area may have historically been impacted by windborne transmigration of stack released radioactivity due to predominant at height meteorological conditions for the LACBWR Site as documented in the LACBWR Site Original Environmental Report.

Survey Unit L3012102

Description:
This survey unit includes the current LACBWR Site Switchyard and Transmission Sub-Station Switch House grounds, which are located on the north end of the LACBWR Site. This survey unit encompasses 11,711 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The area is all located outside of the LACBWR RCA fence and away from the associated buffer areas and was historically used for or part of LACBWR operations. The area in this survey unit has a long history of use as the LACBWR Site Switchyard.

Potential for Contamination:
Media: Gravel, Surface and Subsurface Soils

Continued Investigation Activities:
None Planned

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:
Switchyard Area - The surface soils and gravels as well as subsurface soils will be presented for FSS following any required remedial actions. Soils and gravel not able to pass FSS requirements will be managed as low-level radioactive waste. Facilities and equipment inside the LACBWR Switchyard will be surveyed per FSS requirements and remain in place. Facility materials and equipment not able to pass FSS requirements will be managed as low-level radioactive waste. The Transmission Sub-Station Switch House and Switchyard will be left intact to support future Dairyland Power Cooperative needs.

Classification Status**:**

Survey Unit L3012102 is identified as a MARSSIM Class 3 Area. This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also selected based on the fact that this survey unit is outside the buffer area to the RCA with low potential for contamination translocation due to personnel and equipment movements or surface water runoff from the RCA. This area may have historically been impacted by windborne transmigration of stack released radioactivity due to predominant at height meteorological conditions for the LACBWR Site as documented in the LACBWR Site Original Environmental Report.

Survey Unit L3012103

Description:
This survey unit includes the G-3 Coal Plant grounds located south and east of the LACBWR. This survey unit encompasses 75,257 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The area is all located outside of the LACBWR RCA fence and away from the associated buffer areas and was not historically used for or part of LACBWR operations. The area in this survey unit was used for the siting of the G-3 Coal Plant as well as the associated facilities and grounds.

Potential for Contamination:
Media: Asphalt, Concrete, Surface and Subsurface Soils
Continued Investigation Activities:
Evaluate surface and subsurface soils as well as groundwater.

Current Radiological Conditions Summary:

Grounds Around Buildings (Note--Year of Sampling Event in Parentheses)

Area	Surface Soil Activity Concentration Co-60 (pCi/g)	Surface Soil Activity Concentration Cs-137 (pCi/g)
Back Up Control Center (Pre-Construction)		0.075[2008]
G-3 Ash Silo Area G-3 Outside Offices Area	</=MDA of 0.004 [1995] </=MDA of 0.004 [1995]	0.038 [1995] 0.076 [1995]

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activitie:
The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste. The asphalt and concrete will be surveyed per FSS requirements following any required remedial actions and will remain in place for site use. Asphalt and concrete not able to pass FSS requirements will be managed as low- level radioactive waste. Facilities and equipment will be surveyed per FSS requirements and remain in place. Facility materials and equipment not able to pass FSS requirements will be managed as low-level radioactive waste.

Classification Status**:**
Survey Unit L3012103 is identified as a MARSSIM Class 3 Area. This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also selected based on the fact that this survey unit is outside the buffer area to the RCA with low potential for contamination translocation due to personnel and equipment movements or surface water runoff from the RCA. This area may have historically been impacted by windborne transmigration of stack released radioactivity due to predominant at height meteorological conditions for the LACBWR Site as documented in the LACBWR Site Original Environmental Report.

Survey Unit L3012104

Description:
This survey unit includes the grounds that run along the railroad right of way back to the west to Survey Units L3012101, L3012102, L3012103, and L3012105 and includes the main access road to the LACBWR and G-3 Facility areas. This survey unit encompasses 22,687 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The area is all located outside of the LACBWR RCA fence and away from the associated buffer areas and was not historically used for or part of LACBWR operations.

Potential for Contamination:
Media: Surface and Subsurface Soils and Asphalt

Continued Investigation Activities:
None planned

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:
The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste. The asphalt will be presented for FSS following any required remedial actions. Asphalt not able to pass FSS requirements will be managed as low-level radioactive waste. The asphalt will remain in service as a site access road. The catch basin storm sewer system will remain in place and will be surveyed in accordance with the FSS program requirements.
Classification Status**:** Survey Unit L3012104 is identified as a MARSSIM Class 3 Area.
This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also selected based on the fact that this survey unit is outside the buffer area to the RCA with low potential for contamination translocation due to surface water runoff from the RCA. This area may have historically been impacted by windborne transmigration of stack released radioactivity due to predominant at height meteorological conditions for the LACBWR Site as documented in the LACBWR Site Original Environmental Report.

Survey Unit L3012105

Description:
This survey unit includes the current coal pile areas grounds. This survey unit is located basically in the center of the LACBWR Site. This survey unit encompasses 82,894 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The area is all located outside of the LACBWR RCA fence and away from the associated buffer areas and was not historically used for or part of LACBWR operations. The area in this survey unit originally was used for the siting of the G-3 Coal Plant coal feed piles.

Potential for Contamination:
Media: Surface and Subsurface Soils

Continued Investigation Activities:
None Planned

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:
The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Classification Status**:**
Survey Unit L3012105 is identified as a MARSSIM Class 3 Area. This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also selected based on the fact that this survey unit is outside the buffer area to the RCA. This area may have historically been impacted by windborne transmigration of stack released radioactivity due to predominant at height meteorological conditions for the LACBWR Site as documented in the LACBWR Site Original Environmental Report.

Survey Unit L3012106

Description:
This survey unit includes the retired coal ash pile impoundment area tied to G-3 Coal Plant operations and perimeter access road(s). This area does not include the Independent Spent Fuel Storage Installation (ISFSI)

area, which is defined as the double-fenced, concrete-bunkered, and jersey-barrier area in the survey unit. This survey unit encompasses 116,565 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The area is all located outside of the LACBWR RCA fence and away from the associated buffer areas and was not historically used for or part of LACBWR operations. The area in this survey unit originally was used for the impoundment of coal ash from the operation of the G-3 Coal Plant. This area has since been leveled and covered with soil and plant life for stabilization and erosion control.

Potential for Contamination:
Media: Surface and Subsurface Soils and Asphalt

Continued Investigation Activities:
None planned

Decommissioning/Decontamination Activities:
Activities Performed to Date:

None to date

Planned Decommissioning Activities:
The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste. The asphalt will be presented for FSS following any required remedial actions. Asphalt not able to pass FSS requirements will be managed as low-level radioactive waste. The asphalt will remain in service as a site service road.

Classification Status**:**
Survey Unit L3012106 is identified as a MARSSIM Class 3 Area.
This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also selected based on the fact that this survey unit is outside the buffer area to the RCA. This area may have historically been impacted by windborne transmigration of stack released radioactivity due to predominant at height meteorological conditions for the LACBWR Site as documented in the LACBWR Site Original Environmental Report.

Survey Unit L3012107

Description:
This survey unit includes the area of land owned by Dairyland Power Cooperative across Highway 35 from the LACBWR Site and largely due east of the LACBWR Reactor Site. This survey unit encompasses 76,625 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The area is all located outside of the LACBWR RCA fence and away from the associated buffer areas and was not historically used for or part of LACBWR operations.

Potential for Contamination:
Media: Surface and Subsurface Soils

Continued Investigation Activities:
None planned

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:
The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste.

Classification Status**:**
Survey Unit L3012107 is identified as a MARSSIM Class 3 Area.
This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also selected based on the fact that this survey unit is outside the buffer area to the RCA with no potential for contamination translocation due to surface water runoff from the RCA.

Survey Unit L3012108

Description:
This survey unit includes the area of land which includes the right of way for the railroad and Highway 35. This survey unit encompasses 9,446 m^2 and is depicted by the LACBWR Site Survey Units Map and LACBWR Site Buildings, Figure 5-1 and Figure 2-5, respectively.

History of Use of Area:
The area is all located outside of the LACBWR RCA fence and away from the associated buffer areas and was not historically used for or part of LACBWR operations.

Potential for Contamination:
Media: Surface and Subsurface Soils, Roadway, and Railroad Tracks and Associated Track Bed Gravels

Continued Investigation Activities:
None planned

Decommissioning/Decontamination Activities:
Activities Performed to Date:
None to date

Planned Decommissioning Activities:
The surface and subsurface soils will be presented for FSS following any required remedial actions. Soils not able to pass FSS requirements will be managed as low-level radioactive waste. Railroad track, associated bed gravels, and roadway will be surveyed per FSS requirements and remain in place as currently configured.

Classification Status**:**
Survey Unit L3012108 is identified as a MARSSIM Class 3 Area. This classification is based in part upon the current documentation available and reviewed indicating the radiological conditions on the LACBWR Site and past operations as well as interviews with cognizant site staff. This classification is also selected based on the fact that this survey unit is outside the buffer area to the RCA with no potential for contamination translocation due to surface water runoff from the RCA.

Appendix H
LACBWR Site Wells

Name	Type	Date Installed	Well Depth (feet)	Screen Length (feet)	Well Location Coordinates	Elevation (feet above MSL) Ground Surface	Elevation (feet above MSL) Top of Casing
3	Potable	10/22/63	130	11.5	N43°33.615' W091°13.856'	UNK	UNK
4	Potable	10/22/63	93	12	N43°33.582' W091°13.862'	UNK	UNK
5	Potable	12/16/69	132	15	N43° 33.583' W091°13.927'	UNK	UNK
7	Potable	4/03/14	136	20	N43° 33.564' W091°13.850'	UNK	UNK
B2	Monitoring	4/08/76	32.4	3	N43°33'16.3" W091°14'03.9"	639.98	640.84
B3	Monitoring	4/08/76	62.9	3.5	N43°33.16.4" W091° 14'03.9"	640.35	641.33
B7	Monitoring	4/12/76	25.1	3	N43°33'15.4" W091°13'45.8"	629.80	633.47
B8	Monitoring	4/09/76	31.7	3	N43° 33' 12" W091°13'46.5"	640.49	642.44
B9	Monitoring	4/09/76	32.1	3.3	N43° 33'02.4" W091°13'55.5"	639.94	642.41
B9A	Monitoring	6/20/89	44.8	5	N43° 33'02.4" W091°13'55.9"	640.17	642.51
B11R	Monitoring	8/16/2006	27.2	10	N43°33'35.8" W091°13'48"	639.03	640.75
B11AR	Monitoring	8/16/2006	46.5	5	N43°33'35.8" W091°13'48.1"	639.23	641.21
MW-200A	Monitoring	11/06/2012	25.0	10	Northing 571192.59 Easting 1642062.37	639.29	641.70
MW-200B	Monitoring	11/06/2012	55.0	10	Northing 571195.30 Easting 1642058.27	639.56	641.94
MW-201A	Monitoring	11/07/2012	25.0	10	Northing 571097.63 Easting 1642014.44	638.63	640.69
MW-201B	Monitoring	11/07/2012	55.0	10	Northing 571094.46 Easting 1642013.53	638.48	640.36
MW-202A	Monitoring	11/08/2012	25.0	10	Northing 571079.50 Easting 1641904.94	638.94	641.19
MW-202B	Monitoring	11/08/2012	55.0	10	Northing 571083.12 Easting 1641907.10	638.74	641.14
MW-203A	Monitoring	11/08/2012	25.0	10	Northing 570976.74 Easting 1642031.59	638.89	641.15
MW-203B	Monitoring	11/08/2012	55.0	10	Northing 570980.12 Easting 1642034.82	638.99	641.28
MW-204A	Monitoring	11/06/2012	25.0	10	Northing 570947.05 Easting 1642205.67	638.71	640.86
MW-204B	Monitoring	11/05/2012	55.0	10	Northing 570952.57 Easting 1642207.05	638.62	640.73

Appendix I
Offsite Wells

Address	Type-WI Unique ID Number	Date Installed	Well Depth (Feet)	Screen Length (Feet)	Well Location Coordinates
Edgewood Mobile Home Park, Vernon County, WI	Private-Potable CQ199	10/23/90	165	UNK	T13 N R7W Section 32 SE Quarter
Vernon County, WI	Private- Potable AA310	3/23/90	46	3	T13N R7W Section 32 SE Quarter
Vernon County, WI	Private-Potable GG752	4/29/1996	175	UNK	T13N R7W Section 33 SE Quarter
Vernon County, WI	Private-Potable FW962	10/12/92	185	UNK	T13N R7W Section 33 NW Quarter
Vernon County, WI	Private-Potable AK636	5/24/1989	120	UNK	T13N R7W Section 33 SE Quarter
Vernon County, WI	Private-Potable MF381	2/10/98	475	UNK	T12N R7W Section 5 SE Quarter
Vernon County, WI	Private- Potable QM621	10/30/01	125		T12N R7W Section 4 NW Quarter
Vernon County, WI	Private-Potable HB477	9/2/95	625	UNK	T12N R7W SE Quarter

Appendix J
Well Constructions Logs

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-200A
Boring No. SB-200A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi

Initial Water Level (depth TOC): 20.95 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed 06 Nov 2012
H&A Rep. S. Collinge
Location See Plan

Ground El. 639.29
Datum 641.70

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	639.3
GP	1.0			1.0	638.3
SP				13.0	626.3
				15.0	624.3
	25.0			25.0	614.3

WELL CONSTRUCTION DETAILS

Type of protective cover	Guard Pipe
Depth of Metal below ground surface	0.00 ft
Depth of top of riser below ground surface	N/A
Type of protective casing	Metal
Length	2.5 ft
Inside diameter	4.0 in.
Depth of bottom of Metal	2.5 ft
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	15.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	12.0 ft
Filter Sand	13.0 ft	12.0 ft
	-	-
	-	-

Diameter of borehole	8.5 in.
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Depth to top of well screen	15.0 ft
Depth to bottom of well screen	25.0 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	25.0 ft

COMMENTS:

38705-007_HA-LIB07-1R_SAN_12-07-12.GLB GW INSTALLATION REPORT-07-1 HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\38705 - LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ Dec 7, 12

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-200B
Boring No. SB-200A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi

Initial Water Level (depth TOC): 21.30 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed: 06 Nov 2012
H&A Rep.: S. Collinge
Location: See Plan

Ground El.: 639.56
Datum: 641.94

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	639.6
GP	1.0			1.0	638.6
SP				7.0	632.6
ML/CL	25.0 / 27.0				
SP				39.0	600.6
				42.4	597.2
				45.0	594.6
	55.0			55.0	584.6

WELL CONSTRUCTION DETAILS

Type of protective cover: Guard Pipe
Depth of Metal below ground surface: 0.00 ft
Depth of top of riser below ground surface: N/A

Type of protective casing: Metal
Length: 2.5 ft
Inside diameter: 4.0 in.
Depth of bottom of Metal: 2.5 ft

Type of riser pipe: Schedule 40 PVC
Inside diameter of riser pipe: 2.0 in.
Depth of bottom of riser pipe: 45.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	6.0 ft
Concrete	7.0 ft	32.0 ft
Bentonite	42.4 ft	12.6 ft
Filter Sand	42.4 ft	12.6 ft

Diameter of borehole: 8.5 in.

Type of screen: Machine slotted Sch 40 PVC
Screen gauge or size of openings: 0.010 in.
Diameter of screen: 2.0 in.
Depth to top of well screen: 45.0 ft
Depth to bottom of well screen: 55.0 ft

Bottom of silt trap: N/A
Depth of bottom of borehole: 55.0 ft

COMMENTS:

38705-007_HA-LIB07-1R_SAN_12-07-12.GLB GW INSTALLATION REPORT-07-1 HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\38705 - LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ Dec 7, 12

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-201A
Boring No. SB-201A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi

Initial Water Level (depth TOC): 19.89 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed 07 Nov 2012
H&A Rep. S. Collinge
Location See Plan

Ground El. 638.63
Datum 640.69

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	638.6
SM	1.0			1.0	637.6
SP				13.0	625.6
				15.0	623.6
CL	23.0				
ML	24.4			25.0	613.6
	25.0				

WELL CONSTRUCTION DETAILS

Type of protective cover	Guard Pipe
Depth of Metal below ground surface	0.00 ft
Depth of top of riser below ground surface	N/A
Type of protective casing	Metal
Length	2.5 ft
Inside diameter	4.0 in.
Depth of bottom of Metal	2.5 ft
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	15.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	12.0 ft
Filter Sand	13.0 ft	12.0 ft
	-	-
	-	-

Diameter of borehole	8.5 in.
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Depth to top of well screen	15.0 ft
Depth to bottom of well screen	25.0 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	25.0 ft

COMMENTS:

38705-007_HA-LIB07-1R_SAN_12-07-12.GLB G:\PROJECTS\38705 - LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ HA-TB+CORE+WELL-07-1.GDT GW INSTALLATION REPORT-07-1 Doc 7.12

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-201B
Boring No. SB-201A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi

Initial Water Level (depth TOC): 19.71 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed 07 Nov 2012
H&A Rep. S. Collinge
Location See Plan

Ground El. 638.48
Datum 640.36

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	638.5
SM	1.0			1.0	637.5
				4.0	634.5
SP					
CL	23.0				
ML	24.4 / 24.8				
SP				39.0	599.5
				42.5	596.0
				45.0	593.5
	55.0			55.0	583.5

WELL CONSTRUCTION DETAILS

Type of protective cover: Guard Pipe
Depth of Metal below ground surface: 0.00 ft
Depth of top of riser below ground surface: N/A
Type of protective casing: Metal
Length: 2.5 ft
Inside diameter: 4.0 in.
Depth of bottom of Metal: 2.5 ft
Type of riser pipe: Schedule 40 PVC
Inside diameter of riser pipe: 2.0 in.
Depth of bottom of riser pipe: 45.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	3.0 ft
Concrete	4.0 ft	35.0 ft
Bentonite	39.0 ft	3.5 ft
Filter Sand	42.5 ft	12.5 ft

Diameter of borehole: 8.5 in.
Type of screen: Machine slotted Sch 40 PVC
Screen gauge or size of openings: 0.010 in.
Diameter of screen: 2.0 in.
Depth to top of well screen: 45.0 ft
Depth to bottom of well screen: 55.0 ft
Bottom of silt trap: N/A
Depth of bottom of borehole: 55.0 ft

COMMENTS:

38705-007_HA-LIB07-1R_SAN_12-07-12.GLB G:\INSTALLATION REPORT-07-1 HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\38705_-LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ Dec 7-12

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-202A
Boring No. SB-202A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi

Initial Water Level (depth TOC): 27.83 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed: 08 Nov 2012
H&A Rep.: S. Collinge
Location: See Plan

Ground El.: 638.94
Datum: 641.19

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	638.9
SM	0.3			1.0	637.9
SP				13.0	625.9
				15.0	623.9
	25.0			25.0	613.9

WELL CONSTRUCTION DETAILS

Type of protective cover	Guard Pipe
Depth of Metal below ground surface	0.00 ft
Depth of top of riser below ground surface	N/A
Type of protective casing	Metal
Length	2.5 ft
Inside diameter	4.0 in.
Depth of bottom of Metal	2.5 ft
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	15.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	12.0 ft
Filter Sand	13.0 ft	12.0 ft
	-	-
	-	-

Diameter of borehole	8.5 in.
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Depth to top of well screen	15.0 ft
Depth to bottom of well screen	25.0 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	25.0 ft

COMMENTS:

38705-007_HA-LIB07-1R_SAN_12-07-12.GLB GW INSTALLATION REPORT-07-1 HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\38705 - LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ Doc 7-12

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-202B
Boring No. SB-202A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi

Initial Water Level (depth TOC): 20.62 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed: 08 Nov 2012
H&A Rep.: S. Collinge
Location: See Plan

Ground El.: 638.74
Datum: 641.14

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	638.7
SM	0.3			1.0	637.7
				6.0	632.7
SP					
	30.0				
SP				36.0	602.7
				40.0	598.7
				43.5	595.2
SW	45.0				
--	46.0				
	46.9				
SP					
	53.0			53.5	585.2
CL- ML					
	55.0				

WELL CONSTRUCTION DETAILS

Type of protective cover	Guard Pipe
Depth of Metal below ground surface	0.00 ft
Depth of top of riser below ground surface	N/A
Type of protective casing	Metal
Length	2.5 ft
Inside diameter	4.0 in.
Depth of bottom of Metal	2.5 ft
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	43.5 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	5.0 ft
Concrete	6.0 ft	30.0 ft
Bentonite	36.0 ft	4.0 ft
Filter Sand	40.0 ft	13.5 ft

Diameter of borehole	8.5 in.
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Depth to top of well screen	43.5 ft
Depth to bottom of well screen	53.5 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	55.0 ft

COMMENTS:

38705-007_HA-LIB07-1R_SAN_12-07-12.GLB GW INSTALLATION REPORT-07-1 HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\38705 - LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ Dec 7, 12

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-203A
Boring No. SB-203A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi
Initial Water Level (depth TOC): 20.48 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed 08 Nov 2012
H&A Rep. S. Collinge
Location See Plan

Ground El. 638.89
Datum 641.15

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	638.9
?	0.3			1.0	637.9
?				13.0	625.9
				15.0	623.9
ML/CL	21.8				
	25.0			25.0	613.9

WELL CONSTRUCTION DETAILS

Type of protective cover	Guard Pipe
Depth of Metal below ground surface	0.00 ft
Depth of top of riser below ground surface	N/A
Type of protective casing	Metal
Length	2.5 ft
Inside diameter	4.0 in.
Depth of bottom of Metal	2.5 ft
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	15.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	12.0 ft
Filter Sand	13.0 ft	12.0 ft
	-	-
	-	-

Diameter of borehole	8.5 in.
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Depth to top of well screen	15.0 ft
Depth to bottom of well screen	25.0 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	25.0 ft

COMMENTS:

38705-007_H&-LIB07-1R_SAN_12-07-12.GLB GW INSTALLATION REPORT-07-1 H&-TB+CORE+WELL-07-1.GDT G:\PROJECTS\38705 - LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ Dec 7, 12

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-203B
Boring No. SB-203A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi

Initial Water Level (depth TOC): 20.62 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed 08 Nov 2012
H&A Rep. S. Collinge
Location See Plan

Ground El. 638.99
Datum 641.28

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	639.0
?	0.3			1.0	638.0
				6.0	633.0
?	21.8				
ML/CL	26.0				
ML	27.0				
SP	47.5			37.5	601.5
				41.5	597.5
				45.0	594.0
SP	55.0			55.0	584.0

WELL CONSTRUCTION DETAILS

Type of protective cover: Guard Pipe
Depth of Metal below ground surface: 0.00 ft
Depth of top of riser below ground surface: N/A

Type of protective casing: Metal
Length: 2.5 ft
Inside diameter: 4.0 in.
Depth of bottom of Metal: 2.5 ft

Type of riser pipe: Schedule 40 PVC
Inside diameter of riser pipe: 2.0 in.
Depth of bottom of riser pipe: 45.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	5.0 ft
Concrete	6.0 ft	31.5 ft
Bentonite	37.5 ft	4.0 ft
Filter Sand	41.5 ft	13.5 ft

Diameter of borehole: 8.5 in.

Type of screen: Machine slotted Sch 40 PVC
Screen gauge or size of openings: 0.010 in.
Diameter of screen: 2.0 in.
Depth to top of well screen: 45.0 ft
Depth to bottom of well screen: 55.0 ft
Bottom of silt trap: N/A
Depth of bottom of borehole: 55.0 ft

COMMENTS:

38705-007_H9-LIB07-1R_SAN_12-07-12.GLB G:\W INSTALLATION REPORT-07-1 HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\38705 - LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ Dec 7, 12

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-204A
Boring No. SB-204A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi

Initial Water Level (depth TOC): 20.02 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed: 06 Nov 2012
H&A Rep.: S. Collinge
Location: See Plan

Ground El.: 638.71
Datum: 640.86

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	638.7
?	0.4				
?	0.6			1.0	637.7
SM	0.9				
SP					
				13.0	625.7
--	14.0–14.2				
				15.0	623.7
SP					
ML/SP	23.0–23.5				
	25.0			25.0	613.7

WELL CONSTRUCTION DETAILS

Type of protective cover: Guard Pipe
Depth of Metal below ground surface: 0.00 ft
Depth of top of riser below ground surface: N/A

Type of protective casing: Metal
Length: 2.5 ft
Inside diameter: 4.0 in.
Depth of bottom of Metal: 2.5 ft

Type of riser pipe: Schedule 40 PVC
Inside diameter of riser pipe: 2.0 in.
Depth of bottom of riser pipe: 15.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	12.0 ft
Filter Sand	13.0 ft	12.0 ft
	-	-
	-	-

Diameter of borehole: 8.5 in.

Type of screen: Machine slotted Sch 40 PVC
Screen gauge or size of openings: 0.010 in.
Diameter of screen: 2.0 in.
Depth to top of well screen: 15.0 ft
Depth to bottom of well screen: 25.0 ft

Bottom of silt trap: N/A
Depth of bottom of borehole: 25.0 ft

COMMENTS:

38705-007_HA-LIB07-1R_SAN_12-07-12.GLB GW INSTALLATION REPORT-07-1 HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\38705 - LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ Doc 7.12

HALEY & ALDRICH

GROUNDWATER OBSERVATION WELL INSTALLATION REPORT

Well No. MW-204B
Boring No. SB-204A/B

Project: Hydrogeologic Investigation
Location: La Crosse Boiling Water Reactor (LACBWR)
Client: Dairyland Power Cooperative
Contractor: Onsite Environmental
Driller: A. Kapugi
Initial Water Level (depth TOC): 20.10 ft

Well Diagram: Riser Pipe, Screen, Filter Sand, Cuttings, Grout, Concrete, Bentonite Seal

File No. 38705-007
Date Installed: 06 Nov 2012
H&A Rep.: S. Collinge
Location: See Plan
Ground El.: 638.62
Datum: 640.73

SOIL/ROCK CONDITIONS	DEPTH (ft.)	GRAPHIC	WELL DETAILS	DEPTH (ft.)	ELEVATION (ft.)
				0.0	638.6
?	0.4			1.0	637.6
?	0.6				
SM	0.9				
SP				8.0	630.6
—	14.0 / 14.2				
SP					
ML/SP	23.0 / 23.5				
SP				34.4	604.2
SW	35.5 / 37.0			38.0	600.6
SP				45.0	593.6
SP	50.0 / 55.0			55.0	583.6

WELL CONSTRUCTION DETAILS

Type of protective cover	Guard Pipe
Depth of Metal below ground surface	0.00 ft
Depth of top of riser below ground surface	N/A
Type of protective casing	Metal
Length	2.5 ft
Inside diameter	4.0 in.
Depth of bottom of Metal	2.5 ft
Type of riser pipe	Schedule 40 PVC
Inside diameter of riser pipe	2.0 in.
Depth of bottom of riser pipe	45.0 ft

Type of Seals	Top of Seal (ft)	Thickness (ft)
Bentonite	1.0 ft	7.0 ft
Concrete	8.0 ft	26.4 ft
Bentonite	34.4 ft	3.6 ft
Filter Sand	38.0 ft	17.0 ft

Diameter of borehole	8.5 in.
Type of screen	Machine slotted Sch 40 PVC
Screen gauge or size of openings	0.010 in.
Diameter of screen	2.0 in.
Depth to top of well screen	45.0 ft
Depth to bottom of well screen	55.0 ft
Bottom of silt trap	N/A
Depth of bottom of borehole	55.0 ft

COMMENTS:

38705-007_HA-LIB07-1R_SAN_12-07-12.GLB GW INSTALLATION REPORT-07-1 HA-TB+CORE+WELL-07-1.GDT G:\PROJECTS\38705 - LACBWR\GLOBAL\GINT\38705-007_MW200_MW205.GPJ Dec 7, 12