LA CROSSE BOILING WATER REACTOR
LICENSE TERMINATION PLAN
CHAPTER 7, REVISION 1
UPDATE OF THE SITE-SPECIFIC DECOMMISSIONING COSTS

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LIST OF ACRONYMS AND ABBREVIATIONS

Dairyland	Dairyland Power Cooperative
DOT	Department of Transportation
D-Plan/ PSDAR	Decommissioning Plan and Post-Shutdown Decommissioning Activities Report
FESW	Fuel Element Storage Well
FSS	Final Status Survey
GTCC	Greater Than Class C
ISFSI	Independent Spent Fuel Storage Installation
LACBWR	La Crosse Boiling Water Reactor
LTP	License Termination Plan
NDT	Nuclear Decommissioning Trust
NRC	Nuclear Regulatory Commission
QA	Quality Assurance
QC	Quality Control
ZNPS	Zion Nuclear Power Station

7. Update of the Site-Specific Decommissioning Costs

7.1. Introduction

In accordance with 10 CFR 50.82(a)(9)(ii)(F) and Regulatory Guide 1.179, *"Standard Format and Content for License Termination Plans for Nuclear Power Reactors"* (1), the updated site specific cost estimates and funding plans for completing the La Crosse Boiling Water Reactor (LACBWR) decommissioning are provided. Regulatory Guide 1.179 provides guidance on the details of the information to be presented in the License Termination Plan (LTP).

This chapter provides an estimate of the remaining decommissioning costs at the time of LTP submittal and also compares these estimated costs with the present funds set aside for decommissioning. If it is determined that there is a deficit in the present funding, the LTP must indicate the means for ensuring that adequate funds are available to complete the decommissioning.

The decommissioning cost estimate evaluates the following cost elements:

1. Cost assumptions used, including contingency factors;
2. Major decommissioning activities and tasks;
3. Unit cost factors;
4. Estimated costs for decontamination and removal of equipment and structures;
5. Estimated costs for waste disposal, including disposal site surcharges;
6. Estimated Final Status Survey (FSS) costs; and
7. Estimated total costs.

The cost estimate focuses on the remaining work, including costs of labor, materials, equipment, energy, and services. The cost estimate includes the cost of the planned remediation activities as well as the cost of the transportation and disposal of the waste generated by the planned work.

7.1.1. Historical Perspective

The LACBWR facility was an Atomic Energy Commission Demonstration Project Reactor. The reactor went critical in 1967 and commenced commercial operation in November 1969. The reactor was capable of producing 50 Megawatt Electric (MWe). Dairyland Power Cooperative (Dairyland) purchased LACBWR in July 1973. LACBWR was shut down on April 30, 1987. The *LACBWR Decommissioning Plan* (2) was approved on August 7, 1991. Because the licensing history of LACBWR spans a period that includes several decommissioning regulation changes, The D-Plan has been revised to the *LACBWR Decommissioning Plan and Post-Shutdown Decommissioning Activities Report* (D-Plan/PSDAR) Revision March 2014 (3).

All 333 spent nuclear fuel elements from LACBWR have been transferred from the Fuel Element Storage Well (FESW) to dry cask storage at the on-site Independent Spent Fuel Storage Installation (ISFSI) as of September 19, 2012. The remaining LACBWR buildings and structures are ready for dismantlement and decommissioning activities. Dairyland will continue to operate the Genoa 3 coal-fired generating facility located adjacent to the LACBWR facility.

In a letter dated October 8, 2015 (1), Dairyland and LaCrosse*Solutions*, LLC (Solutions) requested Nuclear Regulatory Commission (NRC) consent to transfer Dairyland's possession, maintenance and decommissioning authorities, under Possession Only License No. DPR-45, from Dairyland to Solutions. NRC provided consent to the license transfer in May 2016. In compliance with 10 CFR 50.75(f)(1) and 10 CFR 50.82(a)(8)(v)(viii), Solutions will demonstrate financial assurance on an annual basis.

After the balance of the site is remediated and the as-left radiological conditions are demonstrated to be below the unrestricted use criteria specified in 10 CFR 20.1402, the licensed area will be reduced to a small area around the ISFSI and Possession Only License No. DPR-45 will be transferred back to Dairyland.

7.1.2. Cost Estimates Previously Docketed with the NRC

An updated cost study was completed in November 2010 and was included as part of a revised LACBWR D-Plan/PSDAR, submitted by Dairyland to the NRC in November 2012. As part of this cost update, ISFSI decommissioning costs were identified uniquely as a specific item.

An updated cost study completed in March 2013 was included as part a revised LACBWR D-Plan/PSDAR submitted by Dairyland to the NRC in March 2014. As part of this cost update, some contaminated structures previously assumed to be decontaminated and left intact were evaluated for demolition and disposal.

7.2. Decommissioning Cost Estimate

The decommissioning cost estimate presented herein represents the projected costs to complete the remaining decommissioning work as of October 1, 2015. This estimate was prepared based upon an assessment of the remaining work and incorporating experience gained while performing similar decommissioning tasks including the ongoing decommissioning of the Zion Nuclear Power Station (ZNPS) through the work of its subsidiary Zion*Solutions* LLC.

The decommissioning cost estimate includes application of contingency, as specific provision for unforeseeable elements of cost within the defined project scope. Contingencies are particularly important where previous experience has shown that unforeseeable events, which may increase costs, are likely to occur. The contingency, as used in this estimate, does not account for price escalation and inflation in the costs of decommissioning over the remaining project duration.

The site-specific decommissioning cost estimate presents a breakdown of all costs associated with completing the decommissioning and unrestricted release of the LACBWR site, other than the area bounded by the ISFSI. The estimate includes the costs required to accomplish unrestricted release and restore the site to a safe and stable condition as well as the operation of the ISFSI until the site and the remaining ISFSI are transferred back to Dairyland.

The following subsections present a description of how the cost estimate was prepared and a summary and breakdown of the estimated costs.

7.2.1. Cost Estimate Description and Methodology

The cost estimates include consideration of regulatory requirements, contingency for unknown or uncertain conditions, and the availability of low and high-level radioactive waste disposal sites.

The methodology utilized to develop the cost estimate follows the basic approach presented in *Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates* (4), which uses a unit cost factor approach for estimating the decommissioning activity costs. It also includes the use of site specific information when available (e.g., hourly labor rates, and commodities).

The updated estimate completed in March 2013 has been utilized to obtain site-specific commodity quantities for this estimate. The commodity weights and estimated unit cost factors were applied, which take into consideration the current decommissioning approach and schedule, to arrive at an updated cost estimated to decommission LACBWR. Dairyland and Solutions also utilized 25 years of corporate experience in planning and scheduling as well as the latest available industry experience (e.g., information from the decommissioning of ZNPS).

The estimate does not include the transfer of spent fuel, which has been previously transferred to an ISFSI facility, the security costs for the ISFSI facility, or the removal of certain large components and decommissioning work previously completed.

Additionally, Dairyland and Solutions performed a contingency and risk analysis so that the potential additional costs due to expected but undefined risks and uncertainties could be addressed and included in the cost estimate.

The resulting information was then compiled into a decommissioning cost estimate. The following sections provide a summary of those results.

7.2.2. Summary of the Site-Specific Decommissioning Cost Estimate

The overall remaining decommissioning cost (including scope risk contingency) is estimated to be $[redacted] Million (in current year dollars), with a base estimated cost of $[redacted] Million, plus a scope risk contingency of $[redacted] Million. The cost estimates include provisions for cost escalation based upon the following assumptions:

- All estimated costs including labor, staff, materials, equipment, professional services, waste transportation and disposal are in 2015 dollars.
- Although all costs in this LTP are in current year dollars, the project baseline does include provisions to escalate costs based on the Consumer Price Index for all Urban Customers – U.S. City Average All Items, Not Seasonally Adjusted (CPI-U NSA).
- The associated Class A radioactive waste management costs are covered by existing fixed-price contracts with Energy*Solutions*. Therefore, the waste management costs for these items are well known and not likely to vary due to waste volume uncertainties.
- No costs for Class B/C waste are included in the estimate, as all materials classified as B/C waste were previously removed by Dairyland.

The cost estimate includes the costs for radiological decommissioning and site restoration. A summary of the cost for each part of the decommissioning program is provided in Table 7-1.

Table 7-1 Cost Summary for Radiological Decommissioning and Site Restoration

	Radiological Decommissioning	Site Restoration[1]	Total Project
Performance Baseline	$[redacted] Million	$2.6 Million	$[redacted] Million
Contingency	$[redacted] Million	$0.3 Million	$[redacted] Million
Total	$[redacted] Million	$2.9 Million	$[redacted] Million

Note 1: Site restoration is included for completeness, but not required for license termination funding purposes.

Detailed breakdowns of the estimated costs for radiological decommissioning and site restoration programs are provided in sections 7.2.3 and 7.2.5, respectively. Spent fuel management is addressed in section 7.2.4. Estimated contingency costs are addressed in section 7.2.6.

7.2.3. Radiological Decommissioning Costs

Consistent with the NRC definition of decommissioning under 10 CFR 50.2, the radiological decommissioning costs under this category consider only those costs associated with normal decommissioning activities necessary for release of the site (other than the ISFSI) for unrestricted use. It does not include costs associated with the disposal of non-radiological materials or structures beyond those necessary to terminate the Part 50 license or the costs associated with construction or operation of an ISFSI.

The estimated cost for radiological decommissioning is $[redacted] Million. A contingency of $[redacted] Million is estimated, bringing the total to $[redacted] Million.

The remaining decommissioning scope of work included in this estimate is described in detail in other chapters of this LTP. Overall, that work scope includes completion of the removal, transportation and disposal of the major components; completion of the removal, transportation and disposal of the remaining equipment; decontamination and/or bulk demolition of radiological impacted structures and transportation and disposal of the resulting radioactive wastes; performance of the FSS and associated license termination activities. The estimated costs include the labor, equipment, materials, services and fees needed to conduct the work. The estimated cost also includes all of the program support activities and services necessary to manage and safely carry out a large-scale dismantlement and demolition project. These program support activities include project management, work controls and site administration; technical support services, such as radiation protection, safety, engineering, security, Quality Assurance (QA)/Quality Control (QC), environmental monitoring, waste management and decommissioning subject matter experts needed to support the project.

A high level breakdown of the estimated radiological decommissioning cost by major project activity is provided in Table 7-2.

Table 7-2 Estimated Radiological Decommissioning Cost by Major Project Activity

PROJECT ACTIVITY	COST[1]
Project Development & LTP Preparation	$1.7 Million
Pre-Mobilization Planning and Rail Upgrades	$3.8 Million
D&D Mobilization and Management	$1.3 Million
Dismantlement & Demolition	$26.5 Million
Radioactive Waste Transportation and Disposal	$[redacted] Million
Final Status Surveys	$1.1 Million
Program Management	$11.1 Million
TOTAL	**$[redacted] Million**

Note 1: Columns may not add due to rounding

A high level breakdown of the estimated radiological decommissioning cost by major resource type is provided in Table 7-3. A more detailed breakdown of the estimated radiological decommissioning cost by project activity is provided in Table 7-4.

Table 7-3 Estimated Radiological Decommissioning Cost by Major Resource Type

RESOURCE	COST[1]
Staff Labor	$6.1 Million
Craft Labor	$11.3 Million
Rad Protection Technicians	$3.6 Million
Materials & Supplies	$4.5 Million
Equipment	$7.5 Million
Subcontracts & Professional Services	$8.1 Million
Radioactive Waste Transportation & Disposal	$[redacted] Million
Other Direct Costs & Fees	$4.2 Million
TOTAL	**$[redacted] Million**

Note 1: Columns may not add due to rounding

Table 7-4 Breakdown of Radiological Decommissioning Costs by Detailed Activity

ACTIVITY		COST[1]
PROJECT DEVELOPMENT & LTP PREPARATION	Total	**$1.7 Million**
LACBWR LTP (313196)		$0.6 Million
ES Bid & Proposal (941351)		$1.1 Million
PRE-MOBILIZATION PLANNING AND RAIL UPGRADES	Total	**$3.8 Million**
Program Development & Planning		$0.6 Million
D&D Pre-Mobilization Planning		$0.1 Million
Rail Upgrades		$2.3 Million
Preliminary Characterization		$0.7 Million
D&D MOBILIZATION AND MANAGEMENT	Total	**$1.3 Million**
D&D Mobilization and Management		$1.3 Million
DISMANTLEMENT & DEMOLITION	Total	**$26.5 Million**
D&D Reactor Building		$8.1 Million
D&D Turbine Building		$7.7 Million
D&D Waste Treatment Building		$1.2 Million
D&D Balance of Plant		$9.5 Million
RADIOACTIVE WASTE TRANSPORTATION AND DISPOSAL	Total	**$[redacted] Million**
FINAL STATUS SURVEYS	Total	**$1.1 Million**
Reactor Building FSS & Support		$0.4 Million
Turbine Building FSS & Support		$0.4 Million
Waste Treatment Building FSS & Support		$0.2 Million
Balance of Plant FSS & Support		$0.2 Million
PROGRAM MANAGEMENT	Total	**$11.1 Million**
Project & Site Management		$5.5 Million
Safety Program		$1.8 Million
Regulatory Program & NRC Fees		$1.0 Million
Radiation Protection Program Management		$0.8 Million
Characterization Program Management		$0.8 Million
Waste Program Management		$1.2 Million
TOTAL		**$[redacted] Million**

Note 1: Columns may not add due to rounding

The total estimated cost for radioactive waste disposition (containers, transportation and disposal) is $[redacted] Million. These waste management costs are comprised of Class A Large Components, Class A Containerized Wastes and Class A Bulk Materials.

The associated Class A radioactive waste management costs are covered by existing fixed-price contracts with Energy*Solutions*. Therefore, the waste management costs for these items are well known and not likely to vary due to waste volume uncertainties. The resulting radioactive waste streams and the disposal and transportation contracts can be categorized as follows:

Class A Large Components. This category of waste includes equipment that will be transported and disposed of intact, enclosed in rail cars or prepared to serve as its own waste container. These items have been radiologically and physically characterized. As such, the inventory of these items and their disposal volumes are known. The associated waste management costs are covered by existing fixed-price contracts with Energy*Solutions* for disposal in Clive, Utah. Therefore, the waste management costs for these items are well known and not likely to vary.

Class A Bulk Materials. This category of waste primarily consists of concrete rubble or similar materials contaminated with low levels of radioactivity, and various large components described above. Waste will be loaded into appropriate containers and trucked to a rail trans-load facility in Winona, MN where the waste container will be transferred to a rail car and then shipped to the Energy*Solutions* disposal site in Clive, Utah. The cost for disposal and transportation of this material is covered by a fixed-price contract that covers any and all material of this type from this decommissioning project, without regard to the total mass or volume. Therefore, these costs are known and are unlikely to vary. This category of waste generally comprises greater than 95% of the total volume and mass and greater than 80% of the estimated waste management costs for all radioactive waste expected to be generated by this decommissioning effort.

Class A Containerized Wastes. This category of waste primarily consists of material that will need to be packaged in strong-tight/industrial containers, such as intermodals or fabricated steel boxes. Typically, this would include small pieces of contaminated equipment, pipe or debris which require containerization to meet Department of Transportation (DOT) regulations or mitigate radiological handling concerns. Waste will be loaded into appropriate containers and trucked to a rail trans-load facility in Winona, MN where the waste container will be transferred to a rail car and then shipped to the Energy*Solutions* disposal site in Clive, Utah.

Greater Than Class C (GTCC) and Class B/C Waste. No costs for disposal of GTCC waste are included in the estimate, as it was included as a part of the previously completed spent fuel disposition. Also, no costs for Class B/C waste are included in the estimate, as all materials classified as B/C waste were previously removed by Dairyland.

7.2.4. Spent Fuel Management

All spent nuclear fuel elements from LACBWR have been transferred from the FESW to dry cask storage in the ISFSI.

Solutions will assume responsibility for the ISFSI Site, including security requirements. Solutions will enter into a "Company Services Agreement" with Dairyland, pursuant to which Dairyland will provide operations, maintenance, access control, and security services to and for

the ISFSI site. Dairyland is responsible for the costs relating to the ISFSI and those costs are not included in this decommissioning estimate.

7.2.5. Site Restoration Costs

Solutions acknowledges that the costs to restore the LACBWR property are not considered by the NRC staff as part of decommissioning costs. Nevertheless, there is significant interest by many stakeholders in these costs and they are presented herein. The estimated cost for the anticipated work scope is $2.6 Million. A contingency of $0.3 Million is estimated, bringing the total cost to $2.9 Million. Overall, that work scope includes removal of any remaining hazardous materials, demolition of remaining structures, backfilling of any open excavations or void spaces, and final grading and stabilization against erosion.

The estimated costs include the labor, equipment, materials, professional services and fees needed to conduct the work. In general, most of this work is anticipated to be performed by contractors however, the estimated cost also includes all of the program support activities and services necessary to manage and safely carry out the work.

A high level breakdown of the estimated site restoration cost by major project activity is provided in Table 7-5. A more detailed breakdown of the estimated site restoration cost by project activity is provided in Table 7-6.

Table 7-5 Estimated Site Restoration Cost by Major Project Activity

PROJECT ACTIVITY	COST[1]
Project Development	$0.2 Million
Pre-Mobilization Planning	$0.1 Million
D&D Mobilization and Management	$0.2 Million
Waste Transportation and Disposal	$0.4 Million
Site Restoration	$0.8 Million
Program Management	$0.8 Million
TOTAL	**$2.6 Million**

Note 1: Columns may not add due to rounding

7.2.6. Contingency

Uncertainty associated with the decommissioning cost estimate, and the need to allocate additional funding to cover contingency has been included in this estimate. Accounting for contingency has been evaluated from two standpoints, operational efficiency and scope expansion risk. Within the context of this cost estimate, operational efficiency contingency is defined as the occurrence of events or circumstances that can prolong project duration or make the execution of a given work scope more difficult. Examples of these types of events include weather related delays, equipment or tool breakage or unavailability, and interferences from other work activities. Scope expansion risk within the context of this estimate is defined as the need to perform unplanned work activities or expansion of the work activities that were planned.

Examples of this type of project risk would be discovering new or additional contaminated media.

Table 7-6 Breakdown of Site Restoration Costs by Detailed Activity

ACTIVITY			COST[1]
PROJECT DEVELOPMENT		Total	**$0.2 Million**
	ES Bid & Proposal (941351)		$0.2 Million
PRE-MOBILIZATION PLANNING		Total	**$0.1 Million**
	Program Development & Planning		$0.1 Million
D&D MOBILIZATION AND MANAGEMENT		Total	**$0.2 Million**
	D&D Mobilization and Management		$0.2 Million
WASTE TRANSPORTATION & DISPOSAL		Total	**$0.4 Million**
	Non-Radioactive Waste Transportation & Disposal		$0.4 Million
SITE RESTORATION		Total	**$0.8 Million**
	Reactor Building Site Restoration		$0.2 Million
	Turbine Building Site Restoration		$0.2 Million
	Waste Treatment Building Site Restoration		$0.0 Million
	Balance of Plant Site Restoration		$0.4 Million
PROGRAM MANAGEMENT		Total	**$0.8 Million**
	Environmental & Project Management		$0.6 Million
	Safety Program		$0.2 Million
TOTAL			**$2.6 Million**

Note 1: Columns may not add due to rounding

requiring remediation, or a need to perform work in a different manner due to unforeseen conditions or changes in requirements.

As shown in section 7.2.2, the overall contingency is estimated at $[redacted] Million; apportioned as $[redacted] Million for radiological decommissioning and $0.3 Million for site restoration. This contingency was estimated using a quantitative Monte Carlo type probability analysis corresponding to a resulting 85 percent confidence level.

The LACBWR contingency analysis process is consistent with that adopted for the ZNPS decommissioning project.

7.3. Decommissioning Funding Plan

As indicated in section 7.2.2, the estimated cost to complete the radiological decommissioning of the LACBWR, including site restoration costs[1] and contingency, is $84.9 Million (current year dollars) as of October 1, 2015. Table 7.7 summarizes the annualized costs.

Table 7-7 LACBWR Summary of Annualized Costs (in Millions)

	2015	2016	2017	2018	2019	Total
Radiological Decommissioning	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Site Restoration	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Performance Baseline	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Contingency	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Project	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

These decommissioning costs will be paid for with funds from the site's Nuclear Decommissioning Trust (NDT) fund. The decommissioning of the LACBWR site ISFSI will be undertaken by Dairyland[2] and will be financed separately to the NDT account amount identified here for decommissioning of the LACBWR site.

The project cash balance of the NDT identified for the decommissioning of the LACBWR site, as agreed to by Solutions, and held in trust by the Owner trustee as of October 1, 2015 was $[redacted] Million.

Based on a time phased cash flow analysis of the radiological decommissioning and site restoration costs, and assuming NDT returns at an annual 2% real, after tax rate of return, the required minimum funding assurance amount to fund the future radiological decommissioning costs equals $[redacted] Million, which is below the $[redacted] Million available balance described above.

This NDT position, together with the $[redacted] Million Surety Bond payable to the NDT, provides for sufficient funding and financial assurance for the completion of the decommissioning of the LACBWR site.

Additionally, although not relied upon here, Solutions parent Energy*Solutions* has agreed with Dairyland to provide a performance guaranty defined in the LACBWR Decommissioning Agreement submitted as part of the license transfer application (5).

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[1] The estimated project decommissioning costs includes an estimate for site restoration costs.

[2] The costs of spent fuel management and associated costs are to be incurred by Dairyland, are estimated to be approximately $2 million per year, and are financed from operating and maintenance funds outside of the NDT. Dairyland has not projected the cost of managing irradiated fuel until title to the fuel and possession of the fuel is transferred to the Secretary of Energy because this cost is indeterminate.

Assuming approval by the NRC of the license transfer application on or before March 31, 2016, Solutions will be submitting the annual demonstration of financial assurance for the year ending 2015 in accordance with 10 CFR 50.75(f)(1) and 10 CFR 50.82(a)(8)(v)-(viii). That submission will be based upon future project costs of radiological decommissioning and site restoration, and the NDT balance as of that date.

7.4. References

1. U.S. Nuclear Regulatory Commission Regulatory Guide 1.179, Standard Format and Content of License Termination Plans for Nuclear Power Reactors, Revision 1 - June 2011.

2. Dairyland Power Cooperative (DPC), LACBWR Decommissioning Plan, Revision – November 2012.

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

4. T.S. LaGuardia et al., Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates, AIF/NESP-036, May 1986.

5. Dairyland Power Cooperative Letter to U.S Nuclear Regulatory Commission, Application for Order Approving License Transfer and Conforming Administrative License Amendments, dated October 8, 2015.