



10 CFR 50.82(a)(4)

December 16, 2019
LIC-19-0007

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, D.C. 20555-0001

Fort Calhoun Station, Unit No. 1
Renewed Facility Operating License No. DPR-40
NRC Docket No. 50-285

Subject: Fort Calhoun Station, Unit No. 1, Post-Shutdown Decommissioning Activities Report

References:

1. OPPD Letter (T. Burke) to USNRC (Document Control Desk), "Certification of Permanent Cessation of Power Operations," dated August 25, 2016 (LIC-16-0067) (ML16242A127)
2. OPPD Letter (M. Fisher) to USNRC (Document Control Desk), "Fort Calhoun Station, Unit No. 1, Post-Shutdown Decommissioning Activities Report," Dated March 30, 2017 (LIC-17-0033) (ML17089A759)
3. Letter from NRC (J. Rubenstone) to OPPD (M. Fisher), "Fort Calhoun Nuclear Generating Station – Foreign Obligations Compliance during Decommissioning," dated August 9, 2018 (ML18201A999)

Pursuant to 10 CFR 50.82(a)(4)(i), Omaha Public Power District (OPPD) is submitting a revised post-shutdown decommissioning activities report (PSDAR) for Fort Calhoun Station (FCS). By letter dated August 25, 2016 (Reference 1), OPPD notified the NRC of its intention to permanently cease power operations at FCS on October 24, 2016.

The Enclosure to this letter provides the revised FCS PSDAR. The PSDAR has been developed consistent with Regulatory Guide 1.185, Revision 1, "Standard Format and Content for Post-Shutdown Decommissioning Activities Report." The FCS PSDAR includes a description of the planned decommissioning activities, a schedule for their accomplishments, a site specific decommissioning cost estimate and a discussion that provides a basis for concluding that the environmental impacts associated with site-specific decommissioning will be bounded by appropriate, previously issued, environmental impact statements. The PSDAR also includes a discussion of the schedule and costs associated with the management of spent fuel and site restoration. Funding for irradiated fuel management will be addressed as an update to the Irradiated Fuel Management Plan pursuant to 10 CFR 50.54(bb).

In Reference 2, OPPD submitted a Post-Shutdown Decommissioning Activities Report in accordance with 10 CFR 50.82, "Termination of License" paragraph (a)(4)(i). This letter is provided to notify the NRC of a significant schedule change to the 2017 PSDAR in accordance with 10 CFR 50.82, "Termination of license", paragraph (a)(7), by which OPPD intends to accelerate the decommissioning schedule. The revised PSDAR is provided as an attachment to this letter. The attached revised PSDAR demonstrates our decision to transition to the DECON method of decommissioning.

In accordance with 10 CFR 50.82(a)(4)(i), a copy of the FCS PSADR is being provided to the States of Nebraska and Iowa by transmitting a copy of this letter and its attachments to the designated State Officials.

One (1) commitment is contained in this submittal. In an August 9, 2018, letter (Reference 3), the NRC recommended that OPPD provide a Regulatory Commitment, or some similar method, to ensure the U.S. Government can fulfill its international obligations with the Government of Japan. As a result, OPPD commits to the following:

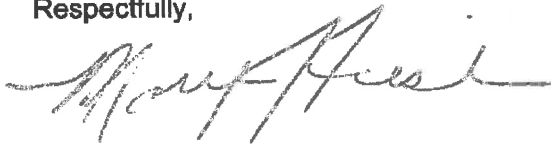
Notify the NRC of the final disposition of the reactor closure vessel head (RCVH) which was obtained from Mitsubishi Heavy Industries in Japan when the RCVH is removed from the FCS site, by transfer to another facility, sold as scrap metal, or any other pathway implemented during the decommissioning process.

It is anticipated that the RCVH will be disposed of as part of the FCS decommissioning process sometime in 2020. The above actions have been entered into the FCS commitment tracking system.

Attachment 1 of this letter contains the new regulatory commitment.

If you should have any questions about the enclosed reports, please contact Mr. Bradley H. Blome at (402) 533-6041.

Respectfully,



Mary J. Fisher
Vice President Energy Production and Nuclear Decommissioning

MJF/cac

Attachment 1: Regulatory Commitments

Enclosure: Fort Calhoun Station, Unit No. 1, Post-Shutdown Decommissioning Activities Report

- c: S. A. Morris, NRC Regional Administrator, Region IV
J. D. Parrott, NRC Senior Project Manager
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Bureau Chief, Bureau of Radiological Health, Iowa Department of Public Health, State of Iowa
Director of Consumer Health Services, Department of Regulation and Licensure,
Nebraska Health and Human Services, State of Nebraska

Regulatory Commitments

This table identifies actions discussed in this letter for which OPPD commits to perform. Any other actions discussed in this submittal are described for the NRC's information and are **not** commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE- TIME ACTION	CONTINUING COMPLIANCE	
<p>Notify the NRC of the final disposition of the reactor closure vessel head (RCVH) which was obtained from Mitsubishi Heavy Industries in Japan when the RCVH is removed from the FCS site, by transfer to another facility, sold as scrap metal, or any other pathway implemented during the decommissioning process.</p> <p>It is anticipated that the RCVH will be disposed of as part of the FCS decommissioning process sometime in 2020. The above actions have been entered into the FCS commitment tracking system.</p>	X		Complete by 12/31/2020

LIC-19-0007
Enclosure

Fort Calhoun Station Unit No. 1,
Post-Shutdown Decommissioning Activities Report

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Acronyms

AIF	Atomic Industrial Forum
ALARA	As Low As Reasonably Achievable
BMP	Best Management Practices
CFR	Code of Federal Regulations
DCE	Decommissioning Cost Estimate
DOE	Department of Energy
DSEIS	Draft Supplemental Environmental Impact Statement (NUREG-1437)
EPA	Environmental Protection Agency
FCS	Fort Calhoun Station
FSAR	Final Safety Analysis Report
GEIS	Generic Environmental Impact Statement (NUREG-0586)
GTCC	Greater than Class C
GW	Groundwater
IPaC	Information for Planning and Consultation system
ISFSI	Independent Spent Fuel Storage Installation
LLRW	Low-Level Radioactive Waste
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MWt	Megawatt-thermal
NDEE	Nebraska Department of Environment and Energy
NEI	Nuclear Energy Institute
NESP	National Environmental Studies Project
NPDES	National Pollutant Discharge Elimination System
NRC	Nuclear Regulatory Commission
OPPD	Omaha Public Power District
PSDAR	Post-Shutdown Decommissioning Activities Report
PWR	Pressurized Water Reactor
SEIS	Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437), Supplement 12 “Regarding Fort Calhoun Station”
SNF	Spent Nuclear Fuel
SSCs	Structures, Systems and Components
UFSAR	Updated Final Safety Analysis Report
USFWS	United States Fish & Wildlife Service

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1.0 INTRODUCTION AND SUMMARY

1.1 Introduction

In accordance with the requirements of Title 10 of the Code of Federal Regulations (CFR) 50.82, “Termination of license,” paragraph (a)(4)(i), this report constitutes the revised Post-Shutdown Decommissioning Activities Report (PSDAR) for Fort Calhoun Station (FCS). This PSDAR contains the following:

1. A description of the planned decommissioning activities along with a schedule for their accomplishment.
2. A discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements and updated environmental supplement.
3. A site-specific decommissioning cost estimate (DCE), including the projected cost of managing irradiated fuel and the post-decommissioning site restoration cost.

The revised PSDAR has been developed consistent with Regulatory Guide 1.185, “Standard Format and Content for Post-Shutdown Decommissioning Activities Report,” (Reference 1). This report is based on currently available information and the plans discussed herein may be modified as additional information becomes available or conditions change. As required by 10 CFR 50.82(a)(7), Omaha Public Power District (OPPD) will notify the Nuclear Regulatory Commission (NRC) in writing, with copies sent to the affected State(s), before performing any decommissioning activity inconsistent with, or making any significant schedule change from, those actions and schedules described in the PSDAR, including changes that significantly increase the decommissioning cost.

1.2 Background

The FCS owned property is approximately 660 acres in size and is located on the Missouri River, 19 miles north of Omaha, Nebraska. FCS employed a Combustion Engineering pressurized water reactor nuclear steam supply system licensed to generate 1,500 megawatts - thermal (MWt). The facility ceased operating on October 24, 2016. The principal structures at FCS site include:

Containment Building – Constructed of pre-stressed steel reinforced concrete with walls almost four feet thick, with an interior one-quarter inch thick steel liner for leak tightness. The containment building contains the reactor and nuclear steam supply system.

Auxiliary Building – Houses the reactor auxiliary systems, including waste treatment facilities, certain safety components, the control room, emergency diesel generators, and fuel handling and storage facilities. The Auxiliary Building is a heavily reinforced concrete structure that forms a “U” around the Containment Building.

Turbine Building – Houses the turbine generator, condensers, condensate and feedwater pumps, feedwater heaters and other turbine heat cycle components. The structural steel superstructure is enclosed with resin wall paneling, it has a reinforced concrete basement.

Service Building – Office space attached to, and of the same construction as, the Turbine Building.

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Intake Structure – Houses the equipment that pumps cool river water into the plant for use in condensing the steam leaving the turbine. The building consists of a structural steel frame enclosed by resin wall panels. The intake structure is made of heavily reinforced concrete below the 1,014 foot elevation and extends over the Missouri River.

Security Access Facility – Serves as the main entrance to the plant.

Switchyard – Houses electrical transmission equipment that is connected to the main generator at the FCS.

Administration Building – Housed offices for management and engineering functions and NRC personnel, associated conference rooms and facilities, a fitness for duty laboratory, a radiological health area and a cafeteria.

Training Center – Includes office spaces, an auditorium, laboratories and control room simulator.

Radioactive Waste Processing Building – Used to sort, compact, decontaminate and store (short-term) low-level solid and liquid radioactive waste. In this building, radioactively contaminated equipment and objects can be decontaminated. The building has a ridged steel framework to support a precast concrete exterior panel siding.

Chemistry and Radiation Protection Building – Houses chemistry and radiological laboratories, a cafeteria, offices, locker and shower room.

Warehouse – A 40,000 square-foot building used for receiving deliveries and storage of spare parts and equipment.

A brief history of the major milestones related to FCS construction and operational history is as follows:

- Construction Permit Issued: June 7, 1968
- Operating License Issued: August 9, 1973
- Commercial Operation: September 26, 1973
- Major Plant Refurbishment: 2006
- Original License Expiration: August 8, 2013
- Renewed License Expiration: August 9, 2033

By letter dated June 24, 2016 (Reference 2), OPPD notified the NRC that it intended to permanently cease power operations of FCS at the end of October 2016. An August 25, 2016 supplement to this letter certified that operations would cease on October 24, 2016 (Reference 2), in accordance with 10 CFR 50.82(a)(1)(i) and 10 CFR 50.4(b)(8). By letter dated November 13, 2016 (Reference 3) OPPD provided the certifications required by 10 CFR 50.82(a)(1)(i) and 10 CFR 50.82(a)(1)(ii), pursuant to 10 CFR 50.82(a)(2), that all fuel had been permanently removed from the FCS reactor vessel and placed in the FCS spent fuel pool. As such, the 10 CFR Part 50 license for FCS no longer authorizes operation of the reactor or emplacement or retention of fuel in the reactor vessel.

Pursuant to 10 CFR 50.51(b), "Continuation of license," the license for a facility that has permanently ceased operations continues in effect beyond the expiration date to authorize ownership and

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possession of the utilization facility until the Commission notifies the licensee in writing that the license has been terminated.

During the period that the license remains in effect, 10 CFR 50.51(b) requires that OPPD:

- Take actions necessary to decommission and decontaminate the facility and continue to maintain the facility including storage, control, and maintenance of the spent fuel in a safe condition.
- Conduct activities in accordance with all other restrictions applicable to the facility in accordance with NRC regulations and the 10 CFR 50 facility license.

10 CFR 50.82(a)(9) states that power reactor licensees must submit an application for termination of the license at least two years prior to the license termination date and that the application must be accompanied or preceded by a license termination plan to be submitted for NRC approval.

1.3 Summary of Decommissioning Alternatives

The NRC has evaluated the environmental impacts of three general methods for decommissioning power reactor facilities in NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors," (GEIS) (Reference 4). The three general methods evaluated are summarized as follows:

- DECON: The equipment, structures and portions of the facility and site that contain radioactive contaminants are promptly removed or decontaminated to a level that permits termination of the license shortly after cessation of operations.
- SAFSTOR: After the plant is shut down and defueled, the facility is placed in a safe, stable condition and maintained in that state (safe storage). The facility is decontaminated and dismantled at the end of the storage period to levels that permit license termination. During SAFSTOR, a facility is left intact or may be partially dismantled, but the fuel is removed from the reactor vessel and radioactive liquids are drained from systems and components and then processed. Radioactive decay occurs during the SAFSTOR period, thereby lowering the level of contamination and radioactivity that must be disposed of during decontamination and dismantlement.
- ENTOMB: Radioactive structures, systems and components (SSCs) are encased in a structurally long-lived substance, such as concrete. The entombed structure is appropriately maintained, and continued surveillance is carried out until the radioactivity decays to a level that permits termination of the license.

The decommissioning approach that is being updated by OPPD for FCS is the DECON method. The primary objectives of the FCS decommissioning project are to remove the facility from service, reduce residual radioactivity to levels permitting unrestricted release, restore the site, perform this work safely, and complete the work in a cost effective manner. The selection of the updated, preferred decommissioning alternative is influenced by a number of factors. These factors include the cost of each decommissioning alternative, minimization of occupational radiation exposure, availability of a high-level waste (spent fuel) repository or a Department of Energy (DOE) interim storage facility, regulatory requirements, OPPD's selection of a decommissioning partner and public concerns. In

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addition, 10 CFR 50.82(a)(3) requires decommissioning to be completed within 60 years of permanent cessation of operations.

Under the DECON methodology, the facility is maintained in a safe and stable condition followed by decontamination and dismantlement. The facility will be decontaminated and dismantled to levels that permit license termination. In accordance with 10 CFR 50.82(a)(9), a license termination plan will be developed and submitted for NRC approval at least two years prior to termination of the license.

The decommissioning approach for FCS is described in the following sections.

- Section 2.0 describes the planned decommissioning activities and the general timing of their implementation.
- Section 3.0 describes the overall decommissioning schedule, including the spent fuel management activities.
- Section 4.0 provides an analysis of expected decommissioning costs, including the costs associated with spent fuel management and site restoration.
- Section 5.0 describes the basis for concluding that the environmental impacts associated with decommissioning FCS are bounded by the NRC generic environmental impact statement related to decommissioning.
- Section 6.0 is a list of references.

2.0 DESCRIPTION OF PLANNED DECOMMISSIONING ACTIVITIES

OPPD is currently planning to decommission FCS using a DECON method. DECON is broadly defined in Section 1.3 of this report. This method still requires the management of spent fuel because of the DOE's failure to perform its spent fuel removal obligations under its contract with OPPD. To explain the basis for projecting the cost of managing spent nuclear fuel (SNF), a discussion of spent fuel management activities for the site is included herein.

The initial decommissioning activities to be performed after plant shutdown entailed de-fueling the reactor and transferring the fuel into the spent fuel pool; draining of fluids and de-energizing systems; reconfiguring the electrical distribution, ventilation, heating, and fire protection systems; and minor deconstruction activities. Systems temporarily needed for continued operation of the spent fuel pool may be reconfigured for operational efficiency.

Staffing and configuration requirements are expected to change during the period of DECON, principally dependent upon the work being performed and the status of the spent fuel being stored on-site. This can be characterized as one of two spent fuel conditions, as follows:

- Wet and dry storage of spent fuel
- On-site dry storage of all spent fuel

Spent fuel has remained in the spent fuel pool (SFP) meeting the criteria for transfer, and the spent fuel is being transferred in an efficient manner to the Independent Spent Fuel Storage Installation (ISFSI). After all fuel is transferred to the ISFSI, the pool and supporting systems will be in a drained and de-energized condition. The spent fuel will be stored in the ISFSI until transfer to the Department of Energy (DOE). Dismantling and Decontamination (D&D) activities are scheduled to commence to enable the

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license to be terminated following transfer of the spent fuel to the ISFSI. Following completion of the D&D activities and termination of the NRC license, site restoration will be performed, to a to-be-determined condition, such that the site may be re-used for beneficial purposes. For the purposes of a current decommissioning cost estimate, it is assumed that remaining structures are to be demolished to three-feet below grade and the excavations backfilled with suitable material and erosion controls emplaced.

Decommissioning activities will be performed in accordance with written, reviewed and approved site procedures. There are no identified or anticipated decommissioning activities that are unique to the FCS site outside the bounds considered in the GEIS.

Radiological and environmental programs will be maintained throughout the decommissioning process to ensure occupational, public health and safety, and environmental compliance. Radiological programs will be conducted in accordance with the facility's revised Technical Specifications, Operating License, Decommissioning Safety Analysis Report (DSAR), Radiological Environmental Monitoring Program, and the Offsite Dose Calculation Manual. Non-radiological Environmental Programs will be conducted in accordance with applicable requirements and permits.

Tables 2-1 and 2-2 provide summaries of the schedule / plant status and costs for decommissioning FCS. The major decommissioning activities and the general sequence of activities are discussed in more detail in the sections that follow.

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Table 2.1

Decommissioning Schedule and Plant Status Summary

Decommissioning Activities / Plant Status	Start	End	Approximate Duration (years)
Pre-Shutdown Planning	2016	Oct 2016	-----
Transition from Operations			
Plant Shutdown	24 Oct 2016	-----	-----
Preparations for SAFSTOR Dormancy	24 Oct 2016	01 Jul 2018	1.68
Spent Fuel Operations			
Wet Storage/Pool to Pad Operations	2018	2020	2.5
Dry Fuel Storage	2020	2058	37.5
Decommissioning Preparations			
Preparations for D&D	2019	2020	1.75
Dismantling & Decontamination			
Large Component & Rad Systems Removal	2022	2023	1.5
Rad Building Decontamination & Demolition	2023	2025	2.75
License Termination	2025	2026	0.5
Site Restoration			
Site Restoration	2025	2026	1
ISFSI Site Restoration	2057	2059	2
Total from Shutdown to Completion of License Termination	24 Oct 2016	31 Oct 2059	43

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Table 2.2
Decommissioning Cost Summary

Period	Item Description	Estimated Cost	Contingency	Total
	1a Total - SAFSTOR & Transition (Completed)		-	-
	1b Total - Spent Fuel Transfer to ISFSI	50,465	5,046	55,511
	Period 1 Total - Transition through SNF Transfer to ISFSI	50,465	5,046	55,511
	2a Total - Decommissioning Planning & Preparations	19,468	1,947	21,415
	2b Total - Rad Decommissioning & License Termination	312,367	39,524	351,891
	2c Total - License Termination Undistributed Costs	315,843	31,584	347,427
	Period 2 Total - License Termination	647,678	73,055	720,733
	3a Total - Clean Demolition & Site Restoration	28,052	2,805	30,857
	3b Total - Site Restoration Undistributed Costs	12,769	1,277	14,046
	Period 3 Total - Site Restoration	40,821	4,082	44,903
	4a Total - Spent Fuel Dry Storage	260,402	28,426	288,828
	4b Total - Spent Fuel & GTCC Transfer to DOE	12,700	1,905	14,605
	Period 4 Total - SNF/GTCC Dry Storage & Transfer to DOE	273,102	30,331	303,433
	5a Total - ISFSI Demolition & Site Restoration	3,111	467	3,578
	5b Total - ISFSI Decommissioning Undistributed Costs	848	85	933
	Period 5 Total - ISFSI Decommissioning	3,959	551	4,511
	Grand Total	1,016,025	113,066	1,129,091

^[a] Columns may not add due to rounding

2.1 Discussion of Decommissioning Activities

The following narrative describes the basic activities associated with decommissioning the FCS. The site specific DCE (detailed in Attachment 1) is divided into phases or periods based upon major milestones within the project or significant changes in the annual projected expenditures. The following sub-sections correspond to the five major decommissioning periods within the estimate.

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2.1.1 Transition through SNF Transfer to ISFSI

The NRC defines DECON as, “A method of decommissioning, in which structures, systems, and components that contain radioactive contamination are removed from a site and safely disposed at a commercially operated low-level waste disposal facility, or decontaminated to a level that permits the site to be released for unrestricted use shortly after it ceases operation.” The facility is left intact (during the dormancy period), with structures maintained in a stable condition. Systems that are not required to support the spent fuel, HVAC, Emergency Plan or site security are drained, de-energized, and secured. Some cleaning/removal of loose contamination and or fixation and sealing of remaining contamination is performed. Access to contaminated areas is maintained secure to provide controlled access for inspection and maintenance.

The process of placing the plant in DECON will include, but is not limited to, the following activities:

- Creation of an organizational structure to support the decommissioning plan and evolving emergency planning and site security requirements.
- Revision of technical specifications, plans and operating procedures appropriate to the operating conditions and requirements.
- Characterization of the facility and major components as may be necessary to plan and prepare for the dormancy phase.
- Management of the spent fuel pool and reconfiguring fuel pool support systems so that draining and de-energizing may commence in other areas of the plant.
- Deactivation (de-energizing and or draining) of systems that are no longer required during the dormancy period.
- Processing and disposal of water and water filter and treatment media not required to support dormancy operation.
- Disposition of incidental waste that may be present prior to the start of the dormancy period, such as excess tools and equipment and waste produced while deactivating systems and preparing the facility for dormancy.
- Reconfiguration of power, lighting, heating, ventilation, fire protection, and any other services needed to decontamination and decommissioning activities as well as periodic plant surveillance and maintenance.
- Stabilization by fixing or removing loose incidental surface contamination to facilitate future building access and plant maintenance. Decontamination of high-dose areas is anticipated.
- Performance of interim radiation surveys of the plant, posting caution signs and establishing access requirements, where appropriate.
- Maintenance of appropriate barriers for contaminated and radiation areas.
- Reconfiguration of security boundaries and surveillance systems, as needed to support efficiency during the dormancy period.

Early activities include operating and maintaining the spent fuel pool and its associated systems, and transferring spent fuel from the pool to the ISFSI. Spent fuel transfer is expected to be

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complete by the end of 2020. After the fuel transfer is completed, the spent fuel pool and systems will be drained and de-energized.

Activities throughout this period will include a 24-hour security force, preventive and corrective maintenance on security systems, area lighting, general building maintenance, freeze protection heating, ventilation of buildings for periodic habitability, routine radiological inspections of contaminated structures, maintenance of structural integrity, and a site environmental and radiation monitoring program.

Security during this period will be conducted primarily to safeguard the spent fuel on site and prevent unauthorized entry. A security barrier, sensors, alarms, and other surveillance equipment will be maintained as required to provide security.

An environmental surveillance program will be carried out during this period to monitor for radioactive material in the environment. Appropriate procedures will be established and initiated for potential releases that exceed prescribed limits. The environmental surveillance program will consist of a version of the program in effect during normal plant operations that will be modified to reflect the plant's conditions and risks at the time.

Later activities will include transferring the spent fuel from the ISFSI to the DOE. For planning purposes, OPPD's current spent fuel management plan for the Fort Calhoun spent fuel is based, in general, upon the following projections: 1) a 2030 start date for the DOE initiating transfer of commercial spent fuel to a federal facility, 2) a 2058 completion date for removal of all Fort Calhoun spent fuel from the site. It is acknowledged that the plant owner will seek the most expeditious means of removing fuel from the site when DOE commences performance. The ISFSI pad and associated facilities will be decommissioned along with the power block structures during the deferred decontamination and dismantling phases.

2.1.2 License Termination (Dismantling & Decontamination)

Prior to the commencement of major decommissioning operations, preparations will be undertaken to prime the site for decommissioning. Preparations include engineering and planning, a full site characterization, and the continued use of a decommissioning management organization. This includes the development of work plans, specifications and procedures.

Following the preparations for decommissioning, physical decommissioning activities will take place. This includes the removal and disposal of contaminated and activated components and structures, leading to the termination of the 10 CFR 50 operating license. Although much of the radioactivity will decrease during the dormancy period due to decay of ^{60}Co and other short-lived radionuclides, the internal components of the reactor vessel will still exhibit radiation dose rates that will likely require remote sectioning under water due to the presence of long-lived radionuclides such as ^{94}Nb , ^{59}Ni , and ^{63}Ni . Portions of the biological shield wall may also be radioactive due to the presence of activated trace elements with longer half-lives (such as ^{152}Eu and ^{154}Eu). It is assumed that radioactive contamination on structures, systems, and component surfaces will not have decayed to levels that will permit unrestricted release. These surfaces will be surveyed and items dispositioned in accordance with the existing radioactive release criteria.

Significant decommissioning activities in this phase include:

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- Reconfiguration and modification of site structures and facilities, as needed, to support decommissioning operations. Modifications may also be required to the reactor or other buildings to facilitate movement of equipment and materials, support the segmentation of the reactor vessel and reactor vessel internals, and for large component removal.
- Design and fabrication of temporary and longer-term shielding to support removal and transportation activities, construction of contamination control envelopes, and the procurement of specialty tooling.
- Procurement or leasing of shipping cask, cask liners, and industrial packages for the disposition of low-level radioactive waste.
- Decontamination or removal of components and piping systems, as required, to control (minimize) worker exposure.
- Removal of piping and components no longer essential to support decommissioning operations.
- Removal of control rod drive housings and the head service structure from reactor vessel head. Segmentation and disposal of the vessel closure head.
- Removal and segmentation of the upper internals assemblies. Segmentation will maximize the loading of the shielded transport casks, i.e., by weight and activity. The operations are conducted under water using remotely operated tooling and contamination controls.
- Disassembly and segmentation of the remaining reactor internals, including the lower core support assembly. Some material is expected to exceed Class C disposal requirements. As such, some material will be packaged into containers similar to spent fuel canisters.
- Segmentation of the reactor vessel. A shielded platform is installed for segmentation as cutting operations are performed in-air using remotely operated equipment within a contamination control envelope. Segments are transferred in-air to containers for transfer and disposal.
- Removal of the activated portions of the concrete biological shield and accessible contaminated concrete surfaces. If dictated by the steam generator and pressurizer removal scenarios, those portions of the associated cubicles necessary for access and component extraction are removed.
- Removal of the steam generators and pressurizer for material recovery and controlled disposal. It is expected the upper portion of the steam domes will be removed and some of the internal components segregated for recycling. The generators will later be moved to an on-site processing center and the lower shell and tube bundle will be packaged for direct disposal. These components can serve as their own burial containers provided that all penetrations are properly sealed and the internal contaminants are stabilized, e.g., with grout.
- Remediation of contaminated surface soil or sub-surface media will be performed as necessary to meet the unrestricted use criteria in 10 CFR 20.1402.
- Underground piping (or similar items) and associated soil will be removed as necessary to meet license termination criteria.

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At least two years prior to the anticipated date of license termination, a License Termination Plan (LTP) will be submitted to the NRC. That plan will include: a site characterization, description of the remaining dismantling / removal activities, plans for remediation of remaining radioactive materials, developed site-specific Derived Concentration Guideline Levels, plans for the final status (radiation) survey (FSS), designation of the end use of the site, an updated cost estimate to complete the decommissioning, and associated environmental concerns.

The FSS plan will identify the radiological surveys to be performed once the decontamination activities are completed and will be developed using the guidance provided in the “Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM).” This document incorporates statistical approaches to survey design and data evaluation. It also identifies commercially available instrumentation and procedures for conducting radiological surveys. Use of this guidance ensures that the surveys are conducted in a manner that provides a high degree of confidence that applicable NRC criteria are satisfied. Once the FSS is complete, the results will be submitted to the NRC, along with a request for termination of the NRC license.

OPPD has already released some unaffected portions of the site on a partial site release basis, and may release more as they become available, before all site decommissioning work has been completed.

2.1.3 Site Restoration

After the NRC terminates the license, site restoration activities will be performed, at the licensee’s discretion. OPPD currently assumes that remaining structures will be removed to a nominal depth of three feet below the surrounding grade level. Affected area(s) would then be backfilled with suitable fill materials, graded, and appropriate erosion controls established.

Non-contaminated concrete rubble produced by the demolition activities may be used for backfilling subsurface voids or may be transported to an offsite area for appropriate disposal as construction debris.

2.1.4 SNF/GTCC Dry Storage & Transfer to DOE

Concurrent to site restoration activities, SNF/GTCC will remain in dry storage at the ISFSI until it is accepted by the Department of Energy (DOE) and transfers it to an off-site facility.

2.1.5 ISFSI Decommissioning

Following transfer of the SNF/GTCC to the DOE the following activities will occur:

- Decontamination of Storage Modules
- Final Status Survey of ISFSI
- Demolition of the Clean HSM’s, ISFSI Pad and ISFSI Support Structures
- Restoration of ISFSI Site
- Preparation of Final Report in ISFSI Decommissioning and NRC Review

2.2 General Decommissioning Considerations

2.2.1 Major Decommissioning Activities

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As defined in 10 CFR 50.2, “definitions,” a “major decommissioning activity” is “any activity that results in permanent removal of major radioactive components, permanently modifies the structure of the containment, or results in dismantling components for shipment containing greater than class C waste in accordance with § 61.55.” The following discussion provides a summary of the major decommissioning activities currently planned for decommissioning of the FCS. These activities are envisioned to occur in the Dismantling and Decontamination Period. The schedule may be modified as conditions dictate.

Prior to starting a major decommissioning activity, the affected components will be surveyed and decontaminated, as required, in order to minimize worker exposure, and a plan will be developed for the activity. Shipping casks and other equipment necessary to conduct major decommissioning activities will be procured.

The initial major decommissioning activity inside the containment building will be the removal, packaging, and disposal of systems and components attached to the reactor, to provide access, support removal, and RV/RVI segmentation. The reactor vessel internals will be removed from the reactor vessel and segmented, if necessary, for packaging, transport and disposal, or to separate greater than Class C (GTCC) waste. Internals classified as GTCC waste will be segmented and packaged into containers similar to spent fuel canisters for transfer to a high-level waste repository. Removal of the reactor vessel follows the removal of the reactor internals. Industry experience indicates that there may be several options available for the removal and disposal of the reactor vessel (i.e., segmentation or disposal as an intact package). The viability of these options will be analyzed as a part of future planning and preparation activities. If segmented, it is likely that the work would be performed remotely in-air, using a contamination control envelope.

Other major decommissioning activities that would be conducted include the removal and disposal of the steam generators, pressurizer, turbine, condenser, main steam piping, feed water piping, pumps and heaters, spent fuel pool support equipment, and neutron activated / contaminated concrete materials.

Other Decommissioning Activities

In addition to the reactor and large components discussed above, all other plant components will be removed from the Reactor, Turbine, Auxiliary and associated support buildings, radiologically surveyed and dispositioned appropriately.

2.2.2 Decontamination and Dismantlement Activities

The overall objective of D&D is to ensure that radioactively contaminated or activated materials will be removed from the site to allow the site to be released for unrestricted use. This may be accomplished by decontamination in place, off-site processing of the materials, or direct disposal of the materials as radioactive waste. A combination of these methods may be utilized. The methods deemed most appropriate will be chosen those for the particular circumstances.

Low-level radioactive waste will be managed in accordance with approved procedures and commercial disposal facility requirements. This includes characterizing contaminated materials,

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packaging, transporting and disposal at a licensed low-level radioactive waste (LLRW) disposal facility.

2.2.3 Radioactive Waste Management

A major component of the decommissioning work scope for the Fort Calhoun station is the packaging, transportation and disposing of primarily contaminated / activated equipment, piping, concrete, and if encountered, soil. A waste management plan will be developed to incorporate the most cost effective disposal strategy, consistent with regulatory requirements and disposal / processing options for each waste type at the time of the D&D activities. Decommissioning wastes from FCS may be disposed of at the Waste Control Specialists site in Andrews County, Texas and or *EnergySolutions* site in Clive, Utah. If other licensed disposal facilities become available in the future, OPPD may elect to use them. Radioactive wastes from Fort Calhoun will be transported by licensed transporters. The waste management plan will be based on the evaluation of available methods and strategies for processing, packaging, and transporting radioactive waste in conjunction with the available disposal facility options and associated waste acceptance criteria.

2.2.4 Removal of Mixed Wastes

If mixed wastes are generated they will be managed in accordance with applicable Federal and State regulations. If generated, mixed wastes from will be transported by authorized and licensed transporters and shipped to authorized and licensed facilities. If technology, resources, and approved processes are available, the processes will be evaluated to render the mixed waste non-hazardous.

2.2.5 Site Characterization

During the decommissioning process, complete site characterization will be performed in which radiological, regulated, and hazardous wastes will be identified, categorized, and quantified. Surveys will be conducted to establish the contamination and radiation levels throughout the plant. This information will be used in developing procedures to ensure that hazardous, regulated, and radiologically contaminated areas are remediated and to ensure that worker exposure is controlled. As decontamination and dismantlement work proceeds, surveys will be conducted to maintain a current site characterization and to ensure that decommissioning activities are adjusted accordingly.

As part of the site characterization process, a neutron activation analysis calculation study of the reactor internals and the reactor vessel was performed. Using the results of this analysis (along with benchmarking surveys), neutron irradiated components were classified (projected for the future D&D time-frame) in accordance with 10 CFR 61, "Licensing requirements for land disposal of radioactive waste." The results of the analysis form the basis of the plans for removal, segmentation, packaging and disposal.

2.2.6 Groundwater Protection and Radiological Decommissioning Records Program

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A groundwater (GW) protection program currently exists at Fort Calhoun in accordance with the Nuclear Energy Institute (NEI) Technical Report 07-07, "Industry Groundwater Protection Initiative - Final Guidance Document." This program is directed by procedures and will continue during decommissioning.

OPPD will also continue to maintain the existing radiological decommissioning records program required by 10 CFR 50.75(g). The program is directed by procedures.

Neither the monitoring results of the groundwater protection program nor events noted in 10 CFR 50.75(g) indicate the presence of long-lived radionuclides in sufficient concentrations to preclude unrestricted release under 10 CFR 20.1402, "Radiological criteria for unrestricted use".

2.2.7 Changes to Management and Staffing

Throughout the decommissioning process, plant management and staffing levels will be adjusted to reflect the ongoing transition of the site organization. Staffing levels and qualifications of personnel used to monitor and maintain the plant during the various periods after plant shutdown will be subject to appropriate Technical Specification and Emergency Plan requirements. These staffing levels do not include contractor staffing which may be used to carry out the future fuel movements, plant modifications in preparation for DECON, and the D&D / license termination / site restoration work. Contractors may also be used to provide general services, staff augmentation or replace permanent staff. The monitoring and maintenance staff will be comprised of radiation protection, radiological environmental monitoring program, plant engineering and craft workers, as appropriate for the anticipated work activities.

3.0 SCHEDULE OF PLANNED DECOMMISSIONING ACTIVITIES

OPPD intends to pursue the decommissioning of Fort Calhoun utilizing a DECON methodology and will make appropriate filings with the NRC. The DECON method involves removal of radioactively contaminated or activated material from the site. Work activities associated with the planning and preparation period began before the plant was permanently shut down and will continue into 2020. The schedule of spent fuel management and major decommissioning activities is provided in Table 2-1. Additional detail is provided in Appendix B of the DCE.

The schedule accounts for spent fuel being stored in the ISFSI until the assumed date of transfer to the DOE.

4.0 ESTIMATE OF EXPECTED DECOMMISSIONING AND SPENT FUEL MANAGEMENT COSTS

10 CFR 50.82(a)(4)(i) requires the submission of a PSDAR within two years following permanent cessation of operations that contains a site-specific DCE, including the projected cost of managing irradiated fuel.

EnergySolutions has prepared an updated site-specific decommissioning cost analysis for FCS, which also provides projected costs of managing spent fuel, as well as non-radiological decommissioning and site restoration costs, accounted for separately. The site-specific DCE is provided in Attachment 1 and fulfills

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the requirements of 10 CFR 50.82(a)(4)(i) and 10 CFR 50.82(a)(8)(iii). A summary of the site-specific DCE, including the projected cost of managing spent fuel is provided in Table 2-2.

The methodology used by *EnergySolutions* to develop the site-specific DCE follows the basic approach originally advanced by the Atomic Industrial Forum (AIF) in its program to develop a standardized model for decommissioning cost estimates. The results of this program were published as AIF/NESP-036, "A Guideline for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," (Reference 5). The AIF document presents a unit cost factor method for estimating direct activity costs, simplifying the estimating process. The unit cost factors used in the study reflect the latest available data, at the time of the study, concerning worker productivity during decommissioning.

Under NRC regulations (10 CFR 50.82(a)(8)), a licensee must provide reasonable assurance that funds will be available (or "financial assurance") for decommissioning (i.e., license termination) costs. The regulations also describe the acceptable methods a licensee can use to demonstrate financial assurance. Most licensees do this by funding a nuclear decommissioning trust (NDT). Nebraska State Statutes provides the regulatory authority that allows OPPD's Board of Directors to establish the inflation rates and earning rates of OPPD.

OPPD maintains two separate trust accounts for this purpose, one for the License Termination Expenditures (NRC minimum decommissioning amount) and another for the Spent Fuel Management and Site Restoration Expenditures. The trustee for both trust funds is First National Bank of Omaha. As of December 31, 2018, the balance in the fund for the NRC minimum decommissioning amount was \$295,783,000 and the balance in the funds accumulated for other decommissioning costs was \$170,173,000.

The two trust funds are currently not commingled and the funds accumulated for the additional decommissioning cost are not included as funds for the NRC minimum decommissioning amount. The funds accumulated for the additional decommissioning costs including additional radiological, site restoration and spent fuel management are available for radiological decommissioning without prior approval by a State regulatory authority and are not subject to disapproval for radiological decommissioning by a State regulatory authority.

10 CFR 50.82(a)(6)(iii) states that, "Licensees shall not perform any decommissioning activities," as defined in 10 CFR 50.2 that, "Result in there no longer being reasonable assurance that adequate funds will be available for decommissioning." OPPD does not intend to perform any decommissioning activities that would jeopardize the availability of adequate funds for the completion of decommissioning.

10 CFR 50.82(a)(8)(iv) states that, "For decommissioning activities that delay completion of decommissioning by including a period of storage or surveillance, the licensee shall provide a means of adjusting cost estimates and associated funding levels over the storage or surveillance period."

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4.1 Means of Adjusting Cost Estimates

Costs are inflated using a blending of the IHS Global Insight's forecasts for Consumer Price Index, All-Urban and Employment Cost Index, Total Private Compensation. The indices are blended based on the ratio of labor and all other costs to the total DCE. For the years beyond the available forecast, the final forecast rate available is held constant for the duration of the analysis.

Consistent with Regulatory Guide 1.159 (Reference 6), OPPD will update the FCS DCE as required. In calculating projected earnings, OPPD uses the IHS Global Insight's forecast for the yield on 5-year Treasury Notes which is within a two percent (2%) annual real rate of return.

4.2 Means of Adjusting Associated Funding Levels

In the event that additional financial assurance beyond the amounts contained in the remaining trust fund for FCS is required pursuant to NRC regulations to complete radiological decommissioning and spent fuel management at FCS, OPPD will augment the NDTs with annual contributions to the NDTs.

As conditions may change, OPPD will adjust the funding, as appropriate, using alternative funding mechanisms acceptable to the NRC.

5.0 ENVIRONMENTAL IMPACTS

OPPD has concluded that the environmental impacts associated with planned FCS site-specific decommissioning activities are less than and bounded by the previously issued environmental impact statements and updated environmental supplement. 10 CFR 50.82(a)(4)(i) requires that the PSDAR include, "...a discussion that provides the reasons for concluding that the environmental impacts associated with site-specific decommissioning activities will be bounded by appropriate previously issued environmental impact statements." The following discussion provides the reasons for reaching this conclusion and is based on two previously issued environmental impact statements and updated environmental supplement:

NUREG-0586, Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors (Reference 4) (Referred to as the GEIS).

NUREG-1496, Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities (Reference 7).

File 127690-003, Updated Environmental Report for Fort Calhoun Station (Reference 17).

In evaluating whether the impacts in these previously issued environmental impact statements and updated environmental supplement are bounding, information from NUREG-1437, Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Supplement 12, Regarding Fort Calhoun Station, (Reference 8) was also considered (herein referred to as the SEIS).

5.1 Environmental Impact of FCS Decommissioning

The following is a summary of the reasons for reaching the conclusion that the environmental impacts of decommissioning Fort Calhoun Station (FCS) are bounded by the GEIS and the environmental supplement. Each environmental impact standard in the GEIS is listed along with a summary as to why

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OPPD concludes the GEIS analysis bounds the impacts of FCS decommissioning on that standard. Information that has changed (e.g., socioeconomics) or been updated (e.g., threatened and endangered species) has discussions as to why the original GEIS is still bounding inclusive of the new information. As a general matter, FCS is smaller than the reference pressurized water reactor used in the GEIS to evaluate the environmental impacts of decommissioning, and is therefore bounded by those assessments. Further, no unique site-specific features or unique aspects of the planned decommissioning have been identified.

5.1.1 Onsite/Offsite Land Use

FCS has sufficient area onsite that has been previously disturbed (due to construction or operations activities) for use during decommissioning. Any construction activities that would disturb one acre or greater of soil would require a stormwater permit from the Nebraska Department of Environment and Energy (NDEE, formerly Nebraska Department of Environmental Quality, NDEQ) prior to proceeding with the activity. The stormwater permit would contain best management practices (BMPs) to control sediment and erosion effect on water courses and wetlands. Section 4.3.1 of the GEIS concluded that the impacts on land use are not detectable or small for facilities having only onsite land use changes as a result of large component removal, structure dismantlement, and low-level waste packaging and storage. Currently, FCS will be able to conduct most of these decommissioning activities on previously disturbed land.

Based on the GEIS, the experience of plants that are being decommissioned has not included any needs for additional land offsite. Consistent with this determination, OPPD does not anticipate any changes in land use beyond the site boundary during decommissioning. Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on onsite/offsite land use are bounded by the GEIS.

5.1.2 Water Use

After plant shutdown, the operational demand for cooling water and makeup water has dramatically decreased. Additionally, after the plant is defueled, the amount of water used by the service water system will be much less than during normal operation of the plant. The need for cooling water will continue to decrease as the heat load of spent fuel in the spent fuel pool declines due to radioactive decay and as spent fuel is relocated from the spent fuel pool to the ISFSI. During plant shutdown, the use of potable water will decrease commensurate with the expected decrease in plant staffing levels. For these reasons, Section 4.3.2 of the GEIS concluded that water use at decommissioning nuclear reactor facilities is significantly smaller than water use during operation.

The GEIS also concluded that water use during the decontamination and dismantlement phase will be greater. However, there are no unique aspects associated with the decommissioning of FCS and water use for such activities as flushing piping, dust abatement, etc. Consequently, FCS water use impacts were addressed by the evaluation of the reference facility in the GEIS.

Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on water use are bounded by the GEIS.

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5.1.3 Water Quality

OPPD has chosen to decommission FCS using the DECON method which includes the prompt removal of all equipment, structures, and portions of the facility and site that contain radioactive contaminants and completion of D&D activities. Regulatory mandated programs and processes designed to minimize, detect, and contain spills will be maintained throughout the decommissioning process. OPPD will maintain all federal, state, and local permits pertaining to water quality throughout decommissioning activities and will obtain additional construction and NPDES permits to avoid and/or minimize impacts to water quality. FCS will also continue to receive potable water from the city of Blair throughout decommissioning and for the several buildings left onsite. In addition to the National Pollutant Discharge Elimination System (NPDES) permit, which regulates surface water discharges from the site (Reference 9), the permits that follow remain in place:

- General NPDES Permit Number NER910000 for Stormwater Discharges from Industrial Activity to Waters of the State of Nebraska (Reference 10).
- General NPDES Permit Number NEG671000, A General NPDES Permit Authorizing Dewatering Discharges (References 11).

Once decommissioning is complete, the above NPDES permits for Industrial Activity discharge will be terminated, as applicable. Industrial water discharge will cease and approximately 96 acres of developed land will be restored back to native grassland or repurposed for industrial or commercial use. Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on water quality are bounded by the GEIS. With the native grassland, the decommissioning of FCS will have a positive impact on water quality once complete.

5.1.4 Air Quality

Air Quality Construction Permit (CP07-0063) was issued by the NDEE and regulates air emission sources at FCS (Reference 12). This permit will remain in place during decommissioning. If new sources of air emissions are added or changed at the facility to support this process, the certificate will be modified as required. As new regulations are issued that impact these sources, these requirements will be addressed at the station. In addition, there are various other air quality regulations that will govern activities involving hazardous air pollutants and indoor air quality.

There are many types of decommissioning activities listed in the Section 4.3.4 of the GEIS that have the potential to affect air quality. For those activities applicable to the DECON option, OPPD does not anticipate any activities beyond those listed in the GEIS that could potentially affect air quality. In addition, federal, state and local regulations pertaining to air quality will remain in effect to regulate emissions associated with fugitive dust; criteria air pollutants, hazardous air pollutants, and ozone-depleting gases. Decommissioning activities will continue to be monitored by the ODCM which sets limits on doses caused by effluents, based upon ALARA (as low as reasonably achievable) objectives of 10 CFR 50.34a, 10 CFR 50.36a, and Section IV.B.1 of Appendix I to 10 CFR 50. These effluents are reported annually to the NRC. Therefore, based

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on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on air quality are bounded by the GEIS.

5.1.5 Aquatic Ecology

Aquatic ecology encompasses the plants and animals in the Missouri River and wetlands near FCS. Aquatic ecology also includes the interaction of those organisms with each other and the environment. Section 4.3.5 of the GEIS evaluates both the direct and indirect impacts from decommissioning on aquatic ecology.

Direct impacts can result from activities such as the removal of shoreline structures or the active dredging of canals. FCS's shoreline structures are similar to the plants listed in Table E-2 of the GEIS, and there are no apparent discriminators based on the salient characteristics (size and location) listed in Table E-5 of the GEIS. Removal of the intake and discharge facilities as well as other shoreline structures will be conducted in accordance with BMPs outlined in permits issued by the ~~and if necessary,~~ the U. S. Army Corps of Engineers. Intake structure dredging will be greatly reduced due to the diminished residual heat removal requirements, and the relocation of the spent fuel to the ISFSI.

As previously discussed in Section 5.1.2, the amount of cooling water withdrawn from the Missouri River will significantly decrease thus reducing the potential impacts from impingement and entrainment of aquatic species. Additionally, any significant potential for sediment runoff or erosion on disturbed areas will be controlled in accordance with BMPs outlined in the stormwater permit. OPPD anticipates minimal disturbance of lands beyond the current operational areas of the plant, so there should be minimal, if any, new impacts to aquatic ecology from runoff associated with land disturbance activities.

OPPD will consult with regulatory and resource agencies to obtain permits and plan activities to minimize duration and extent of any impacts. Impacts to aquatic ecology would be limited to those areas previously disturbed during construction and operation, and there areas would be expected to recolonize as they did following initial construction. Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on aquatic ecology are limited and bounded based on the GEIS.

5.1.6 Terrestrial Ecology

Terrestrial ecology considers the plants and animals in the vicinity of FCS as well as the interaction of those organisms with each other and the environment. Evaluations of impacts to terrestrial ecology are usually directed at important habitats and species, including plant and animals that are important to industry, recreational activities, the area ecosystems, and those protected by endangered species regulations and legislation. Section 4.3.6 of the GEIS evaluates the potential impacts from both direct and indirect disturbance of terrestrial ecology.

Direct impacts can result from activities such as clearing native vegetation or filling a wetland. OPPD anticipates minimal disturbance of habitat beyond the operational areas of the plant. All dismantlement, demolition, and waste staging activities are envisioned to be conducted within

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the operational area of the site. Also, the NDEE controls significant impacts to the environment through regulation of construction activities.

Indirect impacts may result from effects such as erosional runoff, dust or noise. Any construction activities that would disturb one acre or greater of soil would require a stormwater permit from the NDEE prior to proceeding with the activity. The stormwater permit would contain BMPs to control sediment and the effects of erosion associated with the construction activity. Fugitive dust emissions will be controlled through the judicious use of water spraying. The basis for concluding that the environmental impacts of noise are bounded by the GEIS is discussed in Section 5.1.16 below.

Section 4.3.6 of the GEIS concludes that if BMPs are used to control indirect disturbances and habitat disturbance is limited to operational areas, the potential impacts to terrestrial ecology are small. As discussed above, there are no unique disturbances to the terrestrial ecology anticipated during the decommissioning of FCS. Currently, FCS will be able to conduct all of these decommissioning activities on previously disturbed land. As required, the environmental impact will be reevaluated when activity is planned on previously undisturbed land. Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on terrestrial ecology are bounded by the GEIS.

5.1.7 Threatened and Endangered Species

There were thirteen (13) threatened and endangered species identified in the 2002 Environmental Report (Reference 18). In October 2018, a review for plant and wildlife species protected by the Nebraska Nongame and Endangered Species Act was requested by the Nebraska Game and Parks Commission (NGPC). The United States Department of Interior (UDSI) responded on 13 November 2018 (Reference 19) and identified five (5) state listed protected species (threatened or endangered) within the vicinity (3 miles) of the FCS. The only new species that was not listed in 2002 and that was identified in 2018 was the federal and state threatened northern long-eared bat (*Myotis septentrionalis*). The four (4) other species identified were three (3) fish species: the federal and state endangered pallid sturgeon (*Scaphirhynchus albus*), the state threatened lake sturgeon (*Acipenser fulvescens*), the state endangered sturgeon chub (*Macrhybopsis gelida*), and one (1) plant species: the state threatened American ginseng (*Panax quinquefolium*). A separate review was conducted in November 2018 per the federal Endangered Species Act with the U.S. Fish & Wildlife Service's (USFWS) online Information for Planning and Consultation (IPaC) system. The results of the IPaC identified five (5) protected species. Similar to the NGPC review, it identified the federal threatened northern long-eared bat, the endangered least tern (*Sterna antillarum*), the threatened piping plover (*Charadrius melodus*), the endangered pallid sturgeon, and the threatened western prairie fringed orchid (*Platanthera praeclara*). Bald eagle (*Haliaeetus leucocephalus*) was mentioned in the NGPC response and IPaC, but it is not state or federally listed. However, the bald eagle is still protected by the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act. In addition, both the NGPC response and the IPaC review identified eleven (11) bird species that are protected under the Migratory Bird Treaty Act.

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It was determined in the SEIS that due to channelization of the Missouri River and the removing of sandbars, both the least tern and piping plover are not likely to be found at FCS. The western prairie fringed orchid potentially occurs in Washington County based on historic observations. However, no populations are known to occur in the County, and the potential for occurrence on or near FCS is low given the lack of appropriate prairie habitat in these areas.

To assess the presence or absence of the northern long-eared bat, acoustical studies and mist net surveys were conducted in August 2018 in accordance with USFWS and NGPC Scientific and Education Permits and a report was generated (Reference 20). Two (2) acoustic sites were recorded within the riparian corridor along the Missouri River and nine (9) mist net nights were completed across nine (9) separate net location on the FCS property. A total of 856 acoustic files were recorded at the two (2) acoustic sites. Nine (9) species were recorded including eight (8) northern long-eared bat call sequences. The statistical analysis of the data supported the presence of six (6) species: big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), northern long-eared bat, evening bat (*Nycticeius humeralis*), and tri-colored bat (*Perimyotis subflavus*). Northern long-eared bat was confirmed at Site 1 by manual vetting. Nine complete net nights resulted in the capture of two eastern red bats: one adult male and one adult female. No federally listed species were captured.

Section 4.3.7 of the GEIS does not make a generic determination on the impact of decommissioning on threatened and endangered species. Rather it concludes that the adverse impacts and associated significance of the impacts must be determined on a site-specific basis.

With respect to the threatened and endangered aquatic species, the environmental impacts during decommissioning are expected to be minimal. Removal of the intake and discharge facilities as well as other shoreline structures will be conducted in accordance with BMPs outlined in permits issued by the NDEE and the U. S. Army Corps of Engineers. As previously discussed in Section 5.1.2, the amount of cooling water withdrawn from the Missouri River will significantly decrease thus reducing the potential impacts of impingement, entrainment, and thermal discharges on aquatic species. One potential adverse impact from the decrease in cooling water withdrawn may be the elimination of the thermal refuge for aquatic species in the discharge area which are preyed upon by the bald eagle in the winter months.

The environmental impacts during decommissioning are expected to be minimal on threatened and endangered terrestrial species. OPPD currently anticipates minimal disturbance of natural habitat beyond the operational areas of the plant for decommissioning and construction activities. Construction activities that disturb one acre or greater of soil necessitate permits by the NDEE and BMPs are required to be implemented to control sediment and the effects of erosion. Additionally, FCS has administrative controls in place which require that significant project activities undergo an environmental review prior to the activity occurring, which ensures that impacts are minimized through implementation of BMPs. Federal and state regulations pertaining to listed species will also remain in effect, which will further ensure that impacts to listed species and their habitats are minimized.

The Iowa Department of Natural Resources was not contacted as part of the updated environmental supplement because the decommissioning and construction activities including

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ground disturbance are not proposed in the state of Iowa; therefore, it is assumed that the decommissioning of FCS will not result in a significant adverse impact to Iowa protected threatened and endangered species.

Section 4.3.7 of the GEIS also suggests that care be exercised in conducting decommissioning activities after an extended period because there is a greater potential for rare species to colonize the disturbed portion of the site. However as previously discussed, administrative controls and federal and state regulations that will remain in effect would ensure that mitigation measures are implemented as appropriate to protect wildlife.

Based on the above, the planned decommissioning of FCS will not result in a direct mortality or otherwise jeopardize the local population of any threatened or endangered species. Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on threatened and endangered species are bounded by the GEIS.

5.1.8 Radiological

The GEIS considered radiological doses to workers and members of the public when evaluating the potential consequences of decommissioning activities.

Occupational Dose

The occupational radiation exposure to FCS plant personnel will be maintained As Low as Reasonably Achievable (ALARA) and below the occupational dose limits in 10 CFR Part 20 during decommissioning. The need for plant personnel to routinely enter radiological areas to conduct maintenance, calibration, inspection, and other activities associated with an operating plant has been reduced, thus the occupational dose to plant personnel has decreased since the plant is shutdown and defueled.

OPPD has elected to decommission FCS using the DECON alternative. It is expected that the occupational dose required to complete the decommissioning activities at FCS will be within the range of DECON dose estimates found in Section 4.3.8 of Supplement 1 to NUREG-0586 (Reference 4). This is based on the fact that FCS is bounded by the PWRs evaluated in the GEIS as previously discussed in Section 5.1, and because the ALARA program will be maintained to ensure that occupational dose is maintained ALARA and well within 10 CFR Part 20 limits.

Public Dose

Section 4.3.8 of the GEIS considered doses from liquid and gaseous effluents when evaluating the potential impacts of decommissioning activities on the public. Table G-15 of the GEIS compared effluent releases between operating facilities and decommissioning facilities and concluded that decommissioning releases are lower. The GEIS also concluded that the collective dose and the dose to the maximally exposed individual from decommissioning activities are expected to be well within the regulatory standards in 10 CFR Part 20 and Part 50.

The expected radiation dose to the public from FCS decommissioning activities will be maintained within regulatory limits and below comparable levels when the plant was operating through the continued application of radiation protection and contamination controls combined

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with the reduced source term available in the facility. Also Section 4.12.2 of the SEIS (Reference 8) concluded that there were no site-specific radiological dose aspects associated with decommissioning of FCS. Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on public dose are small and are bounded by the GEIS.

5.1.9 Radiological Accidents

The likelihood of a large offsite radiological release that impacts public health and safety while FCS is shut down and defueled is considerably lower than the likelihood of a release from the plant during power operation. This is because the majority of the potential releases associated with power operation are not relevant after the fuel has been removed from the reactor. Furthermore, handling of spent fuel assemblies will continue to be controlled under work procedures designed to minimize the likelihood and consequences of a fuel handling accident. In addition, emergency plans and procedures will remain in place to protect the health and safety of the public while the possibility of significant radiological releases exists.

Section 4.3.9 of the GEIS assessed the range of possible radiological accidents during decommissioning and separated them into two general categories; fuel related accidents and non-fuel related accidents. Fuel related accidents have the potential to be more severe and zirconium fire accidents, in particular, could produce offsite doses that exceed EPA's protective action guides (Reference 13). As part of its effort to develop generic, risk-informed requirements for decommissioning, the NRC staff performed analysis of the offsite radiological consequences of beyond-design-basis spent fuel pool accidents using fission product inventories at 30 and 90 days and 2, 5, and 10 years. The results of the study indicate that the risk at spent fuel pools is low and well within the Commission's Quantitative Health Objectives. The generic risk is low primarily due to the very low likelihood of a zirconium fire. (Reference 4)

The potential for decommissioning activities to result in radiological releases not involving spent fuel (i.e., releases related to decontamination, dismantlement, and waste handling activities) will be minimized by use of procedures designed to minimize the likelihood and consequences of such releases.

Therefore, OPPD concludes that the impacts of FCS decommissioning on radiological accidents are small and are bounded by the previously issued GEIS.

5.1.10 Occupational Issues

Occupational issues are related to human health and safety. Section 4.3.10 of the GEIS evaluates physical, chemical, ergonomic, and biological hazards. OPPD has reviewed these occupational hazards in the GEIS and concluded that the decommissioning approach chosen for FCS poses no unique hazards from what was evaluated in the GEIS. OPPD will continue to maintain appropriate administrative controls and requirements to ensure occupational hazards are minimized and that applicable federal, state and local occupational safety standards and requirements continue to be met. Therefore, OPPD concludes that the impacts of FCS decommissioning on occupational issues are bounded by the GEIS.

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5.1.11 Cost

Decommissioning costs for FCS are discussed in Section 4.0 and in Attachment 1 to this report. Section 4.3.11 of the GEIS recognizes that an evaluation of decommissioning cost is not a National Environmental Policy Act requirement. Therefore, a bounding analysis is not applicable.

5.1.12 Socioeconomics

FCS is in largely rural and agricultural Washington County, Nebraska. According to 2010 Census data, approximately 981,137 people live within 50 miles of the station in both Nebraska and Iowa. Of these, 442,242 live within 20 miles of the station (see Updated Environmental Supplement, Section 5.1.11.1, Reference 17). As FCS transitions from shutdown and into the different phases of decommissioning, an overall decrease in plant staff will occur. The lost wages of these plant staff may result in decreases in revenues available to support the local economy. Although FCS may have some effect on the region as a whole, the vast majority of FCS employees have resided in Washington, Douglas, and Sarpy Counties. Any effect on the local economy will be due to the approximately 400 jobs lost due to plant closure because FCS is a public utility and does not affect the local tax base. FCS employees may be expected to impact the economy the most in terms of real estate and consumer goods within the Counties where they live. Therefore, any effects of FCS's closure can be expected to be focused within these Counties. Although effects outside of the Counties are possible, if the effects within these Counties are negligible, it can be expected that effects in the surrounding areas are also negligible.

In general, the minority population numbers can be said to be relatively stable between 2014 and 2017 (Updated Environmental Supplement, Section 5.1.11.1.1, Reference 17). The changes that have occurred have been increases in minority population within the counties closest to FCS. These data demonstrate that the closing of FCS has not reduced minority populations. Due to the small size of the job losses and the lack of any effect on the tax base, there is no reason that minority populations should be affected.

Data from the 2000 and 2010 censuses and the 2012 – 2016 American Community Survey (ACS) 5-Year Estimates for Washington, Douglas, and Sarpy counties show that the poverty rates in Douglas, Sarpy, and Washington counties parallel a general trend of rising poverty in Nebraska as a whole. The rise in poverty has slowed somewhat due to the generally improved economy since 2010. According to the ACS 5-Year Estimates, there are a total of approximately 296,000 employed workers in Douglas County, 90,000 in Sarpy County, and 11,000 in Washington County. For the three counties together, losing 400 jobs would cause a loss of jobs of 0.1%. Therefore FCS closure should not have a significant adverse impact on the local economy in the years following closure. The similarity between the trajectory of the local and regional numbers demonstrates that, according to the most recent available data, no difference in rates of poverty can be attributed to the closure FCS.

Section 4.3.12 of the GEIS evaluated changes in workforce and population, changes in local tax revenues, and changes in public services. The evaluation also examined large plants located in rural areas that permanently shut down early and selected the DECON option. The GEIS determined that this situation is the likeliest to have negative impacts. While FCS is in a rural

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area, it is a small plant and has chosen DECON as the decommissioning option, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on socioeconomic impacts are bounded by the GEIS.

5.1.13 Environmental Justice

Executive Order 12898 dated February 16, 1994, makes achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health and environmental effects of its programs, policies, and activities on minority populations and low-income populations of the United States.

Based on 2010 census data, the minority population within a 20-mile radius comprises 21.2% of the total population, and within a 50-mile radius is 16.6% of the total population. Douglas County is composed of greater than 10% black and 10% Hispanic populations. Thurston County is composed of the Omaha and Winnebago reservations. Native Americans comprised 55% of Thurston County's population according to 2010 data. Earlier census data found three counties in Nebraska (Thurston, Burt, and Douglas) and one in Iowa (Pottawattamie) within the 50 mile region exceeded the NRC thresholds defining low-income populations.

Section 4.13.3 of the GEIS reviewed environmental justice decommissioning impacts related to land use, environmental and human health, and socioeconomics. OPPD does not anticipate any offsite land disturbances during decommissioning, thus the land use impacts are not applicable for FCS. In addition as previously discussed in Section 5.1.12, it was determined that socioeconomic impacts from decommissioning are bounded by the GEIS. Potential impacts to minority and low-income populations would mostly consist of radiological effects. Based on the radiological environmental monitoring program data from FCS, the SEIS determined that the radiation and radioactivity in the environmental media monitored around the plant have been well within applicable regulatory limits. As a result, the SEIS found that no disproportionately high and adverse human health impacts would be expected in special pathway receptor populations (i.e., minority and or low income populations) in the region as a result of subsistence consumption of water, local food, fish, and wildlife.

Therefore, based on the updated environmental report, OPPD concludes that the impacts of FSC decommissioning on environmental justice are small and are bounded by the SEIS.

5.1.14 Cultural, Historic and Archeological Resources

Based on a review of the FCS property through the Nebraska State Historic Preservation Office (NSHPO) files and information provided by the applicant, the NRC concluded in Section 4.4.5 of the SEIS (Reference 8) that the potential impacts from decommissioning of FCS on historic and archaeological resources would be small. The NRC identified the section of the plant site that lies north of the rail spur and is bounded on the west by U.S. Highway 75 as having Moderate to-High Potential. It contains remnants of the former town of Desoto, a historic property that is potentially eligible for listing on the National Register of Historic Places. Based on the impacts of past construction activities, the plant site being situated on floodplain alluvium, and having been developed since 1850, the section of the site that lies south of the current Union Pacific rail spur should be categorized as having No Potential for cultural resources, either prehistoric or historic.

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Environmental review procedures have been put in place at FCS regarding undertakings that involve land disturbing activities in undisturbed surface and subsurface areas. These environmental protection procedures include contacting the SHPO to establish the actions necessary to protect known or as of yet undiscovered cultural resources before an action is allowed to occur. The cultural, historic, and archeological impact evaluation conducted in the GEIS (Reference 7) focused on similar attributes as the SEIS (Reference 8). The GEIS evaluated direct effects such as land clearing and indirect effects such as erosion and siltation.

The conclusion for the license renewal evaluation is also applicable to the decommissioning period because:

- 1) Decommissioning activities will be primarily contained to disturbed areas located away from areas of existing or high potential for archaeological sites,
- 2) Construction activities that disturb one acre or greater of soil are permitted by NDEE approval and BMPs are required to control sediment and the effects of erosion, and
- 3) Environmental protection procedures pertaining to archaeological and cultural resources will remain in effect during decommissioning.

Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on cultural, historic, and archeological resources are small and are bounded by the GEIS.

5.1.15 Aesthetic Issues

During decommissioning, the impact of activities on aesthetic resources will be temporary and remain consistent with the aesthetics of an industrial plant. In most cases, Section 4.3.15 of the GEIS concludes that impacts such as dust, construction disarray, and noise would not easily be detectable offsite.

The GEIS concluded that the retention of structures during a decommissioning period or the retention of structures onsite at the time the license is terminated is likewise not an increased visual impact, but instead a continuation of the visual impact analyzed in the facility construction or operations final environmental statement.

After the decommissioning process is complete, site restoration activities may result in structures being removed from the site and the site being backfilled, graded and landscaped as needed. The GEIS concludes that the removal of structures is generally considered beneficial to the aesthetic impacts of the site. Under a DECON methodology, the removal of structures and grading will occur sooner than in a SAFSTOR methodology. Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on aesthetic issues are bounded by the GEIS.

5.1.16 Noise

General noise levels during the decommissioning process are not expected to be any more severe than during refueling outages and are not expected to present an audible intrusion on the surrounding community. Some decommissioning activities may result in higher than normal

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onsite noise levels (i.e., some types of demolition activities). However, these noise levels will be temporary and are not expected to result in a significant audible intrusion on the surrounding community.

Section 4.3.16 of the GEIS indicates that noise impacts are not detectable or destabilizing and makes a generic conclusion that potential noise impacts are small. Based on the standard decommissioning approach proposed for FCS and the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on noise are bounded by the GEIS.

5.1.17 Transportation

The transportation impacts of decommissioning are dependent on the number of shipments to and from the plant, the types of shipments, the distance the material is shipped, and the radiological waste quantities and disposal plans. The shipments from the plant would be primarily radioactive wastes and nonradioactive wastes associated with dismantlement and disposal of structures, systems and components.

OPPD compared the assumptions and analysis inputs used for NRC's analysis with waste volumes estimated for FCS decommissioning, transportation mode, and disposal facility options. Due to the availability of the rail line, a substantial portion of the shipments will likely use that mode of transportation. The NRC indicates use of rail reduces radiological impacts by more than a factor of 10 over truck shipments. Furthermore, disposal facilities for FCS radiological waste are less than half the distance assumed by NRC in its analysis. The distance from FCS to the disposal site in Clive, Utah is approximately 1000 miles. Based on FCS's inputs compared the NRC analysis, FCS concludes that the generic impacts bound those associated with FCS.

OPPD will comply with all applicable NRC and U.S. Department of Transportation (DOT) regulations, including Federal Railroad Administration regulations and requirements, and will use approved packaging and shipping containers for waste shipment. OPPD will also comply with State of Nebraska regulations. The NRC has generically concluded that the radiological impacts of transporting radiological waste from decommission will be small and those for FCS are bounded by the GEIS.

The number of GTCC waste shipments expected to occur by truck during decommissioning is expected to be below the number referenced in Table 4-6 of the GEIS. These shipments will occur over an extended period of time and will not result in significant changes to local traffic density or patterns, the need for construction of new methods of transportation, or significant dose to workers or the public.

Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on transportation are bounded by the GEIS.

5.1.18 Irreversible and Irretrievable Commitment of Resources

Irreversible commitments are commitments of resources that cannot be recovered, and irretrievable commitments of resources are those that are lost for only a period of time.

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Uranium is a natural resource that is irretrievably consumed during power operation. After the plant is shutdown, uranium is no longer consumed. The use of the environment (air, water, land) is not considered to represent a significant irreversible or irretrievable resource commitment, but rather a relatively short term investment. Since the FCS site will be decommissioned to meet the unrestricted release criteria found in 10 CFR 20.1402, the land is not considered an irreversible resource. The only irretrievable resources that would occur during decommissioning would be materials used to decontaminate the facility (e.g., rags, solvents, gases, and tools), and the fuel used for decommissioning activities and transportation of materials to and from the site. However, the use of these resources is minor.

Therefore, based on the updated environmental report, OPPD concludes that the impacts of FCS decommissioning on irreversible and irretrievable commitment of resources are bounded by the GEIS.

5.2 Environmental Impacts of License Termination - NUREG-1496

According to the schedule provided in Section 3 of this report, a license termination plan for FCS will not be developed until approximately two years prior to the final site decontamination. At that time, a supplemental environmental report will be submitted as required by 10 CFR 50.82(a) (9). While detailed planning for license termination activities will not be performed until after the fuel transfer period, the absence of any unique site-specific factors, significant groundwater contamination, unusual demographics, or impediments to achieving unrestricted release suggest that impacts resulting from license termination will be similar to those evaluated in NUREG-1496.

5.3 Discussion of Decommissioning in the SEIS

Postulated impacts associated with decommissioning are discussed in Section 7.0 of the SEIS (Reference 8), which identified six issues related to decommissioning as follows:

- Radiation Doses
- Waste Management
- Air Quality
- Water Quality
- Ecological Resources
- Socioeconomic Impacts

The NRC staff did not identify any new and significant information during their independent review of the FCS license renewal environmental report at that time (Reference 14), the site audit, or the scoping process for license renewal. Therefore, the NRC concluded that there are no impacts related to these issues beyond those discussed in the GEIS for license renewal (Reference 15) or the GEIS for decommissioning (Reference 4). For the issues above, the license renewal and decommissioning GEISs both concluded the impacts are small. The NRC found no site-specific issues related to decommissioning and there are no decommissioning activities contemplated that would alter that conclusion.

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5.4 Additional Considerations

While not quantitative, the following considerations are relevant to concluding that decommissioning activities will not result in significant environmental impacts not previously reviewed:

- The release of effluents will continue to be controlled by plant license requirements and plant procedures.
- FCS will continue to comply with the Offsite Dose Calculation Manual, Radiological Environmental Monitoring Program, and the Groundwater Protection Initiative Program during decommissioning.
- Releases of non-radiological effluents will continue to be controlled per the requirements of the NPDES permit and applicable State of Nebraska permits.
- Systems used to treat or control effluents during power operation will either be maintained or replaced by temporary or mobile systems for the decommissioning activities.
- Radiation protection principles used during plant operations will remain in effect during decommissioning.
- Sufficient decontamination and source term reduction prior to dismantlement will be performed to ensure that occupational dose and public exposure will be maintained below applicable limits.
- Transport of hazardous and or radioactive waste will be in accordance with plant procedures, applicable Federal regulations, and the requirements of the receiving facility.
- Site access control during decommissioning will minimize or eliminate radiation release pathways to the public.

Additionally, NUREG-2157 found that the generic environmental impacts of ongoing spent fuel storage are small (Reference 16).

5.5 Conclusions

Based on the above discussions, OPPD concludes that the environmental impacts associated with planned FCS site-specific decommissioning activities will be bounded by appropriate, previously issued environmental impact statements and updated environmental supplement. Specifically, the environmental impacts are bounded by the GEIS (Reference 4) and SEIS (Reference 8) and File No. 127690-003 Fort Calhoun Updated Environmental Report (Reference 17).

The postulated impacts associated with the decommissioning method chosen, DECON, and have already been considered in the SEIS, GEIS and update environmental report.

There are no unique aspects of FCS or of the decommissioning techniques to be utilized that would invalidate the conclusions reached in the SEIS, GEIS and update environmental report.

The methods assumed to be employed to dismantle and decontaminate FCS are standard construction-based techniques fully considered in the SEIS, GEIS and update environmental report.

Therefore, it can be concluded that the environmental impacts associated with the site-specific decommissioning activities for FCS will be bounded by appropriate previously issued environmental impact statements and updated environmental supplement.

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10 CFR 50.82(a) (6) (ii) states that licensees shall not perform any decommissioning activities, as defined in 10 CFR 50.2 that result in significant environmental impacts not previously reviewed. No such impacts have been identified.

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Revised Post-Shutdown Decommissioning Activities Report
Attachment 1: FCS Site-Specific Decommissioning Cost Estimate

Site Specific Decommissioning Cost Estimate (DCE) for Fort Calhoun Station

Project No. 164074

FINAL REV. 0

Prepared for:

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September 10, 2019

Date

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September 10, 2019

Date

- ☒ New Report
- ☐ Title Change
- ☐ Report Revision
- ☐ Report Rewrite

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Appendix B	DECON Project Schedule
Appendix C	Detailed Cost Estimate

Acronyms and Abbreviations

AIF	Atomic Industrial Forum
BWR	Boiling Water Reactors
CFR	Code of Federal Regulations
D&D	Decontamination & Decommissioning
DAW	Dry Active Waste
DCE	Decommissioning Cost Estimate
DGC	Decommissioning General Contractor
DOE	U.S. Department of Energy
ES	EnergySolutions
FSS	Final Status Survey
GTCC	Greater Than Class C Waste
HP	Health Physics
ISFSI	Independent Spent Fuel Storage Installation
LLRW	Low-Level Radioactive Waste
LTP	License Termination Plan
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MPC	Multi-Purpose Canisters
MWt	Megawatt thermal
NRC	Nuclear Regulatory Commission
NSSS	Nuclear Steam Supply System
OPPD	Omaha Public Power District
ORISE	Oak Ridge Institute for Science and Education
PCB	Polychlorinated Biphenyl
PSDAR	Post-Shutdown Decommissioning Activities Report
PWR	Pressurized Water Reactor
SNF	Spent Nuclear Fuel
WBS	Work Breakdown Structure
WCS	Waste Control Specialists LLC
UCF	Unit Cost Factor

1.0 EXECUTIVE SUMMARY

The Omaha Public Power District, on behalf of the Fort Calhoun Station, contracted with EnergySolutions LLC (ES), for the preparation of this Report. The report presents the Site Specific Decommissioning Cost Estimate (DCE) Study of the Fort Calhoun Station (Fort Calhoun), hereinafter referred to as the DCE. Fort Calhoun is owned by the Omaha Public Power District (OPPD).

Fort Calhoun is a 1500 Mwt Combustion Engineering Pressurized Water Reactor.

On June 16, 2016, the Omaha Public Power District board voted unanimously to shut down Fort Calhoun and the plant permanently ceased operation on October 24, 2016. The permanent core off-load was completed on November 13, 2016.

The decommissioning alternatives provided by the U. S. Nuclear Regulatory Commission (NRC) are as follows:

DECON – is the alternative in which the plant structures, systems and components containing radioactive contaminants are removed or decontaminated to levels that permit the site property to be released for unrestricted use following cessation of operations. This is the most expeditious of the decommissioning alternatives and releases the site property for other beneficial use in the shortest period of time.

SAFSTOR – is the alternative in which the facility is placed into and maintained in a condition that permits the facility to be safely stored under monitored conditions and then subsequently decommissioned following a storage period that provides for the significant reduction in plant radiation levels resulting from radioactive decay. This alternative provides for the unrestricted release of the site property within a 60-year time period.

ENTOMB – is not considered a practical decommissioning alternative for Fort Calhoun and is not defined in this report.

The station initially selected the SAFSTOR decommissioning option. In October 2018, the OPPD board authorized Fort Calhoun to transition from the SAFSTOR decommissioning option to a Prompt DECON option, which completes the nuclear decommissioning activities within a significantly shorter time period.

This study has been performed to furnish a Decommissioning Cost Estimate of the costs for license termination under the Prompt DECON decommissioning alternative, based on Estimated Costs to Complete as of December 31, 2018.

All costs represented in this report are provided in 2018 dollars.

The cost estimate results are provided in Table 1-1 below. This table provides License Termination costs (corresponding to 10 CFR 50.75(c) requirements); Spent Fuel Management costs (corresponding to 10 CFR 50.54(bb) requirements) and Site Restoration costs (corresponding to activities such as clean building demolition and site grading etc.).

TABLE 1-1

PROMPT DECON SCENARIO Decommissioning Cost Estimate (thousands of 2018 Dollars)			
License Termination	Spent Fuel	Site Restoration	Total
\$725,243	\$358,944	\$44,903	\$1,129,091

Costs for Greater Than Class C (GTCC) casks and operations during the decommissioning period are included in the License Termination Costs. Costs for Greater Than Class C (GTCC) during long-term Spent Fuel Storage and transfer to DOE are included in the Spent Fuel Costs.

This estimate is based on current existing site and building drawings and plant systems data provided by OPPD combined with EnergySolutions decommissioning experience to establish plant systems and buildings inventories. These inventories, EnergySolutions proprietary Unit Cost Factors (UCFs) and other plant data, were used to generate the required labor-hours, cost, waste volumes, weights and classifications.

It has been assumed that Shutdown and Transition Planning, Fuel Sampling, and ISFSI design/construction activities have been completed prior to December 31, 2018.

It has also been assumed Spent Fuel Pool and Transfer to ISFSI Operations are in progress as of December 31, 2018, and the contract for removal, transportation and disposal of the Legacy Reactor Vessel Head, Pressurizer and Steam Generators is in progress as of December 31, 2018.

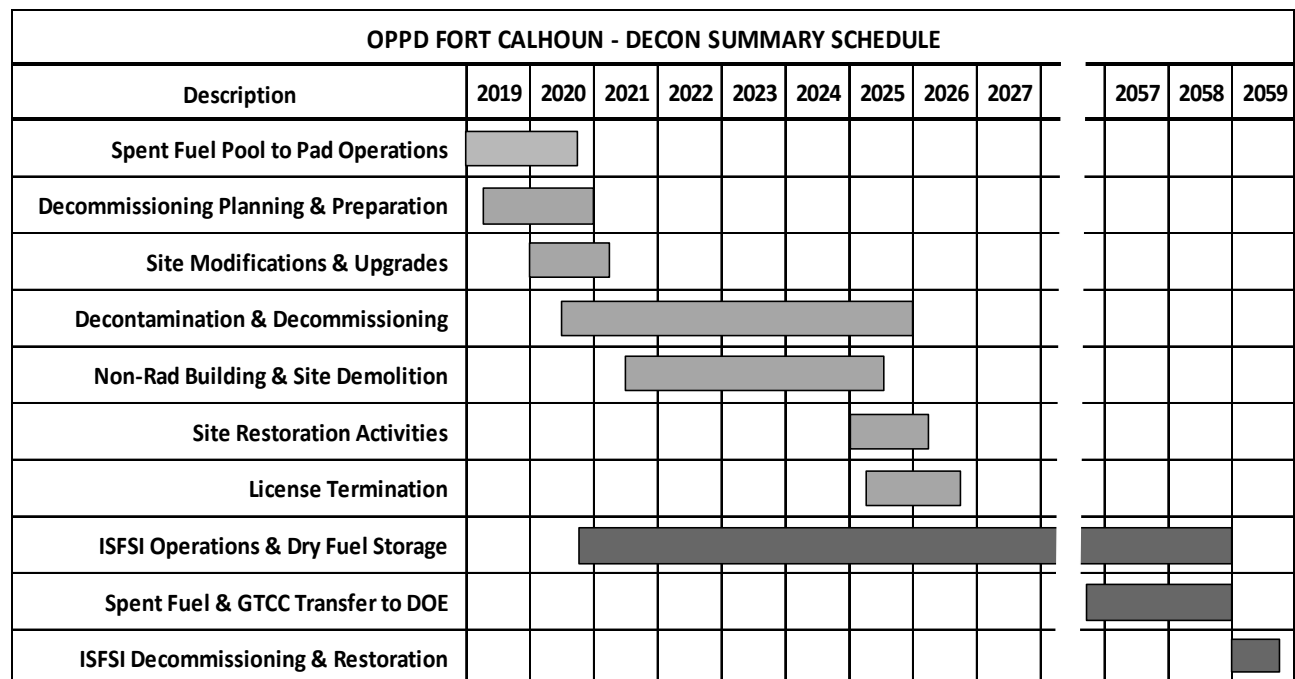
The schedule reflects the effects of sequenced activity-dependent or distributed decommissioning elements such as spent fuel pool to pad operations, planning and preparations, major component removal, building decontamination, building demolition, site restoration, spent fuel storage, etc.

The costs and schedule for the Prompt DECON alternative are divided into three major project categories as follows:

- License Termination
- Spent Fuel Storage
- Site Restoration

Figure 1-1 below shows the summary-level schedule for the Prompt DECON alternative.

FIGURE 1-1



2.0 INTRODUCTION

2.1 Study Objective

This report presents the Site Specific Decommissioning Cost Estimate (DCE) for Fort Calhoun Station, hereinafter referred to as the DCE.

This study has been performed to provide OPPD with an updated Decommissioning Cost Estimate for the selected Prompt DECON decommissioning alternative. It addresses: (1) the decommissioning of Fort Calhoun to the extent required to terminate the plant's NRC license, (2) management of residual spent fuel until acceptance by the U.S. Department of Energy (DOE), and (3) demolition of uncontaminated structures and restoration of the site.

The study methodology follows the basic approach originally presented in the Atomic Industrial Forum/National Environmental Studies Project Report AIF/NESP-036, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates" (Ref. No. 2). The report was prepared in accordance with Nuclear Regulatory Commission (NRC) Regulatory Guide 1.202, "Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Reactors" (Ref. No. 3). The estimate is based on compliance with current regulatory requirements and proven decommissioning technologies.

NRC requirements, set forth in Title 10 of the Code of Federal Regulations (CFR), differentiate between the post-shutdown costs associated with the decommissioning of the nuclear plant facility, those associated with storage of spent fuel on-site, and those associated with the decommissioning of a spent fuel storage facility. The Code of Federal Regulations, however, does not address the entire scope of the decommissioning liability for each nuclear facility. 10 CFR 50.75(c) requires funding by the licensee(s) of the facility for the decommissioning program, but specifically excludes the cost of removal and disposal of spent fuel and structures that do not require disposal as radioactive material. 10 CFR 50.75(c) also excludes the cost of site restoration activities that do not involve the removal of residual radioactivity necessary to terminate the NRC license(s). 10 CFR 50.54(bb) requires funding by the licensee(s) "for the management of all irradiated fuel at the reactor upon expiration of the reactor operating license(s) until title to the irradiated fuel and possession of the fuel is transferred to the Secretary of Energy for its ultimate disposal in a repository." 10 CFR 72.30 requires funding for decommissioning of the on-site spent fuel storage facility after the irradiated fuel is accepted by the DOE.

The study analyzes the Decommissioning Cost Estimate (DCE) of OPPD under the Prompt-DECON license termination scenario.

2.2 Regulatory Framework

Provisions of current laws and regulations affecting decommissioning, waste management, and spent fuel management are as follows:

1. NRC regulations require a license for on-site storage of spent fuel. Wet storage in a spent fuel pool is authorized by a facility's 10 CFR Part 50 license (Ref. No. 1). On-site dry storage of spent fuel at an Independent Spent Fuel Storage Installation (ISFSI) is licensed by either: (a) the general license set forth in 10 CFR 72.210, which requires that a Part 50 license be in place; or (b) a site-specific ISFSI license issued pursuant to 10 CFR Part 72.
2. 10 CFR 50.75(c) requires funding by the licensee(s) of the facility for decommissioning.

3. 10 CFR 50.54(bb) requires the licensee(s), within two years following permanent cessation of operation of the reactor or five years before expiration of the operating license(s), whichever occurs first, to submit written notification to the NRC for its review and preliminary approval of the program by which the licensee intends to manage and provide funding "for the management of all irradiated fuel at the reactor upon expiration of the reactor operating license until title to the irradiated fuel and possession of the fuel is transferred to the Secretary of Energy for its ultimate disposal in a repository."

2.3 Decommissioning Alternatives

The three basic methods for decommissioning are DECON, SAFSTOR, and ENTOMB, which are summarized as follows:

1. DECON: The equipment, structures, and portions of the facility and site that contain radioactive contaminants are promptly removed or decontaminated to a level that permits termination of the license after cessation of operations.
2. SAFSTOR: The facility is placed in a safe, stable condition and maintained in that state (safe storage). The facility is decontaminated and dismantled at the end of the storage period to levels that permit license termination. NRC regulations require decommissioning to be completed within 60 years of cessation of operation.
3. ENTOMB: Radioactive structures, systems, and components are encased in a structurally long-lived substance, such as concrete. The entombed structure is appropriately maintained and monitored until radioactivity decays to a level that permits termination of the license. Since entombment will exceed the requirement for decommissioning to be completed within 60 years of cessation of operation, NRC handles entombment requests on a case-by-case basis.

2.4 Post-Shutdown Spent Fuel Management Alternatives

The options for long-term post-shutdown spent fuel management currently available to power plant operators are (1) wet storage consisting of continued maintenance and operation of the spent fuel pool, and (2) dry storage consisting of transfer of spent fuel from the fuel pool to onsite dry storage modules after a cooling period or any combination of the two.

Transfer to an as yet to be developed, privately owned Interim Spent Fuel Storage Facility, while contemplated, has not been sufficiently developed to warrant discussion and evaluation at this time.

Transfer of Spent Fuel to an ISFSI requires additional expenditures for purchase and construction of the ISFSI and storage modules and ultimate dismantlement and disposal of the ISFSI following completion of spent fuel transfer to DOE.

3.0 STUDY METHODOLOGY

3.1 General Description

EnergySolutions maintains a proprietary decommissioning cost model based upon the fundamental technical approach established in AIF/NESP-036, "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," dated May 1986 (Ref. No. 2). The cost model has been updated frequently in accordance with regulatory requirements and industry experience. The cost model includes elements for estimating distributed and undistributed costs. Distributed costs are activity specific and include planning and preparation costs as well as costs for decontamination, packaging, disposal, and removal of major components and systems. For example, costs for the segmentation, packaging, and disposal of the reactor internals are distributed costs. Undistributed costs, sometimes referred to as collateral costs, are typically time dependent costs such as utility (Licensee) and decommissioning general contractor staff, property taxes, insurance, regulatory fees and permits, energy costs, and security staff.

The methodology for preparing cost estimates for a selected decommissioning alternative requires development of a site-specific detailed work activity sequence based upon the plant inventory. The activity sequence is used to define the labor, material, equipment, energy resources, and duration required for each activity. In the case of major components, individual work sequence activity analyses are performed based on the physical and radiological characteristics of the component, and the packaging, transportation, and disposal options available.

In the case of structures and small components and equipment such as piping, pumps, and tanks, the work durations and costs are calculated based on UCFs. UCFs are economic parameters developed to express costs per unit of work output, piece of equipment, or time. They are developed using decommissioning experience, information on the latest technology applicable to decommissioning, and engineering judgment.

3.2 Schedule Analysis

After the work activity durations are calculated for all distributed activities, a schedule analysis is performed using Oracle Primavera P6. The schedule accounts for constraints and regulatory reviews. The schedule is typically delineated into phases or time periods that differentiate between direct costs requirements and undistributed costs.

In order to differentiate between phase (period) elements of the decommissioning scope of work, EnergySolutions has established a Work Breakdown Structure (WBS) and cost accounting system to treat each element as a subproject. Accordingly, the overall project schedule is divided into interrelated periods with major milestones defining the beginning and ending of each period. The major milestones also serve as the basis for integrating the periods of the three subprojects.

3.3 Decommissioning Staff

EnergySolutions has assumed that the Fort Calhoun decommissioning project will be performed in an efficiently planned and executed manner using project personnel experienced in decommissioning and large-scale project management.

This DCE also assumes that the decommissioning work will be performed by a highly experienced and qualified Decommissioning Contractors, with oversight and management of the decommissioning operations performed by the OPPD staff, working in partnership with, and supplemented by a highly experienced and qualified Decommissioning General Contractor (DGC).

EnergySolutions analyzed the Fort Calhoun licensee staffing needs and developed a site-specific staffing plan. Staff and DGC labor costs were developed by EnergySolutions utilizing OPPD supplied values and ES historical data.

Staffing levels, for both staffing plans and for each project period, are based on the Atomic Industrial Forum (AIF) guidelines, industry and EnergySolutions historical experience. The size of staff is varied in each period in accordance with the requirements of the work activities. Staffing estimates include following departments or functional groups:

- Management & Administrative
- Engineering
- Plant Operations & Maintenance
- Radiation Protection and Chemistry
- Health Physics
- Regulatory Affairs
- Quality
- Waste Operations
- Security
- Decommissioning General Contractor

3.4 Waste Disposal

Waste management costs comprise a significant portion of the decommissioning cost estimate. Additionally, limited future access to disposal sites licensed for receipt of Class B and C wastes introduces a significant level of uncertainty with respect to the appropriateness of using existing rate structures to estimate disposal costs of these wastes. EnergySolutions' approach to estimating waste disposal costs is discussed in the following paragraphs.

Waste Classification

Regulations governing disposal of radioactive waste are stringent in order to ensure control of the waste and preclude adverse impact on public health and safety. At present, LLRW disposal is controlled by 10 CFR 61, which went into effect in December 1983. This regulation stipulates the criteria for the establishment and operation of shallow-land LLRW burial facilities. Embodied within this regulation are criteria and classifications for packaging LLRW such that it is acceptable for burial at licensed LLRW disposal sites.

For each waste classification, 10 CFR 61 stipulates specific criteria for physical and chemical properties that the LLRW must meet in order to be accepted at a licensed disposal site. The LLRW disposal criteria of 10 CFR 61 require that LLRW generators determine the proportional amount of a number of specific radioactive isotopes present in each container of disposable LLRW. This requirement for isotopic analysis of each container of disposable LLRW is met by employing a combination of analytical techniques such as computerized analyses based upon scaling factors, sample laboratory analyses, and direct assay methods. Having performed an isotopic analysis of each container of disposable LLRW, the waste must then be classified according to one of the classifications (Class A, B, C, or Greater Than Class C (GTCC)) as defined in 10 CFR 61.

EnergySolutions' classification of LLRW resulting from decommissioning activities is based on AIF/NESP-036 (Ref. No. 2), NUREG/CR-0130 (Ref. No. 4), plant-specific information and recent industry experience. The estimated curie content of the reactor vessel and internals at shutdown is typically derived from

NUREG/CR-0130 for Pressurized Water Reactors (PWRs) and NUREG/CR-0672 for Boiling Water Reactors (BWRs) and adjusted for the different mass of components and period of decay.

Packaging

Selection of the type and quantity of containers required for Class B and C wastes is based on the most restrictive of either Curie-content, dose-rate, container weight limit, or container volume limit. Residual spent fuel and GTCC wastes from segmentation of the reactor vessel internals and other accident related waste is normally packaged in modified spent fuel canisters and this packaging is assumed for the DCE. The selection of container type for Class A waste is based on the transportation mode (rail, truck, barge, etc.) and waste form. The quantity of Class A waste containers is determined by the most restrictive of either container weight limit or container volume limit. Large components, such as steam generators, pressurizers, and reactor recirculation pumps, are shipped as their own containers with additional shielding as required.

Container costs are obtained from manufacturers specializing in the design and fabrication of storage containers for nuclear materials. Shielded transport cask and liner costs are obtained from the cask owners and operators.

Transportation

Transportation routes to processing and disposal facilities are determined based on available transportation modes (truck, rail, barge, or combinations). Transportation costs for the selected routes and modes are obtained from vendor quotes or published tariffs whenever possible.

Class-A Disposal Options and Rates

Class A waste that meets the waste acceptance criteria are to be disposed of at EnergySolutions' LLRW disposal facility in Clive, Utah. All reported waste disposal costs include packaging, transportation and any applicable surcharges.

Class B and C Disposal Options and Rates

Currently, within the United States, there are only three operational commercial near-surface disposal facilities licensed to accept Class B and C LLRW: the Barnwell facility, operated by EnergySolutions in Barnwell, South Carolina; the U.S. Ecology facility in Richland, Washington; and the facility in Andrews County, Texas, operated by Waste Control Specialists (WCS). Barnwell only accepts waste from states within the Atlantic Compact and U.S. Ecology only accepts waste from states within the Northwest and Rocky Mountain Compacts. However, the WCS facility will accept waste from the Texas Compact (comprised of Texas and Vermont) and from non-Compact generators. The Texas Compact Commission on March 23, 2012, approved amendments to rules allowing the import of non-compact generator LLRW for disposal at the WCS Andrews County facility.

Transportation costs in this estimate for the Class B and C waste are based on a distance of 900 miles one way from Fort Calhoun to the WCS facility.

Greater-Than-Class-C (GTCC)

Wastes identified as 10 CFR 61 Class A, B, and C may be disposed of at near-surface disposal facilities. Certain components are highly activated and may exceed the radionuclide concentration limitations for 10 CFR 61 Class C waste. In accordance with 10 CFR 61, these components, which are referred to as GTCC wastes, cannot be disposed of in a near-surface LLRW disposal facility and must be transferred to a geologic repository or a similar site approved by the NRC.

Highly activated sections of the reactor vessel internals and certain decommissioning processes will result in GTCC waste. Presently, a facility does not exist for the disposal of wastes exceeding 10 CFR 61 Class C limitations. *EnergySolutions* assumes that the DOE will accept this waste along with spent fuel. Although courts have held that DOE is obligated to accept and dispose of GTCC, issues regarding potential costs remain unsettled. Therefore, *EnergySolutions* conservatively estimates a GTCC waste disposal cost.

LLRW Volume Reduction

Because current Class A LLRW disposal rates are significantly lower than LLRW volume reduction rates, *EnergySolutions* does not assume on-site volume reduction techniques such as waste compaction or an aggressive decontamination, survey and release effort.

Non-Radioactive Non-Hazardous Waste Disposal

EnergySolutions assumes that recyclable, non-radioactive scrap metal resulting from the decommissioning program will be sold to a scrap metal dealer.

Hazardous and Industrial Waste Disposal

Uncontaminated lead shielding remaining after shutdown was assumed to be removed from its installed locations and shipped offsite by entities having a need for the material. The entities will receive the lead at no charge in return for providing the removal and shipping services. Non-Radioactive contaminated surfaces coated with tightly adhering and undamaged lead-based paint will be removed as non-hazardous building demolition debris. All other chemicals and hazardous materials present at shutdown will be removed and properly disposed of during decommissioning.

3.5 Final Status Survey

The cost of performing a final status survey (FSS) is based on NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)" (Ref. No. 5). Estimates of MARSSIM Class I, II, and III survey designations are based on radiological assumptions regarding contamination resulting from small and large component removal activities. The FSS activity cost calculation includes the in-place remote survey of underground metal and concrete pipe, soil, and groundwater sampling and analysis. Estimated costs for NRC and Oak Ridge Institute for Science and Education (ORISE) verification are also included, and the NRC review period is incorporated into the project schedule.

3.6 Contingency

Contingencies are applied to cost estimates primarily to allow for unknown or unplanned occurrences during the actual program, e.g., increased radioactive waste materials volumes over that expected; equipment breakdowns, weather delays, and labor strikes. This is consistent with the definition provided in the DOE Cost Estimating Guide, DOE G 430.1-1, 3-28-97 (DOE G) (Ref. No. 6). Contingency "covers costs that may result from incomplete design, unforeseen and unpredictable conditions, or uncertainties within the defined project scope. The amount of contingency will depend on the status of design, procurement, and construction; and the complexity and uncertainties of the component parts of the project. Contingency is not to be used to avoid making an accurate assessment of expected costs." *EnergySolutions* determines site-specific contingency factors to be applied to each estimate based on industry practices.

The DOE has established a recommended range of contingencies as a function of completeness of program design, DOE G. The ranges are:

<u>Type of Estimate</u>	<u>Contingency Range as a % of Total Estimate</u>
Planning Phase Estimate	20-30
Budget Estimate	15-25
Title I (Preliminary Design Estimate)	10-20
Title II (Definitive Design Estimate)	5-15

The Fort Calhoun DECON scenario has had substantial development and the Fuel Pool to Pad program is in progress as of December 31, 2018. For the purposes of this estimate we have considered this to be a Budget Estimate designed to provide sufficient information to OPPD to assess its financial obligations for decommissioning Fort Calhoun. It is not a detailed budget, but a financial analysis prepared in advance of the detailed execution planning and budgeting work required to carry out the decommissioning.

A reactor decommissioning program will be conducted under an NRC-approved Quality Assurance Program which meets the requirements of 10 CFR 50, Appendix B. However, the development of the quality assurance program, the performance of work under that program, and the effort required to ensure compliance with the program, is already included in the detailed cost estimate. Therefore, *EnergySolutions* does not include quality assurance as an element of the contingency allowance. The same is true for contamination. Where radioactive contamination or activated materials are dealt with, the cost factors and associated calculations fully reflect the cost impact of that material, and a separate contingency is not required specifically due to working with contamination.

3.7 Cost Reporting

Total project costs are aggregated from the distributed activity and undistributed costs into the following categories:

- Labor
- Materials and Equipment
- Waste Packaging and Transportation
- Waste Disposal
- Subcontracts
- Other Costs

Other costs include property taxes, insurance, license fees, permits, and energy. Waste Disposal costs include any applicable surcharges. Health physics (HP) supplies and small tool costs are calculated as a component of each distributed activity cost and included in the category of Material and Equipment, with the exception that HP supplies for the Utility HP staff are calculated and reported as an undistributed line item. A line item specific contingency is then calculated for each activity cost element.

4.0 SITE SPECIFIC TECHNICAL APPROACH

4.1 Facility Description

Fort Calhoun is owned by the Omaha Public Power District (OPPD) and is located between Fort Calhoun and Blair, Nebraska, adjacent to the Missouri River.

The Nuclear Steam Supply System (NSSS) consists of a 1500 Mwt Pressurized Water Reactor supplied by Combustion Engineering.

The station has an on-site Independent Spent Fuel Storage Installation (ISFSI) consisting of TRANSNUCLEAR 32PT spent fuel storage canisters stored inside of NUHOMS horizontal storage modules.

4.2 Major Work Periods for Prompt DECON

The estimate has been organized into five Major Work Periods, each with sub-periods and defined scope activities as follows:

Period 1 – Transition through SNF Transfer to ISFSI:

Period 1a – SAFSTOR & Transition:

- Period 1a.1 – Planning & Procedures (completed)
- Period 1a.2 – ISFSI Design & Construction (completed)
- Period 1a.3 – ISFSI Security Modifications (completed)
- Period 1a.4 – Fuel Pool Operations (completed)

Period 1b –Spent Fuel Transfer to ISFSI :

- Period 1b.1 – Security through Fuel Transfer (in progress)
 - ISFSI & Plant Security Staff
- Period 1b.2 – Design & Procure Fuel & GTCC Casks (in progress)
 - Design & Procure Fuel Casks
 - Design & Procure GTCC Casks
 - Cask Vendor Tech Support
- Period 1b.3 – Fuel Pool Operations (in progress)
 - Spent Fuel Operations Support
 - Fuel Pool Water Processing
 - Fuel Pool Clean-up
- Period 1b.4 – Fuel Transfer Operations (in progress)
 - Procure Transport / Transfer Equipment
 - Spent Fuel Transfer
- Period 1b.5 – Utility Staff through Fuel Transfer (in progress)
 - Utility Project Staff
 - ISFSI Operations & Maintenance

Period 2 – License Termination:

Period 2a – Decommissioning Planning & Preparations:

Period 2a.1 – Site Assessments (completed)

Period 2a.2 – LTP Planning & Preparation

- LTP Preparation

Period 2a.3 – Planning Services

- General Planning Services
- Site Surveys & Characterization
- Procurement Planning
- Baseline Development

Period 2a.4 – Infrastructure Upgrades

- Road Upgrades
- Rail Upgrades

Period 2a.5 – Decommissioning Electrical

- Cold & Dark Operations
- Temporary Power Upgrades

Period 2b – Rad Decommissioning & License Termination:

Period 2b.1 – Reactor Vessel

- Develop RVI/RV Plans & Procedures
- Procure RVI Equipment
- RVI Equipment Tech Support
- RVI Segmentation & Removal
- RVI GTCC Operations & Loading
- Procure RV Equipment
- RV Equipment Tech Support
- RV Segmentation & Removal

Period 2b.2 – Large Component Removal

- Heavy Lift / Transfer Equipment
- Remaining Legacy Large Component Removal
- Steam Generator Removal
- Pressurizer Removal
- RCP Removal

Period 2b.3 – Rad Building Interior / Systems D&D

- Asbestos Abatement
- Chemical Decon
- Reactor Bldg. Interior / Systems Demo
- Aux Bldg. Interior / Systems Demo
- Rad Waste Bldg. Interior Demo

- Misc Rad Systems Removal
- D&D Contractor Staff
- D&D Contractor Tools & Equipment
- D&D Contractor Scaffolding

Period 2b.4 – Rad Building Open Air Demolition

- Reactor Building Demo
- Aux Building Demo
- Rad Waste Bldg. Interior Demo
- Misc Rad Building & Open Air Demo
- Firing Range
- Drainage Lagoons
- D&D Contractor Staff
- D&D Contractor Tools & Equipment
- D&D Contractor Scaffolding

Period 2b.5 – Field Waste Operations

- Waste Handling & Loadout Equipment
- Waste Handling & Loadout
- Waste Rad Techs

Period 2b.6 – Rad Waste Transportation & Disposal

- Class A Waste Disposal
- Class B & C Waste Disposal
- Remaining Legacy Large Component Disposal

Period 2b.7 – Non-Rad & Hazardous Waste Disposal

- Recycle Materials
- Non-Rad Local Landfill

Period 2b.8 – Field Radiation Protection

- Rad Protection Techs

Period 2b.9 – Field Rad Surveys & Final Site Surveys

- Final Site Surveys

Period 2c – License Termination Undistributed Costs:

Period 2c.1 – Utility Staff during Decommissioning

- Utility Management Staff
- Temporary Facilities
- Environmental Program
- Decommissioning NRC Fees & Inspections
- Safety Program & Supplies
- Training Program

Period 2c.2 – Plant Operations & Maintenance

- Plant Operations & Maintenance (*non-labor*)
- Water Processing
- Utility Costs

Period 2c.3 – Plant Security during Decommissioning

- Plant Security

Period 2c.4 –Contractor Project Management

- DGC Contractor Mobilization
- DGC Staff
- Contractor Rad Protection Program
- DGC Contractor Demobilization

Period 2c.5 – Insurance and Taxes

- ANI Insurance Costs
- NEIL Insurance Costs
- Property Taxes
- Use Taxes

Period 2c.6 – Corporate Allocations

- Corporate A&G Allocations
- Communications & Telecom Allocations
- Information Technology Allocations
- Stores Expense Allocations

Period 3 – Site Restoration:

Period 3a – Clean Demolition & Site Restoration:

Period 3a.1 – Clean Building Demolition

- Asbestos Abatement
- Turbine Building
- Intake Structure
- Mausoleum
- New & Old Warehouse Demo
- Misc Clean Building Demo
- Underground Piping & Utilities
- Yard/Parking Lot Pavement & Concrete
- MET Tower
- D&D Contractor Staff
- D&D Contractor Tools & Equipment

Period 3a.2 – Fill & Backfill Materials

- Process & Reuse On-Site Fill Materials
- Imported Fill Materials

Period 3a.3 – Backfill & Grade Buildings

- Backfill & Grade Buildings

Period 3a.4 – Non-Rad Environmental Remediation

- Non-Rad Environmental Remediation

Period 3a.5 – Final Site Restoration

- Final Site Grading

Period 3b – Site Restoration Undistributed Costs:

Period 3b.1 – Utility Staff during Decommissioning

- Utility Management Staff
- Temporary Facilities
- Environmental Program
- Safety Program & Supplies
- Training Program

Period 3b.2 – Plant Operations & Maintenance

- Plant Operations & Maintenance (*non-labor*)
- Water Processing
- Utility Costs

Period 3b.3 – Plant Security during Decommissioning

- Plant Security

Period 3b.4 – Contractor Project Management

- DGC Contractor Mobilization
- DGC Staff
- Contractor Rad Protection Program
- DGC Contractor Demobilization

Period 3b.5 – Insurance and Taxes

- NEIL Insurance Costs
- Property Taxes
- Use Taxes

Period 3b.6 – Corporate Allocations

- Corporate A&G Allocations
- Communications & Telecom Allocations
- Information Technology Allocations
- Stores Expense Allocations

Period 4 – SNF/GTCC Dry Storage & Transfer to DOE:

Period 4a –Spent Fuel Dry Storage:

Period 4a.1 – ISFSI Security & Operations

- ISFSI Security during Decommissioning
- ISFSI Security after Decommissioning
- ISFSI Operations & Maintenance
- ISFSI NRC Fees
- ISFSI DAW Waste

Period 4a.2 – ISFSI Insurance & Taxes

- ISFSI Insurance

Period 4a.3 – ISFSI Utility Staff

- ISFSI Utility Staff during Decommissioning
- ISFSI Utility Staff after Decommissioning

Period 4a.4 – ISFSI Corporate Allocations

- Corporate A&G Allocations

Period 4b –Spent Fuel & GTCC Transfer to DOE:

Period 4b.1 – Spent Fuel & GTCC Transfer to DOE

- Procure/Rent Transport/Transfer Equipment
- Spent Fuel & GTCC Transfer Operations

Period 5 – ISFSI Decommissioning:

Period 5a –ISFSI Demolition & Site Restoration:

Period 5a.1 – ISFSI Demolition & Site Restoration

- ISFSI Decommissioning & Demolition
- ISFSI Site Restoration

Period 5b –ISFSI Decommissioning Undistributed Costs:

Period 5b.1 – ISFSI Decommissioning Undistributed Costs

- Security during ISFSI Decommissioning
- Utility Staff during ISFSI Decommissioning

4.3 Decommissioning Staff

EnergySolutions developed staffing based on the assumption that the Fort Calhoun decommissioning project will be performed in an efficiently planned and executed manner using project personnel experienced in decommissioning and large-scale project management. This DCE also assumes that the decommissioning work will be performed by a highly experienced and qualified Decommissioning Contractors, with oversight and management of the decommissioning operations performed by the OPPD staff, working in partnership with, and supplemented by a highly experienced and qualified Decommissioning General Contractor (DGC).

Estimated Staff levels are provided in Section 6.0, Table 6-4.

4.4 Spent Fuel Management

The largest spent fuel staff is in place while the fuel pool is operational during the spent fuel cooling period and the fuel assemblies are being transferred to dry storage. After all spent fuel has been removed from the spent fuel pool, the staff is reduced. During spent fuel pool operations and the dry storage period, the full-time spent fuel management staff is supplemented with part-time staff to support fuel movements. Details on the staff levels are provided in Section 6.0.

4.5 Spent Fuel Shipments

The DOE currently has no plans, program, or schedule in place for acceptance of utility spent fuel. However, for purposes of this Decommissioning Cost Estimate, certain simplifying assumptions must be made regarding the schedule and rate of DOE performance. The spent fuel shipping schedules are based in part on the DOE's "Acceptance Priority Ranking & Annual Capacity Report," dated July 2004. (Ref. No. 7). Based upon the best current information available, this DCE is based on transfer of all Spent Fuel and GTCC material to the DOE by the end of 2058.

5.0 BASES OF ESTIMATE AND KEY ASSUMPTIONS

The Basis of Estimate and key assumptions for this Decommissioning Cost Estimate are presented below:

1. The DCE is based on Prompt DECON Decommissioning using a Hybrid model, where OPPD works in unison with a competent Decommissioning General Contractor, using currently available technologies and in accordance with current regulations.
2. The DCE is presented in 2018 dollars and is based on estimated costs forward from December 31, 2018.
3. It has been assumed that Shutdown, Transition Planning, and Fuel Sampling activities have been completed prior to December 31, 2018.
4. It has been assumed that required ISFSI design and construction activities have been completed prior to December 31, 2018.
5. Spent Fuel Pool and Pool to Pad Operations are in progress as of December 31, 2018.
6. The contract for removal, transportation and disposal of the Legacy Reactor Vessel Head, Pressurizer and Steam Generators is in progress as of December 31, 2018.
7. OPPD staff and security levels are based on the staffing plans provided by OPPD, but may vary based on attrition.
8. OPPD staff and security labor costs are based on 2018 information provided by OPPD.
9. Corporate Allocations and cost included in the DCE are based on the 2018 DCE Data Request including:
 - Employee Severance and/or Retention Costs
 - Site O&M (non-labor and recurring cost)
 - Corporate A&G
 - Post-Shutdown Insurance Premiums
 - NEI, INPO, NEI PADS Memberships, Fees
 - Taxes, Assessments, Payments in Lieu of Taxes
 - Support Services Costs
10. Contingencies included in the estimate are consistent with a budget estimate designed to provide sufficient information to OPPD to assess its financial obligations for decommissioning Fort Calhoun.
11. Costs for transportation of clean scrap metal to a recycler are included in the estimate; however, a credit has been included for the value of scrap metal.
12. Costs for hazardous waste disposal, as well as asbestos and lead abatement, are included in this study.
13. All Class-A waste is assumed to be disposed of at EnergySolutions' facility in Clive, Utah.
14. Class A waste includes Dry Active Waste (DAW) arising from the disposal of contaminated protective clothing and health physics supplies.

15. Class B and C waste disposal costs are based on disposal of activated hardware and resins at the Waste Control Specialists, Texas facility. All resins and filter waste are assumed to be Class B.
16. Transportation costs for the Class B and C waste are based on a distance of 900 miles one way from Fort Calhoun to the WCS facility.
17. The DCE includes estimated costs for GTCC waste to be packaged in modified spent fuel canisters, or similar containers.
18. It is assumed Spent Fuel and GTCC waste will be transferred to the DOE at the Fort Calhoun location, at OPPD expense, and that the DOE will take responsibility for the transportation and disposal of Spent Fuel and GTCC waste at a licensed DOE facility.
19. The 10 CFR Part 50 license will be maintained until DOE has taken possession of the spent fuel and the ISFSI has been decommissioned.
20. The DCE includes the annual NRC 10 CFR 171.15(c)(2) fees, for reactors in decommissioning until decommissioning is completed as a license termination expense. Following completion of decommissioning, this expense is continued as a SNF/GTCC management cost for maintenance of the 10 CFR Part 50 license.
21. The DCE includes NRC inspection fees during each decommissioning period based on the type and level of activities being performed.
22. The PSDAR will require revision to address prompt DECON versus SAFSTOR.
23. The DOE currently has no plans, program, or schedule in place for acceptance of utility spent fuel. However, for purposes of this Decommissioning Cost Estimate, certain simplifying assumptions must be made regarding the schedule and rate of DOE performance. The spent fuel shipping schedules are based in part on the DOE's "Acceptance Priority Ranking & Annual Capacity Report," dated July 2004. (Ref. No. 7). Based upon the best current information available, this DCE is based on transfer of all Spent Fuel and GTCC material to the DOE by the end of 2058.
24. This estimate is based on current existing site and building drawings and plant systems data provided by OPPD combined with EnergySolutions decommissioning experience to establish plant systems and buildings inventories. These inventories, EnergySolutions proprietary Unit Cost Factors (UCFs) and other plant data, were used to generate the required labor-hours, cost, waste volumes, weights and classifications.
25. All transformers on site following shutdown are assumed to be PCB-free; therefore, this study does not include costs for disposition of PCB contaminated transformers.
26. It is assumed that uncontaminated lead shielding remaining is assumed to be removed from its installed locations and shipped offsite by entities having a need for the material. The entities receive the lead at no charge in return for providing removal and shipping services.
27. Non-rad concrete debris and all other demolition debris not suitable for backfill are assumed to be removed from the site and disposed of at a local landfill.
28. Foundations and building exteriors walls are removed to a depth of three feet below nominal grade elevation, surveyed and backfilled with appropriate fill material.

29. Clean backfill will be imported and placed to re-establish grade. The entire disturbed area of the site is to be graded, to restore the natural grade to the extent possible, and seeded.
30. The estimate is based on final site restoration, in which all existing and proposed structures, with the exception of the Training Center, Administration Building, FLEX Building and the Switchyard, will be removed. Clean demolition costs are based on the assumption that all site improvements will be removed in their entirety.
31. Water processing operations are estimated based upon an experienced decommissioning operations contractor performing the decommissioning and understanding the projected water requirements.
32. The waste generated from the segmentation of the reactor vessel internals will be packaged in Multi-Purpose Canisters (MPCs). For this estimate, the MPCs are assumed to be accepted by DOE at the time of shipment.
33. The ISFSI fuel storage structures are assumed to have no activated concrete or surface contamination.
34. The estimate includes contingency, but generally does not include any allowance for substantive schedule delays, nor cost allowance for field labor retained on site while waiting for work to become available.
35. The costs of all required safety analyses and safety measures for the protection of the general public, the environment, and decommissioning workers are included in the cost estimates. This reflects the requirements of:

10 CFR 20	Standards for Protection Against Radiation
10 CFR 50	Domestic Licensing of Production and Utilization Facilities
10 CFR 61	Licensing Requirements for Land Disposal of Radioactive Waste
10 CFR 71	Packaging and Transportation of Radioactive Material
10 CFR 72	Licensing Requirements for the Independent Storage of Spent Nuclear Fuel and High-Level Radioactive Waste
29 CFR 1910	Occupational Safety and Health Standards
49 CFR 170-189	Department of Transportation Regulations Governing the Transport of Hazardous Materials
Reg. Guide 1.159	Assuring the Availability of Funds for Decommissioning Nuclear Reactors

6.0 STUDY RESULTS

Cost Summary by License Termination, Spent Fuel and Site Restoration

A summary of the cost estimate is provided in Table 6-1 below. This table provides License Termination cost (corresponding to 10 CFR 50.75(c) requirements); Spent Fuel Management costs (corresponding to 10 CFR 50.54(bb) requirements) and Site Restoration costs (corresponding to activities such as clean building demolition and site grading etc.).

TABLE 6-1

PROMPT DECON SCENARIO Decommissioning Cost Estimate (thousands of 2018 Dollars)			
License Termination	Spent Fuel	Site Restoration	Total
\$725,243	\$358,944	\$44,903	\$1,129,091

GTCC casks and operations are included in the License Termination Costs. GTCC long-term ISFSI storage and disposition are included in the Spent Fuel Costs.

A detailed cost table is provided in Appendix C.

Summary Schedule

The costs and schedule for the Prompt DECON scenario are divided into major project periods:

Period 1 - Transition through SNF Transfer to ISFSI

Period 2 - License Termination

Period 3 - Site Restoration

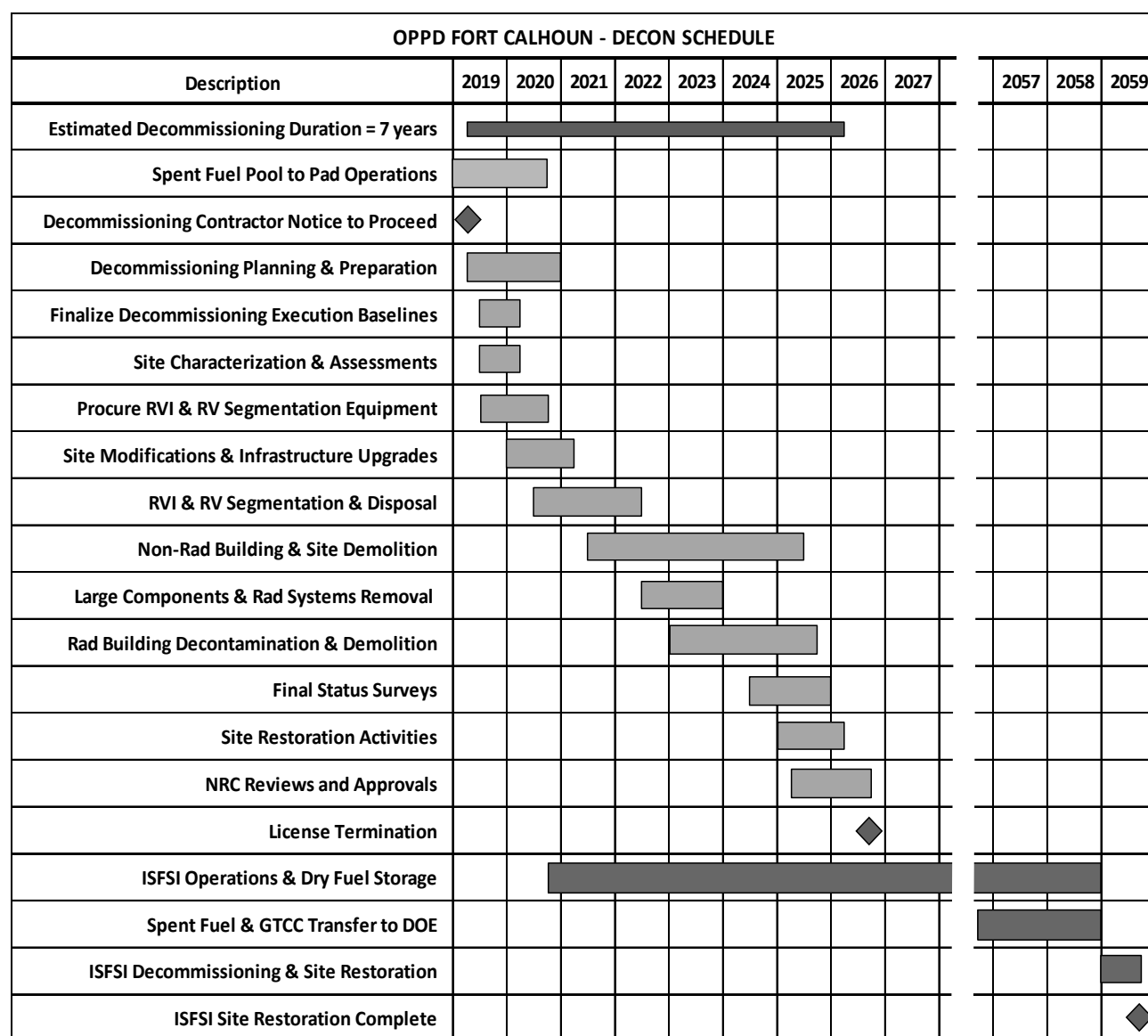
Period 4 - SNF/GTCC Dry Storage & Transfer to DOE

Period 5 - ISFSI Decommissioning

Figure 6-1 below shows a summary-level Prompt DECON schedule.

A detailed schedule is provided in Appendix B.

FIGURE 6-1
Prompt DECON Schedule



Cost Summary by Period

The following Table 6-2 provides a cost summary for the Prompt DECON Scenario by Period.

The detailed Decommissioning Cost Estimate is provided in Appendix C.

TABLE 6-2
DECON Cost Summary by Period

Period	Item Description	Estimated Cost	Contingency	Total
1a Total - SAFSTOR & Transition (Completed)			-	-
1b Total - Spent Fuel Transfer to ISFSI		50,465	5,046	55,511
Period 1 Total - Transition through SNF Transfer to ISFSI		50,465	5,046	55,511
2a Total - Decommissioning Planning & Preparations		19,468	1,947	21,415
2b Total - Rad Decommissioning & License Termination		312,367	39,524	351,891
2c Total - License Termination Undistributed Costs		315,843	31,584	347,427
Period 2 Total - License Termination		647,678	73,055	720,733
3a Total - Clean Demolition & Site Restoration		28,052	2,805	30,857
3b Total - Site Restoration Undistributed Costs		12,769	1,277	14,046
Period 3 Total - Site Restoration		40,821	4,082	44,903
4a Total - Spent Fuel Dry Storage		260,402	28,426	288,828
4b Total - Spent Fuel & GTCC Transfer to DOE		12,700	1,905	14,605
Period 4 Total - SNF/GTCC Dry Storage & Transfer to DOE		273,102	30,331	303,433
5a Total - ISFSI Demolition & Site Restoration		3,111	467	3,578
5b Total - ISFSI Decommissioning Undistributed Costs		848	85	933
Period 5 Total - ISFSI Decommissioning		3,959	551	4,511
Grand Total		1,016,025	113,066	1,129,091

Cost Summary by Cost Type

The following Table 6-3 provides a cost summary for the Prompt DECON Scenario by Cost Type.

For Table 6-3, "Other Direct Costs" generally include miscellaneous services such as Temporary Facilities; Licensing Costs; NRC Fees, Insurances, Taxes, Permits, Corporate Allocations, etc.

The detailed Decommissioning Cost Estimate is provided in Appendix C.

TABLE 6-3
DECON Cost Summary by Cost Type

PROMPT DECON SCENARIO Estimated Costs to Complete as of December 31, 2018 (thousands of 2018 Dollars)	
Labor Cost	\$ 449,408
Materials & Equipment Cost	\$ 68,160
Waste Packaging & Transportation	\$ 27,517
Waste Disposal	\$ 138,189
Subcontracts	\$ 177,654
Other Direct Costs	\$ 155,096
Contingency	\$ 113,066
Total Cost	\$ 1,129,091

Project Staffing

Table 6-4 shows the estimated annual average DECON Staffing & Security Manpower.

TABLE 6-4

OPPD Estimated Staff & Security Manpower Average Personnel Count by Year										
	2019	2020	2021	2022	2023	2024	2025	2026	2027-2058	2059
1b.1.1 OPPD Security Staff through Fuel Transfer	2	2								
1b.5.1 OPPD Utility Staff through Fuel Transfer	18	14								
2d.1.1 OPPD Utility Staff during Decommissioning	185	175	124	105	81	67	33	10		
2d.3.1 OPPD Plant Security during Decommissioning	106	82	6	5	4	3	2	2		
3a.1.1 OPPD ISFSI Security during Decommissioning		9	35	35	35	35	35			2
3a.1.2 OPPD ISFSI Security during Dry Fuel Storage								35	35	
3a.3.1 OPPD ISFSI Staff during Decommissioning		10	10	10	10	10	13			5
3a.3.2 OPPD ISFSI Staff during Dry Fuel Storage								15	15	
Average OPPD Personnel Count by Year	311	291	175	155	130	115	82	62	50	7
2a.3.4 DGC Baseline Development Staff	5	2								
2d.4.2 Decommissioning General Contractor Staff	14	20	22	22	22	22	20	4		
Average DGC Personnel Count by Year	19	22	22	22	22	22	20	4		
TOTAL AVERAGE STAFF & SECURITY PERSONNEL	330	313	197	177	152	137	102	66	50	7

Waste Disposal Volumes

Table 6-5 below provides a summary of Waste Disposal Volumes by Waste Classification.

TABLE 6-5
Waste Disposal Volumes

Waste Class	Volume (cf)
Class A Waste	2,497,082
Class B & C Waste	1,666
GTCC Waste	1,180

Appendix A provides a Waste Disposal Summary itemized by volumes, waste form, waste class, weight, volume and costs for packaging, transportation and disposal.

Estimated Annual Spending

Table 6-6 below shows the estimated Annual Spending.

TABLE 6-6

PROMPT DECON SCENARIO Projected Annual Spending (thousands of 2018 Dollars)				
Year	License Termination	Spent Fuel	Site Restoration	Total
2019	\$ 95,185	\$ 29,326	-	\$ 124,510
2020	\$ 95,701	\$ 29,326		\$ 125,026
2021	\$ 87,270	\$ 7,674	\$ 4,315	\$ 99,260
2022	\$ 87,186	\$ 7,674	\$ 4,315	\$ 99,176
2023	\$ 99,523	\$ 7,674	\$ 11,984	\$ 119,181
2024	\$ 125,874	\$ 7,674	\$ 9,935	\$ 143,484
2025	\$ 114,298	\$ 7,674	\$ 14,042	\$ 136,014
2026	\$ 14,811	\$ 8,057	\$ 312	\$ 23,179
2027	\$ 885	\$ 8,057	-	\$ 8,942
2028	-	\$ 8,057	-	\$ 8,057
2029	-	\$ 8,057	-	\$ 8,057
2030	-	\$ 8,057	-	\$ 8,057
2031	-	\$ 8,057	-	\$ 8,057
2032	-	\$ 8,057	-	\$ 8,057
2033	-	\$ 8,057	-	\$ 8,057
2034	-	\$ 8,057	-	\$ 8,057
2035	-	\$ 8,057	-	\$ 8,057
2036	-	\$ 8,057	-	\$ 8,057
2037	-	\$ 7,213	-	\$ 7,213
2038	-	\$ 7,213	-	\$ 7,213
2039	-	\$ 7,213	-	\$ 7,213
2040	-	\$ 7,213	-	\$ 7,213
2041	-	\$ 7,213	-	\$ 7,213
2042	-	\$ 7,213	-	\$ 7,213
2043	-	\$ 7,213	-	\$ 7,213
2044	-	\$ 7,213	-	\$ 7,213
2045	-	\$ 7,213	-	\$ 7,213
2046	-	\$ 7,213	-	\$ 7,213
2047	-	\$ 7,213	-	\$ 7,213
2048	-	\$ 7,213	-	\$ 7,213
2049	-	\$ 7,213	-	\$ 7,213
2050	-	\$ 7,213	-	\$ 7,213
2051	-	\$ 7,213	-	\$ 7,213
2052	-	\$ 7,213	-	\$ 7,213
2053	-	\$ 7,213	-	\$ 7,213
2054	-	\$ 7,213	-	\$ 7,213
2055	-	\$ 7,213	-	\$ 7,213
2056	-	\$ 10,088	-	\$ 10,088
2057	-	\$ 13,078	-	\$ 13,078
2058	-	\$ 13,078	-	\$ 13,078
2059	\$ 4,511		-	\$ 4,511
Totals	\$ 725,243	\$ 358,944	\$ 44,903	\$ 1,129,091

7.0 REFERENCES

1. U.S. Nuclear Regulatory Commission, "Domestic Licensing of Production and Utilization Facilities," 10 CFR Part 50, 2008.
2. Atomic Industrial Forum, Inc., "Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates," AIF/NESP-036, May 1986.
3. U.S. Nuclear Regulatory Commission, "Standard Format and Content of Decommissioning Cost Estimates for Nuclear Power Reactors," Regulatory Guide 1.202, February 2005.
4. U.S. Nuclear Regulatory Commission, "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station," NUREG/CR- 0130, June 1978.
5. U.S. Nuclear Regulatory Commission, "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)," NUREG-1575, Rev. 1, August 2000.
6. U.S. Department of Energy, "Cost Estimating Guide," DOE G 430.1-1, March 1997.
7. U.S. Department of Energy, "Acceptance Priority Ranking & Annual Capacity Report," DOE/RW-0567, July 2004.

APPENDIX A

Waste Disposal Summary

Appendix A
OPPD - Fort Calhoun Station
Waste Disposal Summary
(thousands of 2018 dollars)

Facility	Waste Form	Waste Class	Waste Weight (LBs)	Waste Volume (CF)	Burial Volume (CF)	Packaging & Transportation	Burial Cost	Total Waste Cost
Rad Waste								
WCS	Cask	B/C	161,178	1,791	1,666	\$ 1,522	\$ 20,819	\$ 22,341
Clive	CWF	A	422,708	9,682	11,613	\$ 2,402	\$ 3,360	\$ 5,763
Clive	Debris	A	139,648,601	2,432,698	2,441,460	\$ 12,955	\$ 102,892	\$ 115,847
Clive	Large Component	A	2,604,487	26,650	28,132	\$ 7,517	\$ 6,427	\$ 13,944
Clive	Legacy Components	A			15,878	\$ 3,121	\$ 3,121	\$ 6,242
			142,836,973	2,470,821	2,498,748	\$ 27,517	\$ 136,619	\$ 164,136
Other								
Local Landf	Clean/Exempt	F	1,982,766	72,184	72,200		\$ 2,922	\$ 3,327
Local Recycl	Recycled Metals	F	24,497,545	1,224,877	1,225,692		\$ (1,715)	\$ (1,715)
On Site	Clean/Exempt	F	182,542,639	2,028,252	2,028,400		\$ -	\$ -
			209,022,949	3,325,313	3,326,292		\$ 1,207	\$ 1,613
Grand Total			351,859,923	5,796,134	5,825,040	\$ 27,517	\$ 137,826	\$ 165,749

APPENDIX B

DECON Project Schedule

Activity ID	Activity Name		Original Duration	Start	Finish	2019		2020				2021				2022				2023				2024				2025				2026				2027				2028				2029				2030	
						Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2					
Major Milestones																																																	
Milestones																																																	
A1000	Decommissioning General Contractor Notice to Proceed (NTP)		0	02-Apr-2019*		◆ Decommissioning General Contractor Notice to Proceed (NTP)																																											
A1100	Spent Fuel Pool to Pad Operations Complete		0		22-Dec-2020	◆ Spent Fuel Pool to Pad Operations Complete																																											
A1200	GTCC Transfer to ISFSI Complete		0		30-Sep-2021	◆ GTCC Transfer to ISFSI Complete																																											
A1300	Reactor Vessel Segmentation Complete		0		30-Jun-2022	◆ Reactor Vessel Segmentation Complete																																											
A1400	All Large Components Off Site		0		31-Jul-2023	◆ All Large Components Off Site																																											
A1500	All Building Demolition Complete		0		30-Jul-2025	◆ All Building Demolition Complete																																											
A1600	All Rad Waste Off Site		0		31-Oct-2025	◆ All Rad Waste Off Site																																											
A1700	Site Restoration Complete		0		31-Mar-2026	◆ Site Restoration Complete																																											
A1800	License Termination Complete		0		30-Oct-2026	◆ License Termination Complete																																											
Period 1 Transition through SNF Pool to ISFSI																																																	
1.b Spent Fuel Transfer to ISFSI																																																	
1b.100	Security through Fuel Transfer		500	02-Jan-2019	22-Dec-2020	Security through Fuel Transfer																																											
1b.200	Design & Procure Fuel & GTCC Casks		250	02-Jan-2019	27-Dec-2019	Design & Procure Fuel & GTCC Casks																																											
1b.300	Fuel Pool Operations		500	02-Jan-2019	22-Dec-2020	Fuel Pool Operations																																											
1b.400	Fuel Pool to Pad Transfer Operations		450	02-Jan-2019	09-Oct-2020	Fuel Pool to Pad Transfer Operations																																											
1b.500	Utility Staff through Fuel Transfer		500	02-Jan-2019	22-Dec-2020	Utility Staff through Fuel Transfer																																											
Period 2 License Termination																																																	
2.a Decommissioning Planning & Preparation																																																	
2a.300	General Planning Services		120	14-Mar-2019	30-Aug-2019	General Planning Services																																											
2a.310	Develop Decommissioning Execution Baselines		180	30-Apr-2019	16-Jan-2020	Develop Decommissioning Execution Baselines																																											
2a.320	Site Characterization & Assessments		180	29-May-2019	13-Feb-2020	Site Characterization & Assessments																																											
2a.200	License Termination Plan (LTP) Preparation		320	25-Jul-2019	28-Oct-2020	License Termination Plan (LTP) Preparation																																											
2a.400	Infrastructure Upgrades		320	03-Sep-2019	08-Dec-2020	Infrastructure Upgrades																																											
2a.500	Cold & Dark and Decommissioning Electrical		420	03-Sep-2019	03-May-2021	Cold & Dark and Decommissioning Electrical																																											
2.b Rad Decommissioning & License Termination																																																	
2b.200	Remove Remaining Legacy Large Components		300	02-Jan-2019	10-Mar-2020	Remove Remaining Legacy Large Components																																											
2b.100	Develop Reactor Vessel Segmentation & Procurement Plan		120	30-Apr-2019	17-Oct-2019	Develop Reactor Vessel Segmentation & Procurement Plan																																											
2b.110	Procure & Deliver RVI Segmentation Equipment		240	19-Sep-2019	31-Aug-2020	Procure & Deliver RVI Segmentation Equipment																																											
2b.500	Field Waste Operations		1415	11-Mar-2020	17-Oct-2025	Field Waste Operations																																											
2b.120	Procure & Deliver RV Segmentation Equipment		240	24-Apr-2020	07-Apr-2021	Procure & Deliver RV Segmentation Equipment																																											
2b.130	Reactor Vessel Internal (RVI) Segmentation		224	12-Oct-2020	31-Aug-2021	Reactor Vessel Internal (RVI) Segmentation																																											
2b.600	Rad Waste Transportation & Disposal		1270	09-Dec-2020	23-Dec-2025	Rad Waste Transportation & Disposal																																											
2b.140	GTCC Waste Transfer to ISFSI		120	13-Apr-2021	30-Sep-2021	GTCC Waste Transfer to ISFSI																																											
2b.150	Reactor Vessel (RV) Segmentation		209	01-Sep-2021	30-Jun-2022	Reactor Vessel (RV) Segmentation																																											
2b.210	Large Component Removal		292	03-Jun-2022	31-Jul-2023	Large Component Removal																																											
2b.300	Rad Building Interior / Systems D&D		360	28-Oct-2022	04-Apr-2024	Rad Building Interior / Systems D&D																																											
2b.400	Rad Building Open Air Demolition		365	21-Feb-2024	30-Jul-2025	Rad Building Open Air Demolition																																											
2b.900	Field Rad Surveys & Final Site Surveys		240	23-Jan-2025	06-Jan-2026	Field Rad Surveys & Final Site Surveys																																											
2b.910	Final Survey Reports & Submittals		120	07-Oct-2025	31-Mar-2026	Final Survey Reports & Submittals																																											
2b.920	NRC Reviews & Approvals		240	18-Nov-2025	30-Oct-2026	NRC Reviews & Approvals																																											
2.c ISFSI Security & Operations During Decommissioning																																																	
2c.100	ISFSI Security & Operations (2020 through 2026)		1526	12-Oct-2020*	30-Oct-2026	ISFSI Security & Operations (2020 through 2026)																																											
2c.300	ISFSI Utility Staff (2020 through 2026)		1526	12-Oct-2020*	30-Oct-2026	ISFSI Utility Staff (2020 through 2026)																																											
Period 3 Site Restoration																																																	
<div>Actual Work</div> <div>Critical Remaining Work</div> <div>Remaining Work</div> <div>◆ Milestone</div>			OPPD - FORT CALHOON STATION APPENDIX B - DECOMMISSIONING COST ESTIMATE SCHEDULE Page 1 of 2																								Project: FCS DCE 01 - OPPD Fort Calhoun DCE - DECON Layout: FCS-01 TASK filter: All Activities Data Date: 01-Jan-2019 Printed: 07-Sep-2019																						

Activity ID	Activity Name	Original Duration	Start	Finish	2019				2020				2021				2022				2023				2024				2025				2026				2027				2028				2029				2030
					Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2						
3.a Clean Demolition & Site Restoration																																																	
3a.100	Clean Building & Site Demolition	1008	30-Jun-2021	30-Jun-2025	<div>Clean Building & Site Demolition</div>																																												
3a.300	Backfill & Grade Buildings	240	17-Oct-2024	30-Sep-2025	<div>Backfill & Grade Buildings</div>																																												
3a.500	Final Site Restoration	240	17-Apr-2025	31-Mar-2026	<div>Final Site Restoration</div>																																												
Period 4 SNF / GTCC Dry Storage & Transfer to DOE																																																	
4.a Spent Fuel Dry Storage																																																	
4a.100	ISFSI Security & Operations (2026 through 2058)	8352	02-Nov-2026*	31-Dec-2058	<div>ISFSI Security & Operations (2026 through 2058)</div>																																												
4a.300	ISFSI Utility Staff (2026 through 2058)	8352	02-Nov-2026*	31-Dec-2058	<div>ISFSI Utility Staff (2026 through 2058)</div>																																												
4.b Spent Fuel & GTCC Transfer to DOE																																																	
4b.100	Spent Fuel & GTCC Transfer to DOE (complete by end of 2058)	650	05-Jul-2056*	31-Dec-2058																																													
Period 5 ISFSI Decommissioning																																																	
5.a ISFSI Demolition & Site Restoration																																																	
5a.200	ISFSI Decommissioning & Demolition (2059)	218	01-Jan-2059*	31-Oct-2059																																													

Actual Work

Critical Remaining Work

Remaining Work

◆

◆

Milestone

OPPD - FORT CALHOUN STATION
APPENDIX B - DECOMMISSIONING COST ESTIMATE SCHEDULE
Page 2 of 2

Project: FCS DCE 01 - OPPD Fort Calhoun DCE - DECON
Layout: FCS-01 TASK filter: All Activities
Data Date: 01-Jan-2019 Printed: 07-Sep-2019

APPENDIX C

Detailed Cost Estimate

Appendix C
OPPD - Fort Calhoun Station
PROMPT DECON SCENARIO
(thousands of 2018 Dollars)

10-Sep-19

Period	Item Number	Item Description	Labor Cost	Materials & Equipment	Waste Packaging & Transportation	Waste Disposal	Subcontracts	Other Direct Cost (ODC)	Contingency	Total Cost (Estimated)	License Termination	Spent Fuel Management	Site Restoration	Man-Hours
1a										-				
1a										-				
	1a.1	Planning & Procedures (completed)	-	-	-	-	-	-	-	-	-	-	-	0
1a	1a.2.1	ISFSI Design & Engineering						-	-	-	-	-	-	
1a	1a.2.2	ISFSI Construction						-	-	-	-	-	-	
	1a.2	ISFSI Design & Construction (completed)	-	-	-	-	-	-	-	-	-	-	-	0
1a	1a.3.1	ISFSI Security Modifications								-				
	1a.3	ISFSI Security Modifications (completed)	-	-	-	-	-	-	-	-	-	-	-	0
1a	1a.4.1	Perform Fuel Sampling & Analysis								-				
1a	1a.4.2	Fuel Pool Operations & Maintenance								-				
	1a.4	Fuel Pool Operations (completed)	-	-	-	-	-	-	-	-	-	-	-	0
1a Total - SAFSTOR & Transition (Completed)			-	-	-	-	-	-	-	-	-	-	-	0
1b	1b.1.1	ISFSI & Plant Security Staff	395							39	434	-	434	7,280
	1b.1	Security through Fuel Transfer	395	-	-	-	-	-	-	39	434	-	434	7,280
1b	1b.2.1	Design & Procure Fuel Casks		10,908						1,091	11,999	-	11,999	
1b	1b.2.2	Design & Procure GTCC Casks		940						94	1,034	-	1,034	
1b	1b.2.3	Cask Vendor Tech Support (incl with procurement)						-	-	-	-	-	-	
	1b.2	Design & Procure Fuel & GTCC Casks	-	11,848	-	-	-	-	1,185	13,033	-	13,033	-	0
1b	1b.3.1	Spent Fuel Operations Support						3,943	394	4,337	-	4,337	-	
1b	1b.3.2	Fuel Pool Water Processing						1,000	100	1,100	-	1,100	-	
1b	1b.3.3	Fuel Pool Clean-up						1,500	150	1,650	-	1,650	-	
	1b.3	Fuel Pool Operations	-	-	-	-	-	6,443	644	7,087	-	7,087	-	0
1b	1b.4.1	Procure Transport/Transfer Equipment						-	-	-	-	-	-	
1b	1b.4.2	Spent Fuel Transfer (includes equipment)					26,799		2,680	29,479	-	29,479	-	
	1b.4	Fuel Transfer Operations	-	-	-	-	26,799	-	2,680	29,479	-	29,479	-	0
1b	1b.5.1	Utility Project Staff	4,980						498	5,478	-	5,478	-	65,520
1b	1b.5.2	ISFSI Operations & Maintenance (incl with Utility staff)						-	-	-	-	-	-	
	1b.5	Utility Staff through Fuel Transfer	4,980	-	-	-	-	-	498	5,478	-	5,478	-	65,520
1b Total - Spent Fuel Transfer to ISFSI			5,374	11,848	-	-	26,799	6,443	5,046	55,511	-	55,511	-	72,800
Period 1 Total - Transition through SNF Transfer to ISFSI			5,374	11,848	-	-	26,799	6,443	5,046	55,511	-	55,511	-	72,800
2a	2a.1.1	Historic Site Assessment (HSA)						-	-	-	-	-	-	
2a	2a.1.2	Environmental Assessments						-	-	-	-	-	-	
	2a.1	Site Assessments (completed)	-	-	-	-	-	-	-	-	-	-	-	0

Appendix C
OPPD - Fort Calhoun Station
PROMPT DECON SCENARIO
(thousands of 2018 Dollars)

10-Sep-19

Period	Item Number	Item Description	Labor Cost	Materials & Equipment	Waste Packaging & Transportation	Waste Disposal	Subcontracts	Other Direct Cost (ODC)	Contingency	Total Cost (Estimated)	License Termination	Spent Fuel Management	Site Restoration	Man-Hours
2a	2a.2.1	LTP Preparation						682	68	750	750	-	-	
	2a.2	LTP Planning & Preparation	-	-	-	-	-	682	68	750	750	-	-	0
2a	2a.3.1	General Planning Services (incl with Utility Staff)						-	-	-	-	-	-	
2a	2a.3.2	Site Surveys & Characterization	1,320	330					165	1,815	1,815	-	-	20,308
2a	2a.3.3	Procurement Planning (incl with Utility Staff)						-	-	-	-	-	-	
2a	2a.3.4	Baseline Development	2,133					1,148	328	3,609	3,609	-	-	15,260
	2a.3	Planning Services	3,453	330	-	-	-	1,148	493	5,424	5,424	-	-	35,568
2a	2a.4.1	Road Upgrades						-	-	-	-	-	-	
2a	2a.4.2	Rail Upgrades					6,126		613	6,738	6,738	-	-	
	2a.4	Infrastructure Upgrades	-	-	-	-	6,126	-	613	6,738	6,738	-	-	0
2a	2a.5.1	Cold & Dark Operations					7,729		773	8,502	8,502	-	-	
2a	2a.5.2	Temporary Power Upgrades (incl with cold & dark)						-	-	-	-	-	-	
	2a.5	Decommissioning Electrical	-	-	-	-	7,729	-	773	8,502	8,502	-	-	0
2a Total - Decommissioning Planning & Preparations			3,453	330	-	-	13,855	1,830	1,947	21,415	21,415	-	-	35,568
2b	2b.1.1	Develop RVI/RV Plans and Procedures	411					221	63	695	695	-	-	2,000
2b	2b.1.2	Procure RVI Equipment		20,009					2,001	22,010	22,010	-	-	
2b	2b.1.3	RVI Equipment Tech Support					2,354		235	2,589	2,589	-	-	
2b	2b.1.4	RVI Segmentation & Removal					8,214		821	9,035	9,035	-	-	
2b	2b.1.5	RVI GTCC Operations & Loading (incl with RVI Removal)						-	-	-	-	-	-	
2b	2b.1.6	Procure RV Equipment		16,478					1,648	18,126	18,126	-	-	
2b	2b.1.7	RV Equipment Tech Support					412		41	453	453	-	-	
2b	2b.1.8	RV Segmentation & Removal					3,791		379	4,170	4,170	-	-	
	2b.1	Reactor Vessel	411	36,487	-	-	14,771	221	5,189	57,079	57,079	-	-	2,000
2b	2b.2.1	Heavy Lift / Transfer Equipment (incl with steam generator)						-	-	-	-	-	-	
2b	2b.2.2	Remaining Legacy Large Component Removal					5,056		506	5,562	5,562	-	-	
2b	2b.2.3	Steam Generator Removal					7,439		744	8,183	8,183	-	-	
2b	2b.2.4	Pressurizer Removal					69		7	75	75	-	-	
2b	2b.2.5	RCP Removal					274		27	301	301	-	-	
	2b.2	Large Component Removal	-	-	-	-	12,837	-	1,284	14,121	14,121	-	-	0
2b	2b.3.1	Asbestos Abatement					4,482		448	4,930	4,930	-	-	
2b	2b.3.2	Chemical Decon (incl with work)					-		-	-	-	-	-	
2b	2b.3.3	Reactor Bldg. Interior / Systems Demo					3,457		346	3,803	3,803	-	-	
2b	2b.3.4	Aux Bldg. Interior / Systems Demo					3,344		334	3,679	3,679	-	-	
2b	2b.3.5	Rad Waste Bldg. Interior Demo					1,729		173	1,902	1,902	-	-	
2b	2b.3.6	Misc Rad Systems Removal					6,820		682	7,502	7,502	-	-	
2b	2b.3.7	D&D Contractor Staff					1,729		173	1,902	1,902	-	-	
2b	2b.3.8	D&D Contractor Tools & Equipment (incl with work)					-		-	-	-	-	-	
2b	2b.3.9	D&D Contractor Scaffolding (incl with work)					-		-	-	-	-	-	
	2b.3	Rad Bldg. Interior / Systems D&D	-	-	-	-	21,560	-	2,156	23,716	23,716	-	-	0

Appendix C
OPPD - Fort Calhoun Station
PROMPT DECON SCENARIO
(thousands of 2018 Dollars)

10-Sep-19

Period	Item Number	Item Description	Labor Cost	Materials & Equipment	Waste Packaging & Transportation	Waste Disposal	Subcontracts	Other Direct Cost (ODC)	Contingency	Total Cost (Estimated)	License Termination	Spent Fuel Management	Site Restoration	Man-Hours
2b	2b.4.1	Reactor Building Demo					8,208		821	9,028	9,028	-	-	
2b	2b.4.2	Aux Building Demo					10,260		1,026	11,286	11,286	-	-	
2b	2b.4.3	Rad Waste Bldg. Interior Demo					2,052		205	2,257	2,257	-	-	
2b	2b.4.4	Misc Rad Building & Open Air demo					6,356		636	6,991	6,991	-	-	
2b	2b.4.5	Firing Range (included)					-		-	-	-	-	-	
2b	2b.4.6	Drainage Lagoons					437		44	481	481	-	-	
2b	2b.4.7	D&D Contractor Staff					-		-	-	-	-	-	
2b	2b.4.8	D&D Contractor Tools & Equipment (incl with work)					-		-	-	-	-	-	
2b	2b.4.9	D&D Contractor Scaffolding					-		-	-	-	-	-	
2b.4 Rad Building Open Air Demolition			-	-	-	-	27,312	-	2,731	30,043	30,043	-	-	0
2b	2b.5.1	Waste Handling & Loadout Equipment (incl with waste handling)						-	-	-	-	-	-	
2b	2b.5.2	Waste Handling & Loadout					9,694		969	10,664	10,664	-	-	
2b	2b.5.3	Waste Rad Techs (incl with waste handling)						-	-	-	-	-	-	
2b.5 Field Waste Operations			-	-	-	-	9,694	-	969	10,664	10,664	-	-	0
2b	2b.6.1	Class A Waste Disposal			22,874	112,679			20,333	155,887	155,887	-	-	
2b	2b.6.2	Class B & C Waste Disposal			1,522	20,819			3,351	25,692	25,692	-	-	
2b	2b.6.3	Remaining Legacy Large Component Disposal			3,121	3,121			936	7,178	7,178	-	-	
2b.6 Rad Waste Transportation & Disposal			-	-	27,517	136,619	-	-	24,620	188,756	188,756	-	-	0
2b	2b.7.1	Recycle Materials						(1,715)	(257)	(1,972)	(1,972)	-	-	
2b	2b.7.2	Non-Rad Local Landfill						3,327	499	3,826	3,826	-	-	
2b.7 Non-Rad & Hazardous Waste Disposal			-	-	-	-	-	1,613	242	1,854	1,854	-	-	0
2b	2b.8.1	Rad Protection Techs					7,599		760	8,359	8,359	-	-	
2b	2b.8.2	Rad Protection Techs	5,972						597	6,569	6,569	-	-	91,879
2b.8 Field Radiation Protection			5,972	-	-	-	7,599	-	1,357	14,929	14,929	-	-	91,879
2b	2b.9.1	Final Site Surveys	5,852	1,951				1,951	975	10,728	10,728	-	-	90,029
2b.9 Field Rad Surveys & Final Site Surveys			5,852	1,951	-	-	-	1,951	975	10,728	10,728	-	-	90,029
2b Total - Rad Decommissioning & License Termination			12,235	38,438	27,517	136,619	93,774	3,784	39,524	351,891	351,891	-	-	183,908
2c	2c.1.1	Utility Management Staff	132,162						13,216	145,378	145,378	-	-	1,556,006
2c	2c.1.2	Temporary Facilities						2,405	241	2,646	2,646	-	-	
2c	2c.1.3	Environmental Program						960	96	1,056	1,056	-	-	
2c	2c.1.4	Decommissioning NRC Fees & Inspections						5,000	500	5,500	5,500	-	-	
2c	2c.1.5	Safety Program & Supplies		2,400					240	2,640	2,640	-	-	
2c	2c.1.6	Training Program (<i>In processing Time</i>)					3,372		337	3,709	3,709	-	-	
2c.1 Utility Staff during Decommissioning			132,162	2,400	-	-	3,372	8,365	14,630	160,929	160,929	-	-	1,556,006
2c	2c.2.1	Plant Operations & Maintenance (<i>non-labor</i>)		5,760					576	6,336	6,336	-	-	
2c	2c.2.2	Water Processing						960	96	1,056	1,056	-	-	
2c	2c.2.3	Utility Costs						1,482	148	1,630	1,630	-	-	
2c.2 Plant Operations & Maintenance			-	5,760	-	-	-	2,442	820	9,022	9,022	-	-	0

<div>Appendix C</div> <div>OPPD - Fort Calhoun Station</div> <div>PROMPT DECON SCENARIO</div> <div>(thousands of 2018 Dollars)</div>														10-Sep-19
Period	Item Number	Item Description	Labor Cost	Materials & Equipment	Waste Packaging & Transportation	Waste Disposal	Subcontracts	Other Direct Cost (ODC)	Contingency	Total Cost (Estimated)	License Termination	Spent Fuel Management	Site Restoration	Man-Hours
2c	2c.3.1	Plant Security	22,704						2,270	24,974	24,974	-	-	418,829
	2c.3	Plant Security during Decommissioning	22,704	-	-	-	-	-	2,270	24,974	24,974	-	-	418,829
2c	2c.4.1	DGC Contractor Mobilization						528	53	581	581	-	-	294,336
2c	2c.4.2	Decommissioning General Contractor Staff	51,353					34,235	8,559	94,146	94,146	-	-	
2c	2c.4.3	Contractor Rad Protection Program		4,699					470	5,168	5,168	-	-	
2c	2c.4.4	DGC Contractor Demobilization						528	53	581	581	-	-	
	2c.4	Contractor Project Management	51,353	4,699	-	-	-	35,291	9,134	100,477	100,477	-	-	294,336
2c	2c.5.1	ANI Insurance Costs						4,390	439	4,829	4,829	-	-	
2c	2c.5.2	NEIL Insurance Costs						2,460	246	2,706	2,706	-	-	
2c	2c.5.3	Property Taxes						154	15	169	169	-	-	
2c	2c.5.4	Use Taxes						2,688	269	2,957	2,957	-	-	
	2c.5	Insurance and Taxes	-	-	-	-	-	9,691	969	10,661	10,661	-	-	0
2c	2c.6.1	Corporate A&G Allocations						16,120	1,612	17,732	17,732	-	-	
2c	2c.6.2	Communications (Telecom) Allocations						2,567	257	2,823	2,823	-	-	
2c	2c.6.3	Information Technology Allocations						17,741	1,774	19,515	19,515	-	-	
2c	2c.6.4	Stores Expense Adder						1,176	118	1,294	1,294	-	-	
	2c.6	Corporate Allocations	-	-	-	-	-	37,604	3,760	41,364	41,364	-	-	0
2c Total - License Termination Undistributed Costs			206,219	12,859	-	-	3,372	93,394	31,584	347,427	347,427	-	-	2,269,171
Period 2 Total - License Termination			221,906	51,626	27,517	136,619	111,001	99,008	73,055	720,733	720,733	-	-	2,488,647
3a	3a.1.1	Asbestos Abatement					1,815		182	1,997	-	-	1,997	
3a	3a.1.2	Turbine Building					4,497		450	4,947	-	-	4,947	
3a	3a.1.3	Intake Structure					3,518		352	3,869	-	-	3,869	
3a	3a.1.4	Admin Building (not removed)					-		-	-	-	-	-	
3a	3a.1.5	Flex Bldg. (not removed)					-		-	-	-	-	-	
3a	3a.1.6	Mausoleum					110		11	121	-	-	121	
3a	3a.1.7	Training Center (not removed)					-		-	-	-	-	-	
3a	3a.1.8	New & Old Warehouse Demo					348		35	382	-	-	382	
3a	3a.1.9	Misc Clean Building Demo					1,098		110	1,207	-	-	1,207	
3a	3a.1.10	Underground Piping & Utilities					4,613		461	5,075	-	-	5,075	
3a	3a.1.11	Yard/Parking lot pavement & concrete					1,944		194	2,139	-	-	2,139	
3a	3a.1.12	MET Tower					28		3	30	-	-	30	
3a	3a.1.13	D&D Contractor Staff (incl with work)						-	-	-	-	-	-	
3a	3a.1.14	D&D Contractor Tools & Equipment (incl with work)						-	-	-	-	-	-	
	3a.1	Clean Building Demolition	-	-	-	-	17,970	-	1,797	19,767	-	-	19,767	0
3a	3a.2.1	Process / Reuse On-Site Fill Materials					6,050		605	6,655	-	-	6,655	
3a	3a.2.2	Imported Fill Materials		1,650					165	1,815	-	-	1,815	
	3a.2	Fill & Backfill Materials	-	1,650	-	-	6,050	-	770	8,470	-	-	8,470	0

Appendix C OPPD - Fort Calhoun Station PROMPT DECON SCENARIO (thousands of 2018 Dollars)														10-Sep-19
Period	Item Number	Item Description	Labor Cost	Materials & Equipment	Waste Packaging & Transportation	Waste Disposal	Subcontracts	Other Direct Cost (ODC)	Contingency	Total Cost (Estimated)	License Termination	Spent Fuel Management	Site Restoration	Man-Hours
3a	3a.3.1	Backfill & Grade Buildings					682		68	751	-	-	751	
	3a.3	Backfill & Grade Buildings	-	-	-	-	682	-	68	751	-	-	751	0
3a	3a.4.1	Non-Rad Environmental Remediation					1,150		115	1,264	-	-	1,264	
	3a.4	Non-Rad Environmental Remediation	-	-	-	-	1,150	-	115	1,264	-	-	1,264	0
3a	3a.5.1	Final Site Grading					550		55	605	-	-	605	
	3a.5	Final Site Restoration	-	-	-	-	550	-	55	605	-	-	605	0
3a Total - Clean Demolition & Site Restoration			-	1,650	-	-	26,402	-	2,805	30,857	-	-	30,857	0
3b	3b.1.1	Utility Management Staff	5,507						551	6,057	-	-	6,057	64,834
3b	3b.1.2	Temporary Facilities						100	10	110	-	-	110	
3b	3b.1.3	Environmental Program						40	4	44	-	-	44	
3b	3b.1.4	Safety Program & Supplies		100					10	110	-	-	110	
3b	3b.1.5	Training Program <i>(In processing Time)</i>					140		14	155	-	-	155	
	3b.1	Utility Staff during Decommissioning	5,507	100	-	-	140	140	589	6,476	-	-	6,476	64,834
3b	3b.2.1	Plant Operations & Maintenance <i>(non-labor)</i>		240					24	264	-	-	264	
3b	3b.2.2	Water Processing						40	4	44	-	-	44	
3b	3b.2.3	Utility Costs						62	6	68	-	-	68	
	3b.2	Plant Operations & Maintenance	-	240	-	-	-	102	34	376	-	-	376	0
3b	3b.3.1	Plant Security	946						95	1,041	-	-	1,041	17,451
	3b.3	Plant Security during Decommissioning	946	-	-	-	-	-	95	1,041	-	-	1,041	17,451
3b	3b.4.1	DGC Contractor Mobilization						22	2	24	-	-	24	12,264
3b	3b.4.2	Decommissioning General Contractor Staff	2,140					1,426	357	3,923	-	-	3,923	
3b	3b.4.3	Contractor Rad Protection Program		196					20	215	-	-	215	
3b	3b.4.4	DGC Contractor Demobilization						22	2	24	-	-	24	
	3b.4	Contractor Project Management	2,140	196	-	-	-	1,470	381	4,187	-	-	4,187	12,264
3b	3b.5.1	NEIL Insurance Costs						103	10	113	-	-	113	
3b	3b.5.2	Property Taxes						6	1	7	-	-	7	
3b	3b.5.3	Use Taxes						112	11	123	-	-	123	
	3b.5	Insurance and Taxes	-	-	-	-	-	221	22	243	-	-	243	0
3b	3b.6.1	Corporate A&G Allocations						672	67	739	-	-	739	
3b	3b.6.2	Communications (Telecom) Allocations						107	11	118	-	-	118	
3b	3b.6.3	Information Technology Allocations						739	74	813	-	-	813	
3b	3b.6.4	Stores Expense Adder						49	5	54	-	-	54	
	3b.6	Corporate Allocations	-	-	-	-	-	1,567	157	1,724	-	-	1,724	0
3b Total - Site Restoration Undistributed Costs			8,592	536	-	-	140	3,500	1,277	14,046	-	-	14,046	94,549
Period 3 Total - Site Restoration			8,592	2,186	-	-	26,543	3,500	4,082	44,903	-	-	44,903	94,549

Appendix C
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10-Sep-19

Period	Item Number	Item Description	Labor Cost	Materials & Equipment	Waste Packaging & Transportation	Waste Disposal	Subcontracts	Other Direct Cost (ODC)	Contingency	Total Cost (Estimated)	License Termination	Spent Fuel Management	Site Restoration	Man-Hours
4a	4a.1.1	ISFSI Security during Decommissioning	20,747						2,075	22,821	-	22,821	-	382,720
4a	4a.1.2	ISFSI Security after Decommissioning	111,735						11,174	122,909	-	122,909	-	2,402,400
4a	4a.1.3	ISFSI Operations & Maintenance						16,700	2,505	19,205	-	19,205	-	
4a	4a.1.4	ISFSI NRC Fees						9,193	1,379	10,572	-	10,572	-	
4a	4a.1.5	ISFSI DAW Waste				1,570			236	1,806	-	1,806	-	
	4a.1	ISFSI Security & Operations	132,482	-	-	1,570	-	25,893	17,368	177,312	-	177,312	-	2,785,120
4a	4a.2.1	ISFSI Property Taxes (not required)						-	-	-	-	-	-	
4a	4a.2.2	ISFSI Insurance						17,041	2,556	19,597	-	19,597	-	
	4a.2	ISFSI Insurance & Taxes	-	-	-	-	-	17,041	2,556	19,597	-	19,597	-	0
4a	4a.3.1	ISFSI Utility Staff during Decommissioning	9,880						988	10,868	-	10,868	-	130,000
4a	4a.3.2	ISFSI Utility Staff after Decommissioning	70,325						7,033	77,358	-	77,358	-	1,029,600
	4a.3	ISFSI Utility Staff	80,206	-	-	-	-	-	8,021	88,226	-	88,226	-	1,159,600
4a	4a.4.1	Corporate A&G Allocations						3,211	482	3,692	-	3,692	-	
	4a.4	ISFSI Corporate Allocations	-	-	-	-	-	3,211	482	3,692	-	3,692	-	0
4a Total - Spent Fuel Dry Storage			212,688	-	-	1,570	-	46,145	28,426	288,828	-	288,828	-	3,944,720
4b	4b.1.1	Procure/Rent Transport/Transfer Equipment		2,500					375	2,875	-	2,875	-	
4b	4b.1.2	Spent Fuel & GTCC Transfer Operations					10,200		1,530	11,730	-	11,730	-	
	4b.1	Spent Fuel & GTCC Transfer to DOE	-	2,500	-	-	10,200	-	1,905	14,605	-	14,605	-	0
4b Total - Spent Fuel & GTCC Transfer to DOE			-	2,500	-	-	10,200	-	1,905	14,605	-	14,605	-	0
Period 4 Total - SNF/GTCC Dry Storage & Transfer to DOE			212,688	2,500	-	1,570	10,200	46,145	30,331	303,433	-	303,433	-	3,944,720
5a	5a.1.1	ISFSI Decommissioning & Demolition					3,111		467	3,578	3,578	-	-	
5a	5a.1.2	ISFSI Site Restoration								-	-	-	-	
	5a.1	ISFSI Demolition & Site Restoration	-	-	-	-	3,111	-	467	3,578	3,578	-	-	0
5a Total - ISFSI Demolition & Site Restoration			-	-	-	-	3,111	-	467	3,578	3,578	-	-	0
5b	5b.1.1	Security during ISFSI Decommissioning	177						18	195	195	-	-	4,160
5b	5b.1.2	Utility Staff during ISFSI Decommissioning	670						67	737	737	-	-	10,400
	5b.1	ISFSI Decommissioning Undistributed Costs	848	-	-	-	-	-	85	933	933	-	-	14,560
5b Total - ISFSI Decommissioning Undistributed Costs			848	-	-	-	-	-	85	933	933	-	-	14,560
Period 5 Total - ISFSI Decommissioning			848	-	-	-	3,111	-	551	4,511	4,511	-	-	14,560
Grand Total			449,408	68,160	27,517	138,189	177,654	155,096	113,066	1,129,091	725,243	358,944	44,903	6,615,276