



# **Westinghouse Columbia Fuel Fabrication Facility Decommissioning Funding Plan**

**Version 2    June 2012**



**Prepared by:**



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Nature of Changes  
2012 CFFF DFP Update

**General Revisions:**

- Controlled Access Area (CAA) Expansion - The newly established expansion has been added to the plan. Details of the expansion are covered in Section 3. Additionally, four final status survey technicians have been added to WBS 1.6 to account for the additional survey requirements related to the expanded CAA.
- Waste Details - The 2012 BSFR waste volume total for Dry Active Waste (DAW) was reduced by 81,800 pounds due to the removal and disposal of material from the MAP area. As a result of the updated waste volumes, the quantity of material scheduled for BSFR was reduced. By means of the waste volume reduction, the number of BSFR shipments has been reduced by two shipments. This adjustment is not apparent in Table 3 as it only addresses equipment and systems. The DAW value in Table 30 has been revised to account for the reduction in the DAW waste volume.
- Per Diem Rates – The per diem rates were updated using the GSA established CONUS per diem rates. Considering the long term status of the project, SNS used a reduced rate of seventy percent of the CONUS maximum rate.
- Transportation – SNS obtained a quotation from a different waste processor than that used in the 2009 DFP. The new processing facility is located half the distance (300 miles vs. 600 miles) from Columbia than that of the previous facility. The fifty percent reduction in mileage also equates to reducing the BSFR transportation by fifty percent. SNS also obtained an updated quotation from the transportation company and the \$/mi charge will remain the same for the 2012 DFP.
- BSFR Waste Processing – SNS obtained a quotation from a different waste processing facility and the cost for BSFR services has been reduced by \$.20/lb.
- Direct Burial Waste – SNS obtained an updated quotation from the burial site and the disposal rate increased by \$.12/lb relative to the rate used in the 2009 DFP. The new disposal rate has been applied to the volume of waste scheduled for direct burial, excluding soil scheduled for direct burial.
- Direct Burial Soil – SNS obtained a quotation from a disposal facility relative to the contaminated soil scheduled for direct burial. The quoted value is identified in the cost sheet for WBS 1.4.
- Inflationary Adjustment – SNS obtained the Cumulative Inflation Rate (CIR) for the period from 2009 to 2012 from the BLS.GOV website. For the stated period, the CIR was 6.1 percent. The CIR was applied to pertinent components of the cost estimate.
- Waste Management – SNS added two Jr. D&D Technicians to support the waste management activities required for the project.
- Resource Hourly Labor Rates – SNS adjusted the hourly rates for the resources to be consistent with the 2012 hourly rates. This was only a partial adjustment, not all resources hourly rates were increased.

- Financial Burdens (Mark-ups) – SNS adjusted the G&A component to be consistent with the actual rates used for the 2012 mark-ups.
- Assumptions and Clarifications - Updated the section to include new assumption relative to the URRS Soil disposal.

#### Detailed Revisions:

<i>Item</i>	<i>Section</i>	<i>Page/Paragraph</i>	<i>Description</i>
1.	Entire Document		Minor editorial revisions.
2.	Figure 2-1 Appendix A	Pg. 2-6	Updated the Work Breakdown Structure to include the URRS Soil.
3.	Appendix B		Updated the Logic Network to include the URRS Soil.
4.	Figure 2-2 Appendix C	Pg. 2-7	Updated the Project Schedule to include the URRS Soil.
5.	Appendix D		Updated Cost Estimate values and included the URRS Soil.
6.	1.0	Pg 1-1 Para. 2	Revised stated D&D Project estimated cost and duration.
7.	1.0	Pg 1-1 Para. 3	Revised licensed material possession limits
8.	1.0	Pg 1-2 Para. 8	Revised stated additional equipment weight.
9.	Table 1	Pg 1-3	Revised cost figures
10.	Table 2	Pg 1-3	Revised yearly cost figures
11.	Table 3	Pg 1-4	Revised additional equipment value.
12.	3.0	Pg 3-1 Para. 2	Updated stated values and added information on the CAA expansion.
13.	Figure 3-2	Pg 3-21	Updated CFFF Main Site – Site Plan
14.	Table 4	Pg 3-22	Updated table to include the intermediate areas.
15.	Table 5	Pg 4-1	Added Prerequisite Man Days Table.
16.	Table 6	Pg 4-2	Added Prerequisite Labor Cost Table.
17.	Table 7	Pg 4-2	Added Prerequisite Remaining Cost Table.
18.	Table 8	Pg 4-3	Added Prerequisite Total Cost Table.
19.	Table 9	Pg 4-11	Added Advance Activities Man Days Table.
20.	Table 10	Pg 4-12	Added Advance Activities Labor Cost Table.
21.	Table 11	Pg 4-13	Added Advance Activities Remaining Cost Table.
22.	Table 12	Pg 4-13	Added Advance Activities Total Cost Table.
23.	Table 13	Pg 4-15	Added D&D Activities Man Days Table.
24.	Table 14	Pg 4-16	Added D&D Activities Labor Cost Table.
25.	Table 15	Pg 4-16	Added D&D Activities Remaining Cost Table.
26.	Table 16	Pg 4-16	Added D&D Activities Total Cost Table.
27.	4.4	Pg 4-19	Added URRS Soil to the DFP. WBS Element 1.4 was assigned to the URRS Soil and all subsequent WBS Element identifiers increased by one numerical value.
28.	Table 17	Pg 4-20	Added URRS Soil Activities Man Days Table.
29.	Table 18	Pg 4-21	Added URRS Soil Activities Labor Cost Table.
30.	Table 19	Pg 4-21	Added URRS Soil Activities Remaining Cost Table.
31.	Table 20	Pg 4-22	Added URRS Soil Activities Total Cost Table.

**WESTINGHOUSE NON-PROPRIETARY CLASS 3**

<i>Item</i>	<i>Section</i>	<i>Page/Paragraph</i>	<i>Description</i>
32.	Table 21	Pg 4-22	Added Waste Management Man Days Table.
33.	Table 22	Pg 4-23	Added Waste Management Labor Cost Table.
34.	Table 23	Pg 4-23	Added Waste Management Remaining Cost Table.
35.	Table 24	Pg 4-23	Added Waste Management Total Cost Table.
36.	4.5	Pg 4-23 Last Para.	Editorial revisions to update waste shipment quantities.
37.	4.5	Pg 4-24 Para. 1	Editorial revisions to update waste shipment quantities and waste shipment cost.
38.	4.5	Pg 4-24 Para. 2 & 3	Editorial revisions to update waste shipment quantities.
39.	Table 25	Pg 4-24	Updated table values.
40.	Table 26	Pg 4-25	Updated table values.
41.	Table 27	Pg 4-25	Added Concluding Activities Man Days Table.
42.	Table 28	Pg 4-26	Added Concluding Activities Labor Cost Table.
43.	Table 29	Pg 4-26	Added Concluding Activities Remaining Cost Table.
44.	Table 30	Pg 4-27	Added Concluding Activities Total Cost Table.
45.	4.6.1.4	Pg 4-33 Para. 1	Editorial revisions to include additional FSS Techs.
46.	Table 31	Pg 4-35	Updated table values.
47.	Table 32	Pg 4-36	Added Project Management Man Days Table.
48.	Table 33	Pg 4-37	Added Project Management Labor Cost Table.
49.	Table 34	Pg 4-37	Added Project Management Remaining Cost Table.
50.	Table 35	Pg 4-38	Added Project Management Total Cost Table.
51.	4.7.10	Pg 4-42 Para. 1	Editorial revisions to include additional Technicians.
52.	6.1.3	Pg 6-1 Para. 1	Updated consumables rate.
53.	Table 36	Pg 8-1	Added Westinghouse Oversight Man Days Table.
54.	Table 37	Pg 8-1	Added Westinghouse Oversight Labor Cost Table.
55.	Table 38	Pg 8-2	Added Westinghouse Oversight Remaining Cost Table.
56.	Table 39	Pg 8-2	Added Westinghouse Oversight Total Cost Table.





## Table of Contents

	<u>Page No.</u>
<b>1.0 EXECUTIVE SUMMARY .....</b>	<b>1-1</b>
<b>2.0 OVERVIEW OF PLANNING EFFORT .....</b>	<b>2-1</b>
2.1 SCOPE OF WORK .....	2-1
2.2 SIEMPELKAMP NUCLEAR SERVICES QUALIFICATIONS & EXPERIENCE .....	2-1
2.3 ASSUMPTIONS AND CLARIFICATIONS .....	2-2
<b>3.0 SITE DESCRIPTION .....</b>	<b>3-1</b>
3.1 FACILITY DESCRIPTION .....	3-2
3.2 SNM-1107 FACILITIES AND WORK AREAS .....	3-4
3.2.1 Facility Operations .....	3-4
3.2.2 UF <sub>6</sub> Pad & Bay .....	3-5
3.2.3 ADU Conversion .....	3-7
3.2.4 Bulk Powder Blending .....	3-7
3.2.5 ADU Pelleting .....	3-7
3.2.6 ADU Fuel Rod Manufacturing .....	3-9
3.2.7 IFBA .....	3-10
3.2.8 Erbia .....	3-11
3.2.9 Waste Processing .....	3-11
3.2.10 MAP .....	3-13
3.2.11 Laboratories .....	3-14
3.2.12 Incinerator .....	3-16
3.2.13 Dissolvers .....	3-16
3.2.14 Solvent Extraction .....	3-17
3.2.15 Decon Room .....	3-18
3.3 CURRENT RADIOLOGICAL CONDITIONS .....	3-22
<b>4.0 TECHNICAL APPROACH TO DECOMMISSIONING .....</b>	<b>4-1</b>
4.1 PREREQUISITE ACTIVITIES (WBS 1.1) .....	4-1
4.1.1 D&D Preplanning (WBS 1.1.1) .....	4-3
4.1.1.1 Develop Release Criteria (DCGLs) (WBS 1.1.1.1) .....	4-3
4.1.1.1.1 HSA .....	4-3
4.1.1.1.2 Scoping Survey .....	4-4
4.1.1.1.3 Characterization Survey .....	4-4
4.1.1.1.4 Modeling .....	4-5
4.1.1.1.5 Develop Data Quality Objectives .....	4-6
4.1.1.2 Develop D&D Plan (WBS 1.1.1.2) .....	4-8
4.1.2 Inventory Disposition (WBS 1.1.2) .....	4-9



4.2	ADVANCE ACTIVITIES (WBS 1.2)	4-10
4.2.1	Pre-Mobilization (WBS 1.2.1)	4-13
4.2.2	Mobilization (WBS 1.2.2)	4-14
4.2.3	Preparatory (WBS 1.2.3)	4-14
4.3	D&D OF FACILITY AREAS AND COMPONENTS (WBS 1.3)	4-15
4.4	URRS SOIL (WBS 1.4)	4-19
4.5	WASTE MANAGEMENT (WBS 1.5)	4-22
4.6	CONCLUDING ACTIVITIES (WBS 1.6)	4-26
4.6.1	Final Status Survey (FSS) (WBS 1.6.1)	4-28
4.6.1.1	Design Survey	4-29
4.6.1.1.1	Inputs to Survey Design	4-30
4.6.1.1.2	Area Classification	4-30
4.6.1.1.3	Survey Units	4-30
4.6.1.1.4	Scanning Surveys	4-31
4.6.1.1.5	Direct Surveys	4-31
4.6.1.1.6	Survey Procedures	4-32
4.6.1.1.7	Documentation	4-32
4.6.1.2	Perform Survey	4-33
4.6.1.3	Assess Survey Data	4-33
4.6.1.4	Prepare FSS Report	4-33
4.6.2	Site Restoration (WBS 1.6.2)	4-34
4.6.3	Demobilization (WBS 1.6.3)	4-34
4.6.4	License Termination (WBS 1.6.4)	4-34
4.6.4.1	Regulatory Confirmation Survey	4-35
4.6.5	Final Project Report (WBS 1.6.5)	4-36
4.7	PROJECT MANAGEMENT (WBS 1.7)	4-36
4.7.1	Supervision	4-39
4.7.2	Level of Effort (LOE) Equipment and Supplies	4-39
4.7.3	Contract Management	4-39
4.7.4	Regulatory Affairs	4-40
4.7.5	Quality Assurance	4-40
4.7.6	Environmental Safety & Health	4-40
4.7.7	Remedial Action Support Surveys	4-40
4.7.8	Community Relations	4-41
4.7.9	Cost and Schedule Tracking	4-42
4.7.9.1	Schedule Tracking and Control	4-42
4.7.10	Waste Coordination	4-43
5.0	PROJECT SCHEDULE	5-1





<b>6.0</b>	<b>WBS COST DETAILS.....</b>	<b>6-1</b>
6.1	COSTS .....	6-1
6.1.1	Labor.....	6-1
6.1.2	Other Direct Costs.....	6-1
6.1.3	Materials & Supplies.....	6-1
6.1.4	Equipment .....	6-2
6.1.5	Sub-contracted work .....	6-2
6.1.6	Waste Disposal.....	6-2
6.2	WORK PACKAGES.....	6-2
<b>7.0</b>	<b>CONTINGENCY.....</b>	<b>7-1</b>
<b>8.0</b>	<b>WESTINGHOUSE OVERSIGHT ORGANIZATION.....</b>	<b>8-1</b>
<b>9.0</b>	<b>REFERENCES .....</b>	<b>9-1</b>

### List of Figures

Figure 2-1:	D&D Project Work Breakdown Structure.....	2-6
Figure 2-2:	Project Schedule .....	2-7
Figure 3-1:	CFFF Site Location Map .....	3-20
Figure 3-2:	CFFF Main Site – Site Plan.....	3-21

### List of Tables

Table 1:	Decommissioning Cost Estimate Summary .....	1-3
Table 2:	Project Cost Summary by Years.....	1-3
Table 3:	Additional Equipment/Systems Since 2009 Estimate .....	1-4
Table 4:	Contamination Survey Limits and Frequencies.....	3-22
Table 5:	Man Days Required To Complete Prerequisite Activities .....	4-1
Table 6:	Total Labor Costs Required To Complete Prerequisite Activities .....	4-2
Table 7:	Remaining Costs For Prerequisite Activities.....	4-2
Table 8:	Total Costs For Prerequisite Activities.....	4-3
Table 9:	Man Days Required To Complete Advance Activities .....	4-11
Table 10:	Total Labor Costs Required To Complete Advance Activities .....	4-12
Table 11:	Remaining Costs For Advance Activities .....	4-13
Table 12:	Total Costs For Advance Activities.....	4-13
Table 13:	Man Days Required To Complete D&D Of Facility Areas .....	4-15
Table 14:	Total Labor Costs Required To Complete D&D Of Facility Areas .....	4-16
Table 15:	Remaining Costs For D&D Activities.....	4-16



Table 16:	Total Costs For D&D Activities.....	4-16
Table 17:	Man Days Required To Complete URRS Soil Remediation.....	4-21
Table 18:	Total Labor Costs Required To Complete URRS Soil Remediation .....	4-21
Table 19:	Remaining Costs For URRS Soil Remediation.....	4-22
Table 20:	Total Costs For URRS Soil Remediation.....	4-22
Table 21:	Man Days Required To Complete Waste Management Activities.....	4-23
Table 22:	Total Labor Costs Required To Complete Waste Management Activities .....	4-23
Table 23:	Remaining Costs For Waste Management Activities.....	4-23
Table 24:	Total Costs For Waste Management Activities.....	4-24
Table 25:	Categories of D&D Waste & Weight Estimates .....	4-25
Table 26:	Waste Disposition.....	4-25
Table 27:	Man Days Required To Complete Concluding Activities.....	4-26
Table 28:	Total Labor Costs Required To Complete Concluding Activities.....	4-27
Table 29:	Remaining Costs For Concluding Activities .....	4-27
Table 30:	Total Costs For Concluding Activities .....	4-28
Table 31:	Worker Unit Cost Schedule.....	4-36
Table 32:	Man Days Required To Complete Project Management Activities .....	4-37
Table 33:	Total Labor Costs Required To Complete Project Management Activities .....	4-38
Table 34:	Remaining Costs For Project Management Activities .....	4-38
Table 35:	Total Costs For Project Management Activities.....	4-39
Table 36:	Man Days Required To Complete Westinghouse Oversight Activities .....	8-1
Table 37:	Total Labor Costs Required To Complete Westinghouse Oversight Activities.....	8-1
Table 38:	Remaining Costs For Westinghouse Oversight Activities .....	8-2
Table 39:	Total Costs For Westinghouse Oversight Activities .....	8-2

## List of Appendices

<b>APPENDIX A</b>	<b>WORK BREAKDOWN STRUCTURE .....</b>	<b>A-1</b>
<b>APPENDIX B</b>	<b>LOGIC NETWORK .....</b>	<b>B-1</b>
<b>APPENDIX C</b>	<b>PROJECT SCHEDULE .....</b>	<b>C-1</b>
<b>APPENDIX D</b>	<b>COST ESTIMATE.....</b>	<b>D-1</b>
<b>APPENDIX E</b>	<b>EQUIPMENT &amp; STRUCTURE LIST .....</b>	<b>E-1</b>





### List of Acronyms

ADU	Ammonium Diuranate
ALARA	As low as reasonably achievable
ANL-E	Argonne National Laboratory – East
ATSR	ANL Thermal Source Test Reactor
CCA	Contamination Controlled Area
CFFF	Columbia Fuel Fabrication Facility
CFR	Code of Federal Regulations
cm <sup>2</sup>	square centimeters
CPD	Chemical Process Development
CWW	Contaminated Waste Water
D&D	Decontamination & Decommissioning
DCGL	Derived Concentration Guideline Level
DFP	Decommissioning Funding Plan
DOT	Department Of Transportation
dpm	disintegrations per minute
DQO	Data Quality Objective
EBWR	Experimental Boiling Water Reactor
ES&H	Environmental Safety & Health
FSS	Final Status Survey
ft	feet
FTE	Full-Time Equivalent
GET	General Employee Training
GERT	General Employee Radiation Training
HAZWOPER	Hazardous Waste Operations and Emergency Response Standard
HEPA	High Efficiency Particulate Air
HF	hydrogen fluoride / hydrofluoric
HNO <sub>3</sub>	nitric acid
HP	Health Physics
HSA	Historical Site Assessment
HVAC	Heating, Ventilation, and Air Conditioning



### List of Acronyms (continued)

IDR	Integrated Dry Route
IFBA	Integral Fuel Burnable Absorber
lbs	pounds
LLRW	Low-Level Radioactive Waste
LOE	Level of Effort
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
MODCON	Moderation Controlled
mrem	milli-roentgen equivalent man
MSL	Mean Sea Level
NaI	Sodium Iodide
PM	Project Manager
PPE	Personal Protective Equipment
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
RCA	Radiological Control Area
RESRAD	Residual Radioactive
RSO	Radiation Safety Officer
SNM	Special Nuclear Material
TBP	tributyl phosphate
TEDE	Total Effective Dose Equivalent
UN	uranyl nitrate
UO <sub>2</sub> F <sub>2</sub>	uranyl fluoride
URRS	Uranium Recycling and Recovery Services
USAEC	United States Atomic Energy Commission
USNRC	United States Nuclear Regulatory Commission
WBS	Work Breakdown Structure
WEC	Westinghouse Electric Company
yr	year



## 1.0 EXECUTIVE SUMMARY

Siempelkamp Nuclear Services, Inc. of Columbia, South Carolina was selected to provide the required triennial adjustments [in accordance with 10 CFR 70.25(e)] to the Westinghouse Electric Company (WEC) Columbia Fuel Fabrication Facility (CFFF) decommissioning cost estimate and to update and validate the existing CFFF Decommissioning Funding Plan (DFP) technical approach. Siempelkamp Nuclear Services was given access to the decommissioning files, license, operational, and applicable commercial records at the CFFF. Additionally, Westinghouse management personnel were available and fully cooperative during this evaluation process. It was determined that the CFFF decommissioning activities are consistent with industry standards and that no unusual circumstances will be encountered.

The CFFF decontamination and decommissioning (D&D) project has an [

](<sup>(d)(e)</sup>) A decommissioning cost estimate summary is presented in Table 1. A project summary cost breakdown by years and activities is presented in Table 2. This DFP establishes the decommissioning parameters and key assumptions used in generating the decommissioning cost estimate presented in Appendix D. Section 4.0, Technical Approach to Decommissioning, forms the basis of the cost estimate.

The CFFF, located along SC Highway 48, Hopkins, South Carolina, has a current Radioactive Materials License, SNM-1107, issued by the United States Nuclear Regulatory Commission (USNRC). The licensed material possession limits are as follows and are authorized for use at the existing CFFF facilities located as stated above: [

](SUNSD)





As such, any desired termination of this license by Westinghouse must comply with the rules of the USNRC as they apply to decommissioning and license termination. Future discontinuation of operations and license termination will require the decontamination and/or systematic removal of the radioactively contaminated equipment and portions of the facility and confirmation that the residual radioactive contamination distinguishable from background radiation result in dose levels of less than 25 mrem/yr to the average member of the critical group. In addition, any residual environmental contamination will be remediated to levels consistent with the 25 mrem/yr unrestricted use criterion.

The safe and effective decommissioning of any nuclear facility is a challenging endeavor. It requires the correct combination of people with extensive knowledge of decommissioning techniques and strong expertise in assessing, planning, performing and verifying compliance with the radiological criteria for license termination (10 CFR 20 Subpart E). Planning the decommissioning process must begin at a very early stage. A full understanding of the regulatory requirements that must be met and the level of effort that must be dedicated to fulfill these license termination requirements must be determined. Identifying essential resources, the financial demands they will place on an organized decommissioning effort, and establishing a monetary mechanism to activate those resources to provide reasonable assurance that all the requirements will be satisfied.

Westinghouse has prepared a DFP for the SNM-1107 license to comply with the USNRC requirements for financial assurance for decommissioning. The DFP and associated cost estimate provides the USNRC assurance that adequate funds will be available to decommission the CFFF. A subsequent financial assurance mechanism was put into place that satisfied the USNRC DFP requirements. The DFP, with its cost estimate, provides a fundamental understanding of the general decommissioning activities and an acceptable baseline of the CFFF decommissioning cost. This plan will not only revise the cost estimate to include the changes in the facility and technical approach but will also provide a basis that can subsequently be used to develop a complete decommissioning plan once a determination is made to terminate the SNM-1107 license.

Since the 2009 decommissioning funding cost estimate was generated, there has been one documented incident in which a contaminated drain line was found to be leaking and resulted in a release of contaminated liquid to the environment within the building footprint. For additional information concerning the contaminated drain line, see Section 4.4 of this plan.

Additional equipment/systems have been installed in the facility since the 2009 cost estimate. The equipment/systems net additional weight is approximately sixteen thousand one hundred pounds (16,100 lbs.). Equipment details and weights are provided in Appendix E.





**Table 1: Decommissioning Cost Estimate Summary**

[


] (d)(e)

**Table 2: Project Cost Summary by Years**

[


] (d)(e)



**Table 3: Additional Equipment/Systems Since 2009 Estimate**

[


](d)(e)



## **2.0 OVERVIEW OF PLANNING EFFORT**

### **2.1 SCOPE OF WORK**

The purpose of preparing this document is to provide an updated DFP, cost estimate and schedule to safely and effectively decommission the CFFF, terminate radioactive material license SNM-1107 and release the site for unrestricted use. The scope of this DFP includes all CFFF structures and land areas.

The first step in the development of a DFP is the formation of the Work Breakdown Structure (WBS). The CFFF WBS was prepared and submitted to Westinghouse, and is presented in Figure 2-1. A project schedule is provided as Figure 2-2. Section 4.0, Technical Approach to Decommissioning, describes the work activities required to accomplish license termination for unrestricted use.

The resource requirements for this scope of work are identified in the individual cost estimate sheets, presented as Appendix D, and in Table 31. This document in its entirety provides additional information that can be utilized as the basis for commencing decommissioning activities and goes beyond a statistical cost estimate utilizing decommissioning cost estimating "rules of thumb". Each D&D work activity was carefully reviewed and resources were assigned by individuals having direct "hands on" experience in decommissioning planning, operations, and management.

### **2.2 SIEMPELKAMP NUCLEAR SERVICES QUALIFICATIONS & EXPERIENCE**

Siempelkamp Nuclear Services is a Columbia, SC, based nuclear services provider with extensive decommissioning and radioactive waste management experience. The "hands on" decommissioning experience of Siempelkamp Nuclear Services personnel includes Zion Nuclear Power Station, Humboldt Bay Power Plant, Argonne National Laboratory-East (ANL-E) Thermal Source Reactor (ATSR), Experimental Boiling Water Reactor (EBWR), Janus Reactor, CP-5 Reactor, Building 211 60-Inch Cyclotron, and Building 301 Hot Cells; Los Alamos National Laboratory Omega West Reactor; Dominion Millstone Nuclear Power Station Unit 1; and Consumers Energy Big Rock Point Nuclear Station. Siempelkamp Nuclear Services developed and implemented the Final Status Survey (FSS) release plans and procedures for unrestricted release incorporating NUREG 1575 (MARSSIM) "Manual for Conducting Radiological Surveys in Support of License Termination" and NUREG 5849 for the ATSR and the Building 211 60-inch Cyclotron Facility.

Siempelkamp Nuclear Services developed extensive cost estimates for the decommissioning of the Savannah River Site Heavy Water Components Test Reactor, Maine Yankee Nuclear Power Station, Connecticut Yankee Nuclear Power Station and Millstone Nuclear Power Station Unit One.





Siempelkamp Nuclear Services successfully completed the removal of components and materials from the Parr Reactor Site for URS Corporation Washington Division. Siempelkamp Nuclear Services responsibilities on this project are to remove the components and materials using processes and methods that are safe, proven, compliant with principles of ALARA and contamination control, and minimize the production of secondary waste. Siempelkamp Nuclear Services previously performed the removal of the Parr reactor moderator tank, thermal shields, and the moderator cavity liner for Carolinas-Virginia Nuclear Power Associates.

Siempelkamp Nuclear Services provided comprehensive D&D management and operational support as part of the Sacramento Municipal Utility District Rancho Seco Reactor Vessel Internals Segmentation and Removal Project. Siempelkamp Nuclear Services was previously the D&D operations contractor for the decommissioning of the National Aeronautics and Space Administration Plum Brook Reactor Facility.

This extensive experience and "lessons learned" from actual D&D projects, as well as previous management of a fixed base radiological waste processing facility, provides a comprehensive basis for qualifying Siempelkamp Nuclear Services in the preparation and performance of this plan and its associated cost estimate and schedule.

### 2.3 ASSUMPTIONS AND CLARIFICATIONS

As with any similar D&D project in a highly regulated environment, there is an extensive amount of information that must be evaluated and assessed for potential impact on decommissioning. This includes such material provided by, or obtained from, Westinghouse, regulatory guidelines, and lessons learned from actual D&D performance. Following a review and evaluation of this information, several key assumptions were developed. These assumptions are necessary for the establishment of baseline methodologies and work activities included in the technical and cost strategy. Identified in this section are specific assumptions considered in the preparation of this document.

- All information provided by Westinghouse is true and accurate.
- The CFFF will maintain current certifications and continued operability of the needed infrastructure at the commencement of decommissioning activities.
- Systems and work areas that were engineered to remain clean (non-radioactive) during normal operations will be in a clean condition at the time of decommissioning.
- Selected High Efficiency Particulate Air (HEPA) systems will be available to support the decommissioning activities as long as deemed necessary by the contractor.
- A large accumulation of obsolete and/or surplus equipment will not be present onsite at the time of decommissioning.





- Pre-decommissioning waste inventories will have been removed prior to the commencement of decommissioning activities.
- No characteristic/listed hazardous or mixed waste will be present.
- The radiological condition of the facility, material quantities, isotopic distribution, concentrations, and dose rates at the time of decommissioning will be consistent with the current conditions.
- Environmental and assumed radiological conditions will be verified by a site wide characterization performed at the commencement of decommissioning activities. The cost for this characterization is included in this estimate.
- The facility and real property outlined in this DFP will be decommissioned to terminate the USNRC license for unrestricted use. The release criteria will be calculated using a modeling program.
- Only minor selective demolition is included in this cost estimate.
- Current industry conditions will exist at the time of decommissioning.
- Contaminated equipment removed from the facility will be sent to an offsite processing facility, relocated to another USNRC licensed facility or sent for direct disposal.
- Waste will be conditioned such that it will meet the acceptance criteria of an offsite processor for further conditioning or for a disposal facility for direct burial.
- Dose rates on materials being shipped off-site will remain within Department of Transportation (DOT) limits without special packaging or shielding.
- The present facility design has not changed.
- A contingency factor has not been included in the cost estimate.
- According to the survey information provided by Westinghouse, decontamination will only be required for designated Restricted Areas or Controlled Contamination Areas (CCA).
- No credit will be taken for metals or salvage value of structures and land remaining.
- Cost of building demolition (other than that required for D&D activities) or restoration of structures and land released for unrestricted use is excluded.



- Sections of flooring are assumed to be removed in areas where chemical processing has been performed. It is also assumed that all of the soil removed from these areas will be disposed as LLRW.
- All production has ceased.
- Westinghouse will ensure that the process equipment and process ductwork has been disassembled and thoroughly cleaned out as part of the final SNM recovery process prior to decommissioning activities beginning.
- All known quantities of uranium have been removed from the site with the exception of limited quantities which may be recovered during the decommissioning activities.
- The waste lagoons are empty of all contents.
- All UF<sub>6</sub> cylinders have been washed out.
- There will be no remaining accumulation of past generated combustible materials.
- Disposal of chemical waste and clean rubble is excluded.
- Ten percent of the built-up roof is considered contaminated and will be packaged for direct disposal at a licensed LLRW disposal facility.
- All work activities will be performed in accordance with procedures written specifically for the decommissioning activities in conjunction with the detailed decommissioning plan.
- In general, only limited decontamination of contaminated process equipment or ductwork will be attempted except in special cases when it may be warranted. The contaminated process equipment and ductwork will be volume reduced as necessary for packaging.
- The NRC has approved an exemption for the estimated volume of contaminated soil (96,563 ft<sup>3</sup>) to be disposed at the US Ecology disposal facility in Grand View, Idaho.
- The DFP assumes all production activities have ceased and the decommissioning activities will take place upon cessation of operations without extended storage periods.
- Only minor selective demolition that will be necessary to terminate the NRC license has been included in this cost estimate
- The DFP cost estimate assumes the work will be performed by an independent third-party contractor.



## Figures





Figure 2-1: D&D Project Work Breakdown Structure [

1(d)(e)





**Figure 2-2: Project Schedule**

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](d)(e)