STATE OF INDIANA

INDIANA UTILITY REGULATORY COMMISSION

FILED
July 26, 2017
INDIANA UTILITY
REGULATORY COMMISSION

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| PETITION OF INDIANA MICHIGAN POWER COMPANY, AN INDIANA CORPORATION, FOR (1) AUTHORITY TO INCREASE ITS RATES AND CHARGES FOR ELECTRIC UTILITY SERVICE THROUGH A PHASE IN RATE ADJUSTMENT; (2) APPROVAL OF: REVISED DEPRECIATION RATES; ACCOUNTING RELIEF; INCLUSION IN BASIC RATES AND CHARGES OF QUALIFIED POLLUTION CONTROL PROPERTY, CLEAN ENERGY PROJECTS AND COST OF BRINGING I&M'S SYSTEM TO ITS PRESENT STATE OF EFFICIENCY; RATE ADJUSTMENT MECHANISM PROPOSALS; COST DEFERRALS; MAJOR STORM DAMAGE RESTORATION RESERVE AND DISTRIBUTION VEGETATION MANAGEMENT PROGRAM RESERVE; AND AMORTIZATIONS; AND (3) FOR APPROVAL OF NEW SCHEDULES OF RATES, RULES AND REGULATIONS. | ) | CAUSE NO. 44967-NONE |

## SUBMISSION OF DIRECT TESTIMONY OF RODERICK KNIGHT

Petitioner, Indiana Michigan Power Company (I&M), by counsel, respectfully submits the direct testimony and attachments of Roderick Knight in this Cause.


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## CERTIFICATE OF SERVICE

The undersigned certifies that the foregoing was served upon the following via electronic email, hand delivery or First Class, or United States Mail, postage prepaid this 26th day of July, 2017 to:

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EXHIBIT I&M-_____

# INDIANA MICHIGAN POWER COMPANY

# PREFILED VERIFIED DIRECT TESTIMONY

# OF

# RODERICK KNIGHT

**PRE-FILED VERIFIED DIRECT TESTIMONY OF RODERICK KNIGHT**
**ON BEHALF OF**
**INDIANA MICHIGAN POWER COMPANY**

**Q. What is your name and business address?**

A. My name is Roderick Knight and my business address is Knight Cost Engineering Services, LLC (Knight CES), 22 Mountain View Terrace, New Milford, Connecticut 06776.

**Q. What is your position?**

A. My position is President of Knight Cost Engineering Services, LLC (KCES).

**Q. What is KCES?**

A. KCES is a sole proprietor cost engineering company under which I provide cost engineering services, primarily to the nuclear industry.

**Q. What are your responsibilities within that organization?**

A. As the sole proprietor of the company, I am responsible for all aspects of cost engineering including estimating, planning, scheduling, material takeoff, cash flow analysis and litigation support. I also contract support staff on an as-needed basis and oversee their work.

**Q. What is your educational and professional experience?**

A. I earned a Bachelor of Science degree in Civil Engineering from the University of New Haven in 1992, graduating Magna Cum Laude. I also earned a Bachelor of Science degree in Natural Resource Management from the University of Maine in 1981. I am a member of Chi Epsilon, an honorary Civil Engineering Society and a Certified Cost Professional through AACE International.

I have over 30 years of experience performing cost estimates for the nuclear industry for commercial, government and research facilities. My expertise includes the analysis of post shutdown cost reduction methods including the analysis of spent fuel storage options, volume reduction techniques, staff levels and schedule optimization. I have also performed numerous prudency reviews of cost estimates developed by others, for confidential clients. More recently, I have taught classes on how to develop decommissioning cost estimates for the International Atomic Energy Agency (IAEA) to members from various countries. The IAEA work also includes the development of lesson plans for future workshops. I have also taught a similar class in South Korea.

I was formerly employed by SCIENTECH, Inc. and by its predecessor NES, Inc. from 1992 until 2004, when I started KCES. As an employee of SCIENTECH/NES I served as Project Manager in the preparation of well over 100 decommissioning cost estimates. I also served as one of eleven members on the EM-6 Expert Review Team for the Department of Energy at Brookhaven National Laboratory. I presented a paper entitled “How Utilities Can Achieve More Accurate Decommissioning Cost Estimates,” at the 1999 ANS Winter Meeting in Long Beach California. I also developed lesson plans and was an instructor at the SCIENTECH-sponsored Decommissioning Workshop. Prior to this, I was employed by TLG Engineering for seven years, where I was responsible for the management of decommissioning cost estimates from preliminary client contact to preparation of the final report.

I also have extensive international experience including numerous missions with the IAEA. These missions include providing decommissioning cost estimating support in Kazakstan for the BN-350 Nuclear Power Plant and in Croatia and Slovenia in support of the Krsko Nuclear Power Plant decommissioning plan. I have also worked as part of a SCIENTECH team contracted by PA Government Services (PA) to assist in developing and promoting a series of reforms for the Armenian energy sector.

In addition to developing decommissioning cost estimates for commercial nuclear power plants, I have developed estimates for a variety of facilities. These estimates were developed for a number of reasons, including proposal support, owner estimates and project funding. This work includes the development of estimates at several National Laboratories, including Los Alamos, Argonne and Brookhaven. In addition, I have developed estimates for manufacturing facilities and research facilities. Most of these estimates included the remediation of both radiological and hazardous wastes.

**Q. What is the purpose of your testimony?**

A. I was asked by Indiana Michigan Power Company (I&M or Company) to review and update the 2013 D.C. Cook Decommissioning Cost Study (2013 Study) to 2015 costs and conditions. The 2013 Study was also developed by KCES utilizing my proprietary estimating program. An updated study was required to determine whether the Company is adequately providing for the eventual decommissioning of the Donald C. Cook Nuclear Power Plant (Cook Plant). One decommissioning scenario was developed for the two-unit Cook Plant. This scenario includes the cost for the immediate decommissioning of the site (DECON), on-site spent fuel storage of spent fuel and the removal of clean structures. The cost estimate is contained in the document entitled Decommissioning Study of the D.C. Cook Nuclear Power Plant, January 21 2016, Revision 0, (2016 Study), as prepared for I&M by KCES, and which has been marked as Attachment RK-1. The purpose of my testimony is to present the results of this study.

**Q. Are you sponsoring any attachments in this proceeding?**

A. Yes. I sponsor the following attachments which were prepared or assembled by me or under my supervision:

- Attachment RK-1: Decommissioning Study of the D.C. Cook Nuclear Power Plant, January 21 2016, Revision 0, (2016 Study)
- Attachment RK-2: Comparison of the 2012 and 2015 D. C. Cook Decommissioning Estimates, Rev 2

**Q. WHAT IS INCLUDED IN THE 2016 STUDY?**

A. The report contains a description of the decommissioning scenario considered to be feasible for the Cook Plant, the cost estimate, and the estimate of the schedule of performance. All costs are in July 2015 dollars, which means that although a task may not actually occur until after final shutdown, its cost is estimated as if it occurred in 2015. The decommissioning cost estimate is shown in Table 1 which follows:

**Table 1**
**Summary of the 2015 Decommissioning Cost Estimate**
**For D.C. Cook Nuclear Power Plant**

| Decommissioning Scenario | Fuel Storage & Decommissioning Costs $ | Dormancy Period Cost $ | Delayed Dismantling Cost $ | Total Program Cost $ |
|---|---|---|---|---|
| **DECON, Indefinite On-Site Dry Storage and Modified Spent Fuel Pool Systems** | | | | |
| Decommissioning | 909,101,900 | N/A | N/A | 909,101,900 |
| Fuel Storage | 529,465,600 | N/A | N/A | 529,465,600 |
| Greenfield | 195,470,900 | N/A | N/A | 195,470,900 |
| | | | TOTAL | 1,634,038,400 |
| Annual ISFSI Storage | 4,912,700 | | | 4,912,700 |
| ISFSI Decommissioning | 56,952,300 | | | 56,952,300 |

**Q. What is the decommissioning scenario?**

A. The decommissioning scenario considered in the study is DECON. This acronym reflects the definition established by the NRC. This option is based on sequential shutdown of Cook Plant Units l and 2 with Unit 1 shutdown occurring on October 25, 2034, and Unit 2 on December 23, 2037.

**Q. What are the line item entries "Decommissioning" and "Greenfield" on Table 1?**

A. The Table 1 term Decommissioning refers to 10 Code of Federal Regulations (CFR) 50.75(c) costs pertaining to the achievement of decommissioning objectives and work but which specifically excludes the costs of removal and disposal of spent fuel and the removal of clean structures. The Table 1 term Greenfield refers to the costs of removal of clean structures and returning the site to greenfield conditions.

**Q. What is the line item entry "Fuel Storage" in Table 1?**

A. While the site is licensed under 10 CFR 50, 10 CFR 50.54(bb) requires funding by the licensee "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." The costs labeled Fuel Storage represent the costs that will be incurred after final shutdown of both Cook Plant units during the period of on-site spent fuel storage in the existing fuel storage pool, on-site dry storage in an Independent Spent Fuel Storage Installation (ISFSI), off-site dry storage at a private fuel storage facility, or some combination of the three. These are the costs that the utility will incur due to the post-shutdown management of spent fuel prior to acceptance by the Department of Energy for disposal at a repository. As prescribed in 10 CFR 50.75(c) a licensee must provide reasonable assurance that funds will be available for the decommissioning process. The NRC definition of decommissioning does not include the operation of the spent fuel pool or the construction and/or operation of an ISFSI. These costs may be included in a site specific estimate but should be clearly defined.

**Q. Are these spent fuel-related costs included in the 2016 Study?**

A. Yes, they are included and specifically identified as such. The 2016 Study updated not only the cost factors associated with spent fuel storage but also the assumptions used to determine the costs and schedules.

**Q. Why was only one scenario considered?**

A. As discussed the 2016 Study consists of one decommissioning scenario. The decommissioning alternative analyzed in this study is DECON. This alternative is further defined and described later in my testimony. The DECON scenario considers that spent fuel will be transferred to an on-site ISFSI within 7.5 years of Unit 2 shutdown. For this scenario it is assumed that the spent fuel will remain in an on-site ISFSI indefinitely.

The 2013 Study provided costs for five scenarios. The reduction to one scenario in the 2016 Study from the five scenarios in the 2013 Study is based on several factors. There has been little movement toward the development of an off-site spent fuel storage repository since 2013. The Annual Capacity Report, identifying spent fuel shipping rates and allocation, has not been updated. There is no viable alternative to the on-site storage of spent fuel. For planning purposes, it is prudent to assume a long term post-shutdown storage of spent fuel will be required. As I&M has historically updated this study every 3 years, new developments in spent fuel storage can be addressed as they occur.

The DECON scenario is typically the preferred scenario when the funds are available to proceed with decommissioning immediately after cessation of operations. It is anticipated that I&M will have a fully funded decommissioning fund at the time of Unit 2 shutdown allowing for immediate decommissioning. Having all spent fuel transferred to dry storage will simplify decommissioning as well as reduce annual spent fuel storage costs.

**Q. How was the 2016 Study developed?**

A. The 2016 Study, consistent with prior studies, is site specific. Unit cost factors for the various elements of work comprising the decommissioning programs were applied to each element of plant equipment and structures. These cost factors reflect 2015 labor rates experienced at Cook Plant. The cost estimate was derived by the "building block" approach, whereby the process of decommissioning was broken down into small elements of work and each element of work activity was individually estimated. These activities were laid out in an optimum chronological sequence and schedule, and the additional costs of management and support services, such as health physics, were estimated for the defined work period. The total estimated costs calculated in the study are the sum of these many basic work elements. The costs directly associated with decommissioning and the costs associated with spent fuel storage are presented in separate tables in the study.

**Q. Please further describe the scenario that you considered in the 2016 Study.**

A. The DECON option is defined as the removal from the plant site of fuel assemblies, source material, radioactive fission and corrosion products, and all other radioactive and contaminated materials having activities above license limits. The reactor pressure vessel and internals will be removed using remote tooling and handling methods. Conventional removal and demolition techniques will be applied to the remaining systems and structures with contamination controls employed as required. After removal of all fixed and removable contamination the site may be released for unrestricted use with no further licensing requirements. The remaining buildings, non-radioactive structures and systems may also be removed and disposed of as is considered in the study. This program would result in a site that could be used for any purpose, since the entire nuclear power plant facility would be dismantled and removed from the site.

**Q. What is the benefit of DECON with respect to social and economic impacts?**

A. The DECON scenario allows for a quick termination of the license and a return to unrestricted use of the site, eliminating long-term maintenance and surveillance costs. There is also a knowledgeable workforce available to assist in the decommissioning. The DECON alternative also eliminates the uncertainty of the availability of low-level waste facilities in the future. The DECON scenario does come at a cost of higher worker and public doses due to lack of decay time. This increased exposure can be controlled through the use of engineered safety barriers and procedural controls as evidenced by the recent successful decommissioning projects.

**Q. What caused the increase in spent fuel storage costs compared to the 2013 Study?**

A. There is an increase in the spent fuel storage cost of $143.2 million. The major reason for this increase is due to the increase in the estimate to construct the expansion to the spent fuel storage pad. In the 2013 Study the estimate for the expanded pad was based on the actual cost to construct the existing pad. The 2013 Study estimate for the pad expansion was $25.1 million, before contingency, for 120 additional storage casks. The 2016 Study uses an estimate that was developed in 2015 by site personnel for the expansion of the pad. This estimate was $135 million, before contingency, for 111 additional storage casks. In both cases the expansion would be sufficient to hold all spent fuel on site after both units shutdown.

This increase was somewhat offset by the decrease in the cost of the spent fuel storage casks. While the cost of the casks increased, from $1.93 million each to $2 million each, fewer casks were estimated to be required. At the time the 2013 Study was being prepared it was estimated that 120 additional casks would be required after shutdown to empty the spent fuel pool. Based on a revised analysis of spent fuel discharges this number was reduced to 111 additional casks. Table 2 provides a summary of spent fuel storage costs.

Except for one modification, the Utility Staff personnel levels associated with the post-shutdown storage of spent fuel have remained the same as in the 2013 Study. The Utility Staff level during period 4 was increased from 14.25 to 33 in the 2016 Study. This increase is due to the in-pool spent fuel cooling period increasing from 5 years to 7 years. This increase causes spent fuel to remain in the spent fuel pool for the majority of period 4, requiring a larger staff.

There were a few changes to the Security Staff levels associated with spent fuel storage. These modifications are a result of new information provided by AEP. Period 4 was also modified due to the increase from 5 years to 7 years for in-pool cooling.

The DECON scenario in both the 2013 Study and the 2016 Study assumes that spent fuel will remain on site indefinitely. The annual costs for long storage increased approximately $432,646 or 9.66%. The main reason for this increase is due a change in the methodology used to calculate the O&M expenses during decommissioning. Since KCES received a more detailed list of these expenses, a more accurate assessment of the costs incurred during decommissioning was made. A more detailed description of the O&M costs is provided below. This increase was partially offset by a decrease in the Utility staff overhead rate from 69.73% to 29.84%. In addition, the spent fuel storage maintenance costs were included in the O&M budget and these values were used in the 2016 Study, as opposed to being estimated separately in the 2013 Study. Table 2 provides a summary of the dry spent fuel storage costs.

**Table 2 – Spent Fuel Storage Costs**
(Costs include contingency – see contingency discussion on page 15 below)

| | **2013 Totals** | **2016 Totals** | **Cost Difference** |
|---|---|---|---|
| Undistributed Costs | $59,888,277 | $78,678,208 | $18,789,930 |
| Pool sys, security & control room mods | $6,030,177 | $6,105,135 | $75,558 |
| New pad construction cost | $30,861,277 | $167,181,700 | $136,320,423 |
| Additional cask costs | $289,462,600 | $277,500,000 | -$11,962,600 |
| Total | $386,242,332 | $529,465,643 | $143,223,311 |
| Number of new casks | 120 | 111 | |

| | | | |
|---|---|---|---|
| Cost per cask, excluding contingency | $1,929,750 | $2,000,000 | $70,250 |
| Period 7 Duration, months | 12 | 12 | |
| Annual Period 7 costs | $4,480,089 | $4,912,735 | $432,646 |

**Q. What are the other major contributors to the cost differences?**

A. The Decommissioning costs increased approximately $106.7 million or 13.30%. The Greenfield costs increased approximately $53.4 million or 37.54% from the DECON scenario in the 2013 Study to the 2016 Study. There are several areas that caused these increases.

Structures and component removal costs increased $40.9 million or 11.26% overall. The systems and structures inventory for the 2013 Study were developed in the 1990s and have been used in every estimate since then. Over the years the unit cost factors have been revised to better reflect industry experience. The systems and structures inventory were developed from current site drawings and database for the 2016 Study. This allowed for better alignment with the current unit cost factors.

Based on the new inventory there was some change in waste volumes. There is now a detailed material takeoff to support the 2016 Study. Based on the changes to the inventories clean demolition and clean disposal increased $35.2 million or 55.74% and $24.5 million or 81.53%, respectively. The decontamination of structures decreased $2.2 million or 4.04%, while the removal of contaminated systems decreased $10.5 million or 20.44%. The majority of these changes are due to the recalculation of the system and structures inventory. Structures and component removal costs are affected, to a much less extent, by the waste disposal and labor costs. Waste disposal costs decreased $6.6 million or 3.47% while labor rates increased 0.85% on average. The Comparison Report provided as Attachment RK-2 provides additional details. O & M Budget item costs increased by approximately $47.7 million or 214.24%. The basis for these costs is similar to that used in the 2013 Study in that the cost for each period was based on a percent of that incurred during operations. At the time of the 2013 Study, the percentages were applied to the operating costs at the department level. The basis was supplied by AEP for a 2006 Study, escalated for each subsequent update, and was not sufficiently detailed to allow for the percentages to be applied at a lower level. For the 2016 Study AEP supplied a more detailed version of these costs, 457 line items versus 190 in 2006. The new information allowed for the percentages to be applied on a line item basis. As an example, at the time of the 2013 Study the same percentage was applied to all costs in the business services department. For the 2016 Study, a separate percentage was applied to each cost category within the business services department. This added detail allows for a better tracking of the costs through the decommissioning.

Utility Staff costs increased by approximately $3.4 million or 2.56% from the 2013 Study to the 2016 Study. The total Utility Staff man-years increased from 889 to 1,066 due to a schedule change. The post shut-down schedule duration increased from 97 months to 112 months. There were two reasons for this increase. The first is due to a revision to the reactor vessel and reactor vessel internals removal duration. The duration increased from 11 months in the 2013 Study to 21 months in the 2016 Study. This increase was due to a modification in the calculations based on more current information. The second is that the in-pool spent fuel cooling period was increased from 5 years to 7 years. The result was that the period dependent costs increased more than the increase due to inflation.

Based on the information provided by AEP, the average base salary increased approximately 25%. Fringes and payroll tax decreased from 69.73% to 29.84%, a 57.21% decrease. This decrease is due to a revised method for determining the Utility overhead percentage rate. The combined effect is to decrease the average cost per man-year by 14.47%.

The Comparison Report provides additional details of the period dependent costs.

**Q. How were waste disposal costs determined in the Cook Plant Study?**

A. A matrix of currently operating low level waste disposal facilities and their current disposal costs was developed. The majority of Low Level Waste was assumed to qualify for processing as Bulk Survey For Release (BSFR), this includes the reactor building floors and walls that will be removed in bulk. The remaining Class A waste will be disposed of at either the Energy*Solutions* Clive, Utah facility, or at the Waste Control Specialist, LLC (WCS) facility in Andrews, Texas.

The WCS facility is currently licensed to accept Class B and C waste. This study assumes that all Class B & C waste will be disposed of at WCS. There is currently only a published fee and surcharge structure for in compact generators. Based on guidance from WCS personnel, increasing the published fees and surcharges by 20% would be representative of the rates that would be charged to out of compact generators. The base disposal rate for Class B & C waste is currently $2,680/cubic foot. This rate was provided by AEP.

Additionally, there is a dose rate surcharge and a millicurie charge that must be added. The basic millicurie charge is $0.55 per millicurie up to $220,000 per shipment. There is also a weight surcharge, up to $20,000 per shipment; a dose rate surcharge, up to $400 per cu. ft.; an irradiated hardware there is an additional surcharge of $75,000 per shipment and a cask handling surcharge of $2,500 per cask. Finally there are State and County fees of 5% each. These rates appear to be unchanged from the time of the 2013 Study. This estimate includes all applicable surcharges and fees.

Table 3 provides a comparison of the disposal rates and volumes between the 2013 Study and the 2016 Study. While the disposal costs either increased or stay the same, the overall costs decreased due to a larger volume going out as BSFR. Smelting was not included in the 2016 Study due to uncertainties in the industry.

**Table 3 – Waste Summary**

| **Waste Disposal (without contingency)** | **2013** | **2016** | |
|---|---|---|---|
| Contaminated Disposal, Includes surcharges | $191,363,101 | $184,723,286 | -3.47% |
| Energy*Solutions* rate, $/cu ft | $158.54 | $171.84 | 8.39% |
| Energy*Solutions* volume, cu. ft. | 278,239 | 190,644 | -31.48% |
| Smelting rate, $/lb | $2.10 | | |
| Smelting volume, cu. ft. | 188,051 | Not Used | |
| WCS disposal rate, $/cu ft | $208.79 | $208.79 | 0.00% |
| WCS disposal volume, cu. ft. | 70,018 | 3,946 | -94.36% |
| BSFR rate, $/lb | $0.13 | $0.25 | 92.31% |
| BSFR volume, cu. ft. | 2,879,629 | 3,389,951 | 17.72% |

The 2016 Study assumes that the reactor vessel and reactor internals will be removed and disposed of based on the same methodology as in the 2013 Study. This waste is assumed to be disposed of at either the Energy*Solutions* facility in Clive, Utah or the WCS facility in Andrews, Texas in the estimate used in the 2016 Study. The increase is due, in part to the increase in disposal costs for B and C waste. Class B waste was increased from $300.00 per cubic foot to $2,680.00 and Class C from $1,200.00 per cubic foot to $2,680.00. There was also a modification to the vessel removal labor costs based on recent experience, increasing the labor costs for the 2016 Study.

The Comparison Report provides details on variations in undistributed costs, starting on page two.

**Q. What is the ISFSI decommissioning cost?**

A. The 2013 Study identified an ISFSI decommissioning cost of $44,370,355 for scenario 1 (DECON). The 2016 Study identifies an ISFSI decommissioning cost of $56,952,300. The ISFSI decommissioning cost includes the cost to dispose of the concrete overpack and concrete pad as contaminated material. It was assumed that this bulk material would be eligible for processing as BSFR material. The cost increase is primarily due to the increase in the BSFR processing cost from $0.13 per pound to $0.25 per pound.

**Q. What is the basis of the contingency factors included in the 2016 Study?**

A. Contingencies are applied to cost estimates primarily to allow for unknown or unplanned occurrences during the decommissioning program, *e.g.* increased radioactive waste material volumes over that expected, equipment breakdowns, weather delays, labor strikes, etc. The U.S. Department of Energy (DOE) Cost Estimating Guide, DOE G 430.1-1, 3-28-97, defines contingency as follows:

> 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.

DOE G 430.1-1 provides a recommended range of contingencies as a function of program design:

| Time of Estimate | Contingency Range as a % of Total Estimate |
|---|---|
| Planning Phase | 20-30 |
| Budget | 15-25 |
| Title I | 10-20 |
| Title II | 5-15 |

Another source for published contingency values is the AIF/NESP-0036 "Guidelines for Producing Nuclear Plant Decommissioning Cost Estimates" (AIF). This document identifies contingencies for activities specific to nuclear power plant decommissioning, such as reactor internals removal. With the exception of system decontamination and reactor vessel and reactor internals removal and disposal, the contingencies presented in AIF are consistent with the values presented in DOE G 430.1-1 for a Budget/Title I estimate. The contingencies identified in AIF for system decontamination and reactor vessel and reactor internals removal and disposal are significantly higher than the ranges identified in DOE G 430.1-1. This is due to the lack of actual decommissioning work performed at the time AIF was published.

Knight CES has determined contingency values specific to Cook Plant utilizing the information presented in AIF and consistent with DOE G 430.1-1. A number of large scale decommissioning projects have recently been completed. The 2016 Study incorporates the lessons learned from these projects. As such, costs can be estimated with a greater degree of confidence than was true at the time AIF was published. This increased level of confidence allows for a downward adjustment to the recommended contingency, especially with regard to system decontamination and reactor vessel and reactor internals removal and disposal. The following table provides a summary of the contingency values used in the 2016 Study:

| | Labor | Packaging | Transportation | Equip & Mat. | Disposal | Energy & Other, $ |
|---|---|---|---|---|---|---|
| Engineering, Utility & DGC | 15% | | | | | |
| Contam. components/concrete | 25% | | 10% | 15% | 25% | |
| Reactor vessel & internals | 50% | | 25% | 25% | 50% | |
| Clean components/concrete | 15% | | 10% | 25% | 10% | |
| Supplies and consumables | | 25% | | | | |
| Other | | | | | | 15% |

Contingency rates identified above were applied to each cost category for each activity. The average overall contingency is 23.60% and 18.91% for Decommissioning and Greenfield, respectively.

The contingency analysis for on-site spent fuel storage varies slightly from that discussed above. There are two components comprising this contingency element: equipment capital cost contingency and on-site fuel storage operation contingency. The capital costs include the cost of acquisition of the multi-purpose fuel storage canisters and their on-site storage overpacks, the on-site dry storage facility, and the skid-mounted systems for modified wet storage in the spent fuel storage pool. Since these items are subject to many unknown or unplanned occurrences for which contingency is based, the above methodology will be applied. The operating costs of the spent fuel storage facility include only a 10% contingency because of the higher degree of knowledge and confidence in the factors comprising the operation of the wet or dry storage facility. It should be noted, however, that any variability as to the duration of the fuel storage period is excluded from the contingency. The average contingency for spent fuel storage is estimated at 23.06%. The calculated contingency for the ISFSI decommissioning is 29.04%, consistent with the final NRC rule I discuss below. A more detailed discussion of the development of the contingency factors is presented in Section 3.6 of the 2016 Study.

**Q. Is there support to conclude that the Cook Plant can be completely dismantled?**

A. Yes. In the United States in the past 15 or so years, twelve commercial nuclear power plants (NPP) have been successfully decommissioned. Each of these NPPs has had their license terminated or modified to allow for the on-site storage of spent fuel. In most of the NPP decommissionings, some combination of reactor vessel and reactor vessel internals have been removed, transported and disposed of in one piece. In some cases the shutdown was of an unplanned nature causing some lack of coordination in the first few years following shutdown. Once the intent to decommission was accepted, decommissioning proceeded in a timely and efficient manner. There are currently 16 NPPs in some phase of the decommissioning process.

In addition to the NPPs there have been numerous government-owned electric generation nuclear power plants, test reactors, research reactors, processing facilities, and many reactor facilities in Canada and Europe that have been successfully decommissioned using proven techniques. The lessons learned from the completed decommissioning projects have been well documented in the reports of successful program completions such as the *Maine Yankee Decommissioning Experience Report, Detailed Experiences 1997 – 2004*, EPRI, Palo Alto, CA: 2004 and the *Connecticut Yankee Decommissioning Experience Report, Detailed Experiences 1996 – 2006*, EPRI, Palo Alto, CA: 2006.

The basic activities of cutting piping, segmenting vessel internals, demolishing reinforced concrete and decontaminating contaminated systems and structures are independent of the size of the structure or megawatt rating of the plant. A contaminated 12-inch diameter pipe in a 3000 megawatt thermal plant utilizes the same segmentation process as a 12-inch diameter pipe in a 58 megawatt thermal plant, although the number of cuts will be greater in the larger plant. The major activities include removal of contaminated piping and components using conventional power saws or torches within contamination control envelopes, followed by disposal at a waste repository. Lessons learned from recently completed or ongoing decommissioning projects include the one piece removal of at least the reactor vessel, bulk removal of contaminated components versus decontaminate, survey and release and utility management of the project versus a decommissioning operations contractor. These recent decommissioning projects have learned from and built on the lessons learned from previous decommissioning programs. The successful application of these decommissioning techniques in both small and large nuclear power plants demonstrates assurance of decommissioning feasibility.

**Q. Why are Greenfield costs included in the estimate?**

A. While not required by NRC regulations, Greenfield or clean system and structure removal costs, have been calculated and are included in the 2016 Study. These costs may be required by local authorities to minimize liability. Removal of clean systems and structures may also be required to access contaminated components and structures. Recently completed decommissioning projects have included the removal of clean systems and structures, to some depth below grade, usually three feet.

**Q. Was there any salvage or scrap value considered for any or the components?**

A. It was assumed that there would be no salvage for any equipment left at the site at shutdown. Scrap value was not included in the estimate due to large fluctuations in scrap values. The 2016 Study assumes all clean material will be disposed of at a local landfill. This approach will also reduce liability concerns. The appropriateness of utilizing a scrap dealer can be addressed in future updates closer to shutdown.

**Q. What regulatory requirements have the greatest effect on decommissioning?**

A. CFR 50.82, Termination of License, governs the procedure to terminate the Part 50 license. Key provisions of the regulations include the certification of permanent cessation of operation within 30 days of permanent cessation, certification of permanent fuel removal, submittal of a Post-Shutdown Decommissioning Activity Report (PSDAR) within two years of shutdown and submittal of a License Termination Plan two years prior to license termination. The PSDAR must contain a site-specific decommissioning cost estimate. Regulatory Guide 1.184 provides a summary and timeline of these regulations.

On June 17, 2011, the NRC published a final rule amending its regulations to improve decommissioning planning. The rule became effective on December 17, 2012 and requires compliance by March 31, 2013. This rule will require licensees to report additional details in their decommissioning cost estimate. To assist in the implementation of the new rule, the NRC revised NUREG-1757, “Consolidated Decommissioning Guidance, Financial Assurance, Recordkeeping and Timeliness,” specifically volume 3. Provisions of the final rule changes to 10 CFR 82 require that the site specific decommissioning cost estimate, included in the PSDAR, will now include the projected cost of managing spent fuel. An additional provision requires that after submitting the site specific decommissioning cost estimate and until the licensee has completed its final radiation survey permitting termination of the license, the licensee must submit, annually, a financial assurance status report.

Changes have also been made to 10 CFR 72 due to the final rule. The amended regulations require licensees to report additional details in their decommissioning cost estimates. In addition, at the time of license renewal and at intervals not to exceed 3 years the decommissioning funding plan must be updated and resubmitted.

**Q. What factors have the greatest impact on the post-shutdown costs associated with on-site storage of spent fuel?**

A. The two primary factors that will determine the magnitude of these costs are the date by which a spent fuel repository will be available and the rate at which DOE will be able to accept spent fuel at that repository. Both of these factors will directly influence the duration of the on-site storage period and, therefore, the costs associated with that period. The 2016 Study has assumed that spent fuel will remain on-site indefinitely, in dry storage. Since the DOE has not specified a spent fuel shipping start date or a shipping rate, it is prudent at this time to assume an indefinite spent fuel storage duration. Future studies will address developments as they occur.

**Q. How will future developments in improved technology and increased or decreased costs be reflected in cost estimates for decommissioning?**

A. The cost estimates prepared by Knight CES for I&M are based on current state-of-the-art technology and on current federal and state regulations. It is my understanding that I&M intends to review these estimates periodically and to revise them to account for cost increases or decreases as influenced by future technology, regulations, labor cost trends and waste disposal trends.

**Q. Have you addressed the means by which decommissioning costs are to be financed or recovered?**

A. No. I have addressed only the development of the total decommissioning cost estimate in 2015 dollars.

**Q. Are there any changes that should be made to the January 2016 Study due to recent revisions to regulations or as the result of new information from ongoing or recently completed decommissioning projects?**

A. The 2016 Study incorporates the most current information available to date. I believe that the costs developed for the 2016 Study provide a realistic estimate of the actual future costs and is reliable for I&M's financial planning purposes.

**Q. Is it necessary to select a decommissioning method at this time?**

A. No. The actual method or combination of methods selected to decommission the Cook Plant should be based on a detailed economic, engineering, and environmental evaluation of the alternatives considering the site and surroundings at the time of decommissioning and reflecting the latest experience in the decommissioning of similar nuclear power facilities. Considering that Cook Plant Units 1 and 2 are licensed to operate until 2034 and 2037, respectively, changes in waste disposal and/or processing costs, locations and methods are likely. NRC regulations governing decommissioning could also change. These changes could influence the decision on whether to proceed with DECON or SAFSTOR. The status of the spent fuel acceptance by the DOE may change, affecting the decision to store spent fuel in the spent fuel pool, on-site dry storage or off-site dry storage. Periodic estimate updates should be able to track the decommissioning trends without locking into a specific method or jeopardizing the availability of adequate decommissioning funds.

**Q. Does this conclude your pre-filed verified direct testimony?**

A. Yes, it does.

## VERIFICATION

I, Roderick W. Knight, President of Knight Cost Engineering Services, LLC (KCES)], affirm under penalties of perjury that the foregoing representations are true and correct to the best of my knowledge, information, and belief.

Date: June 28, 2017

Roderick W.Knight

# Decommissioning Study of the D. C. Cook Nuclear Power Plant

## Prepared for Indiana Michigan Power Company

**Knight Cost Engineering Services, LLC**
**January 21, 2016**

**Revision 0**

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# 1.0 INTRODUCTION

## 1.1 DONALD C. COOK UNITS 1 AND 2 PLANT SITE

The Donald C. Cook Nuclear Power Plant (D.C. Cook Plant) is a nuclear-powered electrical generating facility located in Bridgman, Michigan. D.C. Cook Plant consists of two pressurized water reactors (PWR). Its electrical rating is 1084 MWe for reactor Unit 1 and 1107 MWe for reactor Unit 2. D.C. Cook Plant has been granted a twenty-year license extension by the Nuclear Regulatory Commission (NRC). Based on the terms of this extension, Unit 1 is scheduled for shutdown on October 25, 2034; Unit 2 is scheduled for shutdown on December 23, 2037. Units 1 & 2 are planned to be decommissioned in series following shut down.

This study is an update of the 2012 site-specific Decommissioning Cost Estimate of the D.C. Cook Nuclear Power Plant, Units 1 & 2, prepared for the Indiana Michigan Power Company (the Company). As such, it reflects site-specific plant information and cost factors. The most current decommissioning experience and logic have been incorporated into this estimate, including spent fuel acceptance rates, spent fuel storage issues, decommissioning methodologies, decommissioning management and waste disposal.

## 1.2 OVERVIEW OF THE SCENARIO

This study consists of one decommissioning scenario. This scenario includes the cost for the immediate decommissioning of the site (DECON), on-site storage of spent fuel, and clean removal. In addition, it includes the cost for the removal of the Independent Spent Fuel Storage Installation (ISFSI).

The cost estimate contained herein was developed based on a May 2015 configuration. It utilizes site-specific plant systems and building inventory recently generated based on current site configuration, drawings and component database. Costs have been determined for removal, packaging, transportation and disposal.

The decommissioning activities contained herein were previously developed and have been modified as required, with costs determined for each activity. The critical path schedule was previously developed and has been modified based on new spent fuel discharge assumptions and new and modified task durations. Period-dependent costs include utility staff, decommissioning general contractor staff, security, insurance, energy and others. Cost levels were determined based on specific periods or groups of activities per the schedule. Total period dependent costs were determined by the scenario-specific durations. Activity and period dependent costs were totaled to determine overall costs for each scenario.

The purpose of this study is to provide one cost estimate based the actual spent fuel storage conditions. The costs presented are for financial planning. All costs are in summer, 2015 dollars. All costs are based on the aforementioned spent fuel shipping and storage assumptions.

Utilizing the above estimating methodology, the cost for this scenario is $1,634,038,400. In addition there will be an annual cost of $4,912,700 per year of post decommissioning spent fuel storage and $56,952,300 for the eventual decommissioning of the ISFSI.

## 2.0 SUMMARY

Decommissioning is the safe removal of a facility or site from service and the reduction of radioactivity to a level that permits either the release of the property for unrestricted use and NRC license termination; or a restricted release of the property and NRC license termination.

### 2.1 DECOMMISSIONING ALTERNATIVES

The NRC allows three types of scenarios in estimating the decommissioning of a nuclear site, DECON, SAFSTOR and ENTOMB. The first, DECON, occurs soon after shutdown. It assumes that all systems, structures and contaminated site areas will be removed or decontaminated and that the facility's license will be terminated.

For the second alternative, SAFSTOR, preparations occur soon after shutdown. It assumes limited site decontamination and dismantlement; that all liquid will be drained from systems; that the facility will be placed in a safe and stable condition; that all spent fuel will be held in storage or shipped from the site; and that the site will be decontaminated and its license terminated within sixty years. This study does not consider the SAFSTOR scenario.

In the third alternative, ENTOMB, preparations occur soon after shutdown. It assumes limited site decontamination and dismantlement; that all liquid will be drained from systems; that the remaining radioactive systems and structures will be encased inside an entombment structure; that the facility will be continuously monitored; that spent fuel will be held in storage or shipped from the site; that the site will be decontaminated and license terminated within 60 years; and that most reactors will have radionuclides in concentrations exceeding the limits for unrestricted release after 100 years. This study does not consider the ENTOMB scenario.

Per NRC regulations, there are specific reporting requirements for decommissioning and spent fuel storage. Regulation 10 CFR 50.75, *Reporting and Recordkeeping for Decommissioning Planning, requires* a decommissioning report certifying that financial assurance will be available for decommissioning. The amount funded must be adjusted annually. A report on the status of funding must be submitted every two years. Costs not associated with decommissioning, such as spent fuel storage and clean removal costs, are specifically excluded.

Five years before license expiration or within 2 years after permanent shutdown, whichever occurs first, NRC regulation 10 CFR 50.54(bb) requires the licensee have a program to manage and provide funding for the management of spent fuel following permanent cessation until title to and possession of all of its spent fuel is transferred to the Department of Energy (DOE) for ultimate disposal in a repository. The licensee must demonstrate the actions will be consistent with NRC requirements and will be implemented on a timely basis according to these requirements.

On June 17, 2011, the NRC published a final rule amending its regulations to improve decommissioning planning. The rule became effective on December 17, 2012 and required compliance by March 31, 2013. This rule requires licensees to report additional details in their decommissioning cost estimate. To assist in the implementation of the new rule, the NRC revised NUREG-1757, "Consolidated Decommissioning Guidance, Financial Assurance, Recordkeeping and Timeliness," specifically volume 3. This volume applies to the timeliness and recordkeeping requirements for licensees under Title 10 of the Code of Federal Regulations (10 CFR) Parts 30, 40, 70, and 72. It also applies to financial assurance requirements for licensees under 10 CFR Parts 30, 40, 70, and 72. This volume does not apply to licensees under 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities." Regulatory Guide 1.159, Revision 1, "Assuring the Availability of Funds for Decommissioning Nuclear Reactors," issued October 2003, provides guidance on financial assurance for these licensees. While the final rule applies to reactor licensees, like Cook, the guidance of NUREG-1757 is not directly applicable but does provide additional information useful in the development of this cost estimate.

While none of the above NRC regulations require Greenfield or clean system and structure removal costs, these costs may be required by local authorities to minimize liability. Removal of clean systems and structures may also be required to access contaminated components and structures. Therefore, Greenfield costs have been included in this study.

Table 2-1 provides a summary of the costs for this scenario. Costs are separated into the three cost categories based on the aforementioned spent fuel shipping and storage assumptions and have been determined based on the described estimating methodology.

**TABLE 2-1**
**SUMMARY OF COSTS**

| **DECON, Indefinite On-Site Dry Storage and Modified Spent Fuel Pool Systems** | | | | |
|---|---|---|---|---|
| **Decommissioning Alternative** | **Fuel Storage and Decommissioning Cost** | **Dormancy Period Cost** | **Delayed Dismantling Cost** | **Total Program Cost** |
| 10 CFR 50.75(c) | $909,101,862 | N/A | N/A | $909,101,862 |
| 10 CFR 50.54(bb) | $529,465,643 | N/A | N/A | $529,465,643 |
| Greenfield | $195,470,882 | N/A | N/A | $195,470,882 |
| | | | ***total:*** | **$1,634,038,387** |
| | | | | |
| Annual ISFSI | $4,912,735 per year | | | **$4,912,735 per year** |
| | | | | |
| ISFSI Decommissioning | $56,952,278 | | | **$56,952,278** |

# 3.0 DECOMMISSIONING COST ESTIMATING METHODOLOGIES

## 3.1 DECON

There are typically six periods associated with the DECON methodology of decommissioning cost estimating. Period one consists of decommissioning planning prior to shutdown. Period two involves post-shutdown preparations, including isolation of spent fuel; decontamination of the primary system; flushing and draining of all systems; implementation of cold and dark; and characterization surveys. Period three consists of removal of reactor internals and removal of the reactor vessel. The critical path task for period three is the removal, packaging, shipping and disposal of the reactor internals and the reactor vessel. Also in period three, the steam generators, pressurizers, contaminated systems and structures are removed, packaged, shipped and disposed of. Additionally, clean structures and systems are removed as they become unnecessary. In period four, the buildings undergo decontamination. Building decontamination includes decontamination of the reactor building(s), removal, packaging, shipping and disposition of spent fuel racks after spent fuel has been removed from the spent fuel pool, decontamination of the spent fuel pool and the balance of the auxiliary building(s), a formal site survey of any remaining buildings, and termination of 10 CFR Part 50 license. Period five consists of demolition of clean buildings. In this period, all remaining clean structures are removed with the exception of any required to support spent fuel storage. Period six consists of site restoration. In this period, the site is graded and landscaped to conform to the natural surroundings. Depending on the spent fuel storage assumptions, these periods may be separated by a wet spent fuel storage period, a dry spent fuel storage period, and/or a combination of both.

The estimate in this study utilizes the DECON methodology.

There are advantages to utilizing the DECON methodology. DECON provides sooner termination of the NRC license compared to SAFSTOR. Knowledgeable employees who are familiar with the site will still be available. There is no need for long-term security and surveillance. The DECON method provides a greater certainty of regulatory requirements due to the inherent uncertainty in trying to assess future regulatory requirements. Finally, the total cost will be lower as it is incurred in current dollars and there is no extended dormancy period. DECON offers similar advantages over ENTOMB, primarily avoiding the uncertainty and long-term surveillance costs likely associated with restricted release of the site. In addition, DECON allows more flexible site reuse compared to ENTOMB.

Disadvantages of the DECON methodology compared to SAFSTOR or ENTOMB include the following: the short time period that elapses following shut-down means less radioactive decay and therefore a higher worker dose. The initial cash outlay will be larger. There is time for funds to accrue, which means a larger present value; and work will have to be performed in proximity to the on-site storage of spent fuel.

## 3.2 SPENT FUEL ACTIVITIES

There are many uncertainties associated with the Department of Energy's (DOE) acceptance of spent fuel. The Department of Energy (DOE) originally contracted to begin accepting spent fuel from nuclear power plants no later than January 31, 1998. To date, no commercial spent fuel has been taken by the DOE under the contract. Many utilities have brought legal proceedings against the DOE for their breach of contract with the majority winning court ordered compensation. Recently, all activity at Yucca Mountain has been shutdown and, at least in the near term, has been removed as a potential spent fuel repository. It appears unlikely that that spent fuel shipments to a Federal repository will occur anytime in the foreseeable future. In light of this fact, all nuclear utilities should be prepared to store spent fuel on-site for a long period of time. This scenario assumes indefinite storage.

In October, 2011 the DOE reached a settlement agreement with Indiana Michigan Power Company in regards to their failure to commence acceptance of spent nuclear fuel and high level waste. The agreement allowed Indiana Michigan to recover costs incurred due to the DOE's failure through December 31, 2013. An Addendum to this settlement agreement was issued in January of 2014. The Addendum extended the termination date of the settlement to December 31, 2016. Allowable reimbursements are based on costs incurred above and beyond those that would have been incurred had the DOE performed according to the contract. But for DOE's failure to perform, Indiana Michigan's spent fuel allocations, those spent fuel assemblies that would have been taken by DOE, are identified in attachment 1 of the Addendum.

This scenario assumes all spent fuel will be transferred to an on-site ISFSI after shutdown. Dry storage will be required during operations to maintain full core discharge capabilities, including expanding the ISFSI, if needed. The ISFSI must be expanded, after shutdown, sufficiently to accommodate the long term storage of all spent fuel from both units. The storage system is anticipated to be licensed for both storage and transportation facilitating the eventual transfer to the DOE site.

It is assumed that spent fuel cannot be transferred to dry storage until it has cooled a minimum of seven years in the spent fuel pool. In order to minimize post-shutdown spent fuel storage costs the spent fuel island concept will be implemented. Modifications to the site will provide self-contained fuel pool cooling, cleanup, monitoring, control and electrical power systems. This will isolate the spent fuel pool from the remainder of the site and will allow decommissioning to continue safely on the balance of site. This option will provide the low cost option for the long term on-site storage of spent fuel.

Per ISFSI Licensing requirements, a 10 CFR part 72 license will be required in order to terminate the 10 CFR Part 50 license. Systems approved for use under the provisions of 10 CFR part 72 Subpart K, a Certificate of Compliance, may be used on a site with a 10 CFR part 50 license without a 10 CFR Part 72 Subpart C license. The process to obtain a 10 CFR Part 72 license will be simplified by utilizing a storage system with a Certificate of Compliance. For this reason, this study assumes the dry storage system utilized will have a Certificate of Compliance.

A site re-evaluation is not required to obtain the Part 72 subpart C ISFSI license if it is shown that original site findings have not changed. A re-evaluation would only be required if new information is available that alters the original findings. It is assumed that the system utilized for dry storage will meet or could be modified to meet the original site design conditions.

## 3.3 DECOMMISSIONING MANAGEMENT

The utility staff will retain certain of their ongoing functions during decommissioning, including the following:

- Shipment of low-level waste remaining from plant operations
- Radiological health and safety
- Security
- Quality assurance
- Health physics monitoring
- Defueling of the reactor
- Draining and de-energizing of all systems
- Continued safe on-site storage of spent fuel
- Management of the decommissioning general contractor.

The number of staff during each period depends on the major work planned for each period. Details are provided in section seven of this report.

While not directly applicable, consistent with the reasons stated in the NRC guidance of NUREG-1757, Vol. III, App. A, Section A.3.1, this study assumes that the utility will hire an experienced decommissioning general contractor (DGC) who will be responsible for performing the decommissioning activities. The DGC in turn will hire and be responsible for subcontractors hired to perform activities, such as primary system decontamination flush and large component removal. The number of staff during each period depends on the major work planned for each period. Details are provided in section seven of this report.

## 3.4 COLD & DARK

To simplify the removal of systems and structures, a “cold & dark” status will be implemented. The cold & dark status will allow component removal without individually verifying that each component has been de-energized. To implement cold & dark, all systems will be drained and electrical power to components will be removed as appropriate. After the spent fuel pool isolation has been completed, a new minimized control room will be constructed. Construction power will be supplied to the site for decommissioning and to operate essential loads with color coded wire. This process ensures that all energy sources are removed prior to the beginning of decommissioning activities, simplifying the removal process and greatly increasing safety during the decommissioning process.

## 3.5 DECONTAMINATION PROCEDURES

To facilitate the removal of contaminated large components, contamination control envelopes (CCE's) will be set up inside the reactor building. CCEs will have integral ventilation systems for contamination control and to maintain negative pressure. Cutting stations, including for underwater cutting, will be set up within the reactor building.

The reactor vessel internals will be removed from the vessel and transferred to the fuel transfer canal. Once in the transfer canal, they will be segmented and loaded underwater into shipping liners. The liner outer surfaces will be washed and loaded into shipping casks for transport to the disposal facility.

The reactor vessel will be cut into ring segments with each segment transferred to the fuel transfer canal. Here, each segment will be further segmented and loaded into shipping cask liners. The outer surfaces of the liners will be washed and then loaded into shipping casks for transport to the disposal facility.

With the exception of the upper shell, the steam generator will be removed intact. A steam generator transfer system and support equipment will be installed to remove the steam generator from the reactor building. A CCE and ventilation system, scaffolding, temporary lighting and shielding will also be installed. The insulation will be removed from the steam generators, followed by cutting of the main steam, feedwater and miscellaneous piping. Next the upper shell and components will be cut and removed. These will be surveyed, decontaminated and released if possible.

A steel plate will be welded to the top of the lower shell. The lower shell will be removed, transferred from the building, prepared for transport and transported to the disposal facility.

The pressurizer will be removed in a similar fashion, excluding segmentation.

The following process will be used for removal and disposal of contaminated systems, previously drained by the utility staff: Contaminated pipe and components will be cut free and segmented as necessary. The components will be transferred to a packaging area where a crew will package them, survey the containers and prepare the containers for shipment.

Clean pipe and components will be cut free and segmented when necessary. The components will be transferred to a packaging area where a crew will package the material into containers and prepare for them for shipment. It is assumed that clean waste will be disposed of at a local landfill.

With the exception of the reactor building interior, contaminated concrete surfaces will be decontaminated by partial surface removal. In some cases entire walls and/or floors will be removed. The remaining structures will be surveyed for conformance to release limits. Depending on the results of the survey, more decontamination may be required. Bulk removal of the reactor building interior floors and walls will be performed with all of the material being sent out for off-site processing. This leads to a large disposal volume; however, at a lower rate for bulk processing than for direct burial. In addition, there will be far less characterization and iterative decontamination.

Clean structures will be demolished using explosives and/or mechanical means and disposed of at a local landfill.

## 3.6 CONTINGENCY

Contingencies are applied to cost estimates primarily to account for unknown or unplanned events that experience tells us are likely to occur. These events include increased radioactive waste materials in volumes exceeding the amount anticipated; equipment breakdowns; weather delays; labor strikes, etc. Estimates are based on assumed values of cost, which in reality are subject to variability. The actual costs may be higher or lower than the estimated value; however, they usually go higher. The amount of contingency to be added is directly related to the level of detail and uncertainty contained in the estimate.

The U.S. Department of Energy (DOE) Cost Estimating Guide, DOE G 430.1-1, 3-28-97; defines contingency as follows: "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."

DOE G 430.1-1 provides a recommended range of contingencies as a function of program design:

| Time of Estimate | Contingency Range as a % of Total Estimate |
|---|---|
| Planning Phase | 20-30 |
| Budget | 15-25 |
| Title I | 10-20 |
| Title II | 5-15 |

*The AACE International Certification Study Guide, Second Edition - Revised, 2003*, defines contingency as follows: "Contingency is a cost element of an estimate to cover a statistical probability of the occurrence of unforeseeable elements of cost within the defined project scope due to a combination of uncertainties, intangibles and unforeseen, highly-unlikely occurrences of future events based on management decisions to assume certain risks."

*AIF/NESP-0036 "Guidelines for Producing Nuclear Plant Decommissioning Cost Estimates" (AIF)* is another source for published contingency values. This document identifies contingencies for activities specific to nuclear power plant decommissioning. Except for system decontamination, reactor vessel removal and disposal and reactor internals removal and disposal, the contingencies presented in AIF are consistent with the values presented in DOE G 430.1-1 for a Budget/Title I estimate. The contingencies identified in AIF for system decontamination and reactor vessel and reactor internals removal and disposal are higher than the ranges identified in DOE G 430.1-1. This is in part due to the lack of actual decommissioning work performed during the time period the AIF document was published.

While not directly applicable to a Part 50 reactor license, the NRC guidance of NUREG-1757, Vol. III, App. A, Section A.3.1, states that a contingency factor of 25% is normally appropriate. "Because of the uncertainty in contamination levels, waste disposal costs, and other costs associated with decommissioning, the cost estimate is required to apply an 'adequate' contingency factor. In general a contingency of 25 percent applied to the sum of all estimated decommissioning costs should be adequate, but in some cases, a higher contingency may be appropriate." The guidance goes on to recognize that "Proposals to apply the contingency only to selected components of the cost estimate, or to apply a contingency lower than 25 percent, should be approved only in circumstances when a case-specific review has determined that there is an extremely low likelihood of unforeseen increases in the decommissioning costs." For the reasons developed below, this study is an example of circumstances where a case-specific review has determined that applying a contingency lower than 25 percent to some elements of the cost estimate is appropriate.

An estimate of the nature developed for D. C. Cook would be considered somewhere between a Budget estimate (based on conceptual design) and a Title I (based on more detailed site specific design). As such, an overall contingency in the 15% to 25% range would be appropriate. Knight Cost Engineering Services, LLC (KCES) has determined contingency values specific to DC Cook utilizing the information presented in AIF and consistent with DOE G 430.1-1. There are a number of large scale decommissioning projects in progress or nearing completion. The DC Cook decommissioning cost estimate incorporates the lessons learned from these projects. As such, costs can be estimated with a greater degree of confidence than was true at the time AIF was published. This increased level of confidence allows for a downward adjustment to the recommended contingency where applicable. Other cost elements, particularly with regard to the reactor vessel segmentation, are less well known and contingency up to 50 percent is appropriate. The following table provides a summary of the contingency values that were applied to each activity for each cost category.

**TABLE 3.1**

| | Staff Labor | Craft Labor | Equip & Mtls | Pkging | Trans-portation | Clean Disposal | Contam-inated Disposal | Energy | Other |
|---|---|---|---|---|---|---|---|---|---|
| Engineering and Project Management | 15% | | | | | | | | |
| Contaminated removal | | 25% | | 10% | 15% | | 25% | | |
| Reactor Vessel and Internals | | 50% | | 25% | 25% | | 50% | | |
| Clean removal | | 15% | | 10% | 25% | 10% | | | |
| Supplies and consumables | | | 25% | | | | | | |
| Other | | | | | | | | 15% | 15% |

There is some variation associated with the contingency analysis for on-site spent fuel storage. The activity costs associated with spent fuel storage, such as the purchase and construction of the ISFSI, the modification of the spent fuel pool and the transfer of spent fuel pool to the ISFSI are subject to many of the unknown or unplanned occurrences for which contingency is based. As such, the above methodology will be applied. During periods of spent fuel storage only, either wet or dry, the operating costs of the spent fuel storage facility include only a ten percent contingency because of the higher degree of knowledge and confidence in the factors comprising the operation of the wet or dry storage facility. Any variability in the duration of the fuel storage period due to failed DOE schedules is excluded from the contingency.

## 4.0 ASSUMPTIONS

Following is a list of assumptions developed by KCES in completing this study. These assumptions are based on the most current decommissioning methodologies and site-specific considerations.

1. **Component quantities** with the exception of pipe, conduit, cable tray and duct lengths, were developed from directly from the plan EDB system. Pipe, conduit, cable tray and duct lengths were used as is from the previous estimate.

2. **Structure inventory quantities** were developed for this estimate from general arrangement drawings and the site walkdown.

3. **The utility staff** is assumed to be the same size at the time of Unit 2 shutdown as it was in July, 2015.

4. **Utility staff positions and costs** were supplied by the Company and represent July, 2015 salary and benefit data

5. **Subcontractor base labor rates and fringe benefits** were supplied by AEP for most crafts. These rates were current as of June, 2015. The overhead and profit structure for these rates was developed by KCES.

6. **Craft labor rates** for positions not supplied by the Company were determined by KCES.

7. **Activity labor** costs do not include any allowance for delays between activities, nor is there any cost allowance for craft labor retained on-site while waiting for work to become available.

8. All **skilled laborers** will be supplied by the local union hall and hired by the Decommissioning General Contractor (DGC).

9. The **professional personnel** used for the planning and preparation activities will be paid per diem at the rate of $142.00/day. Since the skilled laborers are being supplied by local union hall they will not be paid per diem.

10. The cost for **Utility personnel** assisting the DGC to develop decommissioning activity specifications is included in the Utility Staff costs.

11. **Health Physics technicians** used during vessel and internal removal will be supplied by the Utility Staff.

12. **The DGC staff salaries**, including overhead and profit, were determined by KCES.

13. **Transportation** costs are based on actual mileage from D. C. Cook to each disposal or processing facility utilized in the estimate.

14. **Class B & C radioactive waste base disposal costs** are based on actual out of compact disposal rates and fees incurred at the WCS facility in Andrews, TX. In addition, the disposal costs of the Greater Than Class C waste, e.g., the core baffle and lower core grid plate, include present day curie surcharges as imposed at the WCS facility to more accurately reflect handling costs for highly radioactive material.

15. **Class A waste** will be disposed of at the Energy*Solutions* facility in Utah, Energy*Solutions* metal melt facility in Tennessee or the Studsvik processing facility in Tennessee, which Energy*Solutions* acquired in 2014. Waste is assumed to be transported to the lowest cost facility for which it qualifies. Further details on these processes are presented in Section 8.1.

16. **Clean waste** is assumed to be disposed of at a local landfill at a cost of $90.00 per ton.

17. It is assumed that **all radioactive waste** generated during operations and stored on-site will be disposed of prior to shutdown. The cost of disposal of this material is considered an operating expense and is assumed not to be a decommissioning cost.

18. **Greater than Class C waste** will be removed from the reactor vessel, segmented and packaged in containers of similar size and shape to the spent fuel assemblies. The containers will be stored in the spent fuel pool or transferred to the ISFSI. The additional containers are assumed to be shipped offsite with the spent fuel and are included in the spent fuel shipping analysis. Eighty-four containers will be filled per unit for both scenarios.

19. **All costs** used in these calculations were current on July, 2015.

20. 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.

21. All post shutdown costs necessitated by the presence of **stored spent fuel** are presented separately.

22. It is assumed that **Unit 1 will shut down** in October, 2034 and that **Unit 2 will remain operational** until December 2037.

23. **On-site dry storage** will utilize the Holtec Vertical Concrete Casks (VCC) and Multi-Purpose Canister (MPC) system. Each MPC is designed to store and transport 32 spent fuel assemblies. Separate overpacks will be used for transportation and disposal.

24. It is assumed that spent fuel will cool seven years in the spent fuel pool prior to being transferred to the ISFSI or shipped off site.

25. Only the costs for the **expanded storage pad**, **canister and overpacks** projected to be purchased after Unit 1 shutdown are included in this study as a spent fuel storage

expense. All canisters and overpacks required during operations, in order to maintain full core discharge capabilities, are assumed to be an operations expense. The cost per canister and storage overpack is estimated to be $2,000,000, including closure services.

26. **The Unit 1 and Unit 2 reactor vessel and internals** will be removed sequentially.

27. **The Unit 1 and Unit 2 reactor vessel and internals** are considered identical.

28. **Vessel and internals curie estimates** were derived from the values for the Reference PWR vessel and internals in NUREG/CR-0130. These values were adjusted for MWT rating, weight and decay period.

29. While there will in all likelihood be some level of property tax after shutdown, this study does not attempt to estimate the amount. It has been assumed for purpose of this study that **property taxes** for the D.C. Cook Plant will be zero after shutdown. This issue will be addressed as more information becomes available.

30. No **PCBs** will be on-site at shutdown.

31. It is assumed that all **asbestos insulation** will have been removed during the operating life of the plant.

32. **Clean building walls and foundations** more than three feet below grade may be left in place if there are no voids.

33. KCES has assumed that a site specific 10 CFR Part 72 license will be required for the balance of the dry storage period prior to terminating the 10 CFR Part 50 operating license.

34. The decommissioning will be performed under the **current regulations.** These regulations require a Post-Shutdown Decommissioning Activities Report (PSDAR) to be submitted prior to or within two years of after shutdown. In addition, certificates for permanent cessation of operations and permanent removal of fuel from the vessel must be submitted to the NRC 90 days after the PSDAR submittal. Major decommissioning activities that meet the criteria of 10 CFR Part 50.59, may be performed provided NRC agrees with the PSDAR.

35. The VCCs and storage pad may have some level of activation, as such the material will be removed and transported to one of the Energy*Solutions* processing facilities in Tennessee .

# 5.0 SCENARIO DESCRIPTION

Utilizing the above described estimating methodology cost for this scenario is $1,634,038,400. In addition there will be an annual cost of $4,912,700 per year of post decommissioning spent fuel storage and $56,952,300 for the eventual decommissioning of the ISFSI. The assumptions pertinent to this scenario are described below.

## 5.1 DECON WITH INDEFINITE ON-SITE DRY STORAGE

This scenario includes Unit 1 shutdown on Oct 25, 2034 and Unit 2 on Dec 23, 2037. The transfer of spent fuel remaining in the spent fuel pool to the dry storage facility will begin in 2039. The existing ISFSI will be expanded to accommodate all spent fuel remaining on-site. With the exception of the last core load of fuel assemblies, transfer of all remaining fuel to the ISFSI will be completed seven years after shutdown. The transfer of the last core load of 193 assemblies and a few remaining assemblies will occur immediately after the required seven year cooling period. The site will remain as an Independent Spent Fuel Storage Installation indefinitely.

The spent fuel pool will be modified immediately after Unit 2 shutdown to isolate it from the remainder of the facility. The capital cost of the skid mounted pool support systems package is included in this estimate. This will allow decommissioning to proceed exclusive of the spent fuel pool. Once all spent fuel has been removed from the spent fuel pool, the spent fuel pool island will be decommissioned. As soon as all spent fuel is transferred to dry storage, the balance of the D.C. Cook Plant will be decommissioned. All spent fuel will be stored on-site in Holtec's VCC and MPC system.

The six sequential periods in this scenario and the major activities occurring in each are as follows:

| Period | Description | Period Duration, Months |
|---|---|---|
| 1 | BETWEEN SHUTDOWN OF UNIT 1 AND SHUTDOWN OF UNIT 2<br>• Planning for spent fuel pool modifications<br>• Planning for cold and dark<br>• Planning for primary systems flush<br>• Select DGC<br>• Planning for decommissioning | 38 |
| 2 | POST-SHUTDOWN ACTIVITIES<br>• Transfer spent fuel from pool to the ISFSI<br>• Modification of spent fuel pool systems<br>• Primary system decontamination flush | 12 |

- Flush and drain non-essential systems
- Perform characterization survey
- Implement cold and dark
- Vessel and Internals removal preparations

| | | |
|---|---|---|
| 3 | REMOVAL OF MAJOR COMPONENTS<br>• Transfer spent fuel from pool to the ISFSI<br>• Removal of Unit 1 and Unit 2 reactor vessels and internals<br>• Removal of Unit 1 and Unit 2 steam generators<br>• Removal of Unit 1 contaminated systems<br>• Remove Unit 1 clean systems<br>• Decontaminate Unit 1 Reactor Building<br>• Begin Unit 1 and Unit 2 structures decontamination | 42 |
| 4 | DECON BALANCE OF SITE<br>• Removal of Unit 2 contaminated systems<br>• Remove Unit 2 clean systems<br>• Decontaminate Unit 2 Reactor Building<br>• Remove spent fuel racks<br>• Decontaminate spent fuel storage building<br>• Completion of Unit 1 and Unit 2 structures decontamination<br>• Final site survey of reactor plant confirming satisfactory removal | 38 |
| 5 | CLEAN STRUCTURES DEMOLITION<br>• Demolition of decontaminated Unit 1 and Unit 2 structures | 18 |
| 6 | RESTORATION OF PLANT SITE<br>• Backfill, grading and landscaping of Unit 1 and Unit 2 sites | 2 |

In this scenario, decommissioning and site restoration will be complete approximately 112 months or 9.3 years after Unit 2 shutdown. Spent fuel will remain on-site indefinitely. The cost for the eventual decontamination and removal of the ISFSI is included in the estimate.

# 6.0 SCHEDULES

A scenario-specific schedule has been developed for this study. The schedule is based on some combination of the following assumptions:

- DECON
- Spent fuel shipping start date
- Spent fuel shipping rate
- Construction and maintenance of on-site dry storage facility

The first step in determining each schedule is assessment of the spent fuel disposition. The spent fuel disposition schedule will have a major influence on the overall schedule critical path. The spent fuel disposition analysis will then be combined with the decommissioning activities to determine the overall project schedule.

Activity durations are determined based on the unit cost factor approach. Once the plant material inventory has been determined specific unit rates for cost, man hours and schedule hours for a specific activity, such as surface decontamination, are applied to the inventory. From this calculation the removal or decontamination cost, total man hours and total schedule hours are determined for an activity. The schedule hours are then entered into the schedule to determine project duration. The schedule will be divided into multiple periods depending on the activities occurring during that time period. The separation into multiple periods allows for better control in determining the period dependent costs such as staffing, insurance and security.

The spent fuel disposition analysis for Unit 1 and Unit 2 are presented in Table 6.1. This scenario assumes an indefinite on-site storage period. A detailed decommissioning schedule, based upon this spent fuel transfer schedule and a critical path analysis of the decommissioning activities, is presented in Appendix A.

## 6.1 DECON WITH ON-SITE DRY STORAGE AND NO SPENT FUEL SHIPPING

Spent fuel is assumed to remain on-site in dry storage indefinitely. The schedule of spent fuel movements is reflected in Table 6.1. The detailed project schedule is present in Appendix A. The decommissioning schedule has been optimized within the limitations imposed by the spent fuel storage requirements. Program periods and durations for this scenario are as follows:

| Period | Description | Duration, months |
|---|---|---|
| 1 | U1 & U2 Decommissioning Planning Cost: | 38 |
| 2 | Post-Shutdown Activities Costs: | 12 |
| 3 | Vessel and Internals Removal Costs: | 42 |

| | | |
|---|---|---|
| 4 | Decontaminate Balance of Site Costs: | 38 |
| 5 | Clean Structure Demolition Costs: | 18 |
| 6 | Restore Site Costs: | 2 |
| 7 | Dry Storage (Indefinitely) | |
| 8 | Eventual decontamination and removal of ISFSI | 21 |

Decommissioning of the site will be complete in 2047, which is 112 months after the shutdown of Unit 2. Spent fuel will remain on site in dry storage indefinitely.

# TABLE 6.1
# SPENT FUEL SHIPPING SCHEDULE

| Year | Unit 1 Fuel Discharged | Unit 2 Fuel Discharged | Assemblies To DOE | Total Assemblies & other items on Site | Assemblies to Dry Storage | Total Assemblies in Dry Storage | Pool Locations Occupied |
|---|---|---|---|---|---|---|---|
| 2015 | | 84 note 1 | | 3684 | 512 | 896 | 2788 |
| 2016 | 89 | 89 | | 3862 | 0 | 896 | 2966 |
| 2017 | 89 | 0 | | 3951 | 0 | 896 | 3055 |
| 2018 | 0 | 89 | | 4040 | 512 | 1408 | 2632 |
| 2019 | 89 | 89 | | 4218 | 0 | 1408 | 2810 |
| 2020 | 89 | 0 | | 4307 | 0 | 1408 | 2899 |
| 2021 | 0 | 89 | | 4396 | 512 | 1920 | 2476 |
| 2022 | 89 | 89 | | 4574 | 0 | 1920 | 2654 |
| 2023 | 89 | 0 | | 4663 | 0 | 1920 | 2743 |
| 2024 | 0 | 89 | | 4752 | 384 | 2304 | 2448 |
| 2025 | 89 | 89 | | 4930 | 0 | 2304 | 2626 |
| 2026 | 89 | 0 | 0 note 3 | 5019 | 0 | 2304 | 2715 |
| 2027 | 0 | 89 | 0 | 5108 | 384 | 2688 | 2420 |
| 2028 | 89 | 89 | 0 | 5286 | 0 | 2688 | 2598 |
| 2029 | 89 | 0 | 0 | 5375 | 0 | 2688 | 2687 |
| 2030 | 0 | 89 | 0 | 5464 | 320 | 3008 | 2456 |
| 2031 | 89 | 89 | 0 | 5642 | 0 | 3008 | 2634 |
| 2032 | 89 | 0 | 0 | 5731 | 0 | 3008 | 2723 |
| 2033 | 0 | 89 | 0 | 5820 | 0 | 3008 | 2812 |
| 2034 | 193 | 89 | 0 | 6102 | 0 | 3008 | 3094 |
| 2035 | | 0 | 0 | 6102 | 0 | 3008 | 3094 |
| 2036 | | 89 | 0 | 6191 | 0 | 3008 | 3183 |
| 2037 | | 193 | 0 | 6384 | 0 | 3008 | 3376 |
| 2038 | | | 0 | 6384 | 0 | 3008 | 3376 |
| 2039 | | 42 note 2 | 0 | 6426 | 320 | 3328 | 3098 |
| 2040 | | 84 | 0 | 6510 | 384 | 3712 | 2798 |
| 2041 | | 42 | 0 | 6552 | 512 | 4224 | 2328 |
| 2042 | | | 0 | 6552 | 512 | 4736 | 1816 |
| 2043 | | | 0 | 6552 | 704 | 5440 | 1112 |
| 2044 | | | 0 | 6552 | 704 | 6144 | 408 |
| 2045 | | | 0 | 6552 | 408 | 6552 | 0 |
| 2046 | | | 0 | 6552 | | 6552 | 0 |

**NOTES:**

1. Discharge supplied by AEP 5/5/15.
2. 84 spent fuel baskets loaded with GTCC will be discharged into the spent fuel pool, from each unit, during internals removal.
3. Spent fuel will remain on-site indefinitely.
4. Assemblies to dry storage determined by AEP through, 2033. Assemblies to dry storage after Unit 1 shutdown determined by KCES
5. Max number of casks required: 205
6. Casks purchased after shutdown 111

# 7.0 PROJECT MANAGEMENT

There are three components to project management during decommissioning, Utility Staff (staff), Decommissioning General Contractor Staff (DGC) and Security. Each of these is further broken down into that required for decommissioning and that required for spent fuel storage. The person levels for each are specific to each decommissioning period.

## 7.1 UTILITY STAFF

The staff size at Unit 1 shutdown is assumed to be the same size and composition as it was in the spring of 2015. Immediately after Unit 1 shutdown, the staff is reduced approximately 33%, severance payments for the severed personnel are included in period one of this study. The majority of the remaining staff is attributed to the operation of Unit 2. Upon shutdown of Unit 2 this staff is reduced to the level required for decommissioning operations and spent fuel storage, the severance payments for the severed personnel are included in period two of this study. Severance payments are tracked through the decommissioning and all costs are included in this study. All severed employees will receive a severance package based on the existing severance policy.

There are two components to the staff, decommissioning and spent fuel storage. The majority of the staff during the early part of the decommissioning process will be attributed to decommissioning. A staff level of 11.5 full time employees (FTE) will be required during period 1, between Unit 1 and Unit 2 shutdown. Upon shutdown of Unit 2, period 2, approximately 145 FTEs will be required to prepare the site for decommissioning, including the spent fuel pool, security and control room modifications. Once these modifications have been made the staff will be reduced to 96 FTEs to support the reactor internals and reactor vessel removal, period 3. The staff will be further reduced to 78 FTEs, 7 FTEs and 3 FTEs for period 4 site decontamination, period 5 structures removal and period 6 site restorations, respectively.

During the decommissioning process there is a need to manage the safe operations of the spent fuel storage facilities, whether spent fuel is in wet storage or dry storage. The Utility staff will maintain responsibility for these actions. Spent fuel will remain in the spent fuel pool for a minimum of seven years. Also, there is an existing ISFSI, required during operations to maintain full core off load capabilities. As such, there are two on-site spent fuel storage scenarios, wet and dry storage in operations at the same time and dry storage only. During the wet and dry storage periods the Utility staff will be 33 FTEs and 14.25 during dry storage only. There will be some fluctuation in these staffs due to sharing of upper management personnel with the decommissioning staff.

## 7.2 DECOMMISSIONING GENERAL CONTRACTOR

The DGC is assumed to have no role in the post shutdown management of the spent fuel storage facility. Upon selection of a DGC contractor, the contractor will begin to mobilize on site. A DGC staff of 27 FTEs is assumed to be on site during the last 12 months of period 1, between Unit 1 and Unit 2 shutdown. A DGC staff of 76 FTEs will be on site to prepare for decommissioning during period 2 site preparations. The DGC staff will be increased to 89 FTEs to support the reactor internals and reactor vessel removal, period 3. The DGC staff will be reduced to 76 FTEs, 34 FTEs and 15 FTEs for period 4 site decontamination, period 5 structures removal and period 6 site restorations, respectively.

## 7.3 SECURITY

There are two components to the security staff, decommissioning and spent fuel storage. The majority of the security staff during the early part of the decommissioning process will be attributed to decommissioning. An apportionment of the full security staff is allocated to Unit 1 during period 1, between Unit 1 and Unit 2 shutdown, estimated to be 5 full time employees (FTE). Upon shutdown of Unit 2, period 2, approximately 72 FTEs will be required during preparations for decommissioning. Once modifications have been made to the spent fuel pool, security and control room the security staff will be reduced to 32 FTEs to support the reactor internals and reactor vessel removal, period 3 and site decontamination, period 4. The staff will be further reduced to 7 FTEs and 2 FTEs for period 5 structures removal and period 6 site restorations, respectively.

During the decommissioning process there will be a need to manage the safe operations of the spent fuel storage facilities, whether spent fuel is in wet storage or dry storage. A dedicated security staff will be assigned to both the wet and dry storage facility. Spent fuel will remain in the spent fuel pool for a minimum of seven years. There is an existing ISFSI, required during operations to maintain full core off load capabilities. As such, there are two on-site spent fuel storage scenarios, wet and dry storage in operations at the same time and dry storage only. During the wet and dry storage periods the security staff will be 20 FTEs and during dry storage only the security staff will consist of 13 FTEs. A security staff of 13 FTEs is attributed to spent fuel storage during the ISFSI removal.

The following Table 7-1 is a summary of the utility staff, DGC and security staff levels required.

## 7.4 DECON WITH INDEFINITE DRY STORAGE

Table 7.1 summarizes the staff level for Decommissioning and Table 7.2 summarizes the staff levels for spent fuel storage as defined above, by period.

## TABLE 7-1 DECOMMISSIONING STAFF SUMMARY

| Position: | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| Health Physics | 2.25 | 29 | 24 | 24 | 0 | 0 | 0 |
| Engineering | 1.25 | 20 | 11 | 10 | 2 | 1 | 0 |
| Maintenance Services | 2.75 | 19 | 5 | 5 | 3 | 0 | 0 |
| Operations | 0.75 | 38 | 14 | 5 | 0 | 0 | 0 |
| Projects | 3.25 | 13 | 29 | 22 | 0 | 0 | 0 |
| Administration | 1.25 | 26 | 13 | 12 | 2 | 2 | 0 |
| | **11.5** | **145** | **96** | **78** | **7** | **3** | **0** |
| | | | | | | | |
| DGC | 27 | 76 | 89 | 76 | 34 | 15 | |
| Security Guards | 5 | 72 | 32 | 32 | 7 | 2 | |

## TABLE 7-2 SPENT FUEL STORAGE STAFF SUMMARY

| Position: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Health Physics | 0 | 5 | 5 | 5 | 1.25 | 1.25 | 1.25 | 4 |
| Engineering | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| Maintenance Services | 0 | 5 | 5 | 5 | 2 | 2 | 2 | 2 |
| Operations | 0 | 13 | 13 | 13 | 5 | 5 | 5 | 6 |
| Projects | 0 | 0 | 0 | 0 | 2 | 2 | 2 | 1 |
| Administration | 0 | 9 | 9 | 9 | 4 | 4 | 4 | 4 |
| | **0** | **33** | **33** | **33** | **14.25** | **14.25** | **14.25** | **17** |
| | | | | | | | | |
| DGC | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| Security Guards | 0 | 24 | 20 | 20 | 13 | 13 | 13 | 13 |

# 8.0 WASTE DISPOSAL

## 8.1 LOW LEVEL WASTE DISPOSAL BACKGROUND

The Low-Level Waste Policy Act (LLWPA), passed by Congress in 1980 and the Low-Level Waste Policy Amendments Act of 1985 encouraged states to form compacts for the disposal of low-level radioactive waste. The Acts made each state responsible for disposing of their own radioactive waste. The formation of compacts allowed states to limit their disposal facility to compact members thereby limiting the amount of waste accepted. On the other hand, the Acts also required that states not participating in the process would be required to take title to waste generated within that state. This provision was overturned by the U. S. Supreme Court in 1992 thus eliminating the need for states to develop their own disposal facility, including those already in a compact. The compact process has not resulted in the expected regionalization of low level radioactive waste disposal; to date there has been just one new disposal facility licensed to accept all low level radioactive waste, including Class A, B & C.

There are currently three facilities licensed to accept all low level radioactive waste: the Barnwell, South Carolina facility operated by Energy*Solutions*, LLC; the Waste Control Specialists, LLC (WCS) facility in Andrews, TX and the Hanford, Washington facility operated by U. S. Ecology. There is one other site in Clive, Utah owned and operated by Energy*Solutions*, LLC; however, this facility is currently licensed to accept only Class A radioactive waste. As of July 1, 2008 the Barnwell facility will only accept waste from the Atlantic Compact states. The Atlantic Compact member states include South Carolina, Connecticut and New Jersey. The Hanford facility only accepts waste from the Northwest Compact and the Rocky Mountain Compact; this has been the case since 1993. The Northwest Compact and Rocky Mountain Compact member states include Alaska, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington and Wyoming. While the WCS facility is the compact disposal facility for Texas and Vermont it will accept waste from out of compact. WCS is licensed to accept Class A, B and C radioactive waste, as such this estimate assumes that Class B & C waste will be disposed of at this facility with the costs based on the current rate structure for out of compact waste.

## 8.2 CLASS A WASTE DISPOSAL

There are currently multiple options for the disposition of Class A waste. These include metal melt, direct burial and waste processing. Table 8-1 provides a summary of waste disposition options for Class A waste and their unit rates considered in this estimate. KCES assumes that each waste stream will be transported to the least cost option for which it qualifies. Packaging and transportation costs have been calculated based on these specific locations.

Table 8-1
Class A Waste Disposal Options

| Description | Disposal Cost, $/cu. ft. |
|---|---|
| ENERGY*SOLUTIONS* disposal | $171.84 per cubic foot |
| WCS disposal | $208.79 per cubic foot |
| BSFR processing | $0.25 per pound |

KCES assumed that the reactor building internal floors and walls will be removed in bulk and sent for processing to a BSFR facility. This approach will produce a large volume of waste compared to the traditional decontamination, survey and release methodology but at a lower rate. In addition, the approach will reduce the amount of characterization and iterative decontamination. Other contaminated structures will follow the decontamination, survey and release approach due to the smaller areas of potentially contaminated surfaces.

The steel in the vertical concrete casks and the storage pad for the ISFSI are assumed to be potentially activated. The entire volume of the VCCs and pad will be sent to the BSFR facility in Tennessee for processing. Sending the entire volume of this material for processing will eliminate the time consuming processing of separating, surveying and repeating as necessary. The remainder of the material associated with the ISFSI will be removed as clean material.

## 8.3 CLASS B & C WASTE DISPOSAL

As discussed above, the WCS facility is licensed to accept Class B and C waste. This study assumes that all Class B & C waste will be disposed of at WCS. There is currently only a published fee and surcharge structure for in compact generators. Based on guidance from WCS personnel, increasing the published fees and surcharges by 20% would be representative of the rates that would be charged to out of compact generators. The base disposal rate for Class B & C waste is currently $2,680/cubic foot. This rate was provided by AEP.

Additionally, there is a dose rate surcharge and a millicurie charge that must be added. The basic millicurie charge is $0.55 per millicurie up to $220,000 per shipment. There is also a weight surcharge, up to $20,000 per shipment; a dose rate surcharge, up to $400 per cu. ft.; an irradiated hardware there is an additional surcharge of $75,000 per shipment and a cask handling surcharge of $2,500 per cask. Finally there are State and County fees of 5% each. These rates appear to be unchanged from 2012. This estimate includes all applicable surcharges and fees.

## 8.4 DISPOSAL OF WASTES GREATER THAN CLASS C

While waste identified as Class A, B and C, according to 10 CFR 61, may be disposed of at a near-surface disposal facility, certain components may exceed the radionuclide concentration limitations for 10 CFR 61 Class C waste. These components cannot be disposed in a near-surface radioactive waste disposal facility based on 10 CFR 61 definitions. They will have to be transferred to a geologic repository or a similar site approved by the NRC.

The KCES site-specific classification of radioactive wastes for the D.C. Cook Plant identified that the Spent Fuel Assemblies and two components within each reactor vessel (the Core Baffle and the Lower Core Grid Plate) will exceed Class C limitations. Like the spent fuel assemblies, the reactor vessel components will be stored with the spent fuel either in wet or dry storage. Here they will wait for transportation to a DOE geologic disposal facility for disposal. The costs for disposing of these components was estimated based upon the maximum curie surcharges currently in effect at the WCS disposal facility. Prior to placing in storage with the spent fuel, these components will be segmented and the pieces placed into spent fuel sized containers, it is estimated that 168 containers will be generated from the two units.

## 8.5 RADIOACTIVE WASTE VOLUMES PER 10 CFR 61 CLASSIFICATIONS

KCES has determined the classifications of radioactive wastes resulting from decommissioning the D.C. Cook Plant. The radioactive waste associated with each decommissioning activity is based upon the site-specific decommissioning calculations prepared for this cost estimate. The total volumes of 10 CFR 61 wastes for Units 1 and 2 are presented in Table 8.2. These volumes represent waste volumes generated at the site, for both units, excluding the waste generated by removing the ISFSI.

**Table 8-2**
**10 CFR 61 Radioactive Waste Volumes (cubic feet)**

| | |
|---|---|
| Class A | 3,622,768 |
| Class B | 5,480 |
| Class C | 2,344 |
| Greater Than Class C | 1,512 |
| Total: | 3,632,104 |

Waste associated with the removal of the ISFSI, is identified in Table 8-3 below.

**Table 8-3**
**10 CFR 61 Radioactive Waste Volumes (cubic feet)**

| | |
|---|---|
| ISFSI | 534,981 |

## 8.6 PROJECTION OF NON-RADIOACTIVE WASTE QUANTITIES

KCES has included the cost for disposal of all non-contaminated waste at a local landfill. As seen in the Maine Yankee decommissioning, on-site use of concrete rubble to fill below grade voids can be problematic. Maine Yankee originally intended to utilize remediated concrete to fill below grade voids. Many felt that this would essentially be considered on-site disposal of radioactive material since the concrete, although below the limits specified in the License Termination Plan (LTP), might still be slightly radioactive. Maine Yankee decided to eliminate potential legacy waste by transporting and disposing of this material in a licensed landfill. For this reason KCES has assumed that all non-contaminated waste, including pipe and components will be disposed of in a licensed landfill at a rate of $0.045 per pound. Table 8-4 presents the total volumes of non-contaminated waste resulting from the decommissioning program.

**Table 8-4**
**Non-Contaminated Waste (pounds)**

| | |
|---|---|
| Structures | 1,006,158,339 |
| Systems | 45,885,045 |

# 9.0 COST SUMMARIES

## 9.1. ESTIMATING APPROACH

The estimating methodology utilized in the development of the cost estimate in this study is consistent with that presented in both *Guidelines for Producing Commercial Nuclear Power Plant Decommissioning Cost Estimates*, AIF/NESP-036, May 1986 and *Revised Analysis of Decommissioning for the Reference Pressurized Water Reactor Power Station*, NUREG/CR-5884, PNL-8742, November 1995. Specifically the estimating methodology used by KCES herein is based on the Unit Cost Factor (UCF) approach. In addition, current experience from recently completed decommissioning projects has been considered in developing the estimating methodology.

KCES has developed a database of unit cost factors specific to the work activities associated with decommissioning a nuclear power reactor such as the cutting of a section of six inch contaminated pipe. These UCFs define the duration of an activity on a unit basis, including for the example above, contamination control set-up, cutting, capping pipe ends, removal from area, removal of contamination control and productivity adjustment factors. From the durations, local labor rates and equipment and material costs, removal costs are determined, including associated consumable costs. Material waste volumes, man-hours, disposal costs, packaging costs and transportation costs are also determined, again on a unit basis for each UCF. Each UCF is adjusted based on site specific factors such as labor rates, transportation costs and disposal rates.

The first step in developing the site specific activity removal and disposal cost is to develop a site specific plant inventory. KCES developed the structure inventory for this estimate from current site specific drawings supported by a site walkdown. The systems inventory was developed from the site component database supported by referencing flow diagrams and the USAR. The plant system inventory list was separated into contaminated and non-contaminated components and unique unit cost factors were developed for each radiological condition. The site specific material quantities are then multiplied by the appropriate UCF to determine the total activity cost and removal man-hours.

The decommissioning activities are inserted into a project schedule and sequenced based on order of performance. The schedule hours, as determined by the UCFs for each activity are then incorporated in the project schedule to determine the critical path of the project. The schedule is then divided into several periods. Each period is defined by an activity or group of activities requiring a specific amount of oversight or support. For instance, during the vessel internals and reactor vessel removal activities the Utility staff, DGC staff and security staff are required to be maintained at a certain level. Once these activities are complete the levels may change based on the controlling activities.

Period dependent costs are those costs that are not specific to the decommissioning activities but are required as support. Costs such as those for the Utility staff, DGC staff, security staff, insurance, health physics supplies and energy are calculated on a monthly basis based on the major activities defining a given period. These monthly costs are then multiplied by the duration of the respective period to determine period dependent costs. The activity and period dependent costs are then summed to determine total decommissioning costs.

These activity and period dependent costs are either spent fuel storage related (10 CFR 50.54(bb)), decommissioning related (10 CFR 50.75(c)), greenfield (g) or a combination of the three. KCES has separated costs in each of these categories during the estimating process.

A detailed decommissioning cost table is presented in Appendix B and is summarized below. All costs are presented in 2015 dollars. The summarized costs include contingency.

## 9.2 DECON WITH INDEFINITE ON-SITE DRY STORAGE

The total cost for this scenario is **$1,634.0** million fixed and **$4.9** million annual, as shown in Table 9.1. A total of $529.5 million fixed is attributed to the preparation and transfer of spent fuel to the ISFSI. An annual cost of $4.9 million will be incurred for the continuing maintenance and surveillance of the ISFSI. A total of $909.1 million is attributed to the decommissioning, and $195.5 million for greenfield. For this scenario, there is a large fixed cost required for the design, license, cask procurement, and construction and installation of the dry storage facility. There are also annual surveillance costs, NRC license fees and NRC inspection fees. The cost attributed to the operation and maintenance of the spent fuel pool has been optimized by minimizing the spent fuel support systems. There is an additional cost of $57.0 million for the eventual decontamination and removal of the ISFSI.

An ISFSI will have been constructed during operations in order to maintain full core offload capabilities in the spent fuel pool. The existing facility will be expanded shortly after Unit 1 shutdown to accommodate the long term storage of spent fuel. The transfer of the spent fuel assemblies remaining in the spent fuel pool at shutdown, to the ISFSI, will begin just after Unit 2 shutdown. This transfer will proceed at a rate sufficient to allow the spent fuel pool to be empty approximately 7.5 years after Unit 2 shutdown. The maximum number of spent fuel assemblies stored at the ISFSI at any time will be approximately 6,552 requiring 205 storage casks, 111 of which will have been purchased to maintain full core offload capability and are an operations expense. In addition to the spent fuel, 168 spent fuel size containers loaded with GTCC will be stored at the ISFSI, requiring an additional six casks.

The existing ISFSI and infrastructure will have to be expanded to accommodate the post shutdown transfer of spent fuel. The additional pad and infrastructure will cost approximately

$135 million, before contingency. It is assumed that the Holtec vertical storage system will be utilized in the ISFSI at a cost of $2,000,000 per 32 assembly PWR canister and overpack, including welding services. All casks purchased during operations to maintain full core offload capability would be expended prior to Unit 1 shutdown, so would not be an expense of the decommissioning trust. A total of 111 casks will be purchased after Unit 2 shutdown at a cost of $222.0 million, before contingency. All costs associated with the operation of the ISFSI such as staff oversight, maintenance costs, insurance costs, etc. are included in the 10 CFR 50.54(bb) costs.

**TABLE 9.1**

| PERIOD | DESCRIPTION | 50.75(c) Cost | 50.54(bb) Cost | Greenfield Cost | Total Cost |
|---|---|---|---|---|---|
| 1 | U1 & U2 DECOMMISSIONING PLANNING COST: | $50,041,436 | $173,086,201 | | $223,127,637 |
| 2 | POST-SHUTDOWN ACTIVITIES COSTS: | $126,358,434 | $153,329,659 | | $279,688,093 |
| 3 | VESSEL AND INTERNALS REMOVAL COSTS: | $487,208,650 | $169,529,044 | $27,958,874 | $684,696,569 |
| 4 | DECONTAMINATE BALANCE OF SITE COSTS: | $245,493,342 | $27,478,897 | $20,813,681 | $293,785,921 |
| 5 | CLEAN STRUCTURE DEMOLITION COSTS: | | $5,493,075 | $144,693,529 | $150,186,604 |
| 6 | RESTORE SITE COSTS: | | $548,766 | $2,004,798 | $2,553,564 |
| | TOTAL COSTS: | $909,101,862 | $529,465,643 | $195,470,882 | $1,634,038,387 |
| 7 | ANNUAL DRY STORAGE | | $4,912,735 | | $4,912,735 |
| 8 | ISFSI DECONTAMINATION AND REMOVAL | | $56,952,278 | | $56,952,278 |

# 10.0 REFERENCES

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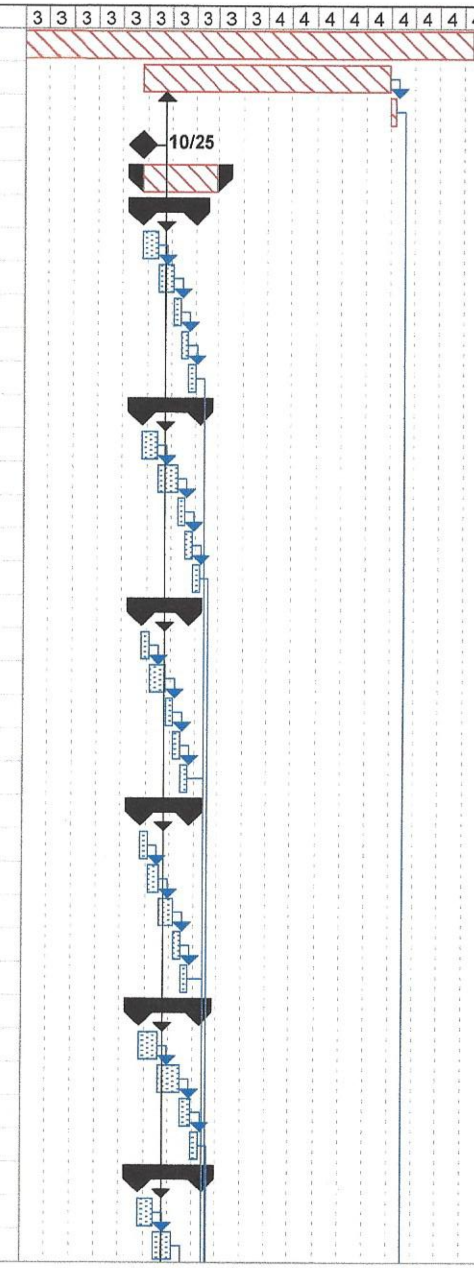
16. U.S. Department of Energy Office of Civilian Radioactive Waste Management, *Report to Congress on the Demonstration of the Interim Storage of Spent Nuclear Fuel from Decommissioned Nuclear Power Reactor Sites*, December 2008

# APPENDIX A

# SCHEDULE

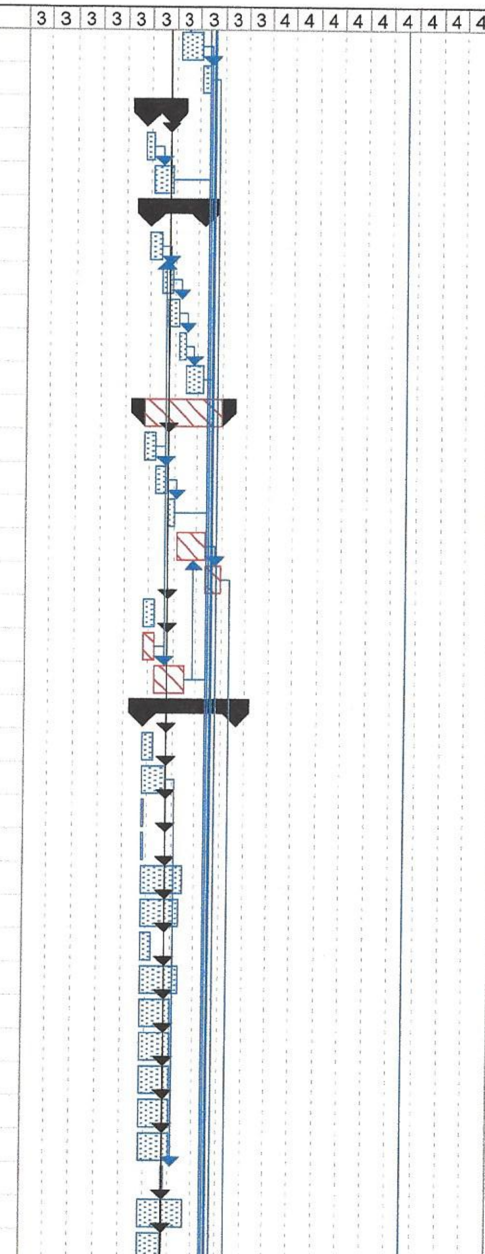
2015 D. C. Cook
Scenario 1

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 1 | Dry spent fuel storage | 1925 wks | Fri 7/1/11 | Thu 5/21/48 | |
| 2 | Post-shutdown wet storage | 531 wks | Wed 10/25/34 | Tue 12/27/44 | 4 |
| 3 | Transfer remaining assemblies to ISFSI | 13 wks | Wed 12/28/44 | Tue 3/28/45 | 2 |
| 4 | Unit 1 Down | 0 days | Wed 10/25/34 | Wed 10/25/34 | |
| 5 | **Period 1 Decommissioning Planning** | **825 days** | **Wed 10/25/34** | **Tue 12/22/37** | |
| 6 | **Modify spent fuel support systems** | **576 days** | **Wed 10/25/34** | **Wed 1/7/37** | |
| 7 | Define systems modification | 168 days | Wed 10/25/34 | Fri 6/15/35 | 4 |
| 8 | Design systems modification and equipment specificatons | 168 days | Mon 6/18/35 | Wed 2/6/36 | 7 |
| 9 | Prepare installation procedures | 80 days | Thu 2/7/36 | Wed 5/28/36 | 8 |
| 10 | Prepare test procedures | 80 days | Thu 5/29/36 | Wed 9/17/36 | 9 |
| 11 | Prepare maintenance procedures | 80 days | Thu 9/18/36 | Wed 1/7/37 | 10 |
| 12 | **Control room relocation** | **624 days** | **Wed 10/25/34** | **Mon 3/16/37** | |
| 13 | Define control room equipment | 168 days | Wed 10/25/34 | Fri 6/15/35 | 4 |
| 14 | Design control room modification and equipment specificatons | 216 days | Mon 6/18/35 | Mon 4/14/36 | 13 |
| 15 | Prepare installation procedures | 80 days | Tue 4/15/36 | Mon 8/4/36 | 14 |
| 16 | Prepare test procedures | 80 days | Tue 8/5/36 | Mon 11/24/36 | 15 |
| 17 | Prepare maintenance procedures | 80 days | Tue 11/25/36 | Mon 3/16/37 | 16 |
| 18 | **Design spent fuel storage security modifications** | **504 days** | **Wed 10/25/34** | **Mon 9/29/36** | |
| 19 | Define modification | 88 days | Wed 10/25/34 | Fri 2/23/35 | 4 |
| 20 | Design modification and equipment specificatons | 176 days | Mon 2/26/35 | Mon 10/29/35 | 19 |
| 21 | Prepare installation procedures | 80 days | Tue 10/30/35 | Mon 2/18/36 | 20 |
| 22 | Prepare test procedures | 80 days | Tue 2/19/36 | Mon 6/9/36 | 21 |
| 23 | Prepare maintenance procedures | 80 days | Tue 6/10/36 | Mon 9/29/36 | 22 |
| 24 | **Primary system decontamination** | **520 days** | **Wed 10/25/34** | **Tue 10/21/36** | |
| 25 | Define scope | 80 days | Wed 10/25/34 | Tue 2/13/35 | 4 |
| 26 | Evaluate processes | 120 days | Wed 2/14/35 | Tue 7/31/35 | 25 |
| 27 | Prepare bid specifications and RFP | 160 days | Wed 8/1/35 | Tue 3/11/36 | 26 |
| 28 | Qualify Contractors | 80 days | Wed 3/12/36 | Tue 7/1/36 | 27 |
| 29 | Evaluate Proposals | 80 days | Wed 7/2/36 | Tue 10/21/36 | 28 |
| 30 | **Select Decommissioning General Contractor** | **640 days** | **Wed 10/25/34** | **Tue 4/7/37** | |
| 31 | Define scope | 200 days | Wed 10/25/34 | Tue 7/31/35 | 4 |
| 32 | Prepare bid specifications and RFP | 240 days | Wed 8/1/35 | Tue 7/1/36 | 31 |
| 33 | Qualify Contractors | 120 days | Wed 7/2/36 | Tue 12/16/36 | 32 |
| 34 | Evaluate Proposals | 80 days | Wed 12/17/36 | Tue 4/7/37 | 33 |
| 35 | **U1 & U2 cold and dark site repowering** | **680 days** | **Wed 10/25/34** | **Tue 6/2/37** | |
| 36 | Define scope | 160 days | Wed 10/25/34 | Tue 6/5/35 | 4 |
| 37 | Design modification and equipment specificatons | 200 days | Wed 6/6/35 | Tue 3/11/36 | 36 |



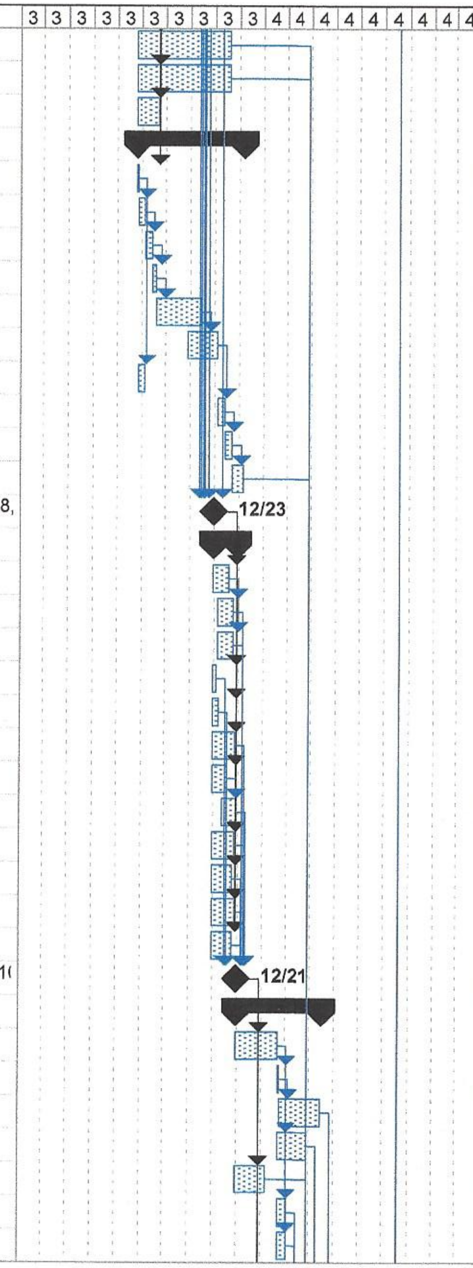
2015 D. C. Cook
Scenario 1

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 38 | Prepare installation procedures | 240 days | Wed 3/12/36 | Tue 2/10/37 | 37 |
| 39 | Prepare test procedures | 80 days | Wed 2/11/37 | Tue 6/2/37 | 38 |
| 40 | **Modify U1 & U2 containment access** | **280 days** | **Wed 10/25/34** | **Tue 11/20/35** | |
| 41 | Select new access location | 80 days | Wed 10/25/34 | Tue 2/13/35 | 4 |
| 42 | Design access and equipment specificatons | 200 days | Wed 2/14/35 | Tue 11/20/35 | 41 |
| 43 | **U1 & U2 Site Characterization** | **590 days** | **Wed 12/27/34** | **Tue 3/31/37** | |
| 44 | Define scope | 120 days | Wed 12/27/34 | Tue 6/12/35 | 56FS-75 days |
| 45 | Prepare bid specifications and RFP | 120 days | Wed 6/13/35 | Tue 11/27/35 | 44 |
| 46 | Qualify Contractors | 120 days | Wed 9/19/35 | Tue 3/4/36 | 45FS-50 days |
| 47 | Evaluate Proposals | 80 days | Wed 3/5/36 | Tue 6/24/36 | 46 |
| 48 | Prepare procedures | 200 days | Wed 6/25/36 | Tue 3/31/37 | 47 |
| 49 | **ADMINISTRATIVE ACTIVITIES** | **825 days** | **Wed 10/25/34** | **Tue 12/22/37** | |
| 50 | Develop staff transition plan | 120 days | Wed 10/25/34 | Tue 4/10/35 | 4 |
| 51 | Develop severance and retention policy | 120 days | Wed 4/11/35 | Tue 9/25/35 | 50 |
| 52 | Prepare project administrative procedures | 80 days | Wed 9/26/35 | Tue 1/15/36 | 51 |
| 53 | Develop area based decommissioning cost estimate | 320 days | Wed 2/20/36 | Tue 5/12/37 | 57FS-19 wks |
| 54 | Develop project budget and schedule controls | 160 days | Wed 5/13/37 | Tue 12/22/37 | 53 |
| 55 | Assemble plant drawings | 120 days | Wed 10/25/34 | Tue 4/10/35 | 4 |
| 56 | Define end product | 120 days | Wed 10/25/34 | Tue 4/10/35 | 4 |
| 57 | Develop technical approach and detailed project plans | 320 days | Wed 4/11/35 | Tue 7/1/36 | 56 |
| 58 | **LICENSING/PERMITTING DOCUMENTATION** | **1000 days** | **Wed 10/25/34** | **Tue 8/24/38** | |
| 59 | Insurance exemption | 120 days | Wed 10/25/34 | Tue 4/10/35 | 4 |
| 60 | Prepare Post-Shutdown Decommissioning Activities Report | 240 days | Wed 10/25/34 | Tue 9/25/35 | 4 |
| 61 | Prepare certification of permanent cessation of operations | 24 days | Wed 10/25/34 | Mon 11/27/34 | 4 |
| 62 | Prepare certification of permanent reactor defueling | 24 days | Wed 10/25/34 | Mon 11/27/34 | 4 |
| 63 | Prepare post-shutdown technical specification modifications | 440 days | Wed 10/25/34 | Tue 7/1/36 | 4 |
| 64 | Update FSAR | 400 days | Wed 10/25/34 | Tue 5/6/36 | 4 |
| 65 | Develop certified fuel handler program | 120 days | Wed 10/25/34 | Tue 4/10/35 | 4 |
| 66 | Prepare post-shutdown emergency plan | 400 days | Wed 10/25/34 | Tue 5/6/36 | 4 |
| 67 | Prepare post-shutdown QA plan | 320 days | Wed 10/25/34 | Tue 1/15/36 | 4 |
| 68 | Prepare post-shutdown security plan | 320 days | Wed 10/25/34 | Tue 1/15/36 | 4 |
| 69 | Prepare post-shutdown fire protection plan | 320 days | Wed 10/25/34 | Tue 1/15/36 | 4 |
| 70 | Prepare post-shutdown radiation protection manual | 320 days | Wed 10/25/34 | Tue 1/15/36 | 4 |
| 71 | Prepare and submit state and local permits | 320 days | Wed 10/25/34 | Tue 1/15/36 | 4 |
| 72 | Respond to NRC questions on PSDAR | 24 days | Wed 9/26/35 | Mon 10/29/35 | 60 |
| 73 | Prepare detailed resource loaded project schedule | 480 days | Wed 10/25/34 | Tue 8/26/36 | 4 |
| 74 | Perform 50.59 unreviewed safety questions | 240 days | Wed 10/25/34 | Tue 9/25/35 | 4 |



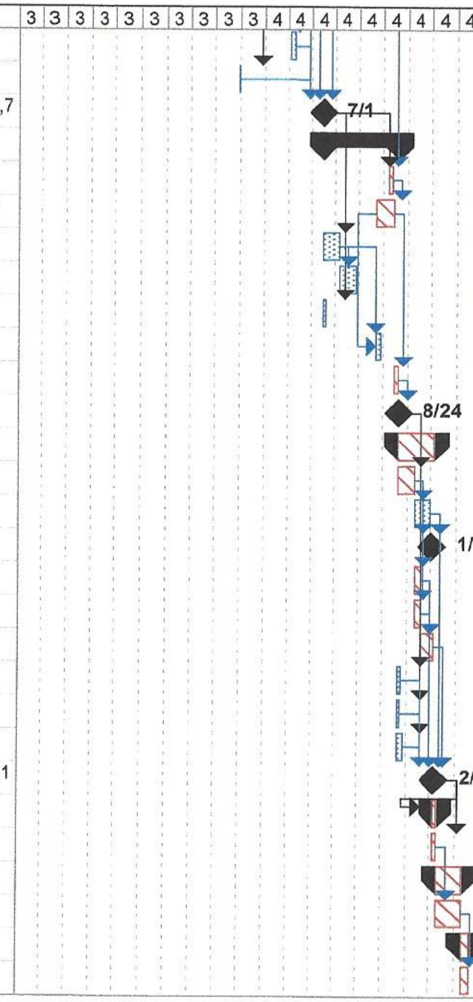
2015 D. C. Cook
Scenario 1

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 75 | Prepare activity specifications | 1000 days | Wed 10/25/34 | Tue 8/24/38 | 4 |
| 76 | Prepare detailed work procedures | 1000 days | Wed 10/25/34 | Tue 8/24/38 | 4 |
| 77 | Select shipping casks and obtain permits | 240 days | Wed 10/25/34 | Tue 9/25/35 | 4 |
| 78 | **LICENSE TERMINATION PLAN** | **1144 days** | **Wed 10/25/34** | **Mon 3/14/39** | |
| 79 | General information | 16 days | Wed 10/25/34 | Wed 11/15/34 | 4 |
| 80 | Site Characterization | 80 days | Thu 11/16/34 | Wed 3/7/35 | 79 |
| 81 | Identification of remaining site dismantlement activities | 80 days | Thu 3/8/35 | Wed 6/27/35 | 80 |
| 82 | Remediation Plans | 40 days | Thu 6/28/35 | Wed 8/22/35 | 81 |
| 83 | Final Radiation Survey Plan | 480 days | Thu 8/23/35 | Wed 6/24/37 | 82 |
| 84 | Compliance with the radiological criteria for license termination | 320 days | Thu 11/27/36 | Wed 2/17/38 | 83FS-150 days |
| 85 | Update decommissioning cost estimate | 80 days | Thu 11/16/34 | Wed 3/7/35 | 79 |
| 86 | Supplement to the environmental report | 80 days | Thu 2/18/38 | Wed 6/9/38 | 84 |
| 87 | Respond to NRC questions | 80 days | Thu 6/10/38 | Wed 9/29/38 | 86 |
| 88 | Update LTP | 118 days | Thu 9/30/38 | Mon 3/14/39 | 87 |
| 89 | Unit 2 Down | 0 days | Wed 12/23/37 | Wed 12/23/37 | 11,17,23,29,34,38, |
| 90 | **Period 2 Post-Shutdown Activities** | **260 days** | **Wed 12/23/37** | **Tue 12/21/38** | |
| 91 | Modify Spent Fuel Cooling System | 173 days | Wed 12/23/37 | Fri 8/20/38 | 89 |
| 92 | Modify control room | 173 days | Mon 3/1/38 | Wed 10/27/38 | 91FS-125 days |
| 93 | Modify security system | 173 days | Mon 3/1/38 | Wed 10/27/38 | 91FS-125 days |
| 94 | Primary System Decon | 40 days | Wed 12/23/37 | Tue 2/16/38 | 89 |
| 95 | Flush & Drain Systems | 60 days | Wed 12/23/37 | Tue 3/16/38 | 89 |
| 96 | Implement cold & dark | 240 days | Wed 12/23/37 | Tue 11/23/38 | 89 |
| 97 | Modify U1 Containment Access | 160 days | Wed 12/23/37 | Tue 8/3/38 | 89 |
| 98 | Modify U2 Containment Access | 160 days | Wed 5/12/38 | Tue 12/21/38 | 97FS-60 days |
| 99 | Historical Site Assessment | 240 days | Wed 12/23/37 | Tue 11/23/38 | 89 |
| 100 | Vessel and internals activation analysis | 215 days | Wed 12/23/37 | Tue 10/19/38 | 89 |
| 101 | Characterization survey | 250 days | Wed 12/23/37 | Tue 12/7/38 | 89 |
| 102 | Test special equipment and training | 215 days | Wed 12/23/37 | Tue 10/19/38 | 89 |
| 103 | End Period 2 | 0 days | Tue 12/21/38 | Tue 12/21/38 | 94,95,96,99,100,1( |
| 104 | **Period 3 Reactor Vessel and Internals Removal** | **920 days** | **Wed 12/22/38** | **Tue 7/1/42** | |
| 105 | Remove Unit 1 reactor vessel internals and reactor vessel | 450 days | Wed 12/22/38 | Tue 9/11/40 | 103 |
| 106 | Transfer Equipment to Unit 2 | 4 wks | Wed 9/12/40 | Tue 10/9/40 | 105 |
| 107 | Remove Unit 2 reactor vessel internals and reactor vessel | 450 days | Wed 10/10/40 | Tue 7/1/42 | 106 |
| 108 | Remove Unit 1 steam generators | 65 wks | Wed 9/12/40 | Tue 12/10/41 | 105 |
| 109 | Remove Unit 2 steam generators | 65 wks | Wed 12/22/38 | Tue 3/20/40 | 103 |
| 110 | Remove Unit 1 contaminated systems | 105 days | Wed 9/12/40 | Tue 2/5/41 | 105 |
| 111 | Remove Unit 1 clean systems | 103 days | Wed 9/12/40 | Fri 2/1/41 | 105 |



2015 D. C. Cook
Scenario 1

| ID | Task Name | Duration | Start | Finish | Predecessors |
|---|---|---|---|---|---|
| 112 | Decon Unit 1 reactor building | 56 days | Wed 2/6/41 | Wed 4/24/41 | 110,111 |
| 113 | Remove miscellaneous structures | 8 days | Wed 12/22/38 | Fri 12/31/38 | 103 |
| 114 | End Period 3 | 0 days | Tue 7/1/42 | Tue 7/1/42 | 108,109,112,113,7 |
| 115 | **Period 4 Building Decontamination** | **822 days** | **Wed 7/2/42** | **Thu 8/24/45** | |
| 116 | Remove Spent fuel storage racks | 8 wks | Wed 3/29/45 | Tue 5/23/45 | 114,3 |
| 117 | Remove Unit 2 contaminated systems | 194 days | Thu 9/22/44 | Tue 6/20/45 | 116FS-174 days |
| 118 | Remove Unit 2 clean systems | 190 days | Wed 7/2/42 | Tue 3/24/43 | 114 |
| 119 | Remove Turbine Building | 188 days | Wed 3/25/43 | Fri 12/11/43 | 118 |
| 120 | Decon Steam Generator Storage Building | 35 days | Wed 7/2/42 | Tue 8/19/42 | 114 |
| 121 | Decon Unit 2 Reactor Building | 56 days | Thu 9/22/44 | Thu 12/8/44 | 117SS,118 |
| 122 | Decon Auxiliary Building | 47 days | Wed 6/21/45 | Thu 8/24/45 | 117 |
| 123 | End Period 4 | 0 days | Thu 8/24/45 | Thu 8/24/45 | 122 |
| 124 | **Period 5 Clean Removal** | **392 days** | **Fri 8/25/45** | **Mon 2/25/47** | |
| 125 | Perform final radiological survey of all structures | 36 wks | Fri 8/25/45 | Thu 5/3/46 | 123 |
| 126 | Perform final survey of the site | 36 wks | Fri 5/4/46 | Thu 1/10/47 | 125 |
| 127 | Obtain NRC approval | 0 days | Thu 1/10/47 | Thu 1/10/47 | 126,125 |
| 128 | Remove Unit 1 reactor building | 80 days | Fri 5/4/46 | Thu 8/23/46 | 125 |
| 129 | Remove Unit 2 reactor building | 80 days | Fri 5/4/46 | Thu 8/23/46 | 125 |
| 130 | Remove Auxiliary Building | 132 days | Fri 8/24/46 | Mon 2/25/47 | 129,128 |
| 131 | Remove Steam Generator Storage Building | 40 days | Fri 8/25/45 | Thu 10/19/45 | 123 |
| 132 | Remove Administration building | 31 days | Fri 8/25/45 | Fri 10/6/45 | 123 |
| 133 | Remove Low Level Radwaste building | 66 days | Fri 8/25/45 | Fri 11/24/45 | 123 |
| 134 | End Period 5 | 0 days | Mon 2/25/47 | Mon 2/25/47 | 129,131,132,133,1 |
| 135 | **Period 6 Restore site** | **40 days** | **Tue 2/26/47** | **Mon 4/22/47** | **134** |
| 136 | Restore site | 8 wks | Tue 2/26/47 | Mon 4/22/47 | 134 |
| 137 | **Period 7 Dry Storage** | **260 days** | **Tue 4/23/47** | **Mon 4/20/48** | |
| 138 | Dry Storage | 52 wks | Tue 4/23/47 | Mon 4/20/48 | 136 |
| 139 | **Period 8 ISFSI Removal** | **84 days** | **Tue 4/21/48** | **Fri 8/14/48** | |
| 140 | Decon and remove ISFSI | 16.8 wks | Tue 4/21/48 | Fri 8/14/48 | 138 |



# APPENDIX B

# COST TABLE

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| | Type | | Staff Labor,$ | Craft Labor,$ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | Subtotal without Contingency, $ | Contingency, $ | Total with Contingency, $ | Staff Manhours | Clean Craft Manhours | Contaminated Craft Manhours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERIOD 1 - U1 & U2 DECOMMISSIONING PLANNING COST: | | | | | | | | | | | | | | | | | |
| | | SPENT FUEL ACTIVITIES | | | | | | | | | | | | | | | |
| | | Modify spent fuel support systems | | | | | | | | | | | | | | | |
| 1 | A 50.54(bb) | Define systems modification | $65,204 | | | | | | | | | $65,204 | $9,800 | $75,004 | 608 | | |
| 1 | A 50.54(bb) | Design systems modification and equipment specificatons | $155,196 | | | | | | | | | $155,196 | $23,300 | $178,496 | 1,568 | | |
| 1 | A 50.54(bb) | Prepare installation procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| 1 | A 50.54(bb) | Prepare test procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| 1 | A 50.54(bb) | Prepare maintenance procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| | | Control room relocation | | | | | | | | | | | | | | | |
| 1 | A 50.54(bb) | Define control room equipment | $65,204 | | | | | | | | | $65,204 | $9,800 | $75,004 | 608 | | |
| 1 | A 50.54(bb) | Design control room modification and equipment specificatons | $188,091 | | | | | | | | | $188,091 | $28,200 | $216,291 | 1,896 | | |
| 1 | A 50.54(bb) | Prepare installation procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| 1 | A 50.54(bb) | Prepare test procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| 1 | A 50.54(bb) | Prepare maintenance procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| | | Design spent fuel storage security modifications | | | | | | | | | | | | | | | |
| 1 | A 50.54(bb) | Define modification | $30,754 | | | | | | | | | $30,754 | $4,600 | $35,354 | 288 | | |
| 1 | A 50.54(bb) | Design modification and equipment specificatons | $107,927 | | | | | | | | | $107,927 | $16,200 | $124,127 | 1,016 | | |
| 1 | A 50.54(bb) | Prepare installation procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| 1 | A 50.54(bb) | Prepare test procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| 1 | A 50.54(bb) | Prepare maintenance procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| 1 | A 50.54(bb) | ISFSI Pad Construction | | $135,000,000 | | | | | | | | $135,000,000 | $32,181,700 | $167,181,700 | 192 | | |
| | | SUBTOTAL - SPENT FUEL ACTIVITIES | $783,758 | $135,000,000 | | | | | | | | $135,783,758 | $32,299,700 | $168,083,458 | 7,904 | | |
| | | SPENT FUEL PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| 1 | PD 50.54(bb) | Utility Staff | | | | | | | | | | | | | | | |
| 1 | PD 50.54(bb) | Security | | | | | | | | | | | | | | | |
| 1 | PD 50.54(bb) | Insurance | | | | | | | | | | | | | | | |
| 1 | PD 50.54(bb) | O & M Budget Items | | | | | | | | | $2,882,843 | $2,882,843 | $432,400 | $3,315,243 | | | |
| 1 | PD 50.54(bb) | Permits & Fees | | | | | | | | | | | | | | | |
| 1 | PD 50.54(bb) | Waste Transfer and Loading | | | | | | | | | | | | | | | |
| 1 | PD 50.54(bb) | Energy | | | | | | | | | | | | | | | |
| 1 | PD 50.54(bb) | Spent Fuel Storage Maintenance Supplies | | | | | | | | | | | | | | | |
| 1 | PD 50.54(bb) | Small Tools | | | $1,350,000 | | | | | | | $1,350,000 | $337,500 | $1,687,500 | | | |
| | | SUBTOTAL - SPENT FUEL PERIOD DEPENDENT | | | $1,350,000 | | | | | | $2,882,843 | $4,232,843 | $769,900 | $5,002,743 | | | |
| | | DECOMMISSIONING ACTIVITIES | | | | | | | | | | | | | | | |
| | | Primary system decontamination | | | | | | | | | | | | | | | |
| 1 | A 50.75(c) | Define scope | $43,826 | | | | | | | | | $43,826 | $6,600 | $50,426 | 328 | | |
| 1 | A 50.75(c) | Evaluate processes | $55,757 | | | | | | | | | $55,757 | $8,400 | $64,157 | 448 | | |
| 1 | A 50.75(c) | Prepare bid specifications and RFP | $55,713 | | | | | | | | | $55,713 | $8,400 | $64,113 | 512 | | |
| 1 | A 50.75(c) | Qualify Contractors | $15,010 | | | | | | | | | $15,010 | $2,300 | $17,310 | 112 | | |
| 1 | A 50.75(c) | Evaluate Proposals | $41,198 | | | | | | | | | $41,198 | $6,200 | $47,398 | 248 | | |
| | | Select Decommissioning General Contractor | | | | | | | | | | | | | | | |
| 1 | A 50.75(c) | Define scope | $83,634 | | | | | | | | | $83,634 | $12,500 | $96,134 | 736 | | |
| 1 | A 50.75(c) | Prepare bid specifications and RFP | $88,549 | | | | | | | | | $88,549 | $13,300 | $101,849 | 776 | | |
| 1 | A 50.75(c) | Qualify Contractors | $23,013 | | | | | | | | | $23,013 | $3,500 | $26,513 | 176 | | |
| 1 | A 50.75(c) | Evaluate Proposals | $41,198 | | | | | | | | | $41,198 | $6,200 | $47,398 | 248 | | |
| | | U1 & U2 cold and dark site repowering | | | | | | | | | | | | | | | |
| 1 | A 50.75(c) | Define scope | $71,703 | | | | | | | | | $71,703 | $10,800 | $82,503 | 616 | | |
| 1 | A 50.75(c) | Design modification and equipment specificatons | $158,617 | | | | | | | | | $158,617 | $23,800 | $182,417 | 1,560 | | |
| 1 | A 50.75(c) | Prepare installation procedures | $222,607 | | | | | | | | | $222,607 | $33,400 | $256,007 | 2,080 | | |
| 1 | A 50.75(c) | Prepare test procedures | $19,042 | | | | | | | | | $19,042 | $2,900 | $21,942 | 192 | | |
| | | Modify U1 & U2 containment access | | | | | | | | | | | | | | | |
| 1 | A 50.75(c) | Select new access location | $31,895 | | | | | | | | | $31,895 | $4,800 | $36,695 | 208 | | |
| 1 | A 50.75(c) | Design access and equipment specificatons | $140,511 | | | | | | | | | $140,511 | $21,100 | $161,611 | 1,320 | | |
| | | U1 & U2 Site Characterization | | | | | | | | | | | | | | | |
| 1 | A 50.75(c) | Define scope | $50,169 | | | | | | | | | $50,169 | $7,500 | $57,669 | 408 | | |
| 1 | A 50.75(c) | Prepare bid specifications and RFP | $56,812 | | | | | | | | | $56,812 | $8,500 | $65,312 | 496 | | |
| 1 | A 50.75(c) | Qualify Contractors | $23,013 | | | | | | | | | $23,013 | $3,500 | $26,513 | 176 | | |
| 1 | A 50.75(c) | Evaluate Proposals | $41,198 | | | | | | | | | $41,198 | $6,200 | $47,398 | 248 | | |
| 1 | A 50.75(c) | Prepare procedures | $139,929 | | | | | | | | | $139,929 | $21,000 | $160,929 | 1,256 | | |
| | | ADMINISTRATIVE ACTIVITIES | | | | | | | | | | | | | | | |
| 1 | A 50.75(c) | Develop staff transition plan | $43,226 | | | | | | | | | $43,226 | $6,500 | $49,726 | 352 | | |
| 1 | A 50.75(c) | Develop severance and retention policy | $43,226 | | | | | | | | | $43,226 | $6,500 | $49,726 | 352 | | |
| 1 | A 50.75(c) | Prepare project administrative procedures | $46,957 | | | | | | | | | $46,957 | $7,000 | $53,957 | 488 | | |
| 1 | A 50.75(c) | Develop area based decommissioning cost estimate | $217,919 | | | | | | | | | $217,919 | $32,700 | $250,619 | 2,240 | | |
| 1 | A 50.75(c) | Develop project budget and schedule controls | $63,304 | | | | | | | | | $63,304 | $9,500 | $72,804 | 648 | | |
| 1 | A 50.75(c) | Assemble plant drawings | $25,276 | | | | | | | | | $25,276 | $3,800 | $29,076 | 296 | | |
| 1 | A 50.75(c) | Define end product | $38,096 | | | | | | | | | $38,096 | $5,700 | $43,796 | 280 | | |
| 1 | A 50.75(c) | Develop technical approach and detailed project plans | $234,546 | | | | | | | | | $234,546 | $35,200 | $269,746 | 2,440 | | |

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| | Type | | Staff Labor, $ | Craft Labor, $ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | without Contingency, $ | Contingency, $ | with Contingency, $ | Staff Manhours | Craft Manhours | Craft Manhours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **LICENSING/PERMITTING DOCUMENTATION** | | | | | | | | | | | | | | | |
| 1 | A 50.75(c) | Insurance exemption | $48,428 | | | | | | | | | $48,428 | $7,300 | $55,728 | 376 | | |
| 1 | A 50.75(c) | Prepare Post-Shutdown Decommissioning Activities Report | $140,561 | | | | | | | | | $140,561 | $21,100 | $161,661 | 1,400 | | |
| 1 | A 50.75(c) | Prepare certification of permanent cessation of operations | $6,394 | | | | | | | | | $6,394 | $1,000 | $7,394 | 40 | | |
| 1 | A 50.75(c) | Prepare certification of permanent reactor defueling | $6,394 | | | | | | | | | $6,394 | $1,000 | $7,394 | 40 | | |
| 1 | A 50.75(c) | Prepare post-shutdown technical specification modifications | $347,695 | | | | | | | | | $347,695 | $52,200 | $399,895 | 3,600 | | |
| 1 | A 50.75(c) | Update FSAR | $322,717 | | | | | | | | | $322,717 | $48,400 | $371,117 | 3,360 | | |
| 1 | A 50.75(c) | Develop certified fuel handler program | $37,648 | | | | | | | | | $37,648 | $5,600 | $43,248 | 336 | | |
| 1 | A 50.75(c) | Prepare post-shutdown emergency plan | $169,694 | | | | | | | | | $169,694 | $25,500 | $195,194 | 1,480 | | |
| 1 | A 50.75(c) | Prepare post-shutdown QA plan | $108,471 | | | | | | | | | $108,471 | $16,300 | $124,771 | 1,000 | | |
| 1 | A 50.75(c) | Prepare post-shutdown security plan | $108,471 | | | | | | | | | $108,471 | $16,300 | $124,771 | 1,000 | | |
| 1 | A 50.75(c) | Prepare post-shutdown fire protection plan | $108,471 | | | | | | | | | $108,471 | $16,300 | $124,771 | 1,000 | | |
| 1 | A 50.75(c) | Prepare post-shutdown radiation protection manual | $108,471 | | | | | | | | | $108,471 | $16,300 | $124,771 | 1,000 | | |
| 1 | A 50.75(c) | Prepare and submit state and local permits | $98,477 | | | | | | | | | $98,477 | $14,800 | $113,277 | 960 | | |
| 1 | A 50.75(c) | Respond to NRC questions on PSDAR | $6,394 | | | | | | | | | $6,394 | $1,000 | $7,394 | 40 | | |
| 1 | A 50.75(c) | Prepare detailed resource loaded project schedule | $267,312 | | | | | | | | | $267,312 | $40,100 | $307,412 | 2,480 | | |
| 1 | A 50.75(c) | Perform 50.59 unreviewed safety questions | $97,771 | | | | | | | | | $97,771 | $14,700 | $112,471 | 736 | | |
| 1 | A 50.75(c) | Prepare activity specifications | $1,807,127 | | | | | | | | | $1,807,127 | $271,100 | $2,078,227 | 18,080 | | |
| 1 | A 50.75(c) | Prepare detailed work procedures | $1,667,732 | | | | | | | | | $1,667,732 | $250,200 | $1,917,932 | 16,080 | | |
| 1 | A 50.75(c) | Select shipping casks and obtain permits | $25,243 | | | | | | | | | $25,243 | $3,800 | $29,043 | 240 | | |
| | | **LICENSE TERMINATION PLAN** | | | | | | | | | | | | | | | |
| 1 | A 50.75(c) | General information | $1,407 | | | | | | | | | $1,407 | $200 | $1,607 | 16 | | |
| 1 | A 50.75(c) | Site Characterization | $35,465 | | | | | | | | | $35,465 | $5,300 | $40,765 | 336 | | |
| 1 | A 50.75(c) | Identification of remaining site dismantlement activities | $35,465 | | | | | | | | | $35,465 | $5,300 | $40,765 | 336 | | |
| 1 | A 50.75(c) | Remediation Plans | $18,631 | | | | | | | | | $18,631 | $2,800 | $21,431 | 176 | | |
| 1 | A 50.75(c) | Final Radiation Survey Plan | $353,367 | | | | | | | | | $353,367 | $53,000 | $406,367 | 3,620 | | |
| 1 | A 50.75(c) | Compliance with the radiological criteria for license termination | $237,240 | | | | | | | | | $237,240 | $35,600 | $272,840 | 2,440 | | |
| 1 | A 50.75(c) | Update decommissioning cost estimate | $57,848 | | | | | | | | | $57,848 | $8,700 | $66,548 | 596 | | |
| 1 | A 50.75(c) | Supplement to the environmental report | $57,848 | | | | | | | | | $57,848 | $8,700 | $66,548 | 596 | | |
| 1 | A 50.75(c) | Respond to NRC questions | $27,395 | | | | | | | | | $27,395 | $4,100 | $31,495 | 200 | | |
| 1 | A 50.75(c) | Update LTP | $53,329 | | | | | | | | | $53,329 | $8,000 | $61,329 | 536 | | |
| | | **SUBTOTAL - DECOMMISSIONING ACTIVITY COSTS:** | **$8,477,411** | | | | | | | | | **$8,477,411** | **$1,272,500** | **$9,749,911** | **81,340** | | |
| | | **DECOMMISSIONING PERIOD DEPENDENT** | | | | | | | | | | | | | | | |
| 1 | PD 50.75(c) | Utility Staff | $3,974,726 | | | | | | | | | $3,974,726 | $596,200 | $4,570,926 | 75,575 | | |
| 1 | PD 50.75(c) | DGC Staff | $4,633,240 | | | | | | | | | $4,633,240 | $695,000 | $5,328,240 | 56,159 | | |
| 1 | PD 50.75(c) | Security | $755,209 | | | | | | | | | $755,209 | $113,300 | $868,509 | 29,573 | | |
| 1 | PD 50.75(c) | HP Supplies | | | $276,718 | | | | | | | $276,718 | $69,200 | $345,918 | | | |
| 1 | PD 50.75(c) | Equipment | | | $301,422 | | | | | | | $301,422 | $75,400 | $376,822 | | | |
| 1 | PD 50.75(c) | Unit 1 Insurance | | | | | | | | | $1,223,073 | $1,223,073 | $183,500 | $1,406,573 | | | |
| 1 | PD 50.75(c) | Unit 2 Insurance | | | | | | | | | | | | | | | |
| 1 | PD 50.75(c) | O & M Budget Items | | | $156,229 | | | | | | | $156,229 | $39,100 | $195,329 | | | |
| 1 | PD 50.75(c) | Permits & Fees | | | | | | | | | $1,995,919 | $1,995,919 | $299,400 | $2,295,319 | | | |
| 1 | PD 50.75(c) | Waste Transfer and Loading | | | | | | | | | | | | | | | |
| 1 | PD 50.75(c) | Energy | | | | | | | | $3,482,181 | | $3,482,181 | $522,300 | $4,004,481 | | | |
| 1 | PD 50.75(c) | Severance | $18,173,408 | | | | | | | | | $18,173,408 | $2,726,000 | $20,899,408 | | | |
| 1 | PD 50.75(c) | Small Tools | | | | | | | | | | | | | | | |
| | | **SUBTOTAL - DECOMMISSIONING PERIOD DEPENDENT** | **$27,536,583** | | **$734,369** | | | | | **$3,482,181** | **$3,218,992** | **$34,972,125** | **$5,319,400** | **$40,291,525** | **161,307** | | |
| | | **TOTAL PERIOD 1 - U1 & U2 DECOMMISSIONING PLANNING COST:** | **$36,797,752** | **$135,000,000** | **$2,084,369** | | | | | **$3,482,181** | **$6,101,835** | **$183,466,137** | **$39,661,500** | **$223,127,637** | **250,552** | | |
| | | **ACTIVITY** | | | | | | | | | | | | | | | |
| | | **UNIT 1 - PERIOD 1 COSTS** | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal 10 CFR 50.75(c):** | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | |
| | | **UNIT 2** | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal 10 CFR 50.75(c):** | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | |
| | | **Common** | | | | | | | | | | | | | | | |
| | | **Total 10 CFR 50.75(c):** | **$8,477,411** | | | | | | | | | **$8,477,411** | **$1,272,500** | **$9,749,911** | **81,340** | | |
| | | **Total 10 CFR 50.54(bb):** | **$783,758** | **$135,000,000** | | | | | | | | **$135,783,758** | **$32,299,700** | **$168,083,458** | **7,904** | | |
| | | **PERIOD DEPENDENT** | | | | | | | | | | | | | | | |
| | | **UNIT 1 - PERIOD 1 COSTS** | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal 10 CFR 50.75(c):** | **$27,536,583** | | **$734,369** | | | | | **$3,482,181** | **$3,218,992** | **$34,972,125** | **$5,319,400** | **$40,291,525** | **161,307** | | |
| | | **Unit 1 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | |
| | | **UNIT 2** | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal 10 CFR 50.75(c):** | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | |
| | | **Common** | | | | | | | | | | | | | | | |

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| | Type | | Staff Labor,$ | Craft Labor,$ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | without Contingency, $ | Contingency, $ | with Contingency, $ | Staff Manhours | Craft Manhours | Craft Manhours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Total 10 CFR 50.75(c): | | | | | | | | | | | | | | | |
| | | Total 10 CFR 50.54(bb): | | | $1,350,000 | | | | | | $2,882,843 | $4,232,843 | $769,900 | $5,002,743 | | | |
| | | Unit 1, Unit 2 & Common | | | | | | | | | | | | | | | |
| | | Total 10 CFR 50.75(c): | $36,013,994 | | $734,369 | | | | | $3,482,181 | $3,218,992 | $43,449,536 | $6,591,900 | $50,041,436 | 242,648 | | |
| | | Total 10 CFR 50.54(bb): | $783,758 | $135,000,000 | $1,350,000 | | | | | | $2,882,843 | $140,016,601 | $33,069,600 | $173,086,201 | 7,904 | | |
| PERIOD 2 - POST-SHUTDOWN ACTIVITIES COSTS: | | | | | | | | | | | | | | | | | |
| | | SPENT FUEL ACTIVITIES | | | | | | | | | | | | | | | |
| 2 | A 50.54(bb) | Modify Spent Fuel Cooling System | | $640,667 | $1,165,000 | | | | | | | $1,805,667 | $444,000 | $2,249,667 | | 9,360 | |
| 2 | A 50.54(bb) | Modify control room | | $588,869 | $800,000 | | | | | | | $1,388,869 | $340,400 | $1,729,269 | | 9,360 | |
| 2 | A 50.54(bb) | Modify security system | | $459,341 | $525,000 | | | | | | | $984,341 | $240,700 | $1,225,041 | | 7,280 | |
| 2 | A 50.54(bb) | Puchase ISFSI casks | | | $111,000,000 | | | | | | | $111,000,000 | $27,750,000 | $138,750,000 | | 7,280 | |
| | | SUBTOTAL - SPENT FUEL ACTIVITIES | | $1,688,877 | $113,490,000 | | | | | | | $115,178,877 | $28,775,100 | $143,953,977 | | 33,280 | |
| | | SPENT FUEL PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| 2 | PD 50.54(bb) | Utility Staff | $3,363,648 | | | | | | | | | $3,363,648 | $504,500 | $3,868,148 | 68,406 | | |
| 2 | PD 50.54(bb) | Security | $1,295,527 | | | | | | | | | $1,295,527 | $194,300 | $1,489,827 | 49,750 | | |
| 2 | PD 50.54(bb) | Insurance | | | | | | | | | $1,619,318 | $1,619,318 | $242,900 | $1,862,218 | | | |
| 2 | PD 50.54(bb) | O & M Budget Items | | | | | | | | | | | | | | | |
| 2 | PD 50.54(bb) | Permits & Fees | | | | | | | | | $1,007,525 | $1,007,525 | $151,100 | $1,158,625 | | | |
| 2 | PD 50.54(bb) | Waste Transfer and Loading | | | | | | | | | | | | | | | |
| 2 | PD 50.54(bb) | Energy | | | | | | | | $848,474 | | $848,474 | $127,300 | $975,774 | | | |
| 2 | PD 50.54(bb) | Spent Fuel Storage Maintenance Supplies | | | | | | | | | | | | | | | |
| 2 | PD 50.54(bb) | Small Tools | | | $16,889 | | | | | | | $16,889 | $4,200 | $21,089 | | | |
| | | SUBTOTAL - SPENT FUEL PERIOD DEPENDENT | $4,659,176 | | $16,889 | | | | | $848,474 | $2,626,843 | $8,151,382 | $1,224,300 | $9,375,682 | 118,156 | | |
| | | DECOMMISSIONING ACTIVITIES | | | | | | | | | | | | | | | |
| 2 | A 50.75(c) | Primary System Decon Unit 1 & 2 | | $8,902,125 | $1,476,125 | | | | $9,340,250 | | | $19,718,500 | $6,008,600 | $25,727,100 | | | |
| 2 | A 50.75(c) | Flush & Drain Systems (PERFORMED BY UTILITY STAFF) | | | | | | | | | | | | | | | |
| 2 | A 50.75(c) | Implement cold & dark | | $773,783 | $1,600,000 | | | | | | | $2,373,783 | $584,500 | $2,958,283 | | 11,520 | |
| 2 | A 50.75(c) | Modify U1 Containment Access | | $351,391 | $525,000 | | | | | | | $876,391 | $215,000 | $1,091,391 | | 5,760 | |
| 2 | A 50.75(c) | ModifyU2 Containment Access | | $351,391 | $525,000 | | | | | | | $876,391 | $215,000 | $1,091,391 | | 5,760 | |
| 2 | A 50.75(c) | Historical Site Assessment | $331,734 | | | | | | | | | $331,734 | $49,800 | $381,534 | 4,880 | | |
| 2 | A 50.75(c) | Vessel and internals activation analysis | $116,901 | | | | | | | | | $116,901 | $17,500 | $134,401 | 640 | | |
| 2 | A 50.75(c) | Characterization survey | $754,270 | | | | | | | | | $754,270 | $113,100 | $867,370 | 12,880 | | |
| 2 | A 50.75(c) | Test special equipment and training | | $947,439 | | | | | | | | $947,439 | $225,900 | $1,173,339 | | 13,440 | |
| | | SUBTOTAL - DECOMMISSIONING ACTIVITY COSTS: | $1,202,906 | $11,326,129 | $4,126,125 | | | | $9,340,250 | | | $25,995,410 | $7,429,400 | $33,424,810 | 18,400 | 36,480 | |
| | | DECOMMISSIONING PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| 2 | PD 50.75(c) | Utility Staff | $15,093,537 | | | | | | | | | $15,093,537 | $2,264,000 | $17,357,537 | 300,570 | | |
| 2 | PD 50.75(c) | DGC Staff | $11,310,434 | | | | | | | | | $11,310,434 | $1,696,600 | $13,007,034 | 157,540 | | |
| 2 | PD 50.75(c) | Security | $3,674,302 | | | | | | | | | $3,674,302 | $551,100 | $4,225,402 | 149,249 | | |
| 2 | PD 50.75(c) | HP Supplies | | | $929,326 | | | | | | | $929,326 | $232,300 | $1,161,626 | | | |
| 2 | PD 50.75(c) | Equipment | | | $1,286,080 | | | | | | | $1,286,080 | $321,500 | $1,607,580 | | | |
| 2 | PD 50.75(c) | Unit 1 Insurance | | | | | | | | | $385,787 | $385,787 | $57,900 | $443,687 | | | |
| 2 | PD 50.75(c) | Unit 2 Insurance | | | | | | | | | $385,787 | $385,787 | $57,900 | $443,687 | | | |
| 2 | PD 50.75(c) | O & M Budget Items | | | $11,459,323 | | | | | | | $11,459,323 | $2,864,800 | $14,324,123 | | | |
| 2 | PD 50.75(c) | Permits & Fees | | | | | | | | | $2,440,340 | $2,440,340 | $366,100 | $2,806,440 | | | |
| 2 | PD 50.75(c) | Waste Transfer and Loading | | | | | | | | | | | | | | | |
| 2 | PD 50.75(c) | Energy | | | | | | | | $4,201,784 | | $4,201,784 | $630,300 | $4,832,084 | | | |
| 2 | PD 50.75(c) | Severance | $28,209,801 | | | | | | | | | $28,209,801 | $4,231,500 | $32,441,301 | | | |
| 2 | PD 50.75(c) | Small Tools | | | $226,523 | | | | | | | $226,523 | $56,600 | $283,123 | | | |
| | | SUBTOTAL - DECOMMISSIONING PERIOD DEPENDENT | $58,288,075 | | $13,901,251 | | | | | $4,201,784 | $3,211,915 | $79,603,024 | $13,330,600 | $92,933,624 | 607,359 | | |
| | | TOTAL PERIOD 2 - POST-SHUTDOWN ACTIVITIES COSTS: | $64,150,156 | $13,015,006 | $131,534,264 | | | | $9,340,250 | $5,050,259 | $5,838,757 | $228,928,693 | $50,759,400 | $279,688,093 | 743,914 | 69,760 | |
| | | ACTIVITY | | | | | | | | | | | | | | | |
| | | UNIT 1 | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal 10 CFR 50.75(c): | | $4,802,454 | $1,263,063 | | | | $4,670,125 | | | $10,735,641 | $3,219,300 | $13,954,941 | | 5,760 | |
| | | Unit 1 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | UNIT 2 | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal 10 CFR 50.75(c): | | $4,802,454 | $1,263,063 | | | | $4,670,125 | | | $10,735,641 | $3,219,300 | $13,954,941 | | 5,760 | |
| | | Unit 2 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | Common | | | | | | | | | | | | | | | |
| | | Common Subtotal - 10 CFR 50.75(c): | $1,202,906 | $1,721,222 | $1,600,000 | | | | | | | $4,524,127 | $990,800 | $5,514,927 | 18,400 | 24,960 | |
| | | Common Subtotal - 10 CFR 50.54(bb): | | $1,688,877 | $113,490,000 | | | | | | | $115,178,877 | $28,775,100 | $143,953,977 | | 33,280 | |

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| | Type | | Staff Labor, $ | Craft Labor, $ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | without Contingency, $ | Contingency, $ | with Contingency, $ | Staff Manhours | Craft Manhours | Craft Manhours | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **PERIOD DEPENDENT** | | | | | | | | | | | | | | | | |
| | | **UNIT 1** | | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal 10 CFR 50.75(c):** | | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | | |
| | | **UNIT 2** | | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal 10 CFR 50.75(c):** | | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | | |
| | | **Common** | | | | | | | | | | | | | | | | |
| | | **Common Subtotal - 10 CFR 50.75(c):** | $58,288,075 | | $13,901,251 | | | | | $4,201,784 | $3,211,915 | $79,603,024 | $13,330,600 | $92,933,624 | 607,359 | | | |
| | | **Common Subtotal - 10 CFR 50.54(bb):** | $4,659,176 | | $16,889 | | | | | $849,474 | $2,626,843 | $8,151,382 | $1,224,300 | $9,375,682 | 118,155 | | | |
| | | **Unit 1, Unit 2 & Common** | | | | | | | | | | | | | | | | |
| | | **Total 10 CFR 50.75(c):** | $59,490,981 | $11,326,129 | $18,027,376 | | | | $9,340,250 | $4,201,784 | $3,211,915 | $105,598,434 | $20,760,000 | $126,358,434 | 625,759 | 36,480 | | |
| | | **Total 10 CFR 50.54(bb):** | $4,659,176 | $1,688,877 | $113,506,889 | | | | | $849,474 | $2,626,843 | $123,330,259 | $29,999,400 | $153,329,659 | 118,155 | 33,280 | | |
| **PERIOD 3 VESSEL AND INTERNALS REMOVAL COSTS:** | | | | | | | | | | | | | | | | | | |
| | | **SPENT FUEL ACTIVITIES** | | | | | | | | | | | | | | | | |
| 3 | A 50.54(bb) | Purcahse ISFSI Casks | | | $111,000,000 | | | | | | | $111,000,000 | $27,750,000 | $138,750,000 | | | | |
| | | **SUBTOTAL - SPENT FUEL ACTIVITIES** | | | $111,000,000 | | | | | | | $111,000,000 | $27,750,000 | $138,750,000 | | | | |
| | | **SPENT FUEL PERIOD DEPENDENT** | | | | | | | | | | | | | | | | |
| 3 | PD 50.54(bb) | Utility Staff | $11,892,900 | | | | | | | | | $11,892,900 | $1,783,900 | $13,676,800 | 241,863 | | | |
| 3 | PD 50.54(bb) | Security | $3,644,479 | | | | | | | | | $3,644,479 | $546,700 | $4,191,179 | 234,534 | | | |
| 3 | PD 50.54(bb) | Insurance | | | | | | | | | $5,725,446 | $5,725,446 | $858,800 | $6,584,246 | | | | |
| 3 | PD 50.54(bb) | O & M Budget Items | | | | | | | | | | | | | | | | |
| 3 | PD 50.54(bb) | Permits & Fees | | | | | | | | | $3,562,320 | $3,562,320 | $534,300 | $4,096,620 | | | | |
| 3 | PD 50.54(bb) | Waste Transfer and Loading | | | | | | | | | | | | | | | | |
| 3 | PD 50.54(bb) | Energy | | | | | | | | $1,939,299 | | $1,939,299 | $290,900 | $2,230,199 | | | | |
| 3 | PD 50.54(bb) | Spent Fuel Storage Maintenance Supplies | | | | | | | | | | | | | | | | |
| 3 | PD 50.54(bb) | Small Tools | | | | | | | | | | | | | | | | |
| | | **SUBTOTAL - SPENT FUEL PERIOD DEPENDENT** | $15,537,379 | | | | | | | $1,939,299 | $9,287,766 | $26,764,444 | $4,014,600 | $30,779,044 | 476,396 | | | |
| | | **DECOMMISSIONING ACTIVITIES** | | | | | | | | | | | | | | | | |
| | | **UNIT 1** | | | | | | | | | | | | | | | | |
| 3 | A 50.75(c) | Install all reactor operating floor contamination control envelopes (CCEs), support structures, rigging, internals work platforms and process equipment (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Finalize Residual Radiation Inventory (WITH SITE CHARACTERIZATION) | | | | | | | | | | | | | | | | |
| 3 | A 50.75(c) | Finalize Internals and Vessel Segmenting Details (WITH ACTIVATION ANALYSIS) | | | | | | | | | | | | | | | | |
| 3 | A 50.75(c) | Remove, pack, ship and bury Unit 1 Pressurizer | | $1,064,197 | | $800 | $71,768 | | $933,410 | | | $2,070,176 | $621,000 | $2,691,176 | | | 19,407 | |
| 3 | A 50.75(c) | Decon, remove, package, ship and bury Unit 1 steam generators | | $4,340,246 | $1,532,267 | $12,800 | $823,395 | | $12,599,366 | | | $19,308,074 | $6,344,800 | $25,652,874 | | | 79,163 | |
| 3 | A 50.75(c) | Remove Unit 1 equipment hatch closure (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Remove Unit 1 control rod drive and reactor cavity missile shieldS (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Remove Unit 1 CRD mechanisms and cables, air ducts, and reactor vessel head (BY UTILI | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Remove, segment, package and bury Unit 1 vessel & vessel head insulation | | $182,000 | | | | | $364,625 | | | $546,625 | $180,700 | $727,325 | | | | |
| 3 | A 50.75(c) | Prepare Unit 1 vessel head for shipment as its own container (WITH VESSEL REMOVAL) | | | | | | | | | | | | | | | | |
| 3 | A 50.75(c) | Decontaminate and clean up Unit 1 plant areas (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Process liquid and solid radioactive wastes (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Decon, remove, package, ship and dispose of Unit 1 contaminated systems | | $13,812,807 | $1,164,896 | $91,337 | $600,074 | | $5,142,875 | | | $20,811,988 | $5,663,600 | $26,475,588 | | | 270,642 | |
| 3 | A Greenfield | Remove, package, ship and dispose of Unit 1 clean systems | | $14,574,158 | $1,244,671 | | $182,236 | $1,043,488 | | | | $17,044,553 | $3,929,700 | $20,974,253 | | 284,077 | | |
| 3 | A 50.75(c) | Install Unit 1 water cleanup system in fuel transfer canal (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Vessel Removal |
| 3 | A 50.75(c) | Segment, package and ship Unit 1 internals as radioactive waste | | $2,605,135 | $526,565 | $90,000 | $5,022,524 | | $38,003,376 | | | $46,247,599 | $16,177,800 | $62,425,399 | | | 47,360 | |
| 3 | A 50.75(c) | Decontaminate internals work platform and store (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Vessel Removal |
| 3 | A 50.75(c) | Install Unit 1 vessel support structure (WITH VESSEL REMOVAL) | | | | | | | | | | | | | | | | Vessel Removal |
| 3 | A 50.75(c) | Segment and process Unit 1 reactor vessel and associated equipment as LLW | | $2,701,810 | $148,187 | $24,000 | $2,339,070 | | $14,901,905 | | | $20,114,971 | $5,809,400 | $26,924,371 | | | 49,100 | |
| 3 | A 50.75(c) | Decontaminate reactor vessel platform and store | | | | | | | | | | | | | | | | Vessel Removal |
| 3 | A 50.75(c) | Decontaminate Unit 1 reactor building | | $2,529,030 | $513,798 | $294,710 | $1,795,462 | | $9,297,096 | | | $14,430,095 | $4,662,600 | $19,092,695 | | | 43,847 | |
| | | **UNIT 2** | | | | | | | | | | | | | | | | |
| 3 | A 50.75(c) | Finalize Residual Radiation Inventory (WITH SITE CHARACTERIZATION) | | | | | | | | | | | | | | | | |
| 3 | A 50.75(c) | Finalize Internals and Vessel Segmenting Details (WITH ACTIVATION ANALYSIS) | | | | | | | | | | | | | | | | |
| 3 | A 50.75(c) | Revise Integrated Work Sequence and Schedule | $53,462 | | | | | | | | | $53,462 | $8,000 | $61,462 | | | | |
| 3 | A 50.75(c) | Transfer all reactor operating floor CCEs support structures, rigging, internals work platforms and process equipment to position and install (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Remove Unit 2 equipment hatch closure (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Remove Unit 2 CRD missile and reactor cavity missile shields (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Remove Unit 2 CRD mechanisms and cables, air ducts, and reactor vessel head (BY UTILI | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Remove, segment, package and bury Unit 2 vessel & vessel head insulation | | $182,000 | | | | | $364,625 | | | $546,625 | $180,700 | $727,325 | | | | |

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| | Type | | Staff Labor, $ | Craft Labor, $ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | without Contingency, $ | Contingency, $ | with Contingency, $ | Staff Manhours | Craft Manhours | Craft Manhours | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | A 50.75(c) | Prepare Unit 2 vessel head for shipment as its own container (WITH VESSEL REMOVAL) | | | | | | | | | | | | | | | | |
| 3 | A 50.75(c) | Decontaminate and clean up Unit 2 plant areas (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Process liquid and solid radioactive wastes (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Utility Staff |
| 3 | A 50.75(c) | Install Unit 2 water cleanup system in fuel transfer canal (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Vessel Removal |
| 3 | A 50.75(c) | Segment, package and ship Unit 2 internals as radioactive waste | | $2,605,135 | $526,565 | $90,000 | $5,022,524 | | $38,003,376 | | | $46,247,599 | $16,177,800 | $62,425,399 | | | 47,360 | |
| 3 | A 50.75(c) | Decontaminate internals work platform and process as LLW (BY UTILITY STAFF) | | | | | | | | | | | | | | | | Vessel Removal |
| 3 | A 50.75(c) | Install Unit 2 vessel support structure (WITH VESSEL REMOVAL) | | | | | | | | | | | | | | | | Vessel Removal |
| 3 | A 50.75(c) | Segment and process Unit 2 reactor vessel and associated equipment as LLW | | $2,701,810 | $148,187 | $24,000 | $2,339,070 | | $14,901,905 | | | $20,114,971 | $6,809,400 | $26,924,371 | | | 49,100 | |
| 3 | A 50.75(c) | Decon reactor vessel cutting equipment and work platform; package and process as LLW ( | | | | | | | | | | | | | | | | Vessel Removal |
| 3 | A 50.75(c) | Decon, remove, package, ship and bury Unit 2 steam generators | | $4,340,246 | $1,532,267 | $12,800 | $823,395 | | $12,599,366 | | | $19,308,074 | $6,344,800 | $25,652,874 | | | 79,163 | |
| 3 | A 50.75(c) | Remove, pack, ship and bury Unit 2 Pressurizer | | $1,064,197 | | $800 | $71,768 | | $933,410 | | | $2,070,176 | $621,000 | $2,691,176 | | | 19,407 | |
| 3 | A 50.75(c) | Decontaminate non-essential structures | | $71,104 | $40,556 | $621 | $10,774 | | $414,819 | | | $537,873 | $185,700 | $723,573 | | | 1,438 | |
| 3 | A Greenfield | Remove non-essential structures | | $2,477,040 | $892,900 | | $331,138 | $2,179,243 | | | | $5,880,321 | $1,104,300 | $6,984,621 | | 42,221 | | |
| | | SUBTOTAL - DECOMMISSIONING ACTIVITY COSTS: | $53,462 | $55,250,915 | $8,270,855 | $641,867 | $19,433,198 | $3,222,731 | $148,460,156 | | | $235,333,185 | $75,821,300 | $311,154,485 | | 326,298 | 705,986 | |
| | | DECOMMISSIONING PERIOD DEPENDENT | | | | | | | | | | | | | | | | |
| 3 | PD 50.75(c) | Utility Staff | $39,164,015 | | | | | | | | | $39,164,015 | $5,874,600 | $45,038,615 | 703,601 | | | |
| 3 | PD 50.75(c) | DGC Staff | $46,406,897 | | | | | | | | | $46,406,897 | $6,961,000 | $53,367,897 | 652,297 | | | |
| 3 | PD 50.75(c) | Security | $5,905,496 | | | | | | | | | $5,905,496 | $885,800 | $6,791,296 | 234,534 | | | |
| 3 | PD 50.75(c) | HP Supplies | | | $10,971,689 | | | | | | | $10,971,689 | $2,742,900 | $13,714,589 | | | | |
| 3 | PD 50.75(c) | Equipment | | | $7,116,150 | | | | | | | $7,116,150 | $1,779,000 | $8,895,150 | | | | |
| 3 | PD 50.75(c) | Unit 1 Insurance | | | | | | | | | $1,364,034 | $1,364,034 | $204,600 | $1,568,634 | | | | |
| 3 | PD 50.75(c) | Unit 2 Insurance | | | | | | | | | $1,364,034 | $1,364,034 | $204,600 | $1,568,634 | | | | |
| 3 | PD 50.75(c) | O & M Budget Items | | | $27,219,510 | | | | | | | $27,219,510 | $6,804,900 | $34,024,410 | | | | |
| 3 | PD 50.75(c) | Permits & Fees | | | | | | | | | $7,910,024 | $7,910,024 | $1,186,500 | $9,096,524 | | | | |
| 3 | PD 50.75(c) | Waste Transfer and Loading | | $9,400,235 | | | | | | | | $9,400,235 | $2,240,900 | $11,641,135 | | | 183,261 | |
| 3 | PD 50.75(c) | Energy | | | | | | | | $12,282,974 | | $12,282,974 | $1,842,400 | $14,125,374 | | | | |
| 3 | PD 50.75(c) | Severance | $2,229,959 | | | | | | | | | $2,229,959 | $334,500 | $2,564,459 | | | | |
| 3 | PD 50.75(c) | Small Tools | | | $1,293,023 | | | | | | | $1,293,023 | $323,300 | $1,616,323 | | | | |
| | | SUBTOTAL - DECOMMISSIONING PERIOD DEPENDENT | $93,706,368 | $9,400,235 | $46,600,371 | | | | | $12,282,974 | $10,638,092 | $172,628,040 | $31,385,000 | $204,013,040 | 1,590,431 | | 183,261 | |
| | | TOTAL PERIOD 3 VESSEL AND INTERNALS REMOVAL COSTS: | $109,297,209 | $64,651,150 | $165,871,226 | $641,867 | $19,433,198 | $3,222,731 | $148,460,156 | $14,222,273 | $19,925,858 | $545,725,869 | $138,970,900 | $684,696,569 | 2,066,828 | 326,298 | 889,247 | |
| | | ACTIVITY | | | | | | | | | | | | | | | | |
| | | UNIT 1 | | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal 10 CFR 50.75(c): | | $27,235,225 | $3,885,711 | $513,646 | $10,652,293 | | $81,242,653 | | | $123,529,529 | $40,459,900 | $163,989,429 | | | 509,519 | |
| | | Unit 1 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal Greenfield: | | $14,574,158 | $1,244,671 | | $182,236 | $1,043,488 | | | | $17,044,553 | $3,929,700 | $20,974,253 | | 284,077 | | |
| | | UNIT 2 | | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal 10 CFR 50.75(c): | $53,462 | $10,893,388 | $2,207,018 | $127,600 | $8,256,757 | | $66,802,683 | | | $89,340,908 | $30,141,700 | $118,482,608 | | | 195,030 | |
| | | Unit 2 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal Greenfield: | | | | | | | | | | | | | | | | |
| | | Common | | | | | | | | | | | | | | | | |
| | | Total 10 CFR 50.75(c): | | $71,104 | $40,556 | $621 | $10,774 | | $414,819 | | | $537,873 | $185,700 | $723,573 | | | 1,438 | |
| | | Total 10 CFR 50.54(bb): | | | $111,000,000 | | | | | | | $111,000,000 | $27,750,000 | $138,750,000 | | | | |
| | | Total Greenfield | | $2,477,040 | $892,900 | | $331,138 | $2,179,243 | | | | $5,880,321 | $1,104,300 | $6,984,621 | | 42,221 | | |
| | | PERIOD DEPENDENT | | | | | | | | | | | | | | | | |
| | | UNIT 1 | | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal 10 CFR 50.75(c): | | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | | |
| | | UNIT 2 | | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal 10 CFR 50.75(c): | | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | | |
| | | Common | | | | | | | | | | | | | | | | |
| | | Total 10 CFR 50.75(c): | $93,706,368 | $9,400,235 | $46,600,371 | | | | | $12,282,974 | $10,638,092 | $172,628,040 | $31,385,000 | $204,013,040 | 1,590,431 | | 183,261 | |
| | | Total 10 CFR 50.54(bb): | $15,537,379 | | | | | | | $1,939,299 | $9,287,766 | $26,764,444 | $4,014,600 | $30,779,044 | 476,396 | | | |
| | | Unit 1, Unit 2 & Common | | | | | | | | | | | | | | | | |
| | | Total 10 CFR 50.75(c): | $93,759,830 | $47,599,952 | $52,733,656 | $641,867 | $18,919,824 | | $148,460,156 | $12,282,974 | $10,638,092 | $385,036,350 | $102,172,300 | $487,208,650 | 1,590,431 | | 889,247 | |
| | | Total 10 CFR 50.54(bb): | $15,537,379 | | $111,000,000 | | | | | $1,939,299 | $9,287,766 | $137,764,444 | $31,764,600 | $169,529,044 | 476,396 | | | |
| | | Total Greenfield | | $17,051,199 | $2,137,571 | | $513,374 | $3,222,731 | | | | $22,924,874 | $5,034,000 | $27,958,874 | | 326,298 | | |
| | | PERIOD 4 DECONTAMINATE BALANCE OF SITE COSTS: | | | | | | | | | | | | | | | | |
| | | SPENT FUEL PERIOD DEPENDENT | | | | | | | | | | | | | | | | |
| 4 | PD 50.54(bb) | Utility Staff | $10,617,670 | | | | | | | | | $10,617,670 | $1,592,700 | $12,210,370 | 215,929 | | | |
| 4 | PD 50.54(bb) | Security | $3,253,696 | | | | | | | | | $3,253,696 | $488,100 | $3,741,796 | 130,866 | | | |
| 4 | PD 50.54(bb) | Insurance | | | | | | | | | | | | | | | | |
| 4 | PD 50.54(bb) | O & M Budget Items | | | | | | | | | $5,111,529 | $5,111,529 | $766,700 | $5,878,229 | | | | |

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| | Type | | Staff Labor,$ | Craft Labor,$ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | without Contingency, $ | Contingency, $ | with Contingency, $ | Staff Manhours | Craft Manhours | Craft Manhours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | PD 50.54(bb) | Permits & Fees | | | | | | | | | $3,180,346 | $3,180,346 | $477,100 | $3,657,446 | | | |
| 4 | PD 50.54(bb) | Waste Transfer and Loading | | | | | | | | | | | | | | | |
| 4 | PD 50.54(bb) | Energy | | | | | | | | $1,731,356 | | $1,731,356 | $259,700 | $1,991,056 | | | |
| 4 | PD 50.54(bb) | Spent Fuel Storage Maintenance Supplies | | | | | | | | | | | | | | | |
| 4 | PD 50.54(bb) | Small Tools | | | | | | | | | | | | | | | |
| | | **SUBTOTAL - SPENT FUEL PERIOD DEPENDENT** | **$13,871,366** | | | | | | | **$1,731,356** | **$8,291,875** | **$23,894,597** | **$3,584,300** | **$27,478,897** | **346,795** | | |
| | | **DECOMMISSIONING ACTIVITIES** | | | | | | | | | | | | | | | |
| 4 | A 50.75(c) | Decon, remove, package, ship and dispose of Unit 2 contaminated systems | | $13,636,892 | $1,131,353 | $84,469 | $554,325 | | $4,704,253 | | | $20,111,292 | $5,437,200 | $25,548,492 | | | 267,188 |
| 4 | A Greenfield | Remove, package, ship and dispose of Unit 2 clean systems | | $14,440,360 | $1,221,482 | | $186,260 | $1,069,979 | | | | $16,918,081 | $3,895,600 | $20,813,681 | | 281,382 | |
| 4 | A 50.75(c) | Decon Steam Generator Storage Building | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! | #REF! |
| 4 | A 50.75(c) | Decon Unit 2 Reactor Building | | $2,529,030 | $513,798 | $294,710 | $1,795,482 | | $9,297,096 | | | $14,430,095 | $4,662,600 | $19,092,695 | | | 43,847 |
| 4 | A 50.75(c) | Remove Spent fuel storage racks | | $2,561,342 | $50,370 | $8,348 | $45,038 | | $1,555,798 | | | $4,220,895 | $1,220,000 | $5,440,895 | | | 49,874 |
| 4 | A 50.75(c) | Decon Auxiliary Building | | $5,741,650 | $1,291,150 | $521,466 | $3,162,576 | | $11,365,733 | | | $22,082,576 | $6,729,600 | $28,812,176 | | | 101,851 |
| 4 | A 50.75(c) | Perform final radiological survey of all structures | | $1,904,750 | $35,583 | | | | | | | $1,940,333 | $463,000 | $2,403,333 | | | |
| 4 | A 50.75(c) | Perform final survey of the site | | $10,033,000 | $229,125 | | | | | | | $10,262,125 | $2,449,000 | $12,711,125 | | | |
| 4 | A 50.75(c) | Obtain NRC approval | | | | | | | | | | | | | | | |
| 4 | A 50.75(c) | Prepare final report of dismantling program | $51,018 | | | | | | | | | $51,018 | $7,700 | $58,718 | 456 | | |
| | | **SUBTOTAL - DECOMMISSIONING ACTIVITY COSTS:** | **$51,018** | **$50,847,024** | **$4,472,861** | **$908,992** | **$5,743,661** | **$1,069,979** | **$26,922,880** | | | **$90,016,415** | **$24,864,700** | **$114,881,115** | **456** | **281,382** | **462,760** |
| | | **DECOMMISSIONING PERIOD DEPENDENT** | | | | | | | | | | | | | | | |
| 4 | PD 50.75(c) | Utility Staff | $28,677,111 | | | | | | | | | $28,677,111 | $4,301,600 | $32,978,711 | 510,377 | | |
| 4 | PD 50.75(c) | DGC Staff | $35,702,442 | | | | | | | | | $35,702,442 | $5,355,400 | $41,057,842 | 497,291 | | |
| 4 | PD 50.75(c) | Security | $5,272,273 | | | | | | | | | $5,272,273 | $790,800 | $6,063,073 | 209,386 | | |
| 4 | PD 50.75(c) | HP Supplies | | | $7,925,608 | | | | | | | $7,925,608 | $1,981,400 | $9,907,008 | | | |
| 4 | PD 50.75(c) | Equipment | | | $8,097,070 | | | | | | | $8,097,070 | $2,024,300 | $10,121,370 | | | |
| 4 | PD 50.75(c) | Unit 1 Insurance | | | | | | | | | $1,217,774 | $1,217,774 | $182,700 | $1,400,474 | | | |
| 4 | PD 50.75(c) | Unit 2 Insurance | | | | | | | | | $1,217,774 | $1,217,774 | $182,700 | $1,400,474 | | | |
| 4 | PD 50.75(c) | O & M Budget Items | | | $13,489,789 | | | | | | | $13,489,789 | $3,372,400 | $16,862,189 | | | |
| 4 | PD 50.75(c) | Permits & Fees | | | | | | | | | $5,964,162 | $5,964,162 | $894,600 | $6,858,762 | | | |
| 4 | PD 50.75(c) | Waste Transfer and Loading | | $8,392,285 | | | | | | | | $8,392,285 | $2,000,600 | $10,392,885 | | | 163,611 |
| 4 | PD 50.75(c) | Energy | | | | | | | | $10,400,066 | | $10,400,066 | $1,560,000 | $11,960,066 | | | |
| 4 | PD 50.75(c) | Severance | $819,169 | | | | | | | | | $819,169 | $122,900 | $942,069 | | | |
| 4 | PD 50.75(c) | Small Tools | | | $1,184,786 | | | | | | | $1,184,786 | $296,200 | $1,480,986 | | | |
| | | **SUBTOTAL - DECOMMISSIONING PERIOD DEPENDENT** | **$70,470,995** | **$8,392,285** | **$30,697,253** | | | | | **$10,400,066** | **$8,399,710** | **$128,360,308** | **$23,065,600** | **$151,425,908** | **1,217,053** | | **163,611** |
| | | **TOTAL PERIOD 4 DECONTAMINATE BALANCE OF SITE COSTS:** | **$84,393,379** | **$59,239,308** | **$35,170,114** | **$908,992** | **$5,743,661** | **$1,069,979** | **$26,922,880** | **$12,131,422** | **$16,691,585** | **$242,271,321** | **$51,514,600** | **$293,785,921** | **1,564,304** | **281,382** | **626,370** |
| | | **ACTIVITY** | | | | | | | | | | | | | | | |
| | | **UNIT 1** | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal 10 CFR 50.75(c):** | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal Greenfield:** | | | | | | | | | | | | | | | |
| | | **UNIT 2** | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal 10 CFR 50.75(c):** | | **$16,165,921** | **$1,645,151** | **$379,178** | **$2,349,787** | | **$14,001,349** | | | **$34,541,386** | **$10,099,800** | **$44,641,186** | | | **311,035** |
| | | **Unit 2 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal Greenfield:** | | **$14,440,360** | **$1,221,482** | | **$186,260** | **$1,069,979** | | | | **$16,918,081** | **$3,895,600** | **$20,813,681** | | **281,382** | |
| | | **Common** | | | | | | | | | | | | | | | |
| | | **Common Subtotal 10 CFR 50.75(c):** | **$51,018** | **$20,240,742** | **$1,606,228** | **$529,814** | **$3,207,614** | | **$12,921,531** | | | **$39,556,948** | **$10,869,300** | **$49,426,248** | **456** | | **151,725** |
| | | **Common Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | |
| | | **Common Subtotal Greenfield:** | | | | | | | | | | | | | | | |
| | | **PERIOD DEPENDENT** | | | | | | | | | | | | | | | |
| | | **UNIT 1** | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal 10 CFR 50.75(c):** | | | | | | | | | | | | | | | |
| | | **Unit 1 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | |
| | | **UNIT 2** | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal 10 CFR 50.75(c):** | | | | | | | | | | | | | | | |
| | | **Unit 2 Subtotal 10 CFR 50.54(bb):** | | | | | | | | | | | | | | | |
| | | **Common** | | | | | | | | | | | | | | | |
| | | **Common Subtotal 10 CFR 50.75(c):** | **$70,470,995** | **$8,392,285** | **$30,697,253** | | | | | **$10,400,066** | **$8,399,710** | **$128,360,308** | **$23,065,600** | **$151,425,908** | **1,217,053** | | **163,611** |
| | | **Common Subtotal 10 CFR 50.54(bb):** | **$13,871,366** | | | | | | | **$1,731,356** | **$8,291,875** | **$23,894,597** | **$3,584,300** | **$27,478,897** | **346,795** | | |
| | | **Unit 1, Unit 2 & Common** | | | | | | | | | | | | | | | |
| | | **Total 10 CFR 50.75(c):** | **$70,522,013** | **$44,798,948** | **$33,948,632** | **$908,992** | **$5,557,401** | | **$26,922,880** | **$10,400,066** | **$8,399,710** | **$201,458,642** | **$44,034,700** | **$245,493,342** | **1,217,509** | | **626,370** |
| | | **Total 10 CFR 50.54(bb):** | **$13,871,366** | | | | | | | **$1,731,356** | **$8,291,875** | **$23,894,597** | **$3,584,300** | **$27,478,897** | **346,795** | | |
| | | **Total Greenfield** | | **$14,440,360** | **$1,221,482** | | **$186,260** | **$1,069,979** | | | | **$16,918,081** | **$3,895,600** | **$20,813,681** | | **281,382** | |

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| | Type | | Staff Labor,$ | Craft Labor,$ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | without Contingency, $ | Contingency, $ | with Contingency, $ | Staff Manhours | Craft Manhours | Craft Manhours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERIOD 5 - CLEAN STRUCTURE DEMOLITION COSTS: | | | | | | | | | | | | | | | | | |
| | | SPENT FUEL PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| 5 | PD 50.54(bb) | Utility Staff | $2,534,303 | | | | | | | | | $2,534,303 | $380,100 | $2,914,403 | 44,552 | | |
| 5 | PD 50.54(bb) | Security | $1,142,376 | | | | | | | | | $1,142,376 | $171,400 | $1,313,776 | 40,644 | | |
| 5 | PD 50.54(bb) | HP Supplies | | | $109,484 | | | | | | | $109,484 | $27,400 | $136,884 | 40,644 | | |
| 5 | PD 50.54(bb) | Equipment | | | | | | | | | | | | | | | |
| 5 | PD 50.54(bb) | Insurance | | | | | | | | | $300,624 | $300,624 | $45,100 | $345,724 | | | |
| 5 | PD 50.54(bb) | O & M Budget Items | | | | | | | | | | | | | | | |
| 5 | PD 50.54(bb) | Permits & Fees | | | | | | | | | $654,924 | $654,924 | $98,200 | $753,124 | | | |
| 5 | PD 50.54(bb) | Waste Transfer and Loading | | | | | | | | | | | | | | | |
| 5 | PD 50.54(bb) | Energy | | | | | | | | $25,365 | | $25,365 | $3,800 | $29,165 | | | |
| 5 | PD 50.54(bb) | Spent Fuel Storage Maintenance Supplies | | | | | | | | | | | | | | | |
| 5 | PD 50.54(bb) | Small Tools | | | | | | | | | | | | | | | |
| | | SUBTOTAL - SPENT FUEL PERIOD DEPENDENT | $3,676,678 | | $109,484 | | | | | $25,365 | $955,548 | $4,767,075 | $728,000 | $5,493,076 | 125,839 | | |
| | | DECOMMISSIONING ACTIVITIES | | | | | | | | | | | | | | | |
| 5 | A Greenfield | Remove Unit 1 reactor building | | $6,713,605 | $4,046,917 | | $1,919,485 | $12,635,197 | | | | $25,315,204 | $4,297,000 | $29,612,204 | | 109,447 | |
| 5 | A Greenfield | Remove Unit 2 reactor building | | $6,713,605 | $4,046,917 | | $1,919,485 | $12,635,197 | | | | $25,315,204 | $4,297,000 | $29,612,204 | | 109,447 | |
| 5 | A Greenfield | Remove Auxiliary Building | | $5,492,728 | $3,843,181 | | $1,107,078 | $7,287,449 | | | | $17,730,435 | $3,241,900 | $20,972,335 | | 86,778 | |
| 5 | A Greenfield | Remove Turbine Building. | | $3,926,953 | $3,659,567 | | $1,090,600 | $7,178,980 | | | | $15,856,100 | $2,808,300 | $18,664,400 | | 64,508 | |
| 5 | A Greenfield | Remove Steam Generator Storage Building | | $787,930 | $1,334,759 | | $159,894 | $1,052,516 | | | | $3,335,099 | $661,900 | $3,996,999 | | 13,110 | |
| 5 | A Greenfield | Remove Electrical Transformers | | $419,247 | $16,504 | | $61,526 | $405,000 | | | | $902,277 | $158,100 | $1,060,377 | | 8,297 | |
| 5 | A Greenfield | Removal of Unit 1 Turbine Generator | | $155,209 | $9,273 | | $6,836 | $45,000 | | | | $216,318 | $45,300 | $261,618 | | 2,697 | |
| 5 | A Greenfield | Removal of Unit 1 Main Condenser | | $1,349,630 | $9,683 | | $75,023 | $493,846 | | | | $1,928,182 | $390,000 | $2,318,182 | | 21,580 | |
| 5 | A Greenfield | Removal of Unit 2 Turbine Generator | | $155,209 | $9,273 | | $6,836 | $45,000 | | | | $216,318 | $45,300 | $261,618 | | 2,697 | |
| 5 | A Greenfield | Removal of Unit 2 Main Condenser | | $1,349,630 | $9,683 | | $75,023 | $493,846 | | | | $1,928,182 | $390,000 | $2,318,182 | | 21,580 | |
| 5 | A Greenfield | Remove of Standby Diesel Generators | | $30,929 | $7,483 | | $2,051 | $13,500 | | | | $53,963 | $11,000 | $64,963 | | 532 | |
| 5 | A Greenfield | Remove Administration building | | $237,595 | $211,979 | | $56,128 | $369,471 | | | | $875,174 | $158,900 | $1,034,074 | | 4,105 | |
| 5 | A Greenfield | Remove Low Level Radwaste building | | $919,637 | $219,468 | | $159,275 | $1,048,444 | | | | $2,346,824 | $413,900 | $2,760,724 | | 14,743 | |
| | | SUBTOTAL - DECOMMISSIONING ACTIVITY COSTS: | | $28,751,958 | $17,727,995 | | $6,815,557 | $44,864,075 | | | | $98,159,584 | $17,268,400 | $115,427,984 | | 467,681 | |
| | | DECOMMISSIONING PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| 5 | PD Greenfield | Utility Staff | $983,855 | | | | | | | | | $983,855 | $147,600 | $1,131,455 | 21,885 | | |
| 5 | PD Greenfield | DGC Staff | $8,592,632 | | | | | | | | | $8,592,632 | $1,288,900 | $9,881,532 | 106,299 | | |
| 5 | PD Greenfield | Security | $557,764 | | | | | | | | | $557,764 | $83,700 | $641,464 | 21,885 | | |
| 5 | PD Greenfield | HP Supplies | | | | | | | | | | | | | | | |
| 5 | PD Greenfield | Equipment | | | $3,276,704 | | | | | | | $3,276,704 | $819,200 | $4,095,904 | | | |
| 5 | PD Greenfield | Unit 1 Insurance | | | | | | | | | $428,340 | $428,340 | $64,300 | $492,640 | | | |
| 5 | PD Greenfield | Unit 2 Insurance | | | | | | | | | $428,340 | $428,340 | $64,300 | $492,640 | | | |
| 5 | PD Greenfield | O & M Budget Items | | | $2,473,265 | | | | | | | $2,473,265 | $618,300 | $3,091,565 | | | |
| 5 | PD Greenfield | Permits & Fees | | | | | | | | | $306,416 | $306,416 | $46,000 | $352,416 | | | |
| 5 | PD Greenfield | Waste Transfer and Loading | | $2,527,775 | | | | | | | | $2,527,775 | $602,600 | $3,130,375 | | 46,905 | |
| 5 | PD Greenfield | Energy | | | | | | | | $414,294 | | $414,294 | $62,100 | $476,394 | | | |
| 5 | PD Greenfield | Severance | $4,084,466 | | | | | | | | | $4,084,466 | $612,700 | $4,697,166 | | | |
| 5 | PD Greenfield | Small Tools | | | $625,595 | | | | | | | $625,595 | $156,400 | $781,995 | | | |
| | | SUBTOTAL - DECOMMISSIONING PERIOD DEPENDENT | $14,218,717 | $2,527,775 | $6,375,563 | | | | | $414,294 | $1,163,096 | $24,699,445 | $4,566,100 | $29,265,545 | 150,069 | 46,905 | |
| | | TOTAL PERIOD 5 - CLEAN STRUCTURE DEMOLITION COSTS: | $17,895,396 | $31,279,733 | $24,213,041 | | $6,815,557 | $44,864,075 | | $439,659 | $2,118,644 | $127,626,104 | $22,560,500 | $150,186,604 | 275,908 | 514,586 | |
| | | ACTIVITY | | | | | | | | | | | | | | | |
| | | UNIT 1 | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal Greenfield (g): | | $8,218,444 | $4,065,873 | | $2,001,344 | $13,174,043 | | | | $27,459,704 | $4,732,300 | $32,192,004 | | 133,724 | |
| | | Unit 1 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | UNIT 2 | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal Greenfield (g): | | $8,218,444 | $4,065,873 | | $2,001,344 | $13,174,043 | | | | $27,459,704 | $4,732,300 | $32,192,004 | | 133,724 | |
| | | Unit 2 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | Common | | | | | | | | | | | | | | | |
| | | Common Subtotal Greenfield (g) | | $12,315,069 | $9,596,248 | | $2,812,869 | $18,515,989 | | | | $43,240,175 | $7,803,800 | $51,043,975 | | 200,233 | |
| | | Common Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| | | UNIT 1 | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal Greenfield (g): | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | UNIT 2 | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal Greenfield (g): | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| | Type | | Staff Labor, $ | Craft Labor, $ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | without Contingency, $ | Contingency, $ | with Contingency, $ | Staff Manhours | Craft Manhours | Craft Manhours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Common | | | | | | | | | | | | | | | |
| | | Common Subtotal Greenfield (g) | $14,218,717 | $2,527,775 | $6,375,563 | | | | | $414,294 | $1,163,096 | $24,699,445 | $4,566,100 | $29,265,545 | 150,069 | 46,905 | |
| | | Common Subtotal 10 CFR 50.54(bb): | $3,676,678 | | $109,484 | | | | | $25,365 | $955,548 | $4,767,075 | $726,000 | $5,493,075 | 125,839 | | |
| | | Unit 1, Unit 2 & Common | | | | | | | | | | | | | | | |
| | | Total Greenfield (g): | $14,218,717 | $31,279,733 | $24,103,558 | | $6,815,557 | $44,864,075 | | $414,294 | $1,163,096 | $122,859,029 | $21,834,500 | $144,693,529 | 150,069 | 514,586 | |
| | | Total 10 CFR 50.54(bb): | $3,676,678 | | $109,484 | | | | | $25,365 | $955,548 | $4,767,075 | $726,000 | $5,493,075 | 125,839 | | |
| PERIOD 6 - RESTORE SITE COSTS: | | | | | | | | | | | | | | | | | |
| | | SPENT FUEL PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| 6 | PD 50.54(bb) | Utility Staff | $253,892 | | | | | | | | | $253,892 | $38,100 | $291,992 | 4,463 | | |
| 6 | PD 50.54(bb) | Security | $114,446 | | | | | | | | | $114,446 | $17,200 | $131,646 | 4,072 | | |
| 6 | PD 50.54(bb) | HP Supplies | | | $9,759 | | | | | | | $9,759 | $2,400 | $12,159 | 4,072 | | |
| 6 | PD 50.54(bb) | Insurance | | | | | | | | | $30,117 | $30,117 | $4,500 | $34,617 | | | |
| 6 | PD 50.54(bb) | Equipment | | | | | | | | | | | | | | | |
| 6 | PD 50.54(bb) | O & M Budget Items | | | | | | | | | | | | | | | |
| 6 | PD 50.54(bb) | Permits & Fees | | | | | | | | | $65,612 | $65,612 | $9,800 | $75,412 | | | |
| 6 | PD 50.54(bb) | Waste Transfer and Loading | | | | | | | | | | | | | | | |
| 6 | PD 50.54(bb) | Energy | | | | | | | | $2,541 | | $2,541 | $400 | $2,941 | | | |
| 6 | PD 50.54(bb) | Spent Fuel Storage Maintenance Supplies | | | | | | | | | | | | | | | |
| 6 | PD 50.54(bb) | Small Tools | | | | | | | | | | | | | | | |
| | | SUBTOTAL - SPENT FUEL PERIOD DEPENDENT | $368,338 | | $9,759 | | | | | $2,541 | $95,729 | $476,366 | $72,400 | $548,766 | 12,607 | | |
| | | DECOMMISSIONING ACTIVITIES | | | | | | | | | | | | | | | |
| 6 | A Greenfield | Backfill, grade and landscape site | | $183,678 | | | | | | | | $183,678 | $43,800 | $227,478 | | 1,757 | |
| | | SUBTOTAL - DECOMMISSIONING ACTIVITY COSTS: | | $183,678 | | | | | | | | $183,678 | $43,800 | $227,478 | | 1,757 | |
| | | DECOMMISSIONING PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| 6 | PD Greenfield | Utility Staff | $42,029 | | | | | | | | | $42,029 | $6,300 | $48,329 | 940 | | |
| 6 | PD Greenfield | DGC Staff | $425,069 | | | | | | | | | $425,069 | $63,800 | $488,869 | 4,698 | | |
| 6 | PD Greenfield | Security | $13,941 | | | | | | | | | $13,941 | $2,100 | $16,041 | 626 | | |
| 6 | PD Greenfield | HP Supplies | | | | | | | | | | | | | | | |
| 6 | PD Greenfield | Equipment | | | $119,433 | | | | | | | $119,433 | $29,900 | $149,333 | | | |
| 6 | PD Greenfield | Unit 1 Insurance | | | | | | | | | $42,912 | $42,912 | $6,400 | $49,312 | | | |
| 6 | PD Greenfield | Unit 2 Insurance | | | | | | | | | $42,912 | $42,912 | $6,400 | $49,312 | | | |
| 6 | PD Greenfield | O & M Budget Items | | | $179,282 | | | | | | | $179,282 | $44,800 | $224,082 | | | |
| 6 | PD Greenfield | Permits & Fees | | | | | | | | | $30,697 | $30,697 | $4,600 | $35,297 | | | |
| 6 | PD Greenfield | Waste Transfer and Loading | | $253,238 | | | | | | | | $253,238 | $60,400 | $313,638 | | 4,699 | |
| 6 | PD Greenfield | Energy | | | | | | | | $22,402 | | $22,402 | $3,400 | $25,802 | | | |
| 6 | PD Greenfield | Severance | $318,566 | | | | | | | | | $318,566 | $47,800 | $366,366 | | | |
| 6 | PD Greenfield | Small Tools | | | $8,738 | | | | | | | $8,738 | $2,200 | $10,938 | | | |
| | | SUBTOTAL - DECOMMISSIONING PERIOD DEPENDENT | $799,605 | $253,238 | $307,454 | | | | | $22,402 | $116,521 | $1,499,220 | $278,100 | $1,777,320 | 6,264 | 4,699 | |
| | | TOTAL PERIOD 6 - RESTORE SITE COSTS: | $1,167,942 | $436,916 | $317,212 | | | | | $24,943 | $212,250 | $2,159,264 | $394,300 | $2,553,564 | 18,871 | 6,456 | |
| | | ACTIVITY | | | | | | | | | | | | | | | |
| | | UNIT 1 | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal Greenfield (g): | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | UNIT 2 | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal Greenfield (g): | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | Common | | | | | | | | | | | | | | | |
| | | Common Subtotal Greenfield (g) | | $183,678 | | | | | | | | $183,678 | $43,800 | $227,478 | | 1,757 | |
| | | Common Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| | | UNIT 1 | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal Greenfield (g): | | | | | | | | | | | | | | | |
| | | Unit 1 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | UNIT 2 | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal Greenfield (g): | | | | | | | | | | | | | | | |
| | | Unit 2 Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | Common | | | | | | | | | | | | | | | |
| | | Common Subtotal Greenfield (g) | $799,605 | $253,238 | $307,454 | | | | | $22,402 | $116,521 | $1,499,220 | $278,100 | $1,777,320 | 6,264 | 4,699 | |

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| Type | | Description | Staff Labor, $ | Craft Labor, $ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | without Contingency, $ | Contingency, $ | with Contingency, $ | Staff Manhours | Craft Manhours | Craft Manhours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Common Subtotal 10 CFR 50.54(bb): | $368,338 | | $9,759 | | | | | $2,541 | $95,729 | $476,366 | $72,400 | $548,766 | 12,607 | | |
| | | Unit 1, Unit 2 & Common | | | | | | | | | | | | | | | |
| | | Total Greenfield (g): | $799,605 | $436,916 | $307,454 | | | | | $22,402 | $116,521 | $1,682,898 | $321,900 | $2,004,798 | 6,264 | 6,456 | |
| | | Total 10 CFR 50.54(bb): | $368,338 | | $9,759 | | | | | $2,541 | $95,729 | $476,366 | $72,400 | $548,766 | 12,607 | | |
| PERIOD 7 - DRY STORAGE COSTS: | | | | | | | | | | | | | | | | | |
| | | SPENT FUEL ACTIVITIES | | | | | | | | | | | | | | | |
| 7 | A 50.54(bb) | Continue to ship fuel to repository | | | | | | | | | | | | | | | |
| | | SUBTOTAL - SPENT FUEL ACTIVITIES | | | | | | | | | | | | | | | |
| | | SPENT FUEL PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| 7 | PD 50.54(bb) | Utility Staff | $1,686,027 | | | | | | | | | $1,686,027 | $252,900 | $1,938,927 | 29,639 | | |
| 7 | PD 50.54(bb) | Security | $760,002 | | | | | | | | | $760,002 | $114,000 | $874,002 | 27,039 | | |
| 7 | PD 50.54(bb) | Insurance | | | | | | | | | $200,000 | $200,000 | $20,000 | $220,000 | | | |
| 7 | PD 50.54(bb) | O & M Budget Items | | | $1,175,365 | | | | | | | $1,175,365 | $117,500 | $1,292,865 | | | |
| 7 | PD 50.54(bb) | Permits & Fees | | | | | | | | | $435,709 | $435,709 | $43,600 | $479,309 | | | |
| 7 | PD 50.54(bb) | Waste Transfer and Loading | | | | | | | | | | | | | | | |
| 7 | PD 50.54(bb) | Energy | | | | | | | | $16,875 | | $16,875 | $1,700 | $18,575 | | | |
| 7 | PD 50.54(bb) | Equipment | | | $22,178 | | | | | | | $22,178 | $2,200 | $24,378 | | | |
| 7 | PD 50.54(bb) | HP Supplies | | | $58,779 | | | | | | | $58,779 | $5,900 | $64,679 | | | |
| 7 | PD 50.54(bb) | Spent Fuel Storage Maintenance Supplies | | | | | | | | | | | | | | | |
| 7 | PD 50.54(bb) | Severance | | | | | | | | | | | | | | | |
| 7 | PD 50.54(bb) | Small Tools | | | | | | | | | | | | | | | |
| | | SUBTOTAL - SPENT FUEL PERIOD DEPENDENT | $2,446,029 | | $1,256,322 | | | | | $16,875 | $635,709 | $4,354,935 | $557,800 | $4,912,735 | 56,679 | | |
| | | TOTAL PERIOD 7 - DRY STORAGE COSTS: | $2,446,029 | | $1,256,322 | | | | | $16,875 | $635,709 | $4,354,935 | $557,800 | $4,912,735 | 56,679 | | |
| | | ACTIVITY | | | | | | | | | | | | | | | |
| | | Common | | | | | | | | | | | | | | | |
| | | Common Subtotal 10 CFR 50.75(c): | | | | | | | | | | | | | | | |
| | | Common Subtotal 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| | | PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| | | Common | | | | | | | | | | | | | | | |
| | | Common Subtotal 10 CFR 50.75(c): | | | | | | | | | | | | | | | |
| | | Common Subtotal 10 CFR 50.54(bb): | $2,446,029 | | $1,256,322 | | | | | $16,875 | $635,709 | $4,354,935 | $557,800 | $4,912,735 | 56,679 | | |
| | | Unit 1, Unit 2 & Common | | | | | | | | | | | | | | | |
| | | Total 10 CFR 50.75(c): | | | | | | | | | | | | | | | |
| | | Total 10 CFR 50.54(bb): | $2,446,029 | | $1,256,322 | | | | | $16,875 | $635,709 | $4,354,935 | $557,800 | $4,912,735 | 56,679 | | |
| PERIOD 8 - ISFSI REMOVAL COSTS: | | | | | | | | | | | | | | | | | |
| | | SPENT FUEL ACTIVITIES | | | | | | | | | | | | | | | |
| | | | | $3,001,256 | $109,980 | | | $175,708 | $25,681,914 | | | $28,968,858 | $10,432,000 | $39,400,858 | | 375 | 54,839 |
| | | SUBTOTAL - SPENT FUEL ACTIVITIES | | $3,001,256 | $109,980 | | | $175,708 | $25,681,914 | | | $28,968,858 | $10,432,000 | $39,400,858 | | 375 | 54,839 |
| | | SPENT FUEL PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| 8 | PD 50.54(bb) | Utility Staff | $3,679,010 | | | | | | | | | $3,679,010 | $551,900 | $4,230,910 | | | |
| 8 | PD 50.54(bb) | DGC Staff | $3,784,123 | | | | | | | | | $3,784,123 | $567,600 | $4,351,723 | | | |
| 8 | PD 50.54(bb) | Security | $1,211,638 | | | | | | | | | $1,211,638 | $181,700 | $1,393,338 | | | |
| 8 | PD 50.54(bb) | HP Supplies | | | $44,630 | | | | | | | $44,630 | $11,200 | $55,830 | | | |
| 8 | PD 50.54(bb) | Insurance | | | | | | | | | $569,934 | $569,934 | $85,500 | $655,434 | | | |
| 8 | PD 50.54(bb) | Equipment | | | $1,962,711 | | | | | | | $1,962,711 | $196,300 | $2,159,011 | | | |
| 8 | PD 50.54(bb) | O & M Budget Items | | | $906,576 | | | | | | | $906,576 | $226,600 | $1,133,176 | | | |
| 8 | PD 50.54(bb) | Permits & Fees | | | | | | | | | $869,819 | $869,819 | $130,500 | $1,000,319 | | | |
| 8 | PD 50.54(bb) | Waste Transfer and Loading | | $1,221,960 | | | | | | | | $1,221,960 | $291,300 | $1,513,260 | | | |
| 8 | PD 50.54(bb) | Energy | | | | | | | | $100,829 | | $100,829 | $15,100 | $115,929 | | | |
| 8 | PD 50.54(bb) | Spent Fuel Storage Maintenance Supplies | | | | | | | | | | | | | | | |
| 8 | PD 50.54(bb) | Severance | $773,659 | | | | | | | | | $773,659 | $116,000 | $889,659 | | | |
| 8 | PD 50.54(bb) | Small Tools | | | $42,232 | | | | | | | $42,232 | $10,600 | $52,832 | | | |
| | | SUBTOTAL - SPENT FUEL PERIOD DEPENDENT | $9,448,430 | $1,221,960 | $2,956,149 | | | | | $100,829 | $1,439,752 | $15,167,120 | $2,384,300 | $17,551,420 | | | |
| | | TOTAL PERIOD 8 - ISFSI REMOVAL COSTS: | $9,448,430 | $4,223,216 | $3,066,128 | | | $175,708 | $25,681,914 | $100,829 | $1,439,752 | $44,135,978 | $12,816,300 | $56,952,278 | | 375 | 54,839 |
| | | ACTIVITY | | | | | | | | | | | | | | | |
| | | Common | | | | | | | | | | | | | | | |

2015 D. C. Cook
Scenario 1
DECON and Permanent On-Site Dry Storage

| Type | Staff Labor,$ | Craft Labor,$ | Equipment & Materials, $ | Packaging, $ | Transportation, $ | Clean Disposal, $ | Contaminated Disposal, $ | Energy, $ | Other, $ | without Contingency, $ | Contingency, $ | with Contingency, $ | Staff Manhours | Craft Manhours | Craft Manhours |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total 10 CFR 50.75(c): | | | | | | | | | | | | | | | |
| Common Subtotal Greenfield (g) | | | | | | | | | | | | | | | |
| Common Subtotal 50.54 (bb) | | $3,001,256 | $109,980 | | | $175,708 | $25,681,914 | | | $28,968,858 | $10,432,000 | $39,400,858 | | 375 | 54,839 |
| PERIOD DEPENDENT | | | | | | | | | | | | | | | |
| Common | | | | | | | | | | | | | | | |
| Total 10 CFR 50.75(c): | | | | | | | | | | | | | | | |
| Common Subtotal Greenfield (g) | | | | | | | | | | | | | | | |
| Common Subtotal 50.54 (bb) | $9,448,430 | $1,221,960 | $2,956,149 | | | | | $100,829 | $1,439,752 | $15,167,120 | $2,384,300 | $17,551,420 | | | |
| Unit 1, Unit 2 & Common | | | | | | | | | | | | | | | |
| Total 10 CFR 50.75(c): | | | | | | | | | | | | | | | |
| Total Greenfield (g): | | | | | | | | | | | | | | | |
| Total 50.54(bb) | $9,448,430 | $4,223,216 | $3,066,128 | | | $175,708 | $25,681,914 | $100,829 | $1,439,752 | $44,135,978 | $12,816,300 | $56,952,278 | | 375 | 54,839 |
| TOTAL ACTIVITY COSTS: | | | | | | | | | | | | | | | |
| UNIT 1 | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 1 10 CFR 50.75(C) COSTS FOR PERIODS 1 - 6 | | $32,037,678 | $5,148,773 | $513,646 | $10,652,293 | | $85,912,778 | | | $134,265,170 | $43,679,200 | $177,944,370 | | 5,760 | 509,519 |
| SUBTOTAL UNIT 1 10 CFR 50.54(bb) COSTS FOR PERIODS 1 - 6 | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 1 GREENFIELD COSTS FOR PERIODS 1 - 6 | | $22,792,603 | $5,310,545 | | $2,183,580 | $14,217,531 | | | | $44,504,258 | $8,662,000 | $53,166,258 | | 417,801 | |
| UNIT 2 | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 2 10 CFR 50.75(C) COSTS FOR PERIODS 1 - 6 | $53,462 | $31,861,763 | $5,115,231 | $506,778 | $10,606,544 | | $85,474,157 | | | $133,617,936 | $43,460,800 | $177,078,736 | | 5,760 | 506,065 |
| SUBTOTAL UNIT 2 10 CFR 50.54(bb) COSTS FOR PERIODS 1 - 6 | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 2 GREENFIELD COSTS FOR PERIODS 1 - 6 | | $22,658,805 | $5,287,355 | | $2,187,604 | $14,244,022 | | | | $44,377,786 | $8,627,900 | $53,005,686 | | 415,106 | |
| COMMON | | | | | | | | | | | | | | | |
| SUBTOTAL COMMON 10 CFR 50.75(C) COSTS FOR PERIODS 1 - 6 | $9,731,335 | $22,033,067 | $3,246,784 | $530,435 | $3,218,388 | | $13,336,350 | | | $52,096,360 | $13,318,300 | $65,414,660 | 100,196 | 24,960 | 153,163 |
| SUBTOTAL COMMON 10 CFR 50.54(bb) COSTS FOR PERIODS 1 - 6 | $783,758 | $136,688,877 | $224,490,000 | | | | | | | $361,962,635 | $88,824,800 | $450,787,435 | 7,904 | 33,280 | |
| SUBTOTAL COMMON GREENFIELD COSTS FOR PERIODS 1 - 6 | | $14,976,787 | $10,489,148 | | $3,144,008 | $20,695,232 | | | | $49,304,175 | $8,951,900 | $58,256,075 | | 244,211 | |
| TOTAL PERIOD DEPENDENT COSTS | | | | | | | | | | | | | | | |
| UNIT 1 | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 1 10 CFR 50.75(C) COSTS FOR PERIODS 1 - 6 | $27,536,583 | | $734,369 | | | | | $3,482,181 | $3,218,992 | $34,972,125 | $5,319,400 | $40,291,525 | 161,307 | | |
| SUBTOTAL UNIT 1 10 CFR 50.54(bb) COSTS FOR PERIODS 1 - 6 | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 1 GREENFIELD COSTS FOR PERIODS 1 - 6 | | | | | | | | | | | | | | | |
| UNIT 2 | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 2 10 CFR 50.75(C) COSTS FOR PERIODS 1 - 6 | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 2 10 CFR 50.54(bb) COSTS FOR PERIODS 1 - 6 | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 2 GREENFIELD COSTS FOR PERIODS 1 - 6 | | | | | | | | | | | | | | | |
| COMMON | | | | | | | | | | | | | | | |
| SUBTOTAL COMMON 10 CFR 50.75(C) COSTS FOR PERIODS 1 - 6 | $222,465,437 | $17,792,520 | $91,198,875 | | | | | $26,884,824 | $22,249,717 | $380,591,373 | $67,781,200 | $448,372,573 | 3,414,844 | | 346,872 |
| SUBTOTAL COMMON 10 CFR 50.54(bb) COSTS FOR PERIODS 1 - 6 | $38,112,937 | | $1,486,131 | | | | | $4,547,036 | $24,140,604 | $68,286,708 | $10,391,500 | $78,678,208 | 1,079,792 | | |
| SUBTOTAL COMMON GREENFIELD COSTS FOR PERIODS 1 - 6 | $15,018,322 | $2,781,013 | $6,683,017 | | | | | $436,696 | $1,279,617 | $26,198,664 | $4,844,200 | $31,042,864 | 156,333 | 51,604 | |
| ANNUAL SPENT FUEL STORAGE | $2,446,029 | | $1,256,322 | | | | | $16,875 | $635,709 | $4,354,935 | $557,800 | $4,912,735 | 56,679 | | |
| UNIT 1, UNIT 2 & COMMON | | | | | | | | | | | | | | | |
| GRAND TOTAL ACTIVITY COSTS FOR PERIODS 1-6 | $10,568,556 | $283,048,581 | $259,087,836 | $1,550,859 | $31,992,416 | $49,156,784 | $184,723,286 | | | $820,128,318 | $215,524,900 | $1,035,653,218 | 108,100 | 1,146,878 | 1,168,746 |
| GRAND TOTAL PERIOD DEPENDENT COSTS FOR PERIODS 1-6 | $303,133,279 | $20,573,532 | $100,102,391 | | | | | $35,350,737 | $50,888,929 | $510,048,869 | $88,336,300 | $598,385,169 | 4,812,276 | 51,604 | 346,872 |
| ANNUAL SPENT FUEL STORAGE | $2,446,029 | | $1,256,322 | | | | | $16,875 | $635,709 | $4,354,935 | $557,800 | $4,912,735 | 56,679 | | |
| GRAND TOTAL | $313,701,835 | $303,622,113 | $359,190,227 | $1,550,859 | $31,992,416 | $49,156,784 | $184,723,286 | $35,350,737 | $50,888,929 | $1,330,177,187 | $303,861,200 | $1,634,038,387 | 4,920,377 | 1,198,482 | 1,515,618 |
| ISFSI DECONTAMINATION AND REMOVAL | $9,448,430 | $4,223,216 | $3,066,128 | | | $175,708 | $25,681,914 | $100,829 | $1,439,752 | $44,135,978 | $12,816,300 | $56,952,278 | | 375 | 54,839 |
| SUBTOTAL UNIT 1 DECON PROGRAM FINANCIAL PLANNING COST FOR 10 CFR 50.75(c): | $27,536,583 | $32,037,678 | $5,883,142 | $513,646 | $10,652,293 | | $85,912,778 | $3,482,181 | $3,218,992 | $169,237,294 | $48,998,600 | $218,235,894 | 161,307 | 5,760 | 509,519 |
| SUBTOTAL UNIT 1 DECON PROGRAM FINANCIAL PLANNING COST FOR 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 1 DECON PROGRAM FINANCIAL PLANNING COST FOR GRENNFIELD (g): | | $22,792,603 | $5,310,545 | | $2,183,580 | $14,217,531 | | | | $44,504,258 | $8,662,000 | $53,166,258 | | 417,801 | |
| SUBTOTAL UNIT 2 DECON PROGRAM FINANCIAL PLANNING COST FOR 10 CFR 50.75(c): | $53,462 | $31,861,763 | $5,115,231 | $506,778 | $10,606,544 | | $85,474,157 | | | $133,617,936 | $43,460,800 | $177,078,736 | | 5,760 | 506,065 |
| SUBTOTAL UNIT 2 DECON PROGRAM FINANCIAL PLANNING COST FOR 10 CFR 50.54(bb): | | | | | | | | | | | | | | | |
| SUBTOTAL UNIT 2 DECON PROGRAM FINANCIAL PLANNING COST FOR GRENNFIELD (g): | | $22,658,805 | $5,287,355 | | $2,187,604 | $14,244,022 | | | | $44,377,786 | $8,627,900 | $53,005,686 | | 415,106 | |
| SUBTOTAL COMMON DECON PROGRAM FINANCIAL PLANNING COST FOR 10 CFR 50.75(c): | $232,196,772 | $39,825,587 | $94,445,659 | $530,435 | $3,218,388 | | $13,336,350 | $26,884,824 | $22,249,717 | $432,687,732 | $81,099,500 | $513,787,232 | 3,515,040 | 24,960 | 500,034 |
| SUBTOTAL COMMON DECON PROGRAM FINANCIAL PLANNING COST FOR 10 CFR 50.54(bb): | $38,896,695 | $136,688,877 | $225,976,131 | | | | | $4,547,036 | $24,140,604 | $430,249,343 | $99,216,300 | $529,465,643 | 1,087,696 | 33,280 | |
| SUBTOTAL COMMON DECON PROGRAM FINANCIAL PLANNING COST FOR GRENNFIELD (g): | $15,018,322 | $17,756,800 | $17,172,164 | | $3,144,008 | $20,695,232 | | $436,696 | $1,279,617 | $75,502,839 | $13,796,100 | $89,298,939 | 156,333 | 295,815 | |
| TOTAL UNIT 1 & 2 DECON PROGRAM FINANCIAL PLANNING COST FOR 10 CFR 50.75(c): | $259,786,817 | $103,725,029 | $105,444,032 | $1,550,859 | $24,477,225 | | $184,723,286 | $30,367,006 | $25,468,708 | $735,542,962 | $173,558,900 | $909,101,862 | 3,676,348 | 36,480 | 1,515,618 |
| TOTAL UNIT 1 & 2 DECON PROGRAM FINANCIAL PLANNING COST FOR 10 CFR 50.54(bb): | $38,896,695 | $136,688,877 | $225,976,131 | | | | | $4,547,036 | $24,140,604 | $430,249,343 | $99,216,300 | $529,465,643 | 1,087,696 | 33,280 | |
| TOTAL UNIT 1 & 2 DECON PROGRAM FINANCIAL PLANNING COST FOR GRENNFIELD (g): | $15,018,322 | $63,208,207 | $27,770,064 | | $7,515,191 | $49,156,784 | | $436,696 | $1,279,617 | $164,384,882 | $31,086,000 | $195,470,882 | 156,333 | 1,128,722 | |
| GRAND TOTAL | $313,701,835 | $303,622,113 | $359,190,227 | $1,550,859 | $31,992,416 | $49,156,784 | $184,723,286 | $35,350,737 | $50,888,929 | $1,330,177,187 | $303,861,200 | $1,634,038,387 | 4,920,377 | 1,198,482 | 1,515,618 |

# APPENDIX C

# CASH FLOW TABLE

2015 D. C. Cook
Scenario 1 Draft
DECON and Permanent On-Site Dry Storage

**Scenario 1 - Yearly costs:**

**UNIT 1**

| Year | Labor | Material & Equipment | Packaging, Transportation & Disposal | Energy | Other | Contingency for 10 CFR 50.75(c) and Greenfield | Total for 10 CFR 50.75(c) and Greenfield | 10 CFR 50.54(bb) costs with Contingency |
|---|---|---|---|---|---|---|---|---|
| 2034 | $1,598,700 | $42,600 | $0 | $202,200 | $186,900 | $308,800 | $2,339,200 | |
| 2035 | $8,715,300 | $232,400 | $0 | $1,102,100 | $1,018,800 | $1,683,600 | $12,752,200 | |
| 2036 | $8,715,300 | $232,400 | $0 | $1,102,100 | $1,018,800 | $1,683,600 | $12,752,200 | |
| 2037 | $8,622,300 | $257,100 | $111,900 | $1,075,800 | $994,500 | $1,720,500 | $12,782,100 | |
| 2038 | $5,011,000 | $1,272,500 | $5,282,900 | $0 | $0 | $3,485,700 | $15,052,100 | |
| 2039 | $11,865,200 | $1,456,000 | $26,572,600 | $0 | $0 | $12,597,400 | $52,491,200 | |
| 2040 | $11,865,200 | $1,456,000 | $26,572,600 | $0 | $0 | $12,597,400 | $52,491,200 | |
| 2041 | $11,865,200 | $1,456,000 | $26,572,600 | $0 | $0 | $12,597,400 | $52,491,200 | |
| 2042 | $5,890,300 | $722,800 | $13,191,700 | $0 | $0 | $6,253,900 | $26,058,700 | |
| 2043 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| 2044 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| 2045 | $1,955,700 | $967,500 | $3,611,100 | $0 | $0 | $1,126,100 | $7,660,400 | |
| 2046 | $5,467,600 | $2,705,000 | $10,095,900 | $0 | $0 | $3,148,300 | $21,416,800 | |
| 2047 | $795,200 | $393,400 | $1,468,300 | $0 | $0 | $457,900 | $3,114,800 | |
| 2048 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| 2049 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| 2050 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| | $82,367,000 | $11,193,700 | $113,479,600 | $3,482,200 | $3,219,000 | $57,660,600 | $271,402,100 | |
| | | | | | | Rounding Allowance: | $52 | |
| | | | | | | | $271,402,152 | |

**UNIT 2**

| Year | Labor | Material & Equipment | Packaging, Transportation & Disposal | Energy | Other | Contingency for 10 CFR 50.75(c) and Greenfield | Total for 10 CFR 50.75(c) and Greenfield | 10 CFR 50.54(bb) costs with Contingency |
|---|---|---|---|---|---|---|---|---|
| 2034 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| 2035 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| 2036 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| 2037 | $115,000 | $30,300 | $111,900 | $0 | $0 | $77,100 | $334,300 | |
| 2038 | $4,772,100 | $1,249,900 | $5,140,100 | $0 | $0 | $3,375,400 | $14,537,500 | |
| 2039 | $3,106,600 | $626,300 | $21,337,500 | $0 | $0 | $8,554,000 | $33,624,400 | |
| 2040 | $3,106,600 | $626,300 | $21,337,500 | $0 | $0 | $8,554,000 | $33,624,400 | |
| 2041 | $3,106,600 | $626,300 | $21,337,500 | $0 | $0 | $8,554,000 | $33,624,400 | |
| 2042 | $6,441,400 | $769,800 | $13,471,900 | $0 | $0 | $6,486,800 | $27,169,900 | |
| 2043 | $9,729,000 | $911,200 | $5,717,500 | $0 | $0 | $4,448,800 | $20,806,500 | |
| 2044 | $9,729,000 | $911,200 | $5,717,500 | $0 | $0 | $4,448,800 | $20,806,500 | |
| 2045 | $8,204,800 | $1,552,800 | $7,283,600 | $0 | $0 | $3,983,600 | $21,024,800 | |
| 2046 | $5,467,600 | $2,705,000 | $10,095,900 | $0 | $0 | $3,148,300 | $21,416,800 | |
| 2047 | $795,200 | $393,400 | $1,468,300 | $0 | $0 | $457,900 | $3,114,800 | |
| 2048 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| 2049 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| 2050 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | |
| | $54,573,900 | $10,402,500 | $113,019,200 | $0 | $0 | $52,088,700 | $230,084,300 | |
| | | | | | | Rounding Allowance: | $121 | |
| | | | | | | | $230,084,421 | |

**Common**

| Year | Labor | Material & Equipment | Packaging, Transportation & Disposal | Energy | Other | Contingency for 10 CFR 50.75(c) and Greenfield | Total for 10 CFR 50.75(c) and Greenfield | 10 CFR 50.54(bb) costs with Contingency |
|---|---|---|---|---|---|---|---|---|
| 2034 | $492,200 | $0 | $0 | $0 | $0 | $73,900 | $566,100 | $10,049,200 |
| 2035 | $2,683,100 | $0 | $0 | $0 | $0 | $402,700 | $3,085,800 | $54,781,600 |
| 2036 | $2,683,100 | $0 | $0 | $0 | $0 | $402,700 | $3,085,800 | $54,781,600 |
| 2037 | $4,085,400 | $371,300 | $0 | $100,700 | $76,900 | $736,200 | $5,370,500 | $57,146,900 |
| 2038 | $60,563,500 | $15,497,800 | $22,700 | $4,196,200 | $3,217,300 | $14,231,200 | $97,728,700 | $150,968,500 |
| 2039 | $29,983,900 | $13,489,700 | $833,400 | $3,485,800 | $3,019,000 | $9,272,900 | $60,084,700 | $48,110,900 |
| 2040 | $29,983,900 | $13,489,700 | $833,400 | $3,485,800 | $3,019,000 | $9,272,900 | $60,084,700 | $48,110,900 |
| 2041 | $29,983,900 | $13,489,700 | $833,400 | $3,485,800 | $3,019,000 | $9,272,900 | $60,084,700 | $48,110,900 |
| 2042 | $30,757,000 | $11,867,600 | $3,080,300 | $3,395,200 | $2,843,300 | $10,035,400 | $61,978,800 | $28,282,800 |
| 2043 | $31,519,000 | $10,268,500 | $5,295,500 | $3,305,900 | $2,670,100 | $10,787,100 | $63,846,100 | $8,734,900 |
| 2044 | $31,519,000 | $10,268,500 | $5,295,500 | $3,305,900 | $2,670,100 | $10,787,100 | $63,846,100 | $8,734,900 |
| 2045 | $27,160,700 | $10,396,300 | $8,476,800 | $2,222,000 | $1,991,800 | $9,872,300 | $60,119,900 | $6,917,700 |
| 2046 | $19,334,100 | $10,625,800 | $14,189,700 | $275,600 | $773,800 | $8,229,500 | $53,428,500 | $3,654,400 |
| 2047 | $4,048,500 | $1,852,800 | $2,063,700 | $62,500 | $229,100 | $1,518,800 | $9,775,400 | $1,080,300 |
| 2048 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 2049 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| 2050 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | $304,797,300 | $111,617,700 | $40,924,400 | $27,321,400 | $23,529,400 | $94,895,600 | $603,085,800 | $529,465,500 |
| | | | | | | Rounding Allowance: | $371 | $ 143 |
| | | | | | | | $603,086,171 | $529,465,643 |
| | **$136,940,900** | **$21,596,200** | **$226,498,800** | **$3,482,200** | **$3,219,000** | **$109,749,300** | **$1,104,572,745** | **$529,465,643**<br>**$1,634,038,387** |

| | |
|---|---|
| Annual Storage Cost | $4,912,700 |
| ISFSI decommissioning Year 1 | $33,123,000 |
| ISFSI decommissioning Year 2 | $23,829,300 |
| | $56,952,300 |

# COMPARISON OF THE 2012 AND 2015 D.C. COOK DECOMMISSIONING COST ESTIMATES, Rev. 2

## Summary

The following is a comparison of the costs for Scenario 1 from the 2012 Decommissioning Cost Estimate and Scenario 1 from the 2015 Decommissioning Cost Estimate. Costs have increased $303,305,160 or 22.79% over the three years, approximately. This comparison identifies the major differences in costs due to changes in the scope-of-work and estimating logic included in the estimates. The material inventory for the 2015 estimate was recreated from site specific drawings and the plant database, as such, there are changes from the inventory used in the previous estimates. This comparison focuses on the following areas: spent fuel storage, undistributed costs, waste disposal, component removal and contingency. Table 1 provides a summary of the total costs for both studies.

**Table 1**
**2012 Scenario 1 vs. 2015 Scenario 1 Total Costs**
(Costs include contingency)

| Category | 2012 | 2015 | |
|---|---|---|---|
| Period Dependent | $405,369,121 | $510,048,869 | $104,679,749 |
| Activity | $676,073,007 | $820,128,318 | $144,055,311 |
| Contingency | $249,291,100 | $303,861,200 | $54,570,100 |
| | **$1,330,733,228** | **$1,634,038,387** | **$303,305,160** |
| | | | |
| Decommissioning 50.75 c | $802,374,964 | $909,101,862 | $106,726,899 |
| Spent Fuel 50.54(bb) | $386,242,332 | $529,465,643, | $143,223,311 |
| Greenfield | $142,115,933 | $195,470,882 | $53,354,949 |
| | **$1,330,733,228** | **$1,634,038,387** | **$303,305,160** |

## Spent Fuel Storage

As shown in Table 1, there is an increase in the spent fuel storage cost of $143.2 million. The major reason for this increase is due to the increase in the estimate to construct the expansion to the spent fuel storage pad. In 2012 the estimate for the expanded pad was based on the actual cost to construct the existing pad. The 2012 estimate for the pad expansion was $25.1 million, before contingency, for 120 additional storage casks. In January of 2015 an estimate was developed by site personnel for the expansion of the pad. This estimate was $135 million, before contingency, for 111 additional storage casks. In both cases the expansion would be sufficient to hold all spent fuel on site after both units shutdown.

This increase was somewhat offset by the decrease in the cost of the spent fuel storage casks. While the cost of the casks increased, from $1.93 million each to $2 million each, fewer casks were estimated to be required. In 2012 it was estimated that 120 additional casks would be required after shutdown to empty the spent fuel pool. Based on a revised analysis of spent fuel discharges this number was reduced to 111 additional casks. Table 4 provides a summary of spent fuel storage costs.

Except for one modification, the Utility Staff person levels associated with the post-shutdown storage of spent fuel have remained the same as in the 2012 study. The Utility staff level during period 4 was increased from 14.25 to 33 in the 2015 study. This increase is due to the in-pool spent fuel cooling period increasing from 5 years to 7 years. This increase causes spent fuel to remain in the spent fuel pool for the majority of period 4, requiring a larger staff. Table 2 provides a comparison of the utility staff.

There were a few changes to the Security Staff levels associated with spent fuel storage. This modifications are a result of new information provided by AEP. Period 4 was also modified due to the increase from 5 years to 7 years for in-pool cooling. Table 3 provides a comparison of the security staff.

Both scenarios assume that spent fuel will remain on site indefinitely. The annual costs for long storage increased approximately $432,646 or 9.66%. The main reason for this increase is due a change in the methodology used to calculate the O&M expenses during decommissioning. Since KCES received a more detailed list of these expenses a more accurate of assessment of the costs incurred during decommissioning was made. A more detailed description of the O&M costs is provided below. In addition, the spent fuel storage maintenance costs were included in the O&M budget and these values were used in the 2015 study, as opposed to being estimated separately in the 2012 study. Table 4 provides a summary of the dry spent fuel storage costs.

**Table 2 – Utility Staff Levels**

| Period | 2012 Spent Fuel | 2015 Spent Fuel |
|---|---|---|
| 1 | | |
| 2 | 33 | 33 |
| 3 | 33 | 33 |
| 4 | 14.25 | 33 |
| 5 | 14.25 | 14.25 |
| 6 | 14.25 | 14.25 |
| 7 | 14.25 | 14.25 |

**Table 3 – Security Staff Levels**

| Period | 2012 Spent Fuel | 2015 Spent Fuel |
|---|---|---|
| 1 | | |
| 2 | 21 | 24 |
| 3 | 21 | 20 |
| 4 | 12 | 20 |
| 5 | 12 | 13 |
| 6 | 12 | 13 |
| 7 | 12 | 13 |

**Table 4 – Spent Fuel Storage Costs**
(Costs include contingency)

| | 2012 Totals | 2015 Totals | Cost Difference |
|---|---|---|---|
| Undistributed with contingency | $59,888,277 | $78,678,208 | $18,789,930 |
| Modify pool systems, security and control room | $6,030,177 | $6,105,735 | $75,558 |
| New pad construction cost | $30,861,277 | $167,181,700 | $136,320,423 |
| Additional cask costs | $289,462,600 | $277,500,000 | -$11,962,600 |
| | $386,242,332 | $529,465,643 | $143,223,311 |
| Number of new casks | 120 | 111 | |
| Cost per cask, excluding contingency | $1,929,750 | $2,000,000 | $70,250 |
| Period 7 Duration, months | 12 | 12 | |
| Annual Period 7 costs | $4,480,089 | $5,912,735 | $432,646 |

**Undistributed Costs**

Table 5 provides a summary of the undistributed costs for both studies. While undistributed costs increased 26.41% overall, there are variations within specific categories. Permits & Licenses, Insurance, Energy, Small Tools, O&M Budget Items and Equipment had the largest cost in increase, 43.30%, 84.27%, 48.94%, 41.11%, 214% and 51.89%, respectively. Health Physics Supplies costs decreased 7.75%. These differences are due to more than just normal inflation.

**Table 5 – 2012 Scenario 1 vs. 2015 Scenario 1 Total Costs**
(Costs include contingency)

| Category | 2012 Totals | 2015 Totals | % Change |
|---|---|---|---|
| Utility Staff | $132,634,100 | $136,026,214 | 2.56% |
| DGC Staff | $111,197,900 | $123,131,415 | 10.73% |
| Permits & Licenses | $22,097,100 | $31,665,294 | 43.30% |
| Insurance | $14,954,700 | $27,556,345 | 84.27% |
| Security | $29,192,400 | $30,348,012 | 3.96% |
| Waste Transfer and Loading | $21,307,100 | $25,478,032 | 19.58% |
| Energy | $27,307,100 | $40,671,912 | 48.94% |
| Health Physics (HP) Supplies | $19,275,900 | $25,342,861 | 31.47% |
| Small Tools | $4,168,400 | $5,881,953 | 41.11% |
| Severance Pay | $52,958,900 | $61,910,768 | 16.90% |
| O & M Budget Items | $22,280,800 | $70,014,563 | 214.24% |
| Equipment | $16,637,800 | $25,270,536 | 51.89% |
| Spent Fuel Maintenance | $3,233,900 | Included in O&M | N/A |
| **Totals** | **$477,246,000** | **$603,297,905** | **26.41%** |

The post shut-down schedule duration increased from 97 months in 2012 to 112 months in 2015. There were two reasons for this increase. The first is due to a revision to the reactor vessel and reactor vessel internals removal duration. The duration increased from 11 months in 2012 to 21 months in 2015. This increase was due to a modification in the calculations based more current information. The second is that the in-pool spent fuel cooling period was increased from 5 years to 7 years. The result was that the period dependent costs increased more than the increase due to inflation.

Utility staff costs increased 2.56% from 2012 to 2015. The total Utility Staff man-years increased from 889 in 2012 to 1,066 in 2015 due to the schedule change. Based on the information provided by AEP, the average base salary increased approximately 25% from 2012 to 2015. Fringes and payroll tax decreased from 69.73% to 29.84%, a 57.21% decrease. This decrease is due to a revised method for determining the Utility overhead percentage rate. The combined effect is to decrease the average cost per man-year 14.47%. Table 6 provides a summary of these values.

**Table 6 –Utility Staff Costs**
(Costs do not include contingency unless noted)

| Category | 2012 Totals | 2015 Totals | % Change |
|---|---|---|---|
| Total man-years | 889 | 1,066 | 19.90% |
| Fringe and payroll tax markup | 69.73% | 29.84% | -57.21% |
| Average $/man-year w/ contingency | $149,153 | $127,574 | -14.47% |

Decommissioning General Contractor (DGC) costs increased 10.73% from 2012 to 2015. The total DGC man-years increased from 615 in 2012 to 709 in 2015 due to the schedule change. The increase in cost due to the schedule change is somewhat offset by a decrease in the average cost per man year of 3.91%. This decrease is due to variations in the average salaries provided by various industry sources. Table 7 provides a summary of these values.

**Table 7 –DGC Staff Costs**
(Costs do not include contingency unless noted)

| **Category** | **2012 Totals** | **2015 Totals** | **% Change** |
|---|---|---|---|
| Total man-years | 615 | 709 | 15.24% |
| Average $/man-year w/ contingency | $180,794 | $173,721 | -3.91% |

Insurance costs increased 84.27% from the 2012 study to the 2015. The annual nuclear property insurance premiums provided by AEP increased 45.36% from 2012 while the annual nuclear liability premiums provided by AEP increased 44.33%. Cost also increased as a result of the extended in-pool spent fuel cooling, from 5 to 7 years. The estimating logic incorporated in the 2015 estimate is similar to that incorporated in the 2012 estimate. Table 8 provides a summary of the inputs used in both studies.

**Table 8 – Insurance Premiums**

| | **2012 Totals** | **2015 Totals** |
|---|---|---|
| NEIL -Primary | $2,984,079 | $4,337,542 |
| Facility (Basic) - | $943,562 | $1,361,796 |

Security costs increased 3.96% from 2012 to 2015. The total Security man-years increased from 381 in 2012 to 502 in 2015 due to the schedule change. The decrease in salaries, as seen in Table 9, was offset by the schedule change and a slightly larger staff level. The adjustment in the staff level is due to more detailed information provided by AEP. Table 9 provides a summary of this information.

**Table 9 – Security Costs**
(Costs do not include contingency unless noted)

| **Category** | **2012 Totals** | **2015 Totals** | **% Change** |
|---|---|---|---|
| Total man-years | 381 | 502 | 31.66% |
| Average base salary - guard only | $43,035 | $41,330 | -3.96% |
| Average base salary - manager only | $108,500 | $90,943 | -16.18% |
| Average base salary - supervisor only | $84,208 | $54,912 | -0.58% |
| Average $/man-year w/ contingency | $76,561 | $60,421 | -21.04% |

Waste transfer and loading costs increased 19.58% from 2012 to 2015. The logic and crew size used in the 2015 estimate is the same as that used in the 2015 estimate. This increase is driven primarily by the increase in Periods 3 and 4 durations.

Energy costs increased 48.94%. There are two factors associated with this increase. One is the increase in the Period 3 and 4 durations. The other is due to an increase in the cost of electricity from $0.0225/kw-hr to $0.0767/kw-hr.

Small tool costs increased by 41.11%. The basis for these costs remains the same as used in 2012, based on the R. S. Means specified factor of 1% of craft labor costs. The increase in costs is due to the increase craft labor due to the schedule change.

O & M Budget item costs increased by 214.24%. The basis for these costs is similar to that used in 2012 in that the cost for each period was based on a percent of that incurred during operations. In 2012 the percentages were applied to the operating costs at the department level. The basis was supplied by AEP in 2006, escalated for each subsequent update, and was not sufficiently detailed to allow for the percentages to be applied at a lower level. In 2015 AEP supplied a much more detailed version of these costs, 457 line items versus 190 in 2006. The new information allowed for the percentages to be applied on a line item basis. As an example, in 2012 the same percentage was applied to all costs in the business services department. In 2015, a separate percentage was applied to each cost category within the business services department. This added detail allows for a better tracking of the costs through the decommissioning.

Severance costs increased 16.90%, from $53.0 million to $61.9 million, from 2012 to 2015. The increase is due in part to the increase in the average cost per man-year for the Utility staff. The number of employees eligible for receiving severance, as reported by AEP, increased from 1051 in 2012 to 1198 in 2015. The severance costs are based on two weeks of pay for every year of service.

Equipment costs increased 51.89% from 2012 to 2015. There was a slight adjustment to the methodology used to calculate the equipment costs, causing an increase in overall costs. In addition, the increase in the duration of Periods 3 and 4 also caused an increase in costs.

**Component Removal and Waste Disposal**

Structures and component removal costs increased 11.26%. The systems and structures inventory for the 2012 study were developed in the 1990's and have been used in every estimate since then. Over the years the unit cost factors have been revised to better reflect industry experience. Since the original inventory remained the property of a previous company, it was necessary to redo the inventory to allow for a better distribution to the appropriate unit cost factors. This was done for the 2015 study.

Based on the new inventory there was some change in waste volumes. Since the original inventories are not available it is not possible to perform a detailed comparison of the two inventories. There is now a detailed material takeoff to support the 2015 study. As an example, Table 10 provides a summary of the Reactor Building waste volumes.

**Table 10 – Reactor Building Waste Volumes**

| | 2012 | 2015 |
|---|---|---|
| Contaminated Waste | 363,988 | 260,877 |
| Clean Waste | 688,608 | 2,580,935 |

Structures and component removal costs are affected by two main components, waste disposal and labor costs. As discussed below, waste disposal costs decreased 3.47% while labor costs, see Table 12, increased 0.85% on average.

Table 13 summarizes the change in costs between 2012 and 2015. Based on the changes identified above, decontamination, removal and disposal costs increased 11.26%. The decontamination and contaminated removal costs decreased while the demolition and disposal of clean structures increased. The change in inventory is the main reasons for these changes, see the example in Table 10.

The decontamination of structures decreased 4.04% from 2012 to 2015. The same basic logic used in the 2012 study was used in the 2015 study. Basically, the majority of the building material inside the Containment Building will be removed and sent out as Bulk Survey For Release (BSFR) as opposed to decontaminate, survey and release. This not only reduces the survey requirement but eliminates the need for scabbling of the surfaces. The removal of contaminated systems decreased 20.44%. The majority of the cost decrease is due to the revision to the system and structure inventories.

Table 11 provides a comparison of the disposal rates and volumes between the 2012 study and the 2015 study. While the disposal costs either increased or stay the same, the overall costs decreased due to a larger volume going out as BSFR. Smelting was not included in the 2015 study due to uncertainties in the industry.

**Table 11 – Waste Summary**

| **Waste Disposal (without contingency)** | **2012** | **2015** | |
|---|---|---|---|
| Contaminated Disposal, Includes surcharges | $191,363,101 | $184,723,286 | -3.47% |
| EnergySolutions rate, $/cu ft | $158.54 | $171.84 | 8.39% |
| EnergySolutions volume, cu. ft. | 278,239 | 190,644 | -31.48% |
| Smelting rate, $/lb | $2.10 | | |
| Smelting volume, cu. ft. | 188,051 | Not Used | |
| WCS disposal rate, $/cu ft | $208.79 | $208.79 | 0.00% |
| WCS disposal volume, cu. ft. | 70,018 | 3,946 | -94.36% |
| BSFR rate, $/lb | $0.13 | $0.25 | 92.31% |
| BSFR volume, cu. ft. | 2,879,629 | 3,389,951 | 17.72% |

The 2015 estimate assumes that the reactor vessel and reactor internals will be removed and disposed of based on the same methodology as in the 2012 study. This waste is assumed to be disposed of at either the EnergySolutions facility in Clive, Utah or the WCS facility in Andrews, Texas in the 2015 estimate. The increase is due, in part to the increase in disposal costs for B and C waste. Class B waste was increased from $300.00 per cubic foot to $2,680.00 and Class C from $1,200.00 per cubic foot to $2,680.00. There was also a modification to the vessel removal labor costs based on recent experience, increasing the labor costs for the 2015 study.

The increase in the disposal cost for the steam generators is due to general increases in labor and equipment and material costs.

**Table 12 – Labor Rates**

| **Craft Labor Billing Rates** | **2012 Totals** | **2015 Totals** | **% Change** |
|---|---|---|---|
| Laborer | $43.89 | $45.28 | 3.16% |
| Craftsmen | $62.72 | $62.27 | -0.71% |
| Foreman | $70.23 | $70.29 | 0.09% |

**Table 13 – Major Component Removal and Disposal**
(Costs do not include contingency unless noted)

| | **2012 Totals** | **2015 Totals** | **% Change** |
|---|---|---|---|
| Decon Structures | $53,650,749 | $51,480,639 | -4.04% |
| Decon & Remove Contaminated Systems | $51,434,478 | $40,923,280 | -20.44% |
| Remove Clean Systems | $31,698,818 | $33,962,634 | 7.14% |
| Demolition of Structures | $63,126,837 | $98,312,543 | 55.74% |

| | | | |
|---|---|---|---|
| Reactor Internals | $82,364,670 | $92,495,199 | 12.30% |
| Reactor Vessel | $36,368,825 | $40,229,943 | 10.62% |
| Steam Generator and Pressurizer | $40,549,368 | $42,756,500 | 5.44% |
| Spent Fuel Racks | $4,249,314 | $4,220,895 | -0.67% |
| **Total** | **$363,443,058** | **$404,381,633** | |

**Contingency**

The average effective contingency for Scenario 1 in 2012 was 23.05%. The average effective contingency for Scenario 1 in 2015 is 22.84%. The methodology for calculating the contingency is the same for both estimates. Since each cost category, labor; equipment & materials; packaging; transportation and disposal has a separate contingency factor applied, the increase is due to the difference in the cost for each category.