LESSONS LEARNED – THE DONALD C. COOK NUCLEAR PLANT STEAM GENERATOR DISPOSAL PROJECT

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ABSTRACT

The disposal of the Donald C. Cook Nuclear Plant's Unit 1 Steam Generators was completed in 2004, but the process began when the generators were replaced in 1999. The project went through many planning steps and there were innovative processes used to finance the project, to monitor and report the project dose, and to improve the planning process. The project was financed through the decommissioning trust fund. The dose was monitored and reported to management by borrowing a project management technique called Earned Value. A new tracking technique called "Dose Earned Value" was created to follow the dose and to be able to report it on a consistent basis. Cook Plant completed a similar project in 1998 with the disposal of the Unit 2 steam generators. Because of the width of the generators, Cook Plant used a complex shield design with shifting saddles on the generators. For the 2004, project simplicity was the key. The generators were trimmed to reduce the width. This made the shielding designs simpler, removed the requirements for shifting the load during transport and it saved a lot of dose. Project risk was approached from a more preventative viewpoint. Some of the lessons learned in operating a nuclear plant were applied to the planning in this project. It allowed for development of contingency plans to deal with the risks and it forced a more proactive approach to remove the risk before it became an issue. The project was a success. The generators were prepared and shipped from Cook Plant to Utah without incident during the preparation and the transportation. The project was done on time and within budget.

INTRODUCTION

American Electric Power/Indiana Michigan Power's Donald C. Cook Plant is located in southwest Michigan on the shores of Lake Michigan. The disposal of the Donald C. Cook Nuclear Plant's Unit 1 Steam Generators was completed in 2004 with the help of Duratek, but the process began when the generators were replaced in 1999. The project went through many planning steps and there were innovative processes used to finance the project, to monitor and report the project dose, and to improve the planning process. This paper will address four different areas: how the project was financed, how dose was monitored, the transportation issues, and the planning process.

The first section of the paper will explain how the project was financed. The funding of the project was unique. It was financed through the decommissioning trust fund. This was made possible by working with the state regulatory agencies and the Nuclear Regulatory Commission to define how the funds were collected and segregated.

Keeping the dose to workers as low as reasonably achievable (ALARA) is always a challenge. A new tool applied to monitor the dose is discussed in the second section of the paper. To keep the dose low a new monitoring tool was developed for the project. The dose was monitored and reported to management by borrowing a project management technique called Earned Value. A

new tracking technique called "Dose Earned Value" was created to follow the dose and to be able to report it on a consistent basis. It also allowed for easier post job analysis to identify problems areas in the total dose received.

The third section will discuss the preparation and transport of the generators. Transportation of large components is always a challenge, but Cook Plant was able to bring some different ideas to address some problems. The same problems many other large component transports encountered were experienced at the Cook Plant. A similar project was completed in 1998 with the disposal of the Unit 2 steam generators. Because of the width of the generators, a complex shield design with shifting saddles on the generators was needed. For the 2004, project simplicity was the key. To make the transportation simple the generators were trimmed to meet the width requirements. This made the shielding designs simpler, removed the requirements for shifting the load during transport and it saved a lot of dose. There were problems with the routing of the generators because of their weight that required a change in burial sites. Also, the DOT changed their standards for exemptions for this type of shipment, so reports and other information were needed to be amended to support the exemption.

Project risk was approached from a more preventative viewpoint, and is explained in the fourth section of the paper. Some of the lessons learned in operating a nuclear plant were applied to the planning in this project. Through the Look Ahead Process, a more comprehensive review of potential risks and operating experience was applied to the project. It allowed for development of contingency plans to deal with the risks and it forced a more proactive approach to remove the risk before it became an issue.

In the end the project was a success. The generators were prepared and shipped from Cook Plant to Utah without incident during the preparation and the transportation. The project was done on time and within budget.

Project Financing

The project was financed through the Decommissioning Trust Fund. This is unique because the Cook Plant is an operating nuclear plant with no plans to start decommissioning any time soon. The Cook Plant's current licenses expire in 2014 and 2017, but an application has been submitted for a license extension. To use decommissioning funds a case needed to be made to the rate commissions in Indiana and Michigan and with the NRC.

The case made to the government agencies was simple. Since the Cook Plant licenses currently expire in 2014 and 2017, and according to Indiana Michigan Power's latest decommissioning cost studies, the steam generators would be shipped for disposal in about 20 years. Disposing of the steam generators was expected to cost $8 million. Based on an annual cost escalation of approximately 10%, the future value of that disposal would be $54 million. The cost escalation for low level waste has been typically 12%-15% over the past 20 years. If the $8 million remain in the trust fund with a 2% earning rate, it would grow to $12 million over the same period of time. Therefore, failure to dispose of the steam generators now is equivalent to adding $42 million ($54M - $12M) in current dollars to future decommissioning expenses. However, permitting the use of the funds now removes that potential increased liability. This provides additional assurance that the trust fund will remain viable at the time of decommissioning. If the extension to the license is granted, the cost for future disposal would be even more dramatic. The argument to dispose of the generators now would have been strengthened.

This argument was accepted by the state regulators without any questions or comments.

An exemption to remove the funds from the decommissioning trusts was sent to the NRC, but after numerous discussions with the NRC, the exemption request was withdrawn. The NRC's problem with the concept was that they did not want to create a precedent on dealing with trust funds for operating plants and that if payments into the trust was stopped soon after the withdrawal, there could be a shortfall. The issue was governed by the fact that Cook Plant only had a commingled fund rather than segregated funds. In other words, all the money in the trust was designated for the one task of decommissioning. The NRC would not approve of removal of funds from the commingled funds. The trusts could also be set up as segregated funds with numerous accounts under the broad umbrella of decommissioning. For example, there could be accounts set up for radiological decommissioning, post-operation fuel management, or non-radiological decommissioning within the trust. Therefore, Cook Plant established a segregated account for steam generator disposal about two years prior to the project being started. It was funded by a small portion of our decommissioning payments that are made each year. Prior to the withdrawal, our decommissioning trust agreement required the NRC be notified. The NRC accepted the notice without question or comment, and the project was able to be financed.

Dose Earned Value

The Steam Generator Disposal Project dose was a majority of the non-outage dose received at Cook Plant during 2004. It was the one project area that received the most management oversight. To help trend dose, a new tool was used to monitor and report the dose to the plant's management.

Earned value is a project management technique that is used to determine how a project is progressing. It is more than just comparing the budget to the project plan. It is applied by breaking down the project to individual tasks, and then determining what percentage of the final project each task is worth. A cost estimate is then applied to each task to get what the total value should be. This should be equal to the total project cost minus the contingencies. As the tasks are completed the actual costs are compared to amount budgeted, and an earned value is calculated. For dose earned value the currency is mrem.

For the Cook Plant Steam Generator Disposal Project, there were 104 different tasks. Each task was assigned a dose and a percentage of the total job. When a task was completed, it was given a dose value for what that task was worth. This could be readily compared to the dose that was actually received. It is an analysis tool to determine if the project is ahead or behind the dose budget and what events are causing the difference.

Figure 1: Steam Generator Disposal – Dose Earned Value shows the progress over the month it that was needed to complete the onsite preparation work normalized on a percent basis. The graph shows a number of different analysis items. In the first week of the project (April 26, 2004 – May 1, 2004), the dose projection and the actual dose track very closely, but the dose earned value lags since there was a need to invest some dose to get some early work to completion. After May 1st, the dose earned value passes the actual dose and was under budget. Using the analysis tool and comparing the dose for the tasks, it could be seen that additional ALARA

techniques and lessons learned were being applied to save dose. Toward the end of the job, the actual dose rises at a steeper rate and eventually passes the dose earned value. By analyzing the data, the rise could actually be attributed to two things. First, the procedure to complete shipping surveys was changed between the time of the estimate and the actual survey. The surveys are a lot more comprehensive then they were in the past, and they required a lot more dose to complete. The other issue is that after the preparation work was completed, the generators were to be shipped out almost immediately. However, there were delays in getting the final piece of rail equipment, the caboose, so the generators were on site for about a week before they shipped out. During that week, routine radiation protection and security surveys were done resulting in more dose even though the work was considered completed.

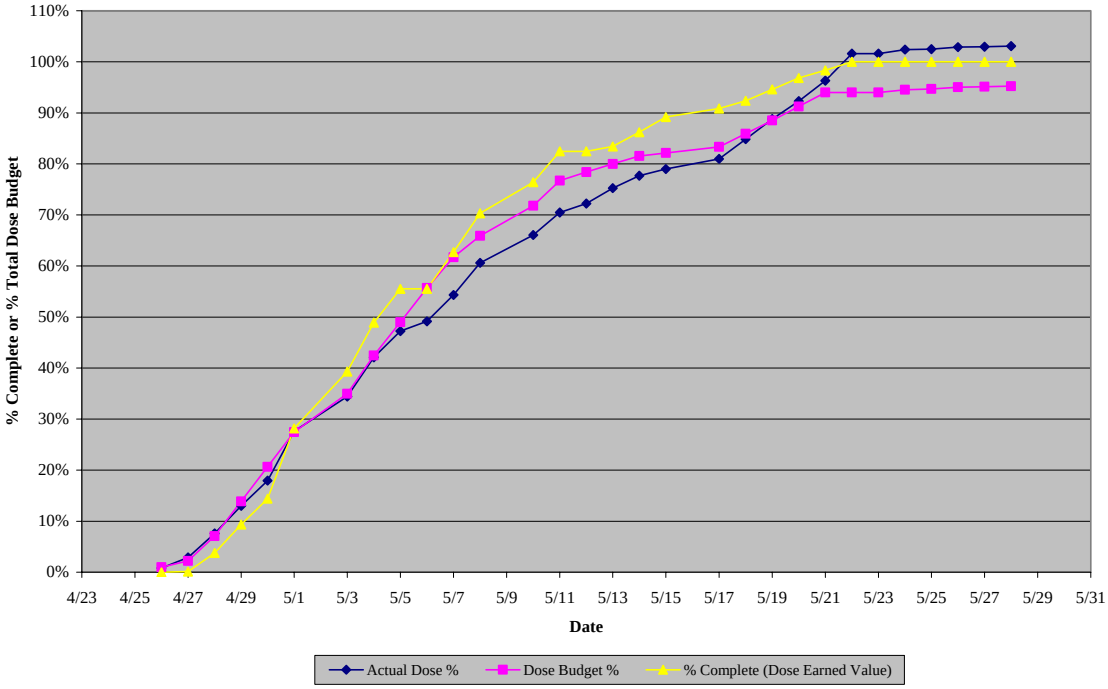

Fig. 1. Steam generator disposal – dose earned value

Dose earned value was an effective tool to track the project progress, to analysis deviations and to report the progress to management.

Transportation Issues

Transportation of large components is always a challenge, but Cook Plant was able to apply some lessons learned from a similar project at Cook Plant in 1999 and other large component shipments throughout the industry. Three issues were notable: the shielding and size of the transportation package, the routing of the generators and the DOT Review of our exemption request.

Cook Plant completed a similar project in 1998 with the disposal of the Unit 2 steam generators. Because of the width of the generators, a complex shield design with shifting saddles on the

generators was used. The generators were oversized and the shifting saddles allowed the generators to be moved on the railcars to make it past obstructions in bridges or tunnels or from passing traffic. For the 2004, project simplicity was the key. To make the transportation simple, the generators were trimmed to meet the width requirements. The trimming was done with a diamond wire saw. About 1.5 inches was trimmed off each side so that the generators would be less than the 14 feet prescribed by the rail companies. This made the shielding designs more simple, removed the requirements for shifting the load during transport and it saved a lot of dose. The new shielding design was a dog house design that was mounted to the railcar rather than attached to the generator. The shielding design can be seen in Figure 2.

Fig. 2. Steam generator shielding design

The choice of burial site was changed because of issues associated with the rail companies. Initially, the burial of the steam generators was to be at Barnwell. However, after the project was underway and contracts were signed it was determined that some of the rail bridges between Cook Plant and South Carolina would not allow something as heavy as the steam generators to cross. Barnwell was the destination of the generators in 1999, but since then some of the bridges were de-rated. Therefore, a new destination was needed, and the only one available was Envirocare.

The shipment of the generator required an exemption from the U.S. Department of Transportation, DOT. The exemption was to ship the generators unpackaged since the steam generator itself is stronger than any box it could be put into. The DOT had a new reviewer, and

he brought his own experiences and areas of focus to the review process. Two issues were of more significant concern than in the past. For the drop test requirements, additional modeling was needed and a supplemental report on the drop test was needed to be sent to the DOT. This was not a concern, but it added addition time pressures since it was not part of the original schedule. The reviewer also had a lot of concern over the pre-removal contamination levels of the generators. At Cook Plant, before the generators were removed or even cut, a coating was put onto the generators for contamination control. After the generators were removed and put into storage for four years, there was no evidence of contamination. However, the reviewer still wanted the records of contamination prior to coating. No simple report or collection of data existed, so numerous radiation protection records were collected, reviewed, summarized, and sent to the reviewer. In the end, the reviewer's requirements were met, and an exemption was issued for the shipment of the steam generators.

Project Risk Analysis

Project risk was approached from a more preventative viewpoint. Some of the lessons learned in operating a nuclear plant were applied to the planning in this project. Cook Plant uses the Look Ahead Process, a more comprehensive review of potential risks and operating experience to apply to a project. It required a detailed work package describing all the physical activities that were to happen for the project. Pre-job briefs were prepared and reviewed each day and before each major evolution. Extensive contingency plans were developed to deal with the risks such as safety risks, radiological and regulatory risks. The contingency plans created more proactive approach to remove the risk before it became an issue or to have a method to deal with the event if it did occur.

The project risk analysis required an exhaustive review of industry operating events for radiological shipments, for rail accidents, and a review of the rail companies safety and inspection programs. The process lead to a point where there was more confidence in the actions taken to prepare the generators for shipment. The process worked since there were no incidents during the project.

CONCLUSION

The project was a success. Figure 3 shows the generators at Envirocare. The generators were prepared and shipped from Cook Plant to Utah without any incidents during the preparation or transportation. The project was done on time and within budget. There were a number of lessons learned from the project. It was successfully financed from the decommissioning trust funds. The project dose was monitored and reported in a more effective way using dose earned value. The transportation challenges were overcome by keeping the designs simple and working with the rail companies and the regulators. And, the project risk was approached from a more comprehensive and proactive standpoint leading to a safe and successful burial of the steam generators.

Fig. 3. Cook Plant steam generators at Envirocare