Packaging, Transportation and Recycling of NPP Condenser Modules- #12262

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ABSTRACT:

Perma-Fix was awarded contract from Energy Northwest for the packaging, transportation and disposition of the condenser modules, water boxes and miscellaneous metal, combustibles and water generated during the 2011 condenser replacement outage at the Columbia Generating Station. The work scope was to package the water boxes and condenser modules as they were removed from the facility and transfer them to the Perma-Fix Northwest facility for processing, recycle of metals and disposition. The condenser components were oversized and overweight (the condenser modules weighed ~102,058 kg [225,000 lb]) which required special equipment for loading and transport. Additional debris waste was packaged in intermodals and IP-1 boxes for transport.

A waste management plan was developed to minimize the generation of virtually any waste requiring landfill disposal. The Perma-Fix Northwest facility was modified to accommodate the ~15m [50-ft] long condenser modules and equipment was designed and manufactured to complete the disassembly, decontamination and release survey. The condenser modules are currently undergoing processing for free release to a local metal recycler. Over three millions pounds of metal will be recycled and over 95% of the waste generated during this outage will not require land disposal.

There were several elements of this project that needed to be addressed during the preparation for this outage and the subsequent packaging, transportation and processing.

- Staffing the project to support 24/7 generation of large components and other wastes.
- The design and manufacture of the soft-sided shipping containers for the condenser modules that measured ~15m X 4m X 3m [50ft X13ft X10ft] and weighed ~102,058 kg [225,000 lbs]
- Developing a methodology for loading the modules into the shipping containers.
- Obtaining a transport vehicle for the modules.
- Designing and modifying the processing facility.
- Movement of the modules at the processing facility.

If any of these issues were not adequately resolved prior to the start of the outage, costly delays would result and the re-start of the power plant could be impacted.

The main focus of this project was to find successful methods for keeping this material out of the landfills and preserving the natural resources. In addition, this operation provided a significant cost savings to the public utility by minimizing landfill disposal. The onsite portion of the project has been completed without impact to the overall

outage schedule. By the date of presentation, the majority of the waste from the condenser replacement project will have been processed and recycled.

INTRODUCTION:

Perma-Fix Environmental entered into a contract with Energy Northwest to manage all of the metal, debris and wash water generated during the condenser replacement at the Columbia Generating Station (CGS). This was a two part project that consisted of on-site (at CGS) waste packaging of debris and oversized condenser components and off-site waste processing at Perma-Fix Northwest. The main condenser modules and water boxes exceeded the DOT requirements based on physical dimensions and/or weight. Each condenser module was ~15m [50 ft] long and weighed ~102,058 kg [225,000 lb] and the water boxes were ~4m [13 ft] tall and weighed ~10,886 kg [24,000 lb]. The most challenging part of the on-site work was the handling and packaging of the oversized components and transport to the Perma-Fix Northwest facility. The work at CGS has completed. The processing of the condenser modules, incineration of debris and decontamination of the scrap metal is on-going. The project is currently scheduled to complete in June of 2012.

PROJECT SCOPE:

The scope of this project included technical support to Energy Northwest to assist in completing the required facility design modifications necessary to accommodate packaging the condenser modules. In addition, the design and fabrication of soft-sided containers for the large components and the personnel deployment to characterize, package and transport the condenser modules, water boxes, debris, contaminated scrap metal and wash water was also included in the work scope. The characterization and packaging that was performed ensured the Waste Acceptance Criteria (Ref 4) for the waste processing facility and Department of Transportation requirements were met.

Prior to the start of the outage, waste processing facility modifications were performed to accommodate the storage and processing of the oversized condenser components. Processing included size reduction/disassembly, decontamination and survey for free release of the metal components. The remaining material generated during the condenser replacement will be burned in the Bulk Processing Unit (BPU) and any metal that cannot be decontaminated is sent to the US Ecology Washington Low-Level Radioactive Waste (LLRW) site for disposal.

ON-SITE OPERATIONS:

The on-site waste management operations consisted of waste characterization, packaging and transportation. Each waste stream had unique considerations, i.e. weight, size, form, etc. that had to be addressed during the project. The large component waste population consisted of twelve condenser modules and nine water boxes. Each condenser module was approximately 3m wide X 3.5m tall X 15m long [10ft wide X 12ft tall X 50ft long] and weighed approximately 102,058 kg [225,000 lb].

The inlet and outlet water boxes were 3.4m wide X 4.9m tall X 7.3m long [11ft wide X 16ft tall X 24ft long] and the intermediate water boxes were 3.7m wide X 2.1m tall X 7.3m long [12ft wide X 7ft tall X 24ft long]. Each water box weighted approximately 10,886 kg [24,000 lb].

The remaining waste population consisted of structural steel that was removed to allow for removal of the condenser modules, liquid waste from hot well and condenser module washing and general debris (PPE, wood, plastic, etc.). The total weight of each waste stream is provided below:

- Condenser Modules - 1,197,484 kg [2,640,000 lb]
- Water Boxes - 94,935 kg [209,295 lb]
- Scrap Metal - 270,489 kg [596,327 lb]
- Dry Active Waste - 84,640 kg [186,600 lb]
- Liquid Waste - 24,703 kg [54,460 lb]

Scrap metal and debris waste was generated throughout the project while the condenser modules and water boxes were removed in specific sequences where timing and coordination were critical. Holes were cut in both ends of the condenser shield walls to allow for removal of the large condenser components. The first items to be removed were the outlet water boxes. These components were essentially clean from a radiological prospective but were packaged in IP-1 Soft Sided containers for transport to the waste processing facility where the free-release survey was performed. The outlet water boxes were over sized but not over weight and could be transported on a standard low-boy trailer. Lifting trunions were installed on each water box so it could be picked with a crane for loading onto the trailer. The trunions were also used to chain the water box to the trailer. The inlet water boxes could not be removed from the building intact and after removal from the condenser; they were cut into sections and packaged into intermodal shipping containers for transport to the waste processing facility. The intermediate water boxes were removed after the six condenser modules were removed. They were also packaged in the soft-sided IP-1 containers for transport to the waste processing facility.

The condenser modules provided the greatest material handling challenge due to the physical size and weight and because of the radiological contamination on the tubes. The modules were rolled out of the condenser shell two at a time. The upper and lower modules were cut apart with torches, separated and then packaged individually. Each module was wrapped in plastic and surveyed to ensure the outer wrapping was free of contamination. The module was then rolled from the Turbine Building to the Turbine Handling Building (THB)-a temporary structure erected for this project. The module was then packaged into a soft sided IP-1 container in preparation for transport off-site. Due to the size and weight of the modules, a specialty conveyance was used to transport the modules from the THB to the gantry crane for trans-loading. The conveyance is a 10 axle trailer powered either by an electric prime mover or a diesel prime mover and is typically called a Goldhofer, which is the manufacturer. Once the module was transported to the gantry crane, it is moved from the electric powered Goldhofer to the

Diesel powered Goldhofer in order to be transported to the waste processing facility. Figure 1 provides the sequence of these operations, including waste packaging in the THB, on-site transport and the trans-loading at the gantry crane.

Fig. 1 Condenser Packaging, On-Site Transport and Trans-Loading in Preparation for Transport

The scrap metal, debris waste and liquid waste were more routine packaging and characterization operations. The waste was packaged in sea-land containers, intermodal containers B-25 boxes and 946 L [250 gal] totes as appropriate. Characterization was performed using contamination and dose rate surveys and the data was used both for verification of Waste Acceptance Criteria (Ref 4) compliance and development of shipping papers.

TRANSPORTATION:

All waste was transported in accordance with the Department of Transportation regulations, 49CFR (Ref 1). The over sized payloads required special permits based on the weight, height and/or width. Permit restrictions included time of day, escorts and markings. No shipments could be made during shift change hours, escort vehicles were required in front and behind the trailer from ENW to the waste processing facility and the trailer was marked “Oversized). The normal scrap metal, debris and liquid waste shipments were not permitted and were fully compliant with 49CFR (Ref 1). Over the duration of the condenser replacement project, a total of 72 shipments were completed without incident.

OFF-SITE WASTE MANAGEMENT FACILITY OPERATIONS:

The initial off-site operations included the waste management facility modifications that were required to allow the condenser modules to be brought into the facility, disassembled, size reduced and decontaminated prior to recycling.

Specific elements of the construction and modification activities included:

- Installation of a concrete pad to stage the condenser modules
- Enlarging the facility access doors
- Installation of a ~15m [50-ft] air lock
- HVAC system reconfiguration
- Installation of condenser tube removal equipment
- Installation of tube decontamination equipment
- Installation of tube counting equipment
- Installation of shield blocks

Several of these modifications can be seen in figure-2. These include the concrete storage pad and air lock, shield blocks and condenser module disassembly equipment.

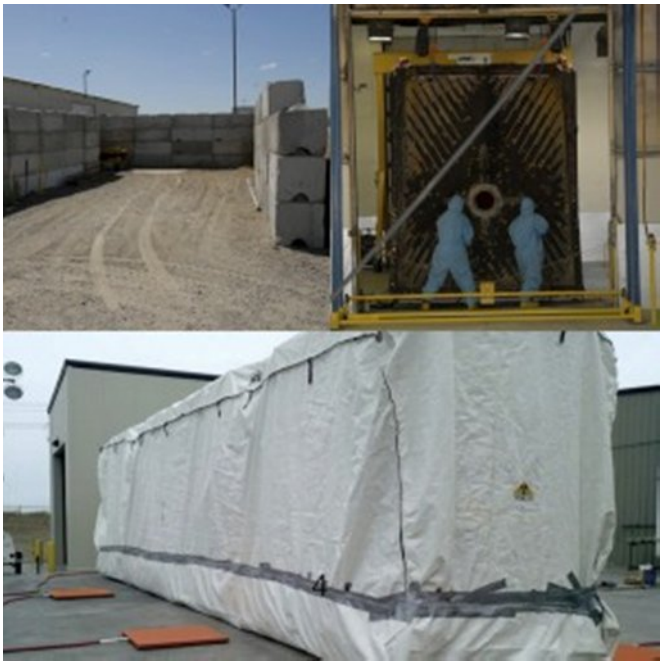

Fig.-2 Waste Processing Facility Modifications

With the facility modifications completed, the condenser components and waste materials were delivered to the waste management facility for processing. The condenser modules are the biggest challenge due to the size and weight. Each module is moved into the facility using air pallets, shown in figure-2. The condenser module disassembly begins by cutting the tubes behind the tube sheet at both ends of the module. This allows the tubes to be pulled through the tube support plates for processing. A hydraulic winch is connected to a group of up to five tubes which are then pulled from the support plates across support stands help keep the tubes as straight as possible. The tubes need to be straight in order to be processed through the

decontamination and counting equipment. The tubes are cut into 3.7m [12 foot] sections for ease of handling during decontamination and survey for free release. Each tube is polished in an abrasive cleaning system to remove any contamination and then placed in an automated counter to verify decontamination is complete and the free release criteria is met.

Figure-3 illustrates the module disassembly process, decontamination and processing. Specific activities include tube cutting to remove the tube sheets, tubes ready for decontamination, tube counting to ensure the free release criteria is met and tubes ready for transport to the recycler.

Fig.-3 Condenser Tube Disassembly and Processing

Each tube scanned through an automated counting system to verify limits identified in Table 1 are met. These limits are contained the waste processing facility's Radiological Materials License (Ref 3) issued by the State of Washington. The limits specified are in accordance with the Regulatory Guide 1.86 (Ref 2) which is issued by the Nuclear Regulatory Commission. As a quality control check, a twelve-inch section is removed from ten percent of the clean tubes, split open and then hand surveyed to verify the accuracy of the automated counting system and ensure that the release criteria are met.

TABLE I

ACCEPTABLE SURFACE CONTAMINATION RELEASE LEVELS

Contamination	Removable	Total (Fixed plus removable)
Beta-Gamma	16.66 Bq/100 cm^2 (1,000 dpm/100 cm^2)	83.33 Bq/100 cm^2 (5,000 dpm/100 cm^2)
Alpha	0.33 Bq/100 cm^2 (20 dpm/100 cm^2)	1.66 Bq/100 cm^2 (100 dpm/100 cm^2)
Sr-90	3.33 Bq/100 cm^2 (200 dpm/100 cm^2)	16.66 Bq/100 cm cm^2 (1000 dpm/100 cm^2)

All other waste material was processed in a manner to minimize off site disposal. The debris waste and liquid waste was processed in the BPU so that only the residual ash required disposal. The structural steel scrap metal is still being decontaminated and surveyed for release to the recycler.

SUMMARY:

The goals for this project included helping Energy Northwest maintain the outage schedule, package and characterize waste compliantly, perform transportation activities in compliance with 49CFR (Ref-1), and minimize the waste disposal volume. During this condenser replacement project, over three millions pounds of waste was generated, packaged, characterized and transported without injury or incident. It is anticipated that 95% of the waste generated during this project will not require landfill disposal. All of the waste is scheduled to be processed, decontaminated and recycled by
June of 2012

REFERENCES:

1. 49CFR, *Transportation* (Code of Federal Regulations Title 49, Parts 100 through 199, Pipeline and Hazardous Materials Safety Administration, Department of Transportation, 1-10-12)

2. Regulatory Guide 1.86, *Termination of Operating Licenses for Nuclear Reactors, June 1974.*

3. Perma-Fix Northwest, *Low Level Radiological Materials License, WN-I0393-1, Amendment 35, 10-14-2010*

4. Perma-Fix Northwest, *Low-Level Radioactive Waste Acceptance Guidelines, Rev. 4, 12-4-2007*