Freestanding Liquids in a Resin Disposal Container – How Unidentified Legacy Issues and Decisions Can Affect Current Radwaste Processing Activities-16605

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ABSTRACT

On Monday, October 27, 2014 a radwaste and transportation specialist was informed that a condensate filter demineralizer (CFD) radwaste disposal container exceeded the radioactive waste disposal facility freestanding liquid requirement for acceptance for disposal (limit is 0.5% of waste volume or 5.6 gallons); 8.5 gallons was measured). As a result, on October 28, the plant was informed that our disposal site use permit was suspended, pending a point-of-origin inspection by the agreement state regulatory authority.

This paper details the investigation conducted to identify causes, especially legacy issues one may not necessarily identify, and documents corrective actions taken to assure similar issues are not repeated.

INTRODUCTION

For a number of years, issues associated with dewatering condensate filter demineralizer resins had been documented. This was attributed with construction of disposal container filter internals being damaged in transit, resulting in frequent leak-by of resin into the dewatering liquid waste stream. The discussion below addresses this issue and others, which were identified and corrected during the investigation. This paper details the investigation conducted to identify causes, especially legacy issues one may not necessarily identify, documents corrective actions taken to assure similar issues are not repeated, and is a reminder to others to dig deeper to identify issues.

DISCUSSION

Energy Northwest, Columbia Generating Station is an 1100 Mw boiling water reactor plant located in Richland, WA.

Leading up freestanding liquid issue, in 2010 the plant's main condenser was replaced. Subsequent to the replacement and plant operation, higher concentrations of iron were measured in the main condenser hotwell and condensate filter demineralizer resin waste disposal liners (CFD liners). This was identified by changes in color (brown, orange, red, black, depending on the oxidation state for the iron), as viewed in the dewatering system sight glass on the dewatering skid. Additionally, depending on particle sizes, the iron had a tendency to pass through dewatering filters and become visible in the sight glass.

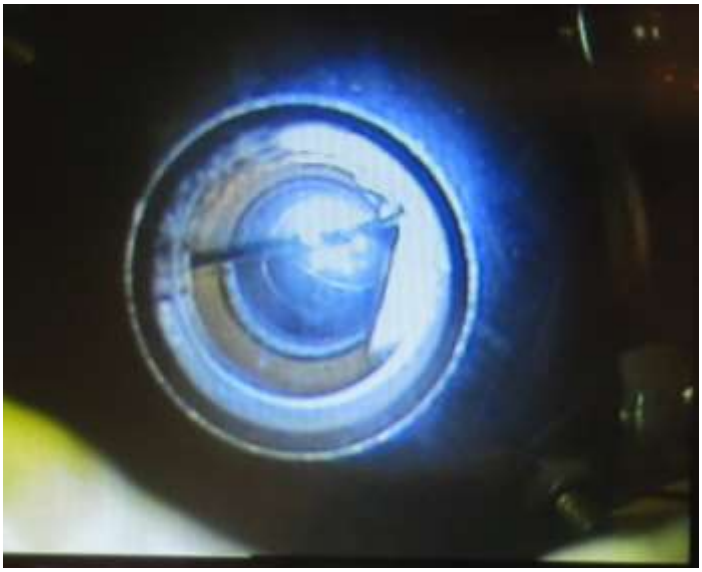

Fig. 1. Dewatering System Sight Glass

On 12/15/2011, a condition report (CR) was written regarding high iron concentrations in the hotwell; however, the evaluation focused on a reactor fuels concern and potential fuel issues.

When issues started to become more prevalent in late 2011 and early 2012, a radioactive waste and transportation specialist misdiagnosed discolored water in the resin drying system sight glass as a failed filter lateral (e.g., broken piping, failed filters, etc.) and not that iron was present. At that time, the plant dewatering system operator was directed to stop using the selected set of dewatering filter laterals, which were misdiagnosed as damaged. This decision had an adverse effect on resin drying time, as well as the ability to assure the processed container met the disposal facility's waste acceptance criteria.

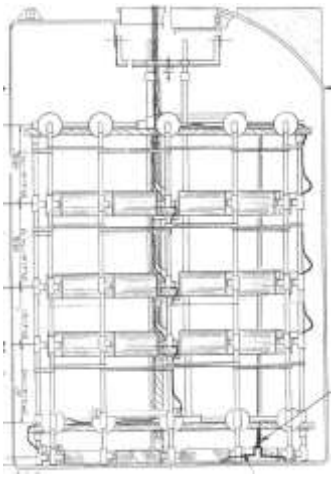

Fig. 2. Cut-Away of Resin Liner used for CFD Powdex

On 05/29/14, another CR was written which once again misdiagnosed the presence of iron vs. a physical failure of the CFD liner internals. As a result of this CR, the disposal container supplier was asked to evaluate their material condition and make

necessary changes to their process. The vendor made changes, which had no effect on how the filters operated within CFD liners. This thought process continued until the freestanding liquid issue associated with CFD Liner 14-033-L occurred.

On 08/11/2014, the dewatering and drying process was completed, per plant procedures, on a condensate filter demineralizer radioactive waste resin liner 14-033-L. On 10/09/2014 shipment 14-32 was transported to and received by the commercial low-level radioactive waste disposal site. This shipment contained liner 14-033-L, along with four similar liners.

Upon receipt, the State Compliance Inspector selected one container, at random, for inspection. 14-032 was selected. A hole was drilled in the side of the container near the base and the presence of liquid was found.

Fig. 3. Liner 14-033-L Freestanding Liquid Test

As a consequence of the freestanding liquid exceeding waste acceptance criteria, the burial site use permit was suspended, pending an investigation.

Authorization was obtained from the disposal facility and state regulator to have all containers on the shipment returned along with the commitment to verify compliance prior to return for disposal

At a minimum, a dewatering verification filter would be driven to the bottom of each container and suction applied to verify no liquids were present prior to returning the containers to the disposal facility.

Investigation Description and Results

The investigation started to along the line that the installation process for filters and piping installed in the resin processing and disposal liners continued to be flawed, which allowed resin to flow past the filters, and be viewed in the dewatering sight glass. The operating procedure for the resin drying system stated:

> During resin dewatering operations the dewatering pump discharge sight glass should be periodically monitored for resin liner filter failure. The water traveling through the sight glass will appear milky if a filter failure occurs. If resin liner filter failure occurs, discontinue filling operation and contact the responsible Radwaste and Transportation Specialist for instructions.

In discussion with personnel who operated the resin drying system, they were told by a previous Radioactive Waste and Transportation Specialist (RWTS) that any discoloration in the sight glass was an indication of filter lateral failure and the specific set of filter laterals should be isolated. Further questioning revealed that at no time was a milky color viewed in the sight glass. They did see black, brown, red and orange. These colors are generally associated with iron oxide and the specific color is dependent of the oxidation state of the iron.

> It was concluded the problem was misdiagnosed (contributing cause. A subsequent resin processing evolution revealed that, if dewatering was continued past the discovery of a color, other than milky in the sight glass, the color cleared up in a short period of time, when the particular set of filter laterals became coated with CFD resin. This in turn indicated that all filter laterals being available during dewatering process significantly increased the ability to successfully dewater and dry the container. This was confirmed by the vendor.

A subsequent discussion with the supplier revealed another piece of the puzzle. The procedure used for resin processing was reviewed in detail. It was noted during the review that, during dewatering of the liner, all filter laterals, including the lowest set (on the bottom of the liner) were utilized during the entire dewatering process.

When asked about this, the vendor stated, per their procedure, the lowest set of dewatering filter laterals is used for a five-minute period to allow a pre-coat with resin and then isolated until the end of the dewatering process to provide filter capacity availability. When this process to save the lowest set of filter laterals until the end was implemented, it proved to be successful.

As an added measure of insurance, a dewatering verification filter was added to the bottom of each disposal container. Upon completion of the resin drying process, a diaphragm pump was hooked up to the dewatering verification filter, directed to a container, and a suction taken for a minimum of five minutes. If no liquid was viewed in the container, the disposal container was deemed to be dry. If liquid was viewed, the container was required to sit for a minimum of one hour before the dewatering verification was again performed. This sequence was repeated until no liquid was observed, which assured the liner met burial site waste acceptance criteria. This dewatering verification was completed for all containers on Shipment 14-32, which included container 14-033-L. An example of the results is depicted below:

Fig. 4. Dewatered and Dried Condensate Filter Demineralizer Resin

In the figure, above, a pipe was pushed to the bottom of the liner through the Powdex resin and the dewatering filter was then placed in the hole to the bottom of liner 14-048-L (close-up). It was easy to see that no liquid was present in the bottom of the hole. Verification filter placed in bottom and pumped to verify no freestanding liquid is present.

Fig. 5. Dewatering Verification Filter, inserted into a filled and dried CFD resin liner.

This liner was already processed (full). Note the cracking of the resin and the deep, orange rust color.

A search of procedure revision history was conducted and revealed the resin dewatering and drying procedure was revised in 1999 to remove the requirement to isolate the lowest set of filters. Due to the fact that iron was not prevalent in the hotwell/CFDs, there was no negative effect to this revision. In fact, the dewatering process was faster due to the increased filtration capacity. It was not until after the

condenser replacement project in 2010 that discolored dewatering liquid in the sight glass started to appear.

This was identified as the primary cause of the problem. When the lowest set of filter laterals was isolated per the vendor procedure and filtration capacity saved until the end of the dewatering process, successful dewatering has been achieved.

The vendor went on to state the RWTS, at the time was reminded of this vendor procedure requirement to isolate the lowest set of filter laterals until the end of the dewatering process, but chose not to act.

Actions Taken to Bring Activities into Full Compliance

The plant procedure (Operation of the Pacific Nuclear Resin Drying System) was revised to:

- Clarify the description and requirements for when discoloration is observed in the dewatering sight glass. Improved guidance for the dewatering system operator is provided to indicate when there may be issues with a set of dewatering laterals. For example, the presence of a milky color is the only indication provided, where powdered ion exchange resin may be passing through the filters and reaching the dewatered liquid stream.

- Use the lowest set of dewatering filter laterals for five minutes, then isolate them until the end of the dewatering process, where they are used for dewatering completion

- Add a dewatering verification filter to each CFD resin liner filled in the future, to be used subsequent to drying as the final verification each liner is dry and meets the disposal facility waste acceptance criteria.

An example of the dewatering verification filters used is provided below:

Fig. 6. Examples of Dewatering Verification Filters, Placed into Unused Condensate Filter Demineralizer Liners

CONCLUSIONS

Actions taken to prevent recurrence have been successful. The five containers shipped, including 14-033, were verified dewatered and dried to comply with the disposal facility waste acceptance criteria. Although discoloration is viewed in the dewatering sight glass, milky color has not been viewed and the dewatering process has continued. Isolation of the lowest set of dewatering filter laterals for use at the end of the dewatering process has worked well and use of the dewatering verification filters has provided evidence that each CRF resin liner was successfully dewatered and dried.

To date, 37 CFD liners have been successfully dewatered, dried, verified, transported to the disposal facility, and buried without incident.

If similar issues are encountered, you should keep an open mind regarding causes including, but not limited to discussions with your vendor and conduct a search of past procedure revisions to gain additional insight regarding program/procedure changes and how they could have an effect on issues, which occur today.

REFERENCES

1. 1. PPM 11.2.23.19, Operation of Pacific Nuclear Resin Drying System, rev 13
2. Nuclear Packaging Instruction Manual, NUPAC Resin Drying System, 02-453-00, rev 0 (05/23/01)
3. US Ecology Radioactive Materials License, #WN-I019-2, rev 40 (02/12/14, expires 12/31/18)