MODIFICATION TO SEGREGATE HIGH-ACTIVITY AND LOW-ACTIVITY RESIN AT BRAIDWOOD STATION

James R. Thuot, John R. Petro
Commonwealth Edison Co.
Braidwood, Illinois 60407

Hoda S. Elguindy
Sargent & Lundy
Chicago, Illinois 60603

ABSTRACT

This paper discusses recent modifications made to the radwaste system at Commonwealth Edison Company's Braidwood Station to segregate low and high activity resins. The segregation will allow Braidwood Station to process and ship the low activity resin without the need for the long storage time required before shipment for radioactive decay of high activity resin shipments. It will also reduce the transportation and burial costs for spent resin shipments. The modifications made extensive use of the existing equipment, simplified the system operation, and improved the accessibility of equipment for maintenance.

INTRODUCTION

This paper describes a recent modification made to the radwaste system at Commonwealth Edison Company's Braidwood Station to provide a tank dedicated to the storage of low-activity spent resin, thereby allowing the existing spent-resin storage tank to be dedicated to the storage of high-activity spent resin. The existing spent-resin tank was originally designed for the storage of spent resin from the primary system, such as that from the primary coolant demineralizers, and of low-activity spent resin from the steam generator blowdown and radwaste demineralizers.

Segregating the high-activity and low-activity resin will allow Braidwood Station to process and ship the low-activity resin without the need for the long storage time required for the high-activity resin to decay before shipment. Also, because the low-activity spent resin constitutes a large fraction of the total spent resin produced at the station, segregation is expected to minimize the number of high-activity resin shipments and, consequently, the transportation and burial costs for the spent-resin shipments from Braidwood Station.

The Braidwood Station radwaste system had been previously modified to process evaporator concentrates in a fluidized-bed-dryer volume reduction (VR) system. Because of this modification, it is possible to bypass the existing concentrates holding tank and transfer the evaporator concentrates directly to the VR waste liquor storage tanks. Since the concentrates holding tank was no longer required for the storage of concentrates, it was modified to serve as a storage tank for low-activity spent resin. The existing spent-resin tank, which was already located in a heavily shielded cubicle, could then be dedicated for the storage of only high-activity resins.

The associated piping, valving, pumping and logic modifications were designed to achieve the required system operation with minimum physical change. The modification made extensive use of the existing equipment, improved the accessibility of equipment for maintenance, and simplified the system's operation.

ORIGINAL SYSTEM DESIGN

In the original system design, the concentrated wastes from the three radwaste evaporators and the two boric acid concentrators were all routed to a common header that fed the concentrates holding tank. The concentrated wastes were either pumped from the concentrated waste tank to a cement solidification system or through a backflushable strainer to the fluidized-bed-dryer feed tanks. The original system, with the new modifications, is shown in Fig. 1.

SYSTEM MODIFICATIONS SUMMARY

The modifications to the system included the following changes:

- Adding a booster pump to the evaporator concentrates header and rerouting the piping so as to bypass the concentrates holding tank;
- Modifying the internals of the concentrates holding tank to convert it to a low-activity spent-resin storage tank;
- Extending the spent-resin sluicing line from the existing spent-resin tank to the new low-activity spent-resin tank;
- Adding the appropriate valves to allow spent resin that normally goes to radwaste to be sluiced from any of the aforementioned demineralizers to either the high-activity or low-activity spent-resin tanks;
- Replacing the centrifugal pumps used to transfer high-activity spent resin with a progressive cavity pump and installing a new progressive cavity pump to be used with the low-activity resin tank.

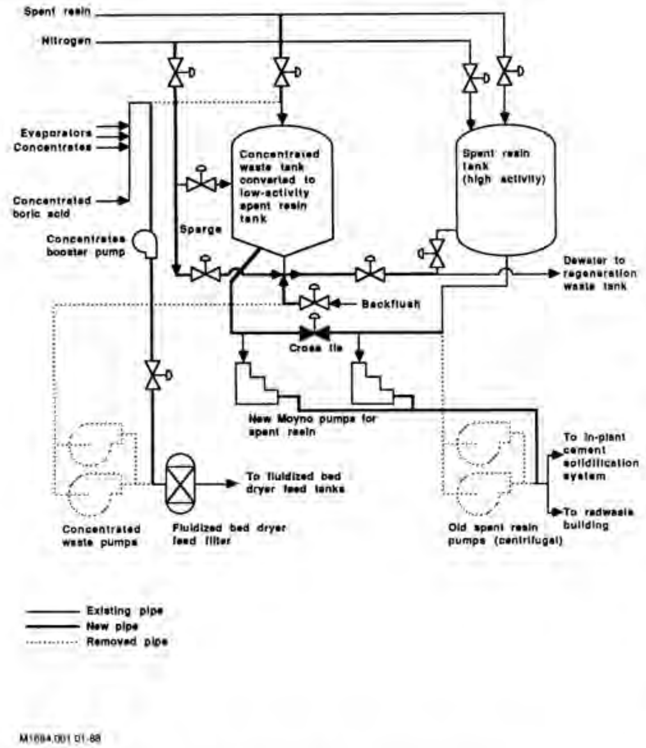

Fig. 1. Simplified Piping Diagram.

DESCRIPTION OF NEW SYSTEM

The sluiced resin from each of the demineralizers will be directed to either the new low-activity resin storage tank or the high-activity resin storage tank based on the measured activity level of the spent resin in each demineralizer. The segregation of the high-activity and low-activity resin will be done administratively (i.e., no interlocks have been added). The spent resin in the new low-activity spent-resin storage tank can then be discharged to either high integrity containers (HICs) or a mobile solidification system for disposal. The high-activity resin will be stored for decay in the high-activity spent-resin storage tank (the original spent-resin tank) for relatively longer periods of time before being packaged and shipped offsite.

Because the concentrates holding tank was converted to a spent-resin tank, the boric acid concentrates and the radwaste concentrates are being transferred to the VR system feed tanks via a booster pump. The centrifugal pumps previously used to pump concentrates have been replaced by a new progressive cavity pump designed to handle the low-activity spent resin. This modification improves the access to and reduces the requirement for maintenance in the pump room.

Concentrates Holding Tank Modifications

The modification to convert the concentrates holding tank required the removal of some of the tank's accessories and the addition of new features required for dewatering, nitrogen sparging (for mixing), and transferring of spent resin. The eductors installed in the concentrates holding tank were removed. A new filter assembly, designed to achieve a dewatering rate sufficient to *completely dewater* the new spent-resin tank in less than 4 hours, was installed in the tank bottom. The filters were also designed to agitate the resin in the bottom portion of the tank when nitrogen sparging gas is passed through them. Water connections were provided to backflush the filters. The pressure of the nitrogen and water lines used for sparging and backflushing, respectively, is adjusted by pressure-regulating valves to protect the filter septa and achieve the intended service. A simplified drawing of the new spent-resin tank, which indicates the filter locations, is shown on Fig. 2. The porous metal type has a nominal removal rating of solids in liquids of 17μm.

A new plate was also installed in the tank's bottom to provide a sloped bottom instead of the existing conical bottom (see Fig. 2). A stress analysis of the new tank bottom, including plate location, angle, and material welding, was performed to ensure the integrity and reliability of the tank. The tank was also hydraulically tested to be qualified as a pressure vessel. An instrument for the detection of air/liquid and liquid/resin interface level was added in the new low-activity spent-resin storage tank. The instrument is a

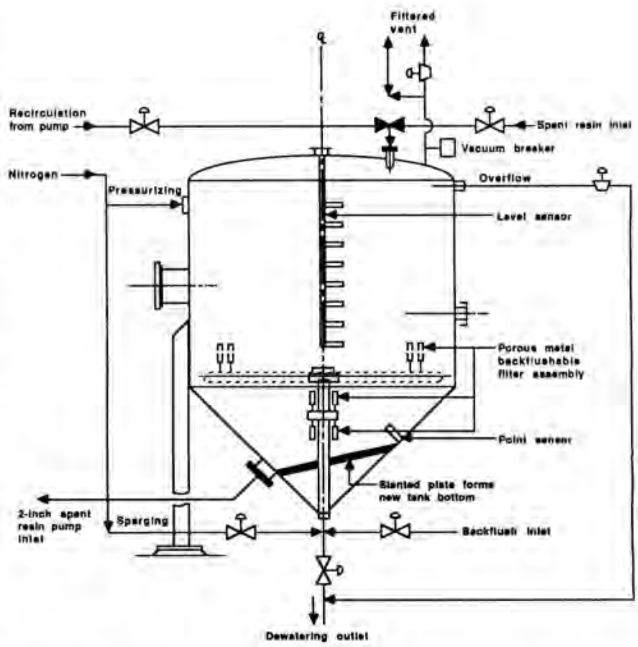

Fig. 2. Concentrate Holding Tank Converted to Spent Resin Tank.

multiple-point sensor that detects the interface level based on the distinct difference in thermal conductivity between air, liquid, and solid (resin) phases.

New Spent-Resin Tank Operation

The fill and discharge system for the low-activity spent-resin storage tank has been designed to provide semi-automatic operation. The modes of operation include fill, dewater, backflush, sparge, discharge, recirculate, flush, and standby. Each mode of operation can be initiated by the operator via a pushbutton on the radwaste control panel, which will align the appropriate valves for each mode. Manual overrides have been provided to allow more flexibility of operation while appropriate interlocks have been provided to ensure safe operation of system equipment.

Before operation of the low-activity spent-resin tank, all the associated valves are in the standby mode. In this mode, all valves are returned to their "fail safe" condition. In particular, the tank vent and overflow valves are open in this mode. The system returns to the standby mode of operation after each of the other modes of operation and if an abnormal condition arises. In the fill mode, the inlet valve for spent-resin slurry opens and the fill process continues until the water/resin mixture reaches the high-level sensor in the tank. After allowing the resin beads to settle while the tank systems are in the standby mode, the dewatering mode is initiated by a pushbutton. During this mode, the tank is isolated and pressurized with nitrogen gas to a pressure of approximately 5 psig (34.5 kPa). A lighted display on the radwaste control panel that shows the liquid and resin levels in the tank can be continuously monitored during the dewatering process. Once the water level reaches the point sensor directly above the point sensor that indicates the presence of resin, the dewatering process is terminated and the tank pressure returns to atmospheric pressure by entering the standby mode. The gas in the tank vents to the plant's filtered vent system.

When initiating the backflush mode, the resin sludge that collects on the dewatering filter septums is backflushed with short burst of 60-psig (414-kPa) primary water. The system then returns to the standby mode.

If the resin level in the tank (shown on lighted display) is sufficiently high to allow discharge, a recirculation and sampling mode can be initiated to obtain a representative sample. If the sample is found to be suitable for discharge, the tank can be sparged with nitrogen. During the sparging mode, nitrogen will flow through the dewatering filters to agitate the resin bed and provide a free-flowing slurry prior to discharge.

After sparging, the resin slurry can be discharged through the tank side opening by initiating the discharge mode. Once the slurry level reaches the low-level sensor installed near the tank's bottom, the flush mode is initiated to clean the pipes connecting the tank with the mobile vendor's tank or HIC in the truckbay. When the vendor's tank or HIC becomes full during the discharge or flush mode, the vendor will open the return valve to recirculate the liquid back to the appropriate spent-resin tank. Appropriate interlocks have been provided in the system design to prevent any possible mix between the high- and low-activity resin during the resin transfer operation to or from either of the two spent-resin tanks.

This spent-resin handling system has been installed and the prestartup testing of the system is scheduled for the spring of 1988.

CONCLUSION

The recent modification made to the radwaste system at Commonwealth Edison Company's Braidwood Station will provide a tank dedicated to the storage of low-activity spent resin and one dedicated to the storage of high-activity spent resin. The modification made extensive use of existing equipment, improved the accessibility of equipment for maintenance, and simplified the system's operation.

Segregating the high-activity and low-activity resin will allow Braidwood Station to process and ship the low-activity resin without the need for the long storage time required before shipment for radioactive decay of the high-activity resin. Also, segregation is expected to minimize the number of high-activity resin shipments and reduce the transportation and burial costs for the spent-resin shipments from Braidwood Station.