Lessons Learned – New Resin Processing System Selection, Procurement, Delivery, Set-up, Training, and Operation

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ABSTRACT

Energy Northwest's first resin dewatering and drying system was purchased in 1989. Although the system functions acceptably, parts are no longer available and containers are no longer off-the shelf items, which require special manufacturing, thus higher cost, as compared to those used by many plants today. The decision was made to procure a new resin processing system [Self-Engaging Rapid Dewatering System, or SERDS). This paper provides lessons learned regarding each aspect of pre-planning, to procurement, acceptance testing, procedure development, and operation, including challenges as well as successes, which could help others in their decision making when contemplating procurement of a similar system.

INTRODUCTION

The process of replacing the Pacific Nuclear resin drying system (RDS) started in July 2014. Replacement was necessary as spare parts were no longer available, and the station did not want to chance reliance on a 35 year-old system. Finally, the decision to proceed with the procurement of SERDS occurred in July 2014. There were many positive attributes with SERDS, including, but not limited to a projected one rem per year dose savings due to the remote fill head, cost savings associated with disposal containers, improved controls and operation, and similar operating principles, as compared to the dated Pacific Nuclear resin drying system (RDS. The following discussion includes procurement challenges, a long lead time for construction of the system, factory acceptance testing, timing associated with delivery, and procedure issues. Despite all of that, SERDS is currently operating as expected, without issue.

DISCUSSION

Procurement Activities

The plant was given the option whether to purchase SERDS or long-term lease SERDS. The vendor was very supportive in providing a lease-purchase option, where a portion of the first 12 month's lease payments would go towards purchase (financial details are between you and the vendor). This was very attractive to station management; however, we are eight months into the lease and funds are still unavailable to purchase SERDS.

Procurement of SERDS will need to include:

- A vendor technical services representative at your facility for up to four weeks in order to set up SERDS, conduct pre-operational testing, and staff training, as we have personnel who are trained in RDS operations, but needed training on the differences and all operational aspects of the new system. This may not be necessary if you have contract vendor staff available on-site.
- Hard schedule for delivery – Our station was initially told there was a minimum six-month lead time for construction. We decided to pay an additional fee for guaranteed delivery with a set payback of the guarantee if delivery was late. Because there were construction delays, we recouped our entire fee for on-time delivery. As it turned out, we would have rather had the on-time delivery.
- Establish a contract schedule for obtaining all manuals, operating procedures, drawings (especially those, which provide dimensions/footprints of the skids), and training materials. We were quite surprised at the dimension of the drying skid, which was much larger than anticipated, as well as the cabinet, which houses the control panel and Iso-Lok sampler control box, and the air dryer.
- Include in the procurement a pre-construction meeting with the vendor's engineering and operations staff and construction contractor. This turned out to be more important than we could have imagined, as we did not do this. Two examples include: the dewatering pump is 'hidden' in the middle of the plant control skid (includes incoming resin isolation valve, sampler, and dewatering liquid back to the plant. The pump, from experience, is the weakest link in the entire system). The other is the crud trap, which is built into SERDS. There is a drain line located just downstream of the waste (resin) isolation valve which is located at the low point of the system. We worked with the vendor, post-delivery, to install a check valve to prevent resin from flowing the wrong way and figured out how to conduct a post transfer flush of this line to prevent resin build-up. This could/should have been prevented early in the construction phase.
- Require construction status updates on a contract-specified periodicity. If they fall behind, get involved in the discussion as to what your vendor is doing to get their vendor back on schedule.
- Ask that an additional monitor be included. During resin transfers, the SERDS comes configured to see only one of the three camera outputs at a time (inside the liner, the dewatering sight glass, and the drying demister tank water level sight glass). Although easy to switch between the three cameras, being able to see the dewatering sight glass and the inside of the resin liner is desired. We simply installed a signal splitter between the camera displaying the inside of the resin liner to an external video monitor, which the vendor supplied.
- Identify necessary spare parts to have on hand well in advance. Ask the vendor to identify those which are off the shelf and those, which require longer lead time. The off the shelf parts could be sent via next day air; therefore, you may not have to stock them.

Time between the Order and SERDS Construction Completion

Identify any nuances within your resin dewatering and drying procedure and determine well in advance where these nuances will be placed. Some examples at our station include:

- Because of an issue in late 2014, where we delivered a resin liner containing freestanding liquid exceeding the disposal facility's license limits (another paper in this conference), we require a dewatering verification filter to be installed and used for selected resin liners. Ensure walkways are as clear as practical from tripping hazards.
- Water processing is included in the operating procedure. The station uses bead resin, received from our equipment drain system to filter and some ion exchange of mop water and collection of miscellaneous liquids before sending them to the floor drain system for reuse in the plant. This activity needed to be included in operating procedures.
- Figuring out the layout of SERDS equipment prior to delivery. Coupled to this is when to remove your old resin processing system. Because of delivery delays and incredibly bad timing, we had to set up SERDS beside our old RDS. This created space issues in our locked high radiation area. As an example, our SERDS drying skid is 285 cm (112 in) long x 117 cm (48 in) wide x 250 cm (98 in) tall. The plant control skid is 122 cm (48 in) wide x122 cm (48 in) long x 130 cm (51 in) tall. The control panel cabinet is 153 cm (60 in) wide x 92 cm (92 in) deep x 214 cm (84 in) tall.
- Take the time to evaluate hose and cable lengths, as the vendor will ask (you're paying for them as a separate line item of the contract). Consider where SERDS will be located, where the access to demin water and air will come from, service air pressure (minimum of 90 psi; more is better), where the control panel will be located, and most importantly, how process hoses will be routed, taking into consideration the pathway for fill head movement from process containers to the fill head stand.
- Take the time to get your in-house procedures ready to go. When the factory acceptance test was conducted, the vendor operated the SERDS using their vendor procedure. The next day, they operated SERDS using the Plant procedure and were asked to mark it up, as potential issues were identified. This saved us time during our procedure approval process. Obtain preventive maintenance requirements from the vendor. We included these maintenance requirements into our in-house procedure, as the requirements are straight-forward.
- Get the in-house training requirements completed early. If the training tools are in place prior to delivery and setup, getting your personnel qualified to operate SERDS will go smoothly. Because the principles of operation associated with SERDS was similar to RDS and the same operators would operate SERDS, we focused training on the differences in nomenclature, operation of the Iso-Lok sampler, remote fill head, and touch screen operation. Additionally, we required each of our operators to conduct one resin transfer under the guidance of the

vendor operator and two being observed by a staff specialist who was responsible for SERDS procurement, delivery, setup, and operation.
- Get your in-plant SERDS operators' participation and buy-in on each of the bullets above, as they will be the ones to deal with SERDS once it is installed and operational.

Factory Acceptance Testing

As stated previously, take along a copy of your in-house SERDS procedure for use subsequent to operation of the system using the vendor procedure. Additionally, take along a camera to take photos of the components, SERDS as it is set up, relative sizes of the system, and identification of items you want to have changed/fixed prior to delivery.

Conduct a critical walk-down of SERDS. Observe how hoses and cables are routed from the fill head, small wires going from components to the control panel. An example was discovered during our testing. Four thermocouple wires ran separately from the drying skid to the control panel, which were identified as an issue. The vendor was asked to bundle the wires together and run them through conduit for protection. They did so to our satisfaction.

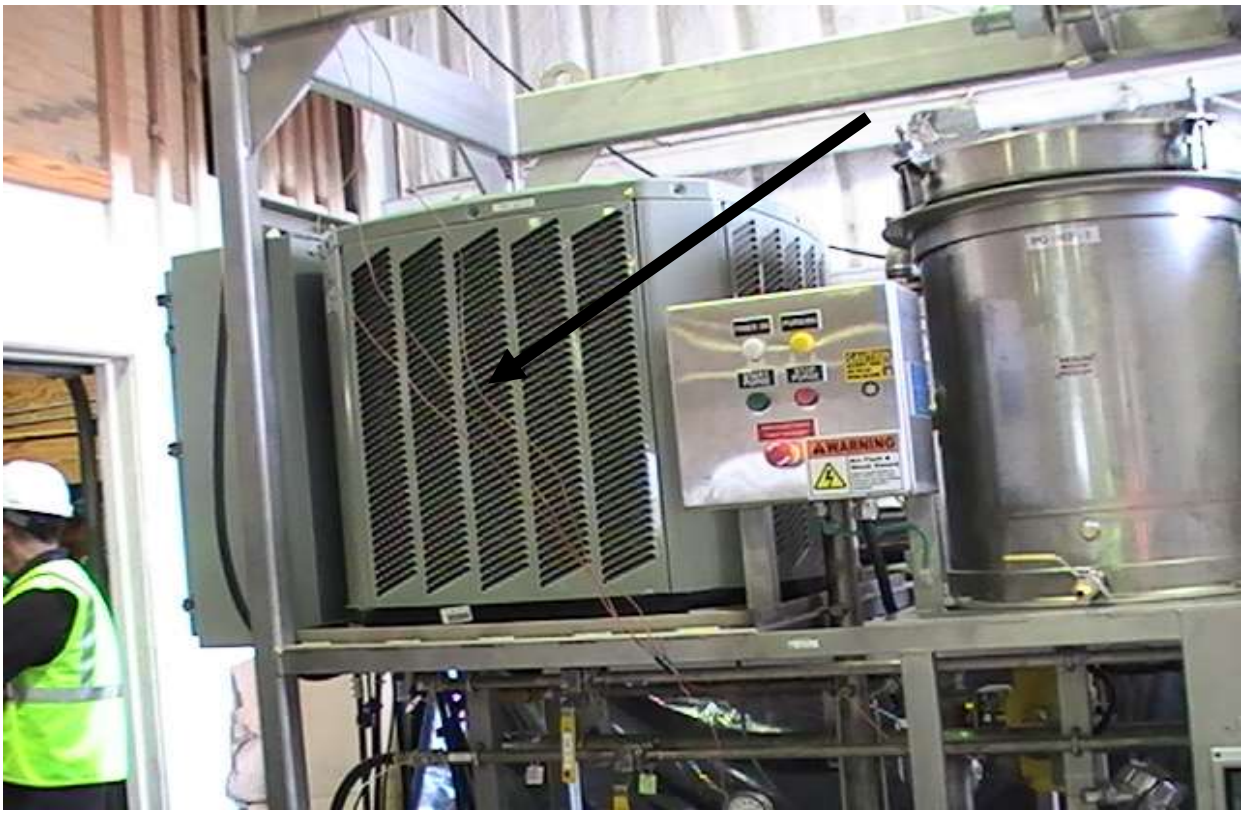

Fig. 1 Thermocouple Wires (not bundled)

Locate the dewatering pump. Is it easy to remove and replace or is it hidden, as ours was? Subsequent to delivery, it was mentioned to the vendor that the pump should be located on a separate skid, which would support a much easier success path for repair or replace the pump, is necessary.

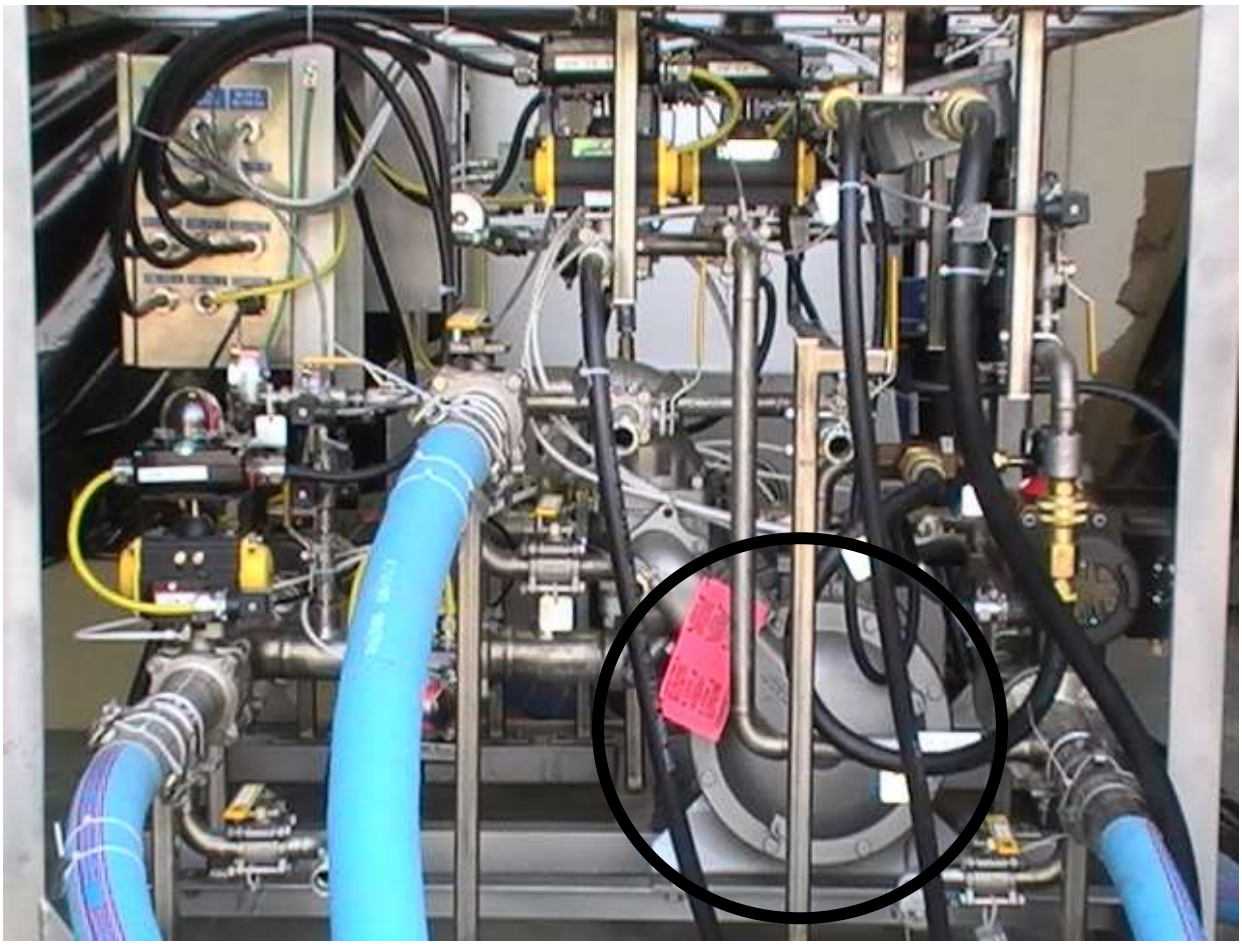

Fig. 2 Location of Dewatering pump (hidden)

As shown, there was no clear pathway for removal of the dewatering pump from the plant control skid. During the factory acceptance testing, the vendor installed unions which, when removed, provided a path for removal of the pump.

Look for potential crud traps. One in particular was identified below, which could have been identified during a pre-construction meeting:

Fig.3. Potential CRUD Trap, Located just Upstream of Waste Isolation Valve (between butterfly valve and upper line)

Look for hoses and cables, which extend outside the envelope volume of each skid. As you are likely aware, if a cable or hose extends needlessly outside the envelope volume, someone will inadvertently pull it, break it, or trip over it. This includes wires and hoses extending from the fill head. All but one hose was placed into a position where they could be bundled for ease of handling. The vendor moved the subject hose, as requested.

Require the vendor to conduct a pre-operational valve lineup. As they do so, have a copy of the system piping and instrumentation diagram (P&ID) available and locate each component as the position is verified. This will help when the pre-operational line-up is conducted when you receive the SERDS, as some of the valves are hard to find. Take photos as well.

Lastly, operate SERDS using your in-house procedure. With the aid of the vendor operator, mark up your procedure accordingly.

Delivery and Operation

Obtain information for your vendor technical services representative (TSR) to arrange for unescorted plant access, as they, along with system operators, will be setting up the SERDS.

When the skids were delivered to the plant a Conestoga trailer was used. The blower skid was too tall for easy unloading (we had to take some of the trailer apart). Verify with the vendor that they have taken care of this issue.

Conduct a detailed walk-down of each skid, with the TSR, to check for damage.

Time the installation for a slower time where resin transfers are not scheduled. Although we had it planned out, the SERDS equipment shipment was delayed a couple of days and our timing in late April was such that a reactor water cleanup resin transfer had to be set up. We had to place SERDS in the warehouse until a window appeared. This did not occur until after our refueling outage (July). Plan for at least one week for SERDS setup and testing, including verification that the in-house procedure works (revise as needed).

During set-up, ensure hoses and power leads are compatible with plant systems and changes as appropriate. At our plant, the resin processing systems are not listed as installed plant equipment, which provides some level of flexibility in changing hose fittings, 480 volt plugs, etc.

Once SERDS is set up and operational, the TSR should spend the remainder if their four weeks training plant operators. The specialist and/or supervisor should plan to spend as much time as practical sitting in on the training. Follow the pre-developed training plan.

Once our plant completed testing and training, SERDS has worked well with no operational issues. Plan for 15 hours of drying time for powdered resin, on top of the transfer time. During resin drying, hourly readings are required, in order to check SERDS performance. We are in the process of training back-shift personnel to conduct these hourly checks, which will cut down the day shift duration to one shift. Bead resin is much shorter (less than eight hours drying time.

CONCLUSIONS

The objective if this paper was to provide lessons learned with respect to procurement to successful installation and operation of a self-engaging rapid dewatering system (SERDS). The keys to success include pre-planning, and the operational experience from those that have been there, done that, and learned from their processes.

REFERENCES

1. Operating Procedure for Energy Solutions Gen II Self-Engaging Rapid Dewatering System (SERDS), CS-OP-PR-085, Energy*Solutions*, Inc. (2015)
2. Energy Northwest Self Engaging Rapid Dewatering System (SERDS) P&ID, DWG-SED-16248-ME-001, EnergySolutions, Inc. (2015)