Dewatering Innovations – 16381

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ABSTRACT

The Liquid and Gaseous Waste Operations (LGWO) project, located at the Oak Ridge National Laboratory, handles wastewater from over 600 generators in 200 facilities. LGWO processes these waters, removing radioactive and chemical contaminants prior to discharge to the environment. Through these processes, LGWO generates various sludges that require dewatering prior to transportation.

The original process was very inefficient. It involved placing PVC tubing in the bottom of a 90ft3 box and sluicing the sludge into the box. Suction was then applied to the PVC tubes to remove water that would settle out of the material. The old process took several evolutions to drain/decant the liquids, which caused unnecessary worker radiation exposure. The moisture content was Near High Moisture content, which presented the possibility that liquids could be released during transport. Due to this fact, disposal costs were very high. Solutions for the "Old" disposal process were to use liquid-rated Super Sacks, add additional Absorbent and then have the containers evaluated for liquid at TSDRF, prior to final disposal.

This paper will describe the innovative packaging that was developed for the processing of these sludges, the ease with which the process was implemented, the versatility of the system and the cost savings associated with the new process.

This system can be used in many other water treatment applications and erosion control.

INTRODUCTION

It has always been important to manage money and the efficiency of your schedule to maximize what your personnel can get accomplished in the least amount of time. As we all know, safety is the key element to maintaining the work that you have and obtaining additional work in the future.

The subject of this discussion is how our project was able to find some new, innovative ways to streamline our sludge-dewatering process. The keys to this entire task were to maintain the current process for removing the sludges from their various tanks and columns, making the dewatering process more user-friendly and decreasing the moisture content in the final waste product.

DISCUSSION

The Liquid Waste Systems that are run by Liquid and Gaseous Waste Operation(LGWO) at ORNL are crucial to the mission of UCOR, the company that is completing the Surveillance and Maintenance and Demolition and Destruction work at all three sites at the Oak Ridge National Laboratories (ORNL) and UT-B, the company that supports the Laboratories and their Surveillance and Maintenance at ORNL.

Within the processing systems, there are many different types of technologies that are used to process wastewater. At some point in each of these processes, there are sludges that are generated to accomplish a large portion of the treatment that is required to remove the radioactive materials and other hazardous materials.

Radioactive Materials

There are many different isotopes that are processed through the Liquid Waste Systems, but the isotopes of highest concern are Strontium and Cesium. Different media remove different isotopes. DOW-X is an ion-exchange resin that is very effective in removing Strontium; Zeolite is very effective in removing Cesium and will also remove some Strontium. The treated wastewater is then sent to another facility that utilizes a flocculent precipitate to remove more of the Strontium and Cesium, which creates a Filter Cake.

Hazardous Materials

The hazardous materials are not solely the obvious RCRA wastes, but they include many other items of concern. For example, phosphorus can cause a problem for our system, since the water is eventually discharges to White Oak Creek. If the phosphorus levels are too high, it can increase algal blooms, which will eventually help to create a higher level of bacteria in the body of water and cause the body of water to become hypoxic. This unnaturally low oxygen concentration can be very stressful to the aquatic life.

Sludges are sluiced out of tanks when they are ready to be changed out. This High Moisture Content material is what has to be dewatered prior to transportation and final disposal at a TSDRF. The main types of sludges that are generated by this process are zeolite and granular activated carbon (GAC).

The Original Process

In the past, these sludges were pumped into 90ft3 containers. Prior to pumping the sludges into the container, they were prepared with a piece of PVC pipe that would run the length of the bottom of the container, up the side and fitted with a coupler. The horizontal section in the bottom of the container had holes in it to allow water to be pulled through the tube, out of the container. This process took about two months and the efficiency was less than desirable. The results for moisture content averaged around 65%.

Due to the nature of what we were trying to ship, we could not use anything other than liquid-rated containers, which are very difficult to find and very expensive. We had great difficulty finding a way to ship the containers that were already filled over the road, compliantly. We finally spoke with PacTec and they were able to supply us with an over pack bag that was liquid-rated. The over packing process required placing the bag (3-layers) in a frame, adding copious amounts of absorbent to the bottom of the bag, lifting the container into the bag with a crane, and then sealing the bag and taping the outer zippers. This was a long and arduous process. We then had to use a closed conveyance to ship the bags, so that they would not be damaged

in transport.

Once the containers arrived at the TSDRF, they began the process of mitigating the water, processing the water and then they were finally able to dispose of the sludges. This process needed to be changed.

The Research Begins

The first step in deciding on a new process was to find out what was available. In June of 2014, I had spoken to PacTec to see if they had anything that might work and that is when the idea began to come to light. PacTec makes GeoTubes that are utilized at many different facilities to help dewater sludges. The one example that was cited to me was a sewage treatment plant. The tubes are a great idea for dewatering, but we have an added concern and that is the radiological activity in our sludges. We could not lay these out on the ground to let them drain due to contamination issue, but there had to be a way to make the process work for us.

I spoke with our packaging engineer and he began working with me on the idea. We got in contact with PacTec and Strategic Packaging Systems (SPS) and began asking for designs that would help to get us started. Designs were submitted through procurement and the decision was made to utilize SPS for this project. Using this company worked very well. They were in close proximity to the site, which afforded us the opportunity to go to their facility when needed to accomplish some very important steps in the design process.

Design testing

SPS set up a simulation for us to observe. Angular sand behaves very similarly to GAC, so it was used for the testing process. A frame was set up, a dewatering bag was placed into the frame, the angular sand was added to the bags and 150 gallons of water was added to sand that had been sitting out in the rain for a week or so. At this point, they lifted the bag to show how the water drained from the bags and that the bags held their shape very well, even with extremely wet material in them (see figure 1). The bags were placed back into the frames and were left until we got back to SPS 3 or 4 days later. First, the bag was lifted in the air and very little water was draining out of the bag. Next, we cut the bag open in a few areas to see how dry the material was and the uniformity of the draining process. The next step was to take a sample of the sand in the bag, at the location that looked the wettest and then grab a sample from the original pile of sand. We sent the samples to our lab and analyzed them for moisture content. Amazingly, the sand on the ground was quite a bit higher in moisture content than the sand in the dewatering bags.

Figure 1 - Test Run at SPS

Getting the Wheels in Motion

The next step was to present the process to the LGWO organization that would be working with the dewatering bags on a regular basis. After they showed enthusiasm about implementing the new process, it was time to present the idea to the characterization group, the transportation group and our waste disposition group. These people determine how and where waste will be sent. These presentations took many months to get everyone to agree to allow us to initiate this new process.

The Final Decisions on the New Process

Each waste stream would require proof-of-process. We would send 2-90ft3 containers, in Liquid-Rated over packs, to an off-site TSDRF. Once the proof-of-process was received from the off-site TSDRF, all subsequent IP-I containers with dewatering bags could be sent to Nevada National Security Site (NNSS) for disposal.

The Procurement Process

Our packaging engineer got SPS all of the specifications that we wanted on the dewatering bags and the dewatering frames. Secondary containment is part of the dewatering frames for remote usage. Once the quotes were received and approve, procurement ordered the materials. At first we ordered three dewatering frames and 12 dewatering bags. Since that time, we have procured 2 more frames and 24 more dewatering bags.

Zeolite -The First Use of the Dewatering Bags

The dewatering bags were placed into the frames. The process is very simple: open the bags and place them over the sides of the frame, securing the bags to the frames on the 4" hook and loop on the sides of the frames. The zeolite was sluiced into the frames and water began draining immediately. Since we are dealing with radioactive material, this is being done inside of a secondary containment under the Radiological Protection Technicians' (RPT) control through use of a Radiological Work Permit (RWP).

Figure 2 – Zeolite in dewatering bags in frames

The bags were allowed to drain for 72 hours (minimum) and a sample was taken to determine moisture content. Figure 3 shows the zeolite after the 72 hour period.

Figure 3 – Dewatered Zeolite

Once this was achieved, it was time for the dewatering bags to go into the shipping containers. The shipping container was placed in front of the dewatering frame. 20

pounds of Quick Solid, a super-polymer absorbent, was placed at the bottom of the shipping container and 5 pounds of Quick Solid were placed on top of the zeolite prior to the bags being closed. The closure of the bags was simply to seal the 4" hook and loop. Next, the lifting straps were gathered and placed onto the crane fixture. The dewatering bag was lifted out of the frame, with a crane, and placed into the shipping container.

Figure 4 – Dewatering bag lifted out of the frame

Figure 5 – Dewatering bag being lowered into the Shipping container

Conclusion

Through use of this process:

- Two of our major waste streams have received the proof-of-process required to send the waste containers to NNSS.
- This saves UCOR and the DOE $4616.00 per container, $6435.00 in labor and $1890.00 in absorbent costs or an estimated $81,281.00 per year (initial, one-time, costs of $31,787.00 for materials and proof-of-processes)
- Time for dewatering decreased from 2 months to 72 hours
- Our operators like the dewatering bags, since it makes the process much simpler and afford them more time to complete other work
- The moisture in these waste streams has decreased from 65% to 44%
- A third waste stream, sump sludges, is soon to be sent for proof-of-process
- This process can be used in many different applications. This material can be made into near-any size bag and the frame can be made to fit.
- The type and/or weight of material can be changed to suit the type of material being dewatered.

Lessons Learned

- More sturdy lids with “tie downs” were purchased to cover the frames during the draining process
- During the first few hours of the draining process, placing a “vacuum” on the frames helps to encourage draining. However; after the first few hours, this does not help the draining process. It actually hinders it.
- Sometimes, it is necessary to put positive pressure on the frames to release the “seal” between the bags and the frames during the removal process
- The drains on the dewatering frames should be a larger diameter (2-3” diameter) for optimal dewatering of Very High Moisture waste streams. In a few instances, we had to move from one dewatering frame to the other and back, since the water could not drain fast enough through a 1” valve.
- If the dewatering bags are in temperatures below 55 degrees Fahrenheit, they will shrink up to 20%, due to the type of material that they are made of. All we had to do was to store the bags inside a building overnight to alleviate this issue the next time.
- Seams that are welded or rolled downward are optimal on the dewatering frames. If the seams are able to hold water from the process, contamination can become a problem.