A Cask Processing Enclosure for the TRU Waste Processing Center – 13408

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ABSTRACT

This paper will discuss the key elements considered in the design, construction, and use of an enclosure system built for the TRU Waste Processing Center (TWPC). The TWPC system is used for the repackaging and volume reduction of items contaminated with radioactive material, hazardous waste and mixed waste. The modular structural steel frame and stainless steel skin was designed for rapid field erection by the use of interchangeable self-framing panel sections to allow assembly of a sectioned containment building and for ease of field mobility. The structure was installed on a concrete floor inside of an outer containment building. The major sections included an Outer Cask Airlock, Inner Cask Airlock, Cask Process Area, and Personnel Airlocks.

Casks in overpacks containing transuranic waste are brought in via an inter-site transporter. The overpack lid is removed and the cask/overpack is transferred into the Outer Cask Airlock. A contamination cover is installed on the overpack body and the Outer Cask Airlock is closed. The cask/overpack is transferred into the Inner Cask Airlock on a cask bogie and the Inner Cask Airlock is closed. The cask lid is removed and the cask is transferred into the Cask Process Area where it is placed on a cask tilting station. Once the Cask Processing Area is closed, the cask tilt station is activated and wastes are removed, size reduced, then sorted and re-packaged into drums and standard waste boxes through bag ports.

The modular system was designed and built as a “Fast Track” project at IP Systems in Broomfield Colorado and then installed and is currently in use at the DOE TWPC located near Oak Ridge, Tennessee.

INTRODUCTION

The TRU Waste Processing Center (TWPC), located on the Oak Ridge National Laboratory (ORNL) reservation, is a regional center for the management, treatment, packaging and shipment

of DOE TRU waste. The TWPC, operated by Wastren Advantage, Inc. (WAI) is also currently tasked with treating Low Level and Mixed Low Level Waste generated at ORNL.

The TWPC has just recently completed the Operational Readiness Assessment and has began operations for a new processing line designed for the processing of RH Concrete Casks containing lower dose Contact Handled waste. The Cask Processing Enclosure (CPE) is intended to assist the production normally performed in a Hot Cell by Remote Handling (RH) Methods. The parallel processing line will allow hands on processing of lower dose waste that would previously be handled by remote manipulator in the Hot Cell, thus doubling the facility output. Currently there are approximately 180 RH waste casks scheduled for processing in the new facility.

PROCESS DISCRIPTION

The TRU waste is brought into the facility 30-Ton Crane Bay in Casks contained in Overpack containers by an inter-site transporter. The overpack is inspected for damage and monitored for radiation level. The typical dose rate on the exterior cask surface is less than 1 mrem/hr. The lid is then removed and the cask/overpack is transferred into the CPE Outer Cask Airlock by the 30 ton crane and placed on a cask bogie. A temporary contamination cover is then installed on the overpack body to prevent contamination exposure to the exterior during the waste removal process. Once the crane is disconnected and moved the Outer Airlock and the ceiling Rigging Slot are closed.

Next the cask/overpack is transferred into the Inner Cask Airlock on the cask bogie. Inside there the cask lid is removed using a special Cask Lid Extraction Tool and a 3-Ton hoist and monorail. Operators inside the Inner Airlock are protected from contamination exposure by the use of full Personal Protective Equipment (PPE) suits with hooded Respiratory Protective Equipment (RPE).

The cask/overpack is then transferred into the Cask Processing Area and placed on a Cask Tilting Station with a 10-Ton hoist and monorail. Upon returning the hoist to the Inner Airlock the Processing Area doors are closed, the cask tilt station is activated and the waste is removed from the cask. The TRU waste is dumped into a sorting station where operation personnel donned in full PPE proceed to size reduce and sort the cask waste.

The conditioned waste is transferred to one of the two bag out stations where it is placed into various sized drums and standard waste boxes suitable for transfer to a DOE waste storage/disposal site.

The empty cask/overpack is then moved from the Processing Area back out to the Inner Airlock where the contamination cover is removed and a lid is placed on the overpack. The overpack is

transferred out of the Inner Airlock on the bogie to the Outer Airlock where it is removed by the 30-Ton crane for transfer to the empty cask disposal process.

Personnel enter and exit the CPE through the Personnel Airlock access doors in the Inner Cask Airlock and the Cask Processing Area. Inside the Personnel Airlock the operators don and doff their PPE as required before entering or exiting the CPE.

CASK PROCESSING ENCLOSURE

The CPE came together by the modification of an existing 30-Ton Crane Bay with the addition of a large Modular Containment Enclosure. IP Systems, Inc. in Broomfield Colorado was contracted by WAI and the TWPC for a "Fast Track" project to provide design and fabrication services for the creation of this enclosure. The concept was for a modular enclosure system that could be fabricated off site, then assembled and installed on site in a quick and efficient manner.

The CPE consists of four functional areas, separated by walls and doors. (Figure 1)

- Outer Cask Airlock (18.5'L x 17'W x 18'H)
- Inner Cask Airlock (23'L x 22'W x 18'H)
- Cask Process Area (24'L x 22'W x 18'H)
- Personnel Airlocks, one (6.5'L x 6'W x 8'H) & two (8'L x 6'W x 8'H)

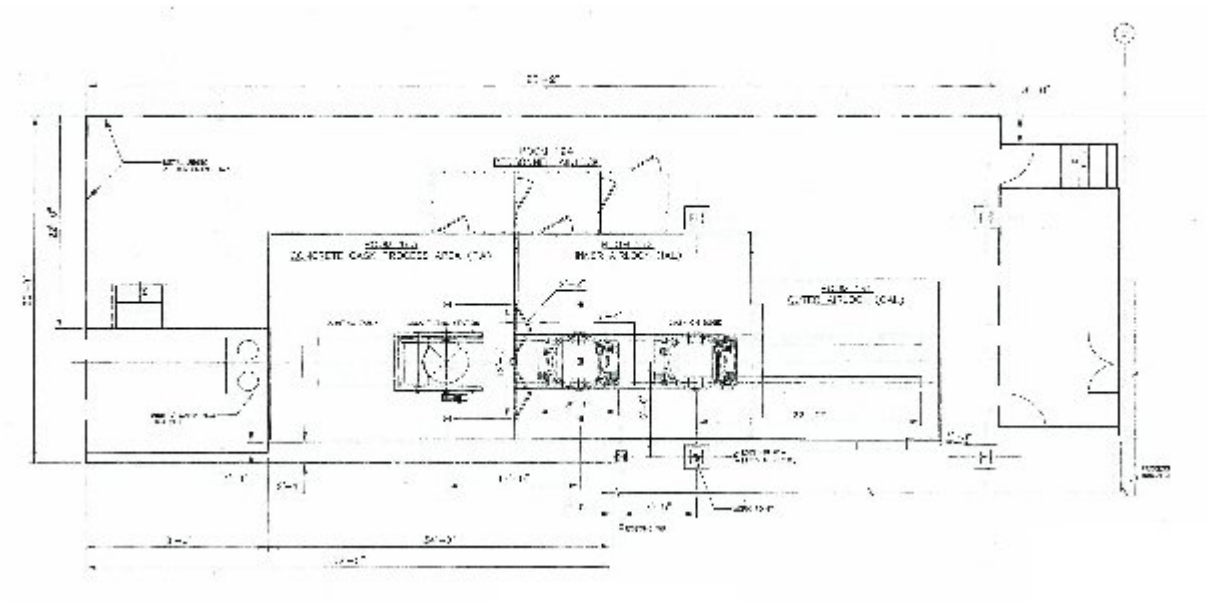

Figure 1

Enclosure Design Details

The enclosure design was created with SolidWorks 3D modeling software based on a preliminary concept provided by WAI in the contract documents. Once the design was complete it was seismically analyzed and found to be structurally sound meeting the project seismic criteria.

The walls and ceiling were designed to be modular panels that were constructed and then bolted together to form the final assembly (Figure 2). This allowed the enclosure to be set-up and assembled in the shop at IP Systems for fit and function testing and then disassembled for shipment to the job site.

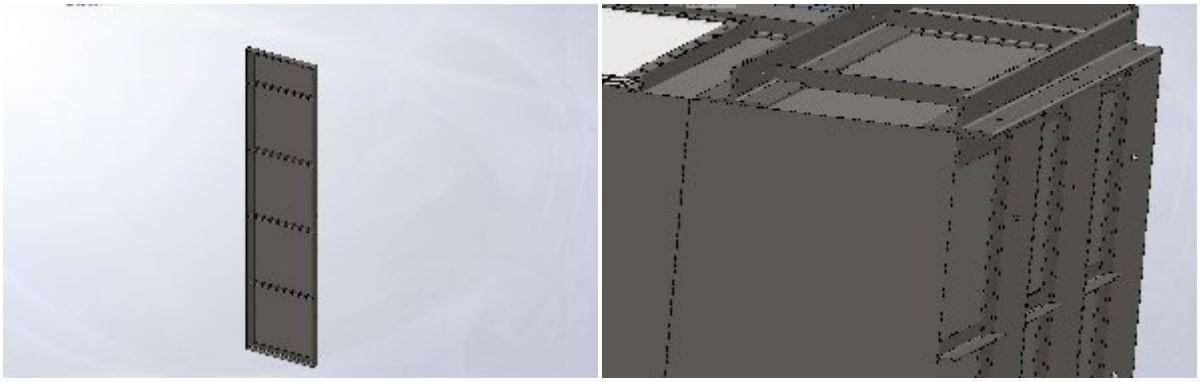

Figure 2

The panels were constructed from powder coated carbon steel angle and channel framing with an attached stainless steel skin. Each side panel spanned from the floor to the ceiling as one continuous piece. Each ceiling panel spanned across the entire width of the enclosure. The panels bolted together in succession to form the completed enclosure walls and ceiling. At final assembly at the job site the seams between the panels were covered with continuous tape strips and the seams between the floor and panels were calked to provide a seal between the inside and outside of the enclosure.

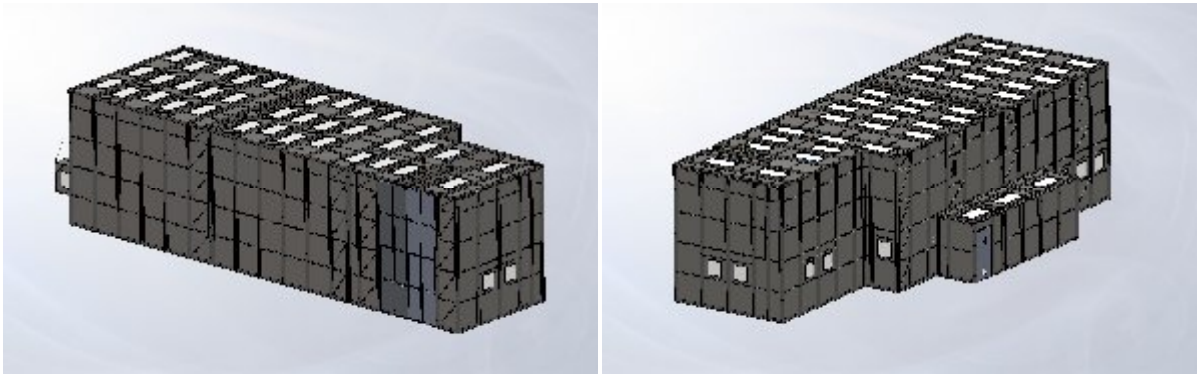

Figure 3

Viewing windows were strategically placed in the wall and ceiling panels to allow internal viewing and light to enter the enclosure. (Figure 3)

The Outer Airlock entry included Bi-Fold Doors and a crane rigging slot to allow the cask/overpacks to be lifted into the enclosure with the facility 30-Ton Crane. The rigging slot was equipped with an actuated door that was closed once the crane rigging was removed.

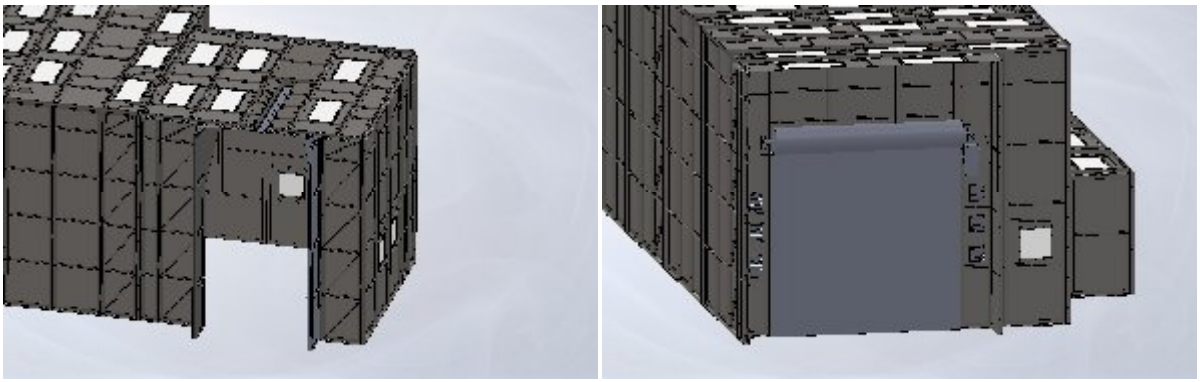

Figure 4

The separation between the Outer Airlock and the Inner Airlock was a roll up door mounted in a wall between the two sections. Back draft dampers were placed in the wall to allow controlled air flow from the outer to the inner airlock which provided contamination containment. (Figure 4)

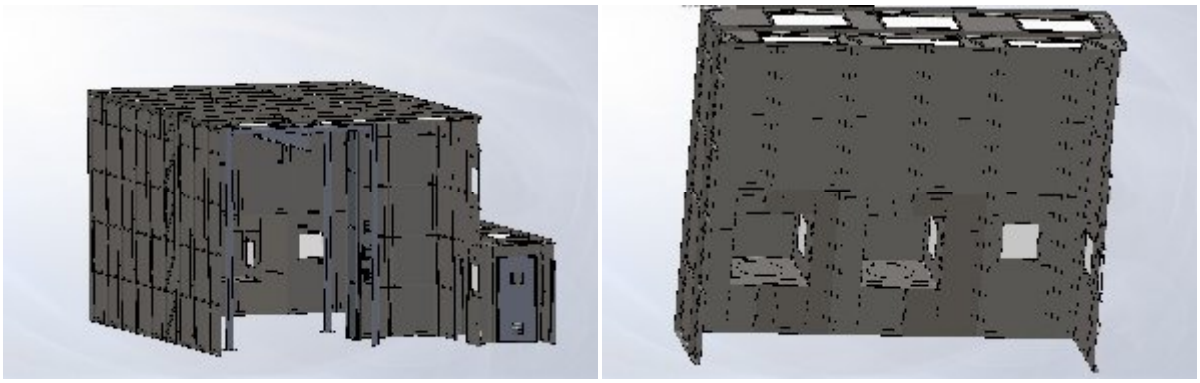

Figure 5

The wall between the Inner Airlock and the Processing Area featured a Bi-Fold Door with a slot that closed around the monorail for the internal 10-Ton Crane used to transfer the cask/overpacks into the Process Area and on to the cask tipping device. The end wall of the Process Area featured two Bag-Out blister sections for waste transfer to the output containers. (Figure 5)

Enclosure Fabrication

All of the enclosure parts were fabricated and assembled at IP System's Broomfield facility under a NQA-1 Quality Assurance Program. The frame structure was welded together and then powder coated. The skin pieces were cut to size and then attached to the finished frames with rivets. Once the parts were all completed the enclosure was assembled and tested for form fit and function. Leak testing was not performed at the factory as the sealing calk and tape was not applied until the final installation at the project job site.

Figure 6

Figure 7

Enclosure Shipping

Upon completion of assembly and testing the enclosure was disassembled and packaged for shipment. All of the pieces were labeled to help simplify the reassembly process. The trucks were loaded and parts were delivered to the job site. (Figure 8)

Figure 8

Enclosure Installation

The enclosure installation was performed by WAI personnel at the TWPC. It was placed inside of another building at the TWPC to become the CPE. All of the cask handling and processing equipment was provided and installed by WAI.

Installation activities included the following. (Figure 9 & 10)

- Enclosure Assembly
- Equipment Installation
- Electrical Installation
- HVAC Installation
- Spray Insulation Coating
- Enclosure Leak Test
- Operational Readiness Review

Figure 9

Figure 10

SUMMARY

In summary the project went very well with no casualties. The CPE passed its Operational Readiness Review and began waste processing operations in late summer of 2012. The system is operating as planned with only a few minor field design modifications.

REFERENCES

1. "WAI Nearing Innovative Processing Line Start-up at TWPC in Oak Ridge" by Linda Green, from the TWPC web page.

2. Equipment Specification "TRU Waste Processing Center", Specification No. T-RH-FW-S-ME-805, by John G. Wagner