RH-TRU Processing to Accomplish Nuclear Footprint Reduction Goals at the Argonne National Laboratory Building 205 K-Wing Hot Cell Facility – 11370

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ABSTRACT

This paper describes the Transuranic (TRU) waste processing activities undertaken to achieve nuclear footprint reduction goals at the Argonne National Laboratory Building 205 K-Wing Nuclear Facility. The objective of the project was to remove (de-inventory) sufficient quantities of radioactive materials from the facility to reclassify it as a less than Hazard Category 3 nuclear facility. The high hazard category contributing materials were primarily the RH-TRU waste. The project contained many unique challenges and substantial time constraints. The facility had been used for performance of experiments with irradiated test specimens and consists of three shielded cells, an operating area, and a laboratory/service area. The waste material in the hot cell facility included both solidified liquid and solid RH- and CH-TRU waste that required treatment and handling prior to disposal at WIPP.

The project overcame the major challenges of 1) development of a method to adequately process the liquids into solid form acceptable to WIPP, 2) the development of work control documents for approval by DOE Office of Science in Washington, D. C., 3) the completion and acceptance of the WIPP Acceptable Knowledge (AK) report, 4) the design and construction of special TRU waste packaging equipment, 5) performance of sampling and analysis of pre-solidified liquid and debris material to complete WIPP AK radiological characterization, and 6) troubleshooting and repair of aged and inoperable equipment. TRU waste processing included the management of debris, homogenous solids, and higher-activity fuel examination waste remaining from previous separation science experiments.

While these challenges were overcome, there was little time left to perform visual examination (VE) and compliant packaging to complete de-inventory activities. The short time to complete the processing activities required quick development and deployment of process improvements that could streamline activities. The project utilized direct-loading of 55-gallon drums to allow for increased packaging efficiency and throughput over the 30-gallon drum packaging configuration previously utilized at Argonne. Facility storage and container throughput limitations were overcome by designing and installing a gantry crane system inside of the facility which was used in conjunction with shielding/transfer casks. This improvement allowed for the immediate return-to-service of the gated drum shield for

continual TRU waste drum loading and storage of up to four drums inside of the facility to streamline the delay in transfer paperwork approvals.

Additionally, higher-activity fuel examination waste remaining from previous separation science experiments proved to be a difficult waste stream to document during VE packaging and required the development of test plans to qualify the measurements for characterization. Remote-size reduction of larger debris (e.g. tables, experimental equipment, etc.) and the strain on in-cell equipment (master-slave manipulators and PaR manipulator) also proved to be difficult.

The project also overcame challenges relating to the documentation and write-off of source materials, for material control and accountability purposes, and the resultant establishment of a less than hazard category 3 nuclear facility to achieve the DOE-SC and DOE-Environmental Management joint milestone.

This paper summarizes the experience and lessons learned from this project.

INTRODUCTION

This paper describes the Transuranic (TRU) waste processing activities undertaken to achieve nuclear footprint reduction goals at the Argonne National Laboratory Building 205 K-Wing Nuclear Facility, a small quantity TRU waste generating site. The objective of the project was to remove (de-inventory) sufficient quantities of radioactive materials from the facility to reclassify it as a less than Hazard Category (HazCat) 3 nuclear facility. The high hazard category contributing materials were primarily the RH-TRU waste. The project contained many unique challenges and substantial time constraints.

The facility had been used for performance of experiments with irradiated test specimens and consists of three shielded cells, an operating area, and a laboratory/service area. The waste material in the hot cell facility included both liquid and solid RH- and CH-TRU waste that required treatment and handling prior to disposal at WIPP. De-inventory activities were accomplished through the execution of work control documents (WCDs) designed to characterize, handle, package, and/or remove specific radioactive materials from the facility.

Project challenges included:

- Development of a method to adequately process the liquids into solid form acceptable to WIPP,
- Development of work control documents for approval by DOE Office of Science in Washington, D. C.,
- Completion and acceptance of the WIPP Acceptable Knowledge (AK) report,
- Design and construction of special TRU waste packaging equipment,

- Performance of sampling and analysis of pre-solidified liquid and debris material to complete WIPP AK radiological characterization, and
- Maintaining operability of 35 year old remote handling equipment during operations requiring greater stress on equipment than the original design.
- TRU waste processing included the management of debris, homogenous solids, and higher-activity fuel examination waste remaining from previous separation science experiments.

FACILTY DESCRIPTION AND PROJECT BACKGROUND

Argonne is one of 23 Department of Energy's national laboratories and technology centers. Argonne is located on 1,508 acres in Du Page County, IL, 25 miles southwest of downtown Chicago. Argonne's campus includes some 105 buildings and 109 other structures.

The Chemical Technology Building, Building 205, containing the K-Wing was built during the 1949 to 1950 time period. The K-Wing kilocurie hot cell complex was designed to conduct metallurgical research on radioactive fuel materials. The facility consists of three heavily shielded cells, an operating area, and a laboratory/service area. The shielded cells are designed to handle up to 10,000 curies of 1 MeV gamma activity in Cells A and B and 10 curies in Cell C. A series of 5 remotely operated manual manipulators services Cells A and B. These manipulators operate in the x, y and z planes and have a hand that can rotate 360^{o} around the z-axis as well as pivot 180^{o}. These manipulators can lift loads of up to 15 lbs. Cell C has a PaR 2000 arm that is electrically operated. A similar device previously existed in Cell B but has been removed. Cells A and B also have a hoisting mechanism that can lift heavier objects. The floor plan of the Facility is included as Figure 1. Specific experimental activities in the facility involved the development of pyroprocessing techniques, aqueous biphasic extraction studies, long-term testing of radioactive waste forms, and experimentation with the Uranium Extraction (UREX) solvent extraction process and separation sciences chemistry. Programmatic operations in the Building 205 K-Wing were suspended temporarily in July 2007. Subsequently, Argonne decided to make that suspension permanent and to de-inventory the facility.

Liquids inventory consisted of approximately 175 liters of aqueous nitric acid waste liquids. The basic process for treating the liquids included identifying, staging, and bulking like liquids. Aqueous acidic liquids were then planned for solidification using NoChar Acidbond A660 sorbent. Multi-phase (organic/aqueous) solutions were to be separated, the aqueous nitric acid waste liquids to be solidified with the NoChar A660 sorbent, and the organic waste streams to be transferred out of the cell for subsequent treatment as low-level waste.

The basic process for processing solids included sorting the waste and identifying and segregating and/or remediating any prohibited items. In order to complete this process several pieces of special hardware were designed and fabricated. An alpha barrier with a drop chute was designed and fitted into the C-Cell that allowed for dropping material into the packaging drum from B-Cell and also provided a barrier to prevent the spread of

contamination from B-Cell to C-Cell. A special Gated Drum Shield was developed that fit around a standard 55-gallon drum which provided for shielding while closing and moving the drums from the facility. Also, a special closure device was designed which allowed for easy, remote closure of the drums, helping to minimize personnel exposure. After materials were size reduced, they were loaded into drums through the drop chute in the alpha barrier. When drums were filled they were transferred to another facility for staging prior to further characterization and subsequent shipment offsite to WIPP.

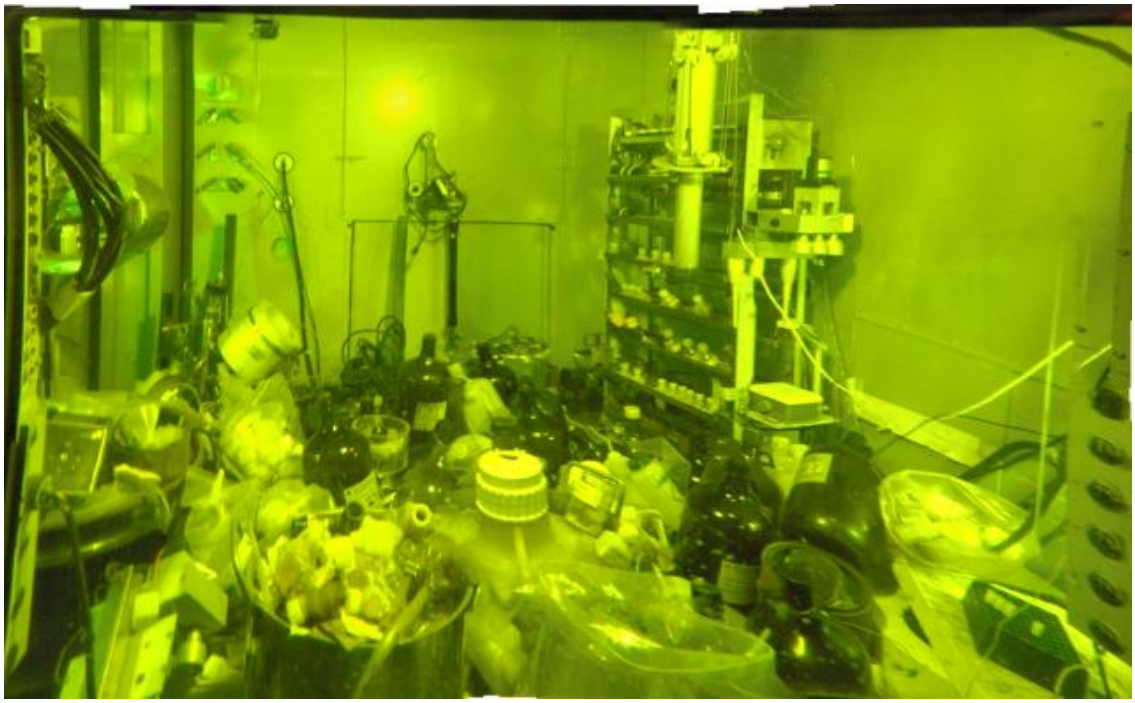

Figure 1 Building 205 K-Wing A-Cell on 10/6/09

FIRST DRUM CAMPAIGN

Permission to commence operations was granted on 11/5/09 with the first drum packaged and picked up on 11/9/09. During this first campaign of nine drums it took three to four workdays to fill a drum, seal and close it, and have it transferred from the facility.

The project's interim milestone was to reduce the facility to less than HazCat 2 by 12/31/09. At the start of operations the HazCat 2 ratio was 1.245.

The first five drums consisted mostly of debris varying from small items to larger pieces experimental equipment. With Drum #6 the project started loading readily identifiable pieces of Fuel Examination Waste (FEW) into the drums. Due to the high anticipated dose rates this FEW was placed into newly fabricated inner shielding containers which reduced the dose rate by a factor of two. The initial five drums averaged dose rates on contact

varied between about 2 and 5.5 R/hr with net weights between 26 and 120 pounds. Drums #6 through #9 varied between 2.5 and 15 R/hr with net weights of 51 to 235 pounds.

The project considered improved methods for packaging FEW to allow more to be packaged into a drum while reducing contact dose rates and still meeting shipping limits. Methods considered were shoring the FEW inner shield containers in the center of the drum and potentially using additional shielding either inside the drum or inside of the inner shields.

By late November 2009 the manipulators began showing signs of wear: the left manipulator in Cell A developed restricted range of motion and both manipulators in Cell A had very limited ability to lift. The B Cell middle manipulator began experiencing problems in the middle of December 2009. This left the facility manipulators at one fully functional manipulator. It became apparent that the facility would need a maintenance outage to repair the manipulators.

Drum #7 was filled and transferred from the facility on 12/10/09. This drum contained 5 pieces of FEW and used two of the newly fabricated shielding containers. The transfer of this drum reduced the HazCat2 ratio by approximately 7%.

During this campaign the Gated Drum Shield (GDS) was damaged during a transfer when it struck the side of the C-Cell door while exiting the cell. A support bracket for one of the lids broke. The new part was promptly procured and installed, resulting in no interruption of its use.

A new hoisting mechanism with greater lifting capacity was installed in the hot cell in the middle of December 2009, which allowed the use of heavier inner shielding containers. By using the cell hoist, the project was able to work around the manipulator limitations. Consequently Drum #8 contained four pieces of FEW placed into two lead shot-filled inner shielding containers. The contact dose readings measured in-cell on the surface of the inner shielding containers was as high as 70 R/hr. These four pieces contributed almost 17% to the HazCat2 ratio.

Drum #9 was transferred from the facility on 12/18/09 and brought the radioactive material inventory in Building 205 K-Wing definitively below the HazCat 2 threshold as defined in DOE-STD-1027 to the level of 0.9374 of the HazCat ratio. This milestone met the commitment for the facility to be less than HazCat 2 by 12/31/09.

MANIPULATOR REPAIRS

Commencing in January 2010the facility went into a maintenance outage to repair manipulators. The decision was made to only repair the identified manipulator deficiencies rather than a complete overhaul in order to resume drum packaging operations as quickly as possible. Having met the interim milestone of less than HazCat 2, the next project milestone was to get the facility below the HazCat 3 threshold by June 30.

In order to perform the repairs several preparatory steps were required:

- Fabrication of a manipulator repair table,
- Development of a remote power supply to power the manipulator Z-motion,
- Erection of a containment tent outside of C-Isolation Room, and
- Dismantlement of the C-Cell alpha barrier and hoist.

These preparations were made and repairs commenced on 1/18/10. The alpha barrier was dismantled, the CRL slave removal fixture was placed on the PaR Arm and the right manipulator from A-Cell was moved into C-Cell. Surface contamination levels on the manipulator required the development of an alternative method of decontamination to minimize personnel exposure and contamination concerns. The plan consisted of remote washing of the manipulator with a decontamination solution and collecting the residual liquid in a 30-gallon container. Decontamination of the first manipulator took longer to complete than expected and the repair was completed ten days later. The second manipulator repair was completed four days later and a spare manipulator from the Alpha Gamma Hot Cell Facility (AGHCF) was obtained and installed in the B-Cell middle position. This allowed the project to continue with in-cell operations and have a ready spare manipulator.

At the end of January, troubleshooting on the hot cell PaR hoist indicated that the hoist motor was seized. Another motor was placed on order.

Due to the extensive effort required to decontaminate the first manipulator, investigation of a more effective method began. An outside contractor with a proprietary chemical decontamination solution, which had been used successfully at several other DOE sites, was investigated and a decision was made to pursue this option. Arrangements were made and in mid-February two manipulators underwent decontamination with the solution, RAD RELEASE. This chemical proved highly effective in reducing surface contamination, resulting in a savings of over 50% in the time required to decontaminate the manipulators.

In middle February 2010, two manipulators that had been previously repaired developed additional problems with their wrist movement. Mechanical repairs to all the manipulators were completed by 2/21/10.

The new hot cell PaR hoist motor was received, prepared, tested and installed on the PaR arm during the week of 2/28/10. This now gave the facility two operable permanent hoists, one on the PaR arm which had been introduced into A/B-Cell and one in C-Cell. Alpha barrier re-installation was then initiated, followed by C-Cell decontamination to reduce surface contamination levels in the cell. This concluded the maintenance outage activities and drum packaging resumed the first week of March 2010.

Although the project was in a maintenance period, sampling operations described in the next section progressed with the available manipulators. In light of the continued problems with the manipulators that developed during this period, the decision to avoid a complete

overhaul of in-cell equipment may have seemed incorrect, however based on further operating experience, the complete overhaul of manipulators would not have prevented further issues that were to plague the project later.

SAMPLING

In order to determine the radiological characterization of the material in each drum, a sampling plan was developed by WIPP-CCP, *CCP-AK-ANL-505A, CCP Sampling and Analysis Plan for the RH TRU Debris Waste Generated in K Wing Rev 0, 12/9/09*. The overall objective of the sampling program was to collect smear samples of the waste material that was representative of the surface contamination and would be used to develop activity concentrations or scaling factors for the applicable radionuclides. It required smear samples be taken of 19 specified surfaces within the hot cell and then analyzed for radiological constituents. Similarly, liquids needed to be bulked together in like categories and then subsequently sampled for analysis under a sampling plan developed by WIPP-CCP, *CCP-AK-ANL-505B, CCP Sampling and Analysis Plan for the RH TRU Debris Waste Generated in K Wing Rev 0, 1/13/10*.

Smear Sampling

This smear sampling effort was conducted in parallel with the manipulator repair maintenance outage. The first debris smear samples were taken on 1/6/10. The plan called for sampling 19 separate surfaces with between 2 to 4 samples from each surface. Cotton swabs were drawn across the surface and placed in 30 ml acid leach bottles. The Argonne Analytical Chemistry Laboratory (ACL) analyzed the samples for gamma spectroscopy, alpha spectrometry, gas-flow proportional counting, and liquid scintillation counting.

Debris smear sampling in A and B cells was completed on 1/12/10 with the last two samples being taken under a WIPP-CBFO-sponsored surveillance. Preliminary analytical results were received on 2/3/10 and final results were received on 3/15/10 and forwarded to WIPP-CCP personnel.

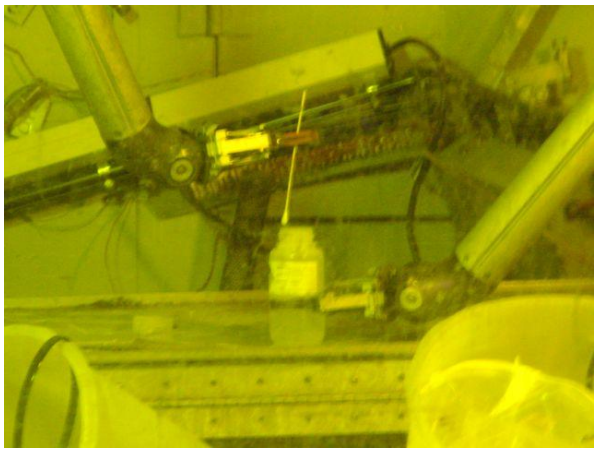

Figure 2 Smear Sample Remotely Collected in 205 K-Wing and Being Placed in Acid Leach Bottle

Liquids Bulking and Sampling

In order to sample the liquids, the 55 original bottles containing approximately 175 liters of liquid had to be bulked into compatible liquid containers of four categories. Some of the bottles contained two phase liquids and also needed to be separated prior to sampling. Four preparatory steps were required: complete an inventory of liquid bottles, create a floor plan with bottle locations, develop a consolidation plan, and introduce consolidation materials and supplies (bottles, pump, and tubing) into B-Cell. These steps were completed by the end of January 2010 and bulking began the first week of February 2010.

During the first two weeks, 42 (single phase) of the original 55 liquid bottles were bulked. Representatives from the USEPA and WIPP-CCP were onsite on 2/16 and 2/17/10 to witness liquids sampling to expedite waste stream approval.

Samples were drawn in the hot cell with a pipette into a 30 ml sample bottle. The sample bottles were then transferred into an adjacent glove box , decontaminated, and then transferred into a nearby fume hood into ACL personnel custody for sample dilution and preparation since ACL could only handle samples up to 100 mRem/hr dose rate.

Separation of the two-phase liquids was performed in-cell with the use of a separatory funnel. During separation of the multi-phase liquids, nine additional containers were generated bringing the total to 64 bottles that needed to be identified and bulked.

The bulking and sampling continued into March 2010. Some of the liquid samples with very high dose rates required dilution in-cell and thus a new balance needed to be placed in-cell. The last of the liquid samples were transferred to ACL on 4/8/10. Preliminary analytical results were received on 4/30/10 and final results were forwarded to WIPP-CCP personnel on 7/16/10.

LIQUIDS SOLIDIFICATION

Liquids solidification was planned to be accomplished by developing solidification treatability recipes derived from surrogate tests of similar chemicals to those in-cell. Based on positive results from preliminary surrogate tests using NoChar, Inc. Acidbond (A660 2-4 mm) absorbent with calcium hydroxide (lime) at a 5:1 sorbent to lime ratio, Argonne utilized a contractor to perform testing. Effectiveness of solidification was initially based on the solidified liquids passing the SW-846 Method 9095 Paint Filter Test (PFT). The corrosivity of the solidified liquid was based on pH as measured using SW-846 Method 9045D where water was added to the solidified surrogate and the pH of the resultant slurry was measured using a standard pH meter.

Three additional surrogate environmental stability tests were conducted to examine the potential for solidified liquids to release free liquid under adverse conditions of pressure, temperature and vibration occurring during transport or interim storage. In the pressure test, the solids were subjected to a vacuum (260 mm Hg) representing an altitude of about 26,000 ft above sea level for four hours. The solids were then subjected to three freeze/thaw cycles (25 – 80 degrees F) over three days. Finally in the vibration/heat test, the surrogate solids were subjected to vibration at 1,700 cpm and a temperature of 115 degrees F for 24 hours. The resulting surrogate solidified acid passed all stability tests at the recommended dosage of 1.5 g/mL.

Upon receipt of the surrogate treatability testing and initial sample batch results in late February 2010, the project began liquid solidification activities. Liquids were solidified primarily into clear 5-gallon containers pre-charged with the Acidbond/lime mixture at the ratio determined during surrogate testing.

The thin-walled clear polycarbonate containers utilized for solidification were chosen to aid in visual examination of container content. However, some of the solidified containers showed signs of deterioration (cracking) within a week, most likely due to the heat of reaction during neutralization and the resultant sorbent expansion stressing the containers. These containers were placed in secondary containers prior to eventual placement in a drum.

By 3/31/10, the liquids were solidified, meeting a project milestone for the completion of this task. Paint filter tests were conducted on the solidified liquid. The solidified liquids containers were ready for outloading into drums upon receipt of analytical results.

SECOND DRUM CAMPAIGN

In early March 2010, RH-TRU drum filling operations resumed. This 27 RH-TRU drum campaign experienced problems right from the start with the B-Cell middle manipulator breaking within days of starting. Also, during drum pouch sealing the RF sealer exhibited unusual heating characteristics. Investigation revealed a defective gun and cable assembly.

A new assembly was obtained from another facility, installed and verified operational. Questions were raised in early March 2010 about the adequacy of the 75 ft-lbs torque specification of the Drum Closure Procedure. It was decided to conduct testing on the drum rings to resolve whether this torque specification could be improved upon. Additional Type A testing was conducted by Skolnik Industries for the Argonne-designed closure ring-equipped 55-gallon drums at a 60 ft-lb torque specification. The testing was successful.

VE packaging and drum filling during this campaign was slow at first but several factors came together to make increased throughput possible. By this time, process improvement had been implemented and little further degradation in the manipulators and the PaR arm allowed for rapid filling of drums. A drum could be filled in just one or two hours, where previously VE packaging a drum could take longer than a day.

Due to continuing manipulator problems, the decision was made to use the PaR arm to place waste into drums. This again slowed the process of loading each drum. On 4/29/10 the PaR arm stopped working in the y-direction, halting drum loading operations and requiring a cell entry to repair. This required partial disassembly of the alpha barrier. The repairs were made, the alpha barrier was reinstalled and drum filling restarted on 5/4/10.

Since the project had only one Gated Drum Shield (GDS), the Waste Management Organization (WMO) was required to pick up each filled drum before the GDS could be turned around to start filling the next drum. This was about a three hour process from the time that the drum was ready until the waste requisition paperwork was completed and WMO picked up the drum. Since the packaging efficiency had improved so much, the project looked for ways to minimize this impact. The facility obtained a lead overpack TRU-Shield drum that provided temporary storage of completed drums and thus allowed immediate turnaround of the GDS to start filling the next drum. This also required procurement of a gantry crane and hoist assembly to transfer the drum from the GDS to the TRU-shield container as well as changes to the applicable procedures. The new process saved approximately three to four hours per drum.

Another process improvement made during this time frame was to develop and install a removable plastic chute funnel. This funnel:

- made the pouch more rigid,
- provided a clearer path to filling the drums thus allowing a greater volume of material to be added to each drum, and
- protected the pouch from tearing while loading irregularly shaped objects.

The PaR arm hand started to lock up on 5/21/10 and several cell entries were required to complete repairs. The manipulators also continued to deteriorate. Two manipulators began showing signs of wear around this time. These malfunctions severely limited the ability to load drums.

The USEPA performed a surveillance visit on 6/18/10 to witness the performance of a test plan to measure and quantify fuel examination waste (FEW). The surveillance resulted in only positive comments.

The last three drums packaged during this campaign contained the remaining identified FEW and all remaining high Hazcat contributors in the hot cell. Since there were a number of small jars and vessels that needed to be opened to access the FEW, it took more time than normal to fill these drums.

As the PaR hand continued to display problems, the decision was made to enter another maintenance period which effectively ended the drum campaign. This maintenance period started on 6/9/10.

DOWNGRADE TO BELOW HAZCAT3

The project continued to remove hazard category-contributing material from the facility through 6/18/10. The removal of this material represented the last of the project scope contributing to the reduction of the HazCat to below HazCat3. A radiological inventory of the remaining items in the cell was conducted and calculations were made based upon smear sampling lab results. The surface area contamination calculations and a corresponding technical basis was documented in the , "*Technical Basis for the Contribution of Residual Surface Contamination to the 205 K-Wing Facility Radiological Facility Sum of Fractions and PuFGE*". This document represented the technical basis for and the quantification of the residual surface contamination in the 205 K-Wing Radiological Facility to support the implementation of a process to ensure that the facility was managed to maintain the inventory below the nuclear facility thresholds.

An estimate of the contribution of residual surface contamination to the HazCat 3 threshold was developed, based on results from the in-cell sampling conducted in accordance with Central Characterization Project Sampling and Analysis Plan for Argonne Remote-Handled Debris Waste (CCP-AK-ANL-505A). Sampling results from Argonne Analytical Chemistry Laboratory (ACL) were utilized.

The HazCat3 ratios were calculated for Cells A and B; contamination in the balance of the facility was assumed to be negligible. The method used to calculate total activity was considered to be conservative in that the residual areas were assigned the maximum contamination levels measured during smear sampling and the balance of the surface area was assigned contamination levels equal to B-Cell tabletop. Since this table was the primary location for conducting in-cell operations, it was expected that its levels would exceed the rest of other surfaces in-cell. Also, surfaces above five feet in each cell were assumed to be contaminated at minimum measured levels since these areas would not have had direct contact with source materials. The total activity was calculated for radioisotopes measured in the sampling campaign, and activity of other radioisotopes conservatively assumed to be present were assigned by scaling.

Upon calculation completion, the surface area/debris item data was utilized to populate the Argonne Radioactive Material System (RMS) for the facility. The purpose of this database system is to document the radiological facility sum of fractions and fissile gram inventory and to ensure that the inventory is controlled below the threshold values for Hazard Category 3 nuclear facilities. This compilation of facility inventory values verified that the facility was indeed less than Hazard Category 3.

On 6/30/10 a letter to DOE was sent informing them of the de-inventory to less than HAZCAT 3 quantities of nuclear material and requesting a downgrade to a Radiological facility.

SECOND MAINTENANCE OUTAGE

The alpha barrier was partially disassembled on 6/9/10 to allow for work on the manipulators. The PaR hand assembly was removed, inspected, lubricated and placed back on the PaR and seemed to operate properly. Without the PaR functioning properly, it would be impossible to remove and repair the slave manipulators.

During a cell entry on 6/11/10, the C-Cell air flow was observed to reverse. Personnel evacuated the cell and the facility was placed in a safe condition and the differential pressures returned to normal. Further cell entries were suspended until this issue was resolved. Investigation of this event revealed material issues with the control air system which controls movement of the ventilation dampers. This of course delayed the planned manipulator repairs. Extensive troubleshooting of the ventilation system revealed a series of problems. Parts for these items were ordered and repairs completed by 8/6/10. This was almost a two month delay.

In-cell activities resumed on 8/9/10 and troubleshooting and repairs of the PaR and manipulators resumed. The PaR tube hoist motor was found to be failing and needed replacement. Repairs to the PaR manipulator were completed on 8/13/10 and the slave manipulator lifting fixture was installed on the PaR. Repair of the first slave manipulator was completed on 8/18/10. In addition to the PaR arm, three manipulators were repaired during this maintenance outage, the alpha barrier was re-installed on 9/16/10 and the C-Cell decontamination was completed the next day and the maintenance outage was declared complete.

SIZE REDUCTION AND THIRD DRUM CAMPAIGN

Although the primary project goal, to reduce the inventory to below Hazcat 3, was completed successfully, there was much large debris in the hot cell that required size reduction for the project to ultimately be successful. There were five large work tables, a shelving unit, a sample carousel, large containers, and many trays and other equipment made of unistrut, angle steel, aluminum, plastic, and stainless steel that would require size

reduction. The first size reduction was attempted using an electric counter-rotating saw outfitted for remote operation. Three five-gallon plastic containers were size reduced but during the operation, the equipment failed.

The project continued remotely dismantling equipment using wrenches which was painstaking and slow. The project began looking for alternatives to make size reduction progress faster. The project modified an abrasive wheel chop saw for remote operations and deployed it in cell. This improved the process for reducing items that could be brought to the saw but the size reduction of stationary debris was still difficult to achieve. The project then evaluated the use of a metal cutting circular saw which was modified for remote operations and placed in the cell on 10/8/10. This improvement initially allowed for remote cutting of stationary metal table tops and larger solid debris. The saw was then outfitted with lifting cables which allowed for cutting using the PaR arm on either horizontal or vertical surfaces.

Figure 3 205 K-Wing A-Cell on 10/6/10

The size reduction continued successfully until the in-cell equipment (PaR and manipulators) again showed signs of wear. This was expected since the in-cell equipment was not designed to be used in this manner with the vibration and lifting required for this type of size reduction. This RH-TRU waste size reduction and drum packaging campaign began on 9/17/10 and ran through 11/2/10 and consisted of 10, 55-gallon drums. After the third maintenance outage, which commenced on 11/3/10, is completed, a fourth RH-TRU packaging campaign will be initiated and possibly a subsequent fourth maintenance outage. There is an estimated 25 additional drums worth of RH-TRU waste still requiring size reduction, VE packaging, and outloading before the project can be declared complete.

Figure 4 shows the current status of 205 K-Wing RH-TRU waste drums outloaded to date.

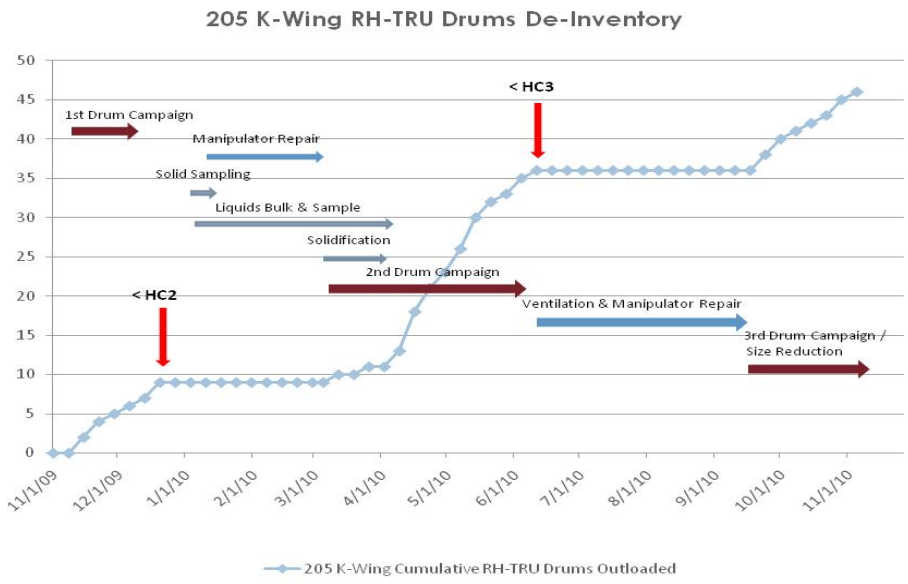

Figure 4 Current 205 K-Wing RH-TRU Drum Progress Chart

SUMMARY AND LESSONS LEARNED

The project was successful in meeting aggressive DOE milestones for downgrading the facility to less than HazCat 3 while still preparing the waste for near term disposal by meeting the WIPP site acceptance criteria. This effort required many innovative approaches and original development of several pieces of equipment. In addition, the challenge of using 35 year old remote equipment at the limit of its design operating limits proved to be the greatest handicap. The project was forced to spend more that 50% of the time in extended maintenance periods to keep the remote equipment operating at only minimum capability. The project was able to compensate for this down time by performing activities which could be accomplished in parallel with the maintenance and by the improved throughput that was achieved due to improvement in operator proficiency gained with experience.

As a result of this project, Argonne again proved to be a leader in the DOE complex in managing RH-TRU waste.