Alpha Gamma Hot Cell Facility De-Inventory at Argonne National Laboratory A Tale of Two Projects - 11316

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ABSTRACT

The Alpha Gamma Hot Cell Facility (AGHCF) at Argonne National Laboratory (Argonne) is currently categorized as a Hazard Category 2 (HC2) nuclear facility, which requires an inert nitrogen atmosphere and for all operations to be performed remotely. The AGHCF began operation in 1964 and was originally designed to examine plutonium bearing fuel elements from the Experimental Breeder Reactor (EBR II) at the former Argonne-West facility at Idaho National Laboratory (INL). Since then, the source of materials was expanded to include specimens and structural samples from other reactors, including several commercial reactors. The facility ceased programmatic research in 2007 and the focus of current operations is to de-inventory the facility in preparation for its ultimate demolition. The inventory of irradiated test specimens (ITS), generated from over 40 years of research and destructive examination activities, is stored in several hundred containers both above grade and below grade inside of the hot cell. In order to de-inventory the several thousand individual specimens, each individual specimen container must be opened and appropriately packaged for final disposition via one of two routes.

The inventory was divided into 2 groups: 1) sodium-bonded fuel specimens from EBR II that are to be packaged and shipped back to INL for further processing and 2) the balance of the fuel specimens that are to be packaged and shipped directly to the Waste Isolation Pilot Plant as Remote-Handled Transuranic (RH TRU) waste. This de-inventory effort began in May 2009 and is funded by DOE's Office of Environment Management as part of the American Recovery and Reinvestment Act (ARRA). This paper will describe the processes that have been developed to manage the de-inventory effort and the challenges that have been encountered since the effort began.

INTRODUCTION

In order for any de-inventory project to be successful there are four fundamental questions that must be answered.

1. What are the characteristics and quantities of the material that is to be removed from the facility?

2. Who is capable of and willing to accept the material?

3. How must the material be prepared to meet the acceptance criteria of the receiving facility?

4. How is the material going to be transported to the receiving facility?

In the early stages of these projects, the quality of the answers to the questions ranged from poor to nonexistent. After eighteen months of sustained effort in two concurrent de-inventory projects, the quality of the answers has improved dramatically. These improved answers will be presented for each project.

As discussed above, there are two de-inventory projects that are being executed in parallel at the AGHCF. The first, *AGHCF Excess Materials and Waste Disposition Campaign*, carries the scope for dispositioning all of the sodium bonded fuel specimens, which account for approximately 25% of the physical ITS inventory in the AGHCF. The second, *Next Phase Transuranic (TRU) Waste Campaign*, carries the scope for dispositioning the balance of the ITS inventory (~75% of the physical ITS inventory), in addition to the size reduction, packaging and shipment of approximately one hundred, 30-gallon drums of RH TRU Debris waste.

THE ANSWERS

AGHCF Excess Materials and Waste Disposition Campaign

Question 1 - What are the characteristics and quantities of the material that is to be removed from the facility?

At the beginning of the project this question seemed to be one of the more straightforward questions to answer – that turned out not to be the case. The historical research activities in the hot cell, following receipt of an intact fuel pin (typically about 25 inches long) into the facility, started with puncturing and sectioning the fuel pin into smaller pieces for some sort of experimentation or examination. Oftentimes, the final pieces of fuel were as small as a quarter of an inch long. It was not uncommon for an individual fuel pin to be cut into dozens of smaller pieces. When a fuel pin came into the facility it was assigned an Alpha Gamma number or "A/G number" (e.g., A/G100). Once sectioned, the individual pieces would be assigned a sub tier A/G number (e.g., A/G100A, A/G100B… A/G100A1…AG/100A2 etc.). After over forty years of research there were just over 4000 individual pieces of fuel in inventory. Most of this work was done before the age of personal computers and therefore the research data was captured primarily in hand-written log books. While an effort was made in the 1990s to transfer all of this data into an electronic database, with over a dozen pieces of information captured for each piece of fuel, the database was understandably full of gaps.

One of the key pieces of data that actually was available for essentially all of the fuel pieces was the name of the reactor in which the fuel was irradiated. One of the initial project working assumptions was that any fuel originating from the EBR II Reactor would need to be returned to INL due to the potential for sodium contamination. Approximately one-third of the hot cell inventory was associated with those three reactors. Following the initial meetings ANL had with INL personnel it was determined that only about half of that inventory consisted of metal sodium-bonded fuel. The other half of the inventory consisted of oxide and carbide fuels which were helium bonded. While all of these fuel types spent time in a sodium-cooled reactor, only the metal sodium-bonded fuels would be candidates for returning to INL for sodium conditioning. The oxide and carbide based fuels were only subject to sodium contamination on the outside of

the cladding. This exterior sodium contamination was routinely removed from the surface of the fuels either before being shipped to ANL or upon receipt at ANL and therefore the sodium hazard was not a concern for that population of fuel segments. However, the metal sodium-bonded fuels contained sodium intermixed with the fuel inside of the cladding and therefore would need to be handled differently in order to condition the remaining sodium out of the fuel before it could be shipped to WIPP for disposal.

INL operates an electro refining process that can accept small pieces of sodium-bonded fuel, clad or unclad, into the feed. The sodium is converted to sodium hydroxide during the process and the uranium and plutonium metals are recovered separately.

Question 2 – Who is capable of and willing to accept the material?

All of the sodium-bonded fuel in question originated from INL and a Memorandum of Agreement (MOA) had previously been signed by ANL and INL that the material was to be returned to INL. However, by the time the funding was provided to prepare and package the material for shipment, the MOA had expired. When ANL project personnel first contacted INL to negotiate an amendment to the existing MOA, INL raised a number of concerns regarding exactly what was being returned and how the material would be handled after receipt. INL assigned a senior project manager to work directly with ANL project personnel and after several visits to ANL over the next four months a common understanding was reached. INL agreed to accept all of the material with the understanding that all reasonable efforts would be made to avoid sending any material to INL that did not have a potential path forward to disposal or could be shipped directly from ANL to WIPP as transuranic waste.

Of particular concern to INL was a subset of the material that had been prepared as metallurgical mounts (met mounts) for examination in a metallograph. Each met mount consisted of a small piece of fuel embedded in a 0.75-1 inch thick Bakelite disk. The Bakelite material posed a problem for INL because the electro refining process that would be used to condition the sodium-bonded fuel could not accept the Bakelite in the feed. This would require the small pieces of fuel to be removed from the Bakelite disks which would be extremely difficult to do in a remote fashion.

As the met mounts were fabricated, it was a common practice to rinse the small pieces of fuel with ethanol or a combination of ethanol and water and to polish the surface of the finished met mount. This raised the question as to whether or not the met mounts still would be considered reactive due to the presence of sodium metal and therefore not acceptable for direct disposal at WIPP. If the project could demonstrate that the met mounts were not reactive in their final form that would further reduce the amount of material to be shipped to INL and eliminate the concern about dealing with the Bakelite. Project personnel worked with ANL's Analytical Chemistry department to develop a simple protocol to test for the presence of sodium in the met mounts.

A representative sample of met mounts were placed, one at a time, into a glass beaker containing a solution of ethanol laced with a phenolphthalein indicator. If any sodium was present, it would react with the ethanol to form hydrogen gas and readily soluble sodium ethoxide ($NaOC_2H_5$) at a relatively fast but easily discernable rate. Additionally, the strongly basic ethoxide product would induce a pink color where it goes into solution. These reactions would be evidenced by gas bubbles being evolved at the specimen surface where sodium metal is present, and by the

appearance of the pink color. The production of gas bubbles is specific for sodium in its reactive metal form. The pink color could also arise from passive forms of sodium that are slightly soluble in ethanol, such as sodium hydroxide, which might be present in the specimen. However, if the sodium is passive, the pink color will form at the liquid/solid interface and diffuse only very slowly into the bulk of the solution; with reactive sodium, the solution will be locally agitated by the gas and heat from the metal reaction and "trails" of pink color would extend very quickly into the overlaying solution. Thus, the observation of gas bubbles in conjunction with pink streamers emanating from the surface of the mounted specimen would provide a positive indication of sodium metal; absence of gas bubbles and pink streamers in the liquid would confirm that reactive sodium metal was not present.

All of the met mount samples that were tested showed absolutely no evidence of sodium reactivity (see Figure 1). This eliminated the need to send the met mounts to INL for conditioning and reduced the inventory of material to be returned to the metal sodium-bonded fuel pieces only (in a form that was normally suitable for conditioning in INL's existing electro refining process).

Fig. 1. *From left to right: A sodium hydroxide tablet submerged in the ethanol/phenolphthalein indicator showing the positive pink color indicative of the ethanol-sodium reaction; a met mount disk held in a remote manipulator hand inside the hot cell; a met mount submerged in the ethanol/phenolphthalein solution inside the hot cell showing no evidence of an ethanol-sodium reaction (no pink color and no hydrogen gas bubbles).*

Question 3 - How must the material be prepared to meet the acceptance criteria of the receiving facility?

With the portion of the overall hot cell inventory to be shipped to INL finally defined, the process of retrieving the material from storage was ready to start at the beginning of November 2009. The final quantity of material to be returned to INL was determined to be approximately 800 individual fuel specimens totaling about 1800 linear inches of fuel. Each individual specimen was stored inside of a primary container (a pipe nipple) and the hundreds of pipe nipples were stored inside of dozens of metal cans.

The project developed a process whereby each individual fuel specimen was removed from the pipe nipple and physically examined to verify that the specimen matched the description contained in the electronic database. After segregating the specimens by reactor type, each specimen was then systematically photographed and then loaded into a 25-inch long fuel element tube with a slightly larger diameter than the diameter of the fuel specimen. Paper forms were used to track which fuel element tube received the specimen as well as the location of the specimen within the tube (the individual elements were essentially stacked one on top of another inside of the tube). Once a fuel element tube was filled and sealed, a form was created in accordance with INL acceptance requirements that detailed the radiological data for each individual fuel specimen as well as the total radiological content of each tube.

The packaging operation went quite smoothly at first until some of the older fuel specimens were encountered. The project anticipated that a small amount of swarf (debris left over from the act of cutting the intact fuel elements into smaller pieces) would be encountered inside the pipe nipples. This negligible amount of material was to be added to the historical inventory of swarf that had been accumulated over the years (a separate process is to be developed to disposition the swarf). However, project personnel noticed that some of the older specimens contained much more swarf than was expected – in certain cases almost half of the material in a pipe nipple was "rubble." Packaging operations were put on hold at that point until the situation could be better understood.

After many conversations with research personnel at both ANL and INL it was determined that some of the fuel specimens had partially oxidized while in storage and became brittle – to the point that portions of the specimen would literally crumble. This situation presented a significant problem for INL because oxidized fuels are not suitable as feed for the existing electro refining process. After several weeks of evaluation it was agreed that ANL would segregate the oxidized fuel specimens from the non-oxidized specimens before packaging the material into the fuel element tubes (see Figure 2 below). It was also agreed that the rubble associated with the oxidized fuel specimens would be packaged into the fuel element tubes along with the intact portion of the fuel specimen in order to maintain the integrity of the material control and accountability data for each specimen. If the rubble had to be segregated from the intact portion of each fuel specimen the project would have had to weigh each portion prior to splitting up the material which would have been immensely challenging in a remote operation.

It took about 10 months to retrieve, inspect, segregate, and package the entire inventory of metal sodium-bonded fuel into just over 60 fuel element tubes. The next step would be to load the fuel tubes into the containers to be used for transportation to INL and to out load those containers from the hot cell into the shipping cask.

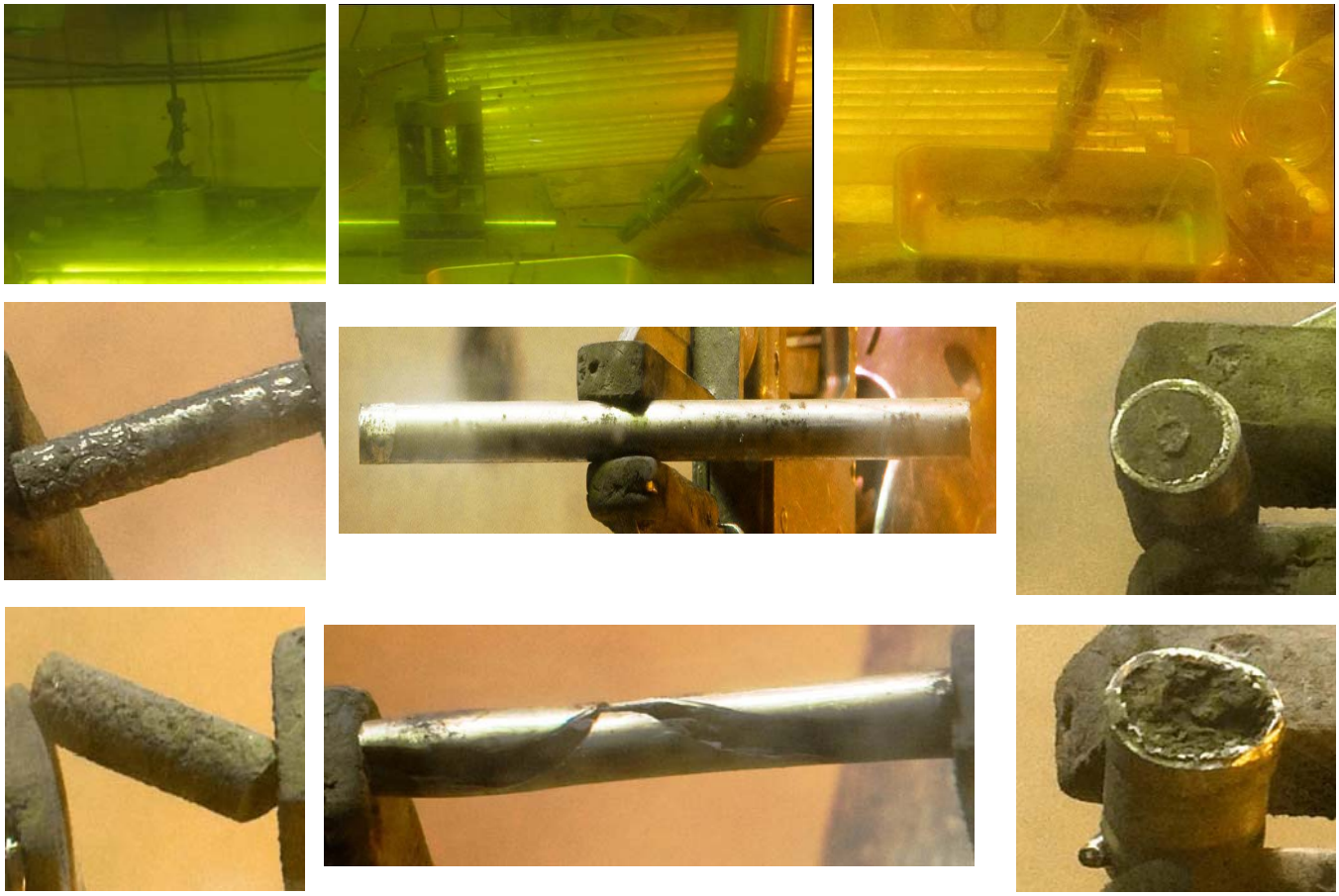

Fig 2. *Row 1 left to right: A can of fuel specimens being retrieved from a below grade storage hole inside the hot cell; a 3-inch piece of a non-oxidized fuel specimen being loaded into a fuel element tube; an example of the rubble collected from an oxidized fuel specimen. Row 2: Examples of non-oxidized fuel specimens – note the relatively smooth surfaces. Row 3: Examples of oxidized fuel specimens – note the pitted surfaces and the split cladding caused by the expansion of the oxidized material.*

Question 4 - How is the material going to be transported to the receiving facility?

Prior to the initiation of this project, the last time any fuel material was shipped from the AGHCF to INL, it was shipped in the T-2 Type B shipping cask. Since then, the Certificate of Compliance (CoC) for the T-2 cask had expired and a new alternative would need to be identified. It was determined that the only viable candidate for shipping the AGHCF material would be NAC International's Legal Weight Truck (NAC-LWT) Type-B Shipping Cask. However, before the cask could be used to ship the specific sodium-bonded fuel in question, a new inner container would need to be designed and fabricated and a revision to the NAC-LWT Safety Analysis Report for Packaging (SARP) would need to be prepared and approved by DOE to support a revision to the cask's CoC.

The container design and fabrication, as well as the SARP revision process, would need to be completed in parallel with the in-cell packaging operation described above in order to complete the project on schedule. It is not uncommon for a SARP revision to take eighteen months or more to prepare and approve. The aggressive schedule set for this ARRA-funded project would only allow for about half that time. To help minimize the schedule for this part of the project it was decided that the inner container design would be based on the already-approved design for a container referred to as the 6CVL (6-inch containment vessel long). The 6CVL had been used to ship similar material in another cask. The container to be used for the AGHCF material would come to be known as the 6CVS (6-inch containment vessel short) – simply a shorter version of the 6CVL. The NAC-LWT cask would be able to accommodate three 6CVSs and the entire inventory of packaged fuel element tubes would end up fitting into a total of three 6CVSs, meaning the entire inventory could be shipped to INL in one shipment.

ANL, INL, NAC, and DOE worked very closely together to get the SARP revised and the CoC for the cask approved in time to support the shipment. However, after the SARP was approved and the CoC was issued, a fabrication issue associated with the 6CVS surfaced that required a second revision to the SARP. Because of the sodium hazard associated with the material the 6CVSs needed to be filled with an inert gas (helium) and sealed. The SARP required that the 6CVSs pass a very strict helium leak test prior to being certified for use. When the fabricator subjected the 6CVSs t to the leak test procedure prescribed in the SARP, all of them failed the test. After a tremendous amount of investigation and troubleshooting, it was determined that a slightly larger O-ring gasket than the one specified in the approved design would allow the container to pass the prescribed leak test. The only other option would be to use a modified version of the leak test protocol that had been used for the 6CVL. In either case, the SARP would need to be revised.

A revision to the SARP was ultimately prepared and approved that allowed for use of the larger O-ring and/or the alternative leak test procedure. It turned out that the larger O-rings worked and the originally prescribed leak test procedure was used to certify the leak tightness of the containers.

In November 2010, eighteen months after the initiation of the project, the 6CVSs and the NAC-LWT cask were delivered and mobilized in preparation for loading. Project personnel did extensive training on the 6CVS loading operation utilizing a mockup of the hot cell facility. The loading of the 6CVS was done by remotely passing the loaded fuel element tubes through a port in the hot cell into the cavity of the 6CVS. A specially designed rig was designed to hold and tilt the 6CVS into place to support the loading operation. The rig also allowed for the 6CVS to be held within a basket inside of an intermediate transfer shield that was necessary to reduce the dose rate to acceptable levels as the loaded container was subsequently transferred out of the AGHCF to the outdoor location where the NAC cask was to be loaded. Once removed from the building, NAC personnel took over responsibility for transferring the 6CVS from the shielded container into the NAC-LWT cask.

The protocol for transferring the loaded 6CVS into the NAC-LWT is highly involved and utilizes a number of shielded transfer mechanisms. In order for the transfer process to occur a basket was designed to hold the 6CVS that would help to ultimately stabilize and center the 6CVS inside of the cask and help guide the 6CVS into the various pieces of transfer equipment used to load the

cask. Part of the basket design included as guide channel to help align the basket in the proper configuration as it worked its way into the cask.

Just as the project was about to come to a successful conclusion, a fabrication flaw in the basket holding the third and final 6CVS surfaced that prevented the basket from being loaded into the cask. This required ANL to have to bring the third loaded 6CVS back into the AGHCF and unload it so that the basket issue could be investigated. Fortunately, project personnel had planned for the possibility of needing to unload a 6CVS and those contingency plans worked as designed. Also fortunately, ANL has a Central Shops organization on site that was able to support the investigation of and correction to the basket flaw. After identifying the flaw (the channel was not wide enough or straight enough to fit over the cask transfer equipment guides). ANL worked with DOE to get approval to make the field modifications to the basket and the Central Shops group re-machined the guide channel.

The third 6CVS was repackaged and ultimately loaded safely into the cask. The shipment left the Argonne site on December 1, 2010, arrived at INL the next day, and the contents were finally unloaded into the Hot Fuel Examination Facility (HFEF) at INL on December 10, 2010.

Next Phase TRU Waste Disposition Campaign

Question 1 - What are the characteristics and quantities of the material that is to be removed from the facility?

There are two separate and distinct sets of RH TRU material that are being managed in the AGHCF. The first, RH TRU Debris, consists of in-cell experimental equipment, tools, hardware, empty element tubes, structural material, and out-of-service remote handling equipment. Much of this material has been size reduced, packaged into intermediate containers, and outloaded into drums for shipment to the Waste Isolation Pilot Plant (WIPP). The majority of this portion of project scope has been accomplished, with 117 drums outloaded by January 31, 2011. The size reduction of these materials was accomplished by adapting relatively common industrial tools for use inside the hot cell. Band saws, angle grinders, and abrasive wheel cut-off saws have all been successfully deployed interior to the hot cell, and each has a slightly different purpose. The abrasive wheel saw has been successful as a stationary tool to handle larger pieces of material, the angle grinders have been successfully used by the PaR Systems Robot as hand-held cutting tools, and the band saw has been instrumental in severing pipe and thin walled metal plates.

While a significant amount of effort and design creativity had been dedicated to these in-cell size reduction tools, the resultant RH TRU Debris had been an approved WIPP Certified waste stream upon project inception. The more difficult process, for describing, characterizing, packaging and shipping the Fuel Examination Waste (FEW) had not been developed, tested or approved. Establishing the program for FEW disposition will be the main focus for the balance of this discussion.

The RH TRU FEW material consists of items that have been generated from the destructive examination of irradiated test specimens, pin fragments, cladding, and RERTR plates. The radiological characteristics of FEW make it different enough from the RH TRU Debris that a

separate system had to be implemented that would direct the safe, accurate, and traceable de-inventory of this material.

The radiological characteristics of this material correspond to the type(s) of material used in the original fuel composition, the irradiation history of the fuel specimens, and the type of reactor - Light Water (LWR), Pressurized Water (PWR), or Fast Breeder (FBR) used to irradiate the specimens. Materials used in the original composition of these specimens included Uranium and Plutonium oxides, carbides and sulfides. Cladding types included several different stainless steel alloys, as well as several different Zircalloy compositions. Irradiation histories varied greatly between all fuel types, with many pieces undergoing multiple irradiation cycles in different rectors (generally the Fast Breeder programs). Reactor types are divided almost equally between the LWR/PWR and FBR when evaluating the irradiation history of the FEW population. Uranium enrichments varied from 0.2% to over 93%.

Question 2 - Who is capable of and willing to accept the material?

The genesis of this answer came from a meeting held in the DOE Carlsbad Field Office (CBFO), with Argonne project managers, DOE-Argonne Site Office personnel, and WIPP-CBFO managers. The discussion centered on the definition of this FEW as RH TRU Waste, and whether this material might be accepted at WIPP for final disposition. The consensus was that this FEW material could be classified as RH TRU Waste, certainly had a Defense pedigree, and was therefore eligible for acceptance at WIPP. This proved to be easier agreed upon than done.

In order for any TRU Waste to be accepted at WIPP, there are many incremental steps that have to be followed in order to have a population of material qualified for acceptance. In this case, the FEW material was all being generated from the AGHCF, which had obtained approval from the Central Characterization Project (CCP) to generate RH TRU Waste. This approval was obtained in 2006, as part of the Phase 1 TRU Waste Disposal Campaign. This approval entailed thousands of hours of work, by Argonne and WIPP-CCP team members, to establish an “Acceptable Knowledge” (AK) report for all materials bound by the AGHCF inventory. This AK report is the WIPP-CCP Waste Stream Profile for all materials that have been evaluated for shipment to WIPP, but had not yet evaluated the FEW specimens.

Therefore, the first step in obtaining approval to ship the FEW to WIPP was to work with the WIPP-CCP technical team to define the FEW population’s physical and radiological characteristics, and have that data incorporated into Argonne’s RH TRU AK Report. This process started in earnest in August 2009, and the revised AK Report was approved on January 14, 2010. This successful outcome was the result of the tireless efforts of the WIPP-CCP Technical Support Team working in concert with Argonne technical project leads, to paint a picture of the FEW in sufficient detail to communicate its characteristics to those that would review and approve the Tier 1 Change Request. Successful completion of the AK Report is the first step in building a Tier 1 Change Request, which is a document that includes the AK data, the Radiological Characterization process description, and demonstrates that the material described meets all WIPP, CBFO, US EPA, and New Mexico Environmental Department (NMED) rules and regulations for management as RH TRU Waste.

Defining an approach to the radiological characterization of the FEW material proved to be utterly simple in concept, but excruciating to demonstrate to all involved parties. The main

reason for this difficulty was that the process was new and, as such, had never been described, documented, or presented to the stakeholders before. The preferred method of radiological characterization prior to this new process development had been Dose-To-Curie (DTC), which involves using a loaded container's dose rate, applied to a set of scaling factors, to generate radiological data. This process works well for many material types, is well understood, and has been vetted over the course of the many years it has been in use. In early test runs, the DTC model produced results that exceeded the error boundaries for desired data quality. As a result, Argonne and WIPP-CCP developed a new, simple, and creative solution to generating the radiological data. Data gathered for the FEW population included all variables necessary to generate ORIGEN calculations for each unique sample pin fragment, which meant that the activity could be determined by obtaining the mass of each unique sample. After several months of evaluating all FEW data sets, Argonne and WIPP-CCP settled on a process that uses FEW measurements (physical dimensions and mass) to generate the radiological inventory for each unique sample as it is packaged in the AGHCF. This new methodology for characterization improved the accuracy of the data, while allowing each piece of the widely varied FEW inventory to be managed as it is encountered in the hot cell.

Once the Radiological Characterization Report (aka, RCTR) was finalized, the Tier 1 Request could be made to the US EPA and CBFO. In the effort to understand the FEW management process in the AGHCF, representatives from the US EPA, WIPP-CCP, and CBFO travelled to Argonne to perform surveillances and assist visits, which turned out to be essential in the approval of the process. The Tier 1 Request was submitted to the US EPA in July 2010, and received approval on November 23, 2010. As a result of this approval, Argonne expects to generate and ship approximately one hundred 30-gallon drums of FEW material to WIPP during FY 2011.

Question 3 - How must the material be prepared to meet the acceptance criteria of the receiving facility?

The method established for managing the FEW inventory was designed to meet the numerous requirements imposed on the movement of this material from its original AGHCF location to its final disposition. Data quality, material tracking, size restrictions, accurate characterization and fissile content limitations were all critical variables in development of the process. Steps have been engineered into the process to satisfy all of these data quality objectives including: maintaining the integrity of the MC&A Data (accountable materials), building predictive models for load management and characterization, using effective load plans to meet on-site and off-site (DOT & RH-72B cask) shipping requirements, and integrating the sorting, packing and outloading evolutions with the WIPP-CCP Program.

The process begins with evaluation of the FEW inventory using data from the Fissile Inventory Management System (FIMS). FIMS contains a separate entry for each sample in the hot cell (identified with a unique "A/G" number) and includes entries for fissile content, physical dimensions, reactor program, enrichment, program reference, Pu FGE value, and other data critical to the tracking and identification of each specimen. This data is evaluated and fed into a load management process, where samples are grouped together and targeted for loading into one of the FEW shield pots. The load plans are critical to packaging operations, as there are limits on Pu FGE, actinide and fission product content, physical form, and dose rate for each drum that will be fed into the disposition chain. By carving out these small specimen groups, the FEW

inventory can be divided into approximately 200 shield pots, which will correspond to one hundred 30-gallon drums of RH-TRU Waste generated from the hot cell when outloaded. The completed FEW Tracking Forms, generated from the load-plan-driven packaging operations, are used to generate radiological characterization data for each shield pot prior to outloading.

The shield pot concept was developed to meet several needs. The FEW had to be shielded (for ALARA purposes when being outloaded), had to meet container volume limits established for criticality control in the hot cell, had to produce waste drums with standard, reproducible geometry, and had to meet the WIPP-CCP & WIPP container requirements. The shield pot is approximately the size of a one-gallon paint can, and consists or a carbon steel right circular cylinder (with an end cap welded to the base) filled with either ¾" or 1" of lead sheeting on the sides and base. The lid is vented, equipped with thumb screws and a lock ring closure, is lead shielded equivalent to the base, and can be fully engaged using remote manipulators in the hot cell. The containers were designed by Project staff and are manufactured on-site by the Argonne Central Shops Group.

Fig. 3. *FEW Specimens being VE Packaged into Shield Pots in the AGHCF.*

The FEW loading process is driven by the load plan and is performed by trained AGHCF Technicians as observed and documented by WIPP-CCP Trained Visual Examination Operators (VEOs). As each FEW specimen is prepared for loading, it is "verified" by matching the A/G number on the specimen to the A/G number specified on the load plan. The physical characteristics are compared to the description, including a verification of the specimen length and width (or diameter), and when both match, the specimen is released for VEO examination and placement into a shield pot. To illustrate, when the load plan directs the de-inventory of a 1-gallon paint can, each sample is removed, the verification made, and the sample loaded. If there is a discrepancy identified with a specimen during verification, it is removed the process, documented, and managed under the AGHCF Material Discrepancy Process. The FEW in question is not offered for VE and is not packaged until the discrepancy is resolved and documented.

Question 4 - How is the material going to be transported to the receiving facility?

Each shield pot is loaded, VE certified, and sealed (using TIDs). Each shield pot is centered in a 7-gallon can using a sturdy centering rig, and the application of a lid, lock ring, and T-Clip to "lock" the ring in place. The 7-gallon cans are then outloaded into 30-gallon Type A drums (See Figure 4, below). The standard configuration is 2 shield pots per drum. Each drum outloaded is transferred to the Argonne Radioactive Waste Storage Facility, where Head Space Gas (HSG)

sampling is performed, and where the Removable Lid Canister (RLC) loading process is initiated.

Prior to loading an RLC, a 3-drum build list is generated by WIPP-CCP for each RLC payload. Three drums are loaded into each RLC, after evaluation of the combined contents demonstrate that the materials meet the Certificate of Compliance for the RH 72B Cask, as well as all DOT regulations for the transport of these materials. The RLC loading & RH-72B Cask loading operation is completed in the yard adjacent to the RWSF, by the Mobile Loading Unit (MLU) Team that is dispatched by CBFO, to ensure competence and consistency in all facets of package preparation, loading, and transportation activities.

Argonne has completed 36 shipments of RH TRU waste to date, during the ARRA funded Next Phase TRU Campaign. The FEW material will comprise approximately 34 additional shipments of RH TRU destined for WIPP between March and September 2011.

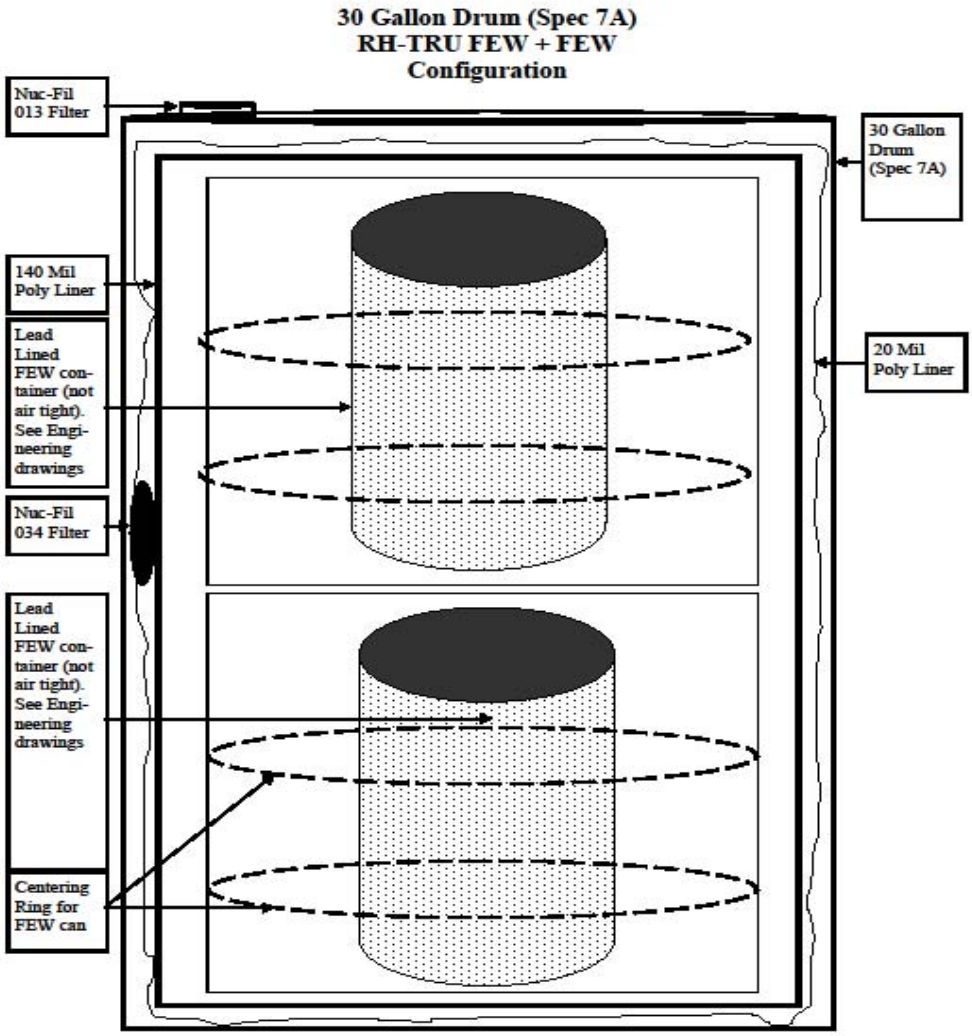

Fig. 4. *30-Gallon Drum Loading Diagram, including FEW Shield Pots*