

**Nuclear Footprint Reduction at Argonne National Laboratory - Out with the Old (Material),
In with the New (Mission) – 14665**

Daniel Pancake *, Cynthia Rock **, Dale Dietzel ***, Andrew Gabel ***

* ANTECH / Argonne National Laboratory

** Argonne National Laboratory

*** US DOE

ABSTRACT

In 2006, Argonne began working on increasing the compliance posture and risk reduction efforts for ten nuclear facilities. One of those facilities, Building 212 Alpha Gamma Hot Cell Facility (AGHCF) was identified by DOE EM as the highest deactivation priority among all Office of Science (SC) facilities (*Reference 1*). At the time of this writing and since the 2006 period, Argonne has reduced the number of its nuclear facilities to four (including the Transportation Nuclear Facility). One of the largest contributing factors to the success of Argonne's de-inventory program is the successful disposition of legacy materials and waste from the AGHCF. In 2013, the Deactivation Projects and Nuclear Footprint Reduction Program have removed nearly 90% of the total amount of nuclear material from the Argonne site. This paper will focus on the many successful outcomes of the Argonne Nuclear Footprint Reduction Efforts.

Major strides forward with NFRDP de-inventory was made possible through the American Recovery and Reinvestment Act (ARRA) during the FY 2009 to FY 2013 time frame. Projects to de-inventory transuranic (TRU) waste and material from the laboratory's legacy hot cell and storage facilities were developed by Argonne and supported by DOE-EM, DOE-ASO, DOE-SC, the Carlsbad Field Office, the National TRU Corporate board, Idaho National Laboratory, and others.

The De-inventory goals contained in the NFRDP were significantly exceeded, especially with regard to the ongoing de-inventory of the Building 212 Alpha Gamma Hot Cell Facility (AGHCF). The Remote Handled (RH) TRU Program developed at Argonne includes several "Fist of a Kind" waste streams that allowed disposition of Fuel Examination Waste (FEW) and Separations Science waste from the hot cells. These Argonne Programs are already being implemented at other DOE TRU Waste sites, and have the potential to add significant value to those Sites' Programs. The inventory reduction from the AGHCF alone amounts to approximately 59x the HazCat 2 (HC-2) SOF TQ. These risk reduction and compliance efforts included removal and disposition of nuclear materials from two additional HC-2 Nuclear Facilities (hot cells), that have since been de-inventoried and downgraded to radiological facilities. These Projects were accomplished on-time and under budget, while transitioning from "vintage" Safety Bases to 3009/3011 compliant Safety Bases. As a result of these de-inventory efforts, Argonne has dispositioned more curies of RH TRU waste to WIPP than all other DOE Lab Programs combined (through close of FY13). This funding and the successful completion of the projects advanced de-inventory efforts at the Laboratory by several years.

Successful completion of the NFRDP Program and Projects earned the Secretary of Energy's Honor Award in 2012, and included team members from Argonne, DOE-ASO, DOE-HQ, INL, WIPP, WIPP-CCP, DOE-CBFO, and others. This award is the highest non-monetary award issued by the Secretary of Energy.

INTRODUCTION

In 2006, Argonne began working on increasing the compliance posture and risk reduction efforts for ten nuclear facilities. One of those facilities, Building 212 Alpha Gamma Hot Cell Facility (AGHCF) was identified by the DOE Office of Environmental Management (EM) as the highest deactivation priority among all Office of Science (SC) facilities. At the time of this writing and since the 2006 period, Argonne has reduced the number of its nuclear facilities to four (including the Transportation Nuclear Facility). One of the largest contributing factors to the success of Argonne's de-inventory program is the successful disposition of legacy materials and waste from the AGHCF. In 2013, the Deactivation Projects and Nuclear Footprint Reduction & Deactivation Program (NFRDP) have removed nearly 90% of the total amount of nuclear material from the Argonne site. This paper will focus on the many



successful outcomes of the Argonne Nuclear Footprint Reduction Efforts.

The most significant indication of the Laboratory's ongoing commitment to reducing radiological risk is through its nuclear footprint reduction effort, which has an end goal of zero nuclear facilities at Argonne within the next decade. Major progress in effective de-inventory was made possible through the American Recovery and Reinvestment Act (ARRA) during the period between FY 2009 and FY 2013. Projects to de-inventory Remote Handled (RH) and Contact Handled (CH) transuranic (TRU) waste and material from the laboratory's legacy hot cell facilities were developed by the Argonne Nuclear Operations and Deactivation (NOD) Program, and supported by DOE EM, the DOE Carlsbad Field Office, the National TRU Corporate board, Idaho National Laboratory, and others.

DISCUSSION

During the period of FY2006 to FY2008, Argonne performed numerous management assessments of the Laboratory's Nuclear Facilities (e.g. safety of the situation, justifications for continued operations, investigation into issues, hazard assessments, and analyses [e.g., cause gap analyses]). In addition, assessments of nuclear and associated programs were executed by internal and external organizations, and the results were used to plan and execute improvement actions. As a first step, Argonne took major action in improving its nuclear organizational design, structure and facility management, cognizant systems engineering, and nuclear safety compliance posture. In addition, the Laboratory immediately de-inventoried three Nuclear Facilities (Area 317 North Vaults, Building 303 Mixed Waste Storage Facility, and Building 202-Source Storage) to less than HC-3 status, and brought all three facilities into 10CFR830 compliance.



Building 205 K-Wing Hot Cell (A-Cell) in 2009 (Top) and 2011 (Bottom).

In addition, Building 205 K-wing was formally segmented from the rest of Building 205, creating a separate HC2

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Nuclear Facility for ongoing work. It was during this period that the 205 G-wing facility underwent significant de-inventory, as major quantities of nuclear test specimen materials and research and development samples were removed from glove boxes and from the facility itself. These materials were transferred to Building 331 Radioactive Waste Storage Facility (RWSF), a HC-2 nuclear facility. At the time, Building 205 (excluding K-wing) was understood to have been de-inventoried from HC-2 to a radiological facility.

From FY2009 to FY2011, the Nuclear Footprint Reduction and Deactivation Plan (NFRDP), in conjunction with DOE, established challenging objectives and milestone commitments that were designed to bring Argonne nuclear facilities into compliance with 10 CFR 830 Part B, while pursuing risk reduction through the off-site disposition of legacy waste.

During this period, Argonne prepared DSAs, revised DSA implementing procedures for facility operations, completed facility modifications, trained staff in the implementation of those procedures, and conducted management assessments and readiness reviews for seven nuclear facilities. Major steps forward in advancing the breadth, depth, and rigor in design and staff implementation of the safety management programs occurred during this period as Argonne advanced through readiness to starting operations under a new safety basis for each nuclear facility. The DSAs were approved by the Approval Authority and the facilities were authorized to operate under the DSAs. At present, DSAs for all operating nuclear facilities are approved and nuclear operations at Argonne are fully compliant with 10 CFR 830. Through the off-site shipment of spent fuel, transuranic waste, and inter site shipments for re-use of nuclear materials, it is estimated that a minimum of 62 HC-2 equivalent nuclear facilities have been removed from the Argonne site since October 2009. One of the most significant operational challenges during this period was the planning and execution of major de-inventory Project work, as each process had to be designed to operate under the “vintage” Safety Analysis Reports (SARs) and transition seamlessly to comply with new compliant BIO and DSA requirements.

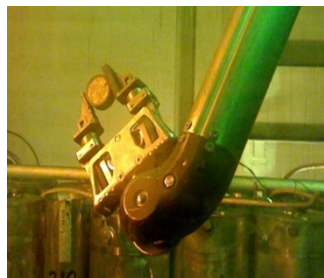
From FY2009 to FY2011, the Laboratory continued to develop a comprehensive framework of processes and procedures for compliant operations of its nuclear facilities. A significant part of the NFRDP included the effort to address and improve the safety management programs nuclear facilities rely upon. The Safety Management Program plan was developed within the Nuclear Operations, Deactivation and Demolition Program (NOD) to identify the major function of each safety management program. Strong

SMPs support robust and effective work outcomes and set the tenor for high levels of performance in quality and safety, helping to ensure deinventory project success.

One of the major factors that supported ongoing de-inventory efforts was the acceptance of our American Recovery and Reinvestment Act (ARRA) proposals. These proposals were submitted to EM for authorization and funding. The receipt of this ARRA funding created a partnership between DOE-SC and DOE-EM at Argonne that was able to produce significant results in deactivation, de-inventory, and demolition activities. The proposals were further developed into projects to de-inventory transuranic waste and material from Building 205 K-Wing, Building 200 MA/MB-Wing, Building 205 G-Wing (i.e., in the 331 RWSF), and the Building



212 AGHCF (including transfer of spent fuel to Idaho National Laboratory). With funding and cooperation from DOE EM, the Carlsbad Field Office, the National TRU Corporate board, Idaho National Laboratory, and others, the de-inventory goals outlined and committed in the NFRDP were significantly exceeded, especially with regard to the de-inventory of the Building 212 AGHCF. This funding and the successful completion of the projects advanced de-inventory efforts at the Laboratory by several years.



Prior to the establishment of the NFRDP, DOE EM identified the Building 212 AGHCF as the highest deactivation priority of all legacy DOE SC nuclear facilities in 2008. Since then, Argonne has maintained an aggressive path forward in removing inventory from the AGHCF, and by the end of FY13 had reduced the AGHCF inventory to below the HC-2 SOF. The inventory of the AGHCF at the end of FY13 is estimated at 0.954 of the HC-2 SOF TQ. In FY2013 alone, Argonne reduced this inventory by an amount equivalent to 19.1 times

the HC-2 SOF TQ.

Argonne's NFRDP and ARRA efforts led directly to the establishment of several new waste streams within the RH TRU Program. Fuel Examination Waste (FEW) and Solidified Separations Science Waste (S3W) streams were developed to drive disposition of irradiated fuel test specimens, SWARF, and solidified liquids generated from UREX experiments in various hot cells. The approval of these waste streams allowed the disposition of 100% of the 205 K-Wing RH TRU, and approximately 80% of the AGHCF discrete inventory, to WIPP near Carlsbad, NM. This leading effort not only enabled the clean out of Argonne hot cells, but also promises complex-wide benefits in the future. There are FEW Programs being established at INL, Sandia, ORNL, and other locations, based on the Program Development successes at Argonne. In addition to technical advances, the Projects were successful from a resource standpoint, and generated savings through the end of FY11 that were used to fund "Buy-Back" scope in FY12 and early FY13. The EM resources were used to decommission and disposition glove box systems from Building 205 G-Wing, as well as inventory and package CH TRU source materials no longer valuable to the research community. In all, the following major accomplishments were achieved during a four year operating window, with approximately \$107M in funding (\$79M ARRA):

- De-inventory and deactivation of Building 205 K-Wing Hot Cells (HC-2 to Radiological Facility (RF))
- De-inventory and Deactivation of Building 200 MA/MB Wing multi-story Hot Cell Facility (HC-2 to RF)
- De-inventory of the AGHCF (Spent fuel repatriated to INL, approx. 350 drums of RH TRU Outloaded and shipped to WIPP, HC-2 to HC-3, reduction of approximately 58X HC2 SOF from beginning of FY10)
- Demolition of the CP-5 Reactor Building to unrestricted use designation for the site allowing the ultimate reuse of the site to support further Argonne Missions. (3,000 LLW shipments)
- Demolition of the Building 310 Fuels Fabrication Facility to installation of an asphalt environmental cap over building footprint and restoration of the surrounding grass areas.



RH 72B Cask Shipments at Argonne

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- Compliant packaging and disposition of approximately 50% of the CH TRU source inventory at Argonne
- Development of 5 new RH TRU characterization methods, and approval of 5 Tier-One Change Requests through the US EPA and CBFO
- Hiring, retaining, training, and transition of approximately 175 employees in the Nuclear Operations, Deactivation and Demolition Program (NOD)
- AGHCF won the UChicago-LLC Award for Team Safety Performance in 2012 and 2013
- Completed all Projects on-time and under budget, generating savings for “Buy-Back” scope

Argonne also shipped valuable legacy radioactive materials off-site for reuse to advance DOE mission efforts at other locations. Research-related materials were sent to DOE Y-12, LANL, and PNNL for re-use. This effort significantly reduced the amount of non-waste, special nuclear material at the laboratory. The Laboratory is currently working on the establishment of an RH TRU Source waste stream, which will allow for the disposition of non-OSRP source material at WIPP.



Argonne’s successful efforts to reduce risk through the NFRDP were recognized on October 4, 2012 in Washington D.C., when the initiative received the Secretary’s Achievement Award. Argonne continues to lead the nation in efforts to rid its site of legacy transuranic waste. In the time period from October 2009 through September 2013, Argonne sent 176 RH-72B shipments to WIPP, and at the time of this writing, has disposed of more curies of RH activity at WIPP than all other DOE sites combined.

Argonne also recently completed the shielded container assembly (SCA) demonstration project, which allows for the removal of three times the amount of material per shipment as compared to the RH-72B cask, and the use of a more efficient location and pathway into the WIPP caverns for each canister. This program, when fully implemented, will provide additional pathways for Argonne and the DOE complex to manage and dispose of RH TRU waste and better utilize WIPP.

CONCLUSION

Finally, Argonne is committed to continue its nuclear footprint reduction initiatives. A goal of reducing the AGHCF to below HC-3 SOF by the end of FY15 has been established, and funding is being determined. The Laboratory’s commitment to reducing and safely removing this risk is further evidenced by the Laboratory’s willingness to use overhead funds to support removal of this RH TRU Waste in FY13 & FY14 in the absence of further DOE EM funding. The Laboratory’s overall objective is to further reduce the AGHCF inventory to less than HC3 by the end of FY15.



Building 200 MA Wing Hot Cells
De-inventoried

Argonne’s important future mission work will benefit greatly from the success of the NFRDP, the accelerated pace of those successes provided by the ARRA funding, and by maintaining a record for safety and production that demonstrates the Laboratory’s expertise in executing high-risk work on a daily basis. The facilities that have been successfully deactivated and de-inventoried are candidates for transfer to DOE EM when funding becomes available for the disposition of those buildings and related structures. Argonne maintains the core set of

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expertise in the realm of RH TRU FEW Program Development and Management, and has been instrumental in partnering with other DOE facilities assisting in implementing similar programs and project work.

REFERENCES

1. U.S. Department of Energy, *Assessment of Facilities, Materials, and Wastes Proposed For Transfer to DOE-EM*, September 23, 2008.

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