

H Canyon Facility Remains a National Asset after Finding Innovative Solution to Funding Issues – 15278

Michael Swain *, Jay Ray **, Michael Lewczyk *

* Savannah River Nuclear Solutions

** US DOE

ABSTRACT

In recent years, there has been an increase in the number of missions for the H-Canyon facility at the Savannah River Site, as its capabilities are being recognized as an increasingly important asset for the Department of Energy (U.S. DOE). The sustainability of that asset was called into question in 2011, when funding from U.S. DOE's Environmental Management (EM) program became insufficient to sustain processing. Through the acquisition of new customers, funding was restored and H Canyon missions have seen new life.

INTRODUCTION

The H-Canyon Separations facility was originally constructed in the 1950s and began operations in 1955. For nearly 40 years the canyon was used to produce nuclear materials in support of our nation's defense weapons programs. The facility separated plutonium and also recovered uranium-235 and neptunium-237 from irradiated, aluminum-clad, enriched-uranium fuel tubes from site weapons production reactors and other domestic and foreign research reactors. During this time, all funding was provided by the U.S. DOE Defense Program budget, as that office was the landlord for the Savannah River Site.

HB-Line was constructed to support the production of plutonium-238 (Pu-238), a power source for the nation's deep space exploration program, and the recovery of re-useable isotopes from the nuclear materials processed in the Canyon. HB-Line has three process lines. Phase I, also known as the Scrap Recovery processing line, became operational in the 1980s and is used to dissolve and disposition legacy plutonium materials. Phase II is the production line for plutonium and neptunium oxides. Phase III was originally the plutonium-238 oxide production line, but is now used to prepare excess plutonium and uranium materials for disposition.

HISTORY OF FUNDING

The end of the Cold War in 1991 led to a significant change in the roles of the H-Canyon and HB-Line facilities at the Savannah River Site, as these facilities, once used to produce weapons-grade nuclear materials, were no longer needed for that purpose. A number of events and federal decisions, along with the unique capabilities and the adaptability of the facilities led to new missions that will last well into the future.

The H-Canyon and HB-Line facilities faced their first major change in March of 1992. A safety concern about the acid resistant brick lining in the Canyon's exhaust stack's ability to withstand a design basis earthquake caused both H-Canyon and HB-Line facilities to be suspended. Coincidental to the end of the Cold War, U.S. DOE issued a decision to stop

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operations at nuclear weapon production sites, including H-Canyon and HB-Line, in April 1992 as the future of the facilities was evaluated. The safety question was resolved by March 1993, with the only allowed operations permitted to resume in H-Canyon and HB-Line being the Pu-238 recovery operations in support of NASA's Cassini Mission to Saturn.

In May 1994, the Defense Nuclear Facility Safety Board (DNFSB) issued Recommendation 1994-1, Improved Schedule for Remediation in the Defense Nuclear Complex, to the U.S. DOE, urging the stabilization of legacy cold war materials, spent fuel and neptunium, throughout the U.S. DOE weapons complex including the Savannah River Site. The implementation plan developed in response to 1994-1 projected that the last of the materials to be stabilized in H-Canyon and HB-Line would be completed by about 2005.

Several possibilities for stabilizing the legacy cold war material were evaluated, including transferring all existing plutonium, neptunium and uranium solutions from H-Canyon and HB-Line to F-Area and standing down both H-Area facilities. In 1995, the Assistant Secretary for Defense Programs and the Assistant Secretary for Environmental Management signed a Memorandum of Agreement, which transferred landlord responsibility for the Savannah River Site, including all facilities previously owned by the Defense Programs, to the Environmental Management (EM) Program, with the exception of the tritium facilities. Thus, the Environmental Management program became responsible for funding H-Canyon/HB-Line operations. As a result of the reduction in the number of facilities that were needed for future defense purposes across the complex, the DNFSB Chair J. Conaway issued a letter to U.S. DOE Secretary H. O'Leary recommending that both F- and H-Canyons at SRS be used to stabilize cold war legacy materials. In the end, the U.S. DOE decided to operate both F-Area and H Area facilities to stabilize materials identified in DNFSB 1994-1. The U.S. DOE announced this decision, referred to as the Phased Canyon Strategy, on July 17, 1997. Immediately upon issuance of the decision, H-Canyon completed an Operational Readiness Review and began dissolving Mk 16/22 spent nuclear fuel from SRS weapons production reactors.

In the ensuing years since the 1997 restart, H-Canyon and HB-Line completed stabilization of the various EM nuclear materials identified in the DNFSB 1994-1 and the subsequent 2000-1 recommendations with the final commitment, the stabilization of the pre-existing neptunium solution, completed in September 2006.

In 2001, an Interagency Agreement was signed between the U.S. DOE and the Tennessee Valley Authority. Under the agreement, U.S. DOE was to provide low enriched uranium (LEU) to the TVA for use in the generation of electrical power. In 2003, H-Canyon began blending U.S. DOE-owned highly enriched uranium (HEU) with natural uranium to form a 4.95% LEU solution suitable for conversion to fuel that could then be used in commercial power reactors by TVA. Initial shipments began to TVA's vendors starting in July 2003, and culminated in their generation of electricity from SRS uranium starting in April 2005. To date, 335 trailers of LEU have been shipped to TVA. That amount of LEU is enough to provide power for all the homes in South Carolina for 8.5 years or every home in the U.S. for 47 days. The amount of HEU blended down to

date is equivalent to nearly 600 nuclear weapons. The disposition of LEU helps meet environmental cleanup and nuclear nonproliferation goals.

From 1997 to 2006, many decisions were made to handle 1994-1 materials that shaped the status of conditions in H-Canyon and HB-Line. While focus continued on safety and disciplined conduct of operations, longer term initiatives were limited including:

- Investment in infrastructure was constrained. Spare equipment inventories were depleted to minimum essential levels to complete the 1994-1/2000-1 missions and technological upgrades such as computer control system installation, were deferred. Decisions were made to limit facility improvements to only those required for those operations slated to be finished in 2006.
- Documented safety analyses were not updated to the most recent guidance and approach resulting in limitations in the operating envelope for the facilities.
- Staffing was reduced more than 25%, with limited project and planning groups. Training was reduced to only that necessary to complete the existing mission.
- Technical baseline upgrades were eliminated. Drawings were not updated and plans to improve identification of field items were cancelled. Flow sheet development was limited to only those materials listed in the DNFSB 1994-1/2000-1 recommendations.

In August 2006, the limited future for the EM Program in H-Canyon and HB-Line began to change with the U.S. DOE approval of the Mission Need (critical decision or CD-0) and the selection of H-Canyon and HB-Line as the Preferred Alternative (CD-1) for enriched uranium disposition. Budget planning began immediately for infrastructure and safety analysis upgrades necessary to support this extended mission. The H-Canyon and HB Line management teams implemented changes in personnel hiring, training, procedures and other programs in order to transition from a shutdown/preparing for deactivation mode to an operations mode for an additional 10-15 year period.

Further changes occurred in the early 2000's that have since increased the need for H-Canyon capabilities. In March 2000, in accordance with the FY2000 Defense Authorization Act, the U.S. DOE established a semi-autonomous entity within U.S. DOE referred to as the National Nuclear Security Administration (NNSA) to carry out the national security responsibilities of U.S. DOE. One aspect of the responsibilities assigned to NNSA dealt with reducing threats posed by nuclear proliferation and terrorism, including unsecured or excess nuclear and radiological materials both domestically and internationally. Subsequent negotiations between the USA and Russia resulted in an agreement in 2001 to dispose of 68 metric tons (34 tons for each country) of surplus weapons grade plutonium, either by irradiating it in nuclear reactors or by immobilizing it for permanent disposition. Following a review of non-proliferation programs and alternative technologies, U.S. DOE determined that it would dispose of its 34 metric tons by turning the material into mixed oxide fuel for use in nuclear reactors. The current Alternate Feedstock 2 (AFS-2) mission in H-Canyon began in 2012 and is incrementally funded by NNSA. It involves converting plutonium

materials into an oxide to meet the specifications of a new Mixed Oxide Fuel Fabrication Facility (MOX) to be located at SRS. Additionally, some non-MOXable plutonium was blended and dispositioned to WIPP in HB-Line gloveboxes.

Since transferring landlords in 1995 to make H-Canyon and HB-Line EM facilities, they have traditionally been funded by the EM Defense Environmental Cleanup program under EM Account Nuclear Materials Stabilization and Disposition. Although certain costs for an HEU blend-down campaign in H-Canyon were funded by NNSA from about 2001 to 2008, these facilities normally utilize EM funding to process numerous types of types of legacy materials from various sources, including sample returns from SRS and U.S. DOE laboratories and spent nuclear fuel (SNF) from both domestic and foreign research reactors.

Although the Canyon is a one of a kind national asset, it was not immune to funding deficiencies that occurred during the national recession that occurred around 2011. That year the SRS Nuclear Materials Disposition Program conducted a very detailed review of H-Area scope, costs and staffing levels, and explored possibilities for other potential Canyon uses. At that time, the EM Program was considering a very limited future for the facilities for the next several years. H-Canyon had been directed to cease enriched uranium/plutonium preparations, to complete remaining HEU blend down, work toward flushing materials out of the dissolvers and head end processes and the rest of the Canyon, and develop staffing and work force restructuring plans for a de-inventoried state. HB-Line had ceased receiving and dissolving plutonium, and was also developing a plan to flush materials.

When it was realized that funding would sustain only maintenance of safety systems and not operations, H Canyon, working closely with the Savannah River National Laboratory and EM, began to look for alternate funding sources in an effort to stay operational.

During this time, what is now NA-24, Office of Nonproliferation and Arms Control sponsored SRNL to establish a test bed facility to demonstrate improved safeguards technology instrumentation. The Canyon was incrementally funded by NA-24 for this purpose.

In early 2000, NNSA announced plans to build a new facility, called MOX, at the Savannah River Site that would mix plutonium with uranium oxide to make fuel for use in nuclear reactors. This process renders the plutonium unusable for nuclear weapons, which supports the NNSA's nuclear nonproliferation goals. Another facility, called the Pit Disassembly and Conversion Facility (PDCF) was planned to take nuclear weapon pits and convert them to oxide as feed to MOX. Budget limitations in 2011 forced NNSA to study alternatives to PDCF. Combinations of proposals were made, in which H-Canyon/HB-Line could dissolve plutonium metal, purify the solution and convert it an oxide powder as MOX feed. EM and NNSA came to an agreement that EM would fund the base operations of H-Canyon and HB-Line and NNSA would fund the production costs. In 2013, H-Canyon began dissolving AFS-2 plutonium materials. HB-Line started up and is now producing plutonium oxide product.

In 2013, EM-1 signed a Supplement Analysis and Amended Record of Decision to process 1,000 bundles of Material Test Reactor fuel, and 200 High Flux Isotope Reactor cores, recover the HEU and blend it with natural uranium to 4.95% enrichment as feed for TVA reactor fuels.

Also in 2013, U.S. DOE EM negotiated an agreement with Atomic Energy of Canada, Ltd (AECL) for acceptance at SRS of Residual Target Material HEU in liquid form. This material would be used in the production of Molybdenum (Mo^{99}) that is used nuclear heart scans. That contract provided that AECL would pay a fee to U.S. DOE totaling \$60 million for acceptance of the proposed material. U.S. DOE has determined that these funds will be used to support H-Canyon Operations for the processing and disposition of this HEU material. H-Canyon has begun readiness activities and facility modifications to be able to begin accepting and processing the HEU in FY16.

In 2014 H-Canyon completed dissolution of Sodium Reactor Experiment thorium/uranium fuel that had been identified as ‘vulnerable’ for long term pool storage. This was blended with high aluminum/low uranium SNF to address viscosity issues and sent directly to the Defense Waste Processing Facility sludge batch feed tank.

Dissolution and disposition of other SNF has begun and will continue over the next several years.

CONCLUSION

Over the years, the H-Canyon facility and workforce have proven their technical ability to stabilize a wide variety of materials and have demonstrated their adaptability to the changing needs of the nation. Today, an increasing number of missions, funded by various sources within the U.S. DOE and by other external customers, are being conducted as a result of H-Canyon’s critical capabilities.

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- 1955- Savannah River Plant began operations; H-Canyon used to produce nuclear materials in support of our nation's defense weapons programs
- 1991- End of Cold War
- March 1992- H-Canyon and HB-Line shut down because of safety concerns
- April 1992- DOE decision to stop operations at nuclear weapon production sites
- 1993- Recovery operations in support of NASA's Cassini mission to Saturn began
- May 1994- Defense Nuclear Facility Safety Board issues Recommendation 1994-1
- 1995- Landlord responsibility for SRS transferred to DOE's EM Program with the exception of tritium
- July 1997- DOE decides to operate SRS facilities to stabilize materials
- March 2000- NNSA created
- 2001- US signs agreement with Russia to dispose of 34 metric tons each (64 total) of surplus weapons grade plutonium
- 2001- Interagency agreement between DOE and TVA signed for H-Canyon to produce low enriched uranium for use at TVA's commercial power reactors.
- 2003- H-Canyon began blending HEU with LEU to make TVA fuel
- July 2003 – First shipment to TVA
- April 2005 – TVA generates electricity with SRS fuel for the first time
- August 2006- DOE Approval of CD-0 and CD-1, which select H-Canyon and HB-Line as preferred alternative for uranium disposal
- September 2006- Completion of stabilization of pre-existing neptunium solution, completing DNFSB 1994-1
- 2011- H-Canyon directed to work toward de-inventoried state due to budget constraints; search for alternate funding begins
- 2013- EM signed Amended Record of Decision to process 1,000 bundles of MTR and 200 HFIR Cores
- 2013- AECL agreement signed
- 2014 through today – ongoing HEU blend down and plutonium oxide missions