



# 2024 Secretary of the Army Environmental Awards

## Environmental Restoration - Team

### THE DEACTIVATED NUCLEAR POWER PLANT PROGRAM (DNPPP)



US Army Corps of Engineers®



#### JUDGING CRITERIA

-  Program Management
-  Technical Merit
-  Orientation to Mission
-  Transferability
-  Stakeholder Interaction
-  Impact/Outcome

Removal of one of the reactor components – the steam generator, from the Vapor Containment Structure which housed the primary reactor systems for the SM-1 Nuclear Power Plant. The steam generator was safely removed in June 2023

## Introduction

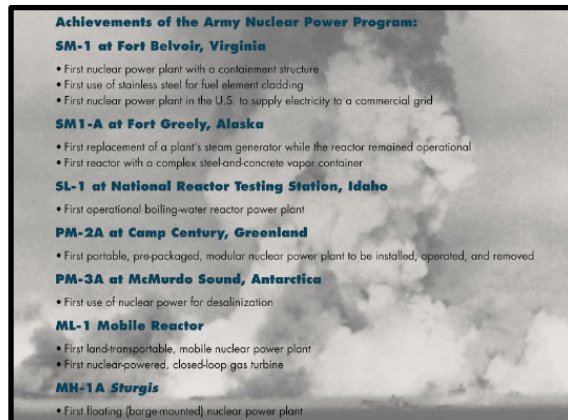
The Deactivated Nuclear Power Plant Program (DNPPP) team continues to make major progress within the Environmental Restoration Program on decommissioning and dismantling the U.S. Army's remaining nuclear power plants. The Department of the Army (DA) is authorized to build and operate nuclear reactors under Section 91.b. of the Atomic Energy Act of 1954. Section 91.b authorizes the U.S. Department of Defense (DoD) to procure and utilize special nuclear material in the interest of national defense and to acquire utilization facilities (i.e., reactors) for military purposes. Section 110.b of the Atomic Energy Act excludes such utilization facilities acquired by DoD from any of the licensing requirements of the Atomic Energy Act. As part of the Army Reactor Program, U.S. Army Corps of Engineers (USACE) is responsible for nuclear reactor engineering and design, reactor construction, and decommissioning design and implementation.



## Background

In 1954, the Secretary of Defense authorized the Army and USACE to develop nuclear power plants, resulting in the development of the Army Nuclear Power Program (ANPP) in partnership with the Atomic Energy Commission, U.S. Navy, and the U.S. Air Force. The goal of the program was to build nuclear power plants to supply heat and power at remote military installations, eliminating the need for conventional fuel shipments. The prototype for the program was the SM-1 nuclear power plant, built at Fort Belvoir, Virginia. As part of the ANPP, USACE built an additional three reactors for the Army, one for the U.S. Air Force, one for the U.S. Navy, and three at the National Reactor Testing Station in Idaho. A total of nine reactors were built and operated from 1957 to 1976.

At the end of the ANPP, all reactors were deactivated with some fully decommissioned



*Reactors constructed as part of the ANPP. Each reactor contributed to the advancement of the nuclear industry.*

while others were placed in a safe storage (SAFSTOR) configuration. The three Army reactors placed in SAFSTOR were maintained and monitored in a condition that allowed residual radioactivity to decay over time. Although the Army discontinued the ANPP in 1976, the program made a lasting contribution to the development of nuclear power in the U.S. and is credited for several important innovations in reactor design, containment and control structures, and nuclear health and safety programs. Moreover, the ANPP was also responsible for training hundreds of nuclear reactor operators who later played key roles in the development of the national commercial nuclear power program.

Once the ANPP was discontinued, USACE implemented the DNPPP to provide oversight, safeguarding, maintenance, and ultimately, decommissioning of the three remaining U.S. Army deactivated nuclear power plants—MH-1A nuclear reactor (STURGIS), SM-1, and SM-1A—in accordance with permits issued under the Army Reactor Program. These reactors are regulated by the Army Reactor Program through Army Regulation (AR) 50-7, and USACE is assigned responsibility for all engineering activities associated with fulfilling their functions in the Army Reactor Program. USACE Headquarters designated a





DNPPP Manager and is the USACE Army Reactor Council Representative. The USACE Program Management Plan, developed by the USACE Directorate of Military Programs Environmental Division, has designated the Baltimore as the executing District responsible for decommissioning and environmental restoration of the Army's remaining nuclear reactors. The Army Reactor Office issues Deactivated Nuclear Power Plant Permits to USACE Headquarters for possession and decommissioning of the plants managed by USACE.

### Decommissioning of the Army's Legacy of Nuclear Power

Baltimore District is home to the USACE Radiological Health Physics Regional Center of Expertise and is leading the way on the DNPPP. In 2019, Baltimore District completed the decommissioning of the Nuclear Barge STURGIS which housed the MH-1A nuclear reactor. The District's team is currently managing the decommissioning of the Army's two remaining deactivated nuclear reactors: SM-1 at Fort Belvoir, Virginia, and SM-1A at Fort Greely, Alaska.



SM-1 is currently undergoing decommissioning and dismantlement under a decommissioning permit issued to the USACE HQ Environmental Division Chief. SM-1A project work has not yet started, although the team holds a Possession Permit and a Decommissioning Permit for implementation in 2024. Permits are issued when the team has prepared documentation that meets all the requirements of the AR 50-7 and the Army Reactor Council, which includes the following federal representatives: Chief of Engineers, Deputy Chief of Staff (G-3/5/7), Deputy Chief of Staff, G-9, Director of Army Safety, U.S. Army Nuclear and Countering Weapons of



Mass Destruction Agency, Provost Marshal General, and the Army Surgeon General.

All of the DNPPP projects have been featured in numerous mainstream media outlets and trade journals. The project team has communicated its successes and lessons learned throughout the project to stakeholders within the Army and externally to a variety of interested parties, including the U.S. Naval Reactors Group, the U.S. Navy Puget Sound Ship/Submarine Recycling Program, and the Maritime Administration – Department of Transportation (MARAD-DOT). The team also utilizes YouTube to provide transparent updates on progress and activities at all project sites.

#### SM-1 Walk-Through



*Screenshot of SM-1A YouTube video, also available on project website*



Baltimore District prioritizes collaborative engagement with all necessary state and federal agencies. Positive partnerships have been developed with Garrison staff at both Fort Belvoir and Fort Greely, to include their respective Department of Public Works, Directorate of Emergency Services, and other support staff. For example, the team has exercised numerous rescue scenarios to ensure preparedness for the complex phases of the projects.

## STURGIS | Mobile, High-Power Model 1A (MH-1A)

In 2019, the USACE celebrated the completion of the decommissioning and dismantling of the historic STURGIS vessel, the world's first floating nuclear power plant. The completion of the project was achieved when the final section of the former vessel was brought ashore for processing and recycling at the International Shipbreaking facility in the Port of Brownsville, Texas. The Decommissioning permit was terminated in 2019. Termination of the permit removed the STURGIS and the MH-1A nuclear reactor from the Army's environmental liabilities and eliminated any future radiological risks associated with the prior mobile reactor, while achieving sustainability goals to further protect the environment.

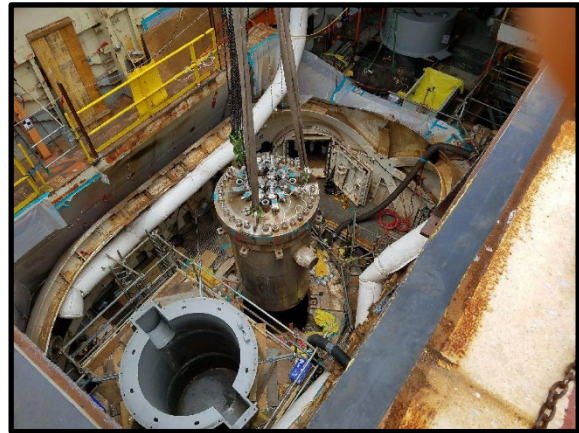


The effort to decommission and dismantle a floating nuclear power plant was truly unprecedented and served as a prime example of successful execution of USACE's mission to provide engineering solutions for the Nation's toughest challenges. This one-of-a-kind, historical power plant was never designed to be taken apart, and the available information about its construction was lacking in many details. A multitude of project hazards required mitigation, dictating a painstaking and deliberate process to avoid any release to the environment and the community while also protecting the health and safety of the workers involved.



Led by a diverse team that included representation from the Baltimore and Galveston Districts, the Marine Design Center, and our Decommissioning contractor, all decommissioning efforts were completed at the Port of Galveston by the

summer of 2018, marked by the safe removal of all components of the deactivated nuclear reactor and associated radioactive waste that was formerly aboard the STURGIS. The vessel was then towed to Brownsville, Texas, in September 2018 for final traditional shipbreaking, completed in March 2019.



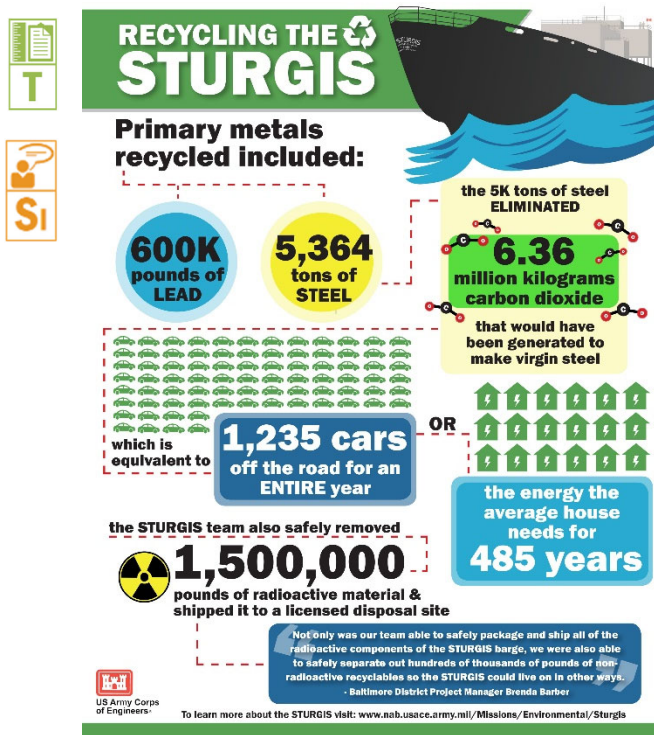
*The Reactor Pressure Vessel was placed inside a shielded shipping container to minimize dose.*

Although the primary hazards being mitigated by this project were radiological, recycling was also a priority for the project. Scrap metal recycling has a large positive impact on the environment and also favorably impacted project disposal costs. Steel is among the most recycled materials in the world, with nearly 40% of the world's steel production coming from scrap. Recycling steel also requires 75% less energy than producing it from raw materials. The 5,364 tons of steel and other scrap metals recycled as a result of this project eliminated an estimated 6.36 million kilograms of carbon dioxide that would have been generated by the production of virgin steel, according to Mike Berner's-Lee's 2011 work, "How Bad are Bananas: The Carbon Footprint of Everything."<sup>1</sup> This would be equivalent of taking more than 1,000 cars off the road for an entire year. It also saved approximately 13.41 million pounds of iron



ore, 7.5 million pounds of coal, and 643,680 pounds of limestone. By implementing a recycling initiative for the STURGIS project, the team realized cost avoidance for disposal of scrap, cost savings for the metals recycled, and provided benefits to the environment through our recycling efforts.

<sup>1</sup> Berners-Lee, Mike. *How Bad Are Bananas?: The Carbon Footprint of Everything* Greystone Books, 2011.



## SM-1 | Stationary, Medium Power Model 1

On the western shore of the Potomac River within the boundaries of Fort Belvoir in Fairfax County, Virginia, is the Stationary, Medium Power Model 1 Nuclear Power Plant (SM-1). SM-1 was the Army’s first nuclear power reactor and the first nuclear power plant in the country to provide nuclear-generated power for a sustained period to the

commercial grid. The construction of SM-1 at Fort Belvoir was completed in March 1957. The reactor achieved criticality in April 1957 and was operational until March 1973. The SM-1 was a single-loop, 10-MW-thermal pressurized water reactor delivering a net 1,750 kilowatts of electrical power. Developed by the Army as part of a movement to harness atomic energy for military purposes, SM-1 design served as a basis for the development of more reactor facilities in the following years. SM-1 was shut down and partially decommissioned from 1973-1974, which consisted of the removal of the majority of the site’s radioactivity. This included the removal of nuclear fuel and control rods, minor decontamination, shipment of radioactive waste, sealing of the Reactor Pressure Vessel, and installation of appropriate warning signs and monitoring devices. The majority of SM-1’s remaining low-level radioactivity is within activated metals and components of the reactor system, which are all secured within the walls of the facility’s containment vessel.

Work at the site began in early 2022 after the completion of project planning and permitting, followed by the start of demolition of the facility in July 2022. The asbestos abatement team and demolition team worked meticulously to progress throughout the facility without compromising safety or impacting schedule. This task was prioritized early in the project’s timeline due to the risks and hazards associated with asbestos and lead paint. Experience from the STURGIS created a significantly safer work environment for SM-1A, which allowed the team to stay on schedule while addressing other project and site challenges.



*Demolition of the support building for the SM-1 Nuclear Reactor – July 2022*



As of August 2023, the team has removed all of the large reactor components from the Vapor Containment structure and is preparing to size and remove the Primary Shield Tank, and ultimately, the Reactor Pressure Vessel. This effort should be completed in calendar year 2023 and will represent the removal of more than 95% of the radioactivity from the site. Soil remediation at the site is ongoing as part of the decommissioning effort. The project is scheduled for completion in 2026, at which time the site will be released for future unrestricted use by the Garrison.



### **SM-1A | Stationary, Medium Power Model 1A**

Located at Fort Greely, Alaska—approximately 100 miles southeast of Fairbanks and 225 miles northeast of Anchorage—Stationary, Medium Power Model 1A Nuclear Power Plant (SM-1A) was designed based on the concept of SM-1. The “1A” moniker designated it as the first field plant of its type. USACE construction of the SM-1A Reactor Facility at Fort Greely began in 1958 and was completed in 1962, with first criticality achieved on March 13, 1962. The final shutdown of the SM-1A reactor was performed in March 1972. Deactivation and



initial decommissioning were performed at the SM-1A Reactor Facility following shutdown. The initial deactivation of SM-1A consisted of placing the facility in a SAFSTOR configuration by removing the nuclear fuel, conducting minor decontamination, shipping some radioactive waste for disposal, sealing the Vapor Container (VC), and installing appropriate warning signs and monitoring devices. Much of the reactor’s primary system components were dismantled, and components inside the VC were encased in concrete and an acrylamide grout-sand-soil mixture. This mixture was capped with 36 inches of reinforced concrete to a finished elevation of about 10 feet above the bottom of the VC, and the VC hatch was sealed. Waste generated during the initial deactivation activities was placed in the spent fuel and waste tanks pits. These pits were then filled with an acrylamide grout-sand-soil mixture and capped with reinforced concrete. The encasement approach was used at the SM-1A site to allow for continued safe use of the Central Heating and Power Plant for Fort Greely.



In late 2021, the team began working with the Defense Logistics Agency, Fort Greely staff, and the installation’s Utilities Privatization Contractor, Doyon Utilities, to implement the separation of utilities between the north and south end of the facility that houses the SM-1A reactor systems. This relocation effort was completed in May 2023, clearing the way for safe implementation of future decommissioning activities at the site.



The project team completed the decommissioning planning in January 2022 and received a decommissioning permit in May 2022. The decommissioning and dismantlement contract award was initially awarded in July 2022, but was later protested. The project team worked diligently to resolve

the protest and ultimately resolved the issue in August 2023.

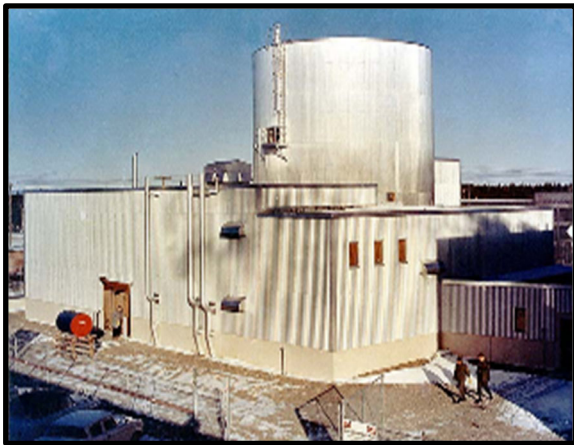


This will be the third and final reactor associated with the Army Nuclear Power Program that our team will be decommissioning. We will be applying a wide variety of expertise and lessons learned



from MH-1A and SM-1 to this project to ensure success. Additionally, we are partnering with our Alaska District counterparts to gain their expertise on working in this remote, interior Alaska location.

legacy in the history of nuclear power. This program has demonstrated the full life cycle of a nuclear power plant and will continue to pave the way for the future generation of Army nuclear power plants.



*Historical photo of the SM-1A at Fort Greely during site operations.*



### Program Completion

The safety and health of the military installations where these reactors are located, their local communities, and our workers are all paramount to the current and future success of our projects at SM-1 and SM-1A. Our team continues to utilize proven controls and precautions to address safety and other engineering details during all stages of decommissioning and dismantlement at these sites.



Both remaining decommissioning efforts are slated to be complete by 2029, ending the Army's liability associated with the prior nuclear power plants – MH-1A, SM-1, and SM-1A. This will ultimately end a major

