Demobilization of the World's Largest Decontamination and Decommissioning Project Project Closeout of three Gaseous Diffusion Plants for Reindustrialization

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ABSTRACT

This paper describes the challenges and lessons learned from the demobilization of the world' largest, and first, successfully decontaminated and decommissioned project. These gaseous diffusion plants are the first plants to be successfully decommissioned in the United States.

INTRODUCTION

In August 1997, BNG America was awarded a fixed-price contract by the Department of Energy. The purpose of the project was to decontaminate and decommission three gaseous diffusion plants (GDP)—K-33, K-31 and K-29—at the East Tennessee Technology Park (ETTP), formerly known as the K-25 site, in Oak Ridge Tennessee.

This project included the removal and dismantlement of over 1,500 converters—some over 30,000 kilograms (66,000 pounds)—decontamination of over 464,000 square meters (5,000,000 square feet) of facilities, and the disposition of 159 million kilograms (350,000,000 pounds) of contaminated materials. The massive size of the facilities, in addition to the cost of the project, made this one of the largest nuclear decommissioning projects in the world. The only project that comes close in size is the DOE Rocky Flats site. All 400 facilities located at Rocky Flats would fit into these three gaseous diffusion buildings—K-33, K-31 and K-29.

Fig. 1. ETTP - K-33, K-31, K-29

This large D&D project employed over 1,400 workers—at its peak—to perform the heavy construction, dismantlement, removal, and disposal of process equipment, support materials, and waste. During the last few years of the project, the BNG America employees maintained worldclass safety statistics with an injury rate of ¼ the National Average; during the demobilization phase of the project, there were zero recordables, no day-away-cases, and no notice of violations. To complete a project of this magnitude with such remarkable safety numbers, BNG America established and operated one of the most sophisticated D&D workshops in the nuclear industry and the largest nuclear Supercompactor in the world.

Fig. 2. BNG America-ETTP Supercompactor

PROJECT DESCRIPTION

All three facilities were built in the early 1950s during the Cold War era and were used primarily for uranium enrichment processes. K-29 encompassed almost 56,000 square meters (603,000 square feet), K-31 covered 139,400 square meters (1,500,000 square feet), and K-33 covered over 260,100 square meters (2,800,000 square feet) equaling 455 square kilometers. All three facilities had similar construction consisting of steel frame structures with reinforced, non-combustible concrete floors.
Production of enriched uranium ended in 1985, and the gaseous diffusion facilities were permanently shut down in 1987. Contaminates that were found in the three buildings consisted of polychloride biphenyls (PCBs), friable and nonfriable asbestos, chlorofluorocarbons (CFCs), chromates, lubricant oils, miscellaneous materials regulated under the Resource Conservation and Recovery Act, uranium, and other radionuclides.

The K-29, K-31 and K-33 process buildings were originally designed and built to house the low enrichment (<20% U^{235} by weight) part of the Oak Ridge Gaseous Diffusion Plant cascade. The plant enriched uranium in the U^{235} isotope by the gaseous diffusion process that utilized uranium hexafluoride (UF^6) as the process gas. During the operation to support highly enriched uranium (HEU) production, peak enrichment level in the cascade was 12.65% for K-29, 6.2% for K-31 and 2.5% for K-33. With the termination of HEU production in the K-25 and K-27 process buildings, the K-29, K-31 and K33 process buildings continued to produce low enriched uranium (LEU) with an average enrichment of 3.2% (peak enrichment of 4.9% for K-29, 2.9% for K-31 and 1.7% for K-33).

All three GDPs operated in a similar manner. The UF^6 gasses were introduced into the piping systems at a high temperature. The gasses then traveled into the diffusion equipment stages. Each stage contained a motor, a compressor and a converter. The UF^6 gasses would flow from the compressor into the converter through the barrier material where the UF^6 gas was diffused. This splits the gas into two streams; one with slightly enriched U-235 content and one with slightly depleted U-235 content. The two streams of gasses produced would then be sent through thousands of stages so that desired enrichment levels could be achieved.

REINDUSTRIALIZATION

In 1996, reindustrialization went into effect with efforts focusing on restoration of the environment, D&D of facilities, and management of legacy wastes. To support this, the DOE established a management group, the Community Reuse Organization of East Tennessee (CROET), which is currently marketing these facilities for re-use. CROET develops and subleases property and equipment owned by the U.S. Department of Energy. Many of its properties were once used to support the World War II nuclear effort while others are pristine greenfields. The intent of this project was to prepare these buildings with reindustrialization in mind, making them available for future use in the industrial industry. BNG America has completed the project through the decontamination of the facilities, all process equipment and the removal of the support equipment. The facilities have been decommissioned to meet "Brown Field" standards, which will allow reindustrialization of these huge facilities. These facilities are now models for reindustrialization efforts across the country.

SAFETY

Without an outstanding safety program, companies in the nuclear industry would not be allowed to conduct these projects. A number of unique programs were developed to address this issue. These programs allowed the project to reach one million man-hours without a lost time accident three times in three years and maintain a Total Recordable Incident Rate that was 1/4 the national average. In addition, during the demobilization phase of the project, there were zero recordables, no day-away-cases, and no notice of violations.

In order to maintain those numbers, employees and management relied on experience attained throughout the project, Lessons Learned, and the implementation of the Behavior Based Safety (BBS) program. Workers were involved in the full spectrum of project activities. Each employee was held accountable for safety from the first day of the project to the last. The attitude toward safety, quality, and continuous improvement was interwoven through every aspect of the project.

Behavioral Based Safety

The Behavioral Based Safety (BBS) program was implemented in an effort to better involve the employees with safety concerns. The program focused on employees observing the behaviors and work practices of fellow workers. When an employee observed a correct or incorrect action, discussions were instantaneous. Providing timely feedback allowed for immediate attention to a potential problem. Through behavioral learning, the expectation was that employees would also take safety practices home. Training was also provided through skits and videos, but the focus was commitment to safety.

The Tennessee Center for Labor-Management Relations awarded BNG America special recognition for its outstanding accomplishment in the design and implementation of the BBS program. Tennessee Center for Labor-Management Relations Dr. Barbara Haskew was very impressed with the project’s accomplishments and encouraged other companies to use BNG America’s BBS program as a catalyst for their own safety issues.

In addition, BNG America implemented other ways to keep people focused as the project ended. “*Make Safety Personal*” was initiated by the BBS Committee. The team offered Popsicle’s during the hot days of summer—Beat the Heat—and a lesson-learned flyer was distributed highlighting two DOE site fatalities. The flyer initiated one-on-one discussions on how fatalities occurred and what could have been done to prevent the accident. A safety poster contest was initiated in an attempt to get children/families involved. The object was to have children submit a drawing, along with a photo of themselves and the family, and use the photos on subsequent safety posters. The object was to bring home the theme, *Make Safety Personal*.

In an effort to keep the employees focused on safety at the end of the project, a safety bonus program was developed. For every week the project went without a recordable injury, a name was drawn for a $1,000 safety bonus. Upon completion, the BNG America management awarded a truck and a boat to two eligible employees.

KEY CHALLENGES AND SUCCESS

Decommissioning three Gaseous Diffusion Plants (GPDs) entailed a number of considerable obstacles. The plants were all Category 2 nuclear facilities, containing significant quantities of fissile material, encompassed significant industrial safety hazards, and contained numerous unknowns. Because of these issues, creativity and foresight were required to continually address the challenges on this type of project. One of the projects greatest successes was their safety record; during the demobilization phase of the project, there were zero recordables, no day-away-cases, and no notice of violations.

Documented Safety Analysis (DSA) and Criticality Safety Programs

The decommissioning of three large GDPs(over 115 acres in size) created the need to be extremely inventive when developing a compliant Documented Safety Analysis (DSA) and Criticality Safety programs. Unique solutions were developed for the creation and implementation of these programs for the decommissioning environment. These solutions were necessary because the work completed on this project was uncommon requiring a special workforce and an atypical work pace. The project was unable to rely on multi-year training programs that would provide highly trained operational personnel with a detailed knowledge of the criticality and authorization basis programs. It was necessary to develop systems that were easier to understand and simple to implement. When developing a nuclear safety infrastructure, it is necessary to develop the programs around the personnel that will be conducting the work. This is critical to the successful operations in a D&D project. Therefore, an analysis was conducted to determine which work force to use. Once this was determined, a program was developed for that specific work force.

In decommissioning there are generally two work force options. The first is the site operational force and the other is usually the building trades. The site workforce is generally more competent and knowledgeable about nuclear safety protocols, work procedures, and have extensive experience with the facility being decommissioned. However, this site workforce does not have significant experience in construction activities nor is there a detailed understanding of the safety issues with the equipment being used. The situation is reversed for the building trades, or craft. The craft have a detailed knowledge of the equipment and safety issues associated with construction and demolition work, but do not have an understanding of nuclear operations. At the ETTP project, the decision was made to use the building trades organization. This decision was made because of the overwhelming hazards on the project were related to a heavy industrial environment. Additionally, the job classification and the type of work was determined to be building trades jurisdiction.

Because of the workforce used on the project, and because of the nature of the project, the development of a simplified and flexible Documented Safety Analysis (DSA) was required. During the decommissioning of a nuclear facility, it was difficult to utilize the normal engineering controls of an operational facility because all existing engineered features had to be removed during the course of the project. There were also risks that the large equipment used in decommissioning the buildings may damage some of those existing systems (ventilation, fire protection, etc.). Because of this risk, a decommissioning DSA was needed to credit the support programs and provide appropriate administrative controls for the same safety envelope. These controls included combustible material limits, preparedness for evacuation, and a simple-to-follow system for facility change in configuration. By using a “fence-to-fence” analysis of the different accident scenarios, the project was able to easily move nuclear material from facility to facility without challenging some of the limits of the different materials. The key to the success of the DSA system was to keep the controls simple and consistent between the three facilities

The Criticality Safety program took a similar tact. The material limits were not described in the controls as one would see in a normal operational facility – i.e. control by a certain number of grams or by size of object. The basis did tie back to a certain amount of material, but the inspection was based on easily understood parameters. These parameters would include the thickness of a deposit and the overall size of a deposit. Because deposits were found in numerous types of equipment (piping, valves, coolers, etc), and because of the large amount of material involved (400 miles of piping), it was impossible to use Non Destructive Assay (NDA) readings for all components prior to removal until the equipment had been removed and inspected for deposits. Because the converters and compressors were large individual components, the project was able to perform NDA measurements prior to removal and control those items by gram levels.

Another method utilized to support the criticality safety program was the use of field criticality safety engineers. Because of the use of the building trades personnel, they did not have a long term in-depth knowledge of criticality safety evaluations as one would see in an operational nuclear facility. Therefore, the project placed nearly full time criticality safety engineers in the facilities during decommissioning activities so that issues could be identified quickly and addressed in an appropriate manner. This reduced the level of knowledge requirement for the average worker.

Although introductory criticality safety training was given to all personnel on the project, a smaller group of people were given more detailed training (criticality safety worker) and would inspect the initial deposits found. By using a smaller group, more detailed training could be conducted without affecting on going operations. Additionally, as higher enrichments of nuclear material were encountered, the project developed a "super" fissile worker qualification. This was a more detailed training arrangement that included a mock-up training area so the trained personnel would gain additional experience in identifying deposits and have a better understanding of the controls necessary for those deposits. This practice was noted as a "Best Practice" during a DOE Headquarters review of the Criticality Safety Program.

Another improvement came in the management of material storage arrays. Because of the extremely high volumes of material removal and transportation, numerous arrays had been developed, which not only reduced material logistics flexibility, but also created several safety infractions – i.e. the more storage areas that existed, the higher the chance for problems. The project took aggressive measures to deal with this issue. The first change came from the additional training requirements noted above. The next change was to look at how to reduce or eliminate the need for arrays. To accomplish this, the project made a dramatic investment in the NDA organization so that suspect deposit components could be measured on an almost real time basis; those components that did not meet certain requirements could be removed from those controls quickly and put back into the normal material flow. Additional deposit removal stations were also added so those components with the deposits could be cleaned quickly and moved on into the normal material flow. This made a tremendous reduction in the required number of arrays. These improvements to the program drastically reduced the number of safety infractions an improved the overall operations.

Fig. 3. BNG America-ETTP process

Material Logistics

Material logistics was the most important aspect of this project because over one hundred and fifty-nine million kilograms (350,000,000 pounds) of material was required to be removed, processed, packaged and shipped for disposal or recycling. Because this material would be touched several times before it was shipped off site, the effort was equivalent to handling over one billion pounds of material. Any breakdown in the logistics supply chain would bring the project to a halt. It was necessary to develop detailed tracking systems, unique characterization protocols, and a large transportation fleet to move the material.

One of the major obstacles was the disposition of contaminated material while working under restrictions/requirements from criticality safety, Authorization Basis/license, radiological safety, industrial hygiene, and hazardous materials safety. The project routinely shipped over 900,000 kilograms (2,000,000 pounds) of contaminated material off site each week. To say that this activity was difficult would be an understatement.

To quickly move this much material on a consistent basis, it was necessary to integrate the characterization of the waste into the packaging and transportation activities. This allowed BNG America to reach its target of shipping the waste within five days of its generation. To achieve this integration, a program was developed to enable the material to be characterized "in place." It is necessary that we mention the importance of using any and all process knowledge and/or historical sampling data during the characterization process. The material was sampled/measured on an area-by-area basis in sufficient detail so the characterization data could be used to ship the waste. This allowed the characterization to be done with only the weight and identity of where the material came from and the amount of U-235 estimated in the field by the technicians using traditional hand-held instrumentation. This was all tracked through procedural requirements. This technique resulted in a significant cost savings.

This method was controlled and validated through measurement of the U-235 content in the Uranium Waste Monitor (UWAM).

Fig. 4. BNG America-ETTP UWAM facility

The UWAM is a large passive neutron counter that was able to count containers as small as a B-25 box or as large as an inter-modal or sealand container. This system was able to measure quantities as low as 5 grams of U-235 and was also used to catch anomalies with any of the waste profiles. With the characterization process, the team was able to "standardize" the process into a database. This meant that when the box left the building and was staged in the storage yard, it had characterization data with it. The shippers merely "downloaded" the data into the correct shipping papers and then shipped the material.

Due to the size of this project, BNG America had to create one of the largest transportation fleets in the nuclear industry. The fleet included in excess of 800 intermodals in process at all times. Since the turnaround time for a container going from Oak Ridge, TN to Clive, UT was 6-8 weeks, it required BNG America to track these containers on a daily basis. This also meant that a tremendous amount of coordination with the removal operations group took place for distribution of containers on site. In addition to containers, BNG America had several vendors supplying railcars. At any one time, there were 30 railcars in process. In addition to railcars, closed van and flatbed trailers were used on a weekly basis. This required a tremendous amount of tracking and coordination.

Once the material was processed, packaged, and characterized, the containers were loaded and transported offsite for disposal. BNG America used several disposal sites/facilities including EOU, EMWMF, NTS, and the Y-12 Landfill with the bulk of the waste going to EOU. The waste was transported via truck or rail with rail being the predominant method of transport, resulting in a significant cost savings. BNG America routinely shipped 50-60 shipments per week. Over the life of the ETTP Project, approximately 122,815 m^3 (4,337,082 ft^3) of contaminated waste was shipped to EOU; 52,545 m^3 (1,855,585 ft^3) of contaminated waste was shipped to NTS; 11,356 m^3 (401,025 ft^3) of contaminated waste was shipped to EMWMF, and 3,143 m^3 (110,966 ft^3) of contaminated waste was shipped to other outlets.

Over the life of the project, BNG America shipped 12,684 shipments:

Truck: 4,872

- EOU 1,084
- NTS 1,271
- EMWMF 2,253
- Other 264

Rail: 7,812

- EOU 7,812
- NTS 0
- EMWMF 0
- Other 0

PROJECT CLOSE OUT

Decon and Final Status Survey

Closeout of the decontamination and final survey phase of the project was extremely challenging. After obtaining over one hundred and fifty million measurements as part of the final survey, numerous hot spots had to be addressed. Additional analysis was required to determine whether the hot spot could be left or whether it had to be removed. This was critical as the "end state" of the facilities was "re-use" and additional decontamination could deteriorate the structural stability of the facility.

BNG America began the decontamination and final status survey activities in building K-33 in late 2002. The scope of work included the development and implementation of a survey process that resulted in the unconditional release of the buildings and prepared the buildings for reindustrialization. In addition to K-33, BNG America was responsible for the unconditional release of building K-31. Both buildings consisted of over 2,000,000 square meters (22,000,000 square feet) of surface area. The process included performing housekeeping of the buildings, which consisted of physically wiping and/or vacuuming all accessible surfaces in the building. Once the cleaning was complete, BNG America performed both removal and fixed radiological surveys. Surveys were conducted based on process knowledge, historical data, and sampling and analysis data. The data was then analyzed for decontamination and further characterization planning. The data that exceeded the contract end-point criteria required BNG America to evaluate the extent of contamination, bound the affected area, and perform a reasonable decontamination effort. Additional surveys were conducted to verify the success of the decontamination effort. This was especially critical with the physical conditions of the buildings, which had a ceiling height of ~ 20 meters (65 feet). In order to access the overheads, survey techs were required to use high-reach manlifts. This effort was compounded by physical problems such as heat stress, insects, and psychological issues due to working at extreme heights.

Some of the challenges were a result of the contract language regarding the existing conditions of the buildings, which indicated the building had minimal amounts of contamination (<2%) and only "trace" amounts of transuranics and Tc-99. BNG America discovered, however, that Tc-99 was the predominate isotope of concern in the overheads. This characterization indicated that >20% of the overhead surfaces were affected and exceeded the contract end-point criteria. Transuranics were discovered and posed a significant problem in K-31, which required imposition of transuranic controls over ~10% of the floor areas. While having a minimal impact on the decontamination, the presence of transuranics required a much more rigorous survey protocol, was more time consuming, and more costly.

During the performance of final status survey in building K-33, BNG America encountered higher than expected levels of radioactivity. It was determined that a request for new end-point criteria could be justified using a dose-based approach. This effort began in November 2003. In late April of 2004, BNG America determined that the quickest path of relief from the current guidelines was a request for supplemental limits for Tc-99 that would be applied only in the overhead area of the buildings. The Department of Energy approved a dose constraint of 0.05 mSv/yr from any combination of radionuclides.

The other contaminant that created problems during this phase of work were PCB’s. *The K-33 Building, Operations and Cell Floor, PCB Remediation* was initiated in July 2003. The east side of the K-33 building operations and cell floors (units 1 through 4) concrete floors were remediated (scabbled) while the west side (units 5 through 8) was not. As anticipated, the cell floor post-surface removal verification sample results showed no residual PCB contamination exceeding the limit of detection. The limit of detection was 0.5 mg/kg (0.5 ppm). However, the operations floor verification sample results demonstrated significant residual PCB contamination at concentrations greater than 1 ppm with significant data >10 ppm. Characterization results for the west side demonstrated some PCB contamination >50 ppm in the concrete slab. BNG

America needed to take another approach to dealing with PCB’s, therefore, it was appropriate to evaluate the feasibility of a risk assessment to address the residual PCB contamination remaining in the K-33 Building concrete floors.

A risk assessment would provide a scientific evaluation utilizing exposure models that would calculate the potential dose and risk to a future warehouse worker based on the residual PCB concentrations remaining in the K-33 Building. Since the K-33 Building is an industrial facility, a risk assessment for a warehouse worker and a risk assessment for potential construction type activities would be appropriate.

During the Decon and Final Status Survey process, BNG America had multiple sub-contractors involved in the process. The sub-contractors provided decon technicians, survey technicians, health physics technicians, rad engineers, and floor supervisors. Managing multiple sub-contractors posed its’ own challenges. At peak production, there were ~400 people involved in the Decon and FSS process with 80% of those being sub-contractors.

During the closeout phase of the project, BNG America had several deliverables in the contract, which included providing all radiological and chemical raw data collected during the Decon and FSS process. This data was rolled up into the Building Completion Reports, which were submitted to the DOE. In addition to the data, all hard copies of survey records and sampling and analysis data were copied and submitted to the DOE. Prior to submittal to the DOE, BNG America performed a massive QA/QC check of the data and reports. This effort resulted in a smooth closure of the contract.

Personnel Demobilization

A plan to demobilize the personnel on site (over 1,500 people) was critical during the last phases of the project. A detailed plan was developed so there was an orderly exit of personnel from the project. The plan included the appropriate personnel necessary for project close out and a detailed schedule of remaining work tasks.
The use of a comprehensive resource loaded schedule was paramount to this effort. This resource was key in planning the demobilization of a project this size. This tool allowed the project to perform a detailed analysis of the work activities remaining and determine the appropriate number of personnel needed to safely complete the remaining scope of work. As with any decommissioning project, there were still numerous unknowns discovered and other changes of scope occurred at the end of the project. This tool allowed the project management to easily make changes to the demobilization plan and make appropriate management decisions as to the necessary staffing needs.

As the plan was developed, comprehensive planning sessions were conducted with the different departments to ensure personnel with the appropriate expertise and skill set were identified. It is necessary to ensure that certain levels of personnel within the support organizations are included in the final stages of the project. This ensures that compliance is maintained within those programs as the project completes. As the project began ramping down, several key personnel unexpectedly began to leave the project and accept new job offers. This becomes a critical time of the project to ensure all areas remain covered.

Retention of personnel is an area that cannot be underestimated. This item needs to be planned in the early stages of the project to ensure the right program is developed and the correct people are identified to maintain the necessary skills. The program needs to be affective for the different types of personnel to be retained. On this project, two programs were put in place. The first program targeted the craft personnel. It was determined that adding a large bonus at the end of the project would not be effective for that group. In general, the project management found that most of the craft personnel would leave the project anytime another project was paying a higher wage. It was therefore decided to take the bonus money and increase the hourly rate for this labor group. Additionally, for those that had clearances, which are very difficult to maintain at the end of the project, an additional increase was made to their hourly rate. The management also wanted to target those with the most experience on the project. A sliding scale of hourly rate increase was also added for those that stayed the longest.

In dealing with the salaried staff, a different program was developed. A retention bonus to be paid at the employee’s departure was established. The bonus was originally based on meeting certain cost requirements for the project and meeting certain safety milestones. The project management found that the program would be more effective by tying the payment to schedule milestones rather than cost requirements. Although it was not perfect, it was effective.

Another area of concern was maintaining the safety culture during the final stages of the project. The number of distractions at the end of the project grows exponentially. Not only are large numbers of people leaving the project in accordance with the plan, there were others seeking new employment. In addition, the final scope of the project can be very different than the normal day-to-day activities. Management had to continually review the effectiveness of the safety incentive programs and develop new ideas to keep the remaining personnel focused on the hazards of the remaining work. This included “give-a-ways” for meeting safety milestones and increased management of Local Safety Improvement Teams. Because of the different types of scope to be completed (i.e. the demolition of the project’s super-compactor), increased management attention was required on hazard analysis for these types of activities. During this final phase of the project, communication was extremely important to ensure people understood their demobilization dates and that their employment expectations were well understood.

The final portion was the project closeout phase. This phase is normally underestimated and may be one of the most important. It is the final phase that the client will see of the accomplished work. This lasting impression needs to be handled properly. For this project, the management team again developed a detailed schedule of all activities that needed to be accomplished. This would include equipment demobilization, subcontract closeout, DOE program closeout, records disposition and others too numerous to list. It is important to understand the client’s expectations for this phase of the work as final walk-downs and record transfers can be extremely costly and time consuming. The project team spent numerous hours working with the DOE client to ensure all activities were known and planned to again ensure the right number and type of people were available to close the project. Numerous DOE programs were required to be closed (to be discussed later) which had not been done on pervious projects. This phase of the project is usually the least understood and has created more problems on other projects throughout the complex. If not planned properly, these activities can last for years. Fortunately, on this project, these activities were completed in a few numbers of months.

Equipment Decontamination and Demobilization

A plan to demobilize the project’s equipment on site was also critical during the final phase of the project. A detailed plan was developed in order to identify the most cost effective disposition method.

With the equipment demobilization phase being a major part of the closeout phase, serious consideration had to be given to schedule impacts and project completion. The equipment demobilization effort required the disposition of the following: 700 intermodal containers, 98 sealand containers, 30 railcars, 550 pieces of rolling stock, 30 personnel vehicles, radioactive sources, radiation and industrial safety monitoring instrumentation, and thousands of miscellaneous pieces, tools, and equipment.

As the plan was developed, consideration was given to the equipment requirements for the remaining work. Certain aspects had to be taken into consideration such as whether or not the equipment was leased or owned, the contamination levels, decontamination costs, equipment value, and most importantly disposal and transportation costs. A detailed cost benefit analysis was performed in order to provide a “Go – NoGo” decision point for the responsible manager(s). The decision point was not always straightforward and required daily communications with the contracts, procurement and project controls groups.

BNG America had to evaluate the contractual requirements for the leased sealand containers and intermodals to determine whether it was cost effective to decontaminate and return or purchase “As Is” and resale as “Rad Empty.” Out of the 700 intermodals, approximately 400 were leased and 300 were owned. Due to the radiological contamination levels and other chemical contaminants, the decision was made to purchase the containers and resale “As Is.”

BNG America was able to decontaminate and release approximately 50% of the rolling stock equipment, which was eventually returned to the vendor. This resulted in the procurement group working with the vendors and negotiating a buy out of the remaining contaminated equipment. Once the contaminated equipment was identified, BNG America began several discussions with other DOE contractors and local businesses that possessed a radioactive materials license. It was important that the ultimate decision for the equipment was not disposal but re-use. Some of the contaminated equipment was sold “As Is” and used on other DOE projects while others were part of a bartering agreement, which included the transfer of clean equipment in exchange for the contaminated equipment. This effort resulted in a cost avoidance of approximately $2-3M. The majority of the clean rolling stock equipment was returned to the vendor or sold to non-nuclear companies. This resulted in approximately $2.5M in cash from equipment sales.
BNG America had in excess of 100 radioactive sources in inventory. The sources consisted of both check sources and calibration sources. Due to the limited options for disposing of sealed sources, the sources were sold, bartered, or returned to the manufacturers. This resulted in a significant cost savings.

BNG America had approximately 2,000 pieces of radiation and industrial safety monitoring instrumentation equipment in inventory to support this project. An excess of 98% of the equipment was clean and sold to local small businesses. The contaminated equipment was disposed of as low-level waste.

BNG America had a significant inventory of miscellaneous tools and equipment. A cost benefit analysis was performed and overwhelming supported the disposal of this particular equipment.

Since BNG America did not have the capabilities of transferring the contaminated or clean equipment to another facility for storage, the project had to ensure that the equipment demobilization effort did not jeopardize the project completion date.

Security Closeout

Walk downs
Prior to releasing any floor space in K-33, K-31, and K-29, security/classification walk downs were conducted to ensure there were no classification concerns remaining or that remaining concerns were properly protected and signage was in place. All buildings were walked down 100%. Walk down teams included a member of the BNG American security staff, a DOE security representative, and the project classification officer.

Nuclear Materials Management and Safeguards System
After all accountable material was transferred and written out of the BNG America accountable material inventory, final Nuclear Material Transaction Reports (DOE/NRC Form 741) were submitted to the Nuclear Materials Management and Safeguards System (NMMSS) and DOE for reconciliation in the national database. When confirmation of reconciliation was received, BNG America requested that the BNFL/BNG America Reporting Identification Symbol (RIS) and account be closed.

Classified Computers
The BNG America approved classified computer system was decommissioned in March 2005, prior to moving the Security Office from the Limited Area to the Property Protection Area. DOE was notified of the decommissioning and cancellation of the Computer Security Plan. Classified drives and other media were transferred to the SAIC offsite facility for storage until final destruction. In September 2005, all removable media was transferred to the Bechtel Jacobs Company (BJC) for destruction.

Facility Registrations
Prior to contract closeout all Terminating Contract Security Classification Specifications (CSCS) for all BNG America subcontractors with facility clearances were completed and delivered to DOE.

Badge Readers
All badge readers were purged of all BNG America and subcontractor badges on the morning of turnover to DOE/BJC.

Key Control
All controlled keys were turned over to BJC on the morning of site turnover.

Personnel Security
All access authorizations (clearances) for BNG America employees and subcontractors were terminated with DOE. Termination Statements and Nondisclosure Agreements (SF-312s) were completed and forwarded to the DOE for personnel security files. Badges were retrieved and returned to the site office for destruction. BNG America personnel security clearance files were destroyed and DOE maintains the records copy of all personnel security files. The BNG America personnel security database was reconciled with the DOE SIMS and CPCI listing to ensure that there were no discrepancies and all clearances were terminated.

Ni Turnover
Classified Material Storage Areas that remained for transfer were walk down and records were turned over to BJC/DOE. TID records for all containers were turned over to BJC and responsibility for physical security measures for protection of this material was transferred to BJC.

Records Disposition
All classified documents were returned to the ETTP Document Center, transferred to the DOE Central Library, or destroyed. Records of disposition and/or destruction were transmitted to DOE and all remaining classified electronic media were destroyed by BJC. A DOE Safeguards and Security Representative inspected all repositories that previously contained classified matter and documented that they were empty.

Plans and Procedures
The BNG America Safeguards and Security Plan and all related addendums were cancelled in addition to all security related policies and procedures.

Surveys
DOE conducted a Safeguards and Security Termination Survey and documented the completion of all security related activities in the Final S&S Survey report, dated October 28, 2005. DOE certified that “BNG America does not possess, at their location(s) any classified matter or nuclear and other hazardous material presenting a potential radiological/toxicological sabotage threat or government property used in connection with work performed for the DOE. All findings associated with the facility have been closed, and all safeguards and security activities have been deleted. All security clearances (access authorizations) associated with the contract have been terminated in accordance with security requirements, or will be transferred because of work on another active contract.”

Records Retention/Turnover
All security briefing records (initial, comprehensive, refresher, escort, etc.) for all project employees and subcontractors were turned over to the DOE Security Education Coordinator for possible future use by DOE.

Closeout of Safety Programs and DOE Systems

There are many regulations, rules, orders, manuals, guides and handbooks that provide methods for establishing and maintaining program requirements. Little, if any, guidance is provided on downsizing or eliminating program elements as the project ends. Projects are essentially left to their own devices when it comes to tailoring programs to be phased out. As with any task, advance planning is essential to ensure programs are ready to 'downsize' as the work and work force are downsized. Since there is little guidance for close out, **early communication** with the customer is vital to make certain that expectations are understood and agreed upon. Expect changes and **communicate often** to minimize the impact of those changes.

Quality Assurance

Document Control/Records Management
Plan ahead, ensure staffing is adequate, and be prepared for records to be turned over in large quantities as personnel levels are reduced and offices are emptied. Know your record requirements by understanding what information gets turned over to DOE and what organization will be responsible for maintaining the records. Know what form the records must be in: originals, paper, or electronic. If electronic records are to be used, consider software requirements to retrieve the records later, perhaps years later. Ensure all personnel are aware of record requirements and when in doubt, turn them in.

Audits and Assessments
Tailor audits and assessments to the work that remains and consider the reduction in workforce and the workload of those remaining personnel.

Training
Evaluate the training needs for the work that is remaining, e.g. if respirators are no longer required, there is no sense in training or retraining personnel for respirator use. Consider outsourcing of training. As training requirements diminish, maintaining full-time trainers is inefficient and costly.

Safety Basis
Advance planning will reduce the effort for project completion and turnover of the facilities. Planning for hazard reduction and phase out of controls can be built into the DSA/TSR during annual updates, e.g. step-out criteria. Conditions required to be met and notification requirements are pre-negotiated and approved. The effort in preplanning in the DSA/TSR can significantly reduce the number of reviews (USQDs) needed as the project nears completion.

Staffing
As the work is completed, and the workforce is downsized, support staff will also be reduced. Again, preplanning staffing requirements is essential. Identify the required positions and/or duties (e.g. TSR requirements for staffing, emergency response, etc.). As personnel leave, ensure that essential duties and responsibilities are maintained.

Plan for delays – the end date can change.

CONCLUSION

Completing the single largest nuclear decommissioning project in the United States was challenging and exciting. Because of its massive size and uniqueness, BNG America had to be creative and inventive when solving numerous obstacles. Since there have been no other GDP decommissioning projects done within the DOE environment, there have been no previous programs or protocols from which to glean. Programs and procedures were developed specifically for this project, and equipment was designed from scratch. Experience and Lessons Learned allowed the ETTP team to overcome challenges and maintain one of the best safety records in the industry. Three times in three years BNG America surpassed one million man-hours without a lost time accident and maintained an injury rate of ¼ the national average. During the demobilization phase of the project, there were no recordable injuries, no day-away cases and no notice of violation reports. There is no other project in this industry that can make that claim. Completing this project is a huge accomplishment for BNG America and the DOE, and sets the standard for all future D&D projects.