SAVING TIME, EXPENSE, AND A VALUABLE RESOURCE BY RECOVERING URANIUM FROM A SURPLUS DOE STRATEGIC MATERIAL AT A CONVENTIONAL URANIUM MILL

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ABSTRACT

Beginning in the 1940's, ores were processed in the United States for the recovery of uranium. Byproducts of this original processing, and subsequent processing of the same ores by the Cotter Corporation at a mill in Colorado, were obtained by the U.S. Department of Energy ("DOE"). This material, known as the "Cotter Concentrate", was managed from 1987 until recently by the DOE Nevada Operations Office ("DOE/NV") as a strategic material in inventory at the Nevada Test Site ("NTS"). The suspension of large-scale weapons production operations resulted in DOE no longer needing the material, and declaring it as waste in 1995. At the time the material was declared waste, DOE/NV was unaware of the potential usefulness of the material by an outside organization. Pilot treatability tests to determine how to stabilize metals in the material for disposal were inconclusive, so DOE/NV solicited outside vendors to perform further tests to establish the best method of treatment. The operator of the White Mesa Uranium Mill, an NRC-licensed mill near Blanding, Utah, responded with a proposal to perform uranium extraction on the residue. The Mill's proposal was selected since it would involve a beneficial use of the material, consistent with RCRA's intent to encourage recycling and recovery. Such recycling conserves energy and natural resources, and in this case, saved an estimated three million dollars, while recycling approximately 260 cubic meters of uranium-bearing material.

This paper details this uranium recovery project, including (1) Reclassifying the Cotter Concentrate from a regulated solid waste to a feedstock material, under terms defined by the U.S. Nuclear Regulatory Commission; (2) Amending the Mill's U.S. NRC license to enable the Mill to accept the Cotter Concentrate as an alternate feed material; (3) Deleting Cotter Concentrate from the NTS Federal Facility Compliance Act ("FFCAct") Consent Order and Site Treatment Plan; (4) Overpacking each 55-gallon container in a DOT-compliant container; and (5) Shipping the material to the Mill for uranium reclamation, with disposal of tailings from the process in the Mill's NRC-licensed uranium mill tailings pond. Conclusions revisit the environmental and cost benefits of recycling (vs. disposal). In particular, processing of Cotter Concentrate at the White Mesa Mill resulted in significant cost savings and reduction in the mixed waste stream for DOE/NV. In addition, processing the Cotter Concentrate in lieu of treatment and disposal resulted in the beneficial recovery of source material, conserving energy and natural resources. Finally, although the Cotter Concentrate represented a large portion of the mixed waste stream for DOE/NV, it represents a small portion of the material presently considered waste that potentially contains source material that, if it can be economically reclaimed, could result in a significant reduction in treatment and disposal cost, while conserving energy and natural resources.

INTRODUCTION

Beginning in the 1940's, Belgian Congo and native ores were processed in the United States for the recovery of uranium. Byproducts of this original processing, and subsequent processing of the same ores by the Cotter Corporation at a mill near Canon City, Colorado, were obtained by the U.S. Department of Energy ("DOE"). From 1987 until recently, the DOE Nevada Operations Office ("DOE/NV") managed the material, known as the

"Cotter Concentrate", as a strategic material in inventory at the Nevada Test Site ("NTS"). At the time, it was anticipated that the material would undergo further processing for additional uranium extraction for the nuclear weapons program. The suspension of large-scale weapons production operations eventually resulted in DOE no longer having a need for the material, and subsequent declaration of it as waste in January 1995.

At the time the material was declared as mixed waste, DOE/NV was unaware of the potential usefulness of the material by an outside organization. Pilot treatability tests were subsequently conducted at the NTS to determine how to stabilize metals in the material, in order to prepare for disposal. Since the tests were inconclusive, DOE/NV solicited outside vendors to perform further tests to establish the best method of treatment.

During the solicitation process, the operator of the White Mesa Uranium Mill, an NRC-licensed mill near Blanding, Utah, responded with a proposal to perform uranium extraction on the residue. The Mill's proposal was selected since it would involve a beneficial use of the material, consistent with RCRA's intent to encourage recycling and recovery. Such recycling conserves energy and natural resources, and in this case, saved an estimated three million dollars.

Submitting the Cotter Concentrate for additional uranium extraction by the Mill, instead of stabilizing the waste on site, expedited processing of the Cotter Concentrate by two years and recycled approximately 260 cubic meters of uranium-bearing material.

This paper examines the details of this uranium recovery project, including:

1. Reclassifying the Cotter Concentrate from a regulated solid waste to a feedstock material, under terms defined by the U.S. Nuclear Regulatory Commission;
2. Amending the Mill's U.S. NRC license to enable the Mill to accept the Cotter Concentrate as an alternate feed material;
3. Deleting Cotter Concentrate from the NTS Federal Facility Compliance Act ("FFCAct") Consent Order and Site Treatment Plan;
4. Overpacking each 55-gallon container in a DOT-compliant container;
5. Shipping the material to the Mill for uranium reclamation, with disposal of tailings from the process in the Mill's NRC-licensed uranium mill tailings pond.

The conclusions of this paper revisit the environmental and cost benefits of recycling (vs. disposal).

ORIGIN AND HISTORY OF COTTER CONCENTRATE

Cotter Concentrate was the residue resulting from the processing and reprocessing of raw ore for the extraction of uranium and thorium from the earlier years of the Department of Energy's ("DOE") nuclear weapons program. The ore was originally processed for uranium extraction in 1942 at the Mallinckrodt facility in St. Louis, Missouri and then again in 1968 at the Cotter facility near Canon City, Colorado. Even after these two processing campaigns, the remaining material still contained approximately 10 percent natural uranium.

The material was purchased by DOE and transferred from the Cotter facility to the DOE Mound facility in the 1970's. DOE Mound, near Miamisburg, Ohio, attempted to extract thorium-230 and protactinium-231 from the material on a smaller scale for DOE programs, but discontinued extraction operations when it was determined to be infeasible. The Cotter Concentrate was shipped to the Nevada Test Site ("NTS") in November of 1987 and was stored as strategic material at the NTS until 1994. At the time, it was anticipated that the material would undergo further processing for additional uranium extraction for the nuclear weapons program. Suspension of large-scale weapons operations eventually resulted in DOE no longer having a need for the material. Unaware that this material could be considered as alternate feedstock material for the uranium mill process, DOE Nevada Operations Office ("DOE/NV") considered disposal as the only option, and the Cotter Concentrate was declared a waste in 1995. The plan was to dispose of the material directly as a low-level waste at the NTS; but based on its corrosive nature, selenium content and radionuclide content, it was declared a mixed waste. Disposal was still the intent, but since the waste was a mixed waste, treatment was required first to address Land Disposal Restrictions ("LDR").

DESCRIPTION OF THE MATERIAL

The physical characteristics of Cotter Concentrate varied somewhat from drum to drum, but it ranged from a sludge to a moist cake matrix, with moisture contents varying from 34-51 percent. The waste moderately phased with regards to liquids and solids. For high moisture content drums where free liquids were present, the top surface of the waste was a thick soup-like liquid with the waste turning thicker deeper into the drum. At the bottom of the drum, the waste was clay-like. For drums containing no free liquids, the waste was a clay-like consistency throughout the drum. Density was roughly 100 pounds per cubic foot. There were 1,248 drums and each drum contained roughly 570 pounds of residue.

Based on process knowledge, DOE/NV established that the material in the drums could be divided into two populations. The first population included 1,240 drums of material that had not undergone processing at the Mound facility and had an average selenium concentration of 2.2 mg/L, which exceeded the Toxic Characteristic Leaching Procedure ("TCLP") regulatory level of 1.0 mg/L, and had an average pH of 12.5. The second population included eight drums that had been processed at Mound. As a result of the processing at Mound, these drums had a selenium content above the regulatory level, and a lower pH than the other population material, with five of the drums having pH levels below 2.0. In addition, carbon tetrachloride and 2-butanone were present in these eight drums, with concentrations in two drums exceeding the TCLP regulatory level for both compounds. The material, all 1248 drums, had uranium concentrations ranging from 1.32 to 27.44 percent, averaging approximately 10 percent uranium. In addition, the Cotter Concentrate had unusually high concentrations of thorium-230 and protactinium-231.

TREATABILITY TESTS

Bench scale treatability tests for treatment to enable disposal were conducted at the NTS by DOE/NV's contractor. The purpose of the tests were two fold: (1) to determine if the waste could be successfully solidified to meet regulatory and on-site waste acceptance criteria for disposal; and (2) to evaluate the effectiveness of chemically and physically binding the inorganic constituents, particularly the selenium, in such a manner as to render the selenium non-leachable to ensure compliance with LDR’s. Concentrate material was mixed with cement, silica fume, attapulgite, and water in varying concentrations, and was allowed to cure for more than thirty days. The solidified masses were then crushed and analyzed for TCLP metals. The results of the selenium leachability portion of the study were inconclusive regarding performance of the concrete in preventing selenium from leaching out of the concrete matrix under TCLP conditions. Because the tests were inconclusive, it was decided to solicit bids from outside vendors with more experience in solidification to perform further tests to establish the best methods of treatment.

SELECTION PROCESS

In April of 1996, the DOE/NV contractor issued a request for proposals for treatment of Cotter Concentrate in the Commerce Business Daily ("CBD"). A total of 25 vendors responded, one of them being International Uranium (USA) Corporation ("IUSA"). The operator of IUSA's White Mesa Uranium Mill, an NRC-licensed mill near Blanding, Utah, responded with a proposal to perform uranium extraction on the residue. The mills' proposal was selected because it would involve a beneficial use of the material, consistent with Resource Conservation and Recovery Act's ("RCRA") intent to encourage recycling and recovery. The other proposals addressed the treatment and disposal plan, which was rejected after learning of a reprocessing opportunity. In addition, DOE will ultimately maintain responsibility for the residue after processing, since under the Uranium Mill Tailings Radiation Control Act ("UMTRCA"), responsibility for all mill tailings reverts to DOE after the mill is decommissioned.

COST CONSIDERATIONS

Submitting the Cotter Concentrate for additional uranium extraction at the mill, instead of treating and disposing of the material on site, expedited the processing of the Cotter Concentrate by two years, reprocessed approximately 260 cubic meters (m^3) uranium-bearing material, and saved more than three million dollars. It eliminated the need to dispose of an estimated 780 m^3 based on the NTS bench scale treatibility tests, and rendered a corrosive material not only less harmful but also useful.

REGULATORY CONSIDERATIONS

Regulatory issue's included DOE reclassification from mixed waste to alternate feed, amendment of the Mill's NRC license to accept the alternate feed, State concurrence, and a review of the data on hazardous constituents in the material.

Classification from Strategic Material to Mixed Waste to Alternate Feed

During 1994, the Cotter Concentrate was recategorized in DOE's material inventory from a strategic material to a waste. After 1994, because Cotter Concentrate was considered a Mixed Waste ("MW") it was managed under the Federal Facility Compliance Act ("FFCAct"). The FFCAct required each DOE site to negotiate an agreement with their respective regulatory agency concerning management of mixed waste. The NTS Site Treatment Plan ("STP") is the planning document containing the options for treating the NTS MW, including the Cotter Concentrate. The NTS Consent Order is the enforceable document which resulted from the negotiations between DOE/NV and the Nevada Division of Environmental Protection ("NDEP") regarding the handling of mixed waste at the NTS. Since a strategy for Cotter Concentrate had previously been negotiated between DOE/NV and NDEP, and was incorporated in the Consent Order, both parties then had to renegotiate revisions to the strategy, as a result of IUSA's proposal. It was determined that the Cotter Concentrate was not subject to solid waste regulations and therefore not a hazardous waste, because as a process byproduct material, and as defined under RCRA, it was being reclaimed. The material then could be reclassified from a mixed waste regulated under the FFCAct and RCRA to an "alternate feed material" in accordance with the Nuclear Regulatory Commission ("NRC") guidance.

NRC Guidance for Acceptance of Alternate Feed at Licensed Uranium Mills

On August 15, 1997, the NRC issued its "Final Position and Guidance on the Use of Uranium Mill Feed Material Other Than Natural Ores" ("Alternate Feed Guidance"). Under this policy the NRC permits licensees to process alternate feed material (material other than natural ore) in uranium mills as long as the following procedures are followed:

- Consideration of the NRC definition of "ore" as "a natural or native matter that may be mined and treated for the extraction of any of its constituents or any other matter from which source material is extracted in a licensed uranium or thorium mill". This would include processing ores which have previously been beneficiated for other minerals and which are now outside of the owner's legal or technical ability to further process.
- A determination of whether the feed material contains hazardous waste. Environmental Protection Agency ("EPA") regulations that implemented RCRA exempt those potential alternate feed materials that exhibit only a characteristic of hazardous waste (ignitable, corrosive, reactive, toxic) from hazardous waste classifications by providing that byproducts that are being reclaimed are not regulated as hazardous waste (40CFR 261.2c(3)).
- A determination of whether the ore is being processed primarily for its source-material content. An ideal case is that the material contain economic levels of recoverable source material. But, other economic considerations may be applied, as well as consideration of the physical or chemical similarity of the material to 11e.(2) byproduct material.

The White Mesa Mill, for example processes "natural" (ie., mined, native) uranium ores, and uranium-bearing "alternate feed materials" for recovery of uranium, often followed by recovery of additional minerals. These alternate feed materials are generally processing byproducts from other extraction procedures. For the Cotter Concentrate, the NRC granted IUSA an amendment to the Mill's NRC license for that particular alternate feed in March of 1997. This approach is being revised to a more flexible, performance-based acceptance standard. This will eliminate the need for individual amendments such as the one obtained for the Cotter Concentrate.

State Concurrences and NRC Concurrence

The NDEP concurred with removal of the Cotter Concentrate from a waste status. Based on information provided as part of the amendment to IUSA's license, NRC also concurred with the classification of the material as alternate feed material in accordance with NRC guidance. The Utah Division of Environmental Quality ("UDEQ") concurred with Nevada's determination that the Cotter Concentrate was not considered a hazardous waste if reclaimed, and that it could be reprocessed for uranium extraction.

Review of Hazardous Constituent Data

As discussed above, by definition under RCRA, the Cotter Concentrate was not considered hazardous. Although the Cotter Concentrate had "characteristic" properties, that, if it was being disposed, would require it to have been classified as a hazardous waste, RCRA allowed for this processed byproduct material to be exempt from hazardous waste requirements because it was being recycled or reclaimed.

Although the Cotter Concentrate contained a number of naturally-occurring metals, only selenium was at levels that were of regulatory concern. In addition, as it was stored, both populations of Cotter Concentrate had pH values that would classify the concentrate as corrosive. Residual amounts of organic compounds from previous solvent extraction processing were also present, but since these compounds were introduced during the processing and were not considered spent when introduced, the residual material did not retain a "listed" waste classification.

The Cotter Concentrate contained concentrated levels of uranium, thorium, and their progeny. On contact (with individual drums) dose readings ranged from 10 to 20 mRem/hr. Due to elevated concentrations of uranium and thorium, the residue also generated significant quantities of radon.

TRANSPORTATION, RECEIVING, AND STORAGE

In order to ship the Cotter Concentrate Material to the White Mesa Uranium Mill, each drum was placed inside a steel overpack drum so that Department of Transportation ("DOT") specifications for the shipment of radioactive and corrosive material were met. This was necessary as the 55-gallon (208 liter) drums that the material had been stored in did not meet the current DOT requirements. The primary container was a 55 gallon steel drum with a 20 millimeter polyethylene liner. The majority of the drums also contained a 3 millimeter plastic liner inside the polyethylene liner. The overpack drums were new 85 gallon (322 liter) drums that met DOT specifications. Transporting the material involved a total of 28 truckloads, with approximately 42 drums in each load. Drums were loaded in rows of three across the width of the trailer. A total of 15 rows were placed into the trailer. Drums were banded together in groups of six for stability, using cotton bands with hand operated release buckles. Space was required between the cab of the vehicle and the most forward placed drums in the trailer in order to comply with DOT requirements for dose limits to the driver. Overpacked containers and banding were returned from the White Mesa Uranium Mill to the NTS for reuse. A sufficient quantity of overpack containers were purchased to allow for 90 drums to be in transit between the NTS and the mill while overpacking of another 90 drums was being accomplished.

Transportation Route

The Cotter Concentrate was transported from the NTS to the White Mesa Mill in over-the-road fully enclosed tractor trailer vans. The transportation route followed Highway 95 south to Interstate 15 north into Utah, east on Interstate 70 to Highway 191 junction, and south to Blanding, Utah. Although shorter routes were available, the other routes would have increased the distance traveled on two lane highways and conflicted more with tourist and vacation traffic through southern Utah.

Receipt and Storage

Upon arrival at the White Mesa Mill, the overpacked containers were taken to a temporary holding area. The 55 gallon drums were subsequently removed from the overpacks and stored in the general area in which the material would be introduced to the mill process.

Because the White Mesa Mill routinely handles and stores uranium concentrates up to 90 percent uranium oxide (U_3O_8), normal provisions for storage and security were adequate for the Cotter material. The first shipment of the Cotter Concentrate arrived at the White Mesa Mill on May 31, 1997 and the final load was received on August 13, 1997.

MILL PROCESS

The White Mesa Mill was permitted and constructed in the early 1980's, originally to process uranium and vanadium ores from the historical Colorado Plateau mining district, and later from the high-grade breccia pipe mines in northern Arizona. Throughout it's operating history, the Mill has demonstrated the flexibility to adapt to wide variations in ore grades and processing parameters, resulting in exceptional recoveries of uranium and vanadium values from over three and one-half million tons of native ores. The Mill circuit can operate at leach temperatures up to 90 degrees centigrade and pH levels as low as 0.5, utilizing sulfuric acid (H_2SO_4). More recently, the Mill has demonstrated recoveries of 90 percent of contained tantalum/niobium values using a combination of sulfuric and hydrochloric acid leach. The Mill has eight high capacity thickeners which are capable of being configured into groups or series of parallel stages. Three separate solvent extraction (liquid ion exchange) circuits are capable of handling aqueous flows up to 800 gallons per minute. Final products can be dewatered, dried, or calcined at temperatures up to 650 degrees centigrade. The Mill is operated by a seasoned professional and operations staff, some of whom have been at the facility since it's startup in spring of 1980. The metallurgical staff has the experience and background to evaluate options and process for the recovery of a wide variety of minerals.

Amenability Testing

Prior to finalizing agreements with the Department of Energy to accept the Cotter Concentrate, it was necessary to understand the processing characteristics of the material and determine if the material had physical or chemical characteristics which would be incompatible with the Mill process equipment or with the NRC licensed tailings disposal system. Initial test work confirmed that the material contained detectable levels of organics, as well as thorium and radium, in addition to 10 percent uranium ("U_3O_8"). All of these phenomenon were attributed to the prior processing activities. The presence of organic compounds, essentially solvent extraction reagents, which remained from prior processing activities, were originally of concern due to possible adverse effects to the rubber linings in several pieces of the Mill's process equipment. Additional testing determined that the levels of organics were low enough and the overall quantity of material small enough that physical degradation of the process equipment would not be a problem. Test work confirmed that the material was amenable to a sulfuric acid leach to solubilize the uranium, followed by liquid solid separation and precipitation of the uranium using anhydrous ammonia. Variations to this procedure were implemented during actual processing to maximize recoveries.

Process Description

A total of 1,248 drums of Cotter Concentrate were received at the Mill, with all but three barrels containing slurried material with various percentages of liquid content. Because of employee health and safety concerns, the barrel lids were initially removed, and the barrels allowed to stand open for several hours prior to loading into the dumping apparatus. This "aeration" process was to allow the radon gas, which had built up in the sealed barrel, to escape. The barrels were then systematically loaded onto the barrel dumping apparatus where they were remotely moved over an open top, mechanically agitated mix tank. The barrel was remotely rotated 135 degrees and the contents removed by the use of high pressure water sprays positioned to completely clean the barrel interior. From the mix tank under the barrel dumping station, the slurried material was pumped to one of three existing pulp storage tanks. From here, the processing utilized existing equipment with piping modifications made to facilitate the specific processing requirements of the Cotter Concentrate.

It was originally hoped that the slurried material would be stored in the pulp storage tanks at approximately 50 percent solids (by weight), but due to the plastic bag inside each of the drums, approximately three times as much water was used to empty a drum, and the resultant slurry was only approximately 20 percent solids. The slurried material was agitated in the pulp storage tank for several days as drums were dumped. Once that tank was full, the solids were allowed to settle and the clear liquid was decanted to a second holding tank. This step constituted the first washing step, and removed a significant amount of the organics, along with potassium and sodium. The clear solution was assayed for uranium, and if the uranium content was less than 0.10 grams per liter
U_3O_8, the solution was pumped to the tailings pond. Solutions with higher grade values of uranium were contacted with 93 percent H_2S0_4 to ensure that all the uranium was in solution and that any suspended solids were fully leached. The solution was also air agitated to help oxidize the uranium. After approximately four hours of leaching time the solution was transferred to the precipitation feed tanks and held for further processing.

Once all of the drummed material had been moved into the pulp storage tanks, batches of the slurried material were moved to one of the Mill's leach tanks. Ninety three percent H_2S0_4 was introduced to the slurried material to dissolve the uranium values. The acid concentration was maintained at a pH of 2.0 for a period of approximately four hours, and the slurry was again agitated with air to help oxidize the uranium. At the end of this period, the uranium bearing solution was decanted off and pumped to the precipitation feed tank. At this point in the process, most of the solids were dissolved as a result of the leaching process. Very few of the uranium and iron solids remained in the original material. The leaching and decanting process were repeated until all of the slurried material had been processed and the remaining barren solids were pumped to the tailings pond.

All of the uranium values were now stored in solution in the precipitation feed tank at a concentration of approximately 40-50 grams per liter U_3O_8, along with a significant amount of dissolved iron and other metals. The pH of the solution was raised from 2.0 to 4.4 to precipitate iron, but not uranium. The precipitated iron solids were pumped to the tailings pond. The uranium-bearing solution was then decanted to the existing mill precipitating circuit where the process was completed by raising the pH to 7.0. The precipitated uranium was then processed through the existing two-stage yellowcake thickener circuit where the uranium solids were allowed to settle to the bottom of the tank. These solids, in a 50 percent slurry, were dewatered in a solid bowl centrifuge and then dried, or calcined, at 650 degrees C in a multiple hearth dryer. The final product is approximately 80 percent U_3O_8. It is packaged in 55-gallon steel drums for shipment to a converter.

Byproduct Management

Waste streams that resulted from processing of the Cotter Concentrate are made up of the liquid and solids from the leaching and precipitation processes and from the residual 55-gallon barrels which were used to transport the material to the White Mesa Mill. Because of the use of an acid leach process the majority of the solids, mostly uranium and iron, were solubilized in the process. After separation and recovery of the uranium, the remain solubilized metals were pumped to the tailings pond. The remaining insoluble solids were likewise disposed into the tailings pond following the final leach. Total volume reduction on the material fed to process was estimated to be 75 percent. None of the 1,248 barrels used to transport the material were salvaged for other uses. As the barrels were emptied and washed, they were periodically transported to the disposal area designated for solid waste, crushed, and covered with soil, in keeping with the approved interim stabilization plan for the tailings management system. The total volume addition to the existing tailing stored at the White Mesa site was less than 0.01 percent.

Employee Radiation Safety

The primary issues affecting employee health and safety in handling the Cotter Concentrate were: (1) radon gas due to the material being stored in sealed containers; (2) beta and gamma radiation from the presence of daughter products remaining from incomplete processing of the material, and also the age of the concentrated uranium; and (3) physical contact with the material due to the caustic nature (high pH) and the presence of organics from previous processing. The possibility of dusting and resultant airborne contamination potential was not a factor due to the high (34-51 percent) moisture content. It was determined that issues surrounding the higher than normal radiological parameters would be handled by modification of the drum handling procedures and by installation of a remote dumping station to introduce the material to the pulp storage section of the Mill. These procedures, plus more frequent rotation of handling personnel, would ensure that there was no additional health and safety risk in processing the material.

The potential hazard due to radon gas was easily mitigated by removal of the barrel lids and allowing the open drums to naturally vent prior to any additional handling. This aeration of the drums took an hour or so to almost entirely eliminate the radon gas buildup. Beta/gamma exposure was initially thought to be the greatest potential health and safety issue. However, it was effectively eliminated by use of the specifically constructed drum handling and dumping facility. After opening and aerating each of the drums, the container was placed on a roll conveyor and remotely moved onto the barrel dumping mechanism where it was again remotely titled, dumped, and washed with fixed fresh water sprays. The presence of three millimeter (ml) thick plastic drum liners extended the dumping time and required some additional employee involvement in the final stages of the dumping operation, but did not present any unusual exposure potential. The chemical exposure potential was mitigated by the use of hooded Tyvex coveralls, rubber gloves and boots, and full face respirators. All employees were subject to the normal on-site health and safety programs, including individual TLD badges, urinalysis, and area breathing zone monitoring. There were no instances of elevated personnel exposure or exceedances of ALARA action levels.

SUMMARY AND CONCLUSIONS

In summary, processing of Cotter Concentrate at the White Mesa Mill resulted in significant cost savings and reduction in the mixed waste stream for DOE/NV. In addition, processing the Cotter Concentrate in lieu of treatment and disposal resulted in the beneficial recovery of source material, conserving energy and natural resources.

Although the Cotter Concentrate represented a large portion of the mixed waste stream for DOE/NV, it represents a small portion of the material presently considered waste that potentially contains source material that, if it can be economically reclaimed, could result in a significant reduction in treatment and disposal cost, as well as, conserve energy and natural resources.

The Cotter Concentrate project generated several "lessons learned":

1. The first lesson learned is that the community can never have enough information. Although this project had to do with processing a material for its intended purpose (uranium recovery) and was consistent with RCRA's intent to encourage recycling and recovery, the public still had some concerns. The public was informed through the Community Advisory Board for the Nevada Test Site; however the amount of public concern generated as a part of the NRC license amendment process was not anticipated. This resulted in extra unanticipated cost for participating in the appeals procedures as part of the license amendment process.
2. Another lesson learned is that one should spend some time evaluating all options early in the process. Once Cotter Concentrate was no longer considered "strategic material," DOE declared it a waste. DOE was narrowly focused on disposing of the material and failed to realize there was a potential user, which could further recover resources from the material, and effectively reduce cost associated with unnecessary disposal.
3. The third lesson learned is the importance of field observations. In retrospect, it would have been helpful to have had mill personnel visit the NTS to observe how material was stored, to ensure proper understanding of how the material was packaged, thereby reducing handling time and processing cost at the mill.

BACK