U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 040-03392/94001(DRSS)

Docket No. 040-03392 License No. SUB-526

Licensee: Allied-Signal, Inc.
P. O. Box 430
Metropolis, IL 62960

Facility Name: Metropolis Works

Inspection At: Metropolis, Illinois

Inspection Conducted: March 08 through 10, 1994

Inspectors: George M. France, III — 04/06/94
George M. France, III — Date
Fuel Facilities Inspector

James R. Kniceley — 04/06/94
James R. Kniceley, Physical — Date
Security Inspector

Approved By: George M. McCann — 04/07/94
George M. McCann, Chief — Date
Fuel Facilities and
Decommissioning Section

Inspection Summary

Inspection on March 08-10, 1994 (Report No. 040-03392/94001(DRSS))
Areas Inspected: This was an unannounced inspection of facility requirements specified in NRC regulations, license and license conditions, including a review of the following activities: Operations Review (IP 88020); program adjustments to meet new Part 20 requirements, Radiation Protection (IP 83822); quality assurance audits on uranium hexafluoride (UF_6) product cylinders and the identification of defective cylinders, Management Organization and Controls (IP 88005); and waste recovery operations, Radioactive Waste Management (IP 88035).
Results: Within the scope of the inspection, no violations were identified. The licensee's product cylinder inspection program meets requirements of the American Nuclear Standards Institute document ANSI N14.1. The calculated external dose from licensed activities was less than 10 millirem (0.1 milliseivert) to the nearest resident.

DETAILS

1. Persons Contacted

R. Allshouse, Quality Assurance Engineer
C. Blanden, Supervisor, Production
*L. Bruce, Supervisor, Environmental Affairs
*M. Kosmider, Plant Manager
*S. Stewart-Powers, Health Physics Specialist
*R. Yates, Supervisor, Health Physics

The inspectors also interviewed workers assigned to the cylinder storage yard, product distillation, and radiation protection programs.

*Denotes licensee attendance at the exit meeting on March 10, 1994.

2. Licensed Program

The Metropolis Works Feed Materials Facility converts uranium ore concentrates (tri-uranium, octa-oxide, or U_3O_8) into uranium hexafluoride (UF_6) by fluorination. The production of UF_6 represents the third step in the nuclear fuel cycle, following mining and milling operations. Finally, the licensee ships UF_6 to a gaseous diffusion facility, where the uranium-235 isotope is enriched and subsequently used in the commercial nuclear power industry.

3. Radiation Protection (IP 83822)

a. Bioassay Program

The licensee's bioassay program requires urine samples for evaluation of internal exposure to soluble uranium. The whole body counting technique is used to determine the lung deposition of insoluble uranium.

The licensee performs urinalysis by fluorometric analysis on workers who are routinely assigned to a restricted area at two week intervals, while other workers that infrequently work in the restricted areas provide urine samples at least monthly.

The licensee has determined that the solubility class of uranium compounds, percent class D, formed during the conversion process ranges from 5 percent solubility for uranium dioxide (UO_2) to 100 percent soluble UF_6. Solubility tests were performed by measuring the solubility concentration of various uranium bearing chemicals in simulated lung fluid. Because of the solubility among the various uranium bearing chemicals, a urinalysis is normally scheduled for workers involved in unplanned releases of uranium bearing materials.

A review of sample results indicates that nearly 1,600 urine samples representing nearly 400 employees will be analyzed by the end of the first quarter, 1994. A review of the available data disclosed that the investigation level of 10 percent ALI (Annual Limit on Intake) was not exceeded.

The licensee's health physics practices and written procedures have been modified to incorporate the requirements of the revised 10 CFR Part 20 regulations (20.1502(b)). The procedures also follow the guidance discussed in Regulatory Guide 8.9 Acceptable Concepts, Models Equations, and Assumptions for a Bioassay Program.

The licensee maintains an onsite capability to conduct *in vivo* measurements. Historically, whole body counts rarely exceed detectable limits. This is partially due to the absence of high (temperature) fired insoluble UO_2, which is normally produced in fuel fabrication plants to make commercial reactor fuel. Tests show that the average particle size of radioactive material produced in drum dumping, ore sampling, and feed materials operations is purported to be about 6.0 microns (μ), or much greater than a 1 μ respirable particle. The size of particles produced by these operations coupled with their solubility properties also contribute to the lack of whole body exposure among Metropolis workers.

The maximum permissible lung burden (MPLB) for uranium-235 is about 194 micrograms (μg). The licensee's whole body counter has a minimum detection limit of about 63 μg. Worker exposure levels for results determined in 1993 were reported to be statistically near the detection limit and significantly less than a MPLB quantity.

b. Radiation Dose Limits for Individual Members of the Public

NRC regulation 10 CFR Part 20.1302, requires the licensee to conduct operations so that an individual member of the public continuously present in the unrestricted area would not exceed an external dose of 100 millirem (mrem) or 1.0 milliseivert (mSv) in a year. Dose to the nearest resident from the licensed operation was less than 10 mrem or 0.1 mSv for the 1993 operating year. Hence, the data indicated that the licensee was in compliance with Part 20.1302. The licensee also indicated that dosimetry measurements at the nearest resident were not significantly different than dosimetry measurements made at the local Metropolis airport.

The inspector concluded that the radiation safety staff exhibited a thorough understanding of applicable NRC requirements and appear to take responsibility in implementing and enforcing the radiation safety program.

No violations or deviations were identified.

4. Management Organization and Controls (IP 88005)

a. Organization

The highest ranking member of management at the plant site is the Plant Manager, who has the primary responsibility for the safe, efficient and reliable operation of the Metropolis Works facility. He coordinates and delegates this responsibility through his staff managers. There has been no recent change in the management staff at the licensed facility, Metropolis Works.

Radiological protection and environmental controls are all administered through the licensee's Department of Regulatory Affairs headed by the Manager, Regulatory Affairs. The licensee's radiation protection organization consists of a Health Physics Supervisor, two Health Physics Specialists (HPS), and seven Health Physics Technicians (HPT). Technicians are deployed to perform various tasks under the supervision of one of the HPS, while *in vivo* and industrial hygiene requirements are conducted by the other HPS. Technicians are also cross trained to perform radiation surveillance as well as urinalyses. The present alignment allows the organization to provide radiation protection services through a 24 hour daily operation.

Upon request, a HPT performed a respiratory fit test on the inspector and demonstrated compliance with Part 20.1703, Use of Individual Respiratory Protection Equipment. The inspectors also noted that the licensee's onsite medical dispensary is manned by a full time nurse and a part time physician. This arrangement allows the licensee on an annual basis, to determine if the individual user is physically able to use respiratory protection equipment. Hence, the licensee satisfies the requirements of Part 20.1703(v).

b. Quality Assurance (QA) Audits

The inspector reviewed the licensee's UF_6 Cylinder QA Manual and Cylinder Wash Operating Manual. These documents were prepared in accordance with the cylinder handling requirements documented in the American National Standards Institute, Standard Nos. ANSI N14.1, N14.30 and the U. S. Department of Energy (DOE) Manual of Good Handling Practices, ORO-650, developed at DOE Oak Ridge Operations.

Conditions observed in the cylinder storage yard coupled with a review of cylinder handling records confirmed that the licensee's cylinder handling program complies with the following elements listed in either ANSI N14.1, N14.30, or ORO-650:

Effective January 1994, no UF_6 cylinders will be shipped from Metropolis Works on vehicles (semi-trailers) that do not comply with ANSI N14.30 titled Semi-trailers Employed in the Highway Transport of Weight-Concentrated Radioactive Loads (Design, Fabrication and Maintenance). Carriers must provide the licensee with documentation that the vehicle is certified.

In accordance with ANSI N14.1 Standard 5 year recertification requirement, empty UF_6 cylinders are washed to remove heel quantities, up to 50 pounds (lb) or 22.7 kilograms (kg) of UF_6. Afterwards, the interior of the cylinder is visually inspected by borescopic techniques for corrosion. After the above preparations are completed, the cylinder is hydrostatically pressure tested.

The five year recertification procedure involves production maintenance, laboratory, and technical department personnel. In 1993, the licensee recertified more than 75 cylinders. Fifteen or more cylinders were rejected because they were not clean enough to allow internal examination, while three were rejected and removed from service because of excessive pitting and gouges to the external cylinder wall.

In the past, cylinders were destroyed by enlarging the holes where the cylinder plug and valve reattached, which prevented their return to service. Recently, the maintenance department received an "R" stamp code which permits them to make pressure vessel and boiler repairs at the plant; and, when feasible, salvage the damaged cylinders.

Cylinders are routinely inspected externally for corrosion, cracks, bulges, dents, gouges, damaged stiffening rings or skirts, improper thread engagement of valve or plugs, deep pitting or other conditions which might render the cylinder unsafe or unserviceable. In response to the inspector, the licensee had no recent memory of external corrosion causing a cylinder to be unserviceable.

Cylinder handling equipment such as the cylinder crane, the cylinder forklift, and cylinder carts are maintained at a preselected frequency.

It is apparent that the licensee's cylinder handling program follows prescribed procedures and standards sanctioned by the NRC.

No violations or deviations were identified.

5. Radioactive Waste Management (IP 88035)

In UF_6 production, fluorides become the dominant impurity in the waste water stream. Calcium hydroxide ($Ca(OH)_2$) is used to precipitate fluorides as insoluble calcium fluoride (CaF_2), or synthetic fluorspar. Because of the low-levels of uranium in the CaF_2, the licensee is authorized to release this material for use in other industries.

When UF_6 is collected in cold traps, the uncondensed gas or off-gas that is formed must be routed through a scrubbing solution. Uncondensed gas consisting of fluorine (F_2), hydrogen fluoride (HF), air, and traces of UF_6 is routed into off-gas scrubbers where contact with aqueous potassium hydroxide (KOH) solution removes fluorides and traces of uranium before release to the atmosphere. Currently, the licensee is testing a recovery system which chemically treats the off-gas scrubber solution and recovers the uranium from an ion exchange medium. Recent results indicate that the ion exchange medium reduces uranium levels in the waste stream from less than 75 parts per million (ppm) or 75 micrograms per gram (75 μg/g) to less than 10 ppm (10 μg/g). This recovery step also reduces the amount of uranium that is detected in the waste solution before it is processed to make synthetic fluorspar (CaF_2). By License Condition, the average concentration of uranium in CaF_2 released to other manufacturers shall not exceed 212 picocuries per gram (pCi/g) or 7.86/Becquerels per gram (Bq/g) in any 12 consecutive months.

Synthetic fluorspar is shipped to a briquette plant, where it is mixed with natural fluorspar and other materials to form briquettes. Subsequently, the briquettes are used in removing impurities from molten steel. By maintaining the concentration of radioactivity below the 212 pCi/g or 7,86 Bq/g limit, the licensee assures that the maximally exposed individual, a briquette maker, is exposed to less than 2 mrem or 0.02 mSv per year.

The inspector confirmed that the licensee has improved its waste recovery program by reducing the amount of radioactive material discharged in liquid effluent. Furthermore, an additional benefit of recovering uranium from the waste stream by ion exchange, changes the pH (potential hydrogen ion concentration) of the stream and removes its hazardous waste classification, a requirement regulated by USEPA.

No violations or deviations were identified.

6. Operations Review (IP 88020)

The inspector toured the conversion plant control room, conducted interviews with distillation operators and observed their preparation for removing filled UF_6 cylinders from the cylinder fill area.

A distillation operator explained specific control room functions and operator preparation for filling nonroutine or small UF_6 cylinders (2½ ton 30-B cylinders). The operator noted that each cylinder placed

in the fill position rests on a special load cell which is set to alarm through control room instrumentation. The alarm is set to correspond with target weights for filling 30-B cylinders. The operator emphasized the importance of these engineering controls to ensure that cylinder capacity was not exceeded, during UF_6 cylinder fill operations.

The inspector toured the cylinder fill area and observed that a cylinder check sheet was in place to aid the operator in checking the cylinder before and after filling. Defective valves are listed on the check sheet by specific lot numbers. A warning is printed on the check sheet to prohibit the filling of any cylinder equipped with valves bearing defective lot numbers.

The licensee indicated that operators are allowed to make independent preparations such as positioning the transfer cart and crane yoke, before actually removing a filled cylinder from the fill station. However, a foreman must be present along with an assistant operator/crane operator while the operator disconnects a filled cylinder from the manifold and prepares the cylinder to be crane-lifted to the transfer cart.

Through additional discussion with licensee staff, the inspector concluded that the operator was knowledgeable about the safety concerns of UF_6 cylinder handling and distillation operations.

No violations or deviations were identified.

7. Exit Meeting

The inspectors met with the individuals denoted in Section 1 of this report at the conclusion of the onsite inspection. The inspectors summarized the scope and findings of the inspection and discussed their observations. The importance of self-assessment audits was strongly emphasized during the exit meeting.

Although the ongoing ion exchange system is new to the licensee's uranium waste recovery operation, the licensee did not indicate that any information discussed during the inspection was proprietary.