9 pgs

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James H. Allen, Radiation Specialist (Supervisory)
Division of Compliance, Region III

MAR 9 1964

Original Signed by
R. B. Chitwood

Richard B. Chitwood, Inspection Specialist (Criticality)
Division of Compliance, Headquarters

PART 70 INSPECTION, UNITED NUCLEAR CORPORATION, HEMATITE, MISSOURI - LICENSE NO. SNM-33 - DOCKET NO. 70-36

CO:HWC

Attached are the results of the inspection of the subject licensee made by H. W. Crocker and R. B. Chitwood on February 18 and 19, 1964.

We did not observe any significant items of noncompliance.

One minor infraction was noted in that 15-gallon drums of scrap residues were not properly spaced in an outdoor storage area. The licensee stated that this condition would be corrected promptly. This item is covered on page 5 of the report.

Also, a question arose over their authorized practice of loading UF_6 gas enriched to 6% in the isotope U^{235} from 8-inch diameter cylinders into 5-inch diameter cylinders for connection to the Green Room process. The Green Room process consists of the precipitation of ammonium diuranate (ADU) by bubbling UF_6 gas through NH_4OH, followed by cake filtration, drying, and conversion to UO_2 in a furnace at high temperature. The work is conducted in large size equipment suitable for processing uranium up to a maximum U^{235} enrichment of 6%. Administrative batch control is used to prevent criticality in this area. A 5-inch diameter gas cylinder contains a safe batch of UF_6 at a U^{235} enrichment of 6% and is the basic control for the precipitation operation. The inspectors pointed out that a breakdown of administrative control might result in the erroneous connection of a 5-inch diameter cylinder of highly enriched UF_6 (93% U^{235} enrichment) to the ADU precipitation station which would allow unsafe quantities of U^{235} to be added. Ways of preventing this accident were discussed with the licensee. Additional discussion of this situation is covered on pages 3-4 of the report.

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In general, we feel the licensee is conducting the operations in a safe manner. Control of the various operations and SNM appears to be close enough that violations in criticality control will be readily detected.

Attachment:
Cpy insp rpt dtd 2/18-19/64

cc: W. J. Cooley, CO:V, w/att
bcc: Dr. Charles Luke, LR, w/att

PART 70 INSPECTION

BY: Hilbert W. Crocker, Inspection Specialist (Criticality)
Division of Compliance, Headquarters
DATE: February 18-19, 1964

TITLE: UNITED NUCLEAR CORPORATION, HEMATITE, MISSOURI - LICENSE NO. SNM-33
DOCKET NO. 70-36

I. INTRODUCTION

An inspection was conducted at the United Nuclear Corporation facilities at Hematite, Missouri, by R. B. Chitwood and H. W. Crocker, Division of Compliance, Headquarters, on February 18 and 19, 1964. The purpose of the inspection was to ascertain the adequacy of the licensee's radiological and nuclear safety with special emphasis on the nuclear safety program and practices.

Concurrent with this inspection, Messrs. J. A. Finn and D. Foster, Division of Compliance, Region III, inspected the licensee's radiological safety program and practices. Messrs. Finn and Foster were accompanied on their inspection by three representatives of the State of Missouri Department of Public Health.

One minor infraction was noted in the outdoor storage array of 15-gallon drums used to contain slag and crucible residues. A number of the drums were not separated by 24 inches edge-to-edge as prescribed by the license conditions. In addition, the drums were not covered with plastic as required by the license. These items do not present a reasonable hazard. The licensee indicated he would correct this situation promptly.

A question was made concerning the licensee's authorized practice of subdividing contents of 8-inch diameter cylinders of UF_6 (6% U^{235} enrichment) into 5-inch diameter cylinders which hold less than a safe batch of feed for the large volume tanks utilized in low enrichment uranium processing (Green Room). The 5-inch diameter cylinders are the same type as used for fully enriched UF_6 (93% U^{235} enrichment). It would be possible, with a breakdown in administrative control, to select and connect fully enriched UF_6 in a 5-inch cylinder to the batch controlled low enrichment process line. Gross amounts of U^{235} would be added to the ADU precipitation vessel. This could result in a criticality accident, since there is no geometry control on the large volume vessel.

Provision of special-size adapter fittings for (1) the 5-inch cylinders for low enriched material, and (2) the low enriched processing line feed cylinder connector, would minimize the possibility of connecting highly enriched UF_6 to this system.

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II. DETAILS

A. Scope

The plant operating philosophy and practices were discussed with Dr. E. D. North. Dr. North accompanied the inspectors on a tour of the plant and explained the plant operations in detail.

The following persons were contacted during the visit:

Dr. E. D. North, Plant Manager
D. Darr, Plant Health Physicist
K. V. Miller, Missouri State Department of Public Health
L. D. Diehl, Do
D. J. Hilkemeyer, Do

B. Organization

When the SNM-33 license was reviewed prior to the inspection, some difficulty was encountered in following the history of the plant ownership. At the inspectors' request, Dr. North provided the following historical data.

The United Nuclear Corporation was originally a wholly-owned subsidiary of Mallinckrodt Chemical Company and was set up under the name of Mallinckrodt Nuclear Corporation. Later Mallinckrodt Chemical Company, Olin-Mathieson Industries, and Nuclear Development Associates joined forces and formed a subsidiary known as the United Nuclear Corporation. The Sabre-Pinon Corporation then purchased about 70% of the stock holdings to become the majority owner of the present United Nuclear Corporation. United Nuclear has three divisions: Mines and Milling; Fuels; and Development. Each division is headed by a corporation vice president.

The Hematite plant is part of the Fuels Division. An organization chart of the Fuels Division is attached as Appendix A.

Dr. E. D. North is responsible for plant operation at Hematite. Dr. North stated that Mr. L. J. Swallow had recently been promoted to Manager, Quality Control and Health Physics. In his new capacity, Mr. Swallow serves both the Hematite plant and the new Wood River Junction plant at Rhode Island. The new recovery facility at Rhode Island will be the major scrap recovery plant for the licensee. An application for license of the new facility is presently under review. Mr. D. Darr has been added to the staff as the Health Physicist.

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C. Process

1. Red Room

The "Red Room" is equipped to handle all enrichments of U^{235}. Uranium hexafluoride (UF_6) is the starting material for preparations of uranium tetrafluoride (UF_4), uranium dioxide (UO_2) and uranium metal. Other uranium compounds also are prepared for customers. Current activities in the "Red Room" are the preparation of ~200 kg of uranium metal (20% U^{235} enrichment) from UF_6 and the recovery of uranium-beryllium scrap (93% U^{235} enrichment).

The uranium hexafluoride is converted to UF_4 using an organic reductant (perchlorethylene). The uranium metal then is formed by bomb reduction of the UF_4 using calcium reductant with an iodine booster.

The uranium-beryllium scrap is dissolved in a nitric acid-hydrofluoric acid mixture, and the uranium is purified by solvent extraction. Purified uranium solution then is processed by conventional flowsheet practice to UO_2. The solvent extraction raffinate containing the beryllium is sold to a beryllium processor.

Dr. North stated that when the Wood River Junction plant begins operation, only internally generated scrap would be reprocessed at the Hematite plant. Other scrap then will be reprocessed entirely at Wood River Junction.

2. Green Room

The "Green Room" is used for uranium compound conversions utilizing low ($\leq$6% U^{235}) enrichments. The normal process conditions provide for bubbling UF_6 gas through ammonium hydroxide (NH_4OH) to form ammonium diuranate (ADU) which is then filtered, dried, and calcined to U_3O_8 and treated with cracked ammonia at 700 C to form UO_2. All operations are administration batch controlled.

An order for UO_2 (6% U^{235} enrichment) was being processed in the "Green Room" at the time of the inspection.

The normal procedure for this operation is for the licensee to subdivide the UF_6 (6% U^{235} enrichment) from the original 8-inch diameter container into 5-inch diameter containers identical to those containing fully (93%) enriched uranium. The 5-inch

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diameter cylinders each contain less than one safe batch of uranium (6% U^{235} enrichment) and serve as the batch control basis for the process. The cylinders are tagged and checked by supervision prior to being hooked up to the ADU precipitation station. This brings up a significant point: a cylinder containing fully enriched UF_6 could be attached to the ADU precipitation station by error, and once attached no further controls are present to prevent introduction of gross amounts of U^{235} to the system. This was mentioned to Dr. North, and the inspectors also suggested that the ADU precipitation station feed line connector and the 5-inch diameter cylinders for safe batches of UF_6 (6% U^{235} enrichment) could be provided with permanent type, adapter fittings of special size that would preclude accidental hookup of fully enriched cylinders. Dr. North stated that he requests a specific cylinder of UF_6 (6% U^{235} enrichment) be selected from storage by the operator and that the supervisor checks the cylinder prior to hookup to ascertain that it is the specific cylinder of UF_6 (6% U^{235} enrichment) requested. Dr. North felt that these controls were adequate, but said that he would review this situation and evaluate the desirability of providing special sized adapter fittings to prevent accidental attachment of cylinders containing higher enrichments of U^{235}.

3. Blue Room

The "Blue Room" contains equipment for processing UF_6 to ADU at low ($\leq$6% U^{235}) enrichments. At the time of the inspection, small quantities of uranium were being purified by precipitating as ammonium peruranate (this process is considered plant proprietary information).

4. Pellet Building

Pellet plant operations consisted of experimental batches of depleted UO_2 being processed to determine optimum sinter furnace operating conditions. They plan to process an order of UO_2 pellets (6% U^{235} enrichment) in March 1964.

The large sink, approximately 2' x 2' x 18", noted in the last inspection, is no longer being used according to Dr. North.

5. Item Plant

Special UO_2 fuel pellets are being fabricated in the item plant. These are under Navy contracts NFD-01265 and NFD-5010 and subject to Oak Ridge Operations control.

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D. Inventory and Storage

The SNM inventory consisted of the following materials:

	Uranium kg	Uranium 235 kg
License	4,718.3	195.4
Station*	6,194.7	1,162.8
Total	10,913.0	1,358.2

*Contracts NFD-01265 and NFD-5010 under Oak Ridge health and safety cognizance.

Storage of the materials was in accordance with license conditions with the exception of one outside storage area. In this one area, a number of 15-gallon drums for slag and crucible residue storage were not separated by the prescribed 24 inches edge-to-edge spacing, and the cans were not covered with plastic as stated in the license conditions. Dr. North stated that these conditions would be corrected promptly. He added that some water condensation had occurred inside the plastic covering on drums in the past, and that he may apply for an amendment to the license to eliminate the necessity of the plastic cover.

E. Control

Dr. North stated that the license renewal application submitted to the Atomic Energy Commission contains the complete plant description, rules of operating practice, alarm descriptions, criticality prevention practices and general safety practices.

F. Summary Discussion

A summary discussion was held with Dr. North after the inspection was completed. Dr. North stated that the 15-gallon drum spacing deficiency would be corrected. He appreciated the inspectors' concern on the possibility of connecting highly enriched UF_6 cylinders to the Green Room precipitation process. While he felt the present administrative control is sufficient, he stated that he would review the operation with respect to providing special sized adapter fittings to prevent accidental attachment of highly enriched UF_6 cylinders.

(continued)

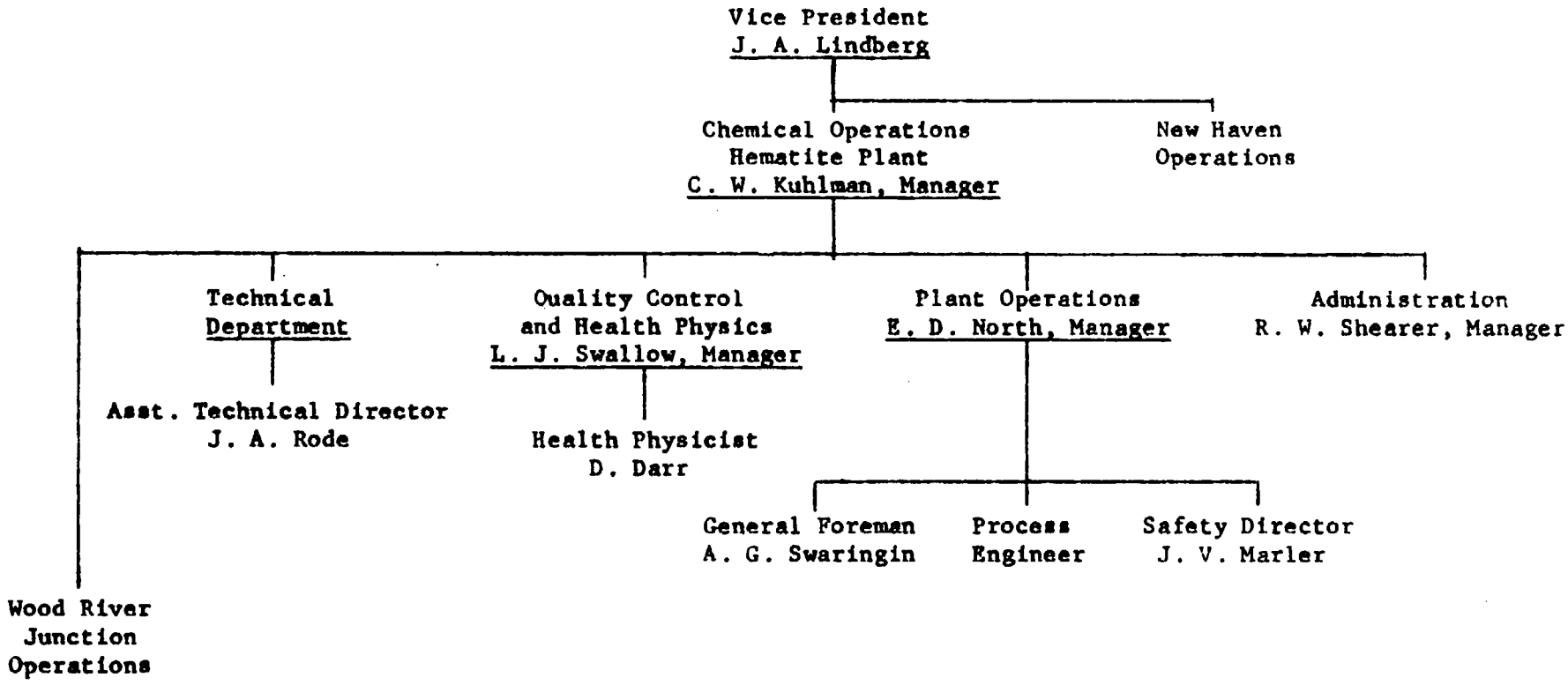
C. Conclusion

The United Nuclear Corporation's Hematite plant appears to be staffed with qualified personnel. They appear to have an adequate program for criticality prevention. A significant improvement in SNM storage has been made since the previous inspection.

Attachment:
Appendix A

UNITED NUCLEAR CORPORATION

Fuels Division



APPENDIX A