MARCH 20→24, 1961

DETAILS

I. GENERAL INFORMATION

9. The special nuclear materials processing program being conducted by Mallinckrodt Chemical Company at Hematite, Missouri, under License No. SNM-33, was initially inspected August 18 and 19, 1958 and no items of noncompliance were reported. This program was reinspected January 12 thru 14, 1960 with no items of noncompliance reported. The licensee's source material activities under License No. C-4495 were initially inspected January 12 thru 14, 1960 and no items of noncompliance were reported. License No. C-4495 was superseded on February 9, 1960 with License No. C-5014 which in turn was superseded October 20, 1960 by License No. C-5308. All of the licensee's activities involving special nuclear and source material are being performed in his plant at Hematite, Missouri, under License Nos. SNM-33 and C-5308.

10. This reinspection of the programs being conducted under License Nos. SNM-33 and C-5308 was made on March 20 - 24, 1961 by W. W. Peery, Inspection Division, OROO. Licensee personnel interviewed and furnishing information during the inspection include the following:

Mr. Frank Zeitlin, Assistant Vice President, Nuclear Division
Dr. E. D. North, Manager, Hematite Plant
Mr. J. W. Miller, Head of the Industrial Hygiene Department

II. ORGANIZATION

11. The Mallinckrodt Nuclear Corporation requested in a letter to the Division of Licensing and Regulation, dated September 29, 1960, that License Nos. SNM-33 and C-5014 be reissued to the Mallinckrodt Chemical Works. In a letter to the licensee dated October 20, 1960 the Division of Licensing and Regulation stated that License Nos. SNM-33 and C-5014 previously issued to the Mallinckrodt Nuclear Corporation were revoked and License No. SNM-33 was reissued in the name of the Mallinckrodt Chemical Works with an effective date of October 20, 1960. License No. C-5308 was also issued to the Mallinckrodt Chemical Works to supersede License No. C-5014. The activities previously authorized under C-5014 were authorized under C-5308 which also has an effective date of October 20, 1960.

12. The licensee's letter of September 29, 1960 stated that the transfer of nuclear fuel business from the Mallinckrodt Nuclear Corporation to the Mallinckrodt Chemical Works includes physical assets, properties and personnel. At the time of the last inspection, January 12 - 14, 1960, the licensee's program at Hematite was being conducted by the Special Metals Division under the management of Mr. F. M. Belmore who reported to Mr. J. Fistere, President of the Company. Dr. E. D. North reported to Dr. R. W. Shearer, Assistant Manager of the Special Metals Division who

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reported to Mr. Belmore.

13. The licensee's program at the time of this inspection on March 20 - 24, 1961 was being conducted by the licensee's Nuclear Division under the directorship of Dr. C. D. Harrington who reports to Mr. H. E. Thayer, President of the Company. Mr. Thayer succeeded Mr. J. Fistere in this capacity when Mr. Fistere retired, however, Mr. Fistere is still a member of the Board of Directors of the Mallinckrodt Chemical Works. Dr. E. D. North, Manager of Operations at the Hematite Plant reports to Mr. Frank Zeitlin, Assistant Vice President in charge of the Commercial Operations, under the Nuclear Division, which processes all nuclear materials for Mallinckrodt's commercial outlets. Mr. Zeitlin reports to Dr. Harrington. At the time of the last inspection Dr. G. W. Tompkins was Manager, Research and Development, under the Special Metals Division, however, Dr. Tompkins is now over research and development in the licensee's Industrial Division and reports to its director, Mr. F. M. Belmore who was previously over the Special Metals Division. There is at present a research and development group at Hematite under Mr. C. W. Kuhlman who reports to Mr. Zeitlin. Dr. North is responsible for over-all criticality problems at Hematite and he was previously assisted by Dr. Tompkins, however, Mr. L. J. Swallow has succeeded Dr. Tompkins in this capacity at the Hematite Plant.

14. Mr. J. W. Miller, Head of the Industrial Hygiene Department reports to Mr. John G. Moore, Vice President in charge of the Operations Division which is involved in operations at the licensee's St. Louis facilities. Mr. Miller has had several years of experience in directing the licensee's health physics program at the licensee's St. Louis and Hematite facilities. Mr. Miller is assisted by two technicians, William McGrath at the Hematite Plant and Earl Roddy at the St. Louis facilities. Mr. McGrath has had about 3 years experience in this capacity and Mr. Roddy about 4 years experience under Mr. Miller.

15. Supervising personnel at the licensee's Hematite Plant include two Process Engineers, Messrs. Jack Rosser and Authur Day. The total number of personnel at the Hematite Plant at the time of the last inspection was 97 as compared to a total number of 78 at the time of this inspection. Both total personnel figures include operations, maintenance, guards and analytical laboratory personnel.

16. The licensee contemplates a merger with the Olin Mathieson Chemical Company and the Nuclear Research and Development Corporation. This is to result in the formation of the United Nuclear Corporation which will have as its President Mr. W. C. Foster who is presently a Vice President of the Olin Mathieson Company. There are to be three divisions of the corporation: The NDA Division (Design), J. R. Menke, Vice President; The

Olin Mathieson Division (Reactor fabrication), E. Hartshorne, Vice President; and The Mallinckrodt Division (Nuclear fuel processing) C. D. Harrington, Vice President. The licensee's present Nuclear Division will be under the Mallinckrodt Division of the new corporation with essentially the same personnel carrying out the program at the Hematite Plant. Dr. R. W. Shearer, who was previously Assistant Manager of the Special Metals Division reporting to Mr. Belmore, will be assistant to Dr. Harrington in the Mallinckrodt Division. The new United Nuclear Corporation will have a total of about 1400 employees.

III. FACILITIES AND PROCESSES

17. The licensee's Hematite Plant is built in about the center of a 150 acre tract of land which is located ~ 40 miles south of St. Louis, Missouri near the town of Hematite, Missouri and is bound on the north by Missouri State Highway 21-A, on the south by Joachim Creek and on the east and west by other private property. The nearest occupied property is a farmhouse located several hundred yards to the northwest of the plant.

18. The production facilities consist of two main buildings each with several thousand feet of floor space. Located between these two buildings are two storage buildings, one for high enriched material and one for low enriched material. A section of the south end of the high enriched storage building is a blender room which also contains some depleted material storage. A small building west of the two main buildings is also used for storage of depleted materials. Offices and a change room are located in a section designated as 240-1 of the west building. The enriched store building (250-1 & 2) is a one-story reinforced concrete building with a concrete floor containing no drain. The blending room (250-3) is constructed of concrete block with dimensions of ~ 20' x 50'. Blending equipment consists of ten (10) equally spaced drum positions inside a dust control hood. The drum positions are separated by 1 ft. thick slabs of concrete. Since the last inspection the tare weight area in the blender room has been enclosed in a hood. The low enriched storage building (251) is constructed similarly to the high enriched building. The small depleted storage building (235) located west of the two main buildings is constructed of reinforced concrete and has dimensions of ~ 10 ' x 20 '. All storage areas are equipped with chains and brackets for proper spacing of materials. UF_6 containers are stored in their individually spaced bird cages.

19. Instrumentation for the licensee's radiation safety program includes the following:

    2 Technical Associates Model 3 Juno (α, β, γ)
    3 Victoreen "Thyac" Model 389C survey meter (β, γ)

3 Victoreen Model 356 survey meters (α, β, γ)
2 Nuclear Measurements Corp. Model PC-3A counters
8 Air samplers (Hudson, Gast and Gelman portable samplers)
1 Eberline portable α proportional counter, Model PAC-3G

An emergency monitoring station has been established in a building located about 200 yards from the main Hematite Plant building. There are two Juno survey instruments available at the emergency station, one with a maximum range of 5 r/hr and the other with a range up to 50 r/hr. Both are checked periodically for operability. Instruction and interrogation sheets are available at the emergency station for preliminary investigation.

20. A Nuclear Measurements Corporation Gammalarm, Model GA-2, system is installed in the licensee's Hematite Plant as required by 10 CFR 70.24. Six of the Gammalarm sensing heads are installed with one in each of the following locations (1) 235 (low enriched storage small bldg. west of main plant bldgs.); (2) 240-2 (high enriched process areas); (3) 240-4 (Solvent extraction - low enriched); (4) 250-2 (high enriched storage bldg.); (5) 251 (low enriched storage bldg.); (6) 255-2 (pellet plant). The main control panel is located in the northwest corner of area 240-1 of the westerly most of the two main buildings which contains Dr. North's office. The control panel shows which area has caused the alarm. The control panel contains two sets of lights. Amber lights only indicate malfunction of the instruments while red lights actuated simultaneously with horn alarms indicate unusually high fields of radiation such as from a nuclear excursion. This separate system actuated by separate signals assists in avoiding false alarms and aids in locating instrument malfunction. The "Gammalarm" system is calibrated at six-month intervals with an NBS calibrated 10 mc Radium source which has an NBS calibration certificate dated February 28, 1958. The system is also routinely tested at the same time each Monday morning with a gamma source for response and as a rough calibration check. The warning system is set to alarm at a radiation level of 10 mr/hr. Written emergency procedures have been distributed to personnel with written instructions from Dr. North to study and know the instructions. The procedures were furnished to the Division of Licensing and Regulation with a letter dated June 5, 1959. The licensee periodically changes critical vacuum tubes in the "Gammalarm" as a preventive maintenance measure. Mr. Miller stated that there have been only two cases of false alarm. One resulted from improper mounting of the detection unit over a door that jarred the instrument and the cause of the other was not determined except that a nuclear excursion was in no way associated with the alarm. All sensing units were observed to be mounted within 120 feet of the place of handling, use or storage of the licensed special nuclear materials as required by 10 CFR 70.24.

21. In a letter from the Division of Licensing and Regulation dated July 13, 1960 the licensee was informed that no further action could be taken on his application, dated April 16, 1960, dealing

with the inclusion under the license of a recently completed storage area (low enrichment) until the licensee notified the Division of Licensing and Regulation that emergency power had been provided for the alarm system. In answer to the Division of Licensing and Regulation letter of July 13, 1960 the licensee stated in a July 19, 1960 letter that the economics of such a system was being studied and that in order to have the facility licensed the licensee stated in the letter that in the meantime he agreed not to move material in or out of the building during a power failure. The letter further stated that the Division of Licensing and Regulation would be informed of the licensee's action on the matter. The license was amended to include the new storage as of July 27, 1960 in accordance with the licensee's proposed procedure. The emergency power supply had not been installed at the time of this inspection. Dr. North stated that there have been only three power failures at the plant in four years of operation with a minimal time of outage. The plant power is drawn from a main feeder line and Dr. North stated that the power company has just recently made extensive modification to the power line system to minimize power failures. The installation of the auxiliary power supply in the plant is still being studied with no firm conclusions at the time of this inspection.

22. Protective clothing including underwear, coveralls, shoes, caps, gloves and respirators are furnished to licensee operating personnel in section 240-1 of the main west building. Two change rooms separated by a shower are provided whereby personnel can change company clothing in one room, shower and change personal clothing in the other. Complete laundry facilities are available in section 255-3 of the main east building. Clothing is pre-laundered before being sent out to a commercial laundry. The pre-laundry wash water has not significantly effected the over-all plant effluent as evidenced by effluent sample results.

23. The main west building of the licensee's Hematite Plant contains processes as follows:

Section 240-2

Manufacture of cermet type fuel elements and metal from uranium enriched in U 235 to 20% and higher.

Auxiliary Areas:

1. Solvent extraction of enriched uranium from scrap.
2. Soluble products area (uranyl nitrate, sulfate and flouride).
3. Process for direct conversion of UF_6 to UF_4.
4. UO_2 shot production.

Section 240-3

Production of low enriched materials to 6% U 235 with end product being ceramic grade UO_2.

Section 240-4

1. Solvent extraction of low enriched uranium from scrap.

2. Manufacture of 5 - 20% U 235 compounds.

The main east building of the plant contains the following:

Section 255-1

1. Research and Development offices.
2. Pilot plant.
3. Storage.

Section 255-2

1. UO_2 pellet production.

Section 255-3

1. Maintenance Shop.
2. General materials supply storage.
3. Depleted storage.
4. Laundry.

IV. RADIATION SAFETY PROGRAM

24. Personnel are routinely monitored with a film badge program furnished entirely by the licensee. Stainless steel badges with open window and shielded reading capability are used and the film is processed and read in facilities, including a dark room, in the Medical Department of the licensee's plant in St. Louis, Missouri. The procedures for the film badge program are similar to those used in the film badge program at the AEC's Weldon Springs plant. Pursuant to 10 CFR 20.101(b)(3), as effective January 1, 1961, the licensee has completed Form AEC-4 "Occupational External Radiation Exposure History" for all employees being monitored for radiation exposure. Forms containing the information required on Form AEC-5 "Current Occupational External Radiation Exposure" have been drawn up and are in use in the licensee's program as required by 10 CFR 20.401(a), as effective January 1, 1961. The film are processed on a monthly frequency with adjustment in the number of days in some periods so that a quarterly record will be maintained. Records of film readings for 1960 show no exposures greater than the 10 CFR 20 limits prior to January 1, 1961, with some few readings up to 100 mrem/wk but the majority of the readings were near the threshold of the film or no greater than 50 mrem/wk. The records of film readings for 1961 show no exposures greater than the permissible limits of 10 CFR 20 as effective January 1, 1961. The highest monthly reading observed was 350 mrem with most all other readings being near the threshold of the film or no greater than 50 mrem/month.

25. Licensee Hematite Plant operating personnel submitted urinalysis samples on a 3 - 6 month basis, as determined by job

assignments, until January 1, 1961, at which time a routine urinalysis program was discontinued. Mr. Miller stated that the program was discontinued because it was felt that the program had been in effect long enough to furnish reliable data for an over-all evaluation of concentrations that may be routinely found in urinalysis samples from personnel working in the licensee's Hematite plant. Other factors related by Mr. Miller as affecting the decision to discontinue the urinalysis program included the cost of the program particularly when compared to its value as a real and practical device for routinely measuring radiation exposure. Mr. Miller stated that where desirable or necessary bio-assay services will be provided as required by 10 CFR 20.108. Complete records have been kept of the urinalysis results. Mr. Miller stated that the American Standards Association recommended values of 110 d/m/liter for 24 hour sample for natural and depleted uranium and 75 d/m/liter for 24 hour sample for enriched uranium have been used as guide values, however, he indicated that resampling has been done when analysis results exceeded 45 d/m/liter for 24 hour sample. The records of the urinalysis results show most readings to be negative or less than 45 d/m/liter, however, in several cases results were in range of 75 to 150 d/m/liter. In many of these cases the result on one resample decreased to less than 45 d/m/l while in other cases the readings decreased to less than 45 d/m/l in two or three resamplings. The highest bio-assay result observed was 726 d/m/l and this decreased within three resamplings to less than 45 d/m/l. In this case and many of the other samples that were above 45 d/m/l, Mr. Miller indicated that contamination of the samples was suspected since well controlled sampling has been a chronic and difficult problem.

26. An air sampling program is in effect at the licensee's Hematite Plant to determine personnel exposures to radioactive airborne concentrations. Mr. Miller stated that a continuing effort is made to isolate processes or equipment that contribute excessively to airborne concentrations. In addition to general air samples, Mr. Miller stated that individual jobs have been carefully sampled with breathing zone type samples and based on these sample results a unit of exposure to airborne concentrations is assigned each job. The foreman is required to faithfully complete a card on each individual showing the time spent performing a given job. This data is used to establish the individuals average exposure to airborne concentrations for a 40 hour week.

27. Enclosed with a letter dated December 15, 1960 from Mr. Frank Zeitlin, Assistant Vice President, Mallinckrodt Chemical Works, the licensee furnished the Division of Licensing and Regulation tables containing data showing integrated airborne uranium dust exposures greater than 5×10^{-11} µc/ml with a high of 7.9×10^{-11} µc/ml for 1959. Tables on the same sort of data for the first three quarters of 1960 show exposures as high as 30.8×10^{-11} µc/ml. Messrs. Zeitlin and Miller were informed that the data established noncompliance with the following:

(1) 10 CFR 20.101(b) Exposures of individuals in restricted areas.

The Licensee records show exposures of individuals to airborne radioactive materials in excess of the limits specified in this section of the regulations.

(2) 20.403(c) Thirty-day reports.

The licensee failed to report, within thirty days, exposures of individuals to concentrations of radioactive materials in excess of the applicable limits of the regulations as required by this section of the regulations.

A review of the licensee's airborne exposure records revealed that for the period from 8-16-60 to 12-31-60 there were about fifteen exposures recorded that slightly exceeded 5×10^{-11} µc/ml uranium averaged over a forty hour week with the highest being 6.5×10^{-11} µc/ml. Masks have been used to reduce exposures to airborne radioactivities but the benefit of the use of the masks in lowering the actual intake of radioactivity is not considered in the licensee's data showing exposures to personnel in excess of permissible limits. It is apparent that if credit is given for the use of masks with respect to the slight over-exposures reported for the period 8-16-60 to 12-31-60 that actual exposures to individuals in excess of the permissible limits did not occur. As indicated in Mr. Zeitlin's letter of December 15, 1960 several corrective measures have been taken to control airborne radioactivity concentrations. A review of licensee airborne radioactivity exposures from January 1, 1961 to the time of this inspection in March 1961 showed four cases of exposure of 5.2×10^{-11} µc/ml to 7.9×10^{-11} µc/ml for forty hour week while all others reviewed were no greater than 5×10^{-11} µc/ml and well below the 1×10^{-10} µc/ml uranium airborne concentrations being applied by the licensee as the permissible limit since the January 1, 1961 effective date of the current 10 CFR 20 regulations.

28. Mr. Miller indicated that exposures of personnel to airborne concentrations of radioactivity at the licensee's Hematite Plant could be kept within the permissible limit of 1×10^{-10} µc/ml averaged over a forty hour week as effective January 1, 1961 in 10 CFR 20. This must be qualified, however, because the licensee has, in the past, taken credit for the use of full-face masks with independent air supply as used by operators while unloading frame filter presses through which ammonium diuranate is filtered inside a large walk-in type hood. Pursuant to 10 CFR 20.103(c)(3), as effective January 1, 1961, the licensee requested, in a letter dated March 14, 1961, and signed by Mr. Zeitlin, that an exemption to 10 CFR 20.103(a) be approved to authorize use of the full face mask during the press unloading operation inside the hood. The licensee's March 14th letter furnished information

as required in 10 CFR 20.103(c)(3)(i)(ii) and (iii). The physical facility and protective equipment appeared to be as described in the licensee's proposal. The rather strong odor of ammonia inside the hood gives incentive for wearing the independent air supply masks, however, Dr. North and Mr. Miller stated that this is not considered a control measure to assure that the masks are worn as required. Mr. Miller stated that this press type filter is by nature very difficult to closely enclose or otherwise control airborne concentrations in close proximity to the press since considerable working space is required to open and unload the press. Mr. Miller indicated that other type filters have been considered that could be more easily enclosed or made a part of a completely closed process system, however, this press type filter is the most efficient for the purpose.

29. The licensee applied to the Division of Licensing and Regulation in letters dated October 6 and November 8, 1960, for approval under License No. SNM-33 to use an incinerator for contaminated trash. The use of the incinerator was authorized by direct reference, in the conditions of the license, to the licensee's proposed use of the incinerator in letters dated October 6, November 8 and 16, 1960. In the licensee's letter of November 8, 1960 the licensee stated that the incinerator flue gases would be monitored continuously during the first month of operation. The monitoring of the flue has not been carried out. Mr. Miller stated that the incinerator has been used primarily for boiling down floor mop water and the sampling equipment which he has available is not suitable for sampling air with a high moisture content. He stated that appropriate sampling equipment will be procured to conduct the sampling program. Air samples at the licensee's restricted area boundry have not exceeded permissible concentrations and the use of the incinerator has not affected the concentrations normally seen in these samples. Dr. North and Messrs. Zeitlin and Miller were informed that the lack of the incinerator flue monitoring constitutes noncompliance with the conditions of License No. SNM-33 and all indicated that the flue would be more directly monitored as proposed in their letter of November 8, 1960.

30. Complete radiation surveys are made at least monthly at the Hematite Plant with Thyac and Juno instruments and records of the survey findings are kept on drawings of the building floor plans and plant area. The records show readings ranging from .5 to 7 mr/hr γ and up to 20 mrep/hr β in the process areas. Most readings were less than 2.5 mr/hr γ and 2.5 mrep/hr β. These are general area readings taken at waist level. Other surveys are made of specific nature if the need arises and records of the survey findings are kept.

31. All plant wastes are discharged through an underground process waste line which empties into a small lake on the licensee's property. The lake is located about 200 yards west of the main plant buildings and is fed by a spring which is also on the licensee's property. The licensee built a concrete dam across

the spring stream to form the lake and installed continuous sampling equipment on the dam. The effluent from the lake flows several hundred feet into Joachim Creek which is not on licensee property. Joachim Creek empties into the Mississippi River several miles from the confluence of the licensee's waste stream and the creek. All floor drains in process areas extend about one foot above floor level and are capped so that only solutions of known content that are deliberately discharged to the drains will flow into the process waste line to the lake. The plant sanitary sewer system is completely separate and flows into Joachim Creek below the lake. Effluent samples are counted weekly of a known proportion of the total effluent flow and extrapolated to concentrations in μc/ml for the total effluent flow. Complete records kept of sample results show the following:

1960

1-7-60 to 6-21-60:

Alpha - 9.63×10^{-8} μc/ml to 6.48×10^{-7} μc/ml with most samples about 1×10^{-7} μc/ml.

Beta - 1.33×10^{-7} μc/ml to 9.0×10^{-7} μc/ml with most samples about 1×10^{-7} μc/ml.

6-21-60 to 12-31-60:

Alpha - 8×10^{-7} μc/ml to 1.9×10^{-6} μc/ml with most samples about 1×10^{-6} μc/ml.

Beta - 8×10^{-7} μc/ml to 1.27×10^{-5} μc/ml with most samples about 1×10^{-6} μc/ml the average concentrations for the year have not exceeded 7×10^{-6} μc/ml uranium in the effluent which is the value applied by the licensee from Appendix B, 10 CFR 20 since the material is identified.

1961

1-3-61 to 3-10-61:

Alpha - 1.9×10^{-7} to 6.77×10^{-7} μc/ml.

Beta - 2.3×10^{-8} to 8×10^{-8} μc/ml.

The licensee plans to use 2.0×10^{-5} μc/ml as the permissible concentration value in effluent since Th 234 has been identified in the effluent and the 2.0×10^{-5} value is stipulated for this material in Appendix B of 10 CFR 20 as effective January 1, 1961. The 2.0×10^{-5} μc/ml value is the same as or less than the limits for U 234, U 235, U 238 and U natural.

Mr. Miller stated that he foresees no difficulty in staying well within the prescribed effluent concentrations.

V. POSTING

32. Plant area, buildings and rooms are posted as required by 10 CFR 20.203(e)(1) with the conventional radiation symbol in yellow on a magenta background with the wording "Caution Radioactive Materials". Containers are labeled as above with statement of the material, amount and date as required by 10 CFR 20.203(f)(1),. (2). The press filter room which is shown by licensee sample results to exceed the permissible airborne radioactivity concentrations of 10 CFR 20 is posted with conventional radiation symbol in magenta on a yellow background with wording "Caution Airborne Radioactivity Area" as required by 10 CFR 20.203(d)(2). However, other areas that have exceeded the permissible airborne concentrations of 10 CFR 20 have not been posted as required by 20.203(d)(2). Specifically the entrance to section 255-2 of the main east Hematite Plant building and the entrance to section 240-2 of the main west building should be posted for airborne activity as required under 20.203(d)(2). The same entrances of the east and west buildings should be posted as required by 10 CFR 20.203(b) with conventional radiation symbol and colors with wording "Caution Radiation Area" since there exists in these areas levels of radiation that could result in exposures in excess of 5 mrem in any one hour. (See paragraph 30 for radiation levels). The posting deficiencies were discussed with Mr. Miller and he stated that the areas will be posted for airborne radioactivity as required by 10 CFR 20.203(d)(2) and for radiation areas as required by 10 CFR 20.203(b). Form AEC-3 is posted as required by 20.206(c).

VI. MATERIAL ACCOUNTABILITY

33. Dr. North continues to have primary responsibility for material accountability. Cylinders of UF_6 are weighed upon receipt and the weight recorded in a log book kept in Dr. North's office. The material is assigned a number which identifies it all the way through the process. During process the material is weighed and records kept of the amounts on process flow sheets. Dr. North stated that he is required to compile a record of all special nuclear material for the insurance company. Dr. North also submits to the AEC periodic material accountability reports on AEC contract station materials on Form AEC-578. The licensee had a maximum of about 800 kg of licensed materials of all enrichments on hand at any one time in 1960. Approximately fifty percent of the materials during 1960 were licensed materials and about fifty percent were station materials. Dr. North stated that most licensed material is of the higher enrichments while station materials have been of low enrichment. Dr. North stated that a very limited amount of work is being done with source materials and only a small amount is kept on hand with most source material procured only as it is needed for special orders. The inventory of materials of all enrichments on hand at the time of this inspection was about 20 kg.

VII. CRITICALITY CONTROL

34. Although this was not a detailed inspection of criticality it was learned that Dr. North continues to have responsibility for the enforcement of criticality control procedures at the licensee's Hematite Plant. Dr. North is assisted by Mr. L. J. Swallow in matters of licensing and criticality. Mr. Swallow has had a two week course in criticality problems at Oak Ridge National Laboratory. Mr. Swallow is an engineer by academic background and as a result of his personal interest and study he has attained considerable knowledge of and competence in dealing with criticality problems. Mr. Swallow makes many of the criticality calculations on special nuclear material containers. In addition, Mr. Swallow has had an opportunity to learn of the radiation safety problems associated with a processing plant at the licensee's Hematite Plant in St. Louis and at the AEC's Weldon Springs plant. Dr. North stated that four methods of criticality control are in effect namely (1) geometry; (2) limited safe mass batches; (3) administrative control; (4) combinations of these. He stated that limited mass and geometry are still the primary controls exercised. Materials appeared to be stored in orderly and predetermined spacing arrangements with no materials observed to be stored in groups of either the same or different size containers.