R3/D2-5 1-11-77

TABLE OF CONTENTS

Section No.		Page No.
1.0	GENERAL INFORMATION	1-1
1.1	Introduction	1-1
1.2	Corporate Information	1-1
1.2.1	Name and Address of Applicant	1-1
1.2.2	Principal Corporate Officers	1-2
1.2.3	Information Regarding Foreign Control	1-2
1.3	Location and General Description of Hematite Plant	1-3
1.4	Summary of Activities	1-3
1.5	Possession Limits	1-6
1.6	Term of License	1-6
1.7	Site Protection	1-6
1.8	Environmental Effects	1-7
√ 2.0	ORGANIZATION, PERSONNEL AND ADMINISTRATION	2-1
2.1	Nuclear Licensing and Organization	2-1
2.1.1	Basic Responsibilities	2-2
2.1.2	Personnel Qualifications	2-3
2.2	Nuclear Materials Management	2-3
2.3	Manufacturing Organization	2-3
2.3.1	General Description	2-3
2.3.2	Manufacturing Organization	2-4
2.3.3	Basic Responsibilities	2-5
2.3.4	Personnel Qualification	2-5
2.4	Process Control	2-6
2.4.1	Chemical Operations	2-6
2.4.2	Fabrication Operations	2-7
2.5	Nuclear and Industrial Safety Control	2-7
2.5.1	Nuclear Licensing and Safety Approval	2-8
2.5.2	Records	2-8
2.5.3	Suspension of Operations	2-9
2.6	Inspections and Audits	2-9

JJ-1

TABLE OF CONTENTS

Section No.		Page No.
2.6.1	Daily Checks	2-9
2.6.2	Weekly Inspections	2-9
2.6.3	Other Inspections	2-10
2.6.4	Annual Audits	2-10
2.7	Training	2-11
2.7.1	Purpose	2-11
2.7.2	New Employees	2-11
2.7.3	Continued Training	2-11
	RESUMES	2-12 THRU 2-24
✓3.0	NUCLEAR CRITICALITY SAFETY STANDARDS	3-1
3.1	Limits for Individual Units	3-1
3.2	Interaction Analysis	3-3
3.2.1	Solid Angle Method	3-3
3.2.2	Surface Density Method	3-3
3.3	Design Requirements	3-7
3.3.1	Fire Hazards	3-7
3.3.2	Structural Integrity	3-7
3.4	Marking and Labeling	3-7
3.4.1	Criticality Limits	3-7
3.4.2	Process Containers	3-8
3.4.3	Exclusion Areas	3-8
✓4.0	HEALTH AND SAFETY	4-1
4.1	General Health Physics Requirements	4-1
4.1.1	Surface Contamination	4-1
4.1.2	Air and Gaseous Effluents	4-3
4.1.3	Records	4-3
4.2	Personnel Monitoring	4-3
4.2.1	Dosimetry	4-3
4.2.2	Bioassay	4-3
4.3	Respiratory Protection Program	4-4
4.4	Facility and Equipment Requirements	4-8
4.4.1	Zoning	4-8

TABLE OF CONTENTS

Section No.		Page No.
4.4.2	Ventilation	4-8
4.4.3	Exhaust Air Cleaning	4-9
4.4.4	Liquid Effluents	4-10
4.5	Instrumentation	4-10
4.5.1	Nuclear Alarm System	4-11
4.5.2	Alpha Counting System	4-13
4.5.3	Alpha Survey Meters	4-13
4.5.4	Air Sampling Equipment	4-13
4.5.5	Beta-Gamma Survey Meter	4-13
4.5.6	Beta-Gamma Counting System	4-14
4.5.7	Emergency Instrumentation	4-14
4.6	Surveillance	4-14
4.6.1	Special Surveys	4-14
4.6.2	Routine Surveillance	4-14
4.6.3	Surface Contamination	4-15
4.6.4	Airborne Concentrations in Restricted Areas	4-15
4.6.5	Air Sampling Criteria	4-15
4.6.6	Air and Gaseous Effluents	4-16
4.6.7	Liquid Effluent Sampling	4-17
4.6.8	Environmental Surveillance Program	4-17
✓5.0	NUCLEAR MATERIAL MANAGEMENT	5-1
✓6.0	EMERGENCY PROCEDURES	6-1
6.1	Organization	6-1
6.2	Notification Lists	6-1
6.3	Procedures	6-2
6.4	Recovery and Re-entry	6-2
6.5	Outside Support	6-3
6.6	Up-dating Provisions	6-3
6.7	Emergency First Aid	6-4
6.8	Medical Treatment	6-4

TABLE OF CONTENTS

Section No.		Page No.
6.9	Periodic Drills	6-4
6.10	Training	6-5
6.11	Emergency Equipment	6-5
7.0	TRANSPORTATION AND STORAGE	7-1
7.1	Shipping Standards	7-1
7.1.1	Purpose	7-1
7.1.2	Container Inspection	7-1
7.1.3	Records	7-2
7.2	Shipping Containers	7-3
7.3	Handling of Shipments	7-3
7.4	Damaged Containers	7-4
7.5	Indoor Storage of SNM	7-4
7.5.1	Sample Storage	7-4
7.5.2	Storage of Sealed Containers	7-4
7.5.3	Storage of In-Process Material	7-5
7.5.4	Non-Process Storage	7-6
8.0	MANUFACTURING OPERATIONS	8-1
8.1	UF_6 to UO_2 Conversion	8-2
8.1.1	Receive and Store UF_6	8-3
8.1.2	UF_6 Conversion Process	8-3
8.1.3	In-Process Storage	8-6
8.1.4	Milling	8-6
8.1.5	Blending	8-7
8.2	Pellet Fabrication	8-7
8.2.1	Agglomeration and Granulation	8-7
8.2.2	Pressing	8-8
8.2.3	Dewaxing and Sintering	8-9
8.2.4	Grinding	8-9
8.2.5	Packaging	8-10
8.2.6	In-Process Storage	8-11

TABLE OF CONTENTS

Section No.		Page No.
8.3	Support Operations	8-11
8.3.1	Filter Clean Out Hood	8-11
8.3.2	Trench and Sump	8-11
8.3.3	Vacuum Sweepers	8-12
8.3.4	Weigh and Sample Hood	8-12
8.4	Recycle Operations	8-12
8.5	UF_6 Heel Removal	8-13
8.5.1	UF_6 Cylinder Wash Station	8-13
8.6.1	Analytical Services	8-14
8.7	Proprietary Supplemental Information	8-17
8.7.1	Material to be Processed	8-17
8.7.2	Process Description Summary	8-18
8.7.3	UF_6 to UO_2 Process Outline	8-19
8.7.4	Agglomeration Station	8-26
8.7.5	Transfer Operations	8-28
8.8	Safety Analysis - UF_6 Releases	8-30
8.8.1	Scope	8-30
8.8.2	General	8-30
8.8.3	Control Systems	8-31
8.8.4	Hazard Evaluation and Accident Response	8-31
8.8.5	Corrective Measures	8-33
8.8.6	UF_6 Cylinder Connection and Disconnection	8-35
8.9	Proprietary Drawings	8-36
8.10	Scrap Recovery	8-37
8.10.1	System Description	8-37
8.10.2	Oxidation and Reduction	8-37
8.10.3	Dissolution	8-39
8.10.4	Filtration, Storage, and Dilation	8-40
8.10.5	UO_4 Precipitation	8-41
8.10.6	UO_4 Separation	8-42
8.10.7	Filtrate Treatment	8-44
8.10.8	Miscellaneous Operations	8-45

TABLE OF CONTENTS

Section No.		Page No.
8.10.9	Utility and Support	8-45
8.10.10	Furnace Scrubber	8-45
8.10.11	UO_4 Dryer Scrubber	8-46A
8.10.12	NO_x Scrubber	8-46A
8.10.13	Radiation Safety	8-47
8.10.14	Exclusion Areas	8-47
9.0	NUCLEAR CRITICALITY EVALUATIONS	9-1
9.1	Surface Density Criteria	9-1
9.1.1	Array Reflection	9-2
9.1.2	Calculation of Fraction Critical	9-3
9.1.3	Effect of Interunit Moderation	9-8
9.1.4	Considerations of Slabs in Arrays	9-10
9.1.5	Mass Limited Units on Single Levels	9-10
9.2	Nuclear Safety Analysis of UF_6 - UO_2 Conversion	9-15
9.2.1	Reactor Vessel and Furnace	9-15
9.2.2	Cooler	9-17
9.2.3	Interaction of the UF_6 - UO_2 Conversion Equipment	9-17
9.2.4	Storage Vessels	9-22
9.2.5	Dry Blenders	9-23
9.2.6	Agglomeration Blenders	9-29
9.3	Moderation Control	9-38
9.3.1	Assumptions	9-38
9.3.2	Special Considerations	9-39
9.3.3	Nuclear Safety	9-40
9.4	Evaluation of Building 251 Storage of 5 gallon pails	9-45
9.4.1	Concrete Block Storage Racks for UO_2	9-47
9.5	Recycle Storage Interaction Calculations	9-48
9.6	Surface Density for Stacked Mass-Limited SIUs	9-52
9.6.1	Non-co-planar Slabs	9-53

TABLE OF CONTENTS

Appendix A — Sources and Evaluation of Water Moderation in Low Enriched UO_2 Powder Process (EH/RAS-71-124)

Appendix B — Operational Controls for the Low Enriched Dry Powder Process (EH/RAS-71-249)

2.0 ORGANIZATION, PERSONNEL AND ADMINISTRATION

All Hematite site activities are conducted under the direction of Nuclear Power Systems Manufacturing, a part of the Nuclear Power Systems Division, headquartered in Windsor, Connecticut. The Hematite Plant Manager reports to the General Manager - Fuel Fabrication. Lines of responsibility are shown in Figure 2-1. Resumes' for Messrs. Lichtenberger, Pianki, Rode,Sheeran, Wahler, Swallow and Eskridge are provided. * The Hematite Organization Chart is shown in Figure 2-2.

2.1 Nuclear Licensing and Safety Organization

Nuclear Licensing and Safety is organized to provide a comprehensive program for nuclear criticality safety, health physics, industrial safety and fire prevention, and medical services for the plant.

On-site nuclear criticality safety, health physics, industrial safety and fire prevention, and medical services control functions are provided by Nuclear Licensing and Safety personnel.

Staff nuclear and industrial safety support is provided by the Nuclear * Criticality Specialist and Nuclear Licensing and Safety - Windsor. The Windsor Nuclear Licensing and Safety Supervisor provides support in the following activities:

a) Establishment of nuclear licensing and safety policies.
b) Preparation of Regulatory Agency applications.
c) Technical support services, as related to nuclear criticality safety and health physics, for review of proposed additions to or modifications of the the plant or equipment.
d) Systematic auditing of plant operations.

The Nuclear Criticality Specialist provides support in the following * activities:

a) Technical support services as related to nuclear criticality safety.
b) Systematic auditing of plant operations for nuclear criticality safety.

2.1.1 Basic Responsibilities

Nuclear Licensing and Safety Supervisor-Windsor

The NLS Supervisor - Windsor is responsible to ensure effective and timely administration of nuclear safety control by systematic audits. He assists in establishing sound programs in compliance with appropriate Federal and State Regulations and ensures continued compliance of these programs through regular audits and follow-up with responsible management. He provides competent technical support services from either in-house specialists or from specialists outside of the Corporation on a consulting basis.

Nuclear Licensing and Safety Supervisor - Hematite

The NLS Supervisor is responsible to ensure effective and timely administration of the nuclear and industrial safety control and audit function. He establishes sound programs in compliance with appropriate Federal and State Regulations and ensures continued compliance of those programs through regular audits and follow-up with responsible management. He provides competent technical and administrative services as follows:

a. He initiates NLS nuclear criticality safety and health physics evaluations of proposed changes. He performs weekly inspections of operations and general plant conditions for the benefit of both Nuclear and Industrial Safety and Operating Personnel. These audits serve as a management tool for joint action to correct any deficiencies noted. All criticality safety evaluations are submitted to the Nuclear Criticality Specialist and the NLS Supervisor-Windsor for overchecking. *

2.1.1 Basic Responsibilities (continued)

b. He provides a sound program in compliance with Federal and State regulations. He performs evaluations of radiological safety and plant inspections, and follows up with responsible operating management.

2.1.2 Personnel Qualifications

The NLS Supervisor shall hold a degree in science or engineering and have at least five years experience in a responsible position in the nuclear industry, at least three years of which have been in an activity which involved nuclear criticality safety and health physics evaluations. An understanding of industrial safety problems and controls is also required.

The Nuclear Criticality Specialists shall hold a degree in science or engineering and have a minimum of three years experience in plant nuclear criticality safety. *

2.2 Nuclear Materials Management

The Nuclear Materials Management responsibilities, controls and operations are described in Section 5.0.

2.3 Manufacturing Organization

2.3.1 General Description

Combustion Engineering's manufacturing operations are organized for the specific purpose of chemical and ceramic processing SNM for further fabrication of fuel assemblies. The organization chart, Figure 2-1, shows the subdivision of the manufacturing operations.

2.3.1 General Description (continued)

Each operation is headed by a Plant Manager who has full responsibility and authority to carry out the functions of that operation in conjunction with contributions of other departments or groups to achieve the overall objectives of the Corporation. Each Manager is directly responsible to his immediate superior for the conduct of his departmental affairs including implementation of disciplinary action against personnel failing to follow instructions. Further, each Manager has line responsibility to the members of his department.

2.3.2 Manufacturing Organization

The manufacturing covered by this license will be carried out under the direct responsibility of the Plant Manager - Hematite, who reports to the General Manager of Nuclear Fuel Manufacturing-Windsor. The manager has the responsibility for manufacture, engineering and shipment applicable to the production of products described in this application. The organization chart, Figure 2-1, shows functional lines of responsibility.

Specific procedures are set up to insure that the proper quantities of uranium are present in the various products produced. Processing procedures are set up within the responsible department.

Management channels are established as the need for delegation of work arises. Changes at levels below the Plant Manager are a management prerogative, and therefore, a detailed listing of the present supervisory levels is not provided, except for the operating Nuclear and Industrial Safety Group.

2.3.2 Manufacturing Organization (continued)

The Hematite Plant is organized for the purpose of converting uranium hexafluoride into UO_2 powder, pressing into pellets, and consolidation and purification of unirradiated scrap and residues. The organization is set up to carry out and control the various functions essential for this operation.

2.3.3 Basic Responsibilities

Plant Manager

The Plant Manager is responsible for the safe efficient operation and maintenance of the plant in conformance with established policies and procedures.

First Line Management

First Line Management reporting to the Plant Manager are responsible for the safe efficient operation of their assigned portions of the facilities. This includes the supervision of any activities assigned to them.

2.3.4 Personnel Qualification

The minimum qualifications of the Plant Manager, and first line management shall be a B.S. degree in a technical field with two years experience in Nuclear plants and laboratories, or high school with ten years nuclear industry experience.

2.4 Process Control

Supervision at all levels is required to assure themselves that all handling, processing, storing and shipping of SNM, is given prior review and approval by Nuclear Licensing and Safety, that suitable control measures are prescribed, and that all pertinent regulations and control procedures relative to nuclear criticality safety or radiological safety are followed by all operating personnel.

Approval by Nuclear Licensing and Safety shall be in accordance with criteria established by the license. The mechanism of such approval is described in more detail in Section 2.5.

2.4.1 Chemical Operations

Control of the process is maintained through a system of standard procedures and parameters, including provisions for reporting and correcting abnormal occurrences.

Operating Procedures

Prepared by the responsible function and issued and controlled by Quality Assurance, provide detailed instructions for equipment operation and material handling, including specific safety requirements. Operating Sheets are the basic control document; before issuance or revision they require Engineering, Production, Quality Assurance, Nuclear Licensing and Safety and Accountability approval by signature.

The minimum frequency for updating all operating procedures involving Special Nuclear Materials will be every two (2) years. *

2.4.1 Chemical Operations (continued)

Process Log Sheets and Shop Travelers

Prepared by Engineering, establish and communicate detailed parameters for each job, within limits established by Operating Sheets.

Operating Reports

Operating reports are prepared as required for production planning and control.

2.4.2 Fabrication Operations

Control of the process is maintained through a system of written operating procedures and provisions for reporting and correcting abnormal occurrences. Operations involving SNM require prior written approval by Nuclear Licensing and Safety.

2.5 Nuclear and Industrial Safety Control

On-site nuclear and industrial safety control is exercised by Operating Supervision with overchecks performed by Process Engineers and Nuclear Licensing and Safety. Operating Supervision must assure that nuclear criticality safety and health physics control procedures are followed as defined by approved operating procedures or posted control limits.

2.5.1 Nuclear Licensing and Safety Approval

NLS Department approval on equipment and operating procedures is identified by signature of the NLS Supervisor on all operating procedures involving SNM and criticality signs. This approval shall only be granted when:

a. Nuclear criticality safety evaluation has been performed by the NLS Supervisor based on the criteria and standards of Sections 3.0 and 4.0. This will be in sufficient detail to permit subsequent reviews.

b. The NLS Supervisor's evaluation has been reviewed by the Nuclear Licensing & Safety Supervisor - Windsor. This review is based on the criteria and standards of Section 3.0 and includes verification of each of the following:

   1) assumptions
   2) correction application of criteria of Section 3.0
   3) completeness and accuracy of the evaluation
   4) familiarity of the installation
   5) compliance with the double contingency criteria

c. The NLS Supervisor's evaluation has concluded that the operation can be conducted in accordance with established health physics criteria. He will also verify that the various aspects of any proposed change will conform to conditions set forth in the proposals.

Review and verification shall include written approval by the reviewer(s).

2.5.2 Records

Records of NLS evaluations and approvals will be maintained for a period of at least six (6) months after use of the operation has been terminated.

2.5.3 Suspension of Operations

Primary responsibility and authority to suspend unsafe operations is placed with Operating Supervision. Within their respective responsibilities, the members of Nuclear Licensing and Safety also have authority to suspend operations not being performed in accordance with approved procedures.

2.6 Inspections and Audits

A continuous re-appraisal of the safety program is provided through a system of daily checks, regular inspections, and audits. NLS personnel, thoroughly familiar with regular operations, make daily checks to determine that there has been no change in the parameters or conditions of operations that may affect safety. A planned schedule of weekly inspections is established and performed by the NLS Supervisor. Infractions and violations are normally corrected on the spot * with the concurrence of the NLS Supervisor. Results of inspections and audits are included in the NLS monthly report. In the absence of the NLS Supervisor, the weekly inspection * will be performed by a designated knowledgeable individual.

2.6.1 Daily Checks

Daily checks made routinely by NLS technicians who observe, note and make general observations in addition to their radiation survey functions.

2.6.2 Weekly Inspections

The weekly inspections, performed by the NLS Supervisor or his * designated respresentative, cover all aspects of criticality

2.6.2 Weekly Inspections (continued)

control, radiation safety and industrial safety. Items requiring corrective action are documented in a report distributed to the Plant Manager and all Supervisors and Foremen. The Production Superintendent is responsible for corrective actions, except where another Supervisor is specifically designated.

2.6.3 Other Inspections

Inspections are performed twice per year by the NLS Supervisor - Windsor and the Windsor Nuclear Laboratory Radiological Safety Officer. These inspections include a performance review of the radiation safety programs, as well as a plant inspection to observe for items requiring corrective action.

An inspection will be conducted by the Nuclear Criticality Specialist - Hematite on a monthly basis covering all phases of nuclear criticality safety and control, including results of previous inspections and follow-up action taken. *

Both the semi-annual and the monthly inspections are documented and reports distributed to the General Manager, Plant Manager, NLS Supervisor and other Supervisors. The Production Superintendent and the NLS Supervisor are responsible for any corrective actions required. *

2.6.4 Annual Audits

Annual audits are more thorough inspections in which the results of previous inspections or audits are also reviewed, as an evaluation on the effectiveness of the program. All aspects of the activities involved, including the equipment, facilities and operator's knowledge are covered. A review of the follow-up action taken on previous audits and inspections, the recommended corrective action, and a schedule date which such action will be accomplished are also covered. These audits may also involve a detailed review of non-safety documents such as operating procedures, shop travelers, etc., and are documented by a formal report to the Vice President-Nuclear Fuel. Records of audits are maintained for at least one year. Annual audits are performed by a team appointed by the Vice President, Nuclear Fuel. The team shall include a Nuclear Criticality Specialist from Windsor who shall audit all phases of Nuclear Criticality Safety. The annual audit will consider ALARA requirements in conformance with the intent of Regulatory Guide 8.10. *

2.7 Training

2.7.1 Purpose

The purpose of the training program is to inform and instruct all employees in the policy and programs of the company as they relate to nuclear criticality safety, health physics and industrial safety, and proper and safe performance of their assignments.

2.7.2 New Employees

The indoctrination of new employees in the safety aspects of the facility is conducted by, or under the supervision of specialists in the various topics. The indoctrination topics include but are not limited to:

a. Fundamentals of nuclear criticality safety and controls.
b. Fundamentals of the health physics program and controls.
c. Emergency alarms and actions required.
d. A review of the facility operations.
e. On the job training, under direct line supervision and/or by experienced personnel.

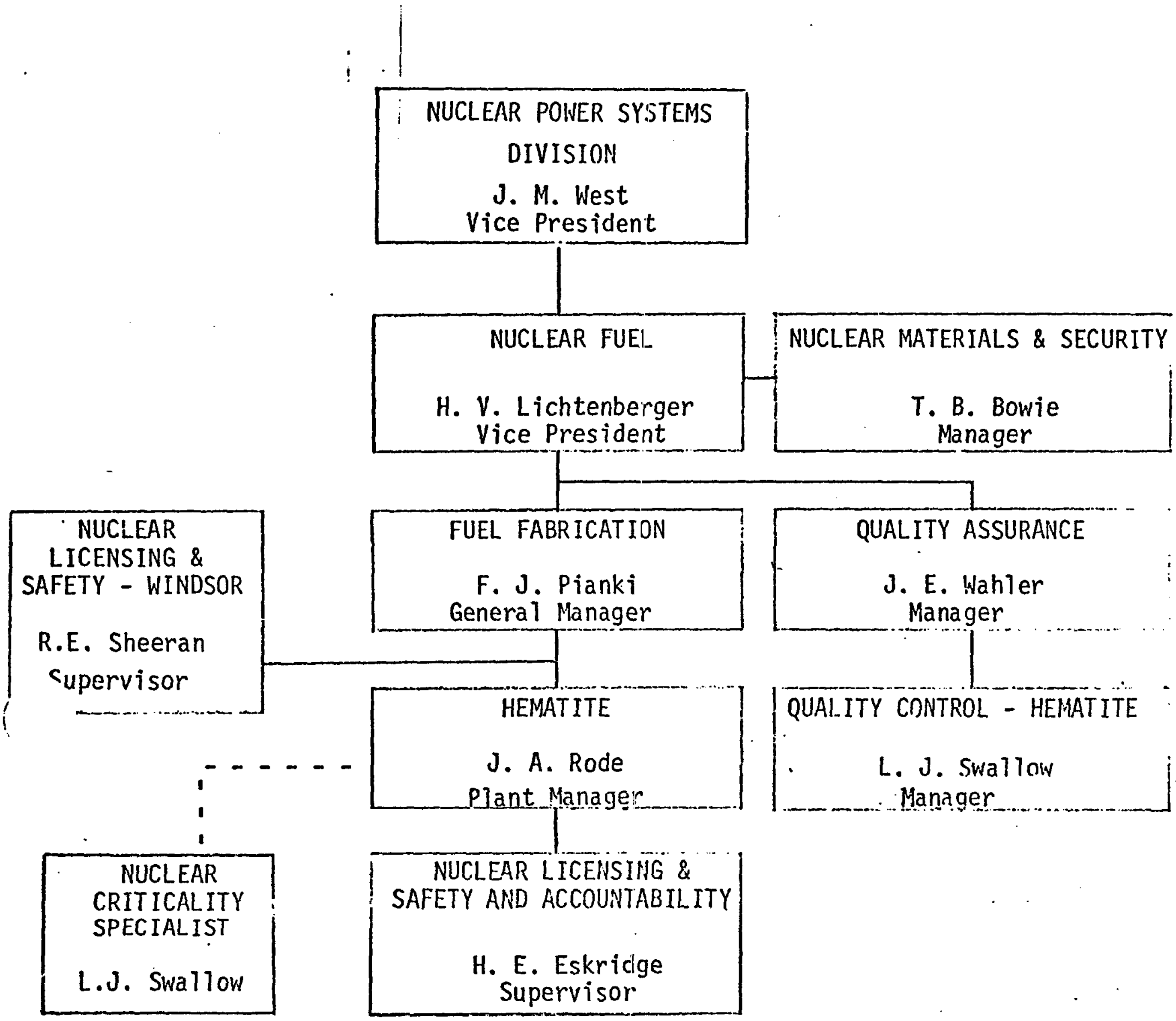
After determining by testing that a new employee has attained sufficient knowledge in the above topics, adequate performance is monitored by the Foreman and NLS prior to permitting work without close supervision. *

2.7.3 Continued Training

The training and personnel safety program is continued with on the job training supplemented by regularly scheduled meetings conducted by line supervision and specialists in the subjects covered. Personnel protective equipment, industrial safety and accident prevention and other safety topics are included. Foremen receive a formal course in radiation safety and criticality *

2.7.3 Continued Training (continued)

control. Sufficient knowledge to enable them to carry out their training functions is determined by testing. All operating personnel receive a re-training course in criticality control and radiation safety on an annual basis.


NUCLEAR POWER SYSTEMS DIVISION
J. M. West
Vice President
NUCLEAR FUEL
H. V. Lichtenberger
Vice President
NUCLEAR MATERIALS & SECURITY
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FUEL FABRICATION
F. J. Pianki
General Manager
QUALITY ASSURANCE
J. E. Wahler
Manager
HEMATITE
J. A. Rode
Plant Manager
QUALITY CONTROL - HEMATITE
L. J. Swallow
Manager
NUCLEAR CRITICALITY SPECIALIST
L.J. Swallow
NUCLEAR LICENSING & SAFETY AND ACCOUNTABILITY
H. E. Eskridge
Supervisor

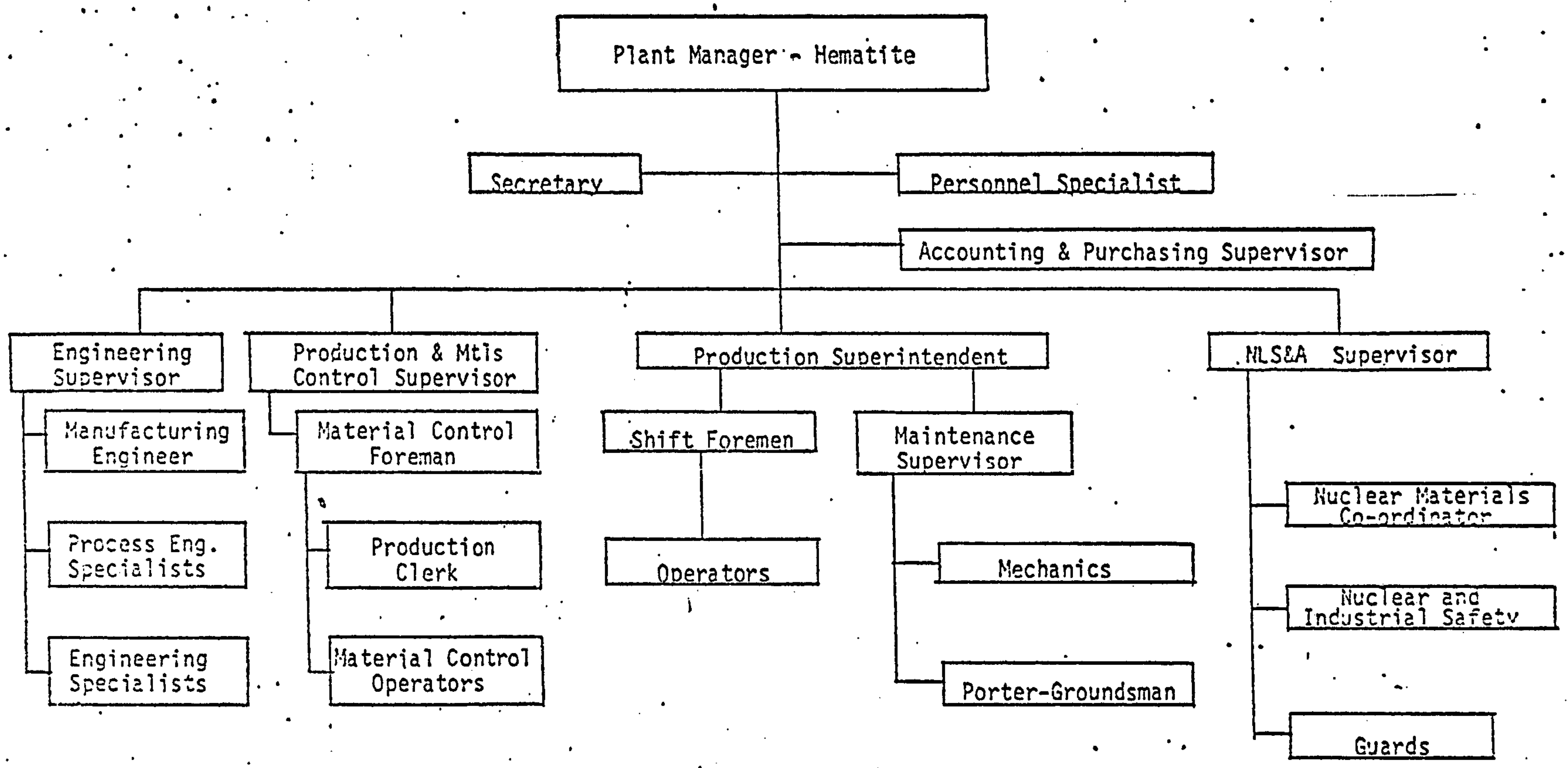
Figure: 2-1

License No. SNM-33, Docket 70-36

Revision: 2

Date: 2/23/76

Figure: 2-2



HEMATITE PLANT

ORGANIZATION CHART

HAROLD V. LICHTENBERGER - VICE PRESIDENT, MANUFACTURING

B. A., Physics, James Milliken University, [redacted] Ex. 6

PROFESSIONAL EXPERIENCE:

Combustion Engineering, Inc., January 1974 to Present
Vice President-Manufacturing - Nuclear Power Systems

Mr. Lichtenberger is responsible for the manufacturing and quality control operations for reactor fuel, control rod drives and other nuclear components including planning, scheduling and the development of improvements in design and processing techniques. He also is responsible for the design and experimental programs for the development of control rod drive mechanisms.

Mr. Lichtenberger is a member of the Corporate Patent Committee and the Nuclear Safety Committee.

General Nuclear Engineering Corporation, 1956 to 1961
Vice President

Mr. Lichtenberger had over-all responsibility for directing the design and construction of the research and training reactors evolved by GNEC, which included the University of Florida Training Reactor and the Georgia Tech Research Reactor. He directed the research and development program for the Gas Cooled Reactor Project undertaken for the East Central Nuclear Group and the Florida West Coast Nuclear Group.

Argonne National Laboratory, 1951 to 1956
Director, Idaho Division

Mr. Lichtenberger supervised important experiments in reactor performance, including the breeding gain measurements of EBR-1 and the BORAX Experiments. He was also in charge of the design, construction, and operation of a facility for performing Zero Power Fast Reactor Criticality Studies.

HAROLD V. LICHTENBERGER (continued)

<u>The University of Chicago, 1942 to 1951</u>
<u>Staff Member, Metallurgical Laboratory</u>
<u>Director, Fast Reactor Project, Argonne National Laboratory</u>

Upon graduation from college, Mr. Lichtenberger joined the staff at the University of Chicago and has been actively engaged in reactor design work since that time. He participated in the construction of the world's first nuclear reactor and the first heavy water moderated nuclear reactor. After these reactors were placed in operation, Mr. Lichtenberger participated in many of the early experiments in neutron physics. In 1946, he undertook experiments on heat transfer and the handling of sodium with a view to using this metal as a reactor coolant. Subsequently (1947 to 1951), he was Director of the Fast Reactor Project at Argonne and, as such, was in charge of the design, construction, and operation of the Experimental Breeder Reactor No. 1 (EBR-1), a sodium-cooled-reactor which was the first reactor to produce electric power.

PROFESSIONAL AFFILIATIONS:

Fellow, American Nuclear Society

FRANCIS J. PIANKI - GENERAL MANAGER, NUCLEAR FUEL MANUFACTURING

B.S., Metallurgical Engineering, Polytechnic Institute of Brooklyn, [redacted] Ex. 6
Graduate Studies, Polytechnic Institute of Brooklyn

PROFESSIONAL EXPERIENCE:

Combustion Engineering, Inc., June 1969 to Present
General Manager, Nuclear Fuel Manufacturing - Windsor

Mr. Pianki is responsible for all Nuclear Fuel Manufacturing activities. He supervises production control, manufacturing engineering, and the production of fuel assemblies, control element assemblies, and control rod drive mechanisms. He is also responsible for the Nuclear Safety and Accountability in the Manufacturing Area.

United Nuclear Corporation 1959-1969
Manufacturing Manager, Nuclear Fuels Department

Mr. Pianki was responsible for directing the activities of the manufacturing group which was engaged in the production of nuclear fuel elements for both power and test reactors. These responsibilities involved the production, production control, materials control and planning for the manufacturing group.

Prior to this assignment, Mr. Pianki was Engineering Superintendent, Production Supervisor and Project Manager within the Manufacturing group.

He was responsible for establishing material control systems, for nuclear and non-nuclear materials, a production control system and the development of administrative policies and practices.

Sylvania Corning Nuclear Corporation, 1956 to 1959
Production Engineering Supervisor

Supervised the activities of the production engineering groups in a manufacturing organization engaged in the fabrication of nuclear fuel elements for both power and test reactors.

FRANCIS J. PIANKI (continued)

Westinghouse Electric Corporation, Bettis Field, 1955 to 1956
Senior Engineer

Development of fabrication techniques for nuclear fuel elements used in Naval reactors.

Sylvania Electric Products, 1952 to 1955
Engineer, Nuclear Fuel Division

Research and development in the fabrication of nuclear fuel elements for both test and power reactors.

JAMES A. RODE - PLANT MANAGER, HEMATITE

B.S., Chemical Engineering, University of Texas, [redacted] Ex. 6

PROFESSIONAL EXPERIENCE:

Combustion Engineering, Inc., 1974 to Present
Plant Manager, Nuclear Fuel Manufacturing - Hematite

Responsible for all Nuclear Fuel Manufacturing activities at the Hematite Plant. Supervises Engineering, Production and Materials Control, Manufacturing, Nuclear and Industrial Safety and Nuclear Material Management.

Gulf United Nuclear Fuels Corporation 1968-1974
Technical Consultant

Responsible for establishing process flow sheets and capacities for production of UO_2, UO_2 pellets, and uranium recovery; and co-ordinating development activities. Also responsible for preparation of stable density pellets and development of process modifications. Technical Assistant to the Manager of Chemicals Operations on major operational problems.

United Nuclear Corporation 1964-1968
Manager of Facilities Development and Technical Director

Responsible for design, construction and startup of the first large scale fluidized-bed process for the production of UO_2 from UF_6. Also responsible for design, construction and startup of companion facilities for converting oxide to pellets.

Responsible as Technical Director for Chemicals Operations process engineering supervision and development activities including design, construction, and operation of a pilot plant for preparation of UO_2 via the reaction of UF_6 and steam and for development, design, construction and startup of a fluid-bed vapor phase coating system.

JAMES A. RODE (continued)

United Nuclear Corporation 1962-1964
Assistant Technical Director

Responsible for process and equipment design in the Rhode Island Scrap Recovery Facility, development work on process for producing pyrolytic carbon coated UO_2, and for continuing development work in Naval Fuel Program.

United Nuclear Corporation 1961-1962
Project Leader

Assumed total responsibility for salvaging a non-operative Naval Fuels Plant including production, quality control, development and customer contacts. The facility was converted into the primary source of profits for the Chemicals Operations.

Mallinckrodt Chemical Works 1958-1961
Group Leader and Production Superintendent

Responsible for the startup of high enrichment metal production and development and startup of the Hematite Pellet Plant. Also provided consulting service to customers.

Responsible as Production Superintendent for detailed supervision of production in both high and low enrichment conversion operations.

Mallinckrodt Chemical Works 1953-1958
Process Engineer and Research Chemist

Participated in preparation of proposals for production of yttrium metal and conversion of 5000 tons per year of UF_6. Responsible for operation of the first ADU pilot plant and startup of the Hematite Oxide Plant.

Participated in metal quality work team, which successfully increased plant yields. Promoted to supervision of metal casting pilot plant and then to supervision of Dinget Pilot Plant, which included thermite reduction, machining and forging.

JAMES A. RODE (continued)

Conducted studies as Research Chemist on reactivity of UO_3 and UO_2, recovery of HNO_3 and rare metals from pitchblende raffinate, electrolytic reduction of uranium, and high density UF_6 production.

Robert E. Sheeran - Nuclear Licensing and Safety Supervisor - Windsor

Bachelor Mechanical Engineering, New York University, [redacted] Ex. 6

Master Metallurgical Engineering, New York University, 1955

aster Business Administration, University of Hartford (24 of 48 credit hours completed)

PROFESSIONAL EXPERIENCE

1971 - Present, Special Projects Supervisor, Combustion Engineering, Inc.

Since 1971 have served in the capacity of Special Projects Supervisor. In this position responsibilities include: long range planning for equipment and facilities; proposal development for new facilities; preparation of capital appropriation requests for new equipment and facilities to meet projected production requirements; coordinating A/E and regulatory agency requirements. Maintaining up to date awareness of Federal, State and local requirements with regard to environmental impact of new equipment and facilities. Prepare environmental impact statements on the Nuclear Manufacturing facilities, and working with the NRC in obtaining approval of such impact statements. Performing other duties as assigned and as directed by the General Manager.

1965-1970, Supervisor Manufacturing Engineering, Combustion Engineering, Inc.

From 1965 to 1970 served in the capacity of Supervisor of Manufacturing Engineering in Nuclear Fuel Manufacturing. In this position responsibilities consisted of: developing manufacturing procedures for all hardware production including tool and fixture design; maintaining liaison with the design organization. Responsible for design and procurement of all facilities to meet product requirements.

Was the designated Nuclear Licensing Officer of the Nuclear Fuel Manufacturing Facilities in Windsor. In this capacity was responsible for all aspects of licensing at the Nuclear Manufacturing facility in Windsor and coordinated all Nuclear Safety nalysis with the C-E Physics department as required. Responsible for implementing the criticality programs for the Manufacturing facility, including the preparation of license submittals and the auditing of Manufacturing operations.

1955-1965, Various capacities ranging from Associate Staff Engineer to Project Engineer, Combustion Engineering, Inc. - Naval Nuclear Fuel Manufacturing

From 1955-1965 served in various capacities ranging from Associate Staff Engineer to Project Engineer. Responsibilities in these positions consisted of: performing mechanical design studies on hardward components and assemblies that were being designed and manufactured to customer specification; performing material selection studies on such hardware; performing reliability testing on the finished hardware.

1954-1955, Staff Engineer, Republic Aviation, Inc., Farmingdale, N.Y.

Performed various mechanical design, testing and development functions relating to various types of structures and materials and their application to hypersonic airframes and engine components.

1953-1954, Research Assistant, New York University, N.Y.

Performed R&D functions related to titanium alloys and their application for ordance and airframe equipment.

JOHN E. WAHLER - MANAGER, QUALITY ASSURANCE

B.S., Mechanical Engineering, Western Michigan University
M.S., Industrial Administration, Yale University

PROFESSIONAL EXPERIENCE:

Combustion Engineering, Inc., 1968 to Present
Manager of Quality Assurance - Nuclear Fuel Manufacturing

Mr. Wahler is responsible for all Quality Assurance activities in Nuclear Fuel Manufacturing. He supervises Quality Engineering, inspection and vendor surveillance.

Westinghouse Atomic Equipment Division 1965-1967
Manager of Quality Assurance Engineering

Mr. Wahler was responsible for the development and institution of quality assurance and reliability systems for the manufacture of commercial and naval nuclear cores, main coolant pumps and control rod drive mechanisms. He was also responsible for inspection and nondestructive testing development, including automated and computer controlled systems.

New York Shipbuilding Corporation 1962-1965
Manager of Quality Control

Mr. Wahler had responsibility for all Quality Engineering, nondestructive testing and inspection involved in the construction and testing of nuclear powered surface ships and submarines. He was also responsible for welding engineering in the nuclear areas.

United Nuclear Corporation 1956-1962
Works Manager

Mr. Wahler was responsible for all phases of operations at United Nuclear's assembly plant which included the manufacture of core structural components and the assembly of naval nuclear cores and power units. Prior to his assignment at the assembly plant, he was Quality Control Manager for all UNC activities.

LOUIS J. SWALLOW - QUALITY ASSURANCE MANAGER - HEMATITE

M.S., Mechanical Engineering, Washington University, 1955
B.S., Mechanical Engineering, Washington University, [redacted] Ex. 6
Nuclear Safety School, Oak Ridge National Laboratory, 1959

PROFESSIONAL EXPERIENCE:

Combustion Engineering, Inc., 1974 to Present
Quality Assurance Manager - Hematite

Responsible for all Quality Assurance activities in Nuclear Fuel Manufacturing-Hematite. Supervises Quality Control Engineering, Quality Assurance Engineering, and Chemical and Physical Test and Inspection.

Gulf United Nuclear Fuels Corporation 1970-1974
Engineering Manager, Chemical Operations

Responsible for Process Engineering, Facilities & Equipment Engineering, Capital budgets. Assigned as Acting Plant Manager during extended absences of the Plant Manager.

During this period, the plant produced 200 MTM of pellets for light water reactor fuel and several thousand kgs of special naval reactor fuel.

United Nuclear Corporation 1968-1970
Nuclear & Industrial Safety Manager, Commercial Products Division

Responsible for establishing the overall safety program for the three manufacturing plants operated by the division. Including AEC license applications and approval.

United Nuclear Corporation 1967-1968
Construction Manager, SWOPP Task Force, Chemical Operations

Responsible for design, planning, scheduling and contracting the construction of the UF_6 conversion plant and UO_2 pellet plant.

United Nuclear Corporation 1964-1967
Operations Control Manager, Chemical Operations

Responsible for Quality Control, Nuclear Safety & Health Physics Program, Special Nuclear Materials Licensing, Special Nuclear Materials Accountability, Scrap Recovery.

LOUIS J. SWALLOW (continued)

<u>United Nuclear Corporation 1958-1964</u>
<u>Research & Development Engineer, Chemical Operations</u>

Responsible for UO_2 pellet encapsulation, Quality Control, Nuclear Safety and Health Physics.

<u>Mallinckrodt Chemical Works 1955-1958</u>
<u>Project Engineer, Uranium Division</u>

Responsible for design and installation of uranium metal production equipment in the Feed Materials Plant.

HAROLD E. ESKRIDGE - SUPERVISOR, NUCLEAR AND INDUSTRIAL SAFETY AND NUCLEAR MATERIALS MANAGEMENT

B.S., Physics, North Carolina State University, [redacted] Ex. 6
M.S., Physics, North Carolina State University, 1963

PROFESSIONAL EXPERIENCE:

Combustion Engineering, Inc. 1974 to Present
Supervisor, Nuclear and Industrial Safety and Nuclear Materials Management

Responsible for all aspects of licensing, safety, and safeguards at Nuclear Fuel Manufacturing - Hematite. Develops and implements the health physics, criticality and industrial safety, and accountability programs for the Hematite facility. Audits manufacturing operations and supervises safety and safeguards personnel in day-to-day operations.

General Electric Company 1972-1974
Nuclear Safety Engineer

Analyzed changes and specified requirements for Wilmington nuclear fuel manufacturing processes, facilities and procedures to assure compliance with regulatory, license and GE conditions. Audited manufacturing operations and radiation protection programs. Planned and conducted development programs in dosimetry, radiation monitoring and environmental sampling.

Salisbury Metal Products Company 1971-1972
Co-Manager

Managed operations for manufacturer of precision components; including sales, finance, production control and quality assurance.

Also served as consultant to Institute for Resources Management on decontamination and radioactive waste disposal projects, and was member of Rowan Technical Institute Advisory Committee.

Environonics, Inc. 1970-1971
Vice President - Nuclear Applications

Performed variety of functions, including market research, proposal preparation, and technical analyses relating to remote sensing, environmental surveys, and health physics services. Contacted potential customers, including government agencies and utility companies with power reactors.

HAROLD E. ESKRIDGE (continued)

EG&G, Inc. 1967-1970
Senior Scientist and Scientific Executive

As head, Radiological Sciences Section and Senior Health Physicist, was responsible for all aspects of radiation and nuclear safety and regulatory compliance for Las Vegas Operations. Provided consultation to other divisions of the company and technical direction for Nuclear Counting Laboratory, Nevada Aerial Tracking System and Aerial Radiation Measuring Surveys Programs. Served as Acting Manager, Environmental Measurements Department, which included above activities, as well as High Energy Neutron Reactions Experiment and Metrology Sections.

North Carolina State Board of Health 1962-1967
Public Health Physicist

Technical, policy, and procedural consultation in all aspects of health physics, environmental surveillance and radiological health. Functioned as administrator of Radioactive Materials Licensing and Regulation. Served as Team Chief of State Radiological Emergency Team in several radiation incidents and one major radiation accident. Also established and equipped a complete laboratory for radiological and chemical analysis of environmental samples.

Astra, Inc. 1960-1961
Nuclear Engineering Assistant

Participated in neutron flux and activation dose rate calculations for Nuclear Aircraft Program.

U.S. Air Force 1954-1957
Nuclear Specialist

Responsible for criticality and radiological safety for nuclear weapon systems and components. Also was instructor in nuclear safety and weapons systems.

3.0 NUCLEAR CRITICALITY SAFETY STANDARDS

This section provides the limits which may be applied to the handling of uranium at the Hematite facility.

Manufacturing operations can be described in terms of Safe Individual Units (SIUs) which are provided herein. These are spaced using the methods and criteria described. Thus, these standards provide the criteria for the design of new facilities and equipment, and the modification of existing equipment, within the procedures established in Section 2.0. The activities for which these standards are applicable are described in Sections 7.0 and 8.0, and the technical backup and support for these standards is provided in Section 9.0.

3.1 Limits for Individual Units

Except as specified, all limits are based on the assumption of full moderation and reflection. Safety factors applied to units calculated to be one per cent subcritical, and incorporated in the SIUs are

a.	Mass	2.3
b.	Volume	1.3
c.	Cylinder diameter	1.1
d.	Slab thickness	1.2

Applicable SIUs are provided in Table 3-1.

TABLE 3-1

Safe individual unit limits for ≤4.1% enriched uranium at optimum moderation. Hetrogeneous limits have been developed with optimum rod size (up to 0.4" diam.) taken to allow for pellet chips, etc.

Mass (Kg of U)	Homogeneous	Hetrogeneous	
≤2.5% U-235	70	51	
2.5-3.0	44	36	
3.0-3.2	38	33	
3.2-3.4	32	29	
3.4-3.6	29	27	
3.6-4.1	21	21	
Volume (liters)			
≤3.5	31	22	20 liter limit for vertical stacking
3.5-4.1	25	18	
Cylinder Diameter (inches)			
≤3.5	10.7	9.5	
3.5-4.1	9.8	8.9	
Slab Thickness (inches)			
≤3.5	5.1	4.1	
3.5-4.1	4.6	3.7	

3.2 Interaction Analysis

All SIUs must have a separation of at least one foot, edge to edge.

Arrays of SIUs are evaluated using the solid angle or surface density methods, as specified herein. *

3.2.1 Solid Angle Method

The solid angle method, as described in K-1019, Rev. 5, is used to establish safe spacing of the SIUs specified in Table 3-1.

3.2.2 Surface Density Method

The surface density method may be used to evaluate arrays of SIUs where each mass limit has a fraction critical of ≤ 0.3, and each geometry limit has a fraction critical of ≤ 0.4. Spacing for mass limited SIUs is such that the contained UO_2 and moderator, if "smeared" over the allowed spacing area, would not exceed 50% of the minimum water reflected infinite slab surface density, based on optimum moderation. For cylinder and volume limited SIUs, a spacing limit based on 25% of the minimum water reflected infinite slab thickness applies. Horizontal slab limited SIUs require no additional spacing and may border the spacing boundary for any other array unit.

3.2.2 Surface Density Method (continued)

In order to provide simplicity in the use of the limits, all mass limited SIUs are provided the same spacing areas. Therefore, many of the limits provided in Table 3-1 are reduced to provide compatability with a single spacing area. These modified limits, designated for use with the surface density method, are provided in Table 3-2. Spacing requirements for the limits specified in Table 3-2 are provided in Table 3-3.

These limits apply under conditions of "in-plant reflection" where the floor is of 16" - thick concrete, and the roof is the equivalent of less than 4" of concrete. It should be noted that these criteria, which assume optimum moderation for all array units, are actually applied to an essentially dry facility. A moderated array unit is not frequently encountered. This consideration adds significantly to the margin of array safety. *

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TABLE 3-2

Safe Individual Unit Limits for ≤4.1% enriched uranium for use with the surface density method.

Mass (Kg of U)	Homogeneous Limit	Homogeneous F	Heterogeneous Limit	Heterogeneous F
≤2.5% U-235	48	0.19	44	0.26
2.5-3.0	36	0.23	34	0.29
3.0-3.2	32	0.23	32	0.29
3.2-3.4	31	0.25	29	0.29
3.4-3.6	28	0.26	27	0.30
3.6-4.1	21	0.25	21	0.27
Volume (liters)				
≤3.5%	31	0.39	22	0.40
3.5-4.1	25	0.38	18	0.38
Cylinder Diameter (inches)				
≤3.5	10.7	0.34	9.5	0.36
3.5-4.1	9.8	0.33	8.9	0.34

Slab Thickness

See Table 3-1

TABLE 3-3

Spacing requirements for mass, volume, or cylinder SIUs specified in Table 3-2.

Spacing areas will be established to provide equal distances from the edges of the units to the spacing boundary in all directions. Co-planar slabs specified in Table 3-1 require no additional spacing. Non-Co-planar slabs are limited to 12-inch vertical differences, and must be separated by a 6-inch horizontal spacing. This is demonstrated in Section 9.6. *

Limit	Spacing Area
Mass	3.5 ft^2
Volume	9.0 ft^2
Cylinder (per ft. of length)	5.0 ft^2

Mass limited SIUs may be stacked on a vertical centerline with at least 10-inch edge separation. This is demonstrated in Section 9.6. MAXIMUM VOLUME OF STACKED UNITS IS 20 LITERS (5.28 gals) PER LICENSE CONDITION 14 & SECTION 9.6 Pg 9-52A. KR *

3.3 Design Requirements

3.3.1 Fire Hazards

Evaluation of proposed changes in facilities, equipment or operations will include consideration of fire hazards. All equipment and operations will be designed, and materials selected, to minimize fire hazards.

3.3.2 Structural Integrity

Whenever nuclear criticality safety is directly dependent on the integrity of a fixture, container, storage rack or other structure, design will include consideration of structural integrity. The fulfillment of structural integrity requirements will be established by physical test or by analysis and certification by an engineer knowledgeable in structural design. Fixtures, containers, storage racks and other structures which maintain a safe geometry or spacing will be checked by NIS personnel during inspections and audits to assure continued reliability of such devices. *

3.4 Marking and Labeling

3.4.1 Criticality Limits

Signs listing approved nuclear criticality safety limits shall be posted such that information thereon is readily discernible to employees. This posting may be for individual pieces of equipment or groups of equipment, depending on the nature of the operations covered.

3.4.1 Criticality Limits (continued)

a. Signs are prepared and issued by Nuclear and Industrial Safety.

b. Signs must be posted piror to use of SNM in the equipment or at the work station.

c. Criticality limit signs are signed in approval by the Nuclear and Industrial Safety Supervisor and the Production Superintendent.

3.4.2 Process Containers

Empty containers used for SNM shall be identified or marked as empty.

Process containers will have information readily available to allow identification of their contents.

This will include the standard radiation symbol, the U-235 enrichment, material type, and the uranium content. Tags will be attached to each container. Empty containers will be considered as being full unless tagged with an "empty" sticker.

3.4.3 Exclusion Areas

Vessels and other items of equipment requiring exclusion areas will have the limits of these areas clearly marked on the floor. SIUs in transit will not be permitted to enter an exclusion area. This rule will be covered in operator training and operating procedures. *

4.0 HEALTH AND SAFETY

4.1 General Health Physics Requirements

The Radiation Protection Program shall comply with the standards established in Title 10, Code of Federal Regulations, Part 20, the Standards of this section and the requirements of other regulatory agencies. Every reasonable effort will be made to maintain radiation exposure of employees and releases of radioactive materials in effluents to unrestricted areas as far below these standards as practicable.

Internal procedures and/or data forms are used in performing and documenting the Health Physics functions in accordance with this section. Changes to these procedures shall be reviewed by the NLS Supervisor.

4.1.1 Surface Contamination

a. Restricted areas (As defined in 10CFR20)

Action	Contamination Action Level (Excluding Process Equipment)
Immediate Cleanup	10,000 alpha dpm/100 cm^2 removable (smear) 100,000 beta dpm/100 cm^2 removable (smear)
End of Shift Cleanup	5,000 alpha dpm/100 cm^2 removable (smear) 50,000 beta dpm/100 cm^2 removable (smear)

Material on processing equipment or fixed on surfaces shall be limited as required to control airborne radioactivity and external radiation exposures.

4.1.1 Surface Contamination (continued)

b. Unrestricted Areas (Release of Materials and equipment but does not include the abandonment of buildings)

1) The maximum amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters shall not exceed 25,000.

2) The average amount of fixed alpha radioactivity in disintegrations per minute per 100 square centimeters shall not exceed 5,000.

3) The maximum amount of removable (capable of being removed by wiping the surface with a filter paper or soft absorbent paper) radioactivity (alpha or beta) in disintegrations per minute per 100 square centimeters shall not exceed 1,000. .2 mg U (4.15% enrich)

4) The maximum level at one centimeter from the most highly contaminated surface measured with an open window beta-gamma survey meter through a tissue equivalent absorber of not more than seven milligrams per square centimeter shall not exceed one millirad per hour.

5) The average radiation level at one centimeter from the contaminated surface measured in the same manner shall not exceed 0.2 millirad per hour.

6) A reasonable effort shall be made to eliminate residual contamination.

7) Radioactivity on equipment or surfaces shall not be covered by paint, plating, or other covering materials unless contamination levels, as determined by a survey and documented, are below the limits specified above prior to applying the covering. A reasonable effort must be made to minimize the contamination prior to the use of any covering.

4.1.2 Air and Gaseous Effluents

The radioactivity concentration limits of 10CFR20 will be followed.

4.1.3 Records

Records of Personnel Monitoring, Monitoring Surveys, Respiratory Protection Program Personnel Instructions and Instrument Maintenance and Calibration shall be maintained by NLS.

4.2 Personnel Monitoring

Personnel monitoring shall be supplied to each individual who is likely to receive a dose in excess of 25% of the applicable limits in 10CFR20 and those personnel who routinely work in the process area.

4.2.1 Dosimetry

The personnel dosimeters shall be sensitive to an exposure of 25 millirem. Hand exposures will be determined by surveys. Exposures in excess of 25% of the applicable limits shall be investigated.

4.2.2 Bioassay

The bioassay program shall satisfy the requirements of Regulatory Guide 8.11, "Applications of Bioassay for Uranium", except that in Table 2 semi-annual in-vivo frequencies may be replaced by annual frequencies for minimum programs only. *

4.3 Respiratory Protection Program

In circumstances in which adequate limitation of the inhalation of radioactive materials by use of process or other engineering controls is impractical, C-E may permit an individual in a restricted area to be exposed to average concentrations of airborne radioactive materials in excess of the limits specified in Appendix B, Table 1, Column 1, of 10CFR20 provided:

a) The individual uses respiratory or other appropriate protective equipment such that the total intake, in any period of seven consecutive days by inhalation, ingestion or absorption, would not exceed that intake which would result from breathing the concentrations specified in Appendix B, Table 1, Column 1, of 10CFR20 for a period of 40 hours.

b) C-E shall advise each respirator user that he may leave the area for relief from respirator use in case of equipment malfunction, physical or psychological discomfort, or any other condition that might cause reduction in the protection afforded the wearer.

c) C-E shall maintain a respiratory protection program adequate to assure that the above objectives are met. Such program shall include:

   1) Air sampling and other surveys sufficient to identify the hazard, to evaluate individual exposure, and to permit proper selection of the respiratory protective equipment;

4.3 Respiratory Protection Program (continued)

2) Procedures to assure proper selection, supervision and adequate training of personnel using such protective equipment;

3) Procedures to assure the adequate fitting of respirators and the testing of equipment for operability;

4) Procedures for maintenance to assure full effectiveness of respiratory protective equipment, including issuance, cleaning and decontamination, inspection, repair and storage.

5) Bio-assays of individuals and other surveys as may be appropriate to evaluate individual exposures and to assess protection actually provided; and

6) Records sufficient to permit periodic evaluation of the adequacy of the respiratory protective program.

d) Evaluation of the protective equipment has determined that, when used to protect against radioactive material under the conditions of use to be encountered, such equipment is capable of providing a degree of protection at least equal to the protection factors listed in Table 4-1.

The factors listed in Table 4-1 apply only to protection against radioactive materials. Additional precautions may have to be taken to protect against concurrent non-radiation hazards.

TABLE 4-1

PROTECTION FACTORS FOR RESPIRATORS

Description	Modes 1/	PROTECTION FACTORS 2/ Particulates and Vapors and Gases
I. AIR-PURIFYING RESPIRATORS		
Facepiece, half-mask		10
Facepiece, full		100
II. ATMOSPHERE-SUPPLYING RESPIRATOR		
1. Air-line respirator		
Facepiece, half-mask	CF	100
Facepiece, half-mask	D	100
Facepiece, full	CF	1000
Facepiece, full	D	500
Facepiece, full	PD	1000
Hood	CF	1000
Suit	CF	4/
2. Self-contained breathing apparatus (SCBA)		
Facepiece, full	D	500
Facepiece, full	PD	1000
Facepiece, full	R	1000
3. Combination respirator		
Any combination of air-purifying and atmosphere supplying respirator.		Protection factor for type and mode of operation as listed above.

1/ CF: continuous flow
D : demand
PD: pressure demand (i.e., always positive pressure)
R : recirculating

2/ (a) For purposes of this authorization the protection factor is a measure of the degree of protection afforded by a respirator, defined as the ratio of the concentration of airborne radioactive material outside the respiratory protective equipment to that inside the equipment (usually inside the facepiece) under the conditions of use. It is applied to the airborne concentration to determine the concentration inhaled by the wearer, according to the following formula:

$$\text{Concentration Inhaled} = \frac{\text{Airborne Concentration}}{\text{Protection Factor}}$$

TABLE 4-1 (Continued)

2/ (b) The protection factors apply:

(i) only for individually fitted respirators worn by trained individuals and used and maintained under supervision in a well-planned respiratory protection program.

(ii) for air purifying respirators only when high efficiency particulate filters and/or sorbents appropriate to the hazard are used.

(iii) for atmosphere supplying respirators only when supplied with adequate respirable air.

3/ Excluding radioactive contaminants that present an absorption or submersion hazard.

4/ Appropriate protection factors must be determined taking account of the permeability of the suit to the contaminant under conditions of use. No protection factor greater than 1000 shall be used except as authorized by the Commission.

NOTE: Protection factors for respirators as may be approved in the future by the NIOSH according to approval schedules for respirators to protect against airborne radionuclides may be used in lieu of the protection factors listed in this Table. Where additional respiratory hazards other than radioactive ones are present, especially those immediately dangerous to life, the selection and use of respirators shall also be governed by the approvals of NIOSH in accordance with their applicable schedules.

4.4 Facility and Equipment Requirements

4.4.1 Zoning

The facility shall be zoned to define contamination areas, limited contamination areas and clear areas. Protective clothing or special clothing, shower and change facilities shall be provided for use in the contamination area. A sink and alpha survey meter or hand monitor shall be provided at the exit from the contamination area.

4.4.2 Ventilation

Air flow shall be from areas of lower to areas of higher contamination. Hoods, glove boxes, or local exhaust will be used to control contamination and airborne concentrations. All dispersible forms of uranium will be handled in ventilated enclosures having sufficient air flow to assure minimum face velocities of 100 Fpm. Face velocities will be checked weekly by NIS.

Glove boxes under negative pressure will be used where airborne material is actively generated, or where large quantities of material are handled such that ventilated hoods would not be adequate.

Fire prevention and the potential for generating explosive atmospheres will be considered in ventilation design. *

4.4.3 Exhaust Air Cleaning

Air effluents from process areas and process equipment involving uranium in a dispersible form will be subject to air cleaning. Exhaust air cleaning will include use of high efficiency filters except where the effluents, evaluated individually, do not contribute significantly to the total emission. All exhaust stacks will be continuously monitored.

Air cleaning equipment that may be used is:

a. Cyclone Collectors.
Used to remove particulates from exhaust streams that are heavily loaded.

b. High Efficiency Particulate Air Filters.
Used in the majority of cases for highest efficiency air cleaning, normally in conjunction with roughing filters to extend useful life and improve reliability.

c. Wet Scrubbers.
Used to clean heavily loaded air streams that are not suited, due to air quality or temperature, to other cleaning methods.

d. Dry Scrubbers.
Used primarily for cleaning air streams containing corrosive agents that render wet scrubbing impractical.

e. Fabric Filters.
Normally used in systems where material impinging on them can be returned to the process using reverse jet, pulsed air or other dislodging methods.

f. Special Filters

Ceramic or metallic frit filters, usually an integral part of process equipment, may be used for special air cleaning requirements.

4.4.4 Liquid Effluents

Process waste and laundry water is transferred to a lagoon or liquid handling system prior to discharge. Where particulate contaminants constitute a significant radioactive component of the liquid, filtration may be required before discharge. The contamination level of these effluents is monitored.

Chemical processing of liquid wastes may be performed. Such treatment might include precipitation, co-precipitation, flocculation, sedimentation, or other appropriate removal techniques.

Untreated liquid effluents may originate from the following sources: storm drains, showers, change room floor drains, and lab sink drains. Disposal of lab analytical residues to the sink drains is not practiced, as they are recycled for recovery.

Liquid wastes from cleaning of glassware in the laboratory are discharged to the industrial waste drain system, which also carries equipment cooling water and serves as the storm drain system. The storm drain system discharges into the site pond which overflows to form the site creek. The overflow is continuously proportionately sampled and analyzed for gross alpha and beta activity.

4.5 Instrumentation

The minimum instrumentation required for operational surveillance is listed below. All instruments are calibrated quarterly or in accordance with the manufacturer's recommendations. The manufacturer's calibration of flowmeters, velometers, rotameters and orifices are used.

4.5.1 Nuclear Alarm System

The nuclear alarm system consists of gamma sensitive detectors, audible alarms and a remote indicator panel at the guard station. The requirements for this alarm system are:

a. Detector units shall have a pre-set alarm level of not less than 5 mR/hr or greater than 20 mR/hr.

b. Detector units shall also have a response time no greater than 3 seconds at a radiation level of 20 mR/hr.

c. Detectors shall be located so as to be capable of detecting and operating the alarm from an incident of the magnitude that would result in a gamma flux of 3×10^5 mR/hr one (1) foot from the source of radiation.

d. Detectors shall be installed within 120 feet of every location where 500 grams or more of Special Nuclear Material is handled, used, or stored.

e. Whenever possible, the location and spacing of the detectors is chosen to avoid the effect of shielding by massive equipment or materials. Low density materials of construction such as 2 x 4 stud construction walls, plaster or metal corrugated panels, asbestos panels, doors, panel walls and steel office partitions are disregarded in determining the spacing. The spacing is reduced where high density building materials such as brick, concrete, or cinder blocks shield a potential accident area from the detector.

4.5.1 Nuclear Alarm System (continued)

f. Calculations to determine adequate coverage through significant shielding materials is performed using the following formula:

$$I = \frac{Io\ (e^{-\mu t})}{d^2}$$

where: I = gamma intensity at the detector (minimum for claculations will be 20 mR/hr)

Io= Unattenuated gamma intensity one (1) foot from the flux source

μ = mass absorption cross section of the shielding material x density of the shield

t = thickness of shield in centimeters. Where angle of incidence θ is not 90° to the plane of the barrier, t will assume the dimension, csc θ t.

d = distance from source in feet.

Such calculations will not include the effect of broad beam attentuation.

g. The detector and alarm circuits shall be equipped with an auxiliary self starting diesel generator which will automatically supply power to the system in the event of disruption of primary power. This backup power system will be checked at least quarterly.

h. The system will be tested by sounding the alarm at least monthly and at the time of each practice evacuation drill.

4.5.1 Nuclear Alarm System (continued)

i. Automatic monitors shall give warning in case of any malfunction which renders the system inoperable.

j. The alarm shall be clearly audible in all portions of areas in which Special Nuclear Materials are handled, used, or stored and in all adjacent areas where significant exposure to radiation may result from an incident.

4.5.2 Alpha Counting System

Minimum detectability - 10 dpm

4.5.3 Alpha Survey Meters

Minimum counting efficiency - ~30% (calibrated to read 2 π)
Minimum Range - 0 - 100,000 counts per minute

4.5.4 Air Sampling Equipment

Lapel samples - ~ 2 liters per minute
Fixed air samples - ~ 10-100 liters per minute

4.5.5 Beta-Gamma Survey Meter

GM type with maximum window thickness of not more than thirty milligrams per square centimeter.

Minimum range - 0 - 60,000 counts per minute
0 - 20 mR/hr

4.5.6 Beta-Gamma Counting System

Minimum detectability - 200 dpm

4.5.7 Emergency Instrumentation

Emergency instrumentation is listed in Section 6.0.

4.6 Surveillance

4.6.1. Special Surveys

All non-routine operations not covered by operating procedures will be reviewed by NLS and a determination made by NLS if radiation safety monitoring is required. *

With the exception of incidents requiring immediate evacuation, spills or other accidental releases shall be cleaned up immediately. Criticality restrictions on the use of containers and water shall be followed at all times. The Foreman and NIS must be notified immediately of such incidents. Appropriate precautions such as use of respirators shall be observed.

4.6.2 Routine Surveillance

Surveys shall be conducted on a regularly scheduled basis consistent with plant operation and survey results. The frequency of survey depends upon the contamination levels common to the area, the extent to which the area is occupied, and the probability of personnel exposures. The minimum frequency for contamination surveys in plant operating areas will be monthly. Clear areas with high potential for tracking of contamination will be surveyed more frequently. Areas with a low use factor will be surveyed less frequently. *

4.6.3 Surface Contamination

Corrective action and/or cleanup is initiated when contamination exceeds the action levels. The frequency of surface contamination surveys is determined as specified in Section 4.6.2.

4.6.4 Airborne Concentrations in Restricted Areas

a. Airborne levels in excess of 25% of the maximum permissible concentration require posting in accordance with 10CFR20 and an investigation of the causes.

b. Airborne levels in excess of the maximum permissible concentration require exposure evaluation. Controls to restrict the personnel to 40 MPC-hours per week shall be required.

c. Air sampling will be performed using fixed sample stations and lapel type samplers.

4.6.5 Air Sampling Criteria

The type of air sample collected at a specific operation or location will depend on the type, frequency, and duration of operations being performed. One or more of these sample methods will be employed at intervals prescribed by the NLS Supervisor. General criteria for sampling are:

a. Fixed sample stations will be used where uranium handling operations are pursued for extended periods of time, or where short term operations occur frequently. These samples will be located as near as practical to the breathing zone of the person performing the operations. Fixed sampling may

4.6.5 Air Sampling Criteria (continued)

a. also be used for investigative purposes. In this case, the samples are located near the point of suspected release of material.

b. Lapel samplers are the primary means of determining exposures. The sample head shall be attached to the lapel or upper torso as close to the breathing zone as practical. The resulting data is used to demonstrate that operator exposures are within acceptable limits. *

c. Emphasis will be placed on sampling new operations or processes until adequate, effective, control of airborne contamination is assured.

4.6.6 Air and Gaseous Effluents

Exhaust air effluent from process areas and process equipment will be sampled continuously during operations. These stack samples will be changed once per day. All samples will be counted after suitable delay for decay of radon daughters, and the results evaluated. MINIMUM ANALYSIS FREQ. WEEKLY FOR GROSS α, IF > TABLE II, COLUMN I, APP. B, EXCEEDED FOR TWO WEEKS, CAUSE WILL BE INVESTIGATED AND CORRECTIVE ACTION TAKEN. LICENSE COND. IS

Effective air control by ventilation systems will be assured by face velocity checks performed at least weekly. These checks may be supplemented by pressure drop measurements across air cleaning devices or inspection of such devices

4.6.6 Air and Gaseous Effluents (continued)

for continued integrity or loading that would impair their effectiveness. When ventilation control suffers or effluent concentrations rise, cleaning devices will be cleaned or replaced.

4.6.7 Liquid Effluent Sampling

Levels of contamination in liquid effluents are measured by representative grab sampling of batch discards, by proportional sampling of continuous discharges, or both. Samples will be collected at or prior to the point of discharge from the waste handling system.

Samples will be analyzed for alpha and beta activity. Where liquid wastes are discharged into a river or stream, a grab sample shall be collected at least monthly from above and below the plant outfall.

LIC. COND. 16 LIQUID EFFLUENT MONITORING PROGRAM WILL BE AS SPECIFIED IN SEC. 5.1.1 AND SEC. 5.1.3.2 OF ENV. IMPACT INFO. DOC. DATED JUNE 1975. SEE ATTACHED PGS.

4.6.8 Environmental Surveillance Program *

The minimum environmental surveillance program will consist of the following samples:

LICENSE COND. 17 A SOIL & VEGETATION MONITORING PROGRAM AS SPECIFIED IN SEC. 5.1.3.3 ENV. IMPACT INFO. DOC. AS MODIFIED BY COND 18. SEE ATTACHED PGS.

LICENSE COND. 18 SAMPLING STATIONS #13 & 15 IN FIG. 5-3

4.6.8 Environmental Surveillance Program

Sample Type	Frequency	Location	Analyses
Air	Daily: when plant is running	All exhaust stacks	Gross Alpha
Liquid	Weekly	Site Dam	Gross Alpha Gross Beta
Liquid	Monthly	Joachim Creek, Above and below site creek outfall	Gross Alpha Gross Beta
Liquid	Quarterly	Joachim Creek at site creek outfall	Gross Alpha Gross Beta
Liquid	Quarterly	Site Dam	Chemical Water Quality
Soil and Vegetation	Quarterly	4 locations surrounding plant	Gross Alpha Gross Beta
Vegetation	Quarterly	As above	Fluorine *

Additional samples will be taken as required for special studies and evaluations.

5.0 NUCLEAR MATERIAL MANAGEMENT

The Combustion Engineering - Hematite "Fundamental Nuclear Material Control Plan", and other Nuclear Material Management information, has been submitted to the NRC Division of Safeguards.

6.0 EMERGENCY PROCEDURES

Written emergency plans and procedures will be maintained and communicated to all personnel in Nuclear Fuel Manufacturing-Hematite. These plans and procedures will adhere to the requirements of Annex B, "Minimum Requirements for Licensee's Plans for Coping with Radiation Emergencies". *

6.1 Organization

The emergency plan establishes an organization for coping with radiation and other emergencies. Specific authorities, responsibilities, and duties are clearly defined and assigned. Persons assigned specific authority and responsibility are initially qualified and will be periodically trained so that they can continue to properly fulfill their duties. The means of notifying persons assigned to the organization in the event of an emergency and the means of notifying appropriate local, state, and Federal agencies so that emergency action beyond the site boundary may be taken will be specified.

6.2 Notification Lists

A list of employees assigned to the emergency organization will be maintained, as well as a list of other employees who have any special qualifications for coping with emergency conditions. A similar list will be made of other persons whose assistance may be needed. The special qualifications of these employees and persons will be specified. All of the foregoing lists will be available to the individuals responsible for directing the action necessary to cope with the emergency.

6.3 Procedures

Emergency procedures will include the actions planned to protect the health and safety of individuals and to prevent damage to property in the event of various types of emergencies that can be anticipated, i.e., internal accidents such as criticality, fire, and explosions, and natural occurrences such as floods, tornadoes, and earthquakes.

The procedures will include the means for determining:

a. The magnitude of the release of radioactive materials, including guidelines for evaluating the need for notification and participation of local, state and Federal agencies.

b. The type and extent of protective action to be taken within and outside the site boundary to protect health and safety and prevent damage to property.

6.4 Recovery and Re-entry

The post-accident recovery and re-entry actions will be specified, including guidelines for implementing these actions which will include:

a. Corrective actions that may be necessary to terminate or minimize the consequences of the accident.

6.4 Recovery and Re-entry (continued)

b. Criteria for plant re-entry.

c. Securing the accident area from inadvertent or unauthorized re-entry.

d. Resumption of operations.

6.5 Outside Support

Procedures will be specified for notifying and agreements to be reached with local, state, and Federal officials for the early warning of the public and for appropriate protective measures should such measures become necessary or desirable.

6.6 Up-dating Provisions

Provisions will be made for maintaining up-to-date;

a. The organization for coping with emergencies.

b. The procedures for use in emergencies.

c. The lists of persons with special qualifications for coping with emergency conditions.

6.7 Emergency First Aid

The procedures will contain specifications for emergency first aid and personnel decontamination facilities, including:

a. Identification of individuals directly involved in the accident.

b. Equipment at the site for personnel monitoring.

c. Facilities and supplies at the site for decontamination of personnel.

d. Facilities and medical supplies at the site for appropriate emergency first aid treatment.

e. Arrangements for the services of a physician and other medical personnel qualified to handle radiation emergencies.

f. Arrangements for transportation of injured or contaminated individuals to treatment facilities outside the site boundary.

6.8 Medical Treatment

Arrangements will be made for medical treatment of individuals at facilities outside the site boundary.

6.9 Periodic Drills

Provisions will be made for testing, by periodic drills, of radiation emergency plans to assure that employees of the

6.9 Periodic Drills (continued)

licensee are familiar with their specific duties. Provisions for participation in the drills by other persons whose assistance may be needed in the event of a radiation emergency will be included.

6.10 Training

Provisions will be made for training, including persons other than employees whose assistance may be needed in the event of a radiation emergency.

6.11 Emergency Equipment

Provisions will be made for maintenance and storage of emergency equipment, considering the various types of accidents that can be anticipated, also, the performance criteria of the various types of equipment.

7.0 TRANSPORTATION AND STORAGE

This section describes the packages, handling and administrative procedures applicable to the shipment of Special Nuclear Material, and the storage of packages and inprocess material.

7.1 Shipping Standards

7.1.1 Purpose

a. To assure compliance with all C-E local, state and Federal criteria, restrictions or regulations concerning the shipment of SNM.

b. To outline periodic inspection criteria to insure that shipping containers meet approved standards.

c. To list records and reports required.

7.1.2 Container Inspection

Prior to each use of any container, the container is inspected to insure that:

a. It has not been significantly damaged.

b. Original design conditions approved by the NRC and DOT are maintained.

c. Marking and labeling is correct as required by the NRC and DOT approvals.

7.1.2 Container Inspection (continued)

Shipping and Receiving is responsible for this inspection. NIS overchecks as part of its audit function.

7.1.3 Records

A record of each shipment of SNM will be maintained for a period of at least 2 years. The record will include:

a. Identification of the container used by model number.

b. Details of any significant defects in the container, including the means used to repair the defects and prevent their recurrence.

c. Type and quantity of SNM in each package.

d. Total quantity of SNM in each shipment.

e. Date of shipment.

f. For Fissile Class III, any special controls exercised.

g. Name and address of the transferee.

h. Address to which shipment was made.

i. Results of inspection described in Section 7.1.2 above.

7.2 Shipping Containers

The following shipping containers will be used for the transportation of SNM:

Amendment No.		Model No.	Package ID No.		
71-28		UNC-2400	USA/5021/B( )F	—	—
71-32		UNC-2700	USA/5663/B( )F	6/3/77	
71-24		UNC-2900	USA/5667/B( )F		
~~71-30~~	6294	UNC-2901	USA/6294/B( )F		
	5419	UNC 2500	5419/B	7/3/71	7/31/75
	6300	UNC 1352	6300/B		

The use of these containers is subject to the conditions specified in the above listed amendments and this license application.

Other containers will be used under the general license provisions of 71.12(b) of 10CFR71. These containers include Models OR-30, 30A, 30B, and CE-250-2.

7.3 Handling of Shipments

SNM-bearing materials in authorized shipping packages may be stored in outdoor locations. Up to 100 transport units may be stored as an array, with 20' separation between arrays. Residues packaged and stored in Type A packaging may be assembled in arrays of unspecified size.

All packages will be sealed, monitored for contamination and labeled as to enrichment and quantity of SNM. All outside storage will be evaluated, and the adequate condition of the packages will be verified. In addition, routine checks on such storage will be made by NIS.

7.4 Damaged Containers

Containers received in a damaged condition will be held separate from other SNM. The contents will be removed under the direction of NIS.

7.5 Indoor Storage of SNM

7.5.1 Sample Storage

Racks for the storage of SNM samples in containers limited to 3.4 Kg U will be located along walls of non-process areas, such as labs, hallways, etc. These will be secured to the walls, and will provide a center to center spacing of at least one foot in both the vertical and horizontal direction. This assures a surface density of 3.4 Kg U/ft^2, the allowable limit, for 4.1% uranium. *

Such arrays will be isolated from other SNM. *

7.5.2 Storage of Sealed Containers

Sealed cans of UO_2 powder will be stored in square lattice arrays on the Building 255-3 floor. Each lattice position will be mass limited (with the enriched uranium, contained in two cans.) The lattice will have a minimum pitch of 1.87 ft., with spacing between cans assured by positive physical means using structual materials. The U-235 enrichment for this material is limited to 3.5%. Lower enrichments have higher allowed mass limits for each lattice position. This storage is based on the use of the surface density method where each mass limited unit is limited to a fraction critical of 0.3, and the array surface density is limited to 50% of the critical infinite slab surface density for optimum moderation, as discussed in Section 3.0. * *

7.5.3 Storage of In-Process Material

Several modes of storage for pails containing in-process material will be provided:

a. One storage system is intended for volume or mass limited SIUs, and has a maximum height of 7 feet. The blocks are of solid 10" thick concrete, having a minimum density of $125\#/ft^3$. Mortar is used to join the blocks and to secure the structure to the building wall. Steel shelves, of at least 16 ga. thickness are built into the structure with a vertical spacing of at least 16 inches. Each shelf measures 16" wide x 14" deep, and is lined on three sides with 1/4" thick mild steel. Section 9.0 provides the nuclear safety analysis which demonstrates that the spacing boundary can be spaced 48 inches from the front of the shelves.

   All pellets are contained in 3-1/2 gallon containers; homogeneous UO_2 is contained in 5-gallon containers. Thus, a vertical column of containers spaced on 16 inch centers provides an equivalent cylinder diameter of less than 9.5 inches for pellets, and 10.7 inches for homogeneous UO_2. Calculations supporting the use of this array are presented in Section 9.4.

b. Recycle storage systems consist of wall mounted storage positions for mass limited containers. These storage positions are on either 30" or 36" centers, with either two or three tiers of storage provided. Calculations supporting the use of the largest of these systems are presented in Section 9.5. *

7.5.4 Non-Process Storage

A portion of Building 251 is used for longer term storage of containers having a maximum capacity of five gallons. This storage consists of four planar arrays, each four tiers high, with 30" center-to-center spacing in both the vertical and horizontal plane.

Storage in this area is limited to dry UO_2 and sintered pellets, with each container limited to one mass SIU. The array calculation for this storage is provided in Section 9.0.

MAR 2 9 1977

SAFETY EVALUATION REPORT

SPECIAL NUCLEAR MATERIAL LICENSE RENEWAL

COMBUSTION ENGINEERING, INC.

HEMATITE, MISSOURI

Docket No. 70-36

License No. SNM-33

TABLE OF CONTENTS

Page

1.0 Summary & Conclusions....................1

2.0 Review Documents....................3

3.0 Facility Description....................5

4.0 Process Description....................5

4.1 UF_6 to UO_2 Conversion
4.2 UO_2 Pellet Fabrication
4.3 Support Operations

4.3.1 Recycle Operation
4.3.2 UF_6 Heel Removal

5.0 Analytical Services....................8

6.0 Facility Organization....................8

7.0 Radiation Safety Administration....................10

8.0 Nuclear Criticality Safety Administration....................11

9.0 Inspections, Audits and Reports....................11

10.0 Radiation Safety Controls and Monitoring....................13

10.1 Protective Clothing and Equipment
10.2 Ventilation
10.3 Penetrating Radiation
10.4 Airborne Radiation
10.5 Bioassay
10.6 Personnel Training

11.0 Nuclear Criticality Safety....................16

11.1 Nuclear Criticality Safety Demonstration
11.2 Nuclear Criticality Safety Requirements

12.0 Environmental Impact....................19

13.0 Environmental Monitoring....................20

13.1 Liquid and Solid Wastes
13.2 Airborne Radioactive Emission

14.0 Compliance Inspection History....................21

1.0 Summary and Conclusions

On August 21, 1975, Combustion Engineering (CE) applied for a renewal of Special Nuclear Material License No. SNM-33, which authorizes uranium fuel processing at their Hematite, Missouri facility. In support of their request for a license renewal CE submitted an Environmental Report and a completely revised license application.

The environmental aspects of this license renewal action have been assessed by the staff and documented in an environmental impact appraisal. On the basis of this appraisal, the staff has concluded that the environmental impact created by the license renewal action is of a magnitude not warranting an environmental impact statement. A negative declaration to this effect will be issued in November, 1976.

The affects of all credible accidents, including accidental nuclear criticality, have been addressed in the environmental impact appraisal and will not be duplicated in this report.

Upon completion of the safety review of the application, subsequent submittals, and the operating history of the facility, as reflected by inspection reports, the staff conculdes that the criteria of Sections 70.33 and 70.35 of Title 10, Code of Federal Regulations, have been met. Section 70.33 of the Regulations state certain requirements of the applicant for the renewal of a special nuclear material license. Section 70.35 states the criteria the Commission will apply in considering an action to renew a license.

The following sections 6 through 10 and 13 contain commitments made by the licensee in their application, dated August 21, 1975, and supplements dated February 23, 1976, March 3, 1976, June 15, 1976, and August 2, 1976, which demonstrate the licensee's intention of meeting the requirements necessary for a favorable licensing action.

The staff recommends that Combustion Engineering be issued a full term renewal of Special Nuclear Material License No. SNM-33 subject to the conditions listed below:

1. Special Nuclear Material shall be used in accordance with statements, representations, and conditions contained in Sections 2, 3, 4, 6, 7 and 8 of the licensee's application. Effective pages of these sections are listed in the licensee's submittal dated August 2, 1976.

2. Pursuant to Section 20.103(c)(1) and (3), 10 CFR Part 20 the licensee is hereby authorized to make allowance for the

use of respiratory protective equipment in determining whether individuals in restricted areas are exposed to concentrations of airborne radioactivity in excess of the limits specified in Appendix B, Table 1, Column 1, 10 CFR 20, subject to the conditions specified in Annex A.

3. The licensee shall develop and maintain an emergency plan and implementing procedures in accordance with the conditions specified in Annex B.

4. The volume limit on stacked units stated in the list line of page 9-52A of the application document shall also apply to Table 3-3 on page 3-6.

5. Regarding Section 4.6.6 of the application document, the licensee shall analyze the samples collected from process area and equipment stacks for gross alpha and beta at least on a weekly frequency. In addition, if results, averaged over a two week period, exceed the applicable limits listed in Table II, Column 1 of 10 CFR 20, Appendix B, the licensee shall investigate and take corrective action.

2.0 Review Documents

The following items were reviewed in the preparation of this safety evaluation report. They constitute the material submitted as, or in support of, the subject application:

* Letter and supporting documents, Combustion Engineering (CE) to NRC dated August 21, 1975, applying for a full term license renewal.
* Letter, NRC to CE dated December 2, 1975, requesting additional information.
* Letter CE to NRC dated February 23, 1976, transmitting a partial response to the NRC request for information dated December 2, 1975.
* Letter, CE to NRC dated March 3, 1976, transmitting a partial response to the NRC request for information dated December 2, 1975.
* Letter, NRC to CE dated May 6, 1976 requesting additional information.
* Letter, CE to NRC dated June 15, 1976, transmitting information requested by the NRC on May 6, 1976.
* Letter, CE to NRC dated July 26, 1976, providing revision in the radiation safety and criticality control personnel and programs.
* Letter, CE to NRC dated August 2, 1976, transmitting information requested by the NRC on May 6, 1976.

3.0 Facility Description

The 152 acre CE Hematite site is located in Jefferson County, Missouri, approximately 35 miles south of St. Louis. Festus-Crystal City, Missouri, is the nearest town of any size, located 3.5 miles east of the site with a population of approximately 11,000. All manufacturing operations are carried out within a fenced-in tract in the central portion of the site. Activities utilizing radioactive materials are housed in several buildings containing equipment for conversion of UF6 to UO2, fabrication of UO2 nuclear fuel pellets and related processes.

This facility has been in operation since 1956 when it was owned by United Nuclear Corporation. Then in 1971 the facility became part of Gulf United Nuclear Fuels Corporation, containing the same operations. In 1974, Combustion purchased the site and continued operating only a portion of the previously authorized activities. All operations are now limited to uranium having a maximum enrichment of 4.1 W/o U_{235}.

4.0 Process Description

Operations involve two main process lines, low enriched UF_6 conversion to UO_2 and UO_2 pellet fabrication, and their support activities.

UF_6 is received in standard 2 1/2 ton cylinders in approved shipping packages. Upon receipt, the cylinders are placed in the UF_6 cylinder storage area which holds up to 49 cylinders. As required, a UF_6 cylinder is removed from storage and connected to the conversion line.

The UF is vaporized by heating the cylinder in a steam chamber. Vaporized UF_6 is then introduced into the first of a series of three reactor vessels where it is hydrolyzed with steam in a nitrogen atmosphere to create UO_2F_2. In the other two vessels the UO_2F_2 is contacted with dissociated ammonia in a nitrogen atmosphere and phrohydrolyzed to UO_2.

The UO_2 is then milled and blended prior to pelletizing.

4.2 UO_2 Pellet Fabrication

UO_2 powder is transferred to a V-blender to be mixed with binders to agglomerate the material. The clumps of material are then granulated to 20 mech or smaller by forcing the material through a screen. Granulated material is preumatically transferred to feed hoppers mounted on pellet pressers. Following pressing the pellets are moved manually to the dewaxing furnace, and again moved manually to the sintering furnace where they achieve the necessary ceramic properties.

4.1 UF_6 to UO_2 Conversion

This system is designed to convert uranium hexafluoride to UO_2 powder suitable for pressing into fuel pellets. The conversion is by the "dry process" as opposed to the conventional "wet process" utilized by the industry.

Sintered pellets are transferred to the grinder feed system and ground under a stream of coolant. Grinder sludge is removed by a centrifuge and stored in mass limited safe individual units.

Properly sized pellets are transferred on a conveyer to trays which are then moved to the inspection area. After inspection the pellets are packaged for shipment.

Finished pellets are shipped to Combustion's Windsor, Connecticut facility to be used in the manufacture of fuel elements for power reactors.

4.3 Support Operations

Support operations include two relatively major activities, recycle operations and UF_6 heel removal.

4.3.1 Recycle Operations

All clean scrap is accumulated for reprocessing and recycle with feed material. Scrap may be milled to yield desired particle size best suited for reprocessing, oxidized and reduced to assure removal of volatile additives and to achieve the desired ceramic properties of the resulting recycle UO_2, and blended to assure uniformity.

4.3.2 <u>UF_6 Heel Removal</u>

Prior to return for refill, 2 1/2 ton cylinders may be washed to remove the UF_6 heel. This is performed when the uranium content of the heel doesnot exceed 50 lbs. Cylinders are washed by introducing four gallons of water, rolling on a roller, and pumping the resulting solution into a five gallon pail. The pail is then transferred to approved storage. These steps are repeated until the heel is removed.

5.0 Analytical Services

Analytical services are provided in several laboratory areas. The laboratories are divided into sections consistent with the testing techniques employed. There are a general lab are, physical testing are, office area and storage.

6.0 Facility Operations

All Hematite site activities are conducted under the direction of Nuclear Power Systems Manufacturing, a part of the Nuclear Power Systems Division, headquartered in Windsor, Connecticut. The Hematite Plant Manager reports to the General Manager-Nuclear Fuel Manufacturing.

Production and safety functions are split into two distinct organizations reporting to the Plant Manager-Hematite.

The Production Superintendent who reports directly to the Plant Manager, is responsible for the operating and maintenance functions. The Production Superintendent directly supervises the Shift Foremen and the Maintenance Supervisor.

The minimum qualifications for the position of Plant Manager and first line management are: a college degree in a technical field and two years experience in the nuclear industry; or a high school degree and ten years experience in the nuclear industry.

The Nuclear Licensing Safety Supervisor, who reports directly to the Plant Manager, is responsible for the administration of the nuclear and industrial safety programs.

The minimum qualifications for the position of NLS Supervisor are: a degree in science or engineering, and five years experience in a responsible position in the nuclear industry, at least three years which have been in an activity which involved nuclear criticality safety and health physics evaluations.

The position Nuclear Criticality Specialist-Hematite is a staff position reporting to the Plant Manager and provides the following support:

1) Technical services related to nuclear criticality safety.
2) Systematic auditing of plant operations to assure adherence to criticality control procedures.

The minimum requirements for the position Nuclear Criticality Specialist-Hematite are: a degree in science or engineering and at least three years experience in plant nuclear criticality safety.

7.0 <u>Radiation Safety Administration</u>

The NLS Supervisor is responsible for the implementation of the radiation safety and environmental monitoring programs and directly supervises the activities of the NLS technicians. AT least one NLS technician is on duty during all operating periods.

The NLS Supervisor approves by signature all operating procedures. He assures that the procedures contain all applicable radiation safety requirements including protective equipment and warnings.

8.0 Nuclear Criticality Safety Administration

NLS Department approval on equipment and operating procedures is identified by signature of the NLS Supervisor on all operating procedures involving SNM and the criticality sings located at every work station. This approval shall only be granted when specific approval had been granted by the NRC or whenever an internal approval, outlined in Section 2.5 of the license document, had been granted.

The internal approval procedure calls for a criticality evaluation by the NLS Supervisor and a review of the evaluation by the Nuclear Criticality Specialist and the Nuclear Licensing & Safety Supervisor-Windsor. The initial evaluation and reviews are limited to the criteria and standards listed in Section 3.0 of the license document.

9.0 Inspections, Audits, and Reports

Daily checks of radiation safety and criticality control practices are made by the NLS Technicians during the course of their regular duties.

Weekly criticality and radiation safety inspections are performed by the NLS Supervisor. Results of the inspections are included in the NLS monthly report.

Monthly inspections are performed by the Nuclear Criticality Specialist covering all phases of nuclear criticality safety and control, including results of previous inspections and follow-up actions taken.

Semi-annual inspections are performed by the NLS Supervisor-Windsor and the Windsor Nuclear Laboratory Radiological Safety Officer. These inspections include a performance review of the radiation safety programs, as well as a plant inspection to observe for items requiring corrective actions.

Both the monthly and semi-annual inspections are documented by reports distributed to the General Manager and Plant Manager. The Production Superintendent and NLS Supervisor are responsible for any required corrective action.

An annual audit of the entire radiation safety and criticality control program is performed by a team appointed by the Vice President-Nuclear Fuel. Included in the audit is an ALARA evaluation which will be part of the audit report to the Vice President.

10.0 Radiation Safety Controls and Monitoring

10.1 Protective Clothing and Equipment

The facility is zoned to define contamination areas. Protective clothing is provided for and required in the contamination areas. Shower, sink, and change facilities are provided for employee's use upon entering or exiting the contamination area. An alpha survey meter is also provided at the exit for employee's use.

Respirators are provided for use when required. The licensee provides training and maintenance in conformance with Annex A specifications.

10.2 Ventilation

Air flow is from areas of lower to areas of higher contamination. Hoods, glove boxes, and local exhausts are used to control contamination and airborne concentrations.

All dispersible forms of uranium are handled in ventilated enclosures having sufficient air flow to assure minimum face velocities of 100 FAM. Face velocities are checked weekly by NLS.

Glove boxes under negative pressure are used where airborne material is actively generated, or where large quantities of material are handled such that ventilated hoods are not adequate.

10.3 Penetrating Radiation

Personal monitoring badges are supplied to all personnel who work regularly in the process area.

10.4 Airborne Radiation

Airborne radiation sampling is performed using both fixed sample locations and lapel samplers. The type of air sample collected at a specific operation depends on the type, frequency, and duration of the activity being performed.

Fixed sample stations are used where uranium handling operations are pursued for extended periods of time, or where short term operations occur frequently.

Lapel samplers are used to provide individual exposure evaluation. Each operator wears a lapel sampler at least twice a week during normal operations.

10.5 Bioassay

A urinalysis program is conducted in conformance with Regulatory Guide 8.11. In vivo measurements for uranium are performed on an annual frequency for all personnel working regularly in the process area.

10.6 Personnel Training

New employees receive a formal indoctrination in the safety aspects of the facility, covering nuclear criticality safety, radiation safety, industrial safety, and emergency procedures. After determining, by testing, that a new employee has attained sufficient knowledge in the above topics, adequate performance is monitored by his foreman and NLS.

The training program is continued on a permanent basis by regularly scheduled meetings conducted by line supervision and specialists in the subjects covered.

Foremen receive a formal course in radiation safety and criticality control to enable them to carry out their training and supervisory functions. Levels of attained knowledge in these areas are determined by written tests.

11.0 Nuclear Criticality Safety

The conclusion that the nuclear criticality safety controls are satisfactory is based on two types of information:

1) The bases for the nuclear criticality safety of the currently authorized activities as specifically described in the safety demonstration, and the history of successful operation.

2) The margins of safety provided by the nuclear criticality safety criteria to be aplied as changes are made in accordance with the license conditions, and the ease of applying the criteria. (This discussion concerns the technical criteria; the adequacy of the administrative arrangements for applying the criteria is discussed under Section 8.0.

11.1 Nuclear Criticality Safety Demonstration

Nearly all of the processing or storage operations under the license have been reviewed, approved and conducted for over five years. Generally, the safety of the individual process or equipment pieces is based on favorable geometries or masses using accepted safe values for conditions of optimum moderation and reflection. These safe values are derived from critical values by using a factor of 0.435 for masses and 0.9 or less for linear dimensions. The interaction between units is analyzed using the solid angle method. For equipment of unusual geometry and/or not based on optimum moderation or reflection, primarily two types of proprietary items in the Semi Works Oxide Pellet Plant (SWOPP), special analyses were made and independently confirmed by AEC.

The applicant's modified solid angle analysis for the new Building 251 sotrage array was checked and was then independently confirmed by NRC using KENO. (The solid angle analysis assumed that those units would be isolated where the straight line between units intercepted 16 inches or more of concrete.)

11.2 Nuclear Criticality Safety Requirements

The nuclear criticality safety criteria to be applied under the license are embodied in three tables of limits. Tables 3.1 and 3.2 given in Section 3 of the license provide specific limits of mass or geometry for isolated units or interacting units, respectively, while Table 3.3 provides the spacing requirements to be met in fulfillment of the surface density method for limiting interaction. The specific values in Tables 3.1 and 3.2 have all been confirmed by appropriate calculations using accepted documents such as DP-1014* as a source of the criticality data. The area requirements of Table 3.3 have been found to meet the nominal criteria of 0.25 of the uniform slab critical thickness value for the geometry limited units and 0.5 of the minimum critical mass per unit area for the mass limited units.

The aforementioned surface density criteria are based on numerous KENO calculations and other analyses reported in the literature. The surface density criteria are easy to apply and, as noted under Section 8.0, the administrative procedures require that the application of the criteria be subject to independent review by competent personnel before changes are made.

* DP-1014, "Critical and Safe Masses and Dimensions of Lattices of U and UO_2 Rods in Water," by H. K. Clark, Feb. 1966.

To allow for the use of slab geometries where the slabs fail to lie in a single plane, the applicant has analyzed the effect of displacement of slab sections. The applicant's conclusion permitting some displacement of slab sections was independently confirmed by NRC calculations.

The applicant's analysis for stacked units of limited mass, volume and spacing was also confirmed by independent calculations. The keff for an array of 5-unit tiers of 20-liter spheres of moderated 4% enriched oxide, infinite in x and y directions, spaced as required, concrete reflected, was found to be 0.877 at the 95% confidence level. The result should be conservative since the units exceed the mass limit by a factor of approximately 2.

12.0 Environmental Impact

Since the initial operation of the facility in 1956, periodic environmental sampling, including liquid and airborne effluent, has been performed. The analytical results of these samples have been submitted to the NRC as part of an Environmental Report (ER) dated June 1975.

As a result of the review of the ER and subsequent information provided by CE and independent staff analysis, the NRC has prepared an environmental impact appraisal for the proposed renewal of Special Nuclear Material License No. SNM-33. On the basis of this appraisal, the Commission has concluded that the environmental impact created by the renewal of the license is of a magnitude not warranting an environmental impact statement, and that a negative declaration to this effect is appropriate.

13.0 Environmental Monitoring

13.1 Liquid

Process liquid wastes and laundry water may undergo chemical treatment if the amount of contained uranium warrants it. Such treatment might include precipitation, flocculation, sedimentation, or other appropraite removal techniques. After processing the liquid waste is transferred to the site pond.

Untreated liquid effluents sent directly to the site pond may originate from: storm drains, showers, change room floor drains, lab sink drains, equipment, cooling water, etc.

The overflow from the site pond into the site creek is continuously sampled and analyzed for gross alpha and beta activity on a weekly basis.

A grab sample is taken from the Joachim Creek above and below the site creek outfall on a monthly basis and analyzed for gross alpha and beta.

13.2 Airborne Particulate Effluent

Exhause air effluent from process areas and process equipment are sampled continuously during operations. These stack samples are changed daily and counted for gross alpha and beta at least on a weekly basis. If results exceed the applicable limits listed in Table II, Column 1 of 10 CFR 20, Appendix B averaged over a two week period, the licensee investigates and takes corrective action.

Soil and vegetation samples are collected from flow locations surrounding the plant on a quarterly basis. The samples are analyzed for gross alpha and beta. In addition the vegetation samples are analyzed for fluoride content.

14.0 Compliance Inspection History

The initial nuclear safety inspection of this facility since the license was transferred to CE, took place on September 4-6, 1974. Subsequent reinspections have been performed on approximately a semi-annual basis, the last being in August 1976.

During the period of operation by the current license there have been no recurring items of non-compliance that would show a basic flaw in their safety programs. Deficiencies have been noted in the areas of: employee training records, operating procedures, criticality analyses, SNM storage, and SNM shipping records. All of these deficiencies were corrected by the licensee and covered adequately in the revised license application document in support of their license renewal application.