SAFETY EVALUATION REPORT
BY THE
DIVISION OF FUEL CYCLE AND MATERIAL SAFETY
RELATED TO THE
NRC SPECIAL NUCLEAR MATERIAL LICENSE RENEWAL
FOR THE
COMBUSTION ENGINEERING
NUCLEAR FUEL MANUFACTURING FACILITY
HEMATITE, MISSOURI
DOCKET 70-36
LICENSE NO. SNM-33

December 30, 1983

H-29

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I. INTRODUCTION

A. General

The Combustion Engineering (Combustion) facility at Hematite, Missouri, is devoted to the production of fuel for eventual encapsulation in fuel assemblies for light-water-moderated power reactors. The plant has been operated under license by Combustion since 1974. The current possession limits include 4100 kilograms of U-235 contained in uranium enriched to not more than 4.1 w/o U-235, 350 grams U-235 of any enrichment, and 20,000 kilograms of thorium or unenriched uranium.

B. Location Description

The Combustion site is located approximately 35 miles south of the city of St. Louis, Missouri. The plant is situated about 3/4-mile northeast of the unincorporated town of Hematite. About 3% of the 152 acre site is being used for licensed activities. Figure 1 shows the geographical location of the site near the town of Hematite. Figure 2 shows the relative locations of buildings and facilities on site.

C. License History

The Combustion facility was originally built by Mallinckrodt Chemical Works and produced high- and low-enriched uranium compounds from UF_6. The AEC issued Materials License SNM-33 for the facility in March 1956. After a number of owners, Combustion bought the facility in March 1974 and the license was transferred to Combustion in July 1974.

On August 21, 1975, Combustion applied for renewal of SNM-33. The license was renewed on March 31, 1977 and limited the production of compounds of uranium enriched to not more than 4.1 w/o U-235. Since renewal, the license has been amended nine times to authorize the incineration and wet

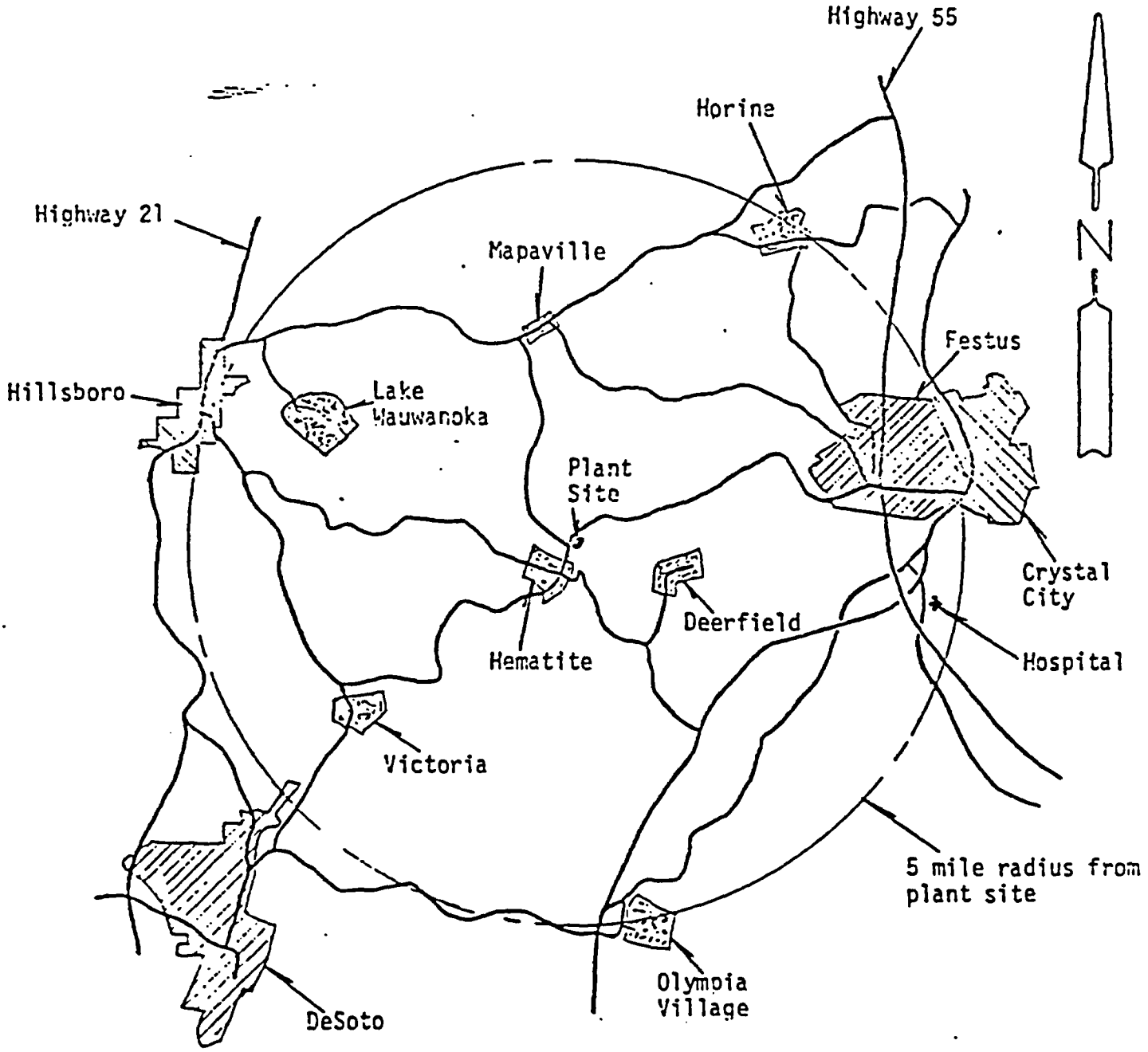


Figure 1

Area Within 5 Mile Radius
of Combustion Engineering Plant
Site

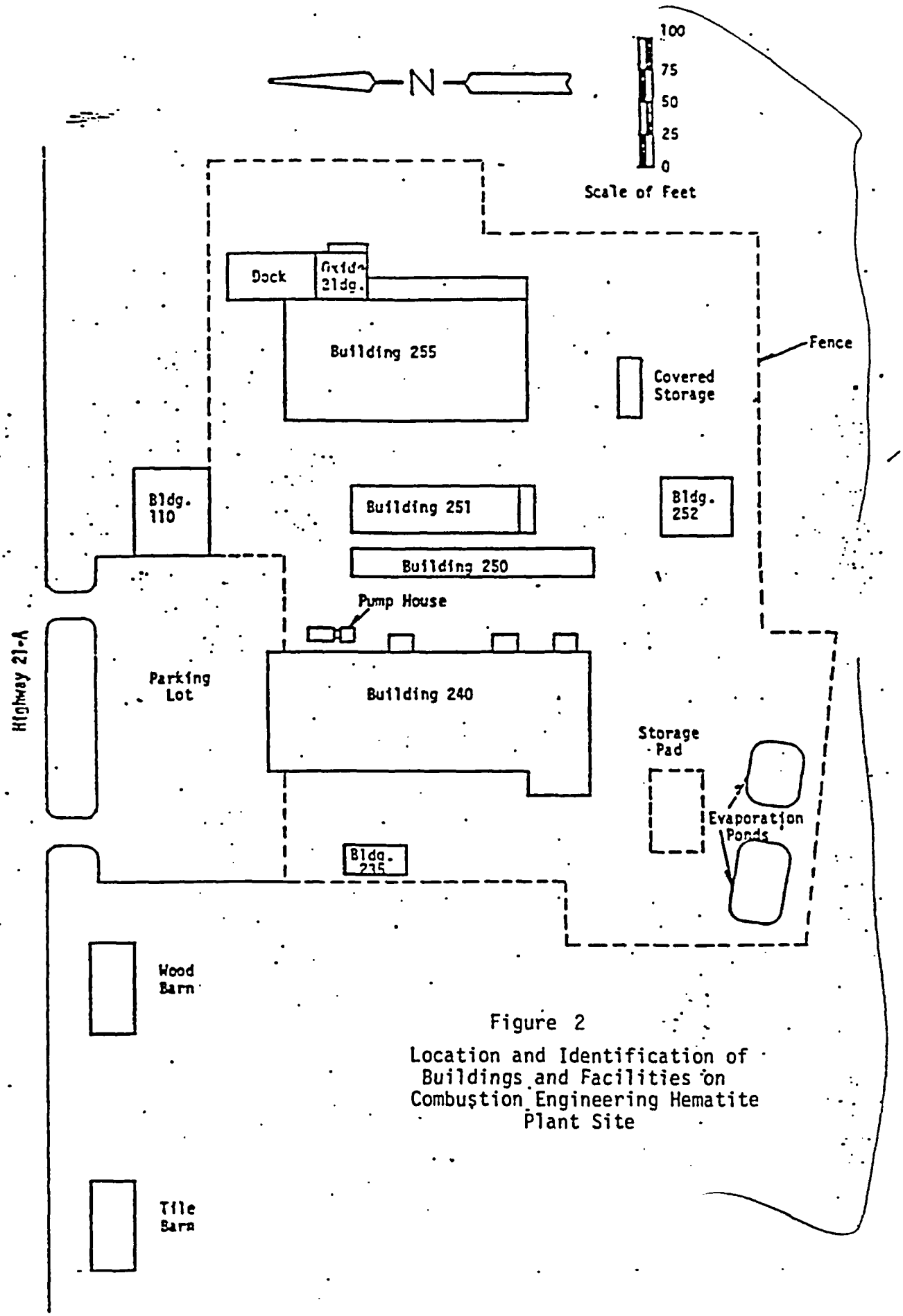


Figure 2

Location and Identification of Buildings and Facilities on Combustion Engineering Hematite Plant Site

scrap recovery, to impose action levels related to gaseous effluents to assure compliance with the requirements of EPA's 40 CFR 190, and to approve a radiological contingency plan for the site.

II. AUTHORIZED ACTIVITIES (PROPOSED)

A. General Summary

The renewal license will authorize Combustion to perform the following activities:

1. Processing Uranium Enriched Up to 4.1 w/o in U-235

The license will authorize dry fluid bed conversion of UF_6 to UO_2 powder, manufacture of UO_2 pellets, uranium recovery of onsite generated scrap, laboratory operations, incineration of uranium-bearing combustible waste, and effluent treatment.

2. Use of Uranium of Any Enrichment

The license will authorize use of enriched uranium for laboratory standards.

3. Processing Source Material

The license will authorize the same activities as for uranium enriched up to 4.1 w/o in U-235 and for new process testing.

4. Cobalt-60

The license will authorize possession and use of sealed sources for instrument calibration and testing.

B. Process Description

The main process operations are (a) conversion of UF_6 to UO_2, (b) pellet fabrication, (c) scrap recovery, and (d) waste disposal.

1. Conversion of UF_6 to UO_2 - The process of chemically converting uranium fluoride to uranium dioxide is carried out in process lines which use a proprietary, direct conversion dry fluid bed process. The operation is conducted in closed vessels, generally cylindrical vessels of limited size, designed to enhance nuclear criticality safety.

   UF_6 is received in standard 2½-ton cylinders inside protective overpacks. The cylinders and overpacks have been approved by the NRC and DOT for the shipment of UF_6. As needed, the cylinders are moved into one of two steam chambers located on the Oxide Building dock. Inside the Oxide building, the vaporized UF_6 passes through metering valves and, along with a carrier gas, is transported directly to the conversion reactor where UF_6 and steam are mixed to produce UO_2F_2. In the other two reactors, the UO_2F_2 is reduced to UO_2 by contact with cracked ammonia. The UO_2 is stored, blended, and either packaged for shipment or transferred to the pellet fabrication process area.

2. Pellet Fabrication

   Dry powder is agglomerated, granulated, and fed to the pellet press. Pressed pellets are dewaxed, sintered, and processed through a grinder and packaged for shipment.

3. Scrap Recovery

   Clean scrap is treated to achieve the desired ceramic properties and recycled with other feed material. Wet recovery of other scrap-contaminated material, residues, combustibles, and UF_6 cylinder wash water includes oxidation, reduction, dissolution, filtration, precipitation, and drying of UO_4 product. This material is then processed as clean scrap.

4. Waste Disposal

Laundry water and cooling water are treated and discharged to the industrial waste system via the storm drain which discharges into the site pond. Sanitary waste liquid effluent enters the site creek below the pond. Mop water is evaporated for uranium recovery. Process water from wet scrap recovery is evaporated; the evaporator bottoms are solidified for shipment to licensed burial.

Contaminated combustible wastes are volume reduced in a gas-fueled incinerator or oxidized in the scrap recovery plant. The residues are treated for uranium recovery and/or shipped to a licensed burial facility. Bulky items are placed in boxes for shipment to burial.

Gaseous effluents from the UF_6 conversion process are passed through packed towers, containing limestone rock, to remove the hydrofluoric acid and trace quantities of uranium.

The limestone rock is converted to calcium fluoride which is disposed of as onsite landfill material. Contaminated limestone is stored onsite.

Nonradioactive solid waste is sent to a commercial waste firm.

III. POSSESSION LIMITS (PROPOSED)

Material	Form	Quantity
Uranium enriched to maximum 4.1 weight percent in the U-235 isotope	Any, excluding metal	8000 kg contained U-235
Uranium, any U-235 enrichment	Any, except metal powder	0.35 kg U-235
Source Material	Any uranium and/or thorium, except metal powder	20,000 kg
Cobalt-60	Sealed Sources	40 millicuries, total

IV. FACILITIES

Authorized activities are to be conducted in the following buildings and facilities on the Hematite site:

Number	Name	Present Utilization
101	Tile Barn	Emergency center and equipment storage
110	New Office Building	Guard station and offices
120	Wood Barn	Equipment storage
-	Oxide Building and Dock	UF_6 to UO_2 conversion, UF_6 receiving
235	West Vault	Source material storage
240	240-1	Offices and cafeteria
	240-2	Recycle and recovery area
	240-3	Incinerator and storage
	240-4	Laboratory and maintenance shop
250	Boiler Room and Warehouse	Steam supply and storage
251	Warehouse	Shipping and receiving, storage
252	South Vault	Radioactive waste storage
255	Pellet Plant	Pellet fabrication, storage and packaging.

V. RENEWAL APPLICATION

A. Review History

The safety review of Combustion's renewal application included:

1. Renewal application dated February 26, 1982.
2. Supplement dated July 21, 1982. (Revision of proprietary pages.)
3. Supplement dated February 21, 1983.
4. Supplement dated July 8, 1983.
5. Compliance History for the period 1978 to 1982.

As part of the review, G. H. Bidinger, M. H. Killinger, and A. L. Soong, NMSS, accompanied by C. C. Peck of Region III, visited the Hematite facility on December 7-9, 1982. Mr. Eskridge, CE, and Mr. Peck toured the NMSS personnel through the facility. The NRC representatives discussed questions and potential responses with Messrs. J. Rode, Plant Manager, and H. Eskridge, Supervisor, Nuclear Licensing, Safety and Accountability. A revised request for supplemental information was forwarded to Combustion Engineering on December 29, 1982.

B. Compliance History

A review of the licensee's compliance history was made using the NRC Region III Inspection Reports from the NRC Docket Files. Thirteen reports were reviewed for the 1978 to 1982 time period. No health and safety items of noncompliance were reported.

C. Current Application

In the renewal application and supplements, the staff has reviewed the Combustion organizational structure and technical capability to administer nuclear criticality safety and radiological safety programs. The technical requirements of the safety programs were also reviewed. The radiological contingency plan, as currently approved, was not reviewed.

VI. ORGANIZATION AND ADMINISTRATIVE PROCEDURES

A. Organization

1. Radiation and Nuclear Safety Responsibilities

Combustion Engineering has been involved in nuclear activities for over 30 years. All nuclear activities are carried out in the Nuclear Power Systems Division.

The Hematite Plant Manager is responsible for safe operation of the plant. The Supervisor, Nuclear Licensing, Safety and Accountability (NLS&A), has delegated responsibility for health physics and nuclear criticality safety programs.

The Plant Manager reports to the General Manager, Fuel Fabrication, who is located in Windsor, Connecticut. The corporate structure and the plant organization are shown in Figures 3 and 4. As can be seen in Figure 4, the Production Superintendent and the Supervisor, NLS&A, both report independently to the Plant Manager. Corporate technical support and services are available to the Plant Manager and the Supervisor, NLS&A, from the Windsor site.

2. Minimum Technical Qualifications

The safety related staff positions in Figures 3 and 4 must be filled by individuals who meet minimum qualifications of academic training and professional experience, as follows:

Plant Manager

The Plant Manager and first line management shall have a BS degree in a technical field and a minimum 2 years experience in a nuclear facility or a high school degree with 10 years experience in a nuclear facility.

Supervisor, NLS&A

The Supervisor shall hold a technical degree in science or engineering and have a minimum 5 years experience in a nuclear facility. At least 3 of the 5 years of experience shall have involved nuclear criticality and health physics evaluations.

Figure I.2-1

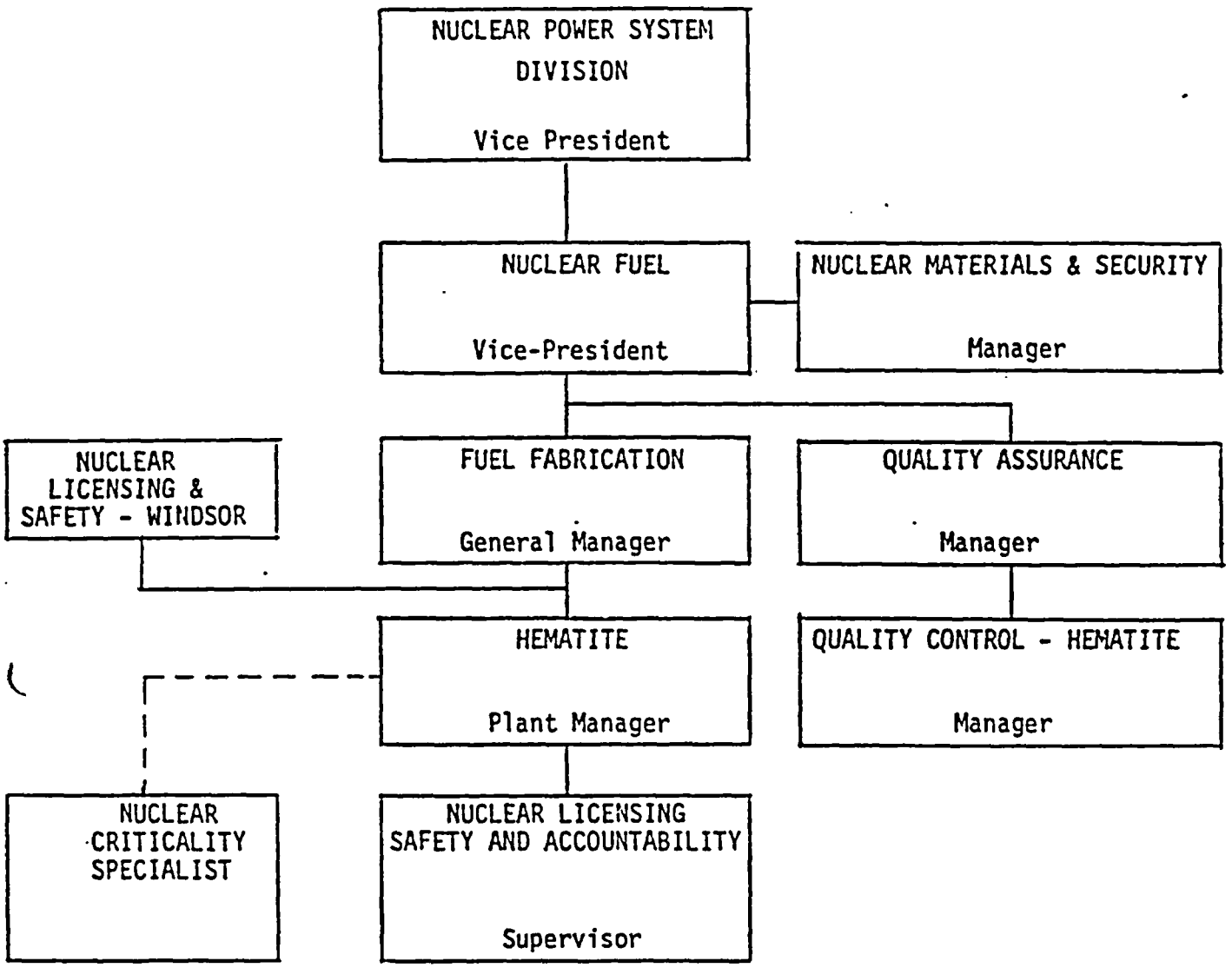
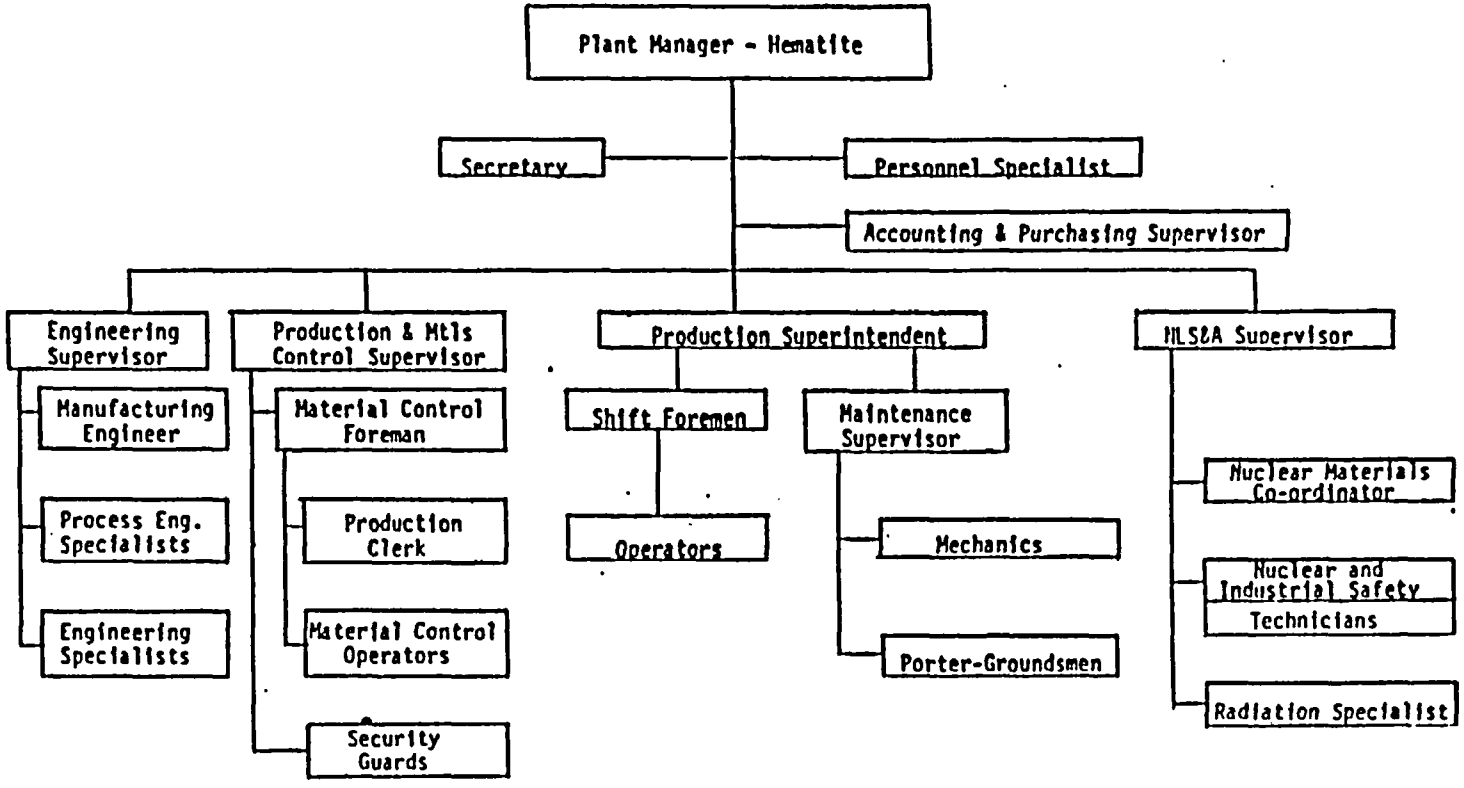


Figure 3
Combustion Engineering Organization



Hematite Plant
Organization Chart

Figure 4

Figure I.2-2

Nuclear Criticality Specialist

The Nuclear Criticality Specialist shall hold a degree in science or engineering and have a minimum of 3 years experience in plant nuclear criticality safety.

Safety Auditors

The audit team shall include a Nuclear Criticality Specialist and a Radiation Specialist from the Windsor, Connecticut site. Qualifications for the Windsor Specialists, set forth in Materials License No. SNM-1067, are equal in educational requirements, but require 1 or 2 years less experience.

The NRC staff considers the minimum qualifications for the above specified positions to be acceptable.

B. Administrative Practices

1. Written Procedures

Operating procedures are prepared by the responsible function. Before initial issuance or revisions, signature approval by NLS&A, Engineering, Production, and QA is required. QA controls the issuance of all procedures.

Supervisors are responsible for assuring that procedures exist for all operations and that the procedures are available to operators. Supervisors are also responsible for assuring that all aspects of written procedures are followed.

2. NLS&A Approvals

Except for minor changes to existing procedures, all NLS&A reviews will be documented. Safety evaluations by the Supervisor, NLS&A, will be based on criteria in Chapter 3, Radiation Protection and

Chapter 4, Nuclear Criticality Safety. Both chapters are in the license condition section of the renewal application. The Criticality Specialist will document his review and approval of any NLS&A evaluation involving criteria from Chapter 4 of the license condition section.

3. Review and Update

All operating procedures involving special nuclear material will be reviewed and updated at a minimum frequency of every 2 years.

C. Inspections and Audits

NLS&A technicians will make daily tours of operating areas. Problems normally will be corrected immediately by the Shift Foreman. Significant problems will be reported on the Daily Exception Report, which is distributed to the Plant Manager and all supervisors. The Production Superintendent is responsible for corrective action.

Monthly inspections for radiation and nuclear criticality safety are made by the Supervisor, NLS&A, or his designated representative. Items requiring action are reported to the Plant Manager, supervisors and foremen. The person responsible for corrective action is identified in the report. Documentation of corrective actions is required. To ensure that a record exists for all preplanned inspections by the NLS&A Supervisor or his designee, the staff recommends the following license condition:

> Quarterly inspections by the Supervisor, NLS&A, or his representative shall be preplanned and shall be documented. Such documentation shall be maintained for 2 years.

The Nuclear Criticality Specialist makes semi-annual inspections. Reports of inspections are sent to the General Manager, the Plant

Manager, and supervisors. The Production Superintendent and the Supervisor, NLS&A, are responsible for corrective actions.

An annual audit of radiation protection and nuclear criticality safety is performed by a team appointed by the Vice President-Nuclear Fuel. The team includes, as a minimum, a Criticality Specialist and a Radiation Specialist from the Windsor site. A formal report is made to the Vice President. Corrective action, if required, is the responsibility of the Supervisor, NLS&A.

D. Personnel Training

New employees are given training in nuclear criticality safety and radiation protection, including emergency procedures. After demonstration by testing the proficiency of knowledge of the subject matter, the new employee is given on-the-job training under close supervision of his foreman or an experienced employee. Adequate performance is monitored by NLS&A prior to permitting independent activity. Retraining and testing of operating personnel is done annually. Foremen, who are given formal training and testing, serve as trainers. The training program and results are documented.

VII. RADIATION PROTECTION

RADIATION SAFETY

A. Radiation Safety Administration

The Supervisor of Nuclear Licensing, Safety and Accountability (NLS&A) is responsible for establishing and maintaining a safety program for ensuring the protection of plant employees and the public and for monthly inspection of plant operations for compliance with license conditions and radiological regulations. He is authorized to suspend any operation which he believes does not comply with the regulations or approved operating procedures set forth in the license.

The responsibilities of NLS&A functions include:

1. Review and approval of the safety aspect of changes to operating procedures associated with the handling of licensed material. This approval procedure ensures proper health and safety review of all standard requirements affecting radiological safety.

2. Conducting routine radiation monitoring surveillance of the facility and the investigation of reportable radiation events.

3. Approval of radiation work permits.

4. Conducting a training program in radiological protection.

The overall objectives of the program are to ensure adequate containment of radioactive material and to reduce the levels of radiation to the employees and the public to meet the As Low As Reasonably Achievable (ALARA) goal.

Two special features of the radiation safety administration, the radiation work permits and ALARA commitment, are described below:

Radiation Work Permit (RWP)

For an SNM operation not covered by an operating procedure, a RWP containing all safety requirements for the proposed operation shall be prepared and approved by the health and safety personnel.

ALARA Commitment

Combustion management has made commitment to maintain the exposure of employees and the release of radioactive material to unrestricted areas to ALARA. The annual audit team will assess all phases of the plant radiation safety program to ensure that the implementation of the program meets the ALARA requirements. The NLS&A Supervisor is responsible for followup of the findings and recommendations made by the audit team.

After reviewing the licensee's ALARA Program, the staff concluded that CE's program should be strengthened by more direct involvement by management. In order to correct this deficiency, the staff recommends that the following license condition be incorporated in the renewal license:

> A written report shall be made by the NLS&A Supervisor to the Plant Manager every 6 months reviewing employee radiation exposure (internal and external) and effluent release data to determine:
>
> a. if there are any upward trends developing in personnel exposure for identifiable categories of workers, types of operations, or in effluent releases,
>
> b. if exposures and releases can be lowered in accordance with the ALARA commitment, and
>
> c. if equipment for effluent and exposure control is being properly used, maintained, and inspected.

B. Systems of Exposure Controls and Exposure Levels Experienced

External Exposure

External exposure of personnel at Combustion is controlled and evaluated on the basis of the data from personnel dosimeters (film badge or TLD) which must be used as required by 10 CFR 20. The personnel external exposure is evaluated on a monthly or quarterly basis depending on the type of dosimeters used. Should an individual's exposure exceed 25% of the permissible limit, Combustion will conduct an investigation into the cause of the exposure so as to prevent that individual's exposure from exceeding the limit.

External exposure of personnel has generally not been a problem in uranium fuel fabrication plants, and the Combustion plant is fairly typical. The external exposure data submitted by CE for the period 1977

through 1981, as represented by Table I, show that annual exposure are typically less than 10% (all less than 20%) of the permissible limit of 5 rems per year.

TABLE I

Annual External Radiation Exposure Summary

Annual Dose Ranges (Rem)	Max. % of Allowable Limit	% of Personnel in Range 1979	1980	1981	1982
No measurable exposure	0	18	25	29	23
Less than 0.10	2	75	59	41	35
0.10 - 0.25	5	5	16	30	25
0.25 - 0.50	10	2	0	0	13
0.500 - 0.75	15	0	0	0	1
0.75 - 1.00	20	0	0	0	3
Greater than 1.00	--	0	0	0	0

Internal Exposure

Radioactive material may enter the body by breathing contaminated air or by ingesting such material as a consequence of poor hygiene or inadequate self-monitoring. At the Combustion plant, protection of the operating personnel from excessive internal exposure is provided by the use of:

1. A ventilation system designed to limit the concentration of radioactive material in breathing air in the work area.

2. An air sampling program in working areas to detect the presence of unsafe concentrations.

3. A bioassay program to monitor and detect any significant deposition of radionuclides in the body.

4. Protective clothing and shoes to minimize direct contact with the radioactive material.

5. Respiratory protective equipment to limit the inhalation of airborne radioactive material. The use of respiratory protection devices is in accordance with Regulatory Guide 8.15, "Acceptable Program for Respiratory Protection." This complies with the requirements in 10 CFR 20.103.

6. Routine radiation surveys to detect the presence and extent of radioactive surface contamination.

7. Procedures including action levels for investigation, control, and decontamination of contaminated surfaces.

Description of Equipment Ventilation Systems

The ventilation system of the facility provides a negative pressure so that air flow is directed from the work area into the process equipment, hoods, or glove boxes. The air from the oxide building, pellet plant, and recovery building is treated by filtration prior to its release through the stacks. The effectiveness of the ventilation system is checked to assure the airflow into hoods or glove boxes is greater than 100 FPM.

Monitoring of Air Concentration of Radioactivity and Controlling of Internal Exposure

The ventilation system at Combustion was designed and is operated to move air from areas of potential low concentration to higher contamination.

The airborne concentration of radioactivity in the worker's breathing air is continuously sampled using fixed sampling heads mounted at various locations. These samples are changed and air concentration analyzed for each shift. The representativeness of the fixed sampling will be reevaluated when any licensed process or equipment changes are made. For

a short duration of work, personnel lapel samplers are used to monitor the radioactivity of the breathing zone air. Worker's internal exposure from airborne radioactivity is calculated by the hours an individual works at an assigned location and the measured breathing air concentration for the location. If a sample indicates the air concentration exceeds the maximum permissible limit for occupational area as specified in 10 CFR 20, the licensee will investigate the cause.

In-Plant Airborne Activity Levels

Data on the concentration of airborne radioactivity in various work areas for the past 2 years are shown in Table II.

TABLE II

Quarterky Average of Weekly Exposure
(10E-10 μCi-hr/cc/wk)

Operation	1981				1982			
	1st	2nd	3rd	4th	1st	2nd	3rd	4th
Oxide Conversion	5.7	7.0	6.7	7.8	13.6	13.1	8.2	11.0
Pellet Production	7.5	10.6	9.7	13.8	13.6	14.7	11.6	12.9
Scrap Recycle/Recovery	7.0	8.0	9.7	12.4	11.3	8.6	7.1	6.4
Maintenance	3.2	3.6	4.9	8.0	7.0	6.7	6.6	6.2
Material Handling	3.8	5.4	3.7	7.3	7.4	6.8	4.0	5.4

No weekly exposure exceeded the limit of 40 MPC-hrs during 1981 and 1982.

C. Bioassay Program

Internal exposure is evaluated and controlled by a bioassay program conducted in accordance with provisions similar to those in Regulatory Guide 8.11, "Application of Bioassay for Uranium." The Combustion bioassay program for operators provides for routine collection and analysis of urine samples 12 times per year and in vivo lung counts once per year. The bioassay

frequency will be increased, based on the latest quarterly average of airborne uranium concentration, as specified in Table 3 of Regulatory Guide 8.11. Data provided by Combustion indicates that for the past 4 years (1979-1982), all urinalysis results indicated less than 7 µgU/liter which is less than the action level of 25 µgU/liter. In vivo lung counting results for the same period of time indicated the majority of individuals (94%) have lung burdens of U-235 ranging from 0-29% of the maximum permissible lung burden (MPLB). No individual has been detected to have a deposition of uranium exceeding one half of the MPLB.

D. Control of Surface Contamination

The restricted areas of the CE plant are zoned as contaminated and clean areas. In the contaminated areas, protective clothing must be worn. When a person is leaving the area, he must wash his hands and monitor himself for possible contamination. Each defined area is surveyed routinely by an instrument, which is calibrated twice a year, for any undesirable surface contamination. The frequency of this survey is determined based on the extent to which the area is occupied and on the potential hazard presented by the presence of surface contamination. When the contamination level exceeds the specified level, the licensee takes action to decontaminate the area involved. The licensee's survey frequency and action level for decontamination are within those specified in Regulatory Guide 8.24, "Health Physics Surveys During Enriched Uranium-235 Processing and Fuel Fabrication."

CE has requested authorization to use sealed Co-60 sources for calibration of survey instruments. To ensure that these sources remain leaktight, the staff recommends adding the following license condition:

> The licensee shall leak test sealed sources in accordance with the enclosed "License Condition For Leak Testing Sealed Byproduct Material Sources."

The licensee requests authorization to release equipment and material from the plant to offsite or from controlled area onsite in accordance with "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Materials," dated July 1982. Accordingly, the staff recommends the following license condition:

> Release of equipment and material from the plant site or to clean areas onsite shall be in accordance with the attached "Guidelines for Decontamination of Facilities and Equipment Prior to Release For Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," dated July 1982.

E. Effluent Control

Air Effluent

Potentially contaminated air, generated from process areas and equipment, is released to the unrestricted area through eight stacks which are monitored continuously and analyzed for radioactivity on a weekly basis. The effluents from the oxide building, pellet plant (except the pellet furnace room air), and Recycle/Recovery areas are passed through HEPA filters prior to release to the atmosphere. If exhaust air effluent radioactivity, averaged over a 2 week period, exceeds the MPC_{air} limit specified in Table II, Column I, of 10 CFR 20, Appendix B, the Health Safety staff shall conduct an investigation and take corrective action. Data reported by the licensee shows that airborne effluent released from the plant in 1981 and 1982 are less than 11% of the limits for unrestricted areas as specified in 10 CFR 20.

Liquid Effluent

No liquid process waste streams are discharged to the unrestricted area. Two liquid waste streams are discharged to the unrestricted area surface waters. The two streams are:

1. Liquid waste generated from cooling water, laundry water, and lab glassware wash water are discharged by the storm drain system (industrial waste system) into the site pond which overflows to an adjacent creek. The overflow is sampled and analyzed weekly for radioactivity.

2. Water from the change room sinks and showers is routed by the sanitary sewer system to the sewage treatment plant, sampled and analyzed for radioactivity, and then discharged into the site creek.

If the sample results from the liquid effluents, averaged over a calendar quarter, exceed the MPC_w limit specified in Table II, Appendix B, 10 CFR 20, the licensee will conduct an investigation and take corrective action. Data reported by the licensee shows that liquid effluent released from the plant in 1981 and 1982 are less than 1% of the limits for unrestricted areas as specified in 10 CFR 20.

Effluent releases from the CE Hematite facility are and have been within all license conditions and regulatory requirements for discharge of radioactivity to unrestricted areas. Detail descriptions of the effluent releases from the CE facility and impacts resulting from the overall plant operation were published in the Environmental Impact Appraisal related to the license renewal.

Solid Waste

Low-level radioactive solid wastes are packaged in accordance with all applicable regulations and transported to an approved disposal site. The conditions of storage of the waste, waste containers, and contaminated equipment will be reviewed by the NLS&A's monthly audit program.

The licensee requested authorization to treat or dispose of waste and scrap materials containing uranium enriched in U-235 and/or source material by incineration. The staff recommends the following license condition:

Pursuant to 10 CFR 20.302, the licensee is authorized to treat or dispose of waste and scrap materials containing uranium enriched in U-235 and/or source material by incineration.

The licensee routes offgases from the conversion process to limestone rock-packed scrubbers for hydrogen fluoride removal. Grab samples of spent limestone, collected as the scrubbers are emptied, are surveyed for alpha contamination. If alpha contamination is less than 100 dpm/100 cm^2 of rock surface, the limestone rock has been used as fill material both inside and outside the restricted area fence. If alpha contamination exceeds 100 dpm/100 cm^2, the rock has been stored outdoors within the restricted area.

In response to questions posed by the NRC staff, Mr. Eskridge, CE, reported by phone in July 1983, that samples of spent rock shows beta contamination (probably technetium-99). Prior to the sample analysis in mid-1983, no beta analysis had been made. Limited analyses also indicated that the beta-emitter is not water soluble. The quantity of Tc-99 disposed of with the spent limestone rock, and the environmental effects thereof, are unknown.

To assess and control the environmental effects of the disposal of spent limestone rock, the staff recommends the following license conditions:

Within 60 days of the date of this license renewal, the licensee shall submit to the NRC a description of a proposed monitoring program to determine the quantity and environmental effects of radioactivity on spent limestone rock used as onsite fill material and to determine the environmental effects of outdoor storage of the alpha-contaminated material.

The licensee shall survey spent limestone rock discharged from each HF scrubber for beta contamination. Rock with beta contamination which exceeds five times the background of fresh rock shall not be used for landfill.

Within 60 days of the date of this license renewal, the licensee shall submit to the NMSS a plan, including schedule, for the disposal of alpha-contaminated spent limestone rock.

F. Conclusion

Upon completion of the radiation safety review of the licensee's renewal application and compliance history, the staff has concluded that Combustion Engineering, Inc. has the necessary technical staff at Hematite to administer an effective radiological safety program. Conformance by CE to their proposed conditions as well as to those developed by the staff should ensure a safe operation and the quick detection of unfavorable trends by CE or Region III for corrective action.

VIII. NUCLEAR CRITICALITY SAFETY

A. Administrative Requirements

The administrative requirements previously used by the licensee are essentially unchanged in the renewal application. Nuclear criticality safety will be based on the double contingency policy, viz., safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible. Changes in nuclear safety analyses will receive independent reviews and approval by the criticality specialist.

Safety analyses, reviews, and approval procedures were described in Section VI above. If an analysis exceeds the technical requirements of Chapter 4.0 of the license, a license amendment will be necessary.

Criticality limits will be posted to aid licensee personnel in the conduct of safe operations. Mass limited process equipment will be labelled to identify the uranium content. Empty containers will be labelled as such or placed in controlled storage areas.

B. Technical Requirements

1. Engineered Safeguards

Whenever practical, the licensee is committed to use physical controls and engineered safeguards in the establishment of safety.

2. Basic Assumptions

Safe Individual Units (SIU) will be based on:

- Optimum moderation will be assumed when the addition of moderating material is credible.
- Infinite reflection will be assumed for any reflector.
- Optimum moderation (mist) will be assumed between units in arrays unless less mist is limited by design or administrative control.
- Optimum credible heterogeneity will be assumed.
- Safety factors for double batching will be utilized.
- Unless specifically analyzed, SIU will be spaced a minimum 12-inches from other SIU.

Safety factors for SIU are:

• Mass	2.3	
• Volume	1.3	
• Cylinder Diameter	1.1	
• Slab Thickness	1.2	
• Surface Density	0.4	Geometry-limited units in Table 4.2.4
	0.3	Mass-limited units in Table 4.2.4

Arrays of SIU will be spaced using the surface density method or the solid angle method in TID-7016, Rev. 2. For the SIU in Table 4.2.4, the spacing areas in Table 4.2.5 will be used.

Validated computer calculations may be used for situations where the above SIU and array spacing criteria is not appropriate. The maximum reactivity of the unit or the array will be 0.95, i.e., k-effective + 2 sigma + bias ' 0.95. Such calculations will be submitted to the NRC as part of a license amendment application.

3. Special Considerations

Concentration-controlled SIU will not be considered to contribute to interacting arrays. These SIU will be limited to a maximum 25 grams of uranium per liter and to a maximum safe mass.

Fixed neutron poisons may be used in accordance with ANSI Standard N16.4-1979.

The structural integrity of fixtures, storage racks, containers, etc., shall be certified by an engineer knowledgeable in structural design.

C. Conclusions

The staff's conclusion that the proposed controls are adequate is based on:

- The history of safe plant operation with respect to nuclear criticality safety during the past 5 years of operation.

- The demonstrated qualifications of the Plant Manager and the nuclear criticality safety personnel.

- The proposed license conditions which are essentially unchanged from current conditions should ensure continued compliance with accepted practice.

- The nuclear safety analyses demonstrate sufficient, valid application of proposed administrative and technical requirements.

The changes to the criteria were made primarily to clarify license requirements. In the Demonstration Section of the application, the licensee removed the demonstration, using two-group cross-sections, of the effect of mist on an array of unit. Our assessment indicated that two-group cross-sections do not adequately represent the physical situation of SIU in mist.

The review by the NRC staff shows that the safety demonstrations are consistent with the proposed license conditions. The proposed license conditions, which assure no undue risk to personnel or property, are adequate for the conversion of UF_6 to UO_2 powder or pellets and the associated activities of scrap recovery, lab analyses, storage, and transport activities.

IX. ENVIRONMENTAL MONITORING

CE has an environmental monitoring program which involves periodic sampling of air, soil surface and groundwater, and vegetation. Two onsite, remote air stations are run continuously and analyzed quarterly for gross alpha. Surface waters in the Joachim Creek are grab sampled monthly or quarterly for gross alpha and beta. Onsite wells are monitored monthly and an offsite well quarterly for gross alpha and beta. Vegetation is monitored onsite quarterly for gross alpha and beta and fluoride. The assessment and adequacy of this program was reported in the November 1982, "Environmental Assessment Related to Renewal of Special Nuclear Materials License No. SNM-33." On the basis of the assessment, a Negative Declaration dated November 23, 1982, was published in the Federal Register on November 30, 1982.

One issue, identified in the Environmental Assessment, is decontamination of the former evaporation ponds. The staff considers that continued seepage of radionuclides from the ponds is undesirable and that decommissioning of the ponds should be completed as soon as reasonably achievable. Accordingly, the staff recommends the following license condition:

> The licensee shall decommission the evaporation ponds as soon as reasonably achievable. Within 90 days of the date of this license, the licensee shall submit a proposed decommissioning plan for NRC approval. The plan shall include decommissioning criteria, a schedule for decommissioning, and a demonstration that the schedule provides for decommissioning as soon as reasonably achievable.

In order to assure compliance with Title 40, Code of Federal Regulations, Part 190, the following license condition is recommended:

(a) If the radioactivity in plant gaseous effluents exceeds 150 μCi per calendar quarter, the licensee shall, within 30 days, prepare and submit to the Commission a report which identifies the cause for exceeding the limit and the corrective actions to be taken by the licensee to reduce the release rates.[1] If the parameters important to a dose assessment change, a report shall be submitted within 30 days which describes the changes in parameters and includes an estimate of the resultant change in dose commitment.[1]

(b) In the event that the calculated dose to any member of the public in any consecutive 12-month period is about to exceed the limits specified in 40 CFR 190.10, the licensee shall take immediate steps to reduce emissions so as to comply with 40 CFR 190.10. As provided in 40 CFR 190.11, the licensee may petition the Nuclear Regulatory Commission for a variance from the requirements of 40 CFR 190.10. If a petition for a variance is anticipated, the licensee shall submit the request at least 90 days prior to exceeding the limits specified in 40 CFR 190.10.

[1]The report or petition should be submitted to the Director, Office of Nuclear Material Safety and Safeguards with a copy to the Regional Administrator of Region III.

X. RADIOLOGICAL CONTINGENCY PLANS

The existing radiological contingency plan was approved by Amendment No. 9 of the current license. The same implementing condition (with editorial revision) is recommended for the renewal license, as follows:

> The licensee shall maintain and execute the response measures of his Radiological Contingency Plan submitted to the Commission on January 27, 1982, and revised on September 3, 1982. The licensee shall also maintain implementing procedures for his Radiological Contingency Plan as necessary to implement the plan. The licensee shall make no change in his Radiological Contingency Plan that would decrease the response effectiveness of the Plan without prior Commission approval if the changes do not decrease the response effectiveness of the Plan. The licensee shall maintain records of changes that are made to the Plan without prior approval for a period of 2 years from the date of the change and shall furnish the Chief, Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, NMSS, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, and the appropriate NRC Regional Office specified in Appendix D of 10 CFR Part 20, a report containing a description of each change within 6 months after the change is made.

XI. FIRE SAFETY

CE has designed, constructed, and maintained facilities consistent with applicable fire safety codes. A copy of the Certificate of Insurability for the Hematite Facility from American Nuclear Insurers was included in the renewal application.

XII. PLANT DECOMMISSIONING

CE has incorporated the Decommissioning Plan, dated January 15, 1979, and approved by Amendment No. 3 to the current license, as a condition of the license renewal. By letter dated March 8, 1979, CE committed current revenues of the corporation for decommissioning. Accordingly, the following license condition is recommended:

> At the end of the plant life, the licensee shall decontaminate the facilities and site in accordance with the general decommissioning plan submitted in the enclosure to the letter dated January 12, 1979, so that these facilities and grounds can be released to unrestricted use. The financial commitment to assure that funds will be available for decommissioning, in the letter dated March 8, 1979, is hereby incorporated as a condition of the license.

XIII. CONCLUSION

Upon completion of the safety review of the licensee's application and compliance history, the staff has concluded that the activities authorized by the issuance of a renewal license to CE, subject to the additional conditions developed by the staff, will not constitute an undue risk to the health and safety of the public. Furthermore, the staff has determined that the application fulfills the requirements of 10 CFR 70.23(a).

The staff discussed the renewal application with Mr. C. Peck, Region III Project Inspector for the CE facility, prior to and during a site visit on December 8-9, 1982. No issues were identified during these discussions and no objection to the renewal was raised.

The staff therefore recommends that the CE-Hematite license be renewed as revised in its entirety in accordance with statements, representations, and conditions in CE's application dated February 26, 1982 and supplements dated July 21, 1982, February 21, and July 8, 1983, subject to the following additional conditions:

11. Quarterly inspections by the Supervisor, NLS&A or his representative shall be preplanned and shall be documented. Such documentation shall be maintained for 2 years.

12. A written report shall be made by the NLS&A Supervisor to the Plant Manager every 6 months reviewing employee radiation exposure (internal and external) and effluent release data to determine:

    a. if there are any upward trends developing in personnel exposure for identifiable categories of workers, types of operations, or in effluent releases,

    b. if exposures and releases can be lowered in accordance with the ALARA commitment, and

c. if equipment for effluent and exposure control is being properly used, maintained, and inspected.

13. The licensee shall leak test sealed sources in accordance with the enclosed "License Condition For Leak Testing Sealed Byproduct Material Sources."

14. Release of equipment and material from the plant site or to clean areas onsite shall be in accordance with the attached "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," dated July 1982.

15. Pursuant to 10 CFR 20.302, the licensee is authorized to treat or dispose of waste and scrap materials containing uranium enriched in U-235 and/or source material by incineration.

16. Within 60 days of the date of this license renewal, the licensee shall submit to the NRC a description of a proposed monitoring program to determine the quantity and environmental effects of radioactivity on spent limestone rock used as onsite fill material and to determine the environmental effects of outdoor storage of the alpha-contaminated material.

17. The licensee shall survey spent limestone rock discharged from each HF scrubber for beta contamination. Rock with beta contamination which exceeds five times the background of fresh rock shall not be used for landfill.

18. Within 60 days of the date of this license renewal, the licensee shall submit to NMSS a plan, including schedule, for the disposal of alpha-contaminated spent limestone rock.

19. The licensee shall decommission the evaporation ponds as soon as reasonably achievable. Within 90 days of the date of this license,

the licensee shall submit a proposed decommissioning plan for NRC approval. The plan shall include decommissioning criteria, a schedule for decommissioning, and a demonstration that the schedule provides for decommissioning as soon as reasonably achievable.

20. a. If the radioactivity in plant gaseous effluents exceeds 150 mCi per calendar quarter, the licensee shall, within 30 days, prepare and submit to the Commission a report which identifies the cause for exceeding the limit and the corrective actions to be taken by the licensee to reduce the release rates.[1] If the parameters important to a dose assessment change, a report shall be submitted within 30 days which describes the changes in parameters and includes an estimate of the resultant change in dose commitment.[1]

    b. In the event that the calculated dose to any member of the public in any consecutive 12-month period is about to exceed the limits specified in 40 CFR 190.10, the licensee shall take immediate steps to reduce emissions so as to comply with 40 CFR 190.10. As provided in 40 CFR 190.11, the licensee may petition the Nuclear Regulatory Commission for a variance from the requirements of 40 CFR 190.10. If a petition for a variance is anticipated, the licensee shall submit the request at least 90 days prior to exceeding the limits specified in 40 CFR 190.10.

21. The licensee shall maintain and execute the response measures of his Radiological Contingency Plan submitted to the Commission on January 27, 1982, and revised on September 3, 1982. The licensee shall also maintain implementing procedures for his Radiological Contingency Plan as necessary to implement the plan. The licensee shall make no change in his Radiological Contingency Plan that would decrease the response effectiveness of the Plan without prior

[1]The report or petition should be submitted to the Director, Office of Nuclear Material Safety and Safeguards with a copy to the Regional Administrator of Region III.

Commission approval as evidenced by a license amendment. The licensee may make changes to his Radiological Contingency Plan without prior Commission approval if the changes do not decrease the response effectiveness of the Plan. The licensee shall maintain records of changes that are made to the Plan without prior approval for a period of 2 years from the date of the change and shall furnish the Chief, Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, NMSS, U.S. Nuclear Regulatory Commission, Washington, DC 20555, and the appropriate NRC Regional Office specified in Appendix D of 10 CFR Part 20, a report containing a description of each change within 6 months after the change is made.

22. At the end of the plant life, the licensee shall decontaminate the facilities and site in accordance with the general decommissioning plan submitted in the enclosure to the letter dated January 12, 1979, so that these facilities and grounds can be released to unrestricted use. The financial commitment to assure that funds will be available for decommissioning, in the letter dated March 8, 1979, is hereby incorporated as a condition of the license.

W. T. Crow
for A. L. Soong
Radiation Safety

George Bidinger
George H. Bidinger
Project Manager

Approved by: W. T. Crow
W. T. Crow
Section Leader