Safety Evaluation Report

By The

Division of Fuel Cycle and Material Safety

Related To The

NRC Special Nuclear Material License Renewal

For

Combustion Engineering, Inc

Fuel Fabrication Plant

Windsor, Connecticut

Docket No. 70-1100

License No. SNM-1067

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Safety Evaluation Report - Combustion Engineering, Inc.

Renewal Application - Windsor, Connecticut

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I. Introduction

A. General

The primary function of the Combustion Engineering, Inc. (CE) facility at Windsor, Connecticut, that is licensed under a special nuclear material license, is the fabrication of components such as fuel rods and assemblies containing low enriched UO_2 for light-water moderated power reactors (LWRs), control rods, control rod drive mechanisms, and reactor core internals. They also have facilities for the development, design, analysis and testing of nuclear components and systems. The plant was originally licensed on May 29, 1968 and authorized operations included the fabrication of UO_2 fuel assemblies starting from UO_2 powder. The current possession limits include 500,000 kilograms of uranium enriched to no more than 4.1% ^{235}U, 4,800 grams ^{235}U in uranium enriched to less than 20% ^{235}U, 128 grams ^{239}Pu in eight (8) encapsulated neutron sources, 10 grams of ^{238}Pu in five (5) encapsulated ^{238}Pu neutron sources, 160 micrograms plutonium as analytical samples, and 10,500 kilograms natural and/or depleted uranium.

B. Location Description

The CE site is located approximately 5 miles northwest of Windsor, Connecticut. It consists of a plot of approximately 1,200 acres. East Granby, Connecticut, the nearest town to the site, is 3 miles north of the site. Figures 1 and 2 show the geographical location of the site. It is approximately 180 feet above mean sea level. The Farmington River flows along the northern border of the site. Figure 3 shows the relative locations of the buildings on the site.

The principal activities of the nuclear manufacturing operations are carried out by the Nuclear Fuel Manufacturing Department in Building #17, a one-level building. The shop section has concrete flooring, corrugated asbestos siding, and a poured gypsum roof deck approximately 25 feet above floor level. The remainder of the building, used for offices (front section), has concrete

flooring, exterior concrete block, and a poured gypsum roof deck approximately 11 feet high.

A warehouse, Building #21, is provided for the storage of incoming fuel shipping containers, raw materials, and finished components. This building is a prefabricated rigid frame steel structure located approximately 100 feet west of Building #17.

The other buildings, where fissile materials may be stored or handled, are used by the Development Department. Buildings #1 and #1A are used for radioactive material storage; Buildings #2, #2A, #3, #5, #16, and #18 are used for laboratories; and Building #3A is primarily used for Development Laboratory offices.

C. License History

CE first applied for a license to process low enriched uranium in 1968 and was issued a license on May 29, 1968, for a five-year period (expiration date May 31, 1973). The license authorized the fabrication of fuel assemblies that met physical and enrichment specifications for specific fuel assembly designs. By letter dated April 16, 1973, CE filed a renewal application. The license remained in effect in accordance with the timely renewal provisions of subsection 70.33(b) of 10 CFR 70 until the current one was issued on January 30, 1976. The license allowed the licensee a limited flexibility in making changes to his operations without prior NRC approval. However, the license was still a "specific license" as distinguished from a "broad license" in which the licensee has greater flexibility in making changes in his operation without prior NRC approval. The license was scheduled to expire on January 31, 1981. There are 36 amendments associated with the current license, 11 of which have been issued since the renewal application was filed. By letter dated December 18, 1980, CE filed a renewal application and the license has remained in effect in accordance with the timely renewal provisions of the regulations. The renewal application was submitted in a format which generally

followed Regulatory Guide 3.52, "Standard Format and Content for the Health and Safety Sections of Renewal Applications for Uranium Fuel Fabrication Plants."

II. Authorized Activities

A. General Summary

The renewed license will authorize CE to perform the following activities at the Windsor site:

1. The fabrication of light water reactor (LWR) fuel assemblies starting with UO_2.

2. Research and development activities related to the fabrication of LWR fuels and the testing of reactor fuel assemblies and components.

The license does not authorize the possession, storage or processing of UF_6.

B. Process Description

1. Manufacturing Operations

a. Introduction - The manufacturing operations are conducted in Buildings 17 and 21. The main process operations are described under the headings of (1) pellet fabrication, (2) fuel cladding, assembly, and test, (3) scrap recovery, and (4) liquid waste disposal.

b. Pellet Fabrication - The UO_2 powder, from the CE conversion plant in Hematite, Missouri, is blended with binder, dried, granulated and pressed into pellets. The pellets are then sintered in a reducing atmosphere, ground to size, washed, dried, and inspected.

The nuclear criticality safety of the pellet fabrication operations is based primarily on the use of favorable slab and cylinder geometry.

c. Fuel Cladding, Assembly and Testing - Fuel pellets are loaded into empty tubes which are then plugged and seal welded. The sealed rods are inspected, cleaned, autoclaved, and leak tested. The tested rods are assembled into fuel assemblies.

The nuclear criticality safety of the cladding, assembly, and testing operations includes both mass and container geometry controls. Where water moderation cannot be excluded, optimum water moderation is assumed unless the only source of water is that from overhead sprinkler systems and the open space between fuel pieces cannot be filled with water (see discussion under VII. Nuclear Criticality Safety).

d. Scrap Recovery - All clean scrap is accumulated for reprocessing and recycle. The scrap may be milled, oxidized and reduced to assure removal of volatile additives and to achieve the desired ceramic properties for recycle UO_2. All other scrap (e.g., grinder sludge) is dried and then stored for final disposition.

e. Liquid Waste Disposal - The radioactive liquid wastes from the manufacturing operations (consisting primarily of floor mop water, effluents from sinks and showers in contaminated areas) is pumped into a settling tank whose design precludes possible criticality, passes through a closed loop centrifuge (sampled to verify acceptable discharge levels) and then to the retention tanks in Building 6. Radioactive liquid wastes from the laboratory operations (generated primarily in wet chemical analysis and cleaning of glassware used in the analysis of UO_2) is also discharged to the retention tanks. The wastes are sampled,

analyzed, and diluted (if necessary) prior to discharge to an onsite creek from which it flows into the Farmington River.

2. Nuclear Laboratory Operations

a. The ceramic laboratory is involved with the development and testing of research fuel materials and routine pellet testing for the fuel fabrication plant. Research is also performed on testing different reactor materials. Uranium oxide is pelletized, sintered, and loaded into fuel rods for testing.

b. The chemistry laboratory performs quality control analysis on UO_2 powder and pellets at various production stages.

c. The metallography laboratory evaluates pellets made in both the manufacturing and in the ceramic laboratory facilities.

d. The fuel and material laboratory conducts research on nonirradiated core materials that includes fuel cladding, neutron poisons, and fuel rod assembly materials.

III. Possession Limits

Material	Form	Quantity
A. Uranium enriched to ≤ 4.2 wt % U-235	A. Oxide powder, pellets, rods and finished fuel assemblies	A. 20,000 kilograms of U-235
B. Uranium enriched to < 20 wt % U-235	B. Any	B. 4800 grams U-235
C. Natural and/or depleted uranium	C. Any	C. 10,000 kilograms total uranium
D. Pu-238	D. Encapsulated neutron sources	D. 5 sources, each containing less than 2.0 grams Pu-238
E. Pu	E. Any	E. 160 micrograms as analytical samples
F. Uranium enriched in the U-235 isotope	F. Contained in encapsulated U_3O_8 sources	F. 8 sources, each containing less than 1.7 grams U-235 at any enrichment

IV. Facilities

Building	Activities
1, 1A, 3, 3A	Storage of small quantities of radioactive material (< 350 grams U-235)
2, 2A	Fabrication and decontamination of reactor servicing equipment, storage of archive fuel rods, and related activities
5, 16	Research and development activities utilizing SNM, including the operation of a radiochemistry laboratory, ceramics laboratory, and related facilities. Source material is used for R & D work in the thermal hydraulic testing of reactor fuel and components
6	Waste water processing from manufacturing and laboratory activities
17	Manufacturing PWR assemblies utilizing low enriched uranium (up to 4.1 weight percent U-235) in the form of uranium oxide powder, pellets, rods, and in assemblies
18	Testing of reactor fuel assemblies and components
21	Storage of SNM in shipping containers

V. License Application

A. Review History

The safety review of the Combustion Engineering renewal application included an evaluation of the application transmitted by letter dated December 18, 1980, its revision dated October 1, 1981, written in response to NRC comments and to conform with the draft Regulatory Guide on "Standard Format and Content for Health and Safety Sections of Renewal Applications for Uranium Fuel Fabrication Plants" (Regulatory Guide 3.52), its second revision dated May 14, 1982, to be more responsive to the earlier NRC comments and to respond to additional NRC comments resulting from the first revision. CE chose to submit an entire revised application each time rather than only page changes. This approach extended the time required for the review. It included a review of the compliance history, and a detailed review of the organization, administration, radiation protection, and nuclear criticality safety programs.

During the period of the initial safety review, N. Ketzlach spent February 9 through 12, 1981, at the Windsor facility accompanying J. Roth of Region I on a nuclear criticality safety inspection. The site visit included a tour of both the manufacturing and laboratory facilities and a discussion on the need to clarify the organization on the relationship between the responsibilities for safety in Nuclear Fuel Manufacturing and in the Nuclear Laboratories and the need for including the criteria in the license condition sections of the renewal application for all process and storage operations. A. L. Soong spent February 24 through 27, 1981, at the Windsor facility accompanying P. Clemons of Region I on a radiation safety inspection. The site visit also included a tour of the licensed activities at the facility.

The license renewal review also included three (3) visits by CE personnel to the Silver Spring offices of the NRC to discuss the renewal application: (1) July 22-23, 1981, F. J. Pianki, G. A. Johnstone, and G. J. Bakevich of CE met with N. Ketzlach, A. L. Soong, and J. Roth of NRC to discuss the NRC preliminary comments; (2) January 27, 1982, R. E. Sheeran and G. J. Bakevich

of CE met with N. Ketzlach, A. L. Soong, and J. Roth to discuss the CE draft responses to the formal NRC comments. There were a number of shortcomings to the CE responses (e.g., didn't address all comments, added new criteria without justification); (3) May 4, 1982, R. E. Sheeran and G. J. Bakevich met with N. Ketzlach and A. L. Soong to discuss the proposed CE responses to the remaining NRC comments.

Following the first visit of CE personnel to the NRC offices, they submitted a revised application dated October 1, 1981. Since the revision was incomplete, CE made their second visit to the NRC offices to discuss its shortcomings. CE requested the third visit to discuss a draft of the second revision to their renewal application. The latter was formally submitted on May 14, 1982. Supplements were submitted dated March 23, September 16, and October 4, 1982.

B. Compliance History

The licensee's compliance history was reviewed, based on inspections made by Region I personnel, since the current license was issued on January 30, 1976 through February 27, 1981. There were 24 safety inspections made in this period and 55 items of non-compliance were found. Although none were considered major violations as defined by the NRC, the large number warranted a more detailed review and analysis of the inspection reports. The non-compliance items in the health physics area involved items such as failure to self monitor upon leaving controlled areas, release of equipment from controlled areas without monitoring, inadequate written procedures, inadequate protective clothing used by personnel, and the absence of a safety technician during scheduled off-shift work hours. The non-compliance items in the area of nuclear criticality safety included the use of unauthorized storage areas, inadequate written procedures, exceeding the batch limit (by 5%), and the absence of work station signs.

Because of the large number of items of non-compliance cited, the compliance history review was extended to the inspections through July 1982. It appears most of the problems occurred prior to 1980. In fact, there were 24 items of

non-compliance in 1979 alone. Since that time, however, the number of non-compliance items was reduced to 6 - 7 per year. CE has been responsive to correcting the items and the improvement in their performance is apparent. The number of personnel performing health physics monitoring has been increased during the review period and the training program has been strengthened. The future compliance history of CE should be closely monitored, although their staffing appears to be adequate. In their current organization, the Nuclear Safety Consultant is not a full-time CE employee (replaced the Manager, Nuclear Licensing, Safety, and Accountability) and the present Supervisor, Health Physics and Safety does not have the health physics analytical capabilities of the former employee in this position.

C. Current Application

In the application, CE has demonstrated that it has the necessary technical staff with the proper qualifications to administer effective nuclear criticality and radiation safety programs. The following sections contain a description of the principal aspects of the CE organization, administrative procedures and nuclear and radiation safety programs, as proposed by CE, and the additional license conditions developed by the staff of the Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards.

VI. Organization and Administrative Procedures

A. Organization

1. Designation of Radiation Safety and Nuclear Safety Responsibilities

Operations at the CE Windsor facilities are administered by a staff organized according to Figures 4 and 5. There are two separate and independent components at CE who handle licensed materials: (1) Products, Services and Development and (2) Nuclear Fuel

Manufacturing. Both components report to the Nuclear Power Systems Division Vice President.

The Vice President, Development, is responsible through the Vice President, Products, Services and Development to the Vice President, Nuclear Power Systems for the accountability, nuclear criticality safety, and radiological safety related to all special nuclear and source materials received by the Development Laboratories and used in any development process. In his position, the Vice President, Development, has delegated to the Manager, Health Physics responsibility to assure that all operations involving nuclear materials have been analyzed to establish the required safety limits and controls. The organization in the laboratories provides separate, independent, and parallel lines of authority and reporting for the research and development (R & D) and safety functions. The Manager, Health Physics is responsible for the surveillance of all Development Laboratory activities in which radioactivity is involved to ensure that the health and safety standards set forth in the license are met. The Manager, Health Physics, reviews and approves all changes in operations involving licensed materials. He has the necessary authority to halt any operation which falls outside approved limits and is responsible for indicating what remedial action is necessary to bring the operation within acceptable limits.

The General Manager, Nuclear Fuel Manufacturing, is responsible through the Vice President, Nuclear Fuel Manufacturing, to the Vice President, Nuclear Power Systems, for the accountability, nuclear criticality safety, and radiological safety related to all special nuclear and source material received by the nuclear fuel manufacturing facility and used in the manufacturing process. The General Manager has delegated to the Production Superintendent and the Engineering Manager responsibility to assure that all operations involving nuclear materials have been analyzed to establish the required safety limits and controls. The Manager, Nuclear Licensing

and Accountability (NLS&A, now a vacant position), and in his absence the Nuclear Licensing Consultant, reports to the General Manager and assists the Engineering Manager and Production Superintendent by performing the analysis required and establishing appropriate controls. The Nuclear Licensing, Safety and Accountability group provides separate, independent and parallel lines of authority with the Production and Engineering group and reports to the General Manager, Nuclear Fuel Manufacturing. In addition, the Supervisor, Health Physics and Safety, who reports to the Nuclear Licensing and Accountability Manager, assures that the required safety limits and controls are being followed. The Health Physics and Safety Supervisor is responsible for the surveillance of all Nuclear Fuel Manufacturing activities in which radioactivity is involved to ensure that the health and safety and nuclear criticality safety requirements of the license are met. He has the necessary authority to halt any operation which falls outside authorized limits and is responsible for indicating the remedial action necessary to bring the operation within limits. However, if the operation is halted because of criticality safety considerations, the Health Physics and Safety Supervisor contacts the Manager NLS&A, the Nuclear Licensing Consultant, or the Nuclear Safety Committee, who determines the necessary corrective action to be taken.

A Nuclear Safety Committee, reporting to the Vice President, Nuclear Power Systems, provides independent assurance to management that nuclear manufacturing operations are carried out in a safe manner. All committee members are competent senior staff members and are not involved in the operation under review.

2. Minimum Technical Qualifications

The safety related positions shown in Figures 4 and 5 are filled by individuals who meet stated minimum qualifications of academic training and professional experience, as follows:

General Manager, Nuclear Fuel Manufacturing

The minimum qualifications of the General Manager is a bachelor's degree in one of the sciences or engineering and five years' experience in nuclear fuel fabrication facilities. In addition, at least three years' supervisory experience is required as well as an understanding of the nuclear criticality safety, health physics, and industrial safety aspects of fuel handling, and knowledge of administrative controls imposed on nuclear fuel handling operations.

Manager, Nuclear Licensing, Safety and Accountability or Nuclear Licensing Consultant

The minimum qualifications for these positions is a bachelor's degree in one of the sciences or engineering and a minimum of three years' experience in positions which demonstrate sufficient judgment and analytical capability to establish and maintain technically sound and effective nuclear criticality safety, health physics, industrial safety and nuclear material accountability programs. He will also meet the minimum qualifications of a Nuclear Criticality Specialist.

Nuclear Criticality Specialist

The minimum qualifications for the nuclear criticality safety specialist is a bachelor's degree in one of the sciences or engineering or equivalent and two years' experience in outside-of-reactor nuclear criticality safety or two years' experience in nuclear reactor physics and one year's experience in outside-of-reactor nuclear criticality safety. Experience in outside-of-reactor nuclear criticality safety is with methods of analysis similar to those required for analyzing the types of activities authorized by their license.

Supervisor, Health Physics and Safety

The minimum qualifications for the health physics and safety supervisor is a bachelor's degree in one of the sciences, engineering, or equivalent and a minimum of two years' experience in radiation safety protection in positions which demonstrate sufficient judgment and capability to establish and maintain an effective nuclear criticality safety and radiation safety program for the types of activities authorized by their license.

Radiation Specialist

The minimum qualifications for the radiation specialist is a bachelor's degree in one of the sciences, engineering or equivalent and a minimum of two years' experience in radiation safety protection.

Manager, Health Physics

The minimum qualifications for the health physics manager is a bachelor's degree in one of the sciences, engineering or equivalent and a minimum of three years' experience in positions which demonstrate sufficient judgment and capability to establish and maintain an effective nuclear criticality safety and radiation safety program. It is recommended a license condition be added to include the minimum qualifications of the Radiation Specialist as part of the minimum qualifications of the Manager, Health Physics.

Nuclear Safety Committee Membership

The minimum qualifications of members of the nuclear safety committee as a whole are the following:

a. Bachelor of Science degree in engineering or one of the sciences with seven years' experience in the nuclear industry.

b. Highly competent senior staff members.

c. Capable of evaluating radiological and nuclear criticality safety programs.

d. Independent of the production or development facility utilizing the nuclear material.

e. Member or consultant to the Committee who performs the independent criticality safety review meets the minimum qualifications of the Nuclear Criticality Specialist and is neither the person who is authorized to conduct the monthly criticality audits nor is the initial criticality reviewer.

f. Member or consultant to the Committee who performs the independent radiological safety review meets the minimum qualifications for the Manager, Health Physics and is neither the person authorized to conduct the monthly radiological safety audit nor is the initial reviewer.

The license application specifies that the independent nuclear criticality or radiological safety review is made by a Committee member. These reviews are actually made by qualified consultants to the Committee. This is satisfactory as the need for qualified independent reviews is met. Therefore, it is recommended that License Conditions 11 and 12 be added to authorize qualified Committee consultants to make the independent reviews.

Radiological Engineer/Senior Radiological Engineer

These persons meet the minimum qualifications for a radiation specialist.

Laboratory HP Technicians

The minimum qualifications for the HP technicians to approve RWPs is two years' experience in the health physics aspects of working with unclad uranium.

Production, Quality Control, or Engineering Manager

The minimum qualifications for these positions are a bachelor's degree in one of the sciences or engineering and three years' experience in nuclear fuel fabrication facilities. They have an understanding of the criticality and health physics aspects of fuel handling and a knowledge of administrative controls imposed on fuel handling operations.

Production Superintendent, General Foreman, Foreman

The minimum qualifications for all foremen are a high school diploma or equivalent and two years of manufacturing experience. The minimum qualifications for the production superintendent are a high school diploma or equivalent and two years' manufacturing experience in radioactive materials handling.

Manager, Nuclear Materials

The minimum qualifications for the nuclear materials manager are a bachelor's degree in one of the sciences or engineering and two years' experience in nuclear materials management.

B. Administrative Procedures

CE has developed an internal review system which ensures that activities at the site are conducted in a safe and efficient manner. The responsibilities for and organization of the system are summarized above under Section VI.A.

The following procedures are used for initiation and review of a proposed new project or a change to an existing project:

1. Nuclear Fuel Manufacturing

a. Proposal - Project personnel submit the proposed changes in writing to the Health Physics and Safety Supervisor.

b. The Manager NLS&A, the Nuclear Licensing Consultant or the Supervisor, Health Physics and Safety, determines what administrative procedure shall be followed when changes in process, equipment or procedures are to be made. That is, he determines whether the changes can be made within the framework and in accordance with the license requirements, or whether an NRC amendment to the license is needed to authorize the changes.

c. Analysis - The Supervisor, Health Physics and Safety, reviews and approves the proposed change or operations and transmits his approval in writing to the cognizant individual. His approval incorporates the results of criticality safety and radiological safety reviews and includes recommendations to assure that appropriate controls are implemented.

The Manager, NLS&A, or the Nuclear Licensing Consultant reviews, evaluates, and approves facility and process changes, equipment rearrangements and additions affecting criticality safety provided that an independent review is performed by the

Nuclear Safety Committee or persons designated by that Committee.

d. Review - All records of analyses (evaluations) are maintained in sufficient detail to permit independent review of the analyses. The Chairman of the Nuclear Safety Committee designates the qualified person who performs the independent nuclear criticality safety reviews.

Any changes in (or new) operating procedures for the Health Physics and Safety Group are reviewed by the Manager, NLS&A, the Nuclear Licensing Consultant, or by the General Manager, Fuel Fabrication.

e. Management Review - Prior to approval of revised or new operating procedures by the Supervisor, Health Physics and Safety, he must incorporate the related results of analysis made by the initial safety reviewer and the independent safety reviewer including recommendations made to assure appropriate controls are implemented. The supervisor's signature on the approval document indicates all required reviews and approvals have been obtained.

f. Documentation - All approval documents and records of evaluations are maintained in sufficient detail to permit independent review of the analyses. Approval documents and records are maintained for a minimum of six months after termination of the operations to which they apply.

2. Development Laboratories

The Laboratories, because of the nature of the work to be performed, do not utilize standard operating procedures. The use of Radiation

Work Permits (RWPs) for all work with radioactive materials assures that appropriate procedures are followed.

Written health and safety restrictions for all operations on radioactive materials are provided in the form of approved RWPs or approved detailed procedures, and appropriate operational limits are posted in the vicinity of work stations. Authorized HP technicians, the Radiological Engineer, Senior Radiological Engineer, or the Manager, Health Physics, may approve RWPs. The RWPs are reviewed weekly by an individual having the minimum qualifications of a Radiation Specialist.

The Laboratories have simple mass limited areas separated by at least 12 feet, making nuclear criticality safety an easily managed program. Requested changes in criticality control areas are formally described in writing and submitted to the Manager, Health Physics, for review and approval. He also determines whether the proposed changes in these areas can be approved internally or whether a license amendment is required.

All approval documents and records of evaluations are maintained in sufficient detail to permit independent review of the analyses and the records are maintained for at least six months after termination of the operation evaluated.

C. Audits and Inspections

1. Nuclear Fuel Manufacturing

Radiation protection and nuclear criticality safety audits are formally performed as follows:

a. Once each work day by an HP technician for radiation and nuclear criticality safety compliance. The findings are reported in writing to the Supervisor, Health Physics and Safety.

b. Once each month for radiation safety by an individual who meets the minimum qualifications of a Radiation Specialist. The audit is to determine compliance with all regulations and operating procedures and to assess the adequacy of the radiation safety program. The findings are documented and submitted to the General Manager, Nuclear Fuel Manufacturing.

c. Once each month for nuclear criticality safety by an individual who meets the minimum qualifications of a Nuclear Criticality Specialist. The audit is to determine compliance with all regulations and operating procedures and to assess the adequacy of the criticality safety program. The findings are documented and reported to the General Manager, Nuclear Fuel Manufacturing.

d. Once each year by the Nuclear Safety Committee for review of all aspects of the criticality and radiation safety programs. Their findings are reported in writing to the Vice President, Nuclear Fuel, with copies to the Vice President, Nuclear Power Systems and to operational supervision.

Follow-up actions on the audits are the responsibility of the General Manager, Nuclear Fuel Manufacturing.

2. Development Laboratories

Radiation protection and nuclear criticality safety audits are formally performed as follows:

a. Once each month by an individual who meets the minimum qualifications of the Health Physics and Safety Supervisor to assess the adequacy of the radiation and nuclear criticality safety programs. The findings are documented and copies submitted to operational supervision, the Vice President, Development, and to the Vice President, Nuclear Power Systems.

b. Once each year by an individual independent of the Development Laboratories who meets the minimum qualifications of the Manager, Health Physics. The audit is an overall review for compliance with all regulations and license requirements. The findings are documented and copies submitted to operational supervision, to the Vice President, Development, and to the Vice President, Nuclear Power Systems.

Follow-up actions on the audits of the Development Laboratories is the responsibility of the Manager, Health Physics.

D. Personnel Training

New employees receive safety training by the Supervisor, Health Physics and Safety for Fuel Manufacturing personnel and by the Manager, Health Physics, for Development Laboratories personnel prior to working in restricted areas. The training includes principles of radiation safety (including ALARA practices), nuclear criticality safety, industrial safety, emergency procedures, an introduction to 10 CFR Parts 19 and 20, and specific information related to their jobs. Specialized training for radiation and nuclear criticality safety is commensurate with the extent of the employees' contact with radioactive materials.

All trainees must complete a test to ascertain the effectiveness of the training. The test must be satisfactorily completed in accordance with established criteria before being allowed to handle radioactive materials without direct supervision. Records of all formal training sessions are kept.

All production personnel who work with radioactive materials attend a formal annual safety retraining session, with no more than 13 months between training sessions. Besides including topics in the initial training session, the retraining sessions emphasize problem or potential problem areas.

Salaried manufacturing personnel who normally enter restricted areas also attend a formal annual retraining session directed toward observation and supervision in restricted areas rather than the actual handling of radioactive material.

The laboratory personnel who handle radioactive material are given formal retraining at least every two years.

The HP technicians in manufacturing and in the laboratories are given their initial training in health physics and in the use of instruments, contamination control, environmental sampling, and other aspects relative to their jobs before they are allowed to perform their jobs without direct supervision. They also receive sufficient training in nuclear criticality safety to enable them to carry out their daily inspection functions. The HP technicians, in both manufacturing and in the laboratories, also receive annual retraining.

E. Records

The licensee has committed to the maintenance of records for various required actions, such as the records of criticality analyses, plant alterations or additions, abnormal occurrences associated with radioactivity releases, audits and inspections, instrument calibration, ALARA findings, training and retraining, personnel exposures, and routine radiation and environmental surveys. CE has decided to retain the records relating to health and safety indefinitely.

VII. Nuclear Criticality Safety

The CE nuclear criticality safety criteria provides reviews by two different qualified reviewers for those changes which involve nuclear criticality safety considerations.

The technical criteria that the reviewers use to establish the criticality safety of a proposed, revised, or new operation are provided in detail in Part I of the license application. The important criteria are as follows:

1. The basic policy is the double contingency policy: Process designs incorporate sufficient factors of safety to require at least two unlikely, independent, and concurrent changes in process conditions before a criticality accident is possible. This is the basic policy endorsed by Regulatory Guide 3.4, "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors."

2. Safe mass limits are listed for homogeneous and heterogeneous systems and have a safety factor of 2.3, an accepted safety factor. These mass limits are based on data and calculations reported in Documents WCAP-2999, DP-1014, LA-3612 and the UKAEA Handbook of Criticality Data. The mass limits and correct applications of safety margins were checked by the staff against other data sources and were compared with limiting values listed in other licenses for low enriched uranium processing.

3. Safe cylinder diameters, slab thicknesses, and unit volumes are tabulated in the license. Safety factors of 1.1, 1.2 and 1.3, respectively, were used. The specific values in the license were also checked as indicated above under Item 2.

4. Nuclear safety is independent of the degree of moderation within the process unit when addition of moderating materials is considered credible.

5. When the interspersed moderation from sprinklers is the only source of water moderation between units, a maximum interspersed water density is assumed.

6. Optimum credible conditions of heterogeneity are considered in all cases.

7. Unit limits are based on assumed infinite water reflection.

8. Credit for moderation control may be taken by CE when the moisture content of the material has been analyzed, the container is closed, and the material is maintained in an atmosphere which contains no additional source of moderation and has no source of moderation piped to it.

9. The computed k_{eff} for fuel assemblies, including allowances for computational error and all applicable uncertainties and bias, will not exceed 0.95. These computations will be performed by a Nuclear Criticality Specialist and the results independently reviewed by a second criticality safety specialist designated by the Chairman of the Nuclear Safety Committee. The method of analysis and the computer codes used are first validated in accordance with the criteria established in Regulatory Guide 3.41, for applicability to the problem being analyzed.

10. The maximum authorized calculated k_{eff} (by methods used at CE) for arrays, with interspersed water moderation in controlled areas in which the only source of water is from the sprinklers in the room, will be reduced to 0.80 because of the absence of experimental data and larger uncertainties in the results of calculations when compared with results of calculations made by the staff using different computer codes. CE stated in a license condition section of its application that the k_{eff} limit of 0.80 "shall apply for calculations

performed for maximum mist controlled areas." In order to clarify the area of application, it is recommended a license condition be added that specifies the k_{eff} criterion applies for calculations performed for maximum credible mist (density of 0.02 g/cm^3) controlled areas. In uncontrolled areas optimum mist density for maximum k_{eff} is considered and the maximum authorized k_{eff} is 0.93.

11. CE generally spaces process equipment and stored units to meet the surface density criteria specified in Part I of the license renewal application. These criteria have been justified using KENO calculations and by conservatively basing the safety of a unit on the optimum conditions for the minimum critical parameter specified and the minimum surface density for the array at optimum moderation for minimum mass per unit area.

12. At all other times the safety of an array will be based on a calculated k_{eff} of 0.95 or 0.80 (see Items 9 and 10 above) using validated methods of analysis.

The nuclear safety review and our conclusions that the controls are acceptable are based on:

1. The history of safe plant operation with respect to nuclear criticality safety since the original license was issued.

2. The demonstrated qualifications of the nuclear criticality safety personnel.

3. The submitted application has been revised twice to increase the broadness of the license, improve clarity, correct discrepancies, and ensure continued compliance with accepted practice. The basic policy underlying the conditions sections of the license is in accordance with Regulatory Guide 3.4, "Nuclear Criticality Safety in Operations with Fissionable Materials Outside Reactors."

4. The validity of the nuclear criticality safety analyses made under the license, including justification for the surface density criteria, establishment of the maximum interspersed moderator density from sprinklers, and the safety demonstration, has been confirmed.

The last three of the foregoing points are expanded briefly in the following paragraphs:

1. Qualifications of Personnel

The competence of the incumbents in the positions of Nuclear Licensing Consultant and the Nuclear Criticality Safety Specialist designated by the Chairman of the Nuclear Safety Committee are demonstrated by the analyses they have made. CE has retained a Nuclear Licensing Consultant who performs the regular nuclear criticality safety audits as well as the nuclear criticality safety reviews and analyses to fill the gap in their full-time organization because of the lack of a Manager, Nuclear Licensing, Safety and Accountability qualified to perform the required safety audits, reviews and analyses.

2. Broadness of License

The previous CE license was restrictive and did not provide much latitude for making changes without NRC approval. All operations were conducted in accordance with criteria in two tables: (1) specific safe individual units and (2) safe arrays of units based on the safe surface densities. All proposed operations outside the limits of the two tables required a license amendment. Indeed, 36 amendments were required during the lifetime of the license.

The renewed license is broad and changes to existing operations can be made in accordance with broad criteria based on specified safety margins without obtaining an amendment to the license. CE has demonstrated they have an adequate internal program to perform the required nuclear criticality safety analyses and have them independently reviewed and approved by qualified personnel.

The wording in the revised license application makes clear the objective of the review of the analyses is to ensure fulfillment of the double contingency policy and that such reviews are made by a qualified person other than the original analyst.

3. Nuclear Criticality Safety Reviews

The reviews by the FCUF staff of the nuclear criticality safety analyses for new or revised process operations have shown correct conformance with the license conditions.

Although the review by the FCUF staff of the nuclear criticality safety analyses indicated CE should have done a better job of proof-reading the demonstration section of the application (e.g., omission of Greek symbols in several formulas and several typographical errors), our conclusion that the nuclear safety organization and controls of the licensee are adequate is not changed. This was discussed with R. E. Sheeran, CE Supervisor, Health, Physics and Safety. The licensee will rectify the indicated type inadequacies in the demonstration section of the application at a later date.

VIII. Radiation Safety

A. Radiation Safety Administration

The Vice President, Nuclear Power Systems, is responsible for all activities involving licensed material that are carried out in both

Nuclear Fuel Manufacturing (NFM) and the Development Department Laboratories (DDL). At NFM, it is the Health Physics and Safety Supervisor's (HPSS) responsibility to establish and maintain a radiation protection program for ensuring the protection of plant employees. He is also responsible for inspecting plant operations for compliance with license conditions and radiological regulations. At DDL, the Manager, Health Physics, is responsible for establishing and maintaining a radiation protection program for the area. Both the HPSS and the Manager, Health Physics, are authorized, for their own areas, to suspend any operation which they believe does not comply with the regulations or operating procedure set forth in the license.

In detail, the responsibilities of both health physics and safety components include:

1. Review and approval of health physics aspects of changes to operating procedures associated with the processing, handling or storage of SNM.

2. Conducting routine radiation monitoring surveillance of the facility, and reviewing the trends of personnel exposure and effluent releases to ensure they are within the limits as specified in the regulations and meet the ALARA goal.

3. Approval of radiation work permits.

4. Conducting a training program in radiological physics.

The overall objectives of the programs are to ensure adequate containment of radioactive material and to reduce the levels of radiation exposure to the employees and the public to meet the ALARA goal.

The positions of the Health Physics and Safety Supervisor and the Manager, Health Physics, are filled by individuals who must meet the minimum qualifications stated in Section VI of this report. These technical qualifications assure these individuals have an adequate background, and professional experience, complete with special training in health physics.

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

Radiation Work Permit (RWP)

At the Nuclear Fuel Manufacturing facility, for any operation not already covered by an effective operating procedure, such as nonroutine maintenance or a repair operation on equipment, an RWP shall be prepared by the Nuclear Licensing, Safety and Accountability group. The RWP shall include all safety requirement features for the proposed operation and be reviewed every month to ensure that the operation is conducted in a safe manner. At DDL, all work with radioactive material requires an RWP which has similar features of safety requirements in it. The RWPs issued to the Nuclear Laboratory are reviewed weekly.

ALARA Commitment

CE management has made a commitment to ALARA by keeping radiation exposure to personnel and release of radioactive material in effluents to unrestricted areas to a minimum. CE's program to achieve the ALARA goal in NFM and DDL are similar but conducted independently. (1) At the Nuclear Fuel Manufacturing facility, a qualified HP shall review monthly the trends in personnel exposure (internal and external), radiation levels, airborne activity levels, effluent release, etc. His evaluation plus his recommendations necessary to achieve the ALARA goal are reported to the General Manager, who is responsible for implementing the recommendations. Furthermore, CE's Nuclear Safety Committee is responsible for a comprehensive annual review of the adequacy of NFM's radiation safety program.

The Committee's report is transmitted to the VPs, Nuclear Fuel and Nuclear Power Systems, and to Operational supervisors. (2) At DDL, the program is conducted by a qualified HP who is independent of the DDL. His annual report and recommendations for the changes to achieve ALARA are reported to the VPs, Development and Nuclear Power Systems.

5. Systems of Exposure Controls and Exposure Levels Experienced

External Exposure

External exposure of the personnel at CE is controlled and evaluated on the basis of the data from personnel dosimeters which must be used as required by the regulations of 10 CFR 20. The dosimetry reading is evaluated by radiation safety components on a monthly basis. When a high exposure is suspected, the individual's badge will be processed immediately.

The external exposure data submitted by CE for the period 1977 through 1979, as represented by Table 1, show that annual exposures are typically less than 20% of the permissible limit, with no exposure near the 5 rem per year limit.

Table 1 Annual external radiation exposure summary
Combustion Engineering, SNM-1067

Annual dose ranges (REM)	Max. percent of allowable limit	No. of individuals in each range 1977	1978	1979
Less than 0.1	2	61	59	64
0.1 - 0.5	10	45	55	50
0.5 - 1.0	20	25	19	36
1.0 - 2.0	40	9	7	8
2.0 - 3.0	60	0	0	1
Over 3.0	0	0	0	0

Internal Exposure

Introduction

Radioactive material may enter the body by breathing contaminated air or by ingesting as a consequence of poor hygiene and failure to self monitor. At the CE facility, 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 work areas.

2. An air sampling and analysis program for monitoring the concentration of radioactivity 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 protective devices is in accordance with Regulatory Guide 8.15, Acceptable Programs for Respiratory Protection. This complies with the regulations specified in 10 CFR 20.103.

6. Surveys to detect the presence and extent of radioactive surface contamination.

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

Monitoring of Air Concentration of Radioactivity

The ventilation system at both NFM and DDL are designed and operated to move air from areas of low contamination potential to areas of high contamination potential. At NFM, there are four separate exhaust systems providing the ventilation for the areas of Powder Preparation and Pressing, Furnace H_2 Burn Off, Pellet Grinding and Rod Loading, and Recycle Powder. The exhaust air from room air hoods is filtered by HEPA filters and continuously monitored for radioactivity before it is discharged through the stacks. The systems maintain the face velocity of the ventilated hood in the facility above 100 FPM and pressure differential across the HEPA filters above 4 inches of water. The exhaust air from the powder preparation and pressing area may discharge back into the unclad fuel area. The concentration of radioactive material in the recycled air is monitored and analyzed by fixed air samplers in the operating areas near the discharge point.

Exhaust systems at DDL are similar to NFM's except smaller in total capacity, and there is no recirculated air discharged back into the laboratories. The specifications for hood face velocity and pressure differential across the HEPA filters in the DDL are the same as for NFM.

The air quality in the CE plant is maintained through tests and maintenance of the ventilation system and filters. For instance, tests are performed at least monthly at NFM to determine that air flows are from low contaminated areas to more highly contaminated areas. The HEPA filters are changed or cleaned whenever the differential pressure across the filter exceeds 4 inches of water. The minimum frequencies for checking the pressure drop across the filters and face velocity in the ventilated hoods are weekly for NFM and monthly for DDL.

The airborne concentration of radioactivity in the room air is continuously monitored and at NFM, is analyzed every shift. This is done based on the data obtained by using fixed sampling heads mounted at work locations

where the potential for airborne contamination exists. If a single air sampling station indicates the air level of radioactivity exceeds the 1 MPC_{air} limit specified in Table I, Column I of Appendix B to 10 CFR 20, the licensee shall investigate the cause. Individual internal exposure is evaluated based on the data obtained from personal breathing zone (BZ) samplers which must be worn by workers during their work at least 75% of the time.

After reviewing the licensee's procedure for monitoring the airborne concentration of radioacivitiy, the staff has found two deficiencies:

(1) The licensee evaluates an individual's internal exposure based on the air concentration data obtained by sampling only 75% of the time during the operating period. This practice could result in inaccuracies in the estimation of the individual's internal exposure.

(2) The licensee does not have a specified schedule to analyze the air concentration level in Nuclear Laboratory.

In order to correct these two deficiencies, the staff has recommended the following two license conditions be incorporated in the renewal license:

Condition 14: Notwithstanding the statements made in Section 3.2.5 of the revised application dated May 14, 1982, by June 30, 1983, the licensee shall evaluate the individual's internal exposure to airborne radioactivity based on breathing zone sampling data which are obtained by continuous sampling for the period of his presence in the work area where the unclad radioactive material is handled. If permanently mounted air sampling equipment is used to determine the breathing zone air concentration levels, the licensee shall evaluate its representativeness

at least once every 12 months and whenever any licensed process or equipment change is made.

Condition 15: When the monitoring of airborne concentration of radioactivity is required as specified in 10 CFR 20.103, the air concentration of radioactivity in the Nuclear Laboratories shall be analyzed within 24 hours after each operating shift.

In-Plant Airborne Activity Levels

Data on the concentration of airborne radioactivity in various work areas for the past two years are shown in the following table:

Table 2 Average airborne concentration levels at CE. Expressed as % of MPC air specified in Table I, Column I, Appendix B to 10 CFR 20, SNM-1067

Area	1978 June-Dec.	1979	1980 Jan.-June
Powder preparation	5	3	<6
Press area	<3.5	4	<6
Grinder	<8	<6	<6
Oxidation-reduction furnace	<3	<3	<3
Micronizer	<3	<3	<3

The table indicates the average airborne concentration level in the work area is less than 8% of MPC level specified in 10 CFR 20.

C. Bioassay Program

Internal exposure is evaluated and controlled by a bioassay program conducted in accordance with detailed provisions similar to those in Regulatory Guide 8.11. The pertinent parts of the license application include the definition of sampling frequencies, types of analyses made and action levels, and action to be taken.

The CE bioassay program provides for routine collection and analysis of urine samples 12 times per year from individuals exposed to soluble uranium compounds and once per year from individuals exposed to insoluble uranium compounds. Annual in vivo lung counts are also taken for all workers routinely working in areas of potential exposure to uranium to determine individual lung burdens. The bioassay frequency will also increase according to the most recent quarterly average of airborne uranium concentration as specified in Table 3 of Regulatory Guide 8.11, "Application of Bioassay for Uranium." Data provided by CE indicate that for the past three years (1977-1979), all urinalysis results indicated less than 4 µgm U/liter which is far less than the action level of 25 µgmU/liter. In-vivo lung counting results for 1979 indicated the majority of individuals (85%) had a lung burden ranging from 0 to 25% of the maximum permissible lung burden (MPLB). No individual has been detected to have a lung burden of uranium exceeding the MPLB.

D. Control of Surface Contamination

The restricted areas of the CE plant are zoned to define areas as contaminated areas and clean areas; each defined area is surveyed routinely by an instrument which is calibrated twice per year for any undesirable surface contamination. The frequency of this survey and action levels for clean up are based on the use for which the areas are committed and on the potential hazard presented by the presence of surface contamination. Specifications for control of surface contamination used by CE are within

the range of levels used at other fuel fabrication facilities with similar types of material and potential for contamination. They are summarized as follows:

Table 3 Guide to surface contamination control levels
SNM-1067

Areas	Action levels dpm/100 cm^2 removable alpha	Frequency	Action to be taken
Contaminated areas	5000	weekly	24 hrs clean up
(Pellet shop and contaminated area of DDL)	10,000	weekly	immediately clean up
Clean areas (Such as office, warehouse)	50	monthly	24 hrs clean up
	100	monthly	immediately clean up
Lunch room	10	daily	immediately clean up
Personnel body and clothing	indistinguishable from background	before leaving contaminated area	*

*If contaminated level detected exceeds the established background level, Health Physics staff shall assist the individual in cleaning up.

CE has requested authorization to use 13 encapsulated SNM sources for generating neutrons. To ensure that these sources remain leaktight, the staff has recommended adding as a license condition Annex A, "License Condition for Leak Testing Sealed Source Which Contains Alpha Emitter."

The staff has also added a condition (Condition 17) requiring release of equipment and packages from the plant site or to clean areas onsite which shall be in accordance with attached Annex B, "Guidelines for Decontamination of Facilties and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Materials," dated July 1982, which is a recently revised internal guide developed by NMSS staff.

E. Effluent Control

Air Effluent

Potentially contaminated exhaust air generated from NFM is filtered prior to release to unrestricted areas through stacks which are continuously monitored and analyzed for radioactivity on a daily basis. The exhaust air from NL is released through 8 stacks which are continuously monitored for radioactivity and analyzed routinely. If air effluent radioactivity, averaged over a two-week period (from NFM or DDL), exceeds 25% of the limit specified in Table II, Column I, of 10 CFR 20, Appendix B, Health Physics staff shall investigate the cause and take corrective action. Data reported by the licensee show that airborne effluent released from CE is within the 15% limit for unrestricted areas specified in 10 CFR Part 20.

Liquid Effluent

All potentially contaminated liquid wastes generated by CE's operation are first stored at one of ten 2,000-gallon retention tanks located in the liquid wastes building #6. The tanks fill automatically in sequence. The liquid is discharged to the Windsor site creek which flows into the Farmington River only when the liquid was measured to have a concentration of uranium at or below 3×10^{-6} µc/ml by gross alpha count or the measured concentration at or below 3×10^{-9} µc/ml for unidentified mixtures of radionuclides. These are 10% of MPC_w specified in Table II, Column II, of Appendix B of 10 CFR 20. If the concentration of uranium is greater, the liquid is diluted to acceptable levels prior to discharge. It is recommended Condition 18 be added requiring an annual calibration of the instruments measuring the liquid level in each dilution tank.

Solid Wastes

Low-level radioactive solid wastes will be packaged in accordance with all applicable regulations and transported to an approved disposal facility. Prior to shipment to the disposal facility, low level solid waste packages may be stored outside in a fenced area within the CE site. All outside storage is sealed and checked four times each year to ensure that no radioactive contamination has leaked from the package.

The section which describes the packaging of the radioactive wastes did not address specifically that all radioactive packages for outside storage meet the NRC requirement in 10 CFR Part 71. Accordingly, the following condition is recommended:

Condition 19: Notwithstanding the statements in Section 5.1.3, page I.5-2 of the application, revision 2 dated April 6; 1982, all wastes contaminated with radioactive material to levels in excess of limits specified in Annex B shall be packaged in accordance with the requirements of 10 CFR 71 and disposed of at a licensed radioactive waste-burial ground.

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

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 Windsor 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 I for corrective action. The ongoing program of engineering improvements to reduce airborne activity levels should result in a gradual reduction in internal exposures.

IX. Environmental Monitoring

CE has an environmental monitoring program which involves periodic sampling of rainfall and particulate fallout from stations distributed concentrically on the site property, liquid samples taken from site wells and ponds, the site creek and points upstream and downstream from the confluence of the site creek and the Farmington River, sediment samples from the site ponds, the industrial stream and points upstream and downstream from the confluence of the industrial stream and the Farmington River, and vegetation and soil samples taken at each of the fallout stations onsite and from tobacco fields offsite. The adequacy of this program was evaluated and established as part of the environmental impact appraisal and reported in May 1982 as the "Environmental Impact Appraisal of the Proposed Special Nuclear Material License Renewal Related to the Nuclear Fuel Fabrication Plant, Combustion Engineering, Inc., Windsor, Connecticut." The appraisal included the gaseous, liquid, and solid waste effluent.

In order to assure compliance with Title 40, Code of Federal Regulations, Part 190 and pursuant to Title 10, Code of Federal Regulations, Parts 70 and 40, it is recommended Condition No. 20 be added as follows:

Condition 20:

(a) If the radioactivity in the plant gaseous effluents exceeds 18 μCi gross alpha activity in total uranium 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 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.

(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.

X. Radiological Contingency Plans

By letter dated June 7, 1982, CE transmitted to the NRC a revised Radiological Contingency Plan incorporating the additional information requested by the NRC as part of Amendment 35 to the existing license dated March 26, 1982. The revised plan is adequate to demonstrate the licensee has accomplished the purposes of onsite radiological contingency planning: (1) The plant is properly configured to limit releases of radioactive materials and radiation exposures in the event of an accident. (2) A capability exists for measuring and assessing the significance of accidental releases of radioactive materials.

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

(3) Appropriate emergency equipment and procedures are provided onsite to protect workers against radiation hazards that might be encountered following an accident. (4) Notifications are promptly made offsite to Federal, State and local government agencies. (5) Necessary recovery actions are taken in a timely fashion to return the plant to a safe condition following an accident.

The CE facility's emergency response capability, because of the extensive nonradiological activities on the same site, has the advantage of a large installation (skilled work force, fire brigade, etc.) for coping with the nonradiological consequences of any accident or incident involving radioactive materials. Its response capability is further strengthened by its inclusion, by State requirements, in the Connecticut State Emergency Operations Plan. It is recommended that the Radiological Contingency Plan be incorporated in Condition 21.

XI. Fire Safety

CE has stated the manufacturing and laboratory facilities have been constructed and are operated in accordance with the applicable National Fire Protection Association (NFPA) safety codes. Documentation of the adequacy of the fire protection program for the uranium fuel handling facilities has been provided by the Nuclear Energy Liability-Property Insurance Association (NELPIA). A copy of the American Nuclear Insurers (ANI) inspection report and the NELPIA report containing evidence of insurability of the facilities is included in an addendum to this safety evaluation report.

XII. Plant Decommissioning

CE has incorporated the decommissioning plan approved April 23, 1979, as Amendment No. 19 to the current license condition section of the renewal application.

The performance objective is to assure that the health and safety of the general public are protected by decontaminating the site and facilities so that they can be released for unrestricted use.

The CE Decommissioning Plan was reviewed by the staff and appears to be adequate in that the Performance Objective complies with the NRC Guidelines; the procedures proposed (together with the radiation control program associated with the license) are reasonable, acceptable to the staff, and should allow the Performance Objective to be attained.

CE, by letter dated March 23, 1982, stated that when the Windsor operations are phased out and it becomes necessary to decommission the facility, funds will be made available for such decommissioning costs at the time they are incurred through the use of current revenues.

The CE commitments for decommissioning and financial arrangements have been incorporated by the FCUF staff as a license condition to identify the decommissioning requirements at the end of plant life.

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 FCUF 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 has discussed the renewal and the proposed license conditions with Mr. J. Roth, Region I Project Inspector of the CE facility, on November 9 and 10, 1982. He feels the license, as written, addresses all of Region I's concerns and has no objection to the issuance of the renewal.

The staff, therefore, recommends that the Windsor license be renewed to revise it in its entirety, in accordance with the statements, representations and conditions in CE's application dated December 18, 1980, its revision dated October 1, 1981, and its second revision dated May 14, 1982, subject to the following additional conditions:

9. Authorized Use: For use in accordance with statements, representations and conditions contained in Part 1 of the licensee's revised application dated May 14, 1982, and supplements dated March 23, September 16, and October 4, 1982.

10. Authorized Place of Use:

    a. The licensee's existing facilities approximately 5 miles northwest of Windsor, Connecticut, as described in the referenced application.

11. The Nuclear Safety Committee member or consultant to the Committee who performs the independent criticality safety review shall meet the minimum qualifications of the Nuclear Criticality Specialist and shall not be the person who is authorized to conduct the monthly criticality audits and shall not be the initial reviewer.

12. The Nuclear Safety Committee member or consultant who performs the independent radiological safety review shall meet the minimum qualifications for the Manager - Health Physics and shall not be the person who is authorized to conduct the monthly radiological safety audit and shall not be the initial reviewer.

13. The maximum authorized calculated k_{eff} of 0.80 for arrays with interspersed water moderation in controlled areas in which there is no moderation at the work or storage station and the only other source of water will be from sprinklers in the room shall be based on the maximum credible mist density of 0.02 g/cm^3.

14. Notwithstanding the statements made in Section 3.2.5 of the revised application dated May 14, 1982, by June 30, 1983, the licensee shall evaluate the individual's internal exposure to airborne radioactivity based on breathing zone sampling data which are obtained by continuous sampling for the period of his presence in the work area where the unclad radioactive material is handled. If permanently mounted air sampling equipment is used to determine the breathing zone air concentration levels, the licensee shall evaluate its representativeness at least once every 12 months and whenever any licensed process or equipment change is made.

15. When the monitoring of airborne concentration of radioactivity is required as specified in 10 CFR 20.103, the air concentration of radioactivity in the Nuclear Laboratories shall be analyzed within 24 hours after each operating shift.

16. The licensee shall conduct a leak test on all encapsulated sources in accordance with the attached Annex A, "License Condition for Leak Testing Sealed Source Which Contains Alpha Emitter."

17. Notwithstanding the statements made in Section 3.2.8.2 and Section 3.2.8.3 of page I.3-14 and Page I.3-15, respectively, of the application, revision 2, dated April 6, 1982, release of equipment and material from the plant to offsite for unrestricted use or from contaminated to clean areas onsite shall be in accordance with the attached Annex B, dated July 1982.

18. The instruments measuring the liquid-waste level in each dilution tank prior to discharge to the Farmington River shall be calibrated at least annually.

19. Notwithstanding the statements in Section 5.1.3, page I.5-2 of the application, revision 2 dated April 6, 1982, all wastes contaminated with

radioactive material to levels in excess of limits specified in Annex B shall be packaged in accordance with the requirements of 10 CFR 71 and disposed of at a licensed radioactive burial ground.

20. The licensee shall take the following action on plant gaseous effluent releases:

(a) If the radioactivity in the plant gaseous effluents exceeds 18 μCi gross alpha activity in total uranium 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 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 changes in parameters and includes an estimate of the resultant change in dose commitment.

(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 June 7,

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

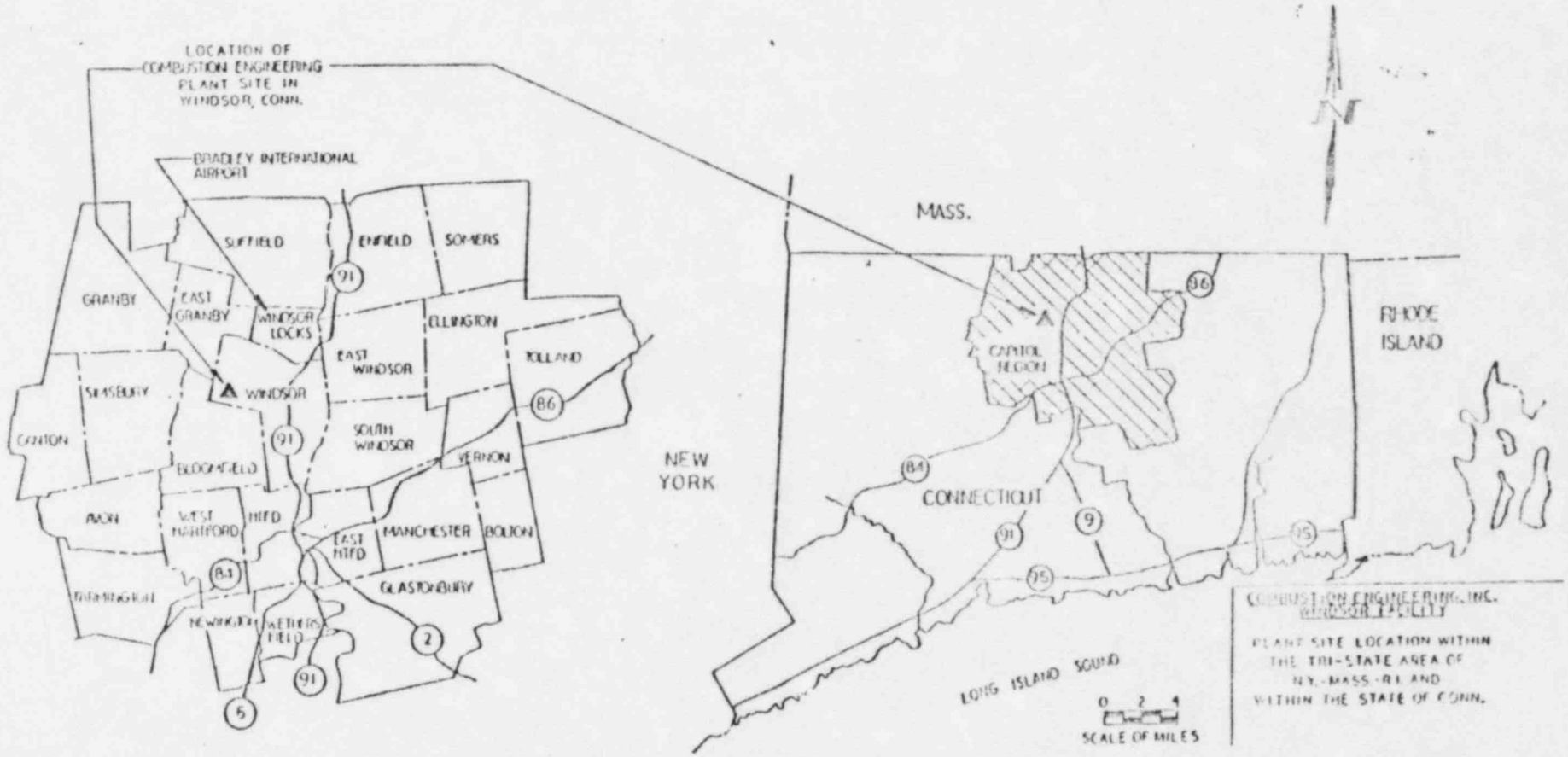
1982. The licensee shall maintain implementing procedures for his Radiological Contingency Plan as necessary to implement the Plan. The licensee shall make no change in his Radiological Contingency Plan that would decrease the response effectiveness of the Plan without prior Commission approval as evidenced by a license amendment. The licensee shall maintain records of changes that are made to the plan without prior approval for a period of two 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 six months after the change is made.

22. At the end-of-plant life, the licensee shall decontaminate the facility and site in accordance with the general decommissioning plan submitted with your renewal application dated May 14, 1982 so that these facilities and grounds can be released for unrestricted use. The financial commitment assuring funds for decommissioning, submitted by letter dated March 23, 1982, is hereby incorporated as a condition of the license.

A. L. Soong
Radiation Safety

Norman Ketzlach
Project Manager

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



Combustion Engineering, Inc. Site Location

Figure 1

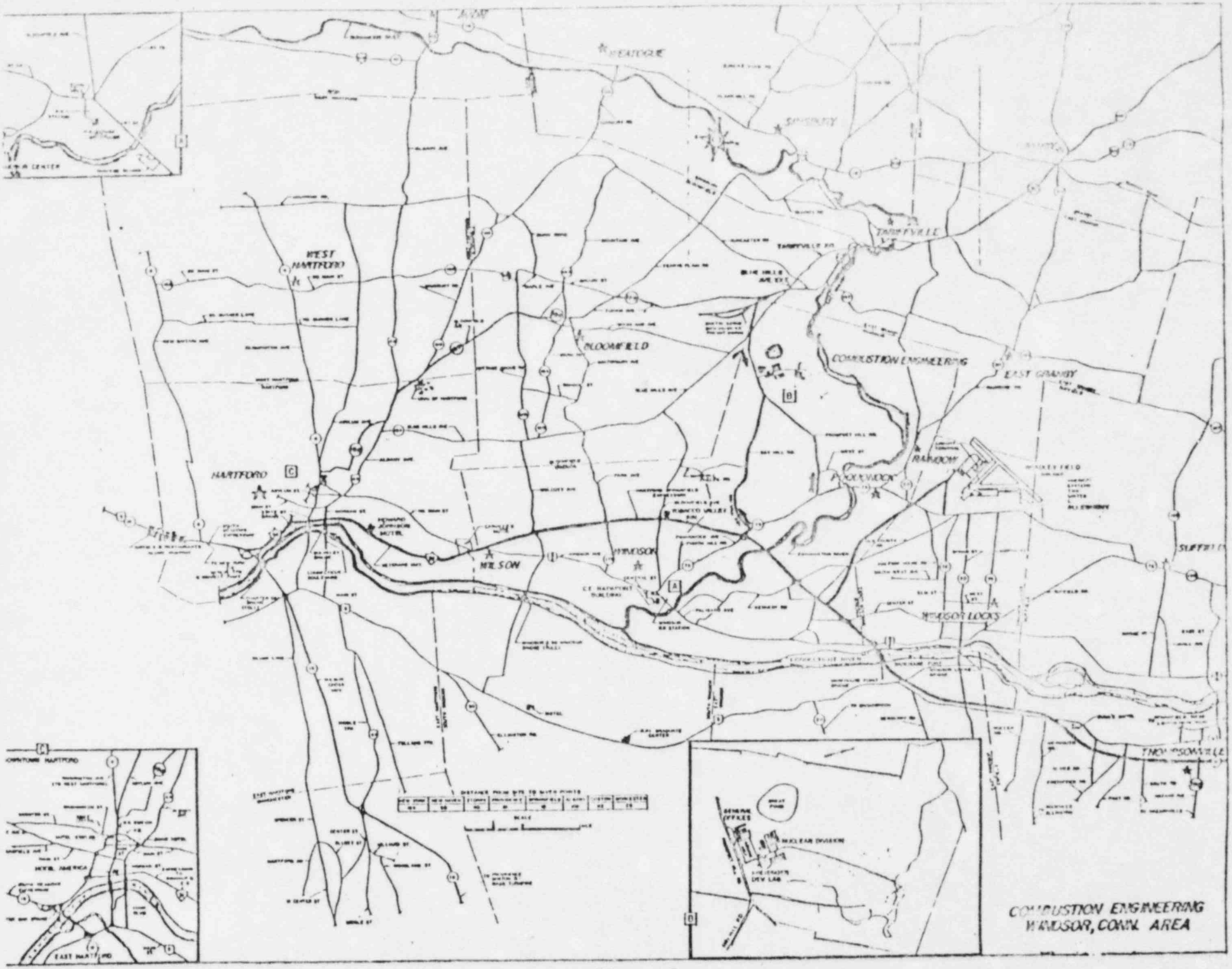

AVON
CANTON
SIMSBURY
TARIFFVILLE
WEST HARTFORD
BLOOMFIELD
COMBUSTION ENGINEERING
EAST GRANBY
WINDSOR
HARTFORD
WINDSOR LOCKS
SUFFIELD
THOMPSONVILLE
COMBUSTION ENGINEERING
WINDSOR, CONN. AREA

Figure 2

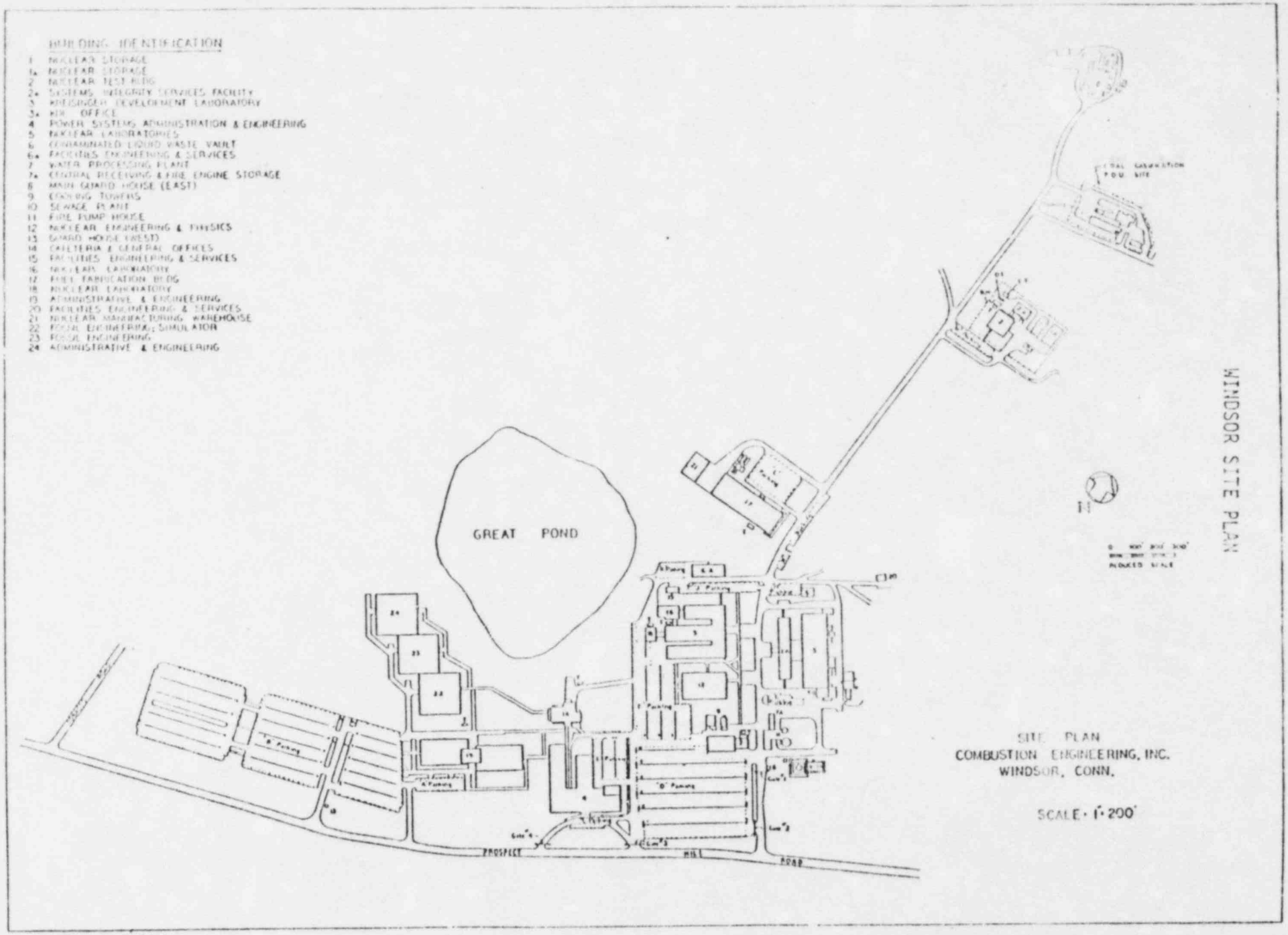
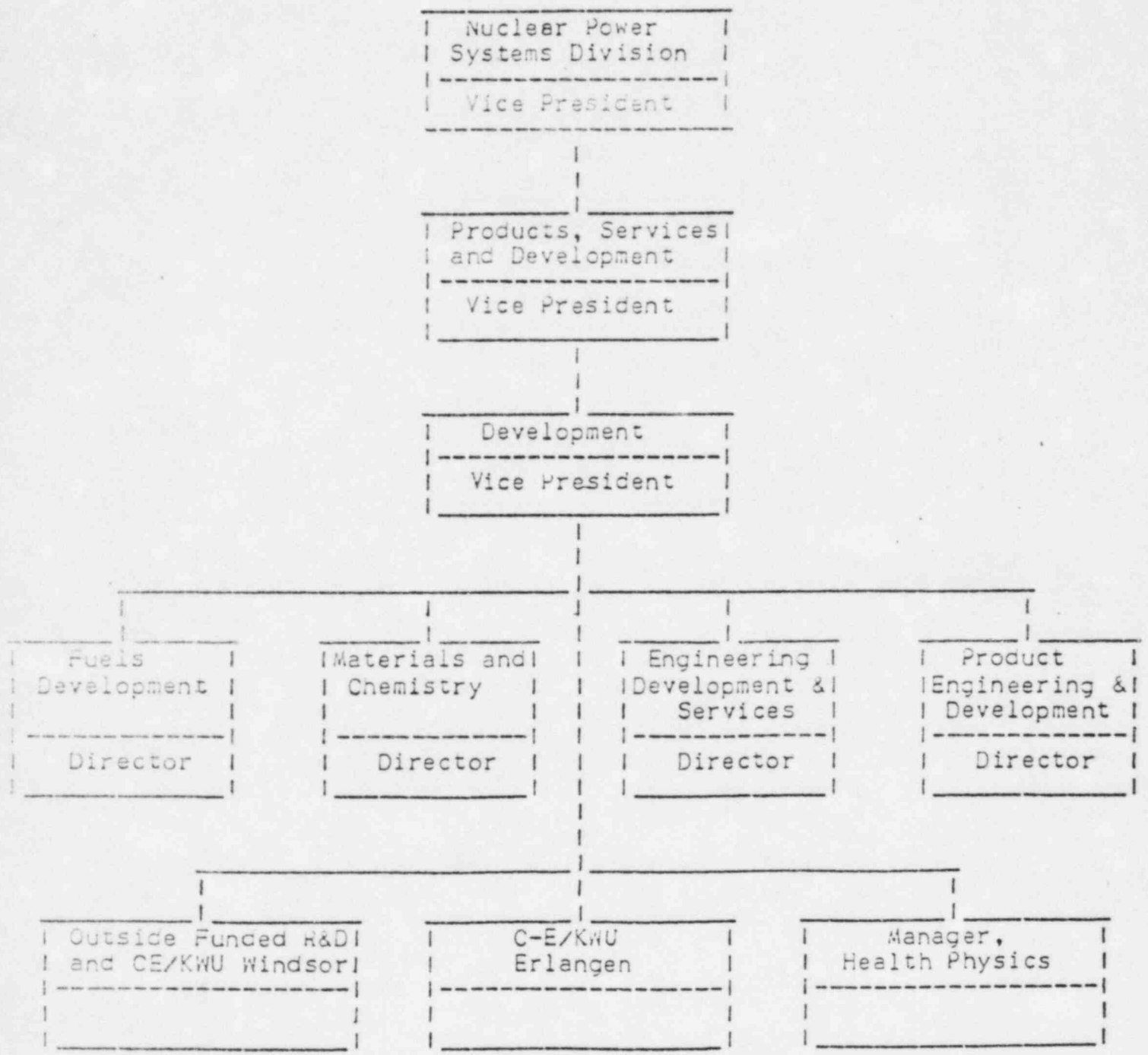
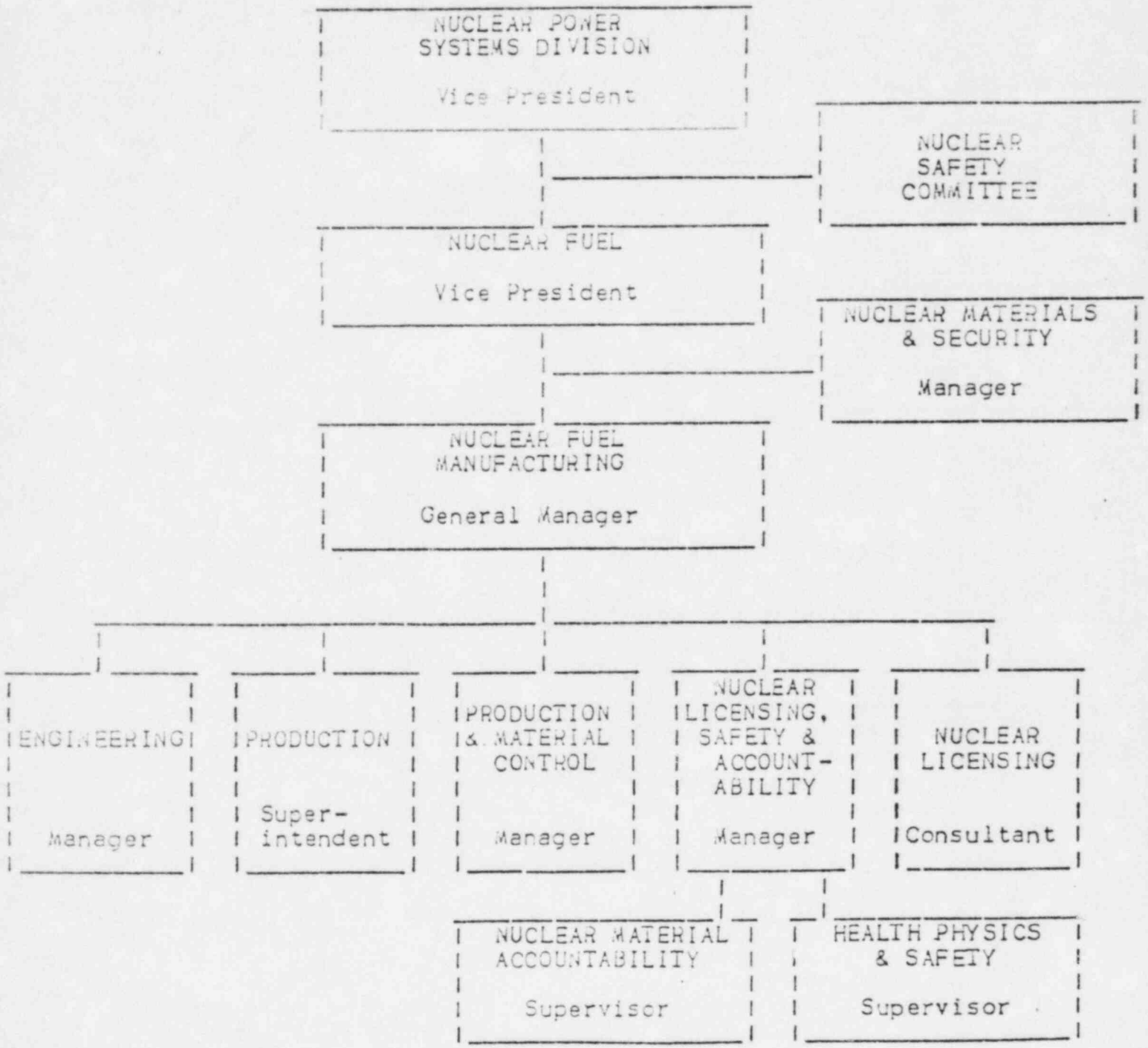

BUILDING IDENTIFICATION
1 NUCLEAR STORAGE
1A NUCLEAR STORAGE
2 NUCLEAR TEST BLDG
2A SYSTEMS INTEGRITY SERVICES FACILITY
3 KREISINGER DEVELOPMENT LABORATORY
3A KDL OFFICE
4 POWER SYSTEMS ADMINISTRATION & ENGINEERING
5 NUCLEAR LABORATORIES
6 CONTAMINATED LIQUID WASTE VAULT
6A FACILITIES ENGINEERING & SERVICES
7 WATER PROCESSING PLANT
7A CENTRAL RECEIVING & FIRE ENGINE STORAGE
8 MAIN GUARD HOUSE (EAST)
9 COOLING TOWERS
10 SEWAGE PLANT
11 FIRE PUMP HOUSE
12 NUCLEAR ENGINEERING & PHYSICS
13 GUARD HOUSE (WEST)
14 CAFETERIA & GENERAL OFFICES
15 FACILITIES ENGINEERING & SERVICES
16 NUCLEAR LABORATORY
17 FUEL FABRICATION BLDG
18 NUCLEAR LABORATORY
19 ADMINISTRATIVE & ENGINEERING
20 FACILITIES ENGINEERING & SERVICES
21 NUCLEAR MANUFACTURING WAREHOUSE
22 POWER ENGINEERING SIMULATOR
23 POWER ENGINEERING
24 ADMINISTRATIVE & ENGINEERING
GREAT POND
PROSPECT HILL ROAD
WINDSOR SITE PLAN
SITE PLAN
COMBUSTION ENGINEERING, INC.
WINDSOR, CONN.
SCALE · 1" · 200'

Figure 3



Product, Services and Development Organization

Figure 4



NUCLEAR FUEL MANUFACTURING ORGANIZATION

Figure 5

ADDENDUM

1. American Nuclear Insurers Inspection Report
2. NELPIA Evidence of Insurability

AMERICAN NUCLEAR INSURERS

INSURANCE INSPECTION REPORT

CONFIDENTIAL: This report is prepared for property insurance purposes and is to be made available only to authorized persons.

COMBUSTION ENGINEERING, INC.
1000 PROSPECT HILL ROAD
WINDSOR, HARTFORD CO., CT 06095

Date: May 14, 1982

By: W. M. Sullivan

Property File No: W-6

Nature of Facility: Fuel Fabrication

Met with: Messrs: P. Rosenthal, Manager, Health Physics
T. Bowie, Nuclear Security Manager
M. Clarey, Manager, Facilities Eng. & Services

PROTECTION OF PROPERTY - FIRE

RECENT CHANGES AND COMMENTS (82-2)

Recommendation 82-1 is submitted since ANI now insures Buildings Nos. 15 & 16. Both buildings contain moderate combustible loadings.

Operations in Buildings Nos. 1 and 1-A are currently idle.

It was agreed that annual tests of plant fire pumps would be witnessed in conjunction with the insurance carrier of the other buildings at this plant site which are not insured by ANI.

A 24-hour telephone number is now available for contacting ANI in the event of a Fire/All-Risk emergency. Property losses such as fire, explosion, smoke, sprinkler leakage, windstorm, materials handling, etc. and emergency impairments to fire protection equipment may be reported to ANI by dialing 1-800-1243-3172 (calls originating outside of Connecticut) or (203) 677-6989.

NEW RECOMMENDATIONS

82-1 Automatic, ordinary hazard schedule automatic sprinkler protection should be provided for Buildings Nos. 15 and 16, due to combustible occupancy. (See "Recent Changes and Comments)

80-2 The plant fire brigade should be re-instituted, along with periodic drills and training. (To consider. ANI's "Fire Brigade Manual" forwarded to plant.)

RECOMMENDATIONS CONTINUED FROM PREVIOUS REPORT

80-1 The following recommendations pertain to Building No. 1:

b - The painted fire detectors on the automatic fire alarm system should be replaced to ensure reliable operations. (No present plans)

79-2 (Revised 9/9/80) The following should be provided to reduce the potential for fire damage to the electronic equipment located in the basement of Building No. 2: (No present plans)

a - Total flooding of the room using Halon 1301 extinguishing agent. Automatic smoke and products-of-combustion detectors should be installed throughout. Installation should be of the cross-zoned type, by which an alarm only is produced by the operation of a single detector and discharge of Halon 1301 results from actuation of detectors on two different circuits. The extinguishing system should be double-shot with connected reserve. Acceptance will require submittal of full prints and specifications prior to installation and an actual discharge concentration test.

b - Detector activation, system discharge and trouble signals should be transmitted to the annunciator panel at the Guard House.

78-2 A line of eave sprinklers with heat collectors should be provided on the south side of Building No. 21 to minimize the exposure potential of the yard storage of flammable liquids. The sprinklers should be supplied from the existing dry pipe system in Building No. 21. A satisfactory alternative would be to relocate such storage a minimum of 100 ft. from all important buildings and structures. The relocation site should have drainage away from any important facilities. (To investigate storing in listed flammable liquid cabinets. Acceptable to ANI.)

77-1 (Revised 9/9/80) Extra hazard schedule automatic sprinkler protection should be provided beneath the mezzanine in Building No. 17 to protect against fire in the hydraulic pellet presses. (Considering foam - no completion date given)

76-1 (Revised 9/9/80) Due to the severe fire hazard and corrosive and contaminating gases developed by burning polystyrene foam, the polystyrene foam insulation on the Building No. 2 walls should be removed. (No present plans)

78-1 An outside screw and yoke control valve should be provided below the dry pipe valve located in Building No. 21, to assure positive control over the sprinkler system and to minimize the possible water damage. (No plans at this time)

Nuclear Energy Liability - Property Insurance Association
Property Division
The Exchange, Suite 245, 270 Farmington Avenue, Farmington, Connecticut 06032

Declarations attached to and made a part of Policy No. 1474

Rate See Rate Computation Endorsement No. 1 Premium $337,010.

Name of Insured COMBUSTION ENGINEERING, INC.

Mailing Address 900 Long Ridge Road, Stamford, Connecticut

Unless otherwise provided herein, loss, if any, shall be adjusted with and payable to the named Insured.

The policy period shall be for the term of one year from July 1, 1980 to July 1, 1981, beginning and ending at noon, Standard Time at the location of property covered as specified herein.

Description and location of property covered.

Location No. 1 Amount of Insurance $209,000,000. Deductible $25,000.

All Real and Personal Property on the Insured's Plant premises known as Buildings 1, 2,5,6,17,18 and 21 and all Intervening Roadways connecting these Buildings and all Parking Areas adjacent to them as shown by the heavy black line on Combustion Engineering Drawing FP-3, Fire Protection System, dated September 12, 1972 and located in Windsor, Connecticut and including the extension to Building No. 1, designated as Building 1A, which is outside the heavy black line (PROPERTY FILE NO. N-6).

Location No. 2 Amount of Insurance $90,000,000. Deductible $25,000.

All Real and Personal Property on plant premises occupied principally for the processing of uranium hexafluoride, located on Missouri State Highway No. 21-A about one-half mile east of Hematite and six miles west of Festus in Missouri including the 1.47 acre Parcel of land (but excluding any dwellings situated thereon) described by the Survey dated May 30, 1979, Order No. 1346, and tract in United States Survey 423, Township 40 North, Range 5 East, Jefferson County, Missouri (PROPERTY FILE NO. N-1).

Countersignature

Countersigned July 1, 1980, at Farmington, Connecticut

by B.C. PROOM, President
Authorized Representative

BY [signature]
His Attorney

NELPIA 38-A Rev. 8/1/77 (NIRB)
License No. SNM-1067, Docket 70-1100 Revision: 2 Date: 4/6/82