70-1100

RETURN TO 396-SS

COMBUSTION ENGINEERING

License SNM-1067
Docket 70-1100

February 18, 1987

U. S. Nuclear Regulatory Commission
Washington, DC 20555

Attention: Mr. W. T. Crowe, Acting Chief Uranium Fuel License Branch
Division of Fuel Cycle and Material Safety, NMSS

Subject: Changes to SNM-1067

Reference: Letter from H. V. Lichtenberger, CE, to W. T. Crowe, NRC, dated November 6, 1986

Dear Mr. Crowe:

Mr. R. E. Sheeran of my organization met with Mr. N. Ketzlach of your organization on January 28, 1987 in Silver Springs, MD to discuss the subject License changes attached to the referenced letter. At the meeting it was agreed that certain additional changes would be made. Accordingly, a new submittal, containing the agreed upon changes and additions including a copy of CE's 10-K Form for the fiscal year ending December 31, 1985, is attached for your review and approval.

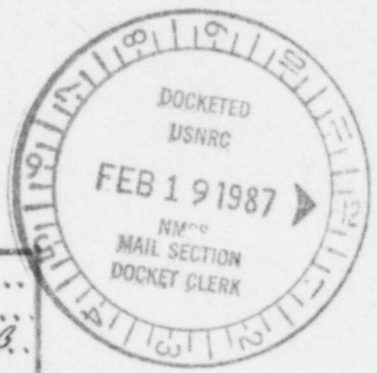
Very truly yours,

H V Lichtenberger

H. V. Lichtenberger
Vice President, Nuclear Fuel

HVL/RES/kfs

Attachment



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February 5, 1987
License SNM-1067
Docket 70-1100

APPENDIX I

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PART I. LICENSE CONDITIONS

1.0 Standard Conditions and Special Authorizations

1.1 Name

Combustion Engineering, Inc., is incorporated in the State of Delaware with its corporate offices at 900 Long Ridge Road in Stamford, CT. The location where licensed activities will be conducted is at 1000 Prospect Hill Road in Windsor, CT.

1.2 Location

The mailing address for all license correspondence is:

Combustion Engineering, Inc.
1000 Prospect Hill Road
Windsor, CT 06095

Licensed activities shall be conducted primarily at the Nuclear Fuel Manufacturing facility (Building #17) and an adjacent warehouse and shipping dock (Building #21).

* Additional activities shall be conducted in Buildings 1, 1A, 2, 2A, 3, 3A, 5, 6, 16, and 18.

1.3 License Number

* Activities are covered by the License SNM-1067; Docket 70-1100.

1.4 Possession Limits & Location

Combustion Engineering, Inc., requests authorization to receive, use, possess, store and transfer at its Windsor site, the following quantities of radioactive materials.

	Isotope	Form	Quantity	Location
1.)	Uranium enriched to $\leq$4.1% weight percent U^{235}	Uranium Oxides	500,000 Kg U	Manufacturing-Bldgs. #17 & #21 & storage in trailers adjacent to Bldgs. #17 & #21. Bldgs 1, 1A, 2, 2A, 3, 3A, 5, 6, 16 and 18.
2.)	Uranium enriched to less than 20 weight percent U^{235}	Any	4800 gms U^{235}	Bldg. 1, 1A, 2, 2A, 3, 3A, 5, 6, 16, 17, 18 & 21 (Bldg. 17 & 21 limited to 350 gm U^{235} each for enrichments exceeding 4.1 weight percent U^{235}).
3.)	Natural and/or Depleted Uranium	Any	10,000 KgU	Bldg. 1, 1A, 2, 2A, 3, 3A, 5, 6, 16, 17, 18, & 21.
4.)	Pu^{238}	Encapsulated Neutron Sources	5 sources, each containing less than 2.0 gm Pu^{238}	Building #17
5.)	Pu	Any Form	160 micrograms as analytical samples	Bldg. 1, 1A, 2, 2A, 3, 3A, 5, 6, 16, 17, 18 & 21
6.)	Encapsulated Neutron Sources	U_3O_8	20 sources, each containing 1.7 gm U^{235}	Bldg. 1, 1A, 2, 2A, 3, 3A, 5, 6, 16, 17, 18 & 21
7.)	Uranium enriched to or greater than 20 weight percent U^{235}	Residue	1000 gms U^{235}	Windsor Site

1.5 Definitions

Any definitions which are not defined in standard references (e.g., ANSI-N-1.1-1976, "American Standard Glossary of Terms in Nuclear Science and Technology" or Title 10 of the Code of Federal Regulations) or that are unique to activities described in this license applications shall be defined where first used in the application.

1.6 Authorized Activities

The primary activities carried out in buildings at the Windsor site include, but are not limited to the following:

* Bldg. #1 & 1A - Storage and use of small quantities of Radioactive
* Material (<350 Gms U235)
* Bldg. #2 & 2A - Product Development Activities.

Bldg. #3 & 3A - Storage of small quantities of Radioactive Material (<350 GMS U235)

* Bldg. 5 - Product Development Activities.

* Bldg. 6 - Waste water processing from manufacturing and product development activities.

Bldg. 16 -Same as Building #5.

Bldg. 17 -Manufacture of fuel 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.

* Bldg. 18 -Product Development Activities

Bldg. 21 -Storage of SNM in shipping containers.

Windsor Site - Residue from prior operations, not to exceed 350 gms U^{235} in any one location. Additional locations to be separated from one another by a minimum of 12 feet.

1.7 Exemptions and Special Authorizations

Licensed activities in Bldgs. 1, 1A, 2, 2A, 3, 3A, 5, 6, 16 and 18 shall

*be of a product development nature and the material may ultimately be returned to the Nuclear Fuel Manufacturing facility. These transfers shall not require the issuance of applicable NRC transfer documents, but shall be transferred in accordance with the provisions of this license, and shall be handled as a departmental transfer and shall be controlled by the Fundamental Nuclear Material Control Plan (FNMC) referenced in Section 9.0 of this application.

2.0 GENERAL ORGANIZATIONAL AND ADMINISTRATIVE REQUIREMENTS

2.1 Licensee's Policy

Combustion Engineering's long standing commitment to safety of the work place is evidenced by corporate management's continued emphasis and support of all aspects of Health and Safety throughout the corporation. An integral part of the overall corporate Health and Safety program specifically in the Nuclear Power Systems Division, is management's commitment to keep radiation exposures to employees and the general public as low as reasonably achievable (ALARA). (See Section 3.1.2 for detail). It is management's intent to be in compliance at all times with all applicable federal and state regulations and the license requirements stated herein.

2.2 Administrative Responsibilities and Controls

The lines of authority for the control of Special Nuclear Material in the possession of the Nuclear Power Systems Division follow the same paths of authority as all other operations with several modifications dictated by the problems associated with handling Special Nuclear and
* Source Material. Operations covered by this license are: Buildings
* 17/21, nuclear fuel manufacturing (NFM-W) which is a low enrichment UO_2 fuel fabrication operation where powder is pelletized, pellets are loaded into rods which are then assembled into fuel bundles, and
* buildings 1, 1A, 2, 2A, 3, 3A, 5, 6, 16, & 18 where Product Development Activities are carried out.

* The Senior Vice President, Nuclear Power Systems is responsible for all
* activities carried out in both Nuclear Fuel Manufacturing and
* Product Development. He has delegated the responsibility for all activities carried out under License SNM-1067 to the Vice President, Nuclear Fuel.

* 2.1.1 Product Development

* The Director of Product Development is responsible through
* the Vice President, Nuclear Fuel for the accountability,
* nuclear criticality safety, and radiological safety related
* to all Special Nuclear and Source Materials received
* and used in product development.

He assures compliance with federal and state regulations and
* the requirements and limitations set forth in the license.
* In this position, the Director of Product Development
* assures that all operations involving nuclear materials have been analyzed to establish the required safety limits and controls.

The Manager of Nuclear Licensing, Safety, Accountability,
* and Security is responsible for the surveillance of all activities in which radioactivity is involved to ensure that the health and safety standards set forth in the license application are met. He has the necessary authority to halt any operation which falls

outside those limits, and he is responsible for indicating what remedial action is necessary to bring the operation within acceptable limits. The basic organization structure is shown in Figure 2.2.1.

2.2.2 Nuclear Fuel Manufacturing

The Plant Manager reports to the Vice President, Nuclear Fuel and is responsible for the accountability, nuclear criticality safety and radiological safety related to all Special Nuclear and Source material received by Nuclear Fuel Manufacturing and used in any manufacturing process. He assures compliance with federal and state regulations and the requirements and limitations set forth in the license during all phases of manufacturing.

In this position, the Plant Manager has delegated to the Production Manager 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, NLSA&S or Nuclear Criticality Specialist shall assist the Engineering Manager and Production Manager by actually performing the analysis required and establishing the appropriate controls. In addition, the Supervisor, Health Physics and Safety shall assure that the required safety limits and controls are being followed by the use of

daily internal audits.

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, as well as criticality standards set forth in the license, are met. He has the necessary authority to halt any operation which falls outside those limits, and is responsible for indicating what remedial action is necessary to bring the operation within acceptable limits. However, if the operation is halted because of criticality safety considerations, the Health Physics & Safety Supervisor will contact the Manager, NLSA&S, the Nuclear Criticality Specialist, or the Nuclear Safety Committee who shall determine necessary corrective actions to be taken. The basic organizational structure for Nuclear Fuel Manufacturing

* is shown in Figure 2.2.1.

2.2.3 Independence of Safety Personnel

* The Director of Product Development reports to the Vice
* President Nuclear Fuel.

The Manager, Nuclear Licensing, Safety, Accountability, and Security, the Nuclear Criticality Specialist, the Engineering

* Manager, and the Production Manager all report to the Plant Manager, Nuclear Fuel Manufacturing.

* The Production Manager will enforce all safety related rules and procedures; He will interact as necessary to ensure uniform compliance.

Conflicts of interest are thus minimized and independence of safety personnel is assured.

2.3 Nuclear Safety Committee

A Nuclear Safety Committee comprised of engineers and scientists, representing all areas of the Nuclear Power Systems Division nuclear and scientific community, has been organized and assigned as one of its responsibilities the function of providing assurance to management that nuclear manufacturing operations are carried out in a safe manner. The

* Committee acts in a staff capacity reporting to the Senior Vice President, Nuclear Power Systems.

The functions of the Committee are to:

- Assure an independent review and approval of all Nuclear Criticality Safety aspects of process and equipment changes not covered by Tables 4.2.5 and 4.2.6 related to nuclear safety. A qualified person designated by the Chairman of the Committee performs the independent criticality safety reviews. The independent reviewer shall meet the minimum qualifications of a nuclear criticality specialist. The two years' experience in outside-of-reactor nuclear criticality safety shall be with methods relevant to the nuclear safety analysis of the operation under review.

* - Audit all manufacturing and Product Development operations involving SNM annually, with no more than 13 months between audits. This audit must include as a minimum, a review of the nuclear criticality and radiological safety programs and their application and to assure that management policies are consistent with the

objective of maintaining occupational radiation exposures as low as reasonably achievable. The Committee member who reviews the criticality safety program shall be a person other than the one who is authorized to perform the monthly criticality safety audit. The committee member who reviews the Radiological Program shall be a person other than the one who is authorized to perform the monthly Radiological Safety Audit.

* The audit reports shall be sent to the Vice President, Nuclear
* Fuel with copies to the Senior Vice President Nuclear Power Systems and operational supervision.

- Reviews and approves applications for SNM license renewals and amendments affecting nuclear criticality safety prior to submittal to NRC.

2.4 Personnel Selection (Approval Authority) for Key Positions

* 2.4.1 Product Development - The Director of Product Development has approval authority for the following key positions:
* Manager-Core Materials Development and Manager-New Product
* Development.
*
*
* 2.4.2 Nuclear Fuel Manufacturing - The Plant Manager, Nuclear Fuel Manufacturing has approval authority for the following key positions: Engineering Manager, Production
* Manager, Production Superintendent, Manager-Nuclear Licensing, Safety, Accountability, & Security, Nuclear Criticality Specialist, and Health Physics & Safety

Supervisor.

* 2.4.3 Nuclear Safety Committee - The Senior Vice President, Nuclear Power Systems has the approval authority for members of this committee.

2.5 Education and Experience Requirements for All Key Safety and Operations Personnel

*

* 2.5.1 Plant Manager, Nuclear Fuel Manufacturing - The qualifications for this position shall be a Bachelors 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 nuclear criticality safety, health physics, and industrial safety aspects of fuel handling and knowledge of administrative controls imposed on nuclear fuel handling operations.

* 2.5.2 Manager-Nuclear Licensing, Safety, Accountability, & Security (NLSA&S)

The minimum qualification for this position shall be a Bachelors Degree in one of the sciences or engineering and a minimum of three years experience in positions which demonstrate sufficient judgement and analytical capability

to establish and maintain technically sound and effective health physics, industrial safety, nuclear material accountability and security programs; and to establish and maintain an effective nuclear criticality and radiation program.

* 2.5.3 Supervisor-Health Physics and Safety - The minimum qualifications for this position shall be a Bachelors Degree in one of the sciences, engineering, or equivalent. A minimum of two years experience in radiation safety protection in positions which demonstrate sufficient judgement and capability to establish and maintain an effective nuclear criticality and radiation safety program for the types of activities authorized by License SNM-1067.

* 2.5.4 Radiation Specialist - The minimum qualifications for this position shall be a Bachelors Degree in one of the sciences, engineering or equivalent and a minimum of two years experience in Radiation Safety Protection.

* 2.5.5 Nuclear Criticality Specialist - The minimum qualifications for this position shall be a Bachelors Degree in one of the

* sciences, engineering or equivalent and three years experience in outside-of-reactor nuclear criticality safety

* or nuclear fuel manufacturing facility criticality safety. Experience in outside-of-reactor nuclear criticality safety

* or nuclear fuel manufacturing criticality safety shall be with methods of analysis similar to those required for analyzing the types of activities authorized by License SNM-1067.

* 2.5.6 Nuclear Materials Manager - The minimum qualifications for this position shall be a Bachelors Degree in one of the sciences or engineering, and two years experience in nuclear materials management.

* 2.5.7 Production, Quality Control, or Engineering Managers - The minimum qualifications for these positions are a bachelors degree in one of the sciences or engineering and three years experience in nuclear fuel fabrication facilities. He must have an understanding of the criticality and health physics aspects of fuel handling and a knowledge of administrative controls imposed on fuel handling operations.

* 2.5.8 Production Superintendent, Supervisors - The minimum qualifications for all Supervisors are a High School diploma (or equivalent) and two years of manufacturing experience. The Production Superintendent will have a High School diploma (or equivalent) and at least two years of manufacturing experience in radioactive materials handling.

* 2.5.9 Nuclear Safety Committee Membership - The minimum qualifications required for the Committee as a whole shall be as follows:

- Committee members must be highly competent senior staff members.
- Committee members must be capable of evaluating radiological and/or nuclear safety and must have had at least seven (7) years experience in the nuclear industry and a Bachelor of Science degree in Engineering or one

of the sciences.

Committee members must not be directly involved in the production or product development facilities utilizing the nuclear material.

- An individual must disqualify himself if there is a conflict of interest with the production or product development groups.
- The Committee member or the Consultant to the Committee who performs the independent criticality safety review shall meet the minimum qualifications for a 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.
- The Committee member or the Consultant to the Committee who performs the independent radiological safety review shall meet the minimum qualifications for the Manager-Nuclear Licensing, Safety, Accountability & Security and shall not be the person who is authorized to conduct the monthly radiological safety audit and shall not be the initial reviewer.

2.5.10 Radiological Engineer/Senior Radiological Engineer - These personnel shall meet the qualifications for a Radiation Specialist.

2.5.11 HP Technicians - The minimum qualifications for HP Technicians shall be a H.S. Graduate (or equivalent) with a minimum of 1 year experience in the Health Physics aspect of working with Radioactive Materials.

2.6 Training

2.6.1 Initial Training

All new employees (whether they are new hires or transferred from within the company) shall attend a formal training session prior to working in restricted areas. This will cover principles of radiation safety (including ALARA practices), nuclear criticality safety, industrial safety, emergency procedures, applicable state & federal regulations (i.e., 10 CFR Parts 19 & 20), and additional information pertaining to their job. Specialized training for radiation protection and nuclear criticality safety shall be commensurate with the extent of the employees contact with radioactive materials. All personnel who will be working with radioactive materials must complete a test to ascertain the effectiveness of the training. All trainees shall satisfactorily complete the test in accordance with established criteria before being allowed to handle radioactive materials without direct supervision. All training will be conducted under the direction of the Health Physics & Safety Supervisor for Manufacturing

* and Product Development. Records of all formal training sessions shall be kept and will include the date held, subject matter covered, attendees, instructor, and the results of the method used to ascertain the effectiveness of the training.

2.6.2 Periodic Retraining - All periodic retraining shall be

* conducted under the direction of the HP&S Supervisor for Mfg.

* and Product Development Personnel. Production personnel who work

with radioactive materials shall attend a formal annual safety training session, with no more than 13 months between training sessions. This training session will include as a minimum the topics covered in the initial training sessions. In addition this session shall emphasize problem or potential problem areas, involving the topics covered, or any other safety related areas.

NFM-W also maintains a comprehensive system of operating procedures which include the appropriate safety precautions. Informal training (not documented with lesson plans, etc.) is conducted by production Supervisors on a continual basis as needed to assure that personnel are properly following approved procedures. The ultimate responsibility to follow the operating procedure lies with the employee. Any change which alters the employees responsibility or actions in regards to safety (criticality, radiation, or industrial) must be approved by the Supervisor,

* Health Physics and Safety, or the Manager NLSA&S who will assure the appropriate training is conducted prior to implementation. This also includes changes to the emergency procedures which affect employee actions in an emergency situation. All maintenance personnel shall attend formal training sessions annually, not to exceed 13 months between sessions. If they have not attended this training, they may enter the restricted area only with a trained escort. Maintenance training sessions will cover the same topics as the production personnel session.

Special emphasis will be given to the internal contamination of equipment.

Salaried personnel who enter restricted areas shall attend a formal training session annually not to exceed 13 months between sessions. These sessions will be directed toward observation and supervision in restricted areas rather than actual handling of radioactive material. The topics listed in the initial training shall be discussed with emphasis on the supervisory aspects of these topics.

* Product Development Personnel who handle radioactive material shall be retrained at least every 2 years not to exceed 25 months. All work in Product Development which involves radioactive material requires an RWP. This system allows for continual control of personnel handling radioactive material. The effectiveness of all retraining is determined by the instructor questioning the personnel on an individual basis to determine their understanding of each topic.

Records of all formal training sessions shall be kept and will include the date held, subject matter covered, attendees, instructor and the results of the method used to ascertain the effectiveness of the training.

2.6.3 Specialized Training

Health Physics Technicians - Health Physics Technicians for

* Nuclear Manufacturing, or Product Development shall receive the initial training (see 2.6.1), and will be instructed by the Supervisor, Health Physics and Safety

* as appropriate, in the use of instruments, the evaluation of contamination, environmental sampling, and other aspects relevant to their assignments. Health Physics Technicians will also receive sufficient training in criticality control to enable them to carry out their auditing functions. The training in criticality control shall be, as a minimum, a review of all limits and controls set forth in this license. Specific details of the H.P. Technician training are outlined in the Nuclear Licensing & Safety Procedures Manual.
Formal annual retraining (not to exceed 13 months) of the
* H.P. Technicians for manufacturing and product development shall be conducted by the Supervisor, Health Physics & Safety and shall include a review of the topics described above.

*

*

* In addition, specific problem areas and changes in federal regulations, or license requirements are emphasized. The effectiveness of this training is determined by the instructor questioning the H.P. Technicians to determine their understanding of each topic.
Records of all formal training sessions shall be kept and will include the date held, subject matter covered, attendees, instructor, and the results of the method used

to ascertain the effectiveness of the training.

2.7 Operating Procedures

* 2.7.1 Product Development

* Product Development, because of the nature of the work to
* be performed, does not utilize standard operating procedures. The use of Radiation Work Permits (RWP's) for all work with
* radioactive materials assures that appropriate safety procedures are followed.

Written health and safety restrictions for all operations on radioactive materials shall be provided in the form of approved Radiation Work Permits or approved detailed procedures, and appropriate operational limits are posted in
* the vicinity of work stations. The supervisor, Health
* Physics or the H.P. Technician, will approve RWP's based on
* the personnel doses which are involved with the work to be performed.

* All RWP's shall be reviewed weekly by an individual having
* the minimum qualifications of The Supervisor-Health Physics
* and Safety. Product Development has simple slab or mass limited areas. The mass limited areas shall be separated by
* a minimum of 12 feet, making criticality safety an easily
* managed program. Changes in criticality areas by Product
* Development personnel shall be formally described and
* submitted to the Manager, Nuclear Licensing, Safety,
* Accountability & Security in writing 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 that such records are maintained for at least six months after termination of the operation evaluated.

* 2.7.2 Nuclear Fuel Manufacturing - It shall be the
* responsibility of the Plant Manager (NFM) to assure that all operations involving radioactive materials have written procedures which include the appropriate safety requirements and are followed.

Written operating procedures are provided by the cognizant engineering supervisor for all operations, including equipment clean-up during enrichment changes. These include all criticality and radiological safety restrictions, and limits, and must be approved by the Manager, NLSA&S, the Nuclear Criticality Specialist, or the Supervisor, Health Physics and Safety prior to the start of any operation. To assure all operating procedures are maintained current and all superseded documents are removed from circulation, all procedures must be processed through the central document control system. This system also assures that appropriate approvals are on all procedures prior to issuance. All approved operating procedures shall be available in the related work area.

Before the cognizant engineering supervisor may initiate

criticality safety which fall within the criteria of Section 4.2 provided that an independent review is performed by the Nuclear Safety Committee or persons designated by that Committee.

The Manager NLSA&S, Nuclear Criticality Specialist or, the Supervisor Health Physics & Safety determine whether a change can be made within the framework of the license or whether an NRC amendment is required for the proposed change.

2.8 Audits

All audits shall be performed in accordance with a written plan.

* 2.8.1 Product Development - Operations in
* Product Development will be formally audited as follows:
* - Operations will be audited on a quarterly
* basis by an individual, who meets the minimum qualifications
* of the Manager NLSA&S. He will verify the adequacy of the Radiation Protection Program and that all designated limits and controls are being followed.

He will review records of radiation exposure, contamination levels and airborne concentrations for trends and abnormalities. His review will determine whether the appropriate corrective actions have been implemented to assure all exposures are maintained as low as reasonably achievable (ALARA). The findings of the quarterly audits shall be documented and copies submitted to operational supervision, to the Vice President - Nuclear Fuel and to the Senior Vice President - Nuclear Power Systems. The reports shall include items for correction, if necessary, and the action taken on items from previous audits.

Once each year by the Nuclear Safety Committee. The committee will review all aspects of the criticality and Radiological Safety Programs and will transmit their report in writing to the Vice President - Nuclear Fuel with copies to the Senior Vice President, Nuclear Power Systems and Operational Supervision.

2.8.2 Nuclear Fuel Manufacturing Operations - Operations at the Nuclear Fuel Manufacturing facility will be formally audited as follows:

- Once each working day by a Health Physics Technician for Health Physics compliance and criticality compliance. He shall submit his findings in writing to the Supervisor Health Physics and Safety.
- Once each month for radiological safety by an individual who meets the minimum qualifications of a Radiation

Specialist. He shall audit for compliance with all regulations and operational procedures and shall assess the adequacy of the radiological safety program. His findings shall be documented and submitted to the

* Plant Manager - Nuclear Fuel Manufacturing.

- Once each month for nuclear criticality safety by an individual who meets the minimum qualifications of: The Manager of Nuclear Licensing, Safety, Accountability and Security; or the Nuclear Criticality Specialist. The Manager NLSA&S or the Nuclear Criticality Specialist shall audit for compliance with all regulations and operating procedures, and shall assess the adequacy of the established criticality safety program. Audit

* findings shall be documented and reported to the Plant Manager-Nuclear Fuel Manufacturing.

- Once each year by the Nuclear Safety Committee. The committee will review all aspects of the criticality and radiological safety programs and will transmit their report in writing to the Vice President-Nuclear Fuel

* with copies to the Senior Vice President, Nuclear Power Systems and operational supervision.

* Follow-up actions on audits of Product Development will be
* the responsibility of the Director, Product Development and
* for audits of the manufacturing facility, it will be the
* responsibility of the Plant Manager, Nuclear Fuel Manufacturing. All audits shall include a section for previously identified items requiring corrective action and the action taken to correct such items.

2.9 Investigations and Reporting of Off-Normal Occurrences

Any unusual events that could lead to radiation health and safety
* problems shall be reported to the Plant Manager, Fuel Fabrication, or
* to the Director, Product Development as appropriate. The NRC shall be
* notified of such occurrences including any event that would
* significantly decrease the effectiveness of the Radiation or Nuclear
* Criticality Safety Program. It is the intent of Combustion Engineering, Inc. to be in compliance with the reporting requirements of 10 CFR Part 21 for reporting of defects and noncompliance and 10 CFR 73.71 for events that significantly threaten or lessen the effectiveness of safeguards.

2.10 Records

Records relating to health and safety shall be retained indefinitely. Such records shall include plant alterations or additions, abnormal, and off-normal occurrences and events associated with radioactivity releases, criticality analyses, audits and inspections, instrument calibration, ALARA findings, employee training and retraining, personnel exposures, routine radiation surveys, and environmental surveys.

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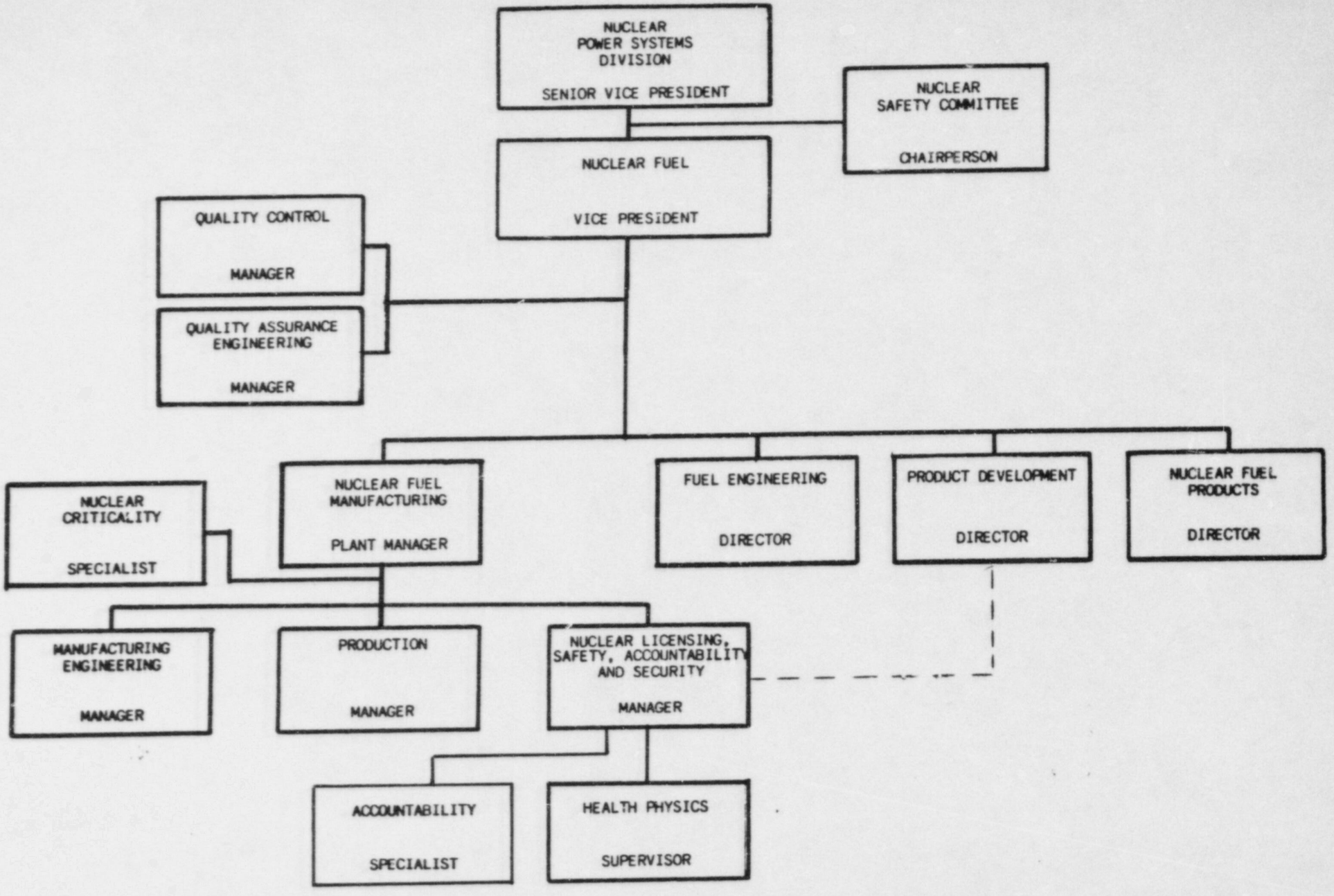
FIGURE 2.2.1


NUCLEAR POWER SYSTEMS DIVISION
SENIOR VICE PRESIDENT
NUCLEAR SAFETY COMMITTEE
CHAIRPERSON
NUCLEAR FUEL
VICE PRESIDENT
QUALITY CONTROL
MANAGER
QUALITY ASSURANCE ENGINEERING
MANAGER
NUCLEAR CRITICALITY
SPECIALIST
NUCLEAR FUEL MANUFACTURING
PLANT MANAGER
FUEL ENGINEERING
DIRECTOR
PRODUCT DEVELOPMENT
DIRECTOR
NUCLEAR FUEL PRODUCTS
DIRECTOR
MANUFACTURING ENGINEERING
MANAGER
PRODUCTION
MANAGER
NUCLEAR LICENSING, SAFETY, ACCOUNTABILITY AND SECURITY
MANAGER
ACCOUNTABILITY
SPECIALIST
HEALTH PHYSICS
SUPERVISOR

3.0 Radiation Protection

3.1 Administrative Requirements

3.1.1 Radiation Work Permit Procedures

* Product Development - All work with
* radioactive materials in the Product Development will require
* a radiation work permit (RWP).
*
* The Health Physics technician
or the Supervisor, Health Physics and Safety shall establish
* radiological requirements and set individual exposure limits.
*
*
*
*

Nuclear Fuel Manufacturing

All non-routine maintenance or repair operations on equipment in contaminated areas must be covered by a Radiation Work Permit (RWP), including those non-routine maintenance operations in which the ventilated containment is compromised. The RWP shall be requested by the cognizant supervisor or engineer. The RWP will be issued by the Nuclear Licensing, Safety, Accountability, & Security (NLSA&S) group. It will include all safety requirements, protective clothing and equipment, and health physics monitoring requirements necessary to assure that the proposed operation is conducted in a safe manner. RWP's shall be reviewed for their need every 30 days as a minimum. A member of the NLSA&S group must also close out on RWP's to assure that

the work was completed in a satisfactory manner prior to restart of the related operation.

Written operating procedures for the Health and Safety group are provided and followed in the manufacturing facility and in Product Development. Any changes in or new operating procedures for the Health Physics and Safety group are approved by the Manager, NLSA&S, the Nuclear Criticality Specialist, or the Plant Manager, Fuel Fabrication in the manufacturing facility, and by the Director, Product Development for those in Product Development.

3.1.2 ALARA Commitment

C-E management is committed to maintaining radiation exposures to personnel as low as reasonably achievable (ALARA). Product Development assures that the ALARA concept is met by the following:

- A Radiation Work Permit (RWP) program that controls all operations involving the handling of radioactive material is utilized with approvals required at various exposure levels to assure all exposures are kept at ALARA.
- An audit of Product Development with emphasis on the ALARA goals is performed annually by the Nuclear Safety Committee as stated in Section 2.8.1. The major emphasis of this audit will be to review all changes implemented by management to achieve ALARA and to make recommendations to assure continued adherence to the ALARA concept. Trends in radiation exposure, contamination levels, and airborne concentrations will be reviewed and recommendations made where necessary.

* - The quarterly audit of Product Development includes a review of the radiation safety program to assure the ALARA concept is being followed.

* Nuclear Products Manufacturing - assures that the ALARA concept is met by the following:

- Trends in personnel exposures, radiation levels, airborne activity levels, surface contamination, effluent releases, and bioassay results are reviewed during the monthly radiological safety audit. The person performing this audit is responsible for determining any required action necessary to assure

* adherence to the ALARA concept. The Plant Manager is responsible to assure that these recommendations are implemented.

- The Nuclear Safety Committee is responsible for a comprehensive review of the radiological safety program on an annual basis. This includes a review of all changes implemented by management to achieve ALARA. The Committee is responsible for recommending any additional changes which are necessary to assure continued adherence to the ALARA concept in all areas of the radiological safety program.

3.2 Technical Requirements

3.2.1 Access Controls

All personnel entering the unclad fuel handling contaminated areas must do so through the change areas provided for this purpose. Protective clothing shall be worn as follows:

- Coverall or Lab Coat
- Special shoes or shoe covers
- Safety glasses

Additional protective clothing shall be worn as prescribed by the Health Physics personnel both in Product Development and in the Manufacturing facility.

3.2.2 Monitoring Requirements (Personnel)

- All personnel must wash their hands before exiting the contaminated area and monitor as a minimum their hands, exposed areas of the body and personal clothing with the alpha personnel monitor located at the change line.
- The frequency and control levels of personal clothing and body surfaces shall be as follows:

PERSONAL CLOTHING AND BODY SURFACE ALPHA ACTIVITY CONTROL LEVELS

Surface	Alpha dpm/100cm2	Min. Survey Frequency
Personal Clothing, Body Surfaces (Hair, Face, Hands)	Indistinguishable from background	Before leaving contaminated area and when contamination is observed on body surfaces.

- If levels are greater than the control levels, the individual shall promptly notify a member of the Health Physics staff and shall not leave the contaminated area until they respond.

3.2.3 Ventilation Requirements

Nuclear Fuel Manufacturing

Ventilation in the Manufacturing facility (Building #17) is provided by four separate exhaust systems as described herein:

FA-1 Powder Preparation and Pressing - This system has a capacity of 12,100 CFM and incorporates prefilters and a double bank of 12 absolute filters, each 99.97% efficient at 0.3 microns. The air exhaust from this system which is either returned to the unclad fuel area or released from the plant is sampled 100% of the time and analyzed each day.

FA-2 Furnace H2 Burnoff - This system has a capacity of 1340 CFM and incorporates prefilters and a single bank of 4 absolute filters, each 99.97% efficient at 0.3 microns. The air exhaust from this system is released from the plant and sampled 100% of the time and analyzed each day.

FA-3 Pellet Grinding and Rod Loading - This system has a capacity of 17,500 CFM and incorporates prefilters and a double bank of 16 absolute filters, each 99.97% efficient at 0.3 microns. The air exhaust from this system is released from the plant and sampled 100% of the time and analyzed each day.

FA-4 Recycle Powder Area - This system has a capacity of 6000 CFM and incorporates prefilters and a double bank of 6 absolute filters, each 99.97% efficient at 0.3 microns. The air exhaust from this system is released from the plant and sampled 100% of the time and analyzed each day.

*

The capacity of the ventilation systems have been matched to provide a negative pressure differential between the Pellet Processing Facility and all surrounding work areas. The direction of air flow shall be checked monthly and documented. If airborne activity results, averaged over a two week period, exceed 25% of the applicable concentration listed in Table II, Column I of 10 CFR 20 Appendix B for air being discharged to an unrestricted area (from manufacturing
* or Product Development Operations), an investigation will be conducted and corrective action taken. In addition, to assure our releases remain as low as reasonably achievable, a quarterly limit of 18 uCi in gross alpha activity of total uranium in plant gaseous effluents shall be maintained. If the radioactivity in plant gaseous effluents exceeds 18 uCi, a report which identifies the cause for exceeding the limit and the corrective actions to be taken to reduce release rates shall be submitted to the NRC within 30 days. Also, 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. The 18 uCi/qtr. limit would result in a lung dose to an individual at the nearest residence of (conservatively) less than 0.10% of the 25 mrem/year standard as specified in 40 CFR 190.

Ventilation system filters and/or prefilters will be changed, rotated, or knocked down whenever a pressure drop of 4 inches of water is measured across the combination of the prefilter and first bank of absolute filters. The pressure drop for all 4

systems shall be checked weekly and documented. When the face velocity at a ventilated hood drops below 100 fpm, the hood filters or ventilation system filter will be changed, brushed, or knocked down to increase the air flow to 100 fpm minimum or the hood will not be used to handle radioactive material. Face velocities will be checked weekly in the manufacturing facility and monthly in Product Development. Any work on filter change involving any of the four fixed air systems in manufacturing shall be performed under an RWP. Following all filter changes or other movement of filters, both the Supervisor and H.P. Technician shall inspect the placement of the absolute filters for proper sealing. In addition, air samples will be taken and counted immediately after 1/2, 2, and 8 hours of operation to assure the absolute filters are adequately filtering the exhaust air.

The adequacy of the sampling techniques to obtain representative samples will be verified quarterly in the Manufacturing facility and annually in Product Development.

Product Development

Airborne wastes are released from Product Development as a result of airborne activity during handling and transfer of UO2 powder for chemical analysis purposes, production of special R&D test fuel, and metallographic examination of production fuel and special test fuel. All airborne waste is exhausted from Product Development (Building #5) via seven individual stacks. The exhaust is continuously monitored whenever operations involving dusting or release of radioactive material are in

progress. All stacks used for the exhausting of radioactive effluents are equipped with sampling connections. All but one of the stacks has absolute filters. The one exception is the environmental test laboratory stack (Stack #7).

Product Development (Building #5) exhaust stacks typically have the following flows:

Stack No.	Area Monitored	Flow (ft3/min.)
1	Chemistry (No longer in use)	6200
2	Hot Chemistry Lab	3100
3	Emission Spectroscopy Lab	2000
5	Radiochemistry Lab, Environmental Labs & Vault	2610
6	Ceramics Lab (Rm 222), Metalographic Lab	2125
7	Environmental Test labs (No longer in use)	2000
8	Ceramics Lab (Rms. 224 A & B)	4500

Air from systems Nos.1,2,3,5,6 and 8 pass through single banks of absolute filters (99.97 percent efficient for >0.3 micron particles), and are vented to the atmosphere. Continuous sampling is provided immediately upstream from the discharge point.

The environmental test lab is connected to System No. 7. However, the system is not presently being used. Ventilation system filters and/or prefilters will be changed, rotated, or knocked down whenever a pressure drop of 4 inches of water is measured across the combination of the prefilter and

first bank of absolute filters. The pressure drop for all systems shall be checked monthly and documented. When the face velocity at a ventilated hood drops below 100 fpm, the hood filters or ventilation system filters will be changed, brushed, or knocked down to increase the air flow to 100 fpm minimum or the hood will not be used to handle radioactive material. Face velocities will be checked monthly in

* Product Development.

The filters in these stacks shall be tested either by 1) counting samples immediately after 1/2 hour of operation or 2) DOP testing the filters in accordance with ANSI standards. Such testing shall be done after all filter changes or movement of the filters to assure they are adequately filtering the exhaust air. The results of these tests shall be documented. Each ventilating filter system described in Section 3.2.3 shall be equipped with an instrument that measures the pressure drop continuously.

3.2. Instrumentation

Capabilities of radiation detection and measurement instrumentation shall be as follows:

* Alpha Counting System	10 - 10,000 dpm
Alpha Survey Meters	0 - 50,000 counts per minute
Beta-Gamma Survey Instruments	.05 mR/hr - 200 mR/hr
Neutron Survey Instruments	.5 - 5,000 mrem/hr

A sufficient number of the instruments, meters and systems listed above shall be maintained operational to adequately conduct our Health Physics program. Additional instrumentation is maintained for emergency use as outlined in Part I Section 8. The detectors for the criticality alarm system are calibrated quarterly and following any repair that affects the accuracy of the measurements. All other instruments are calibrated twice per year and following any repair that affects the accuracy of the measurements. The calibration of the survey instruments shall meet the specifications described in Section 1.11 of Regulatory Guide 8.24, "Health Physics Survey During Enriched

individuals and equipment. The pellet shop is the only place in the manufacturing facility that handles unclad UO2. This portion of the facility is kept at a negative pressure as described in Section 3.2.3. Therefore, continuous air sampling shall be conducted in this area only.

* Product Development

* All operations in Product Developments which involve UO2 powder or the potential for worker exposure to airborne uranium exceeding the limits specified in 10 CFR 20.103, shall be sampled with breathing zone samplers 100% of the time.

Samples shall be analyzed within 24 hours after each operating shift. A one MPC action level and a minimum flow

* rate of 1400 cc/min. shall be used for Product Development operations.

3.2.6 External Exposure (Dosimetry Requirements)

Each individual who enters a restricted area under such circumstances that he is likely to receive a dose in any calendar quarter of 25 percent of the applicable value specified in 10 CFR 20.101(a) shall be supplied with a TLD badge and indium foil for purposes of personnel dosimetry. Badges will be processed monthly. When a high exposure is suspected, the individual's badge will be sent out for immediate processing. All visitors will be supplied with indium foil badges. Area TLD badges and neutron foils are also strategically placed throughout the facility for the purpose of recording background radiation levels as well as

* radiation resulting from a criticality accident. The TLD badges will also be processed monthly during normal operations and immediately following a criticality accident. Procedures to determine high radiation

2) Lung Burden>200ug U235 — Take above corrective action, and in addition, remove the individual from further exposure to airborne radioactivity.

3.2.8 Contamination Surveys

3.2.8.1 Contaminated Areas (Pellet Shop Building #17 & Contaminated Areas of Product Development)

Removable Alpha Contamination	Action to be Taken
10,000 dpm/100 cm2	Immediate Clean-Up
5,000 dpm/100 cm2	24-hour Clean-Up

Contaminated areas shall be surveyed on a weekly basis. Material fixed on processing equipment or on surfaces shall be limited as required to control airborne radioactivity and external radiation exposures.

3.2.8.2 Clean Areas (Other plant areas, office areas, lunch areas)

Removable Alpha Contamination Alpha Level	Action to be Taken
100 dpm/100 cm2	Immediate Clean-Up
50 dpm/100 cm2	24-hour Clean-Up
*10 dpm/100 cm2	Immediate Clean-up
*(lunch rooms only)	

Other manufacturing areas, office areas, and the warehouse (Bldg. 21) shall be surveyed on a monthly basis. The lunch rooms shall be surveyed once a day, as a minimum.

Fixed Alpha Contamination

Monthly fixed alpha contamination levels in the non-contaminated areas (and for release of equipment from contaminated areas) shall be less than 500 dpm/100 cm2 average.

Committee. He shall meet the minimum qualifications for a Nuclear Criticality Specialist and shall not be the initial reviewer.

As stated in section 4.1.3, all such approvals shall be recorded in a log maintained under the supervision of the Supervisor, Health Physics & Safety.

4.1.6 Marking and Labeling of SNM - All mass-limited containers shall be labeled as to enrichment and content. All geometry limited containers and processes are safe up to the maximum allowable enrichment of 4.1% U^{235}. An exception to this would be the 11" dia. x 40" lg. cylindrical hopper which is limited to 3.5 wt.% U^{235}.

4.1.7 Audits

* 4.1.7.1 Product Development - Nuclear criticality safety for
* all Product Development operations shall be limited to quantities smaller than a minimum critical mass with the exception of one slab limited storage area
* in Both Buildings 2 and 5. Each such mass limited area shall be isolated from all other fissile material by at least 12 feet. Criticality control
* by any other means (volume, geometry, etc.) shall not be permitted. Thus, the nuclear
* criticality safety program in Product Development
* consists of simple mass or slab limit. The quarterly radiological safety audit of Product Development operations required by section 2.8 shall include verifications to assure that all nuclear safety limits are being
* adhered to. An annual audit of

* Product Development shall be conducted in accordance with the requirements of section 2.8.

4.1.7.2 Nuclear Fuel Manufacturing Operations - Operations at the Nuclear Fuel Manufacturing facility shall be formally audited for nuclear criticality safety as required by the audit schedule in section 2.8.

4.1.8 Training and Retraining - All training and retraining with respect to nuclear criticality safety shall be conducted in accordance with the requirements of section 2.6.

4.2 Technical Requirements

4.2.1 Preferred Approach to Design - It is the intent of Combustion Engineering to use physical controls and permanently engineered safeguards on processes and equipment in the establishment of nuclear safety limits wherever practical. Use of administrative controls in the establishment of safety limits will be minimized.

4.2.2 Basic Assumptions and Analytical Methods - Written health and safety restrictions for all operations on radioactive material shall be provided in the form of approved Radiation Work Permits or approved detailed procedures, and appropriate operational limits shall be posted in the vicinity of work stations in both the manufacturing facility and Product

* Development. Each operation on fissile material in

* Product Development shall be limited to 350 gm U^{235} for uranium enriched to more than 5% U^{235}, and to 740 gms U^{235} for uranium enriched to $<$5% U^{235}, and

shall be separated from any other fissile material by 12 feet. Rods containing sintered UO2 pellets enriched to a maximum of 5.0% U235 shall be stored in Buildings #2 or #5. Slab storage in Buildings #2 or #5 shall be limited to maximum height of 3.7".

A continuous log shall be maintained for each mass limited work station or storage area in Product Development to assure that the limit is maintained and that the enrichment of all material is recorded. No additional criticality controls are required for Product Development.

Criticality safety of the less complex manufacturing operations is based on the use of limiting parameters which are applied to simple geometries. Safe Individual Units (SIU) shall be selected from Table 4.2.5. These units shall be spaced using the surface density method.

The remaining manufacturing operations are evaluated using two dimensional transport and/or 3 dimensional Monte Carlo Codes. The sixteen group Hansen-Roach cross section library is used for homogeneous systems while the CEPAK Code is used to generate multigroup cross sections for heterogeneous systems. All calculational methods involving computer codes shall be validated in accordance with the criteria established in Regulatory Guide 3.4, "Nuclear Criticality Safety in Operations with Fissionable Materials at Fuels and Materials Facilities."

shall be indicated with a colored line. The line may be crossed by carts only to permit an operator to transfer that SIU to an available storage position.

4.2.7 Structural Integrity Policy - All storage racks, furnaces, containment, and processing equipment which provide nuclear safety limiting parameters shall be designed to assure against failure under normal and reasonable overload conditions and under conditions of shock or collision foreseeable in the plant area. All equipment designed shall incorporate a minimum safety factor of 3.0. All equipment design shall conform to standard design practices, thereby assuring adequate structural integrity. Materials of construction shall be selected to assure, as far as possible, resistance to fire and corrosion. The individual engineer responsible for the purchasing or design of the new equipment shall assure that the minimum safety factor of 3 has been incorporated into the design of the equipment. The minimum qualifications for engineers shall be a bachelors degree in engineering or related fields.

4.2.8 Zoning for Fire Protection - An overhead sprinkler system as well as portable extinguishers are located throughout the fuel manufacturing facilities and Product Development. Onsite and Offsite fire protection service personnel have been instructed to use only portable dry chemical extinguishers in the Bldg. #17, to maintain the highest possible margin of nuclear criticality safety. Fire hoses shall not be permitted in Bldg. #17.

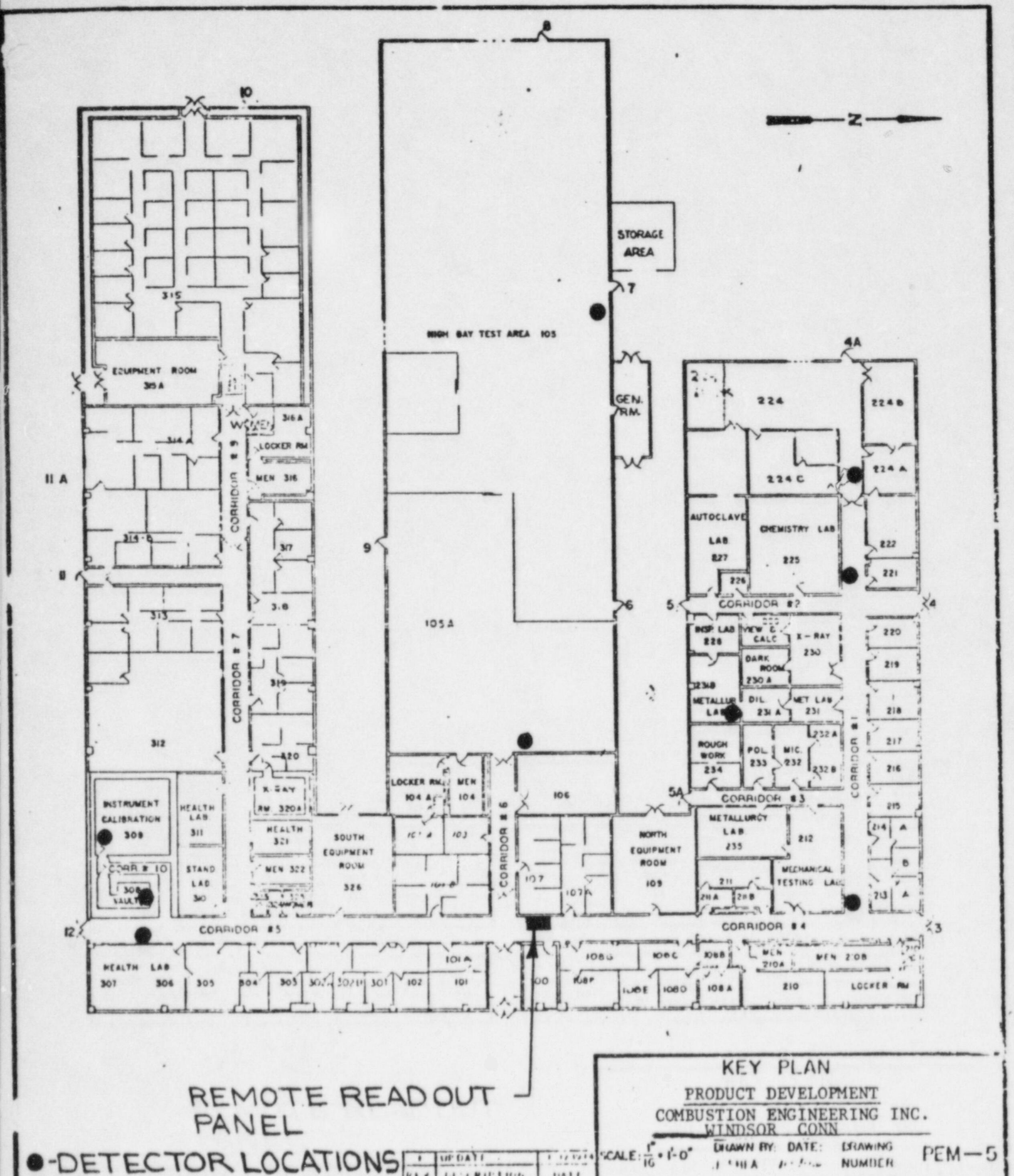
4.2.9 Criticality Alarm System - A criticality alarm system which meets the requirements of 10 CFR 70.24 (a) (1), Regulatory Guide

8.12, "Criticality Accident Alarm System" shall be maintained
* in Product Development areas and the manufacturing facility.
* The detectors operate in the range of 1-10,000 mR/hr. The locations of the detectors within the manufacturing facility are shown in Figure 4.2.1 and within the laboratories in Figure 4.2.2. The radiation intensity is shown on a central panel located in the Health Physics office for the manufacturing facility (Bldg. #17), and in the main hallway
* in Bldg. #5 of Product Development and in the HP office in
* Building #2. There is an alarm which serves as a local and general audible radiation evacuation alarm. When the alarm is sounded, the Emergency Plan is immediately put into effect. The monitors are connected to the emergency power system, which is supplied to all emergency lights and alarms in the event of a general power failure within the facility. This electrical system renders the alarm system operative at all times. This system is tested for operability quarterly. Operation is further enhanced by visual observation by Health Physics personnel. Alarm operational tests of the radiation monitors are performed monthly by Health Physics personnel. A radioactive source is used to perform these tests. The entire system is calibrated quarterly and following any repair that affects the accuracy of the measurement.

4.3 Specific Criticality Safety Criteria

Specific criticality safety criteria in addition to the general criteria described in Section 4.2 are necessary to assure nuclear safety for several process operations, as described below:

FIGURE 4.2.2



REMOTE READOUT PANEL

●-DETECTOR LOCATIONS

KEY PLAN

PRODUCT DEVELOPMENT
COMBUSTION ENGINEERING INC.
WINDSOR CONN

SCALE: 1/16" = 1'-0" | DRAWN BY: | DATE: | DRAWING NUMBER: PEM—5

6.0 INDUSTRIAL SAFETY

* The Director, Product Development shall be responsible for compliance with all applicable industrial safety (OSHA) regulations for all
* activities in Product Development covered by License No. SNM-1067. The Supervisor, Health Physics and Safety shall be responsible for compliance in the manufacturing facility.

7.0 DECOMMISSIONING PLAN

Combustion Engineering's Decommissioning Plan dated 1/15/79 was
* submitted previously and is included as Appendix A to this License.
*

8.0 RADIOLOGICAL CONTINGENCY PLAN

* Combustion Engineering's Radiological Contingency Plan, approved as
* Amendment No. 35 to SNM-1067 on March 26, 1982, is considered to be part of this license.

9.0 FUNDAMENTAL NUCLEAR MATERIAL CONTROL PLAN (FNMC)

Combustion Engineering's FNMC dated February 1980 was submitted June 11,
* 1980 and should be considered part of this License.

PART II. SAFETY DEMONSTRATION

1.0 OVERVIEW OF OPERATIONS

1.1 Corporate Information and Financial Qualifications

1.1.1 Name and Address of Licensee:

COMBUSTION ENGINEERING, INC.
1000 PROSPECT HILL ROAD
WINDSOR, CONNECTICUT 06095

Combustion Engineering is incorporated in the State of Delaware.

Location of Principal Office: Windsor, Connecticut

1.1.2 Names, Addresses and Citizenship of Principal Officers

	Name	Position	Address	Citizenship
	SANTRY, A. J., Jr.	Chairman and Chief Executive Officer	900 Long Ridge Road Stamford, Conn.	U.S.
*	HUGEL, Charles E.	President and Chief Executive Officer	900 Long Ridge Road Stamford, Conn.	U.S.
*				
*				
*	KELLY, James	Vice President Power Systems	1000 Prospect Hill Road Windsor, Conn.	U.S.
*	BARNETT, Charles E.	Vice President & General Counsel	900 Long Ridge Road Stamford, Conn.	U.S.
*	RUBINS, Jeffrey S.	Vice President & Controller	900 Long Ridge Road Stamford, Conn.	U.S.

C-E has organized four service divisions (Finance, Research, International and Administration) and the following operating divisions:

Engineering and Construction Group - This group has a broad international involvement in the design, engineering, and construction supervision of projects in the chemical, petrochemical, petroleum, metallurgical and other process industries.

Process Equipment Group - This group manufactures and markets a wide range of energy-related products including oil and gas production processing equipment, heat exchangers, and pollution control equipment.

Industrial Products Group - This group provides a full range of services in the architectural, engineering, and planning disciplines with recognized special competency in environmental engineering, resource recovery and disposal of solid waste, transportation systems and the production of high temperature industrial ceramic materials for lining furnaces and other heat processing auxiliary equipment.

*

*

Power Systems Group - C-E Power Systems provides fossil and nuclear fueled steam generating equipment, nuclear fuel and components, and air quality control systems for the electric utility industry, and steel transmission structures. This group also provides industrial steam generating equipment, fuel burning and auxiliary equipment, and chemical recovery systems and boilers for pulp and paper mills as well as heavy

thick-walled pressure vessels for the chemical, petrochemical and petroleum processing industry.

The Nuclear Power Systems Division of the Power Systems Group has approximately 1200 (as of January 31, 1980) employees, of whom approximately 70% are scientists and engineers. More than two-thirds of the professional staff have at least five years experience in the nuclear field and approximately 50% have continued their education beyond the Bachelors Degree level. This staffing provides competence in the field of nuclear science and technology and extensive experience in the following specific areas: theoretical and experimental physics, mathematics, reactor analysis, chemistry, metallurgy, instrumentation controls, mechanical design, thermal sciences and nuclear and radiological safety.

Nuclear Products Manufacturing

Nuclear Products Manufacturing (NPM) is equipped to provide a variety of services necessary in the development and manufacture of precision reactor components such as fuel rods and assemblies containing low enriched UO_2 and control rods.

Equipment is also available to fabricate certain alloys of metals used for control rods and other special components.

Product Development

Product Development maintains complete facilities for the development, design, analysis and testing of nuclear components and systems. Product Development

* consists of two functional sections:

* New Product Development - Establishes experimental basis for fuel design systems, specifies materials for prototype fuel fabrication; reviews drawings, specification and other documents for prototype fuel performs dynamic and structural testing of reactor components; evaluates
* test data, and test results; provides in-service
* inspection and field inspections for fuel.

* Core Materials Development - Reviews material specifications; analyzes material problems, recommends materials for specific applications and environments; reviews fabrication and test procedures; develops and maintains chemistry specifications; performs metal-
* lurgical and chemical testing;
* analyzes chemistry
* related problems;
* predicts the effects of irradiation on material properties; performs irradiated materials testing.
* The Product Development staff is comprised of
* metallurgists, chemists, engineers, and technicians.
* Product Development occupies a 14,000 square foot

* area in Building #5.

* Product Development maintains equipment for mechanical testing, X-ray diffraction, vacuum and inert atmosphere heat treating, radiography, powder processing, and ceramics processing.

1.1.4 Information Known to Applicant Regarding Foreign Control

There is no information known to Combustion Engineering, Inc. of any control exercised over it by any alien, foreign corporation, or foreign government. The stock of Combustion Engineering is traded on the New York Stock Exchange. According to the stock records of Combustion Engineering maintained by its Transfer Agent, The Chase Manhattan Bank, as of December 31, 1979, there were approximately 26,742 stockholders of record, holding 16,337,119 shares of Combustion capital stock issued and outstanding. Of this number less than 1 percent of all stockholders gave foreign addresses.

1.1.5 Financial Qualifications

* Combustion Engineering's 10-K which details its financial

* position is attached as Appendix B.

1.2 Operating Objective and Process - Summary

The process at the manufacturing facility begins with receipt of UO2 powder enriched to a maximum of 4.1% U235 from Combustion Engineering's

* oxide conversion plant in Hematite, Missouri. This powder is then made up into batches with various additives and pressed into pellets. The pellets are dewaxed in a furnace where volatile additives are removed. The pellets then pass through a sintering furnace where they densify and attain the desired characteristics. Final sizing is accomplished through the use of a centerless grinder. The finished pellets are then loaded into zirconium tubes which are sealed and combined into finished PWR fuel assemblies. The assemblies are finally loaded into approved shipping containers and delivered to a carrier for transport to their final destination.

* Analytical operations are carried out by Product

* Development. These operations may require uranium in any form and enriched to <20% U235.

1.3 Site Description

1.3.1 Population

The area surrounding Combustion Engineering's 1200-acre site is sparsely populated. Windsor, Connecticut is the nearest town of significant size, approximately five miles away, with a population of 22,502 and a population density of 760.2 per square mile. East Granby, Connecticut is the nearest town to the site, approximately three miles away, with a population of 3,532 and a population density of 198.4 per square mile. The distribution of population in the area is shown in Table 1.3. Figure 1.3.1 is a map of the general area showing the location of the towns listed in Table 1.3.

Hills to the west and northwest are a source of summer thunderstorms which, when accompanied by wind and hail, sometimes do condsiderable damage to the crops in the Connecticut Valley. Frequently during the winter, when rain falls through the cold air trapped in the Valley, the resultant icing creates hazardous conditions for transportation and utility installations. On clear nights in the late summer or early autumn, cool air drainage into the Valley, plus Connecticut River moisture, produce ground fog which sometimes becomes quite dense through the Valley and hampers ground and air transportation.

1.3.4 Geology

The surrounding area has been subjected to the actions of glacial ice. All dominant geological features are a result of * erosion and depositions caused during the Pleistocene era. The State of Connecticut has favorable earthquake history. Ten earthquakes are listed, the first recorded in 1791 and the last in 1925. All of these, with the exception of the first, were local in nature and of moderate intensity.

1.3.5 Hydrology

The surface drainage in the surrounding area is excellent. The predominantly sandy nature of the soil and heavy forest cover results in very moderate run-off even after heavy prolonged precipitation.

The site creek, into which all site effluents are discharged, flows into the Farmington River which flows along the northwest corner of the Combustion site, shown in Figure 1.3.2. Two and

1.5 History of License

Combustion Engineering first applied for a license to process low enriched uranium by the methods described in section 1.2 in 1968. License SNM-1067 was then issued for a period of 5 years by the U.S.

* Atomic Energy Commission (AEC). The License was renewed at 5 year intervals with the latest renewal approved in March 1983 for an additional 5 year period.

*

*

then connected to the low voltage metal clad switch gear for distribution through the building. A further step-down to 208/120 volt is made for lighting and general convenience power.

Emergency Power System

A diesel generator serves as a back-up emergency power system for both the manufacturing and laboratory facilities. The generator produces 3-phase, 480 volts, and 200 KW. The described generator feeds a rated distribution panelboard which has several 100 ampere, 3-phase 480 volt circuit breakers. The panelboard is switched from normal power to generator (emergency) power by an Asco transfer switch. Diesel start-up and transfer takes approximately ten to twelve seconds. A circuit breaker within this panelboard is used to supply emergency

* power to the manufacturing and product development facilities.

The principal site water supply is provided by the Metropolitan District, the source of city water for the greater Hartford area. Chemical and radiological analyses for both raw and treated well water have been made, and any changes in composition or activity from any cause will be discovered rapidly.

2.3 Heating, Ventilation, and Air Conditioning (HVAC)

The Building #17 office area, consisting of 4800 square feet is heated and cooled by hot and chilled water respectively supplied by the Windsor site central boiler house. Office areas have built-in convectors which heat and cool the areas depending on the time of year. Each office has an exhaust system which ventilates the area and allows fresh air to be brought in.

The main shop area of Building #17 consists of approximately 36,000

3.0 Organization and Personnel

Functions of key positions, specifics on education and experience required for key personnel, organization procedures, and unit functions (including safety committees) are described in Part I, sections 2.2, 2.3, 2.4, and 2.5 of this renewal application.

3.1 Organization Charts

Current Organizational charts and structure are provided in Figure

* 3.1.1.

3.2 Resumes of Key Personnel

Resumes of key personnel are provided in this section on the pages following the above described organizational charts.

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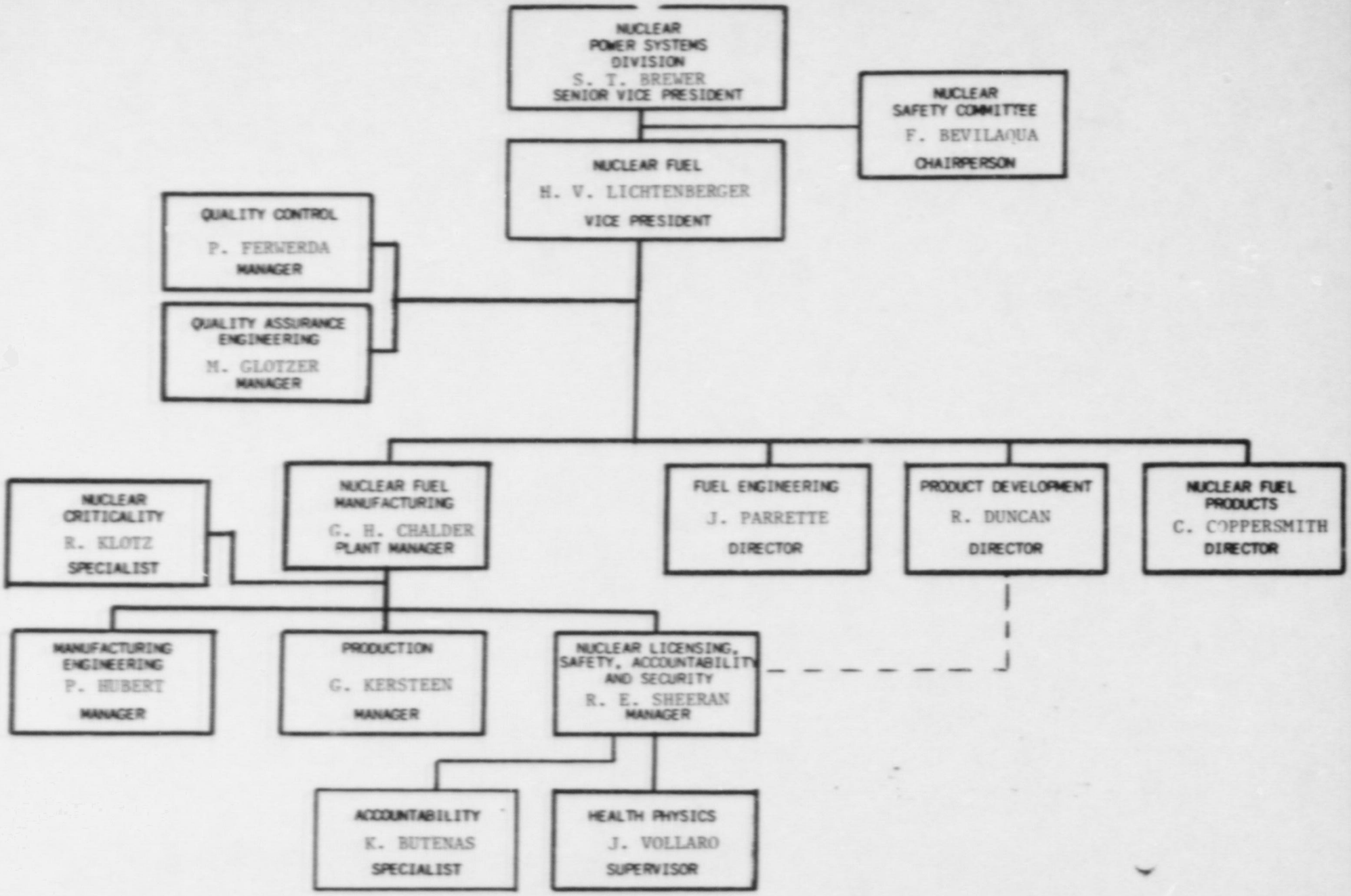
FIGURE 3.1.1


NUCLEAR
POWER SYSTEMS
DIVISION
S. T. BREWER
SENIOR VICE PRESIDENT
NUCLEAR
SAFETY COMMITTEE
F. BEVILACQUA
CHAIRPERSON
NUCLEAR FUEL
H. V. LICHTENBERGER
VICE PRESIDENT
QUALITY CONTROL
P. FERWERDA
MANAGER
QUALITY ASSURANCE
ENGINEERING
M. GLOTZER
MANAGER
NUCLEAR
CRITICALITY
R. KLOTZ
SPECIALIST
NUCLEAR FUEL
MANUFACTURING
G. H. CHALDER
PLANT MANAGER
FUEL ENGINEERING
J. PARRETTE
DIRECTOR
PRODUCT DEVELOPMENT
R. DUNCAN
DIRECTOR
NUCLEAR FUEL
PRODUCTS
C. COPPERSMITH
DIRECTOR
MANUFACTURING
ENGINEERING
P. HUBERT
MANAGER
PRODUCTION
G. KERSTEEN
MANAGER
NUCLEAR LICENSING,
SAFETY, ACCOUNTABILITY
AND SECURITY
R. E. SHEERAN
MANAGER
ACCOUNTABILITY
K. BUTENAS
SPECIALIST
HEALTH PHYSICS
J. VOLLARO
SUPERVISOR

FRANK BEVILACQUA

Professional Experience

Combustion Engineering, Inc. (1956 to present)

Vice President & Chief Scientist, Nuclear Power Systems Div. (March 1985-Present)

Overview responsibility: for maintaining the technical capability of the NPS division; for coordinating the resolution of specifically assigned major technical problems; for review of and recommendation on general technical issues; for review and recommendation on safety issues; and for presentation of NPS technology nationally and internationally. Chairman of the Nuclear Safety Committee, the Technical Review Committee, and the Steam Generator Design Review Committee. Promote the management mission through participation in the Human Resources Advisory Council.

Vice President, Engineering, Nuclear Power Systems Division (1974-1985)

Responsible for the engineering, design, and design-related activities for the pressurized water reactor type nuclear steam supply system (NSSS) offered by Combustion Engineering. Engineering includes the following departments: Plant Engineering, Instrumentation and Control Engineering, Physics and Computer Analysis, Reactor Design, Mechanical Design, and Performance Analysis.

C-E Managerial Positions (1964-1974)

Previous to the above position, held PWR managerial positions in instrumentation and controls, core (thermal-hydraulic) design, and reactor engineering. In these positions was responsible for the conception, development, and design of major portions of the commercial NSSS offered and sold by Combustion Engineering. Personally conceived many of the designs presently being used in C-E NSSS.

Manager, Heavy Water Moderated Organically Cooled Reactor (HWOCR)

Responsible for directing the C-E design and analytical activities associated with an AEC sponsored design study of the feasibility of a D_2O moderated, organically cooled reactor for large power producing nuclear systems.

Project Manager, General Nuclear Engineering Corp. (Combustion Engineering, Inc. subsidiary) (1956-1964)

During the development and design of the Boiling Nuclear Superheater (BONUS) reactor, was responsible for:

- Management of the Bonus research and development program
- Design and preparation of specification for controls and instrumentation

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SHELBY T. BREWER

Education: Columbia University, B.A. in Humanities, 1959
Columbia University, B.S. in Engineering Physics, 1960
Massachusetts Institute of Technology, M.S. in Nuclear Engineering, 1966
Massachusetts Institute of Technology, PH.D in Nuclear Engineering, 1970

Professional Experience

Combustion Engineering, 1984 to Present Senior Vice President - Nuclear Power Systems

Responsible for all Combustion Engineering, Inc. Business Units associated with Nuclear Energy, including Nuclear Reactor systems, Nuclear Fuel, Nuclear Services, Nuclear Component Manufacturing, and U.S. Naval Reactors.

U.S. Department of Energy, 1981 to 1984
U.S. Assistant Secretary of Energy (for Nuclear Energy)

Responsible for Nuclear Energy; managing all Civilian Nuclear Research, Development and Demonstration Programs; U.S. Navy Reactor Development and Deployment; The U.S. Uranium Enrichment Enterprise; Nuclear Waste Management; and Special Applications of Nuclear Technology such as Power Isotope and Reactor Systems for Space Missions

U.S. Navy, Industry, MIT, 1970 to 1981

Various responsibilities with the U.S. Navy, the Massachusetts Institute of Technology, and the U.S. Atomic Energy Commission.

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KEVIN F. BUTENAS

Education

Associates of Arts & Science, Manchester Community College, 1974

Professional Experience

Combustion Engineering 1978 - Present

Senior Engineer
Responsible for Designing/Developing Training Programs on Design/Operation/Maintenance of Fossil Systems. Prepare detailed analysis reports with recommendation for improving Plant availability, performance and efficiency.

Junior Engineer
Responsible for preparing/presenting Training Programs to Utility and Industrial Boiler Customers.

Envirotech Laboratories 1975 - 1987
Performed chemical/physical testing of varicus types of materials.

G. H. CHALDER

B.S. Metallurgy, University of Durham, England (1951).

PROFESSIONAL EXPERIENCE

Combustion Engineering, Inc., Windsor, Connecticut April 1986 to Present
Plant Manager, Windsor, Nuclear Fuel Manufacturing.

Responsible to the Vice-President, Nuclear Fuel for the operation of a plant producing nuclear fuel and control assemblies for use in commercial PWRs, including the functions of process engineering and development, production control, manufacturing, licensing, nuclear material accountability and security.

Combustion Engineering Canada, Moncton, N.B., Canada March 1984 to March 1986 Manager, Nuclear Fuel

On assignment to CE Canada Mr. Chalder was responsible to the Vice-President, Operations of CE Canada for all operations at the Moncton Nuclear Fuel Plant.

The plant is a self-contained facility dedicated to the manufacture and sale of fuel assemblies for use in CANDU nuclear power reactors and includes the design and process engineering, manufacturing, R & D and Quality Assurance functions associated with the product.

Combustion Engineering, Inc., Erlangen, West Germany 1982 to 1984
Manger CE/KWU Coordination

As CE's resident representative at Kraftwerk Union, Mr. Chalder was responsible for expediting the transfer of nuclear technology between the companies under the CE/KWU Technical Exchange Agreement.

Combustion Engineering, Inc., Windsor, Connecticut 1976 to 1982
PED Task Area Manager, Materials and Services

In this position Mr. Chalder had technical and budgetary responsibility for internally-funded R & D programs in the areas of nuclear materials and services including irradiation testing and inspection for the coordination of this work with corresponding programs at KWU under the joint CE/KWU Technical Agreement.

During this period Mr. Chalder also acted as coordinator of outside-funded development, negotiations with customers, monitoring of technical progress and budgetary control.

Halden Reactor Project, Norway 1973 to 1976
Senior Scientific Adviser

While attached by CE to the Halden Project during this period, Mr. Chalder provided technical consultation to the internationally-supported Halden Base Program on irradiation testing and performance analysis of water reactor fuels, besides supervising the proprietary fuel test program conducted by CE and Kraftwerk Union (KWU) of Germany at Halden as part of their joint technical agreement.

Combustion Engineering, Inc., Windsor, Connecticut 1970 to 1973
Section Manager, Fuels and Control Materials

During this period, Mr. Chalder managed a group responsible for all phases of work in the Nuclear Laboratories on fuel and control materials for the CE PWR and LMFBR programs, including preparation of specifications, fabrication development, applications and economic analyses and evaluation of physical properties and irradiation performance.

Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada 1955 to 1970
Senior Research Officer and Group Leader, Fuel Materials

During this period, Mr. Chalder had technical and supervisory responsibility for a number of programs in the area of nuclear fuel development, which included both in-house activities and outside contracts. These programs included fabrication development of a variety of fuel materials and in-and out-reactor testing and evaluation of a range of fuel element and fuel assembly designs.

U.K. Atomic Energy Authority, Culcheth, England 1951 to 1955
Scientific Officer

Mr. Chalder was involved in process metallurgy development of uranium and refractory metals for a variety of nuclear applications.

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HAROLD V. LICHTENBERGER

B. A., Physics, James Milliken University, 1942

PROFESSIONAL EXPERIENCE:

Combustion Engineering, Inc., 1985 to Present
Vice President - Nuclear Fuel - Nuclear Power Systems

* Mr. Lichtenberger is responsible for the design, development, manufacturing, and quality control of all nuclear fuel products.

Combustion Engineering, Inc., 1961 to 1985
Vice President - Nuclear Fuel - Nuclear Power Systems Division

Mr. Lichtenberger had responsibility for the manufacturing and quality control operations for reactor fuel, control rod drives and other nuclear components including planning, scheduling and the development of improvements in design and processing techniques.

General Nuclear Engineering Corporation, 1956 to 1961
Vice President

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

Argonne National Laboratory, 1951 to 1956
Director, Idaho Division

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

PROFESSIONAL AFFILIATIONS: Fellow, American Nuclear Society

*

DOUGLAS L. PARKS

Education: University of Massachusetts, Accounting, 1974

PROFESSIONAL EXPERIENCE

Combustion Engineering, Inc. 1974 - Present

Nuclear Materials Manager 1985 - Present

Responsible for all Special Nuclear Material used within the Manufacturing Organization of Nuclear Fuel.

Fleet Controller - 1982 to 1985

Fixed Asset Accounting; SEC Reports; Year-End Tax Package; Liaison with Data Processing Department on a continuous basis relative to providing them with all appropriate financial data, as well as verifying output for content and accuracy - work with them in automating new financial/accounting systems as well as improving existing systems; Accounts Payable and Receivable, including credit and collection activities; Current Account Reconciliations; and consolidate subsidiary for reporting to Corporate.

Staff and Senior Accountant 1974 to 1983

Input new Bookings and Supplemental Abstracts; reconciled Total Cost, Total Billings, Sales, Cost of Sales, Work-in-process, Unbilled Shipments, Advance Payment, and Advance Billings; prepared monthly sales journal; established and wrote automated Kardex System program; submitted and reconciled invoices for Sales Register; and prepared monthly financial reports.

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SECURITIES AND EXCHANGE COMMISSION

Washington, D.C. 20549

FORM 10-K

ANNUAL REPORT PURSUANT TO SECTION 13 OR 15(d) OF THE SECURITIES EXCHANGE ACT OF 1934

For the fiscal year ended December 31, 1985

Commission file number 1-117-2

COMBUSTION ENGINEERING, INC.

(Exact Name of Registrant As Specified In Its Charter)

Delaware	13-1587569
(State or Other Jurisdiction of Incorporation or Organization)	(I.R.S. Employer Identification No.)
900 Long Ridge Road, P.O. Box 9308, Stamford, Connecticut	06904
(Address of Principal Executive Offices)	(Zip Code)

Registrant's telephone number, including area code (203) 329-8771

Securities registered pursuant to Section 12(b) of the Act:

Title of Each Class	Name of Each Exchange on Which Registered
Common Stock—$1 Par Value	New York Stock Exchange
7.45% Sinking Fund Debentures Due 1996	New York Stock Exchange

Securities registered pursuant to Section 12(g) of the Act:

(Title of Class)

(Title of Class)

Indicate by check mark whether the registrant (1) has filed all reports required to be filed by Section 13 or 15(d) of the Securities Exchange Act of 1934 during the preceding 12 months (or for such shorter period that the registrant was required to file such reports), and (2) has been subject to such filing requirements for the past 90 days.

Yes X No

Indicate the number of shares outstanding of each of the registrant's classes of common stock, as of the latest practicable date.

Class	Outstanding at March 7, 1986
Common Stock—$1 Par Value	33,223,287

The aggregate market value of the voting stock held by non-affiliates of the registrant on March 7, 1986, was approximately $1,125,000,000.

Documents Incorporated By Reference

The following documents are incorporated by reference:

(1) "Financial Section" of the Annual Report to Shareholders for the year ended December 31, 1985, in response to Items 1(a) and 1(d) and Item 3 of Part I, and Items 5 through 8 of Part II; and in partial response to Item 1(b) and 1(c) of Part I, and Items 14(a), (c) and (d) of Part IV.

(2) The Company's Proxy Statement dated March 14, 1986, in connection with its Annual Meeting of Shareholders to be held on April 22, 1986, in response to Items 11 through 13 and in partial response to Item 10 of Part III.

PART I

ITEM 1. DESCRIPTION OF THE BUSINESS

References to the Company contained herein shall be deemed to refer to the Company and its consolidated subsidiaries. References to the Annual Report shall be deemed to refer to the Annual Report to Shareholders for the year ended December 31, 1985.

Item 1(a) General Development of Business

In September 1985, the Company announced plans to sell major portions of its oil and gas equipment and services operations. Accordingly, the results of those operations have been classified as discontinued operations. See Note 4 of the Notes to Financial Statements on Page 43 of the "Financial Section" of the Annual Report. Unless otherwise indicated, all items included in this Form 10-K relate only to continuing operations.

Reference is made to Note 2 of the Notes to Financial Statements on page 42 of the "Financial Section" of the Annual Report regarding acquisitions.

Item 1(b) Financial Information About Industry Segments

Reference is made to Note 14 of the Notes to Financial Statements on pages 47 to 49 of the "Financial Section" of the Annual Report regarding financial reporting by business segments.

Much of the Company's business, especially that relating to steam generating systems, equipment and services for the electric utility industry and design, engineering and construction services, involves long-term contracts of various types, including fixed price and cost plus fee type contracts with some contracts including variations of both types. Certain contracts include incentive provisions whereby the profit is adjusted depending upon performance. The largest portion of sales under long-term contracts is derived from fixed price contracts. Most contracts provide for progress or scheduled payments over the life of the contracts. The contract price in fixed price contracts either includes an amount for the estimated increase in the cost of labor, materials and services over the period required for performance of the contract, or is subject to adjustment based on a price escalation clause.

Profits on long-term contracts for financial reporting purposes are recorded principally on the basis of the estimated stage of completion. However, no profits are recorded on contracts for equipment manufactured in the Company's plants prior to billing the customer and, in most cases, prior to shipment of the equipment. These contracts extend over a period of from several months to four or more years. Revisions in cost estimates during the progress of the work under long-term contracts have the effect of including in subsequent accounting periods adjustments necessary to reflect the results indicated by the revised estimates of final cost. Projected or realized losses under long-term contracts, if any, are provided for in the period when first determined. See Note 1(d) of the Notes to Financial Statements on page 38 of the "Financial Section" of the Annual Report.

Cost estimates for long-term contracts take into account all anticipated costs including, among others, engineering, manufacturing, subcontracting and field construction costs which are required to meet the specifications, including warranties, of the contracts. In addition, when a long-term contract for steam generating equipment is completed for accounting purposes (usually after payment by the customer of amounts retained under terms of the contract and satisfactory operating performance of the equipment), provision is made for future warranty costs, generally on the basis of past experience.

Item 1(c) Narrative Description of the Business

Reference is made to "Business Segments and Brief Description of the Business" shown on page 51 of the "Financial Section" of the Annual Report regarding a narrative description of the Company's business.

Raw Materials

The principal raw material used by the Company's business segments is steel; principally sheet, plate, bar structurals, tubing, rod, forgings, castings and wire. However, many other materials are also required. Raw materials are purchased by the Company as needed for individual contracts or to maintain proper inventory levels. The Company normally does not encounter difficulties in procuring adequate supplies of raw materials.

Patents and Licenses

The Company has numerous United States and foreign patents and patent applications which relate to many different products and processes, and are deemed by the Company to be adequate for the conduct of the business. The Company does not believe that any single patent is of material importance in relation to any business segment or the Company as a whole.

The maintenance of licenses issued by the Nuclear Regulatory Commission is essential to the conduct of certain portions of the Company's nuclear business.

Backlog

Reference is made to the "Management Discussion and Analysis of Financial Condition and Results of Operations—Unfilled Orders" on page 33 of the "Financial Section" of the Annual Report. Approximately 48% of the consolidated December 31, 1985, backlog of unfilled orders is expected to be recorded as sales (principally on the percentage of completion method) in 1986 and the remainder in subsequent years. Not included in backlog at December 31, 1985, is the $230 million Detroit resource recovery contract announced in December 1985, pending release of escrowed financing.

The backlog of unfilled orders cannot be projected into an annual rate of net sales for a variety of reasons, including the length of time required for the completion of contracts and changes in customer requirements.

Competitive Conditions

With respect to equipment, products and services for industrial markets, the Company is one of numerous manufacturers or suppliers and, in certain cases, is one of the leading manufacturers or suppliers. In general, the Company conducts this portion of its operations under highly competitive conditions.

With respect to steam generating systems, equipment and services for the electric utility industry, the Company is one of the largest domestic manufacturers of fossil fueled steam generating systems and equipment and is one of four domestic manufacturers of nuclear steam supply systems. The competitors for fossil fueled steam generating systems include The Babcock & Wilcox Company, a wholly-owned subsidiary of McDermott International, Inc. and Foster Wheeler Corporation. The other domestic manufacturers of nuclear steam supply systems are Westinghouse Electric Corporation, General Electric Company and The Babcock & Wilcox Company. In addition, there is a substantial amount of competition in foreign markets including Framatone (France), Westinghouse Electric Company and K.W.U. (Germany).

Lummus Crest Inc., the principal component of the design, engineering and construction services segment of the Company, continues to be one of the largest domestic firms engaged in designing, engineering and constructing chemical process plants, petroleum refineries and other industrial facilities. However, the changing nature of the industry has created differing degrees of competition due to a shift in the size and nature of recent contract awards. As a result, the Company now competes with various engineering firms of all sizes, including the major firms which had been our primary competitors in the past.

Usually, the Company competes for new orders by responding to specific invitations to bid. The principal basis of competition would include the following factors, but not necessarily in their order of importance: design of the equipment or process to be furnished in response to the customer's specifications, technical support and services, ability to meet the customer's delivery schedule, price and, in certain cases, project financing.

Research and Development

The estimated amount spent during 1985, 1984 and 1983 on Company sponsored research and development activities was $60,062,000, $98,891,000 and $48,284,000, respectively; and on that which was customer sponsored was $19,141,000, $19,649,000 and $23,025,000 respectively.

Compliance with Environmental Protection Laws

Compliance by the Company with Federal, state and local environmental protection laws required capital expenditures of $226,000 in 1985, $983,000 in 1984 and $2,249,000 in 1983. It is estimated that capital expenditures in 1986 for such purposes will be approximately $300,000.

Employees

At December 31, 1985, the Company employed 24,761 persons.

Item 1(d) Financial Information about Foreign and Domestic Operations and Export Sales

Reference is made to Note 14 of the Notes to Financial Statements shown on pages 47 to 49 of the "Financial Section" of the Annual Report.

ITEM 2. PROPERTIES

The principal manufacturing and processing plants and other important physical properties are set forth below. The industry segment(s) which use the property is also identified. Unless noted, the property is owned by the Company or a subsidiary.

Andersonville, Georgia (2)*#
Bloomfield, New Jersey (4)*
Brantford, Ontario (1)
Chattanooga, Tennessee (1) (2) (3)
Chicago, Illinois (1)*
Dry Branch, Georgia (2)#
East Chicago, Indiana (1) (3)
Gabbs, Nevada (2)*#
Houston, Texas (4)*
Maple Grove, Ohio (2)#
Marion, North Carolina (1) (3)
Monongahela, Pennsylvania (1) (3)
Northampton, England (2)*
Ottawa, Ontario (1) (3)*
Paris, France (4)*
Rochester, New York (1)
Sandersville, Georgia (2)#
Sherbrooke, Quebec (1) (3)
Springfield, Ohio (1)
Stamford, Connecticut
(Corporate Office)*
Stevenage, England (1)
St. Catherines, Ontario (1) (2)
The Hague, Netherlands (4)*
Valley Forge/King of Prussia, Pennsylvania (1) (2)
Walnut Creek, California (2)
Waterford, Pennsylvania (2)*
Wellsville, New York (1) (3)
Windsor, Connecticut (1) (3)*
Worcester, Massachusetts (1)

(1) Equipment for industrial markets
(2) Products and services for industrial markets
(3) Steam generating systems, equipment and services for the electric utility industry
(4) Design, engineering and construction services

* Includes leased facilities
#Includes mining properties some of which are under lease

The Company's manufacturing facilities are of varying ages and are well maintained, in good operating condition and suitable for the purposes for which they are being used. All of the principal manufacturing and processing plants are utilized on the basis of at least one shift and some operate with more than one shift. Management regards these facilities as having adequate capacity to meet current production requirements.

ITEM 3. PENDING LEGAL PROCEEDINGS

Reference is made to Note 12 of the Notes to Financial Statements shown on page 46 of the "Financial Section" of the Annual Report for the year ended December 31, 1985.

ITEM 4. SUBMISSION OF MATTERS TO A VOTE OF SECURITY HOLDERS

None.

PART II

ITEMS 5. THROUGH 8.

The "Financial Section" of the Annual Report to Shareholders for the year ended December 31, 1985, is hereby incorporated by reference.

	Page Number in "Financial Section" of Annual Report
Item 5—Market for the Registrant's Common Stock and Related Security Holder Matters	56 to 59
Item 6—Selected Financial Data	28
Item 7—Management's Discussion and Analysis of Financial Condition and Results of Operations	29 to 33
Item 8—Financial Statements and Supplementary Data	34 to 55

ITEM 9. DISAGREEMENTS ON ACCOUNTING AND FINANCIAL DISCLOSURE

None.

PART III

ITEMS 10. THROUGH 13.

The Company's Proxy Statement dated March 14, 1986, in connection with its Annual Meeting of Shareholders to be held on April 22, 1986, has been filed with the Securities and Exchange Commission and the information set forth under "Executive Compensation" on pages 6 to 12 thereof and information with respect to stock ownership set forth on pages 2 to 5 thereof is hereby incorporated by reference.

Listed below are the officers of the Company:

Name	Age	Position Presently Held
Charles E. Hugel	57	President and Chief Executive Officer
George S. Kimmel	51	Executive Vice President and Chief Financial Officer
Charles E. Barnett	46	Vice President, General Counsel and Secretary
Joseph F. Condon	60	Vice President-International
William J. Connolly	56	Vice President-Corporate and Investor Relations
James B. Kelly	58	Vice President in charge of Industrial Group
Mitchell Kiamie	64	Vice President-Operational Performance and Analysis
Sven A. Kreipke	60	Vice President
Donald E. Lyons	56	Vice President in charge of Power Systems Group
John F. Mangold	59	Vice President in charge of Oil and Gas Group
Robert H. Masson	50	Vice President and Treasurer
Dudley C. Mecum	51	Vice President in charge of Urban Systems and Services, and Engineering and Construction Group
John R. Peterson	52	Vice President-Strategy and Business Development
Jeffrey S. Rubin	42	Vice President and Controller
Dale E. Smith	42	Vice President-Human Resources
Eugene T. Yon	49	Vice President in charge of Engineered Systems and Controls Group

There are no family relationships among the foregoing officers.

There are no arrangements or any understandings between the above persons and any other persons pursuant to which such persons were elected to the offices indicated.

Election to the offices indicated is for a term of one year.

A brief account of each officer's business experience during the past five years is set forth below:

Mr. Hugel was elected Chief Executive Officer in April 1984 and President and Director of the Company effective September 1, 1982. Prior to joining the Company, he was an Executive Vice President of American Telephone & Telegraph and, prior to that, he was the President of Ohio Bell Telephone.

Mr. Kimmel was elected an Executive Vice President in December 1984, Vice President-Finance in June 1980 and a Vice President of the Company in April 1979. He was elected a Director in April 1981.

Mr. Barnett was elected a Vice President of the Company in January 1984. Prior to joining the Company, he was Vice President, General Counsel and Secretary of St. Joe Minerals Corporation.

Mr. Condon was elected a Vice President of the Company in January 1978 and is responsible for coordinating the Company's international manufacturing and licensing activities, sales and market services.

Mr. Connolly was elected a Vice President of the Company in April 1976 and was responsible for corporate marketing and communications until September 1980 when he became Vice President-Corporate and Investor Relations.

Mr. Kelly was elected a Vice President of the Company in April 1967. During the past five years he has been the senior operating officer of the Industrial Group.

Mr. Kiamie was elected a Vice President of the Company in August 1967. Prior to April 1984 he was the principal accounting officer of the Company.

Mr. Kreipke was elected a Vice President of the Company in June 1981. Prior to November 1985 he was the senior operating officer of the Engineering and Construction Group.

Mr. Lyons was elected a Vice President of the Company in September 1982. Effective with his election, he was placed in charge of the Power Systems Group. Prior to assuming his present position, he was Vice President of Operations for the Power Systems Group and, prior to that, Vice President of Fossil Power Systems.

Mr. Mangold was elected a Vice President of the Company in January 1982. Effective March 1, 1984 he was placed in charge of the Oil and Gas Group. Prior to that, he had been a senior operating officer of the Process Equipment Group.

Mr. Masson was elected a Vice President of the Company in November 1980. Prior to joining the Company, he was Vice President and Treasurer of PepsiCo, Inc.

Mr. Mecum was elected a Vice President and Director in April 1985. Effective with his election he was placed in charge of the Urban Systems and Services business of the Company. In November 1985 he was also placed in charge of the Engineering and Construction Group. Prior to joining the Company he was managing partner of the New York office of Peat, Marwick, Mitchell and Co. and a member of the firm's operating committee.

Mr. Peterson was elected a Vice President of the Company in September 1980 and is responsible for directing corporate-level programs in the overall strategic planning and business development areas of the Company. Before assuming his present position, he was Corporate Staff Vice President of Marketing.

Mr. Rubin was elected a Vice President of the Company in May 1984. Prior to joining the Company he was associated with Atlantic Richfield Company, most recently as Vice President Planning & Control, ARCO Metals Company.

Mr. Smith was elected a Vice President of the Company in November 1985. Prior to 1985 he was Vice President of Operational Management of Vetco Offshore, Inc., a subsidiary of the Company. Prior to joining the Company, he held several executive positions in county government in Ventura, California.

Dr. Yon was elected a Vice President of the Company in April 1985. Dr. Yon joined C-E in January 1984 and was placed in charge of the Engineered Systems and Controls Group. Prior to joining C-E he was a consultant with Booz, Allen & Hamilton most recently as Vice President and lead partner serving high technology industries.

PART IV

ITEM 14. EXHIBITS AND FINANCIAL STATEMENT SCHEDULES

(a) Documents:

NOTES:

(a) Financial statements for unconsolidated subsidiaries and 50% owned companies have been omitted as not being required since considered in the aggregate as a single subsidiary, they would not constitute a significant subsidiary.

(b) References to the Annual Report shall be deemed to refer to the Annual Report to Shareholders for the year ended December 31, 1985.

Schedules I, II, III, IV, IX, X, XI, XII and XIII are not submitted because they are not applicable or not required.

3. Exhibits—

(3) Restated Certificate of Incorporation of Combustion Engineering, Inc.—Note (a)
By-Laws of Combustion Engineering, Inc.—Note (b)
(10) 1982 Stock Option Plan of Combustion Engineering, Inc.—Note (c)
Amended Incentive Compensation Plan, as amended November 21, 1985
Deferred Compensation Plan for Non-Employee Directors, as amended November 21, 1985
Deferred Compensation Plan
Key Employee Retention and Severance Benefit Plan and Form of Agreement—Note (d)
Executive Retirement and Life Insurance Plan, as amended November 21, 1985, and Form of Life Insurance Agreement
Supplemental Retirement Benefit Agreement with Charles E. Hugel—Note (d)
Supplemental Benefit Plan for Salaried Employees—Note (e)
Agreement with Arthur J. Santry, Jr.—Note (g)
Consulting Agreement with Robert C. Seamans, Jr.—Note (f)
(11) Computation of Net Income Per Share
(13) Annual Report to Shareholders for the year ended December 31, 1985
(22) Subsidiaries of the Registrant
(24) Consent of Experts
(25) Powers of Attorney

NOTES:

(a) Incorporated by reference to Form 10-Q for the second quarter of 1983
(b) Incorporated by reference to Form 10-Q for the second quarter of 1985
(c) Incorporated by reference to Proxy Statement for Annual Meeting on April 27, 1982
(d) Incorporated by reference to Form 10-K Report for 1982
(e) Incorporated by reference to Form 10-K Report for 1983
(f) Incorporated by reference to Form 10-K Report for 1980 and 1981
(g) Incorporated by reference to Form 10-K Report for 1984

Report of Independent Public Accountants on Schedules

To the Board of Directors and Shareholders of Combustion Engineering, Inc.:

In connection with our examinations of the financial statements included in the Combustion Engineering, Inc. Annual Report to Shareholders and incorporated by reference in this Form 10-K, we have also examined the supplemental schedules listed in Item 14(a)2. Our examinations of the financial statements were made for the purpose of forming an opinion on those statements taken as a whole. The supplemental schedules are presented for purposes of complying with the Securities and Exchange Commission's rules and are not part of the basic financial statements. The supplemental schedules have been subjected to the auditing procedures applied in the examinations of the basic financial statements and, in our opinion, fairly state in all material respects the financial data required to be set forth therein in relation to the basic financial statements taken as a whole.

Arthur Andersen & Co.

Stamford, Connecticut
February 14, 1986

COMBUSTION ENGINEERING, INC. AND SUBSIDIARY COMPANIES

PROPERTY, PLANT AND EQUIPMENT

YEARS ENDED DECEMBER 31, 1983, 1984 AND 1985

(Dollars in Thousands)

Column A	Column B	Column C		Column D	Column E	Column F
		Additions at Cost[3]				
Classification	Balance at Beginning of Period	Beginning Balance of Acquired Companies[1]	Other	Retirements[4]	Other Changes Add (Deduct)	Balance at End of Period
Year Ended December 31, 1983:						
Land and land improvements	$ 49,305	$ 3,325	$ 1,402	$ 3,222	($ 150)	$ 50,660
Clay and other mineral deposits	34,377	—	3,514	—	—	37,891
Buildings	206,687	8,834	6,380	5,331	(743)	215,827
Machinery and equipment	608,533	22,836	35,504	23,720	(8,968)	634,185
Construction in progress	27,534	672	2,540[2]	—	(51)	30,695
	$ 926,436	$ 35,667	$ 49,340	$ 32,273	($ 9,912)[5]	$ 969,258
Year Ended December 31, 1984:						
Land and land improvements	$ 50,660	$ 1,108	$ 571	$ 7,652	($ 235)	$ 44,452
Clay and other mineral deposits	37,891	—	—	1,097	—	36,794
Buildings	215,827	8,916	2,943	17,905	(1,976)	207,805
Machinery and equipment	634,185	44,054	51,739	59,731	(2,713)	667,534
Construction in progress	30,695	935	(996)[2]	4	(9)	30,621
	$ 969,258	$ 55,013	$ 54,257	$ 86,389	($ 4,933)[5]	$ 987,206
Year Ended December 31, 1985:						
Land and land improvements	$ 44,452	$ 336	$ 1,271	$ 3,917	$ 35	$ 42,177
Clay and other mineral deposits	36,794	—	66	2,934	226	34,152
Buildings	207,805	2,249	6,307	14,234	1,986	204,113
Machinery and equipment	667,534	2,168	58,202	28,911	237	699,230
Construction in progress	30,621	—	11,960[2]	—	(4)	42,577
	$ 987,206	$ 4,753	$ 77,806	$ 49,996	$ 2,480[5]	$1,022,249

NOTES:

[1] Includes $33,110 with respect to Taylor Instrument Company in 1983 and $39,232 and $9,150 with respect to Jamesbury Corp. and Impell Corporation, respectively, in 1984.

[2] Net of transfers to completed property, plant and equipment.

[3] Reference is made to Note 1(g) of the Notes to Financial Statements on page 40 of the "Financial Section" of the Annual Report.

[4] Includes $15,688 in 1983 relating to the sale of building products manufacturing and distribution facilities.

[5] Balance at the beginning of 1983 has been restated for translation adjustments resulting from the adoption of FAS 52. The amounts shown in Column E above represent translation adjustments applicable to the years 1983, 1984 and 1985. Reference is made to Note 1(f) of the Notes to Financial Statements on page 39 of the "Financial Section" of the Annual Report.

SCHEDULE VI

COMBUSTION ENGINEERING, INC. AND SUBSIDIARY COMPANIES
ACCUMULATED DEPRECIATION, DEPLETION AND AMORTIZATION OF PROPERTY, PLANT AND EQUIPMENT
YEARS ENDED DECEMBER 31, 1983, 1984 AND 1985

(Dollars in Thousands)

Column A	Column B	Column C		Column D	Column E	Column F
		Additions				
Classification	Balance at Beginning of Period	Beginning Balance of Acquired Companies	Charged to Costs and Expenses	Retirements[2]	Other Changes Add (Deduct)	Balance at End of Period
Year Ended December 31, 1983:						
Land improvements	$ 6,335	$ —	$ 1,714	$ 48	$ 7	$ 8,008
Clay and other mineral deposits	2,277	—	3,272	—	—	5,549
Buildings	94,414	—	15,471	1,928	1	107,958
Machinery and equipment	348,271	—	55,616	15,282	(4,461)	384,144
	$451,297	$ —	$ 76,073[1]	$ 17,258	($ 4,453)[3]	$505,659
Year Ended December 31, 1984:						
Land improvements	$ 8,008	$ —	$ 1,369	$ 562	($ 12)	$ 8,803
Clay and other mineral deposits	5,549	—	365	453	—	5,461
Buildings	107,958	—	3,806	4,702	(296)	106,766
Machinery and equipment	384,144	—	45,136	36,487	(1,512)	391,281
	$505,659	$ —	$ 50,676	$ 42,204	($ 1,820)[3]	$512,311
Year Ended December 31, 1985:						
Land improvements	$ 8,803	$ —	$ 558	$ 492	($ 12)	$ 8,857
Clay and other mineral deposits	5,461	—	456	489	—	5,428
Buildings	106,766	—	1,522	9,065	(26)	99,197
Machinery and equipment	391,281	—	72,293	38,475	(116)	424,983
	$512,311	$ —	$ 74,829[1]	$ 48,521	($ 154)[3]	$538,465

NOTES:

[1] Includes $20,565 and $12,300 representing adjustments to certain fixed assets in connection with the provisions for adjustments to facilities and operations in 1983 and 1985, respectively. Reference is made to Note 3 of the Notes to Financial Statements on page 42 of the "Financial Section" of the Annual Report.

[2] Includes $5,996 in 1983 relating to the sale of building products manufacturing and distribution facilities.

[3] Balance at beginning of period has been restated for translation adjustments resulting from the adoption of FAS 52. The amount shown in Column E above represents translation adjustments applicable to the years 1983, 1984 and 1985. Reference is made to Note 1(f) of the Notes to Financial Statements on page 39 of the "Financial Section" of the Annual Report.

SCHEDULE VII

COMBUSTION ENGINEERING, INC. AND SUBSIDIARY COMPANIES

GUARANTEES OF SECURITIES OF OTHER ISSUERS

DECEMBER 31, 1985

(Dollars in Thousands)

Column A	Column B	Column C	Column D	Column E	Column F	Column G
Name of Issuer of Securities Guaranteed by Person for Which Statement is Filed	Title of Issue of Each Class of Securities Guaranteed	Total Amount Guaranteed and Outstanding	Amount Owned by Person or Persons for Which Statement is Filed	Amount in Treasury of Issuer of Securities Guaranteed	Nature of Guarantee	Nature of Any Default by Issuer of Securities Guaranteed in Principal, Interest, Sinking Fund or Redemption Provisions, or Payment of Dividends
Lummus Crest Inc./ Salzgitter Lummus G.m.b.H. Joint Venture	Overdraft Facility	$ 2,001	$ —	$ —	(1)	None
Jamesbury Corp./ OyM S.A.	Bank Note	927	—	—	(1)	None
Jamesbury Corp./ Hammel Dahl, Inc.	Note	1,000	—	—	(1)	None
		$ 3,928	$ —	$ —		

NOTE:

(1) Guarantee of principal and interest.

COMBUSTION ENGINEERING, INC. AND SUBSIDIARY COMPANIES
VALUATION AND QUALIFYING ACCOUNTS AND RESERVES
YEARS ENDED DECEMBER 31, 1983, 1984 AND 1985

(Dollars in Thousands)

Column A	Column B	Column C			Column D	Column E
		Additions				
Description	Balance at Beginning of Period	Beginning Balance of Acquired Companies[1]	Charged to Costs and Expenses	Charged to Other Accounts	Deductions	Balance at End of Period
Year Ended December 31, 1983:						
Reserves Deducted In The Balance Sheet From The Asset To Which They Apply:						
Reserve for doubtful accounts and allowances	$11,738	$ 740	$ 6,230	$ —	$ 2,854[2]	$15,854
Reserves Included In Current Liabilities:						
Reserve for warranty[5]	$36,009	$ 845	$ 7,109	$ —	$ 4,379[3]	$39,584
Reserve for supplementary pension plan	2,405	—	813	—	260[4]	2,958
	$38,414	$ 845	$ 7,922	$ —	$ 4,639	$42,542
Year Ended December 31, 1984:						
Reserves Deducted In The Balance Sheet From The Asset To Which They Apply:						
Reserve for doubtful accounts and allowances	$15,854	$ 222	$ 3,081	$ —	$ 4,114[2]	$15,043
Reserves Included In Current Liabilities:						
Reserve for warranty[5]	$39,584	$ —	$ 3,898	$ —	$ 4,978[3]	$38,504
Reserve for supplementary pension plan	2,958	—	520	—	101[4]	3,377
	$42,542	$ —	$ 4,418	$ —	$ 5,079	$41,881

Schedule VIII continued on following page.

COMBUSTION ENGINEERING, INC. AND SUBSIDIARY COMPANIES
VALUATION AND QUALIFYING ACCOUNTS AND RESERVES
YEARS ENDED DECEMBER 31, 1983, 1984 AND 1985

(Dollars in Thousands)

Column A	Column B	Column C			Column D	Column E
		Additions				
Description	Balance at Beginning of Period	Beginning Balance of Acquired Companies[1]	Charged to Costs and Expenses	Charged to Other Accounts	Deductions	Balance at End of Period
Year Ended December 31, 1985:						
Reserves Deducted In The Balance Sheet From The Asset To Which They Apply:						
Reserve for doubtful accounts and allowances	$15,043	$ —	$ 3,443	$ —	$ 1,895[2]	$16,591
Reserves Included In Current Liabilities:						
Reserve for warranty[5]	$38,504	$ —	$18,042	$ —	$ 9,427[3]	$47,119
Reserve for supplementary pension plan	3,377	—	750	—	351[4]	3,776
	$41,881	$ —	$18,792	$ —	$ 9,778	$50,895

NOTES:

[1] Represents reserve accounts of acquired companies.

[2] Represents uncollectible receivables.

[3] Represents additional costs incurred and adjustments.

[4] Represents supplemental pension payments.

[5] See comment in Item 1(b) on page 2 with respect to cost estimates for long-term contracts and provisions for future warranty costs.

SIGNATURES

Pursuant to the requirements of Section 13 or 15(d) of the Securities Exchange Act of 1934, the registrant has duly caused this report to be signed on its behalf by the undersigned, thereunto duly authorized.

COMBUSTION ENGINEERING, INC.

By Charles E. Hugel
President and Chief Executive Officer, Director

By George S. Kimmel
Executive Vice President and Chief Financial Officer, Director

By Jeffrey S. Rubin
Vice President and Controller

Pursuant to the requirements of the Securities Exchange Act of 1934, this report has been signed below by the following persons on behalf of the registrant and in the capacities and on the date indicated.

By Arthur J. Santry, Jr.
Chairman of the Board

By Dudley C. Mecum
Director

By Harry J. Bolwell*
Director

By Scott L. Probasco, Jr.*
Director

By Thomas A. Ennis*
Director

By Robert C. Seamans, Jr.*
Director

By Walter H. Helmerich, III*
Director

By Robert G. Stone, Jr.*
Director

By Robert M. Jenney*
Director

By Kenneth J. Whalen*
Director

By _____
Paul W. MacAvoy
Director

*Pursuant to Power of Attorney

Dated: March 27, 1986