SAFETY EVALUATION REPORT

BY THE

DIVISION OF INDUSTRIAL AND MEDICAL NUCLEAR SAFETY

RELATED TO THE RENEWAL OF

SPECIAL NUCLEAR MATERIAL LICENSE SNM-1168

FOR THE

B&W FUEL COMPANY

COMMERCIAL NUCLEAR FUEL PLANT

LYNCHBURG, VIRGINIA

DOCKET 70-1201

SEPTEMBER 1990

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

SEP 24 1990

I. INTRODUCTION

A. General

The primary activity of the B&W Fuel Company's (BWFC) Commercial Nuclear Fuel Plant (CNFP) at Lynchburg, Virginia, under special nuclear material license, is the fabrication of nuclear reactor fuel. In addition, BWFC stores and maintains reactor field service operation equipment which is used for failed fuel rod detection, fuel assembly spring repair, fuel reconstitution, and fuel consolidation. The field service operations at reactors are not authorized by this license.

The license was scheduled to expire on May 31, 1988. BWFC submitted a timely renewal application on April 11, 1988, and accordingly, the license has been in a timely renewal status since May 31, 1988.

B. Location Description

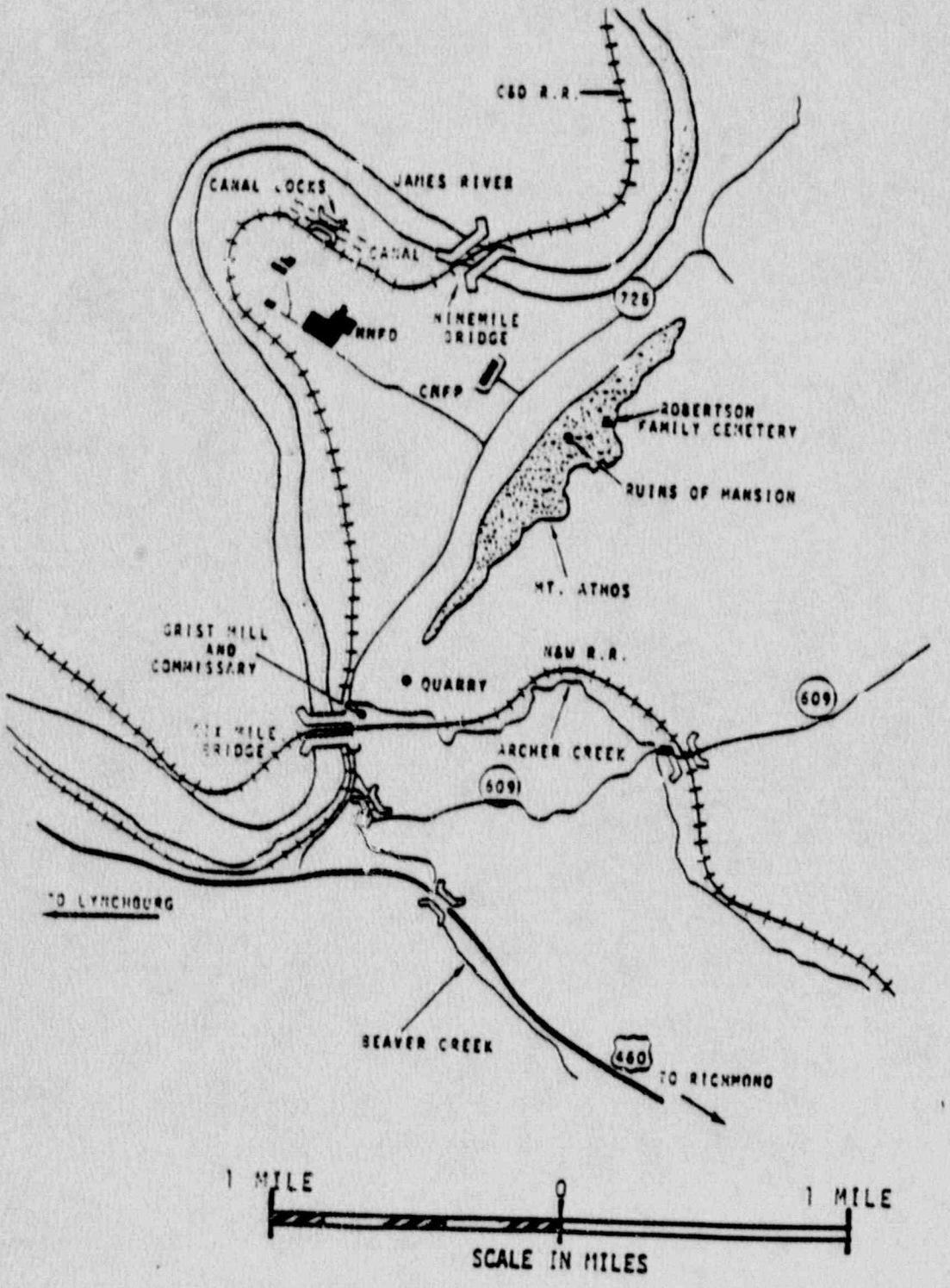
The CNFP site is located on a 76-acre tract in Campbell County, Virginia, approximately 4 miles from Lynchburg. The site is adjacent to the Babcock and Wilcox Naval Nuclear Fuel Division (NNFD) and the NNFD-Research Laboratory. The CNFP site lies on a river bend bounded on three sides by the James River. Figure 1 shows the geographic location of the site.

C. License History

Initial operations at the CNFP site with enriched uranium were authorized in December 1969, by the AEC License SNM-1168. The NRC renewed the license in April 1976 and again in June 1983. On April 11, 1988, BWFC submitted an application for renewal of SNM-1168. During a site visit on March 6 and 7, 1989, the NRC staff requested that additional information be provided concerning the April 11, 1988, submittal. BWFC responded by submitting a revised application on June 21, 1989. On June 18, 1990, the NRC staff again visited the CNFP site to discuss BWFC's June 21, 1989, submittal. In response to staff's comments, BWFC transmitted a draft application to NRC by letter dated June 21, 1990. As a result of a telephone conversation with a BWFC representative regarding the draft application, BWFC submitted by letter dated June 22, 1990, a revised application which superseded, in its entirety, the previous submittal.

The current authorized possession limits are 25,000 kilograms of U-235 at enrichments up to 4.1 percent, 5,000 kilograms of U-235 enriched to 5 percent as uranium hexafluoride, 930,000 kilograms of natural or depleted uranium as uranium oxide in powder or pellet form, 3,000,000 pounds of natural uranium as uranium hexafluoride, 51 curies of encapsulated byproduct material contained in sealed sources, 6 grams of encapsulated plutonium in sealed sources, 3 milligrams of Californium-252 in sealed sources, 100 grams of U-235 in any form, 20 curies of byproduct material as contamination on/within equipment and/or as waste, and 5 curies of Americium-241 in sealed sources. All of the uranium hexafluoride is possessed for storage only.

FIGURE 1


C&O R.R.
CANAL LOCKS
JAMES RIVER
CANAL
NINEMILE BRIDGE
726
NNPD
CNPP
ROBERTSON FAMILY CEMETERY
RUINS OF MANSION
MT. ATHOS
GRIST MILL AND COMMISSARY
N&W R.R.
QUARRY
609
SIX MILE BRIDGE
ARCHER CREEK
609
TO LYNCHBURG
BEAVER CREEK
460
TO RICHMOND
1 MILE
0
1 MILE
SCALE IN MILES

II. LICENSE APPLICATION

A. Review History

The safety review of the BWFC renewal application includes the revised application dated June 22, 1990; two site visits on March 6, 1989, and June 18, 1990; discussions with the Region II inspection staff; and meetings on April 11, 1988, and June 21, 1989, with the BWFC staff.

B. Compliance History

The Region II staff conducted 28 inspections of health and safety activities. These reports were reviewed and covered the period from October 1983 to June 1990. Nine (9) violations were reported; none of the violations were reported as Severity I, II, or III. Severity levels are defined in 10 CFR 2.

C. Current Application

The NRC staff reviewed the licensee's commitments concerning organization and administration of the safety program for radiation protection and nuclear criticality safety. These proposed commitments and special authorizations are in Part I, Chapters 1-8, of the renewal application. The staff also reviewed the safety demonstration portion in Part II, Chapters 9-16, of the renewal application.

The following sections contain a description of the principal aspects of the organization and safety programs.

III. POSSESSION LIMITS (PROPOSED)

The licensee has requested the following materials, forms, and quantities of licensed material:

	Material	Form	Maximum Quantity
A.	Uranium enriched up to 4.1 w/o U-235	A. Uranium oxide, pellet, or powder	A. 25,000 kilograms of U-235
B.	Uranium enriched up to 5.0 w/o U-235	B. UF_6	B. 5,000 kilograms of U-235
C.	Uranium, natural or depleted	C. Oxide, pellet or powder	C. 1,000,000 kilograms of uranium
D.	Uranium, natural	D. UF_6	D. 1,400,000 kilograms of uranium

E.	Byproduct material	E. Sealed sources	E. 51 curies with atomic numbers 3 to 83, inclusive
F.	Plutonium	F. Sealed sources	F. 6 grams plutonium
G.	Californium-252	G. Sealed sources	G. 3 milligrams of Californium-252
H.	Uranium enriched in U-235	H. Any	H. 100 grams of U-235
I.	Americium-241	I. Sealed sources	I. 5 curies Americium-241
J.	Byproduct material and Plutonium	J. Contamination or waste associated with the equipment used in field service operations	J. 20 curies, total

IV. AUTHORIZED ACTIVITIES (PROPOSED)

A. General Summary

The general activities being assessed in this safety review include:

1. The fabrication of light water reactor fuel from uranium oxide pellets.

2. The storage, maintenance, and decontamination of field operation equipment.

3. Support activities which include process development, laboratory operations, and waste disposal.

4. Storage of enriched, natural, and depleted uranium compounds.

B. Process Description

The proposed process activities being assessed in the safety review include:

1. Cladding of UO_2 pellets and assembly of fuel rods into fuel assemblies.

2. Treatment of various solid, liquid, and airborne waste streams for disposal.

3. Laboratory operations.

4. Field Operations Department activities involving equipment, processes, and areas contaminated with byproduct materials.

5. Process and product development activities.

To authorize these activities, the staff proposes the following license condition:

> Authorized use: For use in accordance with statements, representations, and conditions of Part I of the licensee's application dated June 22, 1990.

V. FACILITIES

The locations of the facilities at the CNFP site are shown in Figure 2. The primary facilities and associated activities are:

CNFP Main Building - Receipt of UO_2 pellets and manufacture of fuel assemblies.

Liquid Rad Waste Retention Facility - Sampling and analysis of potentially contaminated liquids before release to the James River.

UF_6 Storage Area - Storage of UF_6 in shipping containers.

Uranium Oxide Storage Building - Storage of natural and depleted uranium oxides in 55-gallon drums.

ECHO 330 Building - Storage and maintenance of field service operations equipment.

To authorize these facilities, the staff proposes the following license condition:

> Authorized place of use: The licensee's existing facilities at Lynchburg, Virginia.

VI. ORGANIZATION AND ADMINISTRATIVE PROCEDURES

A. Organization, Personnel Responsibilities and Minimum Qualifications

The BWFC is a partnership of B&W Fuel, Inc., and Virginia Fuels, Inc. Both of the partners and the resultant partnership are organized and exist under the laws of Delaware. The organizational structure is shown in Figure 3.

According to the revised application, the Plant Manager has ultimate responsibility for ensuring that all company activities are conducted safely and in compliance with license conditions. This responsibility is administered through the BWFC professional staff. The licensee has proposed that the Plant Manager have, as a minimum, a bachelor's degree in science or engineering, 10 years of experience in the nuclear industry, and years' experience in management positions.

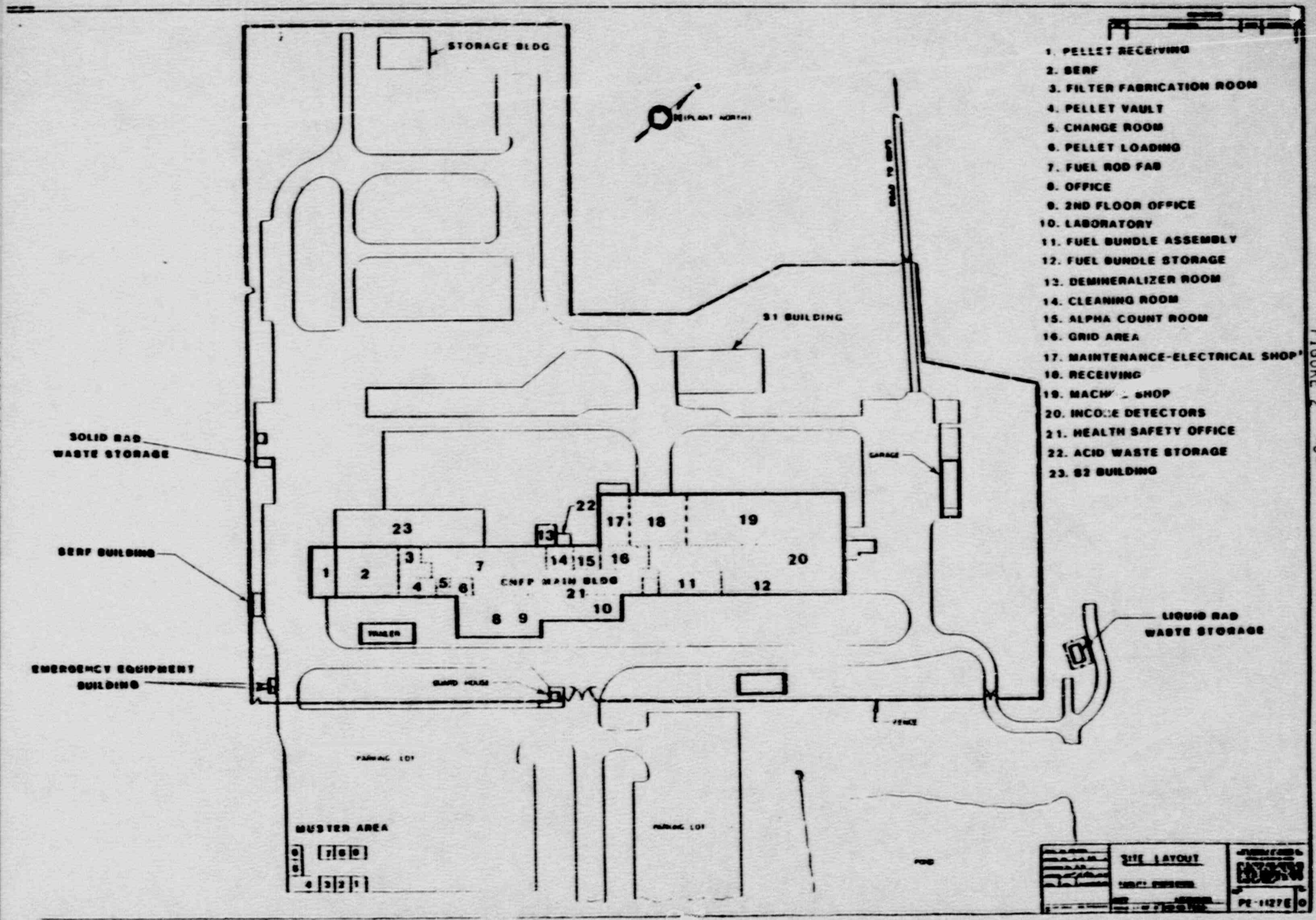
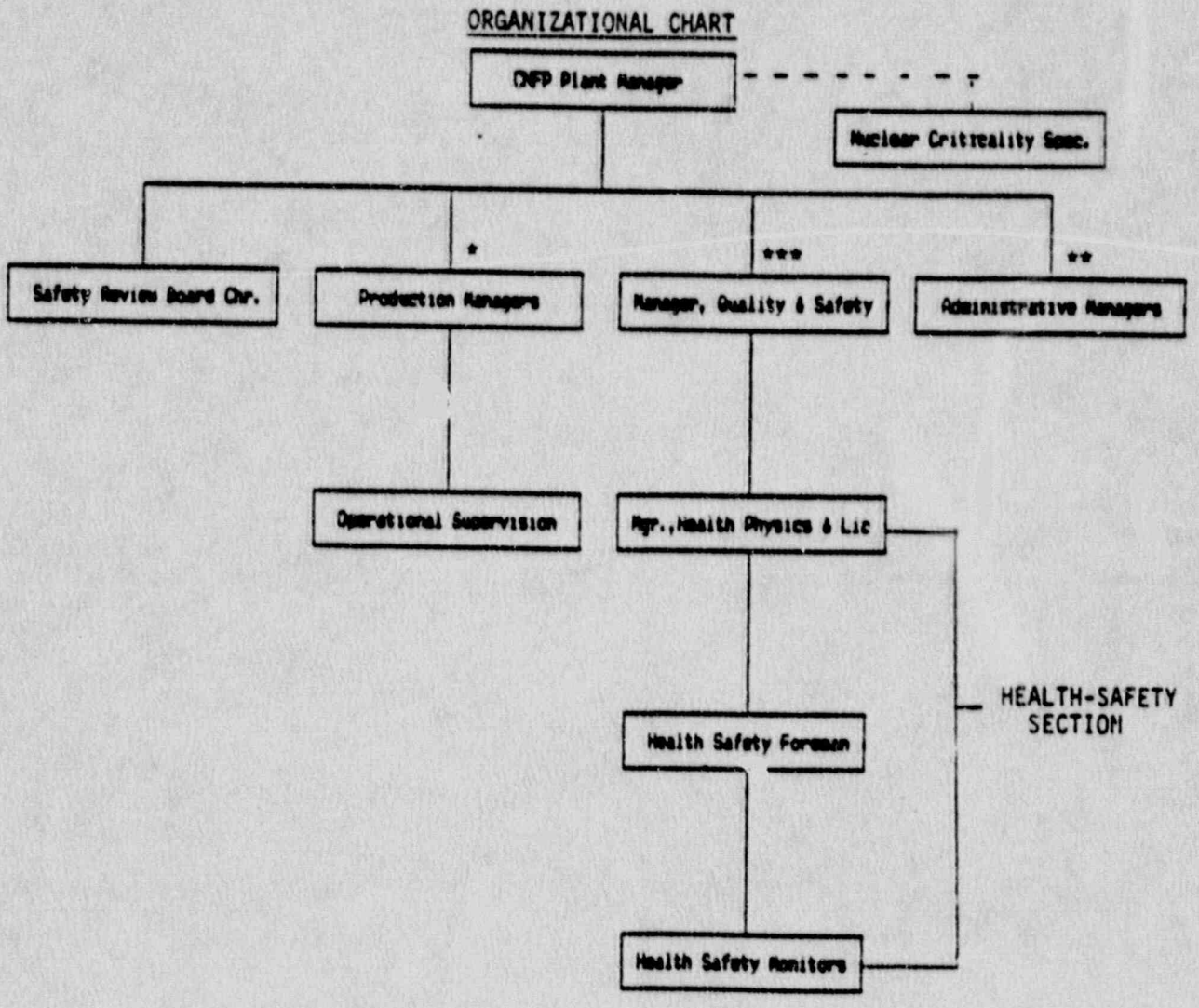

STORAGE BLDG
PLANT NORTH
ROAD TO GATE
S1 BUILDING
SOLID RAD WASTE STORAGE
SERF BUILDING
EMERGENCY EQUIPMENT BUILDING
GARAGE
CNFP MAIN BLDG
TRAILER
GUARD HOUSE
FENCE
PARKING LOT
PARKING LOT
POND
LIQUID RAD WASTE STORAGE
MUSTER AREA
1. PELLET RECEIVING
2. SERF
3. FILTER FABRICATION ROOM
4. PELLET VAULT
5. CHANGE ROOM
6. PELLET LOADING
7. FUEL ROD FAB
8. OFFICE
9. 2ND FLOOR OFFICE
10. LABORATORY
11. FUEL BUNDLE ASSEMBLY
12. FUEL BUNDLE STORAGE
13. DEMINERALIZER ROOM
14. CLEANING ROOM
15. ALPHA COUNT ROOM
16. GRID AREA
17. MAINTENANCE-ELECTRICAL SHOP
18. RECEIVING
19. MACHINE SHOP
20. INCORE DETECTORS
21. HEALTH SAFETY OFFICE
22. ACID WASTE STORAGE
23. S2 BUILDING
SITE LAYOUT
PE-1427E

FIGURE 2 -6-

FIGURE 3



*(e.g., Manufacturing Engineering, Fuel Operations, Field Operations)
**(e.g., Accounting, Personnel, Purchasing, Information Services)
***(not directly responsible for production functions)

Production Managers report directly to the Plant Manager and are responsible for managing the operational supervisors and production function. Each Production Manager shall have, as a minimum, a bachelor's degree in science or engineering, followed by 2 years' experience in the nuclear industry.

The Manager, Quality and Safety, reports to the Plant Manager and is responsible for providing management with the assurance of the effectiveness of the safety program. This responsibility is administered through the Health and Safety Section by maintaining an audit program that includes periodic inspections of controls and operations, reports to management, followup of nonconforming conditions, and necessary documentation. The licensee has proposed that the Manager, Quality and Safety, have, as a minimum, a bachelor's degree with 5 years' experience which would develop an understanding of nuclear and radiation safety.

The Health and Safety Section consists of a Health Physicist, who reports to the Manager, Quality and Safety; a Health Safety Foreman; and Health Safety Monitors.

The Health Physicist (HP) is responsible for providing management with assurance of the effectiveness of the health and safety program. The licensee proposes that the Health Physicist will have, as a minimum, a bachelor's degree in science or engineering with 2 years' experience in applied health physics and sufficient formal training that provides an understanding of health physics and nuclear safety hazards.

The Health Safety Foreman, who reports to the HP, is responsible for supervising the activities of the Health Safety Monitors and assuring that the requirements of the health and safety program, as defined by the license and safety procedures, are carried out. The Health Safety Foreman will have, as a minimum, a high school diploma and 3 years of experience in radiation safety.

The Health Safety Monitors, who report to the Health Safety Foreman, are responsible for conducting routine monitoring, sample collection, and analytical tests to determine radiation and contamination levels. The Health Safety Monitors shall have, as a minimum, a high school diploma or GED equivalent with 6 months of experience as a Health Safety Monitor.

Operational Area Supervisors report to a Production Manager and are responsible for control of materials, personnel, equipment, and activities in their cognizant areas. These responsibilities include assuring that approved written procedures are available and followed. The Operational Area Supervisors will have, as a minimum, a high school diploma and 2 years of experience in the nuclear industry. This experience will include the practical application of safety control techniques applicable to the CNFP operations.

The Nuclear Criticality Safety Specialist is in a separate component within the corporate structure and therefore independent of the BWFC. The Nuclear Criticality Specialist is responsible for evaluating the nuclear criticality safety limitations imposed at the CNFP. The Nuclear Criticality Safety Specialist will have, as a minimum, a bachelor's degree in science or engineering with either 2 years' experience in nuclear reactor physics and 1 year experience in nuclear criticality safety analysis or 2 years' experience performing nuclear criticality safety analyses. BWFC has stated that all nuclear criticality safety evaluations are independently reviewed and approved by an individual having, as a minimum, 2 years' of experience as a Nuclear Criticality Safety Specialist.

The licensee has a Safety Review Board (SRB) which meets quarterly to review safety-related operations and to provide SRB actions in writing to the Plant Manager. This includes review of new or revised facilities, analysis of equipment and processes involving hazardous materials, fire safety, continuing effectiveness of established controls and safeguards, maintenance of ALARA criteria, safety-related audit and inspection findings, and other items such as abnormal occurrences. In addition, the SRB will evaluate the effectiveness of the radiation/nuclear safety training program at least every 2 years.

The SRB is composed of BWFC Production Managers; the Manager, Quality and Safety; and others as deemed necessary by the Chairman as well as outside technical consultants as necessary. The SRB Chairman shall decide whether or not the necessary disciplines are present during a board meeting. The licensee has provided minimum qualifications for the SRB Chairman which include a bachelor's degree in science or engineering and 5 years of experience in nuclear safety.

The staff has reviewed the position qualifications for the licensee's management and safety organization. The staff finds that the minimum qualifications are adequate for the proposed activities.

The licensee has provided resumes for individuals assigned to the positions important to safety. The staff has reviewed these resumes and concludes that, except for the Plant Manager, the licensee has demonstrated that it has individuals who meet the minimum qualifications. The individual assigned to the position of Plant Manager has been the Plant Manager since 1981, and had 7 years of prior experience as the plant's manufacturing manager. The staff finds that the experience of the incumbent is adequate in lieu of a bachelor's degree. This is discussed further in Section XIII.

B. Administrative Practices

The licensee has made the commitment that operating procedures will be prepared by the responsible function. Operating procedures where nuclear and radiological safety are involved will include specific reference to applicable safety requirements. Before initial issuance or revision, specific approval is required by the Manager, Quality and Safety, and the appropriate Production Manager.

New operations and major operational changes will require the written recommendation of the SRB Chairman prior to implementation. In addition, the licensee has committed to a review of the safety-related operating procedures at least every 2 years by the appropriate Production Manager and Manager, Quality and Safety.

Health and safety operating procedures will be developed by and for the Health and Safety Section function. The procedures will specify the method by which safety-related activities are to be accomplished and will be reviewed at least annually for technical corrections and applicability.

C. Inspections and Audits

An internal health and safety inspection program will be maintained to provide assurance that plant activities are conducted safely and in accord with license specifications. The Manager, Quality and Safety, will be responsible for the inspection program. As part of routine daily activities, health and safety personnel will conduct informal inspections of plant activities. Any adverse findings will be formally documented Health and safety personnel will also conduct formal monthly inspections of plant activities. The inspection results will be documented and distributed to plant management and supervision.

At least semiannually, individuals meeting the minimum qualifications of the Health Physicist and Nuclear Criticality Safety Specialist will conduct audits of radiation protection and nuclear criticality safety practices, respectively. These audits will be conducted in accordance with written instructions or procedures. A report documenting audit results will be prepared and distributed to the Plant Manager and the Manager, Quality and Safety. Actions taken as a result of audit findings will be documented.

D. Training

Initial indoctrination of employees to nuclear and radiological safety is the responsibility of the Health and Safety Section and will conform with 10 CFR 19. Initial training will include topics such as license conditions; federal regulations; operating and emergency procedures; and radiation, nuclear criticality, and chemical safety. This training will be further supplemented by on-the-job training which is required to be satisfactorily completed prior to the employee operating independently. Refresher training is provided to the radiation workers on an annual basis and will include radiation and nuclear safety.

VII. RADIATION PROTECTION

A. Administrative Requirements

The Health and Safety Section is responsible for establishing and maintaining a radiation safety program to ensure the protection of the workers and the public.

The specific responsibilities of the Health and Safety Section include:

1. Developing safe operational guidelines,

2. Reviewing and approving operating procedures to assure safe operations and license compliance,

3. Providing radiation monitoring facilities and collecting data relative to the radiation exposure of employees,

4. Maintaining a training program, and

5. Conducting routine safety inspections of plant activities.

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

For a proposed operation which is not covered by an operating procedure and for which the concentration of radioactive contamination is likely to exceed regulatory limits, the Health Physicist will issue an RWP containing all safety requirements for the operation. An RWP previously approved may be reissued and approved by the Health Safety Foreman. The RWP will be reviewed at least monthly to ensure the operation is conducted in a safe manner.

BWFC management has made a commitment to maintain radiation exposures of employees and radioactive contamination in effluents as low as reasonably achievable (ALARA). The SRB will, on a quarterly basis, review the maintenance of ALARA criteria with respect to the airborne concentration of radioactivity and surface contamination levels generated from operations. In addition, an annual ALARA report which includes the employees' exposures and effluent data shall be prepared under the direction of the Manager, Quality and Safety. The report will be submitted for review to the SRB to determine: (1) if there are any upward trends developing in personnel exposures (internal and external) for identifiable categories of workers, types of operation, or effluent releases; (2) if exposures and releases might be lowered in accordance with the ALARA concept; and (3) if equipment for effluent and exposure controls has been properly used, maintained, and inspected. A copy of the annual ALARA report and the results of the SRB review and recommendations will be sent to the Plant Manager.

B. Systems for Exposure Control

External exposures to BWFC personnel are controlled in accordance with the requirements of 10 CFR Part 20.202. TLD dosimeters are processed and analyzed on a monthly or quarterly basis. The external exposure data reported for the period 1986 through 1989 shows that more than 99 percent of the quarterly exposures for individuals are less than 20 percent of the allowable limit. No exposure approached the 1.25 rem per quarter limit. The staff finds that the licensee's external exposure control program is satisfactory.

Radioactive material may enter the body by breathing contaminated air or by ingestion as a consequence of poor hygiene or inadequate self-monitoring. BWFC has committed to the protection of the operating personnel from excessive internal exposure by:

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

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

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

4. Protective clothing to minimize direct contact with radioactive material.

5. Respiratory protective equipment to limit the inhalation of airborne radioactive material.

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

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

The ventilation system for the uranium process area is designed and operated to move air from uncontaminated areas to contaminated areas. The exhaust air from process operations is filtered through HEPA filters and continuously sampled for radioactivity prior to release through the stacks. At BWFC, at least one filter housing or bank in each system will be equipped with a device for monitoring the pressure differential across the filter. The pressure differential is checked on a weekly basis. BWFC replaces the HEPA filter when the pressure drop across the filter exceeds 4 inches of water. Upon installation or following major maintenance, the filtration efficiency will be evaluated in accordance with Regulatory Guide 3.2, "Efficiency Testing of Air-Cleaning System Containing Devices for Removal of Particles." The ventilation system also maintains the minimal face velocity of the ventilated hood at 100 LFM. The flow rate will be checked on a weekly basis.

Recirculated room air, which is prefiltered prior to reentering the controlled areas, is sampled on a continuous basis. Air will not be recirculated if airborne concentration levels exceed 25 percent of MPC as specified in 10 CFR 20, Appendix B.

In the uranium process areas, the airborne concentration of radioactivity will be continuously sampled using fixed air samples. These samples will be changed and analyzed for air concentration for each operational shift. If any sample indicates that the air concentration exceeds the MPC_{air} for restricted areas, the investigation, cause, and corrective action taken will be documented. The locations of the fixed air samplers will be examined for effectiveness (representativeness) on an annual basis or when operations that would effect the contamination levels are modified.

The licensee indicates that in work areas involving beta gamma contamination (Radiation Control Zone), the breathing zone air shall be sampled continuously during operations and analyzed for airborne concentrations of radioactivity after each operational shift. The licensee will conduct an investigation if an individual receives internal exposure more than 2 MPC-hours on a daily basis or 10 MPC-hours in any 7-day period.

Bioassay Program

Internal exposures are evaluated and controlled by a bioassay program which includes excreta and in vivo lung counting, as well as actions for results which exceed preset action levels. For personnel working in the uranium areas, BWFC's bioassay program will be conducted in accordance with Regulatory Guide 8.11, "Application of Bioassay for Uranium." For personnel working in the fission product contamination areas, the other bioassay program will be conducted in accordance with provisions similar to those in the "American National Standard for Internal Dosimetry for Mixed Fission and Activation Products," ANSI-N343-1978. This latter program provides for in vivo lung counts at least once per year. Additional bioassays (excreta) will be performed when, in the judgement of the Health and Safety Section, conditions are such that significant internal exposure may have occurred. The program establishes the action levels at 10 percent of the maximum permissible organ burden.

BWFC has a respiratory protection program to limit the worker's intake of radioactive material to below those defined in 10 CFR 20. The program is conducted in accordance with the provisions specified in 10 CFR 20.103.

Data on internal exposures for the period of 1986 through 1989 indicates that all workers' internal exposures have been less than 10 percent of the maximum allowable quarterly limit of 520 MPC-hr. The staff finds that the licensee's internal control program is satisfactory.

Control of Surface Contamination

For the purpose of contamination control, the CNFP is divided into two areas, controlled and uncontrolled. In the controlled area, protective clothing must be worn, and upon exiting the area, individuals must monitor themselves for possible contamination. Each defined area is surveyed for contamination by an instrument which is calibrated twice a year. When the contamination level exceeds the specified action level, cleanup operations will commence no later than at the start of the next shift.

The BWFC specifications used for controlling surface contamination are summarized as follows:

Action Limits for Surface Contamination Control

Area	Action Levels dpm/100cm2		Survey Frequency	
	Alpha area	Beta-gamma area	Alpha area	Beta-gamma area
Controlled	5,000	20,000*	Weekly	Daily
Change area	500	1,000	Daily	Daily
Uncontrolled (clean area)	200	1,000	Monthly	Monthly
Personnel skin	Instrument detecting limit	Instrument detecting limit	Before leaving controlled area	Before leaving controlled area

*When maintenance operations are complete, the level will be kept at 5,000.

BWFC has requested authorization to possess sealed sources which will be leak tested. The licensee's proposed leak testing program meets the requirements established by the IMSB staff for leak testing sealed sources.

C. Effluents Control

Air from the process area will pass through HEPA filters prior to release to unrestricted areas. Gaseous effluents will be representatively sampled on a continuous basis and analyzed for radioactivity on a daily basis. If the exhaust air effluent radioactivity averaged over a quarter exceeds 10 percent

of the limit specified in Table II, 10 CFR 20, Appendix B, the health and safety staff will conduct an investigation and take necessary corrective action.

At BWFC, potentially contaminated liquid effluents will be collected and processed through an evaporator and released as gaseous effluents via the HEPA filtration system. As an alternate disposal method, the contaminated liquid waste may be released to the unrestricted area through the liquid retention tank system. If this route is used, the liquid will be analyzed for radioactivity prior to release.

Low-level radioactive solid waste will be packaged in accordance with applicable regulations and transported to a licensed burial site for disposal. Release of contaminated equipment from the controlled area to an uncontrolled area will be in accordance with the NRC "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material," August 1987.

D. Conclusion

Upon completion of the radiation safety review of the licensee's renewal application, the staff concludes that BWFC has the necessary technical staff to administer an effective radiological safety program. Conformance to BWFC's proposed conditions should ensure a safe operation at the CNFP.

VIII. NUCLEAR CRITICALITY SAFETY

A. Administrative Requirements

The licensee has committed to a philosophy similar to the Double Contingency Principle as defined in ANSI/ANS-8.1 for establishing nuclear criticality safety requirements for all equipment, systems, and operations. The licensee has committed to a Double Contingency Requirement without exception. BWFC has also committed to using favorable geometry whenever practical.

In Section 4.1.2, the licensee has made the commitment that nuclear criticality safety evaluations will be performed by an individual having, as a minimum, the qualifications of a Nuclear Criticality Specialist. These evaluations will be reviewed and approved by an individual who has been a Nuclear Criticality Specialist for at least 2 years.

Prior to the initiation of a new process, the licensee has committed to conduct a pre-operational inspection to confirm that assumed controls are in place. The licensee has stated that a knowledgeable representative of the Health and Safety Section will conduct this inspection. The staff believes that the individual who established the limits and controls for the new operation should conduct the pre-operational inspection. This is to assure that any assumptions made in the analysis are reflected in the proposed limits and controls and are implemented properly. In the revised application, the licensee made the

commitment that prior to initiation of a new or changed process, the individual who performed either the nuclear criticality safety evaluation or the independent review shall participate in the pre-operational inspection.

In addition, the licensee has committed to maintaining nuclear safety postings specifying parameters that are subject to procedural controls.

B. Technical Requirements

Where minimum reflected critical mass, volume, or geometry data is available, BWFC has proposed safety factors for establishing safe individual units. The safety factors range from 2.3 for a safe mass unit to 1.1 for a safe diameter cylinder. The licensee has stated that the safety of multiple units and arrays will be determined by the solid angle method, the surface density method, or by the use of validated analytical methods. In Section 4.2.2, BWFC has proposed maximum k-effective values of 0.87 for normal conditions and 0.95 for abnormal conditions.

For all safety analyses, the licensee will use experimental results or calculations using methods that have been validated. The current computing package that is used by the licensee is the system of computer codes for performing Standardized Computer Analyses for Licensing Evaluations (SCALE) which was developed by Oak Ridge National Laboratory. The analyses will be based on optimum moderation and full reflection except as noted below.

The licensee committed to the use of fixed neutron poisons in the pellet storage vault and moderation control in the fuel assembly processing area. The licensee has committed to the following special controls to assure this moderation control:

1. No sprinkler systems are permitted in the assembly room.

2. A volume restriction limiting the containers in the area to 1 gallon.

3. Double containment of water piping in the area.

4. The use of fire hoses is prohibited unless authorization has been received from a management representative of the plant emergency response organization. Simultaneous application of more than one fire hose is prohibited under all circumstances.

C. Review of Demonstration of Nuclear Criticality Safety Administration

In Chapter 11, the licensee described the facility and equipment change procedure. The operational area supervisor is responsible for initiating these changes. The requested change is documented and submitted to the Safety Review Board Chairman for initial review. Once the Chairman determines that the proposed modification changes the basis on which the safety was originally assessed, a technical evaluation is performed by the cognizant safety group.

The Safety Review Board Chairman reviews the analyses and determines whether Safety Review Board approval is required. Board approval may not be necessary in the case of minor changes where existing safety practices remain the same. However, Board members will be kept appraised of actions taken by the Chairman on minor changes. The changes are reviewed and approved by plant management prior to implementation. Approval and release of plant modifications for routine use is dependent on satisfactory completion of a pre-operational evaluation. This evaluation will consider nuclear, radiological, industrial, and chemical safety as well as license compliance. All analyses, evaluations, pre-operational evaluations, and other pertinent documentation are maintained by the licensee.

In Chapter 14, the licensee described the administrative practices for ensuring criticality safety. The practices include adherence to the Double Contingency Principle, primary reliance on favorable geometry control, the development and use of validated methods for criticality safety analyses, the change method described above, performance of a Criticality Safety Analysis (CSA) for each process, establishment of specifications and procedures to ensure maintenance of assumptions in the CSA and limits derived from the CSA, pre-operational inspections of equipment, training, and audits of operations. Also, the licensee described the basic assumptions contained in the CSA. These include optimum moderation and reflection and the most reactive heterogeneous geometry appropriate to the situation being considered.

The licensee also discussed use of the analytical methods (e.g., solid angle, surface density, and computer methods) and the validation of each method.

D. Review of Demonstration of Process Nuclear Safety

In Chapter 15, the licensee has provided a general description of the process starting with the receipt of UO_2 pellets for the fabrication of fuel assemblies. Each process step description makes reference to the basis for nuclear criticality safety, (e.g., favorable geometry control or k-effective calculations). The basic nuclear criticality control used at the CNFP is that of favorable geometry (i.e., limited slab thickness), combined with separation criteria developed by using the surface density method or computer codes. The licensee has provided very detailed analyses on two of the more complex processes in the facility which are described below.

Pellet Storage Vault

Nuclear safety of the pellet storage vault is maintained by utilizing the safe geometric slab combined with separation distances and limited use of neutron poisons. The vault consists of three "cubicles" that are used for storage of pellet boxes. Each cubicle has inside dimensions of 97-inches high by 72-inches wide. The model was developed assuming each cubicle is infinite in length with 8 inches of concrete on the ceiling, 12 inches of concrete on the floor, and 8 inches of concrete in walls separating the cubicles. There are five horizontal rows of fuel boxes attached to the two end walls and sides of the walls separating the cubicles. The dimensions of the modelled fuel box are 18 inches

in width, 4-inches in height, and infinite in length. The fuel boxes in each cubicle are on 16-inch vertical centers. The four top rows of fuel boxes in each horizontal column contain a 0.25-inch thick sheet of Boral on the underside of the fuel box support. The two walls separating the three cubicles each contain a sheet of 0.25-inch thick Boral on one face. The Boral is 35 w/o B_4C with a density of 2.46 g/cc wrapped in a 0.041-inch thick aluminum sheath. The material in the fuel boxes is assumed to be UO_2 pellets enriched to 4.1 w/o in U-235 with a diameter of 0.4 inch. Polyethylene (less than 10 percent by volume) is used as packing material in the fuel boxes. The licensee conducted a number of calculations representing different credible abnormal situations and reported that the maximum k-effective of the system under normal conditions was 0.53 and under optimum moderation conditions was 0.95. The licensee conservatively calculated k-effective for the system by neglecting the boral on the wall in the calculation. The staff confirmed this result using the 27-group cross-section set found in SCALE, along with KENO-Va, a Monte Carlo code.

Fuel Assembly Storage

The primary control for nuclear criticality safety in the fuel assembly storage area is one of moderation control. The licensee has provided a demonstration of the storage arrays to justify the need for moderation control.

Each fuel rod consists of slightly enriched uranium dioxide pellets 0.37 inch in diameter, encased in zircalloy tubing 0.43 inch in diameter, with a cladding thickness of 0.053 inch. Each assembly contains 208 fuel rods, 16 control rod guide thimbles, and 1 instrument tube arranged in a 15 x 15 matrix with a fuel rod pitch of 0.568 inch.

Fuel assemblies are stored vertically in two-dimensional arrays using the following two spacing configurations: (1) a 21-inch by 38-inch center-to-center spacing and (2) a 36-inch by 36-inch center-to-center spacing. The licensee has shown that under optimum moderation conditions an infinite array spaced in the configuration described in (1) above, produces unacceptable k-effective values. Therefore, the licensee has imposed moderation controls on the storage area. In the configuration described in (2) above, the licensee produced a maximum k-effective value of 0.95 at a water mist of 0.05 g/cc. All licensee calculations were performed using a uranium enrichment of 4 w/o U-235.

E. Conclusion

The staff has concluded that the licensee's proposed criteria is adequate. This conclusion is based on:

1. The history of safe operations with respect to nuclear criticality safety.

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

3. The proposed license conditions are not significantly changed from current conditions.

4. The safety analysis which demonstrates sufficient, valid applications of the proposed administrative and technical requirements.

IX. ENVIRONMENTAL MONITORING

BWFC has an environmental monitoring program which monitors the liquid and airborne effluents. The program also includes ambient air, surface water, vegetation, and soil sampling. Sediment samples are also collected along the James River. The assessment and adequacy of this program were reported in the staff's "Environmental Assessment for License Renewal" (EA) dated May 14, 1990. On the basis of the assessment, a Finding of No Significant Impact dated May 16, 1990, was published in the Federal Register on May 24, 1990.

In the EA, five recommendations were provided to enhance the BWFC program. Since the licensee has already incorporated three recommendations into Part I of the application, the remaining two recommendations will be imposed as the following license conditions:

> The licensee shall inform the Regional Administrator, Region II, within 30 days if the State-permitting agency revokes the State-issued NPDES permit for the discharge of liquid effluents and shall inform the Regional Administrator, Region II, on a semiannual basis if the State-permitting agency supersedes, conditions, modifies, or otherwise nullifies the effectiveness of the State-issued NPDES permit for the discharge of liquid effluents.
>
> The licensee shall conduct a characterization survey and develop an action plan for the cleanup of the contaminated soil from the wet-weather stream and submit the plan to the Chief, Fuel Cycle Safety Branch, for review within 9 months from the date of license renewal.

X. RADIOLOGICAL CONTINGENCY PLAN

The licensee has incorporated, by reference, the Radiological Contingency Plan submitted by letter dated March 15, 1982, and supplements dated July 16 and September 24, 1982; January 10 and May 4, 1984; and February 5 and December 12, 1986. The requirements of the Plan will be implemented through approved written procedures. Changes which decrease the effectiveness of the Plan will not be made without NRC approval. The NRC will be notified of other changes within 6 months of the changes.

XI. FIRE SAFETY

All BWFC buildings are of steel frame or masonry construction, and the roof construction is classified as Underwriters Laboratories Class I. The building materials are therefore classifiable as noncombustible or limited combustible.

One of the high bays, which has the heavier fire load, is sprinklered. The main fuel manufacturing building may thus be considered reasonably fire safe.

In Section 6.2, Fire Protection, the licensee has stated that "fire extinguishing systems compatible with area nuclear safety requirements shall be installed or provided in accord with insurance and federal regulations." However, Building S1, a warehouse, which contains a moderate to heavy fire load and is infrequently visited by employees, is not fitted with an automatic fire suppression system. Contaminated "down-loaded" fuel rod cladding is stored in wooden crates in this building, and potential spread of radioactive contamination in the event of a fire is a distinct concern. However, as discussed in Section XIV, the licensee will be required to evaluate its safety program using the guidance in the Branch Technical Position on Fire Protection for Fuel Cycle Facilities, published in the Federal Register (54 FR 11590-98) on March 21, 1989, and to propose appropriate license conditions in accordance with the guidance. In the interim period, the licensee will install a fire detector/alarm system in the building. The alarm system will be supervised continuously at a guard station.

The licensee will implement administrative controls to prohibit storage of flammable, combustible, or reactive liquids in the buildings. Performance of any operation involving cutting, welding, and such other hot working will likewise be controlled.

Conclusion

Upon completion of the fire safety review, the staff concludes that the BWFC facility has an adequate fire safety program and equipment to minimize fire risk. A reasonably safe operation of the facility is thus ensured.

XII. PLANT DECOMMISSIONING

The licensee included the Decommissioning Plan in Chapter 7 of the application. The performance objective is to assure that the health and safety of the general public are protected by decontaminating facilities to levels allowable for unrestricted use. The Plan contains criteria and procedures.

By letter dated August 23, 1989, J. P. Eckert, Senior Vice President and Group Executive, Babcock & Wilcox, reiterated the financial assurance from Babcock & Wilcox's President (letter dated March 13, 1978) that current working capital significantly exceeds the amount necessary to decommission the facility. Independent of this renewal action, the licensee has submitted a decommissioning financial assurance certification as required by the NRC recently promulgated 10 CFR 70.25 requirements. In separate correspondence, the staff will reassess the licensee's financial assurance based on the submittal.

XIII. EXEMPTIONS AND SPECIAL AUTHORIZATIONS

In Section 1.7 of the application, the licensee requested several exemptions and special authorizations as follows:

1.7.1 The licensee has requested an exemption from the radiation caution labeling requirements in 10 CFR 20.203(e) and (f). Rather than posting each area and container, BWFC has requested the posting of radiation caution symbols

at the areas which house or temporarily store radioactive material. The licensee indicates that this exemption is based on practicality and/or experience and has been applied effectively at the CNFP for the past 20 years. The staff has determined that the exemption request is acceptable.

1.7.2 The licensee requests an exemption from the monitoring requirements of 10 CFR 70.24 for the UF6 storage area. The licensee has committed to the storage of these cylinders in a planar array, and the NRC staff finds this exemption request to be acceptable.

1.7.3 The licensee requests an exemption from the monitoring requirements of 10 CFR 70.24 for the storage of fuel assemblies within NRC licensed shipping containers (Certificate of Compliance No. 6206) provided: (1) the containers and contents have been subject to the inspections and determinations required by 10 CFR 71, Subpart D; (2) the containers are sealed, properly identified, and meet shipment requirements; (3) a minimum 38-inch edge-to-edge separation distance be maintained between the loaded container array and other accumulations of special nuclear material; and (4) the loaded container array has a minimum separation of 12 feet. This exemption request is acceptable to the staff. The staff notes that the separation distances in provisos (3) and (4) are in conflict. The separation distance in (4) is the minimum separation distance.

1.7.4 The licensee requests authorization for disposal of equipment removed from a controlled area to an uncontrolled area when requirements in NRC's "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source or Special Nuclear Material", August 1987, are satisfied. This request is acceptable to the staff.

The licensee also has requested authorization, for a 6-month period from the date of the license renewal, to dispose of material removed from a controlled area to an uncontrolled area in accordance with the above guidelines. The licensee has applied this practice for the past 10 years. In light of NRC's recently published Below Regulatory Concern (BRC) policy, the licensee plans to apply for this disposal authorization under the BRC policy. The licensee's request is acceptable to the staff.

1.7.5. The licensee requested authorization for the incumbent plant manager to be deemed as having the equivalent of the qualifications outlined in the license. The staff reviewed the incumbent's resume and determined that the incumbent's experience is equivalent to a bachelor's degree. Therefore, the request is acceptable.

The staff recommends the following license condition:

> The licensee is hereby granted the exemptions and special authorizations in Sections 1.7.1 through 1.7.5, Chapter 1, of the application.

XIV. 10-YEAR RENEWAL ISSUES

In a Federal Register notice, dated June 19, 1990, the Commission announced a new 10-year policy on renewals for selected fuel facility licensees. The new

policy includes a requirement for periodic updates of the renewal application. The staff paper (SECY-89-364) also discussed rulemaking to provide for earlier submittals of renewal applications. To implement these policy and renewal issues, the staff proposes the following license condition:

> At not more than 2-year intervals from September 30, 1990, the licensee shall update the demonstration sections of the renewal application to reflect the licensee's current operations. The updates to the application shall, as a minimum, include information for the health and safety section of the application as required by 10 CFR 70.22(a) through 70.22(f) and 70.22(i) and operational data or environmental releases as required by 70.21. In lieu of an update at the end of the 10-year renewal period, the licensee shall file a renewal application on or before September 30, 1999.

Decommissioning requirements which become effective at the time of license issuance on or after July 27, 1990, are contained in 10 CFR Parts 70.25 and 70.38. When this rule became effective, only 5-year renewals were being issued. With the advent of 10-year renewals, the staff recommends the following condition:

> On or before September 30, 1995, the licensee shall submit a decommissioning funding plan in compliance with the financial assurance for decommissioning provisions of 10 CFR 70.25(e) and (f), 10 CFR 40.[illegible](d) and (e), and 10 CFR 30.35(e) and (f), as appropriate.

Section 70.22(i) of 10 CFR Part 70 contains requirements for emergency plans which become effective with license renewal applications received on or after April 7, 1990. Because of the change in policy on license renewals, the staff recommends the following license condition:

> On or before September 30, 1995, the licensee shall be in full compliance with the emergency plan requirements of 10 CFR 70.22(i), 10 CFR 40.31(j), and 10 CFR 30.32(i), as appropriate.

On March 21, 1989, the NRC published guidance to applicants/licensees in the form of four Branch Technical Positions (BTP). The staff expects that applicants/licensees will address each of the four BTP. However, BWFC submitted the renewal application before the guidance was published. Accordingly, the staff recommends the following license condition:

> On or before September 30, 1991, the licensee shall evaluate his safety program against the "Guidance on Management Controls/Quality Assurance, Requirements for Operation, Chemical Safety, and Fire Protection for Fuel Cycle Facilities," Federal Register, March 21, 1989, and shall propose license conditions, as appropriate, to modify the license in accordance with the "Guidance ...."

XV. CONCLUSION

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

The staff has discussed the renewal and the proposed license conditions with the Region II Project Inspector. The Project Inspector has no objection to the issuance of the renewed license.

The staff, therefore, recommends that the BWFC license be renewed in accordance with the statements, representations, and conditions in BWFC's revised application dated June 22, 1990, subject to the above identified conditions.

Original Signed By:

Sean Soong
Uranium Fuel Section
Fuel Cycle Safety Branch
Division of Industrial and
Medical Nuclear Safety

Approved by: Original Signed By:
George H. Bidinger, Section Leader

David McCaughey, former NRC employee, contributed to this evaluation.

BWFC/701201 SER

OFC: IMUF:	IMUF:	IMUF:	IMUF:
NAME: SSoong: mh:	ADatta:	VLTharpe:	GHBidinger:
DATE: 9/19/90:	9/18/90:	9/17/90:	/17/90:

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