DOE/EA-1204

Environmental Assessment

Change in Operating Parameters of the Continuous Electron Beam Accelerator Facility and Free Electron Laser, Thomas Jefferson National Accelerator Facility, Newport News, Virginia

October 1997

U.S. Department of Energy
Oak Ridge Operations
Oak Ridge, Tennessee

FINDING OF NO SIGNIFICANT IMPACT

CHANGE IN OPERATING PARAMETERS OF THE CONTINUOUS ELECTRON BEAM ACCELERATOR AND THE FREE ELECTRON LASER AT THE THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY

AGENCY: U.S. DEPARTMENT OF ENERGY

ACTION: FINDING OF NO SIGNIFICANT IMPACT

SUMMARY: The U.S. Department of Energy (DOE) has completed an environmental assessment (DOE/EA-1204) for the proposed change in operating parameters of the Continuous Electron Beam Accelerator and the Free Electron Laser at the Thomas Jefferson National Accelerator Facility (Jefferson Lab), Newport News, Virginia. Based on the results of the impacts analysis reported in the EA, DOE has determined that the proposed action is not a major Federal action that would significantly affect the quality of the human environment within the context of the National Environmental Policy Act of 1969 (NEPA). Therefore, preparation of an environmental impact statement (EIS) is not necessary, and DOE is issuing this Finding of No Significant Impact (FONSI).

PUBLIC AVAILABILITY OF EA AND FONSI: The EA and FONSI may be reviewed at and copies of the documents obtained from

U.S. Department of Energy
Public Reading Room
Thomas Jefferson National Accelerator Facility
12000 Jefferson Avenue (Bldg. 28)
Newport News, VA 23606
Phone: (757) 269-7524

FURTHER INFORMATION ON THE NEPA PROCESS: For further information on the NEPA process, contact

Mr. David R. Allen
Acting NEPA Compliance Officer
U.S. Department of Energy
P. O. Box 2001
Oak Ridge, Tennessee 37831
Phone: (423) 576-0411.

BACKGROUND: DOE evaluated the potential environmental impacts from a proposed change in operating parameters of the Continuous Electron Beam Accelerator Facility (CEBAF), and operation of the Free Electron Laser (FEL) facility beyond the initial demonstration period. CEBAF and the FEL are located at the Thomas Jefferson National Accelerator Facility (Jefferson Lab) in Newport News, Virginia. CEBAF produces an electron beam for experiments in basic nuclear physics, in particular, for

the study of quark structures and behaviors and the forces that govern the clustering of nucleons in the atomic nucleus.

With this proposal, DOE intends to increase CEBAF's operating beam energy from 4.0 GeV [giga-(billion) electron volts] to 8.0 GeV at a beam power of no greater than 1000 kW [1 megawatt (MW)], its maximum attainable level without significant, costly equipment modifications. DOE proposes to take this action to provide the nation with an advanced capability to conduct a more diverse and wider range of experiments in fundamental physics research. The increase in beam energy, up to CEBAF's present maximum capability of 8.0 GeV, would effectively double the energy range over which scientific experiments can be conducted.

Support activities necessary to effect the change in CEBAF operating parameters and to continue research at the FEL would begin in Fiscal Year (FY) 98. The full range of CEBAF energies should be available to serve developmental and operational activities of the physics program in FY 99. Experiments that require maximum beam energy and power are expected to be conducted beyond the year 2005.

ALTERNATIVES: In this EA, DOE evaluates the impacts of the no-action alternative and the proposed action alternative. Alternatives considered, but dismissed from further evaluation, were the use of another accelerator facility and the use of another technology.

ENVIRONMENTAL IMPACTS:

No Action Alternative

If no action is taken on this proposal, DOE would continue operating CEBAF within a beam energy range up to 4.0 GeV, until the potential value of experiments is exhausted. The FEL would continue to operate in a demonstration mode until FY 99. With no action, the environmental effects of CEBAF operation would continue to be minimal, as they have been over the past year of operation.

Proposed Action Alternative

The proposed action will not require major new construction at CEBAF or at the FEL. Thus, the impacts analysis focused on operation of CEBAF at a higher beam energy and operation of the FEL beyond demonstration parameters to assess the potential for impacts to the environment, workers, and the public at and near the site.

Water Resources.

Non-Radiological Impacts. Erosion and sedimentation to onsite ditches and storm drainage systems could result from small (under one acre) land disturbances onsite during construction. Standard erosion control measures would be implemented during disturbance of soils to minimize runoff and potential deposit of sediments in surface waters. Dewatering effluent discharged to surface drainage pathways would not differ in quantity and quality from the present dewatering effluent from CEBAF and FEL operation. Therefore, additional impacts would not occur from future dewatering discharges as the proposed action is implemented.

Radiological Impacts. Sources of radioactive wastewater are not expected to increase with accelerator operation under the proposed parameters. Discharges to the public sewer system would remain the same, however, and would continue to be regulated in accordance with the Hampton Roads Sanitation District permit. Because of this, no additional impacts are projected for operation under the proposed parameters.

Groundwater activation by prompt radiation is directly proportional to the operating electron beam power. During routine operation at 8.0 GeV, induced radioactivity would be constrained by the 1 MW power limit established for safe operation of CEBAF. With a beam energy of 8.0 GeV, there would be a corresponding decrease in beam current to maintain the beam power at or below 1 MW. Thus, there would be no effective increase in the electron beam power during the proposed action, and a net change in the quantity of groundwater activation products would not be anticipated.

The non-routine release of high-power beam dump cooling water, dehumidification condensate, or low-conductivity cooling water could introduce radioactivity into soils and groundwater. The proposed changes in CEBAF operating parameters would not change the nature and quantity of radionuclides from any of these sources. Therefore, even if an accident were to occur, impacts would be the same as those from operation at 4.0 GeV.

Health and Safety.

Non-Radiological Impacts. Non-radiological hazards associated with the proposed action include electrical hazards, chemical hazards, and non-ionizing radiation hazards (lasers), which could injure and in extreme cases kill, occupational workers. Administrative procedures at Jefferson Lab to minimize accidents involving electricity, chemicals and lasers are specified in the Jefferson Lab EH&S Manual and implemented during operation.

Radiological Impacts. Most of the occupational radiation exposure at Jefferson Lab would continue to occur during maintenance activities on activated components. The level of induced radioactivity in the components is directly proportional to the amount of electron beam power lost in the components. CEBAF operation at energies up to 8.0 GeV would result in beam power to the same maximum level as operation at 4.0 GeV (i.e., 1 MW). Consequently, changes in beam energy as proposed would not be expected to increase occupational radiation exposure.

The chief source of radiation exposure for members of the general public is "skyshine" radiation. An analysis of skyshine production mechanisms for electron beam energy in excess of 4 GeV has shown that, for constant beam power, the number of neutrons directed toward the roof tends to decreases as beam energy increases. Thus, with the 1 MW beam power limit and a beam energy increase up to 8.0 GeV, skyshine radiation exposure to the general public would decrease.

The public may be exposed to small quantities of radioactivity induced in air in the CEBAF enclosure as a result of nominal ventilation during routine operations. The production of ozone, oxides of nitrogen, and radioactive gases by CEBAF operation has been shown to be directly proportional to the amount of beam power loss. Because beam power loss is expected to decrease with the proposed action, the amount of ozone, nitrogen oxides and radioactive gases should correspondingly decrease. Thus, effects of airborne radionuclides, ozone, and nitrogen oxides would be less with the proposed change in operating parameters.

Land Use. Proposed activities would not alter the industrial nature of the site.

Socioeconomics. Labor for proposed modifications and operational changes would be drawn from the pool of SURA and other subcontractor staff at Jefferson Lab. Therefore, impacts to the local population, services, and economy would not be expected. With regard to environmental justice, there would be no disproportionate adverse impacts on minority and economically disadvantaged populations in the Newport News area because no significant adverse impacts are expected from any aspects of the proposed action.

Cultural Resources. The Virginia State Historic Preservation Officer has advised DOE that no adverse impacts to archaeological and historic resources would be expected from the proposed action.

Noise. Construction activities would be short-term and localized at the Jefferson Lab site. Given the urban nature of the site and its vicinity, noise from construction would not be unique. While sporadic noise from construction equipment and traffic would occasionally be perceptible in nearby areas, no adverse effects on human hearing would occur.

Non-radiological Air Quality. Operation of equipment and vehicles onsite would produce non-radiological emissions common to construction sites (hydrocarbons, sulfur dioxide, carbon monoxide, etc.). Emissions would be temporary and localized near the site of operation. Therefore, contribution from the proposed action to offsite concentrations of regulated non-radiological air pollutants would be minimal.

Geology. Site geology was thoroughly reviewed in 1995 to support a proposal to change the status of CEBAF in its Commonwealth of Virginia permit from a construction project to an operating facility. The proposed actions would not adversely affect site geology or soils.

Ecology. In accordance with Section 7, Endangered Species Act requirements, DOE informally consulted with the U.S. Fish and Wildlife Service and the Commonwealth of Virginia Department of Game and Inland Fisheries, Department of Agriculture and Consumer Services, and Bureau of Plant Protection for comment on the proposed actions. All agencies reported that no adverse impacts to protected species and/or habitat would be expected from the proposed action.

Floodplain/Wetlands. The CEBAF site is not within a floodplain. In 1987, the U.S. Army Corps of Engineers determined that the forested temporary wetlands proposed to be disturbed in the course of CEBAF construction were not sufficiently permanent to qualify as wetlands. The minor land disturbance needed for this proposed action would be limited to non-forested areas adjacent to existing buildings and structures. Therefore, no adverse impacts would be expected.

Cumulative Impacts. Cumulative impacts are those which result from the incremental contribution from each effect discussed above along with impacts expected from other ongoing or planned actions within the same geographic area. Aside from the actions evaluated in this EA, there are no other sources of induced radioactivity or prompt radiation planned for the CEBAF site or nearby offsite areas. The impacts of CEBAF and the FEL operations are offset by radioactive decay and dilution. The net effect is a steady-state condition which results in radioactivity levels well below permit limits. As long as the weekly average beam power does not exceed 1 MW, operations at the proposed levels would not have a measurable effect on human health and safety when compared to continuous operation at 1 MW over the same time period. Thus, the operation of CEBAF and the FEL would not result in cumulative adverse impacts to occupational and public health and safety.

DETERMINATION: Based on the findings of this EA, DOE has determined that the proposed change in operating parameters of the Continuous Electron Beam Accelerator and the Free Electron Laser at the Thomas Jefferson National Accelerator Facility does not constitute a major Federal action that would significantly affect the quality of the human environment within the context of the National Environmental Policy Act. Therefore, preparation of an environmental impact statement is not required.

Issued at Oak Ridge, Tennessee, this 5th day of November 1997.

James C. Hall
Manager
U.S. Department of Energy
Oak Ridge Operations
Oak Ridge, Tennessee

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ACRONYMS AND ABBREVIATIONS

ALARA	as low as reasonably achievable
CEBAF	Continuous Electron Beam Accelerator Facility
CFR	Code of Federal Regulations
DEQ	Department of Environmental Quality
DOE	U.S. Department of Energy
EA	Environmental Assessment
EH&S	Environment, Health, and Safety
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
FEL	Free Electron Laser
FONSI	finding of no significant impact
FSAD	Final Safety Assessment Document
FY	fiscal year
GeV	giga- (billion-) electron volts
HPBD	high-power beam dump
HRSD	Hampton Roads Sanitation District
IR	infrared
Jefferson Lab	Thomas Jefferson National Accelerator Facility
kW	kilowatt
LCW	low-conductivity water
mrem	millirem
MW	megawatt
NEPA	National Environmental Policy Act
NRCP	National Council on Radiation Protection and Measurements
OSHA	Occupational Safety and Health Administration
pCi	picocuries
R&D	research and development
REIRS	radiation exposure information reporting system
RF	radio-frequency
SA	supplement analysis
SPCC	Spill, Prevention, Control, and Countermeasure
SRF	superconducting radio-frequency
SURA	Southeastern Universities Research Association, Inc.
TLV	Threshold Limit Value
UV	ultraviolet
VPA	Virginia Pollution Abatement
VPDES	Virginia Pollutant Discharge Elimination System

SUMMARY

Proposed Action and Alternatives

In this environmental assessment (EA), the U.S. Department of Energy (DOE) reports the results of an analysis of the potential environmental impacts from a proposed change in operating parameters of the Continuous Electron Beam Accelerator Facility (CEBAF), and operation of the Free Electron Laser (FEL) facility beyond the initial demonstration period. CEBAF and the FEL are located at the Thomas Jefferson National Accelerator Facility (Jefferson Lab) in Newport News, Virginia. CEBAF produces an electron beam for experiments in basic nuclear physics, in particular, for the study of quark structures and behaviors and the forces that govern the clustering of nucleons in the atomic nucleus.

With this proposal, DOE intends to increase CEBAF operating range from its current operating maximum beam energy of 4.0 GeV [giga-(billion) electron volts] to 8.0 GeV at a beam power of no greater than 1000 kW [1 megawatt (MW)], its maximum attainable level, based on current technology and knowledge, without significant, costly equipment modifications. DOE proposes to take this action to provide the nation with an advanced capability to conduct a more diverse and wider range of experiments in fundamental physics research. The increase in beam energy up to 8.0 GeV would effectively double the energy range over which scientific experiments can be conducted. DOE has prepared an EA for this action to determine the potential for adverse impacts from operation of CEBAF and the FEL at the proposed levels.

Changing the operating parameters of CEBAF would require no new major construction and minor modifications to the accelerator, its support systems, the FEL, and onsite utility systems. Modifications and performance improvements would be made to (1) the accelerator housed in the underground tunnels, (2) its support systems located in the above ground service buildings, and (3) the water and equipment cooling systems both in the tunnel and at the ground surface. All work would be performed on previously disturbed land and in, on, or adjacent to existing buildings, structures, and equipment. With the proposed action, the recently constructed FEL facility at the Jefferson Lab would operate in concert with CEBAF beyond its demonstration period and up to its maximum effective electron beam power level of 210 kW.

Support activities necessary to effect the change in CEBAF operating parameters and to continue research at the FEL would begin in Fiscal Year (FY) 98. The full range of CEBAF energies should be available to serve developmental and operational activities of the physics program in FY 99. Experiments that require the proposed maximum beam energy and power are expected to be conducted beyond the year 2005.

In this EA, DOE evaluates the impacts of the no-action alternative and the proposed action alternative. Alternatives considered, but dismissed from further evaluation, were the use of another accelerator facility and the use of another technology.

Environmental Impacts

The findings of the impacts analysis reported in this EA are as follows:

No Action Alternative

If no action is taken on this proposal, DOE would continue operating CEBAF within a beam energy range up to 4.0 GeV, until the potential value of experiments is exhausted. The FEL would continue to operate in a demonstration mode until FY 99. With no action, the environmental effects of CEBAF operation would continue to be minimal, as they have been over the past year of operation.

Proposed Action Alternative

The proposed action is a change in operating parameters that will not require major new construction at CEBAF or at the FEL. Thus, the impacts analysis in this EA focused on operation of CEBAF at a higher beam energy and operation of the FEL beyond demonstration parameters to assess the potential for impacts to the public, the workers, and the environment at and near the site.

Water Resources

The findings of the impacts analysis reported in this EA are as follows:

Non-Radiological Impacts. Erosion and sedimentation to on-site storm water channels and storm drainage systems could result from small (under one acre) land disturbances during onsite construction activities. Standard erosion control measures would be implemented during disturbance of soils to minimize runoff and potential deposit of sediments in surface waters. Dewatering effluent discharged to surface drainage pathways would not differ in quantity and quality from the present dewatering effluent from either CEBAF or FEL operations. Therefore, additional impacts would not occur from future dewatering discharges as the proposed action is implemented.

Radiological Impacts. Sources of radioactive wastewater are not expected to increase with accelerator operation under the proposed parameters. Discharges to the public sewer system would remain the same, however, and would continue to be regulated in accordance with the Hampton Roads Sanitation District permit. Because of this, no additional impacts are projected for operation under the proposed parameters.

Groundwater activation by prompt radiation is directly proportional to the operating electron beam power. During routine operation at up to 8.0 GeV, induced radioactivity would be constrained by the 1 MW power limit established for safe operation of CEBAF. As the beam energy approaches 8.0 GeV, there would be a corresponding decrease in beam current to maintain the beam power at or below 1 MW average weekly beam power. Thus, there would be no effective increase in the electron beam power during the proposed action, and a net change in the quantity of groundwater activation products would not be anticipated.

The non-routine release of high-power beam dump cooling water, dehumidification condensate, or low-conductivity cooling water could introduce radioactivity into soils and groundwater. The proposed changes in CEBAF operating parameters would not change the nature and quantity of radionuclides in any of these sources. Therefore, even if an accident were to occur, impacts would be the same as those from operation at 4.0 GeV.

Health and Safety

The findings of the impacts analysis reported in this EA are as follows:

Radiological Impacts. Most of the occupational radiation exposure at Jefferson Lab would continue to occur during maintenance activities on activated components. The level of induced radioactivity in the components is directly proportional to the amount of electron beam power lost in the components. CEBAF operation at energies up to 8.0 GeV would result in potential beam power loss to the same maximum level as operation at 4.0 GeV (i.e., 1 MW). Consequently, changes in beam energy, as proposed, would not be expected to increase occupational radiation exposure.

The chief source of radiation exposure for members of the general public is "skyshine" radiation. An analysis of skyshine production mechanisms for electron beam energy in excess of 4 GeV has shown that, for constant beam power, the number of neutrons directed toward the roof of each experiment hall tends to decrease as beam energy increases. Thus, with the 1 MW beam power limit and a beam energy increase up to 8.0 GeV, skyshine radiation exposure to the general public would decrease.

The public may be exposed to small quantities of radioactivity induced in air in the CEBAF enclosure as a result of nominal ventilation during routine operations. The production of ozone, oxides of nitrogen, and radioactive gases by CEBAF operation has been shown to be directly proportional to the amount of beam power loss. Because beam power loss is expected to decrease in the experiment halls, the primary gas generation areas, with the proposed action, the amount of ozone, nitrogen oxides and radioactive gases should correspondingly decrease. Thus, effects of airborne radionuclides, ozone, and nitrogen oxides would be less with the proposed change in operating parameters.

Non-Radiological Impacts. Non-radiological hazards associated with the proposed action include electrical hazards, chemical hazards, and non-ionizing radiation hazards (lasers), which could injure and, in extreme cases, kill occupational workers. Administrative procedures at Jefferson Lab to minimize accidents involving electricity, chemicals and lasers are specified in the Jefferson Lab EH&S Manual and are implemented during operation.

Land Use: Proposed activities would not alter the industrial nature of the site.

Socioeconomics: Labor for proposed modifications and operational changes would be drawn from the pool of SURA and subcontractor staff at Jefferson Lab. Therefore, impacts to the local population, services, and economy would not be expected. With regard to environmental justice, there would be no disproportionate adverse impacts on minority and economically disadvantaged populations in the Newport News area because no significant adverse impacts are expected from any aspects of the proposed action.

Cultural Resources: The Project Review Supervisor at the Commonwealth of Virginia Department of Historic Resources has advised DOE that no adverse impacts to archaeological and historic resources would be expected from the proposed action.

Noise: Construction activities would be short-term and localized at the Jefferson Lab site. Given the urban nature of the site and its vicinity, noise from construction would not be unique. While sporadic noise from construction equipment and traffic would occasionally be perceptible in nearby areas, no adverse effects on human hearing would occur.

Non-radiological Air Quality: Operation of equipment and vehicles on-site would produce non-radiological emissions common to construction sites. Emissions would be temporary and localized near the site of operation. Therefore, contribution from the proposed action to offsite concentrations of regulated non-radiological air pollutants would be minimal.

Geology: The site geology was thoroughly reviewed in 1995 to support a proposal to change the status of CEBAF in its Commonwealth of Virginia permit from a construction project to an operating facility. The proposed actions would not affect site geology or soils.

Ecology: In accordance with Section 7, Endangered Species Act requirements, DOE informally consulted with the U.S. Fish and Wildlife Service and the Commonwealth of Virginia Department of Game and Inland Fisheries, Department of Agriculture and Consumer Services, and Bureau of Plant Protection for

comment on the proposed actions. All agencies reported that no adverse impacts to protected species and/or habitat would be expected from the proposed action.

Floodplain/Wetlands: The CEBAF site is not within a floodplain. In 1987, the U.S. Army Corps of Engineers determined that the forested temporary wetlands proposed to be disturbed in the course of CEBAF construction were not sufficiently permanent to qualify as wetlands. The minor land disturbance needed for this proposed action would be limited to non-forested areas adjacent to existing buildings and structures. Therefore, no impacts would be expected.

Cumulative Impacts

Cumulative impacts are those which result from the incremental contribution from each effect discussed above along with impacts expected from other ongoing or planned actions within the same geographic area. Aside from the actions evaluated in this EA, there are no other sources of induced radioactivity or prompt radiation planned for the CEBAF site or nearby offsite areas. The impacts of CEBAF and the FEL operations are offset by radioactive decay and dilution. The net effect is a steady-state condition which results in radioactivity levels well below permit limits. As long as the weekly average beam power does not exceed 1 MW, operations at the proposed levels would not have a measurable effect on human health and safety when compared to continuous operation at 1 MW over the same time period. Thus, the operation of CEBAF and the FEL would not result in cumulative impacts to the environment or to occupational and public health and safety.

1. INTRODUCTION

1.1 BACKGROUND

In this Environmental Assessment (EA), the U.S. Department of Energy (DOE) reports the results of an analysis of the potential environmental impacts from a proposed change in operating parameters of the Continuous Electron Beam Accelerator Facility (CEBAF), and from operation of the Free Electron Laser (FEL) facility beyond its initial demonstration period. CEBAF and the FEL are located at the Thomas Jefferson National Accelerator Facility (Jefferson Lab) in Newport News, Virginia (Figs. 1 and 2). Jefferson Lab is operated by the Southeastern Universities Research Association, Inc. (SURA) under contract to DOE.

CEBAF produces an electron beam for experiments in basic nuclear physics, in particular, for the study of quark structures and behaviors and the forces that govern the clustering of nucleons in the atomic nucleus. On January 12, 1987, DOE issued a finding of no significant impact (FONSI) based on an environmental assessment of the proposed construction and operation of CEBAF (DOE 1987). Construction was completed in early 1995. Commissioning of components paralleled construction activities so that the accelerator began operating to serve the DOE physics program in late 1995 and has continued operating to this day.

In the EA (DOE 1987), the proposed action for which impacts were evaluated was the operation of CEBAF to produce an electron beam in the range from 0.5 to 4.0 GeV [giga- (billion-) electron volts] beam energy with a maximum beam power of 1000 kilowatts (kW). In 1996, in accordance with the DOE National Environmental Policy Act (NEPA) regulation 10 CFR 1021.314, a supplement analysis (SA) was prepared to determine whether the 1987 EA should be supplemented, a new EA should be prepared, or no further NEPA documentation would be required for a proposed change in beam energy from 4.0 GeV to 6.0 GeV, at a maximum beam power of 150 kW, for accelerator testing (DOE 1996a). Based on the SA, DOE found that the proposed action did not have the potential for causing impacts that would exceed those previously documented in the EA and FONSI for construction and operation of CEBAF. Thus, DOE concluded that no further NEPA review was necessary for the change in CEBAF operation in the 4.0 to 6.0 GeV energy range at a maximum beam power of 150 kW.

The proposed action evaluated in this EA involves further changes in the operating parameters of CEBAF. With this proposal, DOE intends to increase the maximum beam energy of CEBAF to 8.0 GeV while maintaining a beam power of no greater than 1000 kW [1 megawatt (MW)]. These parameters reflect the maximum attainable operating level, based on current technology and knowledge, without significant, costly equipment modifications.

The proposed action also involves continued experimentation using the FEL (Fig. 1). In 1996, Jefferson Lab was funded to construct a FEL facility for research applications by the DOE, the scientific community, the Department of Navy, and industrial members of the Laser Processing Consortium. The Laser Processing Consortium is a collaboration of industries (such as DuPont and Newport News Shipbuilding), universities, and Jefferson Lab, which are interested in the practical applications of a machine, such as the FEL, in manufacturing processes.

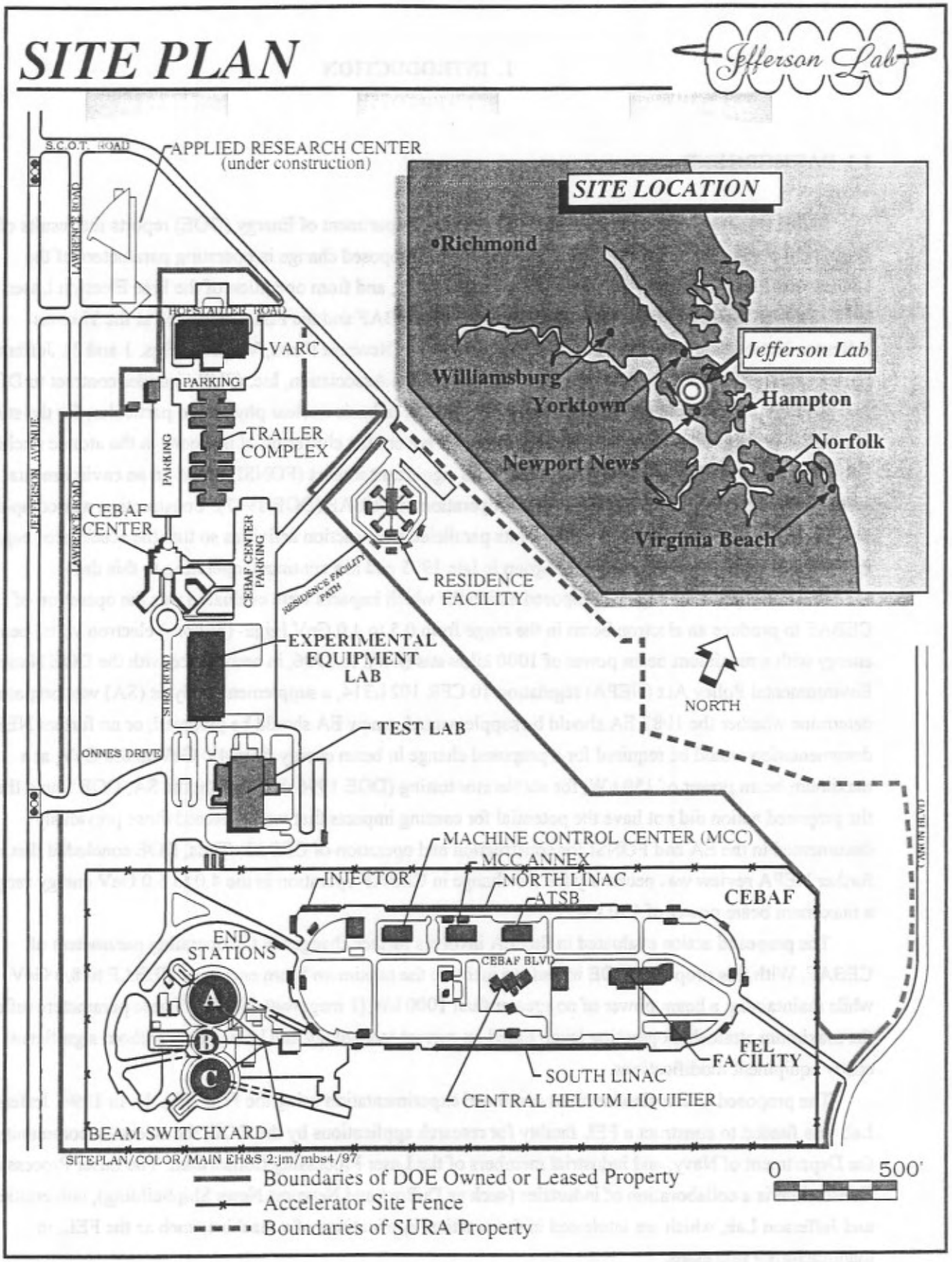

Fig. 1. Site plan of the U.S. Department of Energy's Thomas Jefferson National Accelerator Facility in Newport News, Virginia.

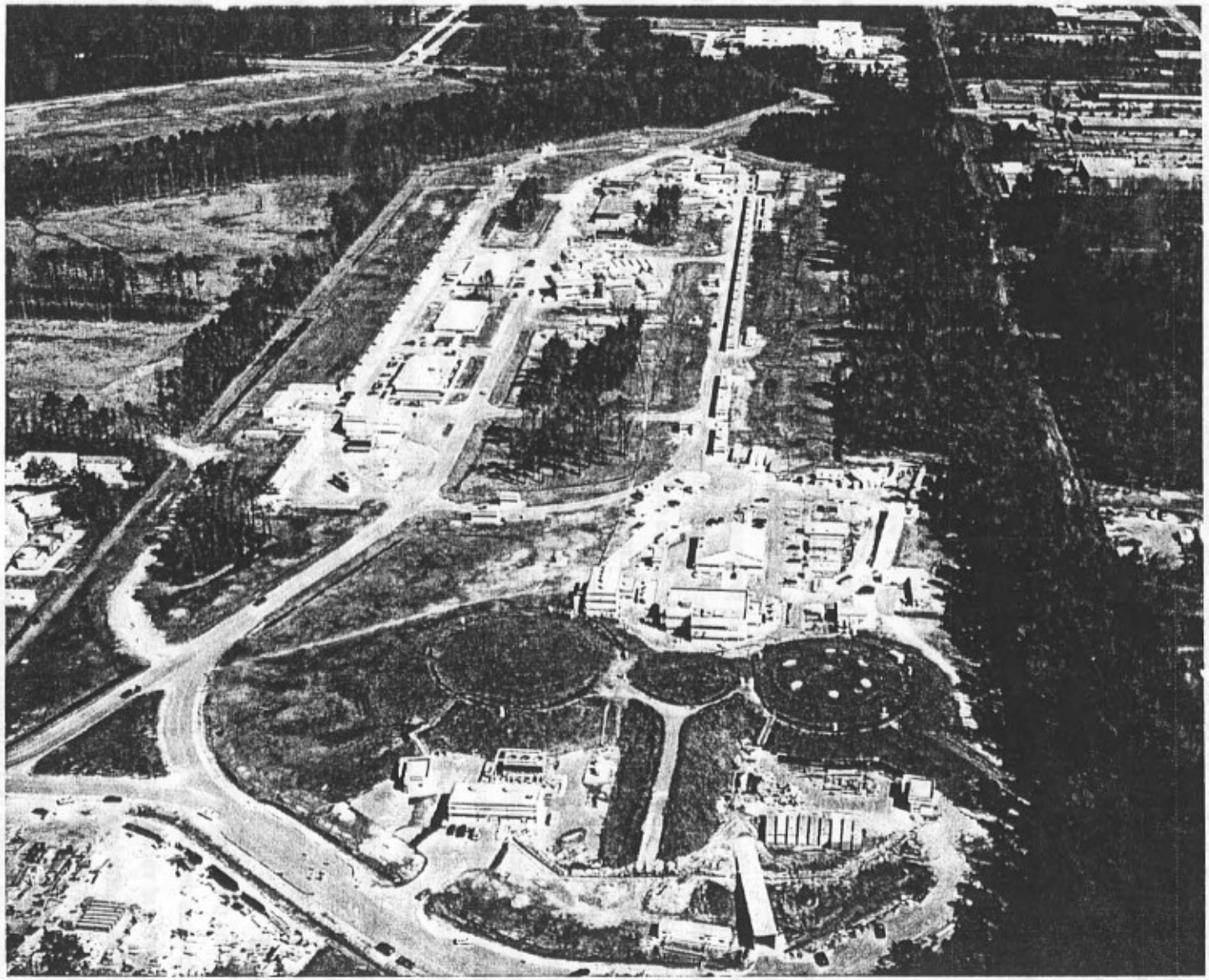

Fig. 2. Layout of the Continuous Electron Beam Accelerator Facility at the Thomas Jefferson National Accelerator Facility in Newport News, Virginia.

Design, construction and operation of the FEL as a Research and Development (R&D) demonstration project were considered to be an associated research activity of CEBAF operations, the impacts of which were addressed in the 1987 EA for CEBAF. The initial phase of the FEL project, which was funded by the Navy, DOE and the Commonwealth of Virginia, was categorically excluded from further NEPA review by DOE (DOE 1996b). The FEL demonstration is intended to produce a 1 kW laser in the mid-infrared (IR) wavelength, with a range from 3 to 6.6 microns.

DOE has prepared this EA to determine the potential for adverse impacts from radiation produced during CEBAF and FEL operations and other sources of potential impact.

1.2 PURPOSE OF AND NEED FOR DOE ACTION

DOE proposes to take this action to provide the nation with an advanced capability to conduct a more diverse and wider range of experiments in fundamental physics research. The Program Advisory Committee, an independent group of internationally recognized scientists (Appendix A) in the nuclear physics community that advises Jefferson Lab on the value of proposed research, has determined that experiments using electrons with energies between 4.0 GeV and 8.0 GeV have the highest potential for increasing knowledge about the fundamental structure of the atomic nucleus. Some experiments, which require energies in the 4.0 GeV through 8.0 GeV range, have already been recommended to SURA by the Program Advisory Committee.

The purpose of the proposed action is to increase the operating limits of CEBAF to provide a beam energy up to its present maximum capability of 8.0 GeV at 1 MW, which would effectively double the energy range over which scientific experiments can be conducted at Jefferson Lab. CEBAF's capability has increased since its design and the inception of operation in 1995 as a result of continuing improvements in superconducting radio-frequency (SRF) accelerator technology. The proposed changes in operating parameters would not require additional funding, yet they would enable Jefferson Lab to expand its research capabilities. Experiments that may be conducted at a beam energy of 8.0 GeV, using a continuous electron beam accelerator, would take decades to complete at other U.S. electron beam facilities, because they operate with a pulsed beam, which generates data at a rate 1000 times slower than the continuous beam option of CEBAF.

The proposed action is also intended to continue the FEL demonstration project beyond the time parameters described in the Categorical Exclusion (DOE 1996b) and to provide the opportunity for the FEL to operate at various wavelengths to support user R&D activities and technology transfer. The FEL mission is to organize and implement plans for collaborative development of cost-effective, high-average power IR-ultraviolet (UV) FELs for industrial and defense purposes. By a factor of 100, this is the highest average power FEL in the world. Its operation at shorter wavelengths will extend its unique capabilities to support research that cannot be performed elsewhere.

2. PROPOSED ACTION AND ALTERNATIVES

2.1 DESCRIPTION OF THE PROPOSED ACTION

The proposed action is a change in the operating parameters of CEBAF that would require minor modifications to the accelerator, its support systems, and on-site utility systems. Another aspect of the proposed action would involve the operational use of the recently constructed FEL facility at the Jefferson Lab, in concert with CEBAF, up to its maximum effective electron beam power level of 210 kW.

2.1.1 CEBAF Operating Parameters

The proposed changes in maximum effective operating parameters of the CEBAF are presented in Table 1.

Table 1. CEBAF maximum effective operating parameters

Parameter	Present operating level	Proposed operating level
Beam power	1000 kW (1 MW)	1000 kW (1 MW)[a]
Beam energy	4.0 GeV	8.0 GeV
Beam current	Variable (see below)	Variable (see below)

[a]Averaged over a one-week period.

Operating beam current would vary depending on the nature of the experiment or test. The product of beam current times beam energy is the beam power. By changing either the beam current or beam energy, the beam power correspondingly changes. Occasional variations in beam current could result in a beam power that exceeds 1 MW; however, the average beam power for one week, the measurable parameter considered in this EA, would not exceed 1 MW. The time needed to make statistically accurate environmental radiation measurements varies from days to months, depending on the parameter measured. Hence, one-week averaging is a reasonable time period to use for this analysis, as one week is less than the minimum reporting period required by any related Jefferson Lab environmental permit.

Proposed changes in operating parameters of CEBAF would be part of a continuous routine improvement initiative in SRF technology at Jefferson Lab. As accelerating units (cryomodules)[1] are removed from the tunnel for maintenance and/or repair, they are replaced with remanufactured or refurbished units

[1]A cryomodule is an assembly of 8 liquid-helium-cooled SRF cavities that function as efficient power transformers, coupling the supplied radio-frequency (RF) power into the electron beam.

having a greater accelerating capability than the originals. As a result, the overall electron beam energy capability of CEBAF increases with maintenance and replacement actions. If necessary, utility systems, including power and cooling capacities, are correspondingly expanded in order to utilize this enhanced capability.

To change operating parameters, modifications and performance improvements would be made to the accelerator housed in the underground tunnels, to its support systems located in the above ground service buildings, and to the water and equipment cooling systems both in the tunnel and at the ground surface. All work would be performed on previously disturbed land and in, on, or adjacent to existing buildings, structures, and equipment. Specific activities expected to be necessary include the following:

- The fabrication and testing of cryomodules and magnets in the existing Test Lab and Experimental Equipment Lab (Fig. 1), would increase slightly but not beyond 2 cryomodules per month, which was analyzed in the 1987 EA.
- New power supplies would be installed in the North and South Linac service buildings, and cryomodules would be replaced with those having improved design characteristics during regular maintenance. The cryomodules would be installed in the underground North and South Linacs and in the lower level of the FEL facility. Other equipment and components may be added or upgraded to support the installation, operation, and use of these devices.
- Bulk materials (e.g., soils, concrete) may be added to shielded areas as part of routine maintenance or installed in non-shielded areas to enhance Jefferson Lab's as-low-as-reasonably-achievable (ALARA) program for radiation protection.
- The capacity of the power distribution and cooling systems in the accelerator service buildings may be increased by about 50%. This would require that additional pipelines, cooling towers, and power distribution systems be installed.
- The cryogenic support systems may need to be upgraded. This would involve adding a few more pipelines and increasing the on-site helium and nitrogen inventories.

In addition to the operating constraints established in this document, CEBAF operations are governed by the Final Safety Assessment Document (FSAD) (SURA 1994). As experience with CEBAF increases or the need arises, the FSAD may be modified to allow operational changes that are consistent with environmental constraints examined in this EA.

2.1.2 Free Electron Laser Facility Operating Parameters

As part of the proposed action, the FEL electron beam current would be increased beyond that of the IR demonstration project (March 5, 1996 through September 30, 1998) to produce a laser beam up to 20 kW IR for experiments and other applications. Additionally, an UV wavelength FEL (0.2 through 1.0 microns) may be produced by adding two SRF cryomodules to the facility and recirculating the electron beam through the FEL Linac. This would result in the capability of producing up to 10 kW UV or 20 kW IR laser beams for experimental use, which is greater than the 1kW IR to be produced during the demonstration period.

2.1.3 Schedule and Labor Requirements

Changes and modifications to support this proposed action would be effected through the continuous improvement in SRF cryomodule technology discussed earlier. Other activities to support the change in CEBAF operating parameters and to continue research at the FEL would begin in fiscal year (FY) 98. The full range of CEBAF energies should be available to serve developmental and operational activities of the physics program in FY 99. Experiments that require maximum beam energy and power levels described in this proposed action are expected to be conducted beyond the year 2005. Labor required for modification to CEBAF and its support systems would be drawn from the existing pool of SURA, state, and subcontractor staff, and operating personnel for CEBAF and the FEL facility would be drawn from the existing SURA staff.

2.2 NO ACTION

If no action is taken on this proposal, DOE would continue operating CEBAF at current levels for experiments within a limited energy range up to 4.0 GeV, until the potential value of such experiments is exhausted. The FEL would continue to operate in a demonstration mode until FY 99; however, continued demonstration activities or changes in operating parameters, including those addressed in this EA, would require further NEPA review. With no action, the potential for continued support by DOE's industrial partners would decrease, which in turn, could compromise the potential for significant technology transfer to the private sector. Without the proposed action, U.S. medium-energy physics researchers would be limited in their ability to address questions and theories posed by the worldwide scientific community.

2.3 ALTERNATIVES DISMISSED FROM CONSIDERATION

2.3.1 Other Accelerator Facilities

DOE has no other existing research accelerator that could be as easily modified to perform at the operating levels proposed by this action. CEBAF is the only high-average-current (200 microamps) continuous electron beam accelerator that can be used for conducting experiments in the 4.0 to 8.0 GeV range. It has the unique capability of providing a continuous beam as well as a pulsed beam. This feature enables it to better support nuclear physics studies because data are generated over a thousand times faster than at other pulsed-beam accelerators. Therefore, the use of an accelerator at another DOE site for the research to be conducted at a beam energy of up to 8.0 GeV is not a reasonable alternative. Furthermore, there is no SRF-based FEL facility in the world capable of producing kilowatt-level laser beams.

2.3.2 Other Technologies

Present theories about the quark-gluon structure of the atomic nucleus can be tested in a timely and cost-effective manner only with the use of a high-average-current, continuous electron beam accelerated to energies in the 4.0 to 8.0 GeV range. For this energy range, the worldwide physics research community has identified this approach as the only one capable of providing reasonable and unambiguous answers to theoretical questions. In like manner, the efficiency of the FEL laser beam cannot be matched by any present technologies. Therefore, the use of other technologies to conduct this research is not a reasonable alternative.

3. NEPA REVIEW PROCESS

3.1 SUMMARY OF 1987 EA

As mentioned in Sect. 1.1, DOE prepared an EA (DOE 1987) prior to construction and operation of CEBAF. The EA evaluated and compared the impacts of the construction and operation of a facility to utilize CEBAF technology as opposed to an alternative technology (i.e., pulsed LINAC with pulse stretcher ring), and considered alternatives to the proposed site at Newport News, Virginia (i.e., Charlottesville or Blacksburg, Virginia).

CEBAF produces an electron beam for experiments in nuclear physics, particularly for the study of quark structures and behaviors and the forces that govern the clustering of nucleons in the atomic nucleus. In the 1987 EA, impacts were evaluated for the proposed operation of an electron beam in the range of 0.5 to 4.0 GeV beam energy with a maximum beam power of 1000 kW. To be conservative, DOE estimated groundwater activation from operation at up to 6.0 GeV beam energy with a beam power of 1200 kW. The maximum beam power within the safety envelope for CEBAF is 1000 kW (SURA 1994).

DOE issued a FONSI on January 12, 1987. No significant environmental impacts were predicted for any alternatives. Short-term impacts to air quality, groundwater, soils, and ambient noise were anticipated from construction activities. Releases of radionuclides to the environment that would have adverse effects on worker and public health and/or the ecosystem were not expected from operation of CEBAF. Construction of CEBAF was completed in early 1995, and regular operations commenced shortly thereafter.

3.2 OTHER ENVIRONMENTAL REVIEWS

Since the 1987 EA and FONSI were issued, certain modifications and alterations have been made to facilities and land areas at the Jefferson Lab site, including support buildings, CEBAF, and the site infrastructure. Before these changes were implemented, they were examined relative to activities covered in the 1987 EA to determine whether further environmental reviews were necessary. With the exception of a proposed increase in the maximum CEBAF beam energy up to 6.0 GeV, for which a SA was prepared (DOE 1996) (see below), all actions were either categorically excluded using criteria in Subpart D of 10 CFR 1021, DOE NEPA Implementing Procedures, or determined to be part of the original scope of actions covered in the 1987 EA (SURA 1990; 1993b; 1996a). In addition, the commitments reported in the EA and FONSI, to take safety precautions, perform mitigation and monitoring, were reviewed to determine whether they had been implemented. Since 1987, DOE has frequently interacted with federal, state, and local agencies and authorities to stay informed of regulatory and policy changes that could affect the operation of CEBAF and the FEL.

The SA reported the results of an assessment of the potential for increased radiological releases due to intermittently increasing the CEBAF beam energy for the purposes of accelerator testing, from energies up to 4.0 GeV, with a maximum beam power of 1000 kW, to energies of 4.0 to 6.0 GeV, with a beam power no greater than 150 kW. Three sources of potential impacts were identified and examined in the SA: radiological impacts on occupational health, radiological impacts on public health, and induced radioactivity in groundwater. On examination, radiological doses to workers and the public were found to be less than those predicted in the original EA, primarily because the average beam power when operating between 4.0 and 6.0 GeV is less than 20% of present operational levels and, therefore, potential doses, which increase as beam power increases, would decrease as well. For the same reason, groundwater activation near the accelerator was expected to remain well below the 5 pCi/ml (picocuries/milliliter) limit of the Commonwealth of Virginia Pollutant Discharge Elimination System (VPDES) permit for CEBAF operation. Thus, it was determined that the action did not have the potential for causing impacts beyond those documented in the original EA and FONSI. Therefore, further NEPA review was not required.

3.3 SCOPE OF THIS EA

This EA was prepared by DOE, with the assistance of SURA and Oak Ridge National Laboratory staff, pursuant to Sect. 102 of NEPA of 1969 (Public Law 91-190), as implemented by regulations promulgated by the President's Council on Environmental Quality (40 CFR, Parts 1500–1508, November 1978) and DOE NEPA Implementing Procedures (10 CFR Part 1021, July 9, 1996). It is intended to:

- provide sufficient evidence and analysis for DOE to determine whether to prepare an EIS or a FONSI;
- assure that DOE complies with NEPA when an EIS is not necessary; and/or
- facilitate preparation of an EIS, should one be determined to be necessary.

Pursuant to Sect. 1508.9 of the Council on Environmental Quality regulations, this EA presents information and analyses of all reasonable alternatives, including the proposed action. Section 2 describes the alternatives and compares the potential environmental impacts of each. The scientific and analytical bases for the comparison of alternatives are located in Sect. 2. Sect. 4 describes the existing environment and reports the environmental impacts of the proposed action. The discussion of impacts in Sect. 4 also includes a description of any adverse effects that cannot be avoided should the proposal be implemented, any irreversible impacts, and mitigation measures, if needed, that may be initiated to minimize adverse impacts.

The proposed action is a change in operating parameters that will not require major new construction at CEBAF or at the FEL. Thus, the impact analyses in this EA focuses on (1) operation of CEBAF at a higher maximum beam energy and (2) operation of the FEL beyond demonstration parameters, in order to assess the potential for radiological impacts to the public and workers and the potential for activation of groundwater and soils near the accelerator, FEL, and experiment halls at the site. As with the proposed change in CEBAF

beam energy evaluated in the 1996 SA, there is little potential for adverse impacts to land use, socioeconomics, cultural resources, noise, non-radiological air quality, surface waters, and local and regional ecology, including protected species, because of the following:

Noise: Construction activities (e.g., pipeline installation) would be short-term and localized at the Jefferson Lab site. Given the urban nature of the site and its vicinity, noise from construction would not be unique. While sporadic noise from construction equipment and traffic would occasionally be perceptible in nearby areas, no adverse effects on human hearing would occur.

Non-radiological Air Quality: Operation of equipment and vehicles on-site would produce non-radiological emissions common to construction sites (hydrocarbons, sulfur dioxide, carbon monoxide, etc.). Emissions would be temporary and localized near the site of operation. Therefore, contribution from the proposed action to offsite concentrations of regulated non-radiological air pollutants would be minimal.

Surface Waters: Erosion and sedimentation to on-site stormwater channels and storm drainage systems could result from small (under one acre) land disturbances during on-site construction. Standard erosion control measures would be implemented during disturbance of soils to minimize runoff and potential deposit of sediments in surface waters. Dewatering effluent from CEBAF experiment halls discharged to surface drainage pathways would not differ in quantity and quality from the effluent from present CEBAF and FEL operations.

Ecology: In accordance with Section 7, Endangered Species Act requirements, DOE informally consulted with the U.S. Fish and Wildlife Service, the Commonwealth of Virginia Department of Game and Inland Fisheries, and the Virginia Department of Agriculture and Consumer Services and Bureau of Plant Protection for comment on the proposed actions. All agencies reported that no adverse impacts to protected species and/or habitat would be expected from the proposed action (see Appendix B).

Geology: The site geology was thoroughly reviewed in 1995 to support a proposal to change the status of CEBAF from a construction project to an operating facility under a Commonwealth of Virginia permit (Malcolm Pirnie, Inc. 1995). The proposed actions would not affect either site geology or soils.

Floodplain/Wetlands: The CEBAF site is not within a floodplain. In 1987, the U.S. Army Corps of Engineers determined that the forested temporary wetlands proposed to be disturbed in the course of CEBAF construction were not sufficiently permanent to qualify as wetlands. The minor land disturbance for this proposed action would be limited to non-forested areas adjacent to existing buildings and structures. Therefore, no impacts would be expected.

Cultural Resources: The Project Review Supervisor at the Commonwealth of Virginia Department of Historic Resources has advised DOE that no adverse impacts to archaeological and historic resources would be expected from the proposed action (see Appendix C).

Land Use: Proposed activities would not change the industrial nature of the site.

Socioeconomics: Labor for proposed modifications and operational changes would be drawn from the pool of SURA and other subcontractor staff at Jefferson Lab. Therefore, impacts to the local population, services, and economy would not be expected. With regard to environmental justice, there would be no disproportionate adverse impacts on minority and economically disadvantaged populations in the Newport News area because no significant adverse impacts are expected from any aspects of the proposed action.

4. ENVIRONMENTAL IMPACTS

The following sections discuss the nature and extent of potential environmental impacts that may result from the proposed change in operating parameters of CEBAF and from operation of the FEL facility for experimental purposes. As reported in Sect. 3.3, the proposed action is not expected to have substantive impacts on land use, geology, soils, cultural resources, socioeconomics, noise, non-radiological air quality, surface waters, ecology, floodplain, wetlands, and threatened and endangered species. Thus, the impact analyses that follow focus on radiation sources and potential impacts to water resources and human health.

Because of the complex nature of radiation and its effects on humans, a brief tutorial is provided to acquaint the reader with related terminology and concepts.

4.1 BACKGROUND

4.1.1 Radiation Associated with Accelerator Operation

Particle beams created by an accelerator produce (1) prompt radiation and (2) induced radioactivity in matter caused by prompt radiation. Prompt radiation is an intentional, routine consequence of accelerator operation. It is localized near the accelerator itself and can be shielded and controlled. Induced radioactivity (also called "activation") results when prompt radiation from an accelerator beam strikes matter (e.g., experimental targets, beam pipes, concrete shielding, soils, water, etc.). Radiation and the changes it causes in matter enable scientists to use accelerators to study the properties of materials or the structure of the nucleus of the atom.

Accelerator operators routinely engage in practices designed to minimize the extraneous production of radiation in undesirable locations. The quantity of induced radioactivity depends on several factors: (1) the type of accelerated particle (e.g., electron, ion, proton); (2) the beam energy; (3) the intensity (beam current); and, (4) the matter or object that it strikes (e.g., experimental targets or shielding). CEBAF and the FEL each accelerates an electron particle beam, which induces radioactivity primarily in the beam-dissipating devices (beam dumps), although the amount of induced radioactivity is substantially less than that produced by other particle (e.g., proton) accelerators with comparable power. In addition, some activation occurs in the structural material enclosing the accelerator and experimental halls (Stapleton et al. 1997). Less than 0.1% of induced radioactivity may be produced outside the accelerator enclosure, primarily in adjacent groundwater and soils. For further details on induced radioactivity the reader is referred to Barbier (1969a) and Sullivan (1992).

Accelerators and experiment facilities are typically sited either underground or at grade with thick concrete walls and substantial earth berms to provide cost-effective shielding. However, radiation can react with the shielding materials. Induced radioactivity in the materials—whether steel, lead, concrete or earth—is

related to both the composition of the material and the type of radiation interacting in the shield. To be conservative, concrete was used to form an underground enclosure that serves as primary shielding for CEBAF to prevent the production of radionuclides outside the enclosure in concentrations that would be unacceptable by regulators. In general, the induced radioactivity remains fixed-in-place in the shield material and cannot be separated from it.

In soils that contain water, some of the induced radioactivity can migrate from the soils into the groundwater. Furthermore, some radioactivity can be induced by the accelerator in the groundwater itself. Both of these mechanisms could cause the water entrained in the earth shielding to become slightly radioactive. The quantity and type of radionuclides that are found in such groundwater are related to the radiation type, its intensity, production mechanisms in the soils, and the process of nuclide transfer and solubility. In addition, the mechanisms for direct production in water are limited to radionuclides having a lower atomic weight than oxygen. For the water in earth shielding to become mixed with groundwater, there needs to be a connection between the water in the earth shielding and the water table; in many cases, this results from infiltration by precipitation. For this analysis, it was assumed that there would be a direct connection between the earth shield and the groundwater.

4.1.2 Radiation Protection at Jefferson Lab

DOE's Jefferson Lab is operated by SURA in accordance with federal laws and regulations, including those specified in a Radiation Protection Program Plan (DOE 1995b) approved by DOE. All significant aspects of radiation safety and protection, including DOE's ALARA goals, are regularly addressed in workshops and programmatic reviews.

An extensive effort is made to monitor and minimize radiation exposure at Jefferson Lab and to minimize offsite exposure of the public. To this end, administrative limits for the amount of ionizing radiation dose, structural design considerations, and good work practices have been adopted to control radiation exposure. Radiation worker exposure is limited under 10 CFR 835, *Occupational Radiation Protection*, to a maximum exposure of 5000 millirem (mrem) per year per person. Jefferson Lab has taken a more conservative approach by requiring a local investigation when a personal dose is above 1000 mrem per year without prior approval. Exposure to a worker in excess of 1000 mrem (1/5th of the limit) requires approval by the Laboratory Director and the Radiation Control Group Head. The general public and any (adult and/or minor) visitors to Jefferson Lab are limited to an annual dose of 100 mrem, unless they qualify as radiation workers.

4.2 EFFECTS ON GROUNDWATER

4.2.1 Affected Environment

The 1987 EA described regional and local hydrogeologic conditions and characteristics at Newport News, Virginia. A more recent Hydrogeologic Review (Malcolm Pirnie, Inc. 1995) focused on the portion of the site that is or could be affected by CEBAF. Updated and new information on both geology and local hydrologic patterns, such as groundwater flow, were provided. The following information on water resources at the CEBAF site is derived from this report, unless otherwise noted.

On-site surface water discharges, including the groundwater dewatering effluent, stormwater, and sump discharges pass through the on-site and of-site storm drainage channel network. This drainage channel is contiguous with Brick Kiln Creek and the Big Bethel Reservoir, which serves as a drinking water source to local military installations. The reservoir is located approximately two miles east of the accelerator site. Groundwater wells have neither been used in the past nor are they presently used as a source of either municipal (Newport News) drinking water supply or as a private source of drinking water. The groundwater dewatering withdrawal rates at the experiment halls have been fairly constant since the completion of construction in that area. Average daily discharge values have ranged from about 12,000 to 21,000 gallons and are substantially lower than originally estimated.

Monitoring wells were installed in 1989 in accordance with a Virginia Pollution Abatement (VPA) permit (VPA01001) to provide a pre-construction water quality baseline on the distribution of groundwater constituents. Following the commencement of full-scale CEBAF operations, the VPA permit conditions were reviewed by DOE and coordinated with the Virginia Department of Environmental Quality (DEQ), and plans for long-term monitoring were developed. As a result, a new VPDES permit (VA0089320) was issued that superseded the VPA permit.

Groundwater monitoring well locations and sampling frequency was selected on the basis of information provided by the Hydrogeologic Review and the subsequent VPDES permit modification request. Baseline groundwater quality for the accelerator site has been monitored under the direction of Jefferson Lab's Radiation Control Group since 1987. Background data through 1995 have been compiled for pH, conductivity, hardness, trace metals, and radionuclides and is documented by Malcolm Pirnie, Inc. (1995) and by the VPA permit modification request and addendum (Helms 1995). Currently, monitoring results at the C-ring wells are compared annually with the baseline water quality levels at the site boundary. In addition, results at the B-ring wells are compared semiannually against permit limits for the wells closer to the accelerator. Also, the results from the wells, A-ring, located closest to the CEBAF enclosure are compared quarterly against action levels.

During construction, naturally-occurring radionuclides (indicated by gross beta and gross alpha activity) were shown to be present in varying levels across the site. Since construction was completed, radionuclide levels have been below permit-specific sensitivity levels, with the exception of gross beta and gross alpha

activity, which are detectable but remain within permit limits. There have been no unexplained variations in non-radiological parameters, with no effects identified that relate to accelerator operations.

Groundwater elevation measurements, taken at the monitoring wells, have indicated that the site high groundwater elevation has shifted slightly from that described in earlier studies. Groundwater flow is generally to the east, south, and west away from the groundwater high, which is located near an open area east of the Test Lab Building and north of the North Linac Service Building near wells GW-12, GW-13, and GW-14 (see Fig. 3). The flow pattern reflects the localized influence of the groundwater dewatering system on the area groundwater flow. Water levels fluctuated during construction, but have since stabilized. Hydraulic conductivities range from 2×10^{-4} cm/sec to 1×10^{-2} cm/sec, with the seepage velocity averaging 11 m/year. The hydraulic conductivities are relatively low across the site, except for one identified area of higher conductivity extending generally northeast to southeast in the experiment hall vicinity. The groundwater velocities are relatively low and have seasonal variations.

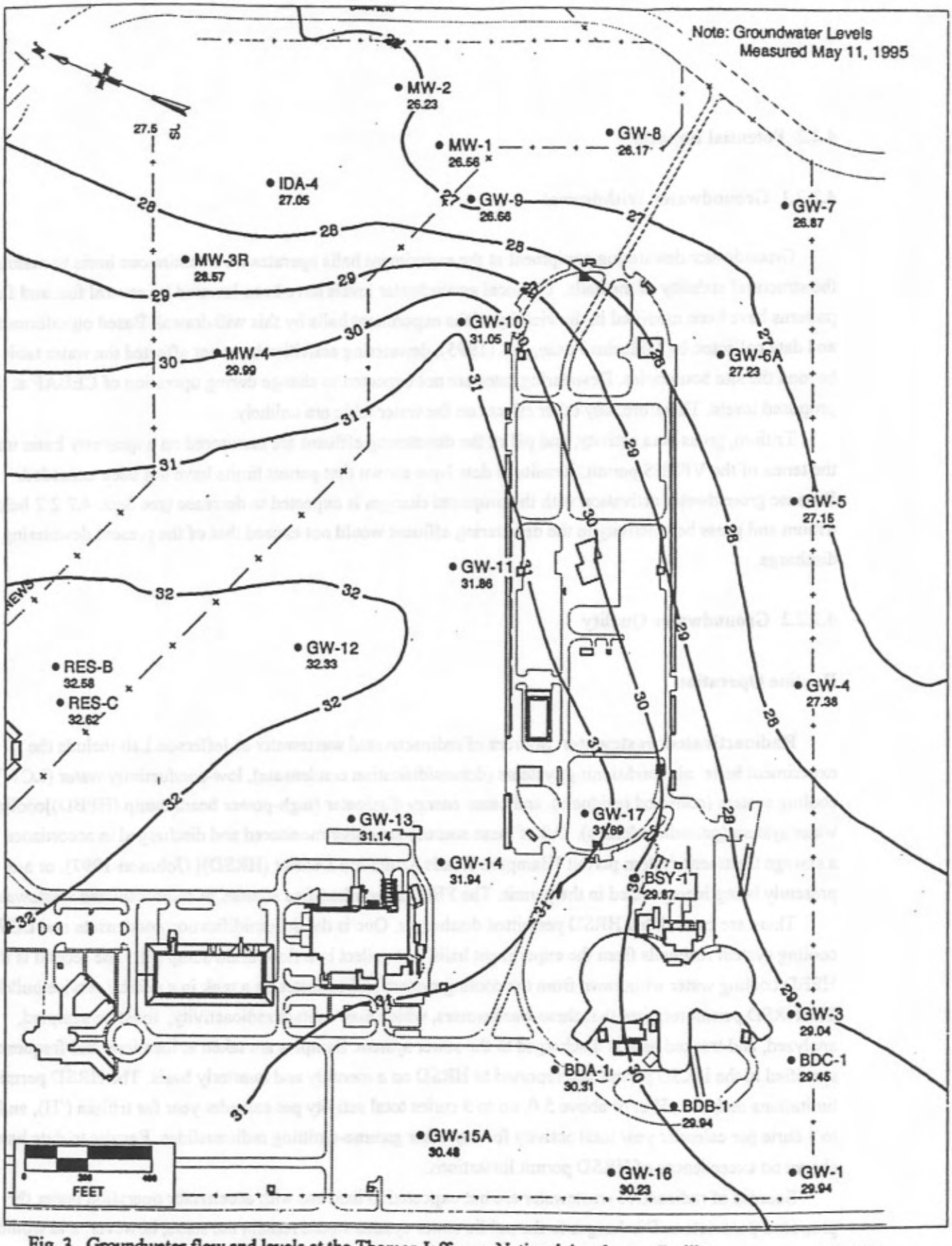

Fig. 3. Groundwater flow and levels at the Thomas Jefferson National Accelerator Facility, Newport News, Virginia

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CEBAF
VPA PERMIT MODIFICATION
NEWPORT NEWS, VIRGINIA

4.2.2 Potential Impacts

4.2.2.1 Groundwater Withdrawal

Groundwater dewatering equipment at the experiment halls operates on a continuous basis to maintain the structural stability of the halls. The local groundwater levels have been lowered by several feet and flow patterns have been modified in the vicinity of the experiment halls by this withdrawal. Based on information and data collected by Malcolm Pirnie, Inc. (1995), dewatering activities have not affected the water table beyond the site boundaries. Dewatering rates are not expected to change during operation of CEBAF at the proposed levels. Therefore, any other effects on the water table are unlikely.

Tritium, gross beta activity, and pH of the dewatering effluent are monitored on a quarterly basis under the terms of the VPDES permit. Results to date have shown that permit limits have not been exceeded. Because groundwater activation with the proposed changes is expected to decrease (see Sect. 4.2.2.2 below), tritium and gross beta activity in the dewatering effluent would not exceed that of the present dewatering discharge.

4.2.2.2 Groundwater Quality

Routine Operation

Radioactivated wastewater. Sources of radioactivated wastewater at Jefferson Lab include the experiment halls' air conditioning systems (dehumidification condensate), low-conductivity water (LCW) cooling system (collected residuals), and beam energy dissipater [high-power beam dump (HPBD)]cooling water system (periodic releases). All of these sources are either monitored and discharged in accordance with a sewage treatment system permit [Hampton Roads Sanitation District (HRSD)] (Johnson 1997), or are presently being incorporated in the permit. The FEL has no identified sources of radioactivated wastewater.

There are two related HRSD permitted discharges. One is the dehumidification condensate and LCW cooling system residuals from the experiment halls that collect in a floor drain sump pit. The second is the HPBD cooling water withdrawn from the cooling system and collected in a tank in a nearby service building. The HRSD permit requires that these wastewaters, which may contain radioactivity, must be sampled, analyzed, and tracked as it is discharged to the sewer system. Samples are taken at locations and frequencies specified in the HRSD permit and reported to HRSD on a monthly and quarterly basis. The HRSD permit limitations include: pH at or above 5.0, up to 5 curies total activity per calendar year for tritium (^{3}H), and up to 1 curie per calendar year total activity for any other gamma-emitting radionuclides. Results to date have shown no exceedences of HRSD permit limitations.

Sources of radioactive wastewater are not expected to increase with accelerator operation under the proposed parameters. Discharges to the public sewer system would remain the same, however, and would

continue to be regulated in accordance with the HRSD permit. Because of this, no additional impacts are projected for operation under the proposed parameters.

Activated groundwater. CEBAF was designed and constructed with additional shielding at locations where prompt radiation had the greatest potential to affect groundwater. However, because groundwater across the accelerator site is shallow and influenced by site drainage, especially at the groundwater dewatering operation, there is a concern that induced radioactivity in groundwater could be transported to local surface waters and ultimately to the drinking water supply in Big Bethel Reservoir located about 2 miles east of the CEBAF Site.

The VPDES permit regulates groundwater quality by placing limits on the radioactivity in the groundwater around the accelerator enclosure and experiment halls, an area that includes the FEL facility. Areas of concern are the beam dump areas, especially the two HPBDs in Halls A and C, and the beam spreader and beam recombiner areas located at each end of the North and South Linacs (see Fig. 1). Quarterly sampling of the 'A' ring wells, semi-annual sampling of the 'B' ring wells, and annual sampling of the 'C' ring wells and the upgradient well are required (see Fig. 4). Parameters monitored are gross beta and potential accelerator-generated radionuclides such as: manganese-54 (^{54}Mn), tritium (^{3}H), sodium-22 (^{22}Na), and beryllium-7 (^{7}Be). Other non-radiological parameters monitored are pH, conductivity, total suspended solids, and total dissolved solids. Results to date show variations in these constituents with season, location, and construction-related factors. To date, Jefferson Lab has been in compliance with all permit requirements.

DOE reported estimates of groundwater activation in the 1987 EA for operation of CEBAF up to a maximum beam energy of 6.0 GeV at 1200 kW beam power. Operating experience, groundwater testing, and calculations have demonstrated that shielding has functioned adequately for beam energies up to 4.0 GeV at 1000 kW beam power (Stapleton et al. 1997). Table 2 provides the maximum pre-operational concentrations of radionuclides measured in groundwater from December 1990 to December 1995. The measurements taken at the C-ring wells were incorporated into the VPDES permit for CEBAF operation as action levels or limits. Since CEBAF began operating in late 1995, radionuclides in groundwater nearest the accelerator enclosure, which has the greatest potential to be affected, have been measured most frequently. Results from all sampling indicate that the predictions made in the EA were conservative (Stapleton et al. 1997). All 1996 operational concentrations of radionuclides measured in groundwater reported to the Commonwealth of Virginia have been less than permit limitations (Table 3), except for a fourth-quarter sample from well GW-20. In this sample, the gross beta concentration exceeded the VPDES permit limit of 50 pCi/L. The source of the exceedence was investigated, and it was determined that the activity was due to the presence of naturally-occurring radionuclides of radium and thorium, which are not accelerator-produced. In reality, therefore, Jefferson Lab did not exceed its VPDES permit limitations during routine operations (SURA 1996b).

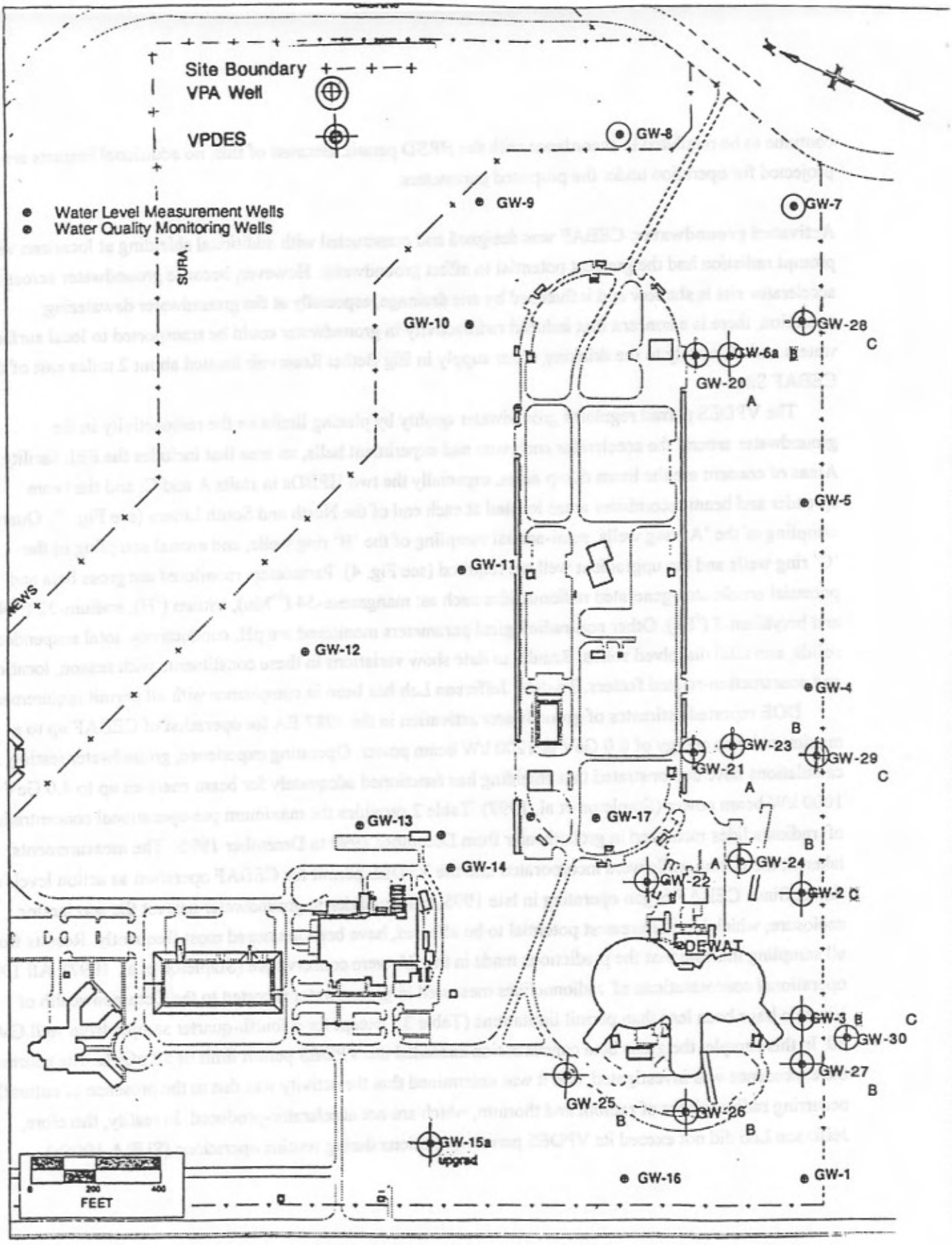

Fig. 4. Monitoring well locations at Thomas Jefferson National Accelerator Facility, Newport News, Virginia.

Table 2. Maximum pre-operational concentrations of radionuclides measured in groundwater at the Thomas Jefferson National Accelerator Facility, Newport News, Virginia, December 1990 through December 1995

Analyte	A-ring	B-ring	C-ring[a/c]
Gross beta[b]	<50 pCi/L	<50 pCi/L	<153 pCi/L
Manmade radioactivity[b]	<1 mrem/yr	<1 mrem/yr	—[d]
Tritium	<5000 pCi/L	<5000 pCi/L	<1000 pCi/L
Sodium-22	<40 pCi/L	<40 pCi/L	<61 pCi/L
Beryllium-7	<600 pCi/L	<600 pCi/L	<835 pCi/L
Manganese-54	<30 pCi/L	<30 pCi/L	<51 pCi/L

[a]Incorporated into VPDES permit for CEBAF operation as permit action levels/limits.
[b]May be a result of naturally-occurring or accelerator-produced radioactivity.
[c]Numbers are representative of pre-operational radionuclide concentrations plus 2 standard deviations, which represent a 99% certainty that deviations above this level are not random.
[d]Baseline data was collected but no permit or action limits were defined under the VPA permit.

Conversion note: 1 pCi = 0.037 Bq, 1 mrem = 0.01 mSv.

Table 3. Maximum concentrations of radionuclides measured in groundwater during CEBAF operation at the Thomas Jefferson National Accelerator Facility, Newport News, Virginia, January 1996 through December 1996

Analyte[e]	A-ring	B-ring	C-ring
Gross beta[a/c]	54.5 ± 8.6 pCi/L[b]	32.9 ± 2.3 pCi/L	14.7 ± 0.7 pCi/L
Manmade radioactivity[a]	<0.063 mrem/yr	<0.079 mrem/yr	—[e]
Tritium	<1000 pCi/L	<1000 pCi/L	<1000 pCi/L
Sodium-22	<40 pCi/L	<40 pCi/L	<40 pCi/L
Beryllium-7	<600 pCi/L	<600 pCi/L	<600 pCi/L
Manganese-54	<30 pCi/L	<30 pCi/L	<30 pCi/L

[a]May be a result of naturally-occurring or accelerator-produced radioactivity.
[b]GW-20 was reanalyzed after removal of solids containing naturally-occurring radionuclides with DEQ approval. Sample value after reanalysis was <50 pCi/L.
[c]± represents 2 standard deviations.
[d]Radionuclides are analyzed at Environmental Protection Agency (EPA) sensitivity levels or better where applicable.
[e]No permit limits specified.

Conversion note: 1 pCi = 0.037 Bq, 1 mrem = 0.01 mSv.

Groundwater activation by prompt radiation is directly proportional to the operating electron beam power. During routine operation at 8.0 GeV, induced radioactivity would be constrained by the 1 MW power limit established for safe operation of CEBAF (SURA 1994). With a beam energy of 8.0 GeV, there would be a corresponding decrease in beam current to maintain the beam power at or below 1 MW. Thus, there would be no effective increase in the electron beam power during the proposed action, and a net change in the quantity of groundwater activation products would not be anticipated.

Accidents

The non-routine release of activated waters, including HPBD cooling water, dehumidification condensate, or LCW cooling water, could introduce radioactivity into soils and groundwater. The proposed changes in CEBAF operating parameters would not change the nature and quantity of radionuclides from any of these sources and no effluents of this nature are expected from FEL operations. Therefore, even if an accident was to occur, impacts would be the same as those from operation at present operating levels.

To mitigate non-routine releases across the site, containment features have been incorporated for each potential source of contamination. The experiment halls "A" and "C" HPBD cooling systems are positioned partly above ground, each in a separate pumproom building and below ground in a tunnel segment. Other containment features for the HPBD cooling system contents include (1) a sump in the above ground pumproom that has been designed to hold the capacity of the above ground piping; (2) a leak detection system; and, (3) two weirs located in each HPBD tunnel segment that have been designed to contain the total volume of water present in the below-ground piping. Suction piping at each weir, that is controlled by locked valves, is designed to remove spilled liquids to a temporary storage tank.

Another part of the HPBD program involves removing small quantities of water from the two cooling systems and collecting it in a HRSD-permitted sampling point (a storage tank) prior to a controlled discharge to the HRSD system. To mitigate releases from this system, pipelines located underground are double-walled and the HRSD sampling point is located inside a building at a position remote from all floor drains. No inadvertent releases of HPBD cooling water have reached any floor drain or the ground surface to date (SURA 1997b).

To mitigate releases of experiment hall area dehumidification condensate and LCW system leaks, the experiment hall staff has implemented the Jefferson Lab's Spill Prevention, Control, and Countermeasure (SPCC) Plan. These effluents are collected by way of a floor drain system and a floor drain sump pit. The contents are sampled and either released to HRSD, or transferred to another storage location for appropriate handling.

The SPCC's program also allows for shut-off of the automated sewer discharge mechanism in the floor drain sump pit, which has substantial reserve capacity. Sumps associated with the floor drain sump pit and experiment hall dewatering collection pits are monitored by automated sampling equipment. The SPCC identifies other controls to provide further containment. If an inadvertent release reaches the ground surface, it

would be contained locally by spill control equipment or retained on-site by the closing of sluice gates positioned near the property boundary.

4.2.2.3 Cumulative Impacts

Cumulative impacts are those which result from the incremental contribution of impacts of the proposed action with impacts expected from other past, ongoing, or planned actions within the same geographic area. Aside from the actions evaluated in this EA, there are no other sources of induced radioactivity either existing or planned for the CEBAF area. The impact of CEBAF and the FEL are offset by factors such as radioactive decay and dilution. The net effect is a steady-state condition which result in radioactivity levels well below permit limits and are, therefore, inconsequential.

4.3 HEALTH AND SAFETY

4.3.1 Radiological Effects

4.3.1.1 Radiological Background Exposure

Humans are exposed to natural background radiological sources in the form of terrestrial radionuclides (e.g., ^{3}H, ^{7}Be, ^{14}C, ^{22}Na) and ^{238}U by-products and extra-terrestrial radiation (solar and cosmic rays). The total estimated average annual whole-body dose received by a typical resident in the Newport News vicinity from natural background radiation is about 278 mrem/yr (millirem/year) (NCRP 1987). For comparison, the average annual contributions from cosmic and terrestrial radiation for the Commonwealth of Virginia are 43 mrem and 235 mrem, respectively. These, added to the internal sources, yield a dose of 296 mrem for the average Virginia resident.

4.3.1.2 Impacts to Radiation Workers

Most of the occupational radiation exposure at Jefferson Lab would continue to occur during maintenance activities on activated components. The level of induced radioactivity in the components is directly proportional to the amount of electron beam power lost in the components. CEBAF operation at energies up to 8.0 GeV would result in beam power to the same maximum level as operation at 4.0 GeV. Consequently, changes in beam energy as proposed would not be expected to increase occupational radiation exposure.

The DOE regulatory limit for occupational exposure of radiation workers is 5000 mrem/year (5 rem/year). Jefferson Lab facilities were designed to maintain radiation worker exposure at less than 250 mrem/year, in accordance with DOE's ALARA objective. The 250 mrem/year administrative limit

applies to all Jefferson Lab radiation workers, whether they work at CEBAF, the FEL, or both. This administrative limit applies to the cumulative occupational exposure from all operations and maintenance activities involving the FEL and CEBAF. Present operations, which implement engineering and administrative controls such as shielding, the Personnel Safety System, interlocks, and beam absorbers, typically result in annual exposures much less than the 250 mrem/year design goal. In 1996, less than 1% of those occupationally exposed to radiation had doses in excess of 100 mrem (SURA 1997a).

4.3.1.3 Effects of Prompt Radiation on the General Public

The annual DOE regulatory limit for prompt radiation exposure to members of the general public is 100 mrem (10 CFR 835). Normal practice for implementing this limit is to identify a critical population near a facility and estimate and measure their resultant exposure to the radiation produced by the facility. DOE and Jefferson Lab, however, have adopted a "good neighbor" policy, which requires that radiation exposure of the affected population near CEBAF be maintained much below any regulatory limit. Consequently, a design goal of 10% of the regulatory limit at the site boundary was established for the Jefferson Lab site (DOE 1995) and was incorporated in Jefferson Lab policy as stated in the CEBAF FSAD (SURA 1994).

The chief source of radiation exposure for members of the general public is "skyshine" radiation. Skyshine is due to neutrons, escaping through the soil on each end station roof that serves as shielding, that scatter back to earth from the air. An analysis of skyshine production mechanisms for an electron beam energy in excess of 4 GeV has shown that, for constant beam power, the number of neutrons directed toward each experiment hall roof tends to decrease as beam energy increases. Thus, with the 1 MW beam power limit and a beam energy increase up to 8.0 GeV, skyshine radiation exposure to the general public would not increase and would most likely decrease.

Reasonable methods of calculation for a wide range of operating conditions have been used to estimate a dose to members of the general public at the site boundary and allow DOE to manage the annual radiation dose effectively. To date, more than a year of experimental physics operations have been performed at CEBAF, and neutron radiation measurements at the site boundary, when compared with estimates derived from calculation, indicate that estimates were reasonably accurate. These measurements substantiate the methodology used in the 1987 EA (Stapleton et al. 1997) and confirm that, under present conditions, DOE is meeting its administrative control level policy of 10% of the regulatory limit for radiation exposure to the general public.

4.3.1.4 Effects of Airborne Radionuclides, Ozone, and Nitrogen Oxides

The public may be exposed to small quantities of radioactivity induced in air in the CEBAF enclosure as a result of nominal ventilation during routine operations. No airborne emissions are expected from the FEL that would contribute to the radiological dose to workers and the public.

The EPA dose limit to members of the general public from radioactive material in air is 10 mrem/year. The EPA also requires that periodic confirmatory measurements be made if the calculated dose to members of the general population exceeds 1% of this annual limit.

Calculations for Jefferson Lab indicate that current CEBAF operations result in dose levels to the general public of 4.1×10^{-3} mrem/yr (Stapleton et al. 1997). This is 0.04% of the annual limit of exposure, and 4% of the level where annual real-time monitoring would be required.

The activated air would also contain the pollutants ozone and oxides of nitrogen. Ozone concentrations have been calculated and measured at CEBAF. The concentration is highest in the experiment halls; peak levels have been measured at less than 10 parts per million. However, the time-weighted average concentration of ozone has been below the Occupational Safety and Health Administration (OSHA) limit and the American Conference of Governmental Industrial Hygienists' Threshold Limit Values (TLV) for occupational exposure (0.1 parts per million) (Stapleton et al. 1997). Because of normal chemical dissociation and ventilation loss when the beam is off, unsafe levels of ozone and oxides of nitrogen cannot be sustained.

The production of ozone, oxides of nitrogen, and radioactive gases have been shown to be directly proportional to the amount of beam power loss (Stapleton et al. 1997). Because the beam power loss at the experiment halls, the primary generation area, is expected to decrease under the proposed action, the amount of ozone, nitrogen oxides and radioactive gases should correspondingly decrease. Thus, effects of airborne radionuclides, ozone, and nitrogen oxides would be less than current effects with the proposed change in operating parameters.

4.3.2 Non-radiological Hazards

Non-radiological hazards associated with the proposed action include electrical hazards, chemical hazards, and non-ionizing radiation hazards (lasers), which could injure and in extreme cases, kill occupational workers. All such hazards were examined in the CEBAF FSAD and reexamined in the recently concluded Work Smart Standards effort at Jefferson Lab. The appropriate regulatory standards that are needed to control the hazards were also identified and are implemented through the Jefferson Lab Environment, Health, and Safety (EH&S) Manual.

Electrical hazards include the potential for electric shock and injury from accidental exposure to RF power. Electric shock hazards are well understood and are readily prevented by standard industry practices. RF power can cause burns to those nearby if a wave-guide is damaged so that it allows RF power to leak. Administrative procedures in place at Jefferson Lab to minimize such accidents are specified in the Jefferson Lab EH&S Manual.

The principal chemical hazard at Jefferson Lab is buffered chemical polish, which is a mixture of nitric, phosphoric, and hydrofluoric acids. A spill could lead to burns from splashed liquid and lung damage from acid mists to those in the immediate vicinity. Procedures to minimize such accidents are specified in the Jefferson Lab EH&S Manual.

Non-ionizing radiation exists at Jefferson Lab principally in the form of laser beams and laser systems. Hazards associated with the use of lasers are direct exposure to the laser light and exposure to specular or diffuse reflections. Procedures for laser safety require that each potential experimenter be formally trained in local safety regulations and specific safety procedures for their test area. Safety operating procedures are developed and approved by the Jefferson Lab Laser System Supervisor and signed off by the Laser Safety Officer. Operation of the FEL beyond the demonstration phase would present no additional laser impacts than those already identified.

4.3.3 Cumulative Impacts

Cumulative impacts are those which result from the incremental contribution from each effect discussed above along with impacts expected from other past, ongoing, or planned actions within the same geographic area. As long as the weekly average beam power does not exceed 1 MW, operations at the proposed levels would not have a measurable effect on human health and safety compared to continuous running at 1 MW over the same time period. Aside from the actions evaluated in this EA, there are no other sources of radiation either existing or planned for the CEBAF area. Thus, the operation of CEBAF and the FEL would not result in cumulative impacts to occupational and public health and safety.

4.4. IMPACTS OF NO ACTION

If no action is taken on this proposal, DOE would continue operating CEBAF within a beam energy range up to 4.0 GeV, until the potential value of experiments is exhausted. The FEL would continue to operate in a demonstration mode until FY 99. With no action, the environmental effects of CEBAF operation would continue to be minimal, as they have been over the past year of operation.

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6. LIST OF PREPARERS

J. R. Boyce, Accelerator Division, Jefferson Lab; Ph.D., Duke University; 25 years experience in establishing accelerator-based research facilities (Duke, Cornell, Schlumberger-Doll Research, CEBAF), served in safety capacity at each, and five years as EH&S Officer for Accelerator Division, Jefferson Lab. Contribution: reviewer Sections 1, 2, and 3; co-author Section 4.

A. W. Campbell, CEP, U.S. Department of Energy, Oak Ridge Operations, Oak Ridge, Tennessee; M.S., B.S., Biology, Wilkes University (PA);18 years experience in NEPA review and environmental impacts assessment. Contribution: author Sections 1 and 2; co-author Section 3; reviewer Section 4.

J. T. Ensminger, Oak Ridge National Laboratory, Oak Ridge, Tennessee; M.S., Biology, East Tennessee State University; B.S., Environmental Health Sciences, East Tennessee State University; 20 years experience in environmental assessment. Contribution: EA coordination; co-author Section 3.

L. L. Even, Office of Technical Performance, Jefferson Lab; B.S., Environmental Engineering, Northwestern University; M.S., Civil Engineering, Illinois Institute of Technology; 12 years experience in environmental protection projects and environmental program development. Contribution: reviewer Sections 1, 2, and 3; co-author Section 4.

M. G. Huskey, Oak Ridge National Laboratory, Oak Ridge, Tennessee; A.S., Professional Secretary, Knoxville Business College; 13 years experience in environmental document preparation. Contribution: publishing coordination.

R. T. May, CHP; Radiation Control Group Head, Accelerator Division, Jefferson Lab; B.S., Virginia Polytechnic Institute and State University; 19 years of experience in Radiological Controls for Environmental, Industrial and Research Applications. Contribution: reviewer Sections 1, 2, and 3; co-author Section 4.

B. M. Morgan, CSP, CHMM; U.S. Department of Energy, Jefferson Lab Site Office; M.S., Industrial Hygiene, Old Dominion University; 16 years experience in Environment, Health, and Safety. Contribution: NEPA Document Manager, reviewer Sections 1, 2, and 3; co-author Section 4; author Section 5.

APPENDIX A

PROGRAM ADVISORY COMMITTEE FOR THOMAS JEFFERSON NATIONAL ACCELERATOR FACILITY

The Program Advisory Committee that was established by Thomas Jefferson National Accelerator Facility (Jefferson Lab) is comprised of many internationally recognized scientists in the nuclear physics community. Membership and frequency of meetings vary. The functions of the Program Advisory Committee include (1) review proposals, extensions, and updates and provide advice on the scientific merit, technical feasibility, and resource requirements of proposed experiments, (2) recommend one of four actions on each proposal, extension, or update (approve, conditionally approve, defer, reject), (3) provide a scientific rating and recommend beam-time allocation for all approved proposals, and (4) provide comments on letters of intent. A list of current members follows.

Brad Filippone (Chair)
California Institute of Technology
Kellogg Radiation Laboratory
Pasadena, CA 91125
Phone/Fax: (818) 395-4517/564-8708
Email: brad@erin.caltech.edu

Jean-Marc Laget
DAPNIA/SPhN
Orme des Merisiers
CEN Saclay
91191 Gif-Sur-Yevette Cedex, France
Phone/Fax: 011-33-16-908-7554/7584
Email: laget@phnx7.saclay.cea.fr

Bernard Frois
DAPNIA/SPhN
BAT 703, Rm 106
CEN Saclay
91191 Gif-sur-Yvette, France
Phone/Fax: 33-1-693 10443/33-1-690-87584
Email: b.frois@cea.fr

Robert Lourie
Renaissance Technology
25 E. Loop Road, Suite 211
Stony Brook, NY 11780
Phone/Fax: (516) 246-5550/5761
Email: lourie@rentec.com

Don Geesaman
Argonne National Laboratory
Physics Division, Bldg. 203
9700 South Cass Avenue
Argonne, IL 60439
Phone/Fax: (708) 252-4059/3903
Email: geesaman@anlphy.phy.anl.gov

Vijay Pandharipande
Department of Physics
University of Illinois at Urbana
1110 W. Green St
Urbana, IL 61801
Phone/Fax: (217) 333-8079/9819
Email: vijay@rsm1.physics.uiuc.edu

Bernie Gittelman
Laboratory for Nuclear Studies
Cornell University
Ithaca, NY 14853
Phone: (607) 255-4882
Email: bg@lns62.lns.cornell.edu

Berthold Schoch
Physikalishes Institute
Universitaet Bonn
D 53115 Bonn, Germany
Email: schoch@physik.uni-bonn.de

Wick Haxton
Department of Physics—FM 15
University of Washington
Seattle, WA 98195
Phone/Fax: (206) 685-2397/0635
Email: haxton@phys.washington.edu

Steven Vigdor
Indiana University
Department of Physics
Swain West 117
Bloomington, IN 47405
Phone: (812) 855-9369
Email: vigdor@indiana.edu

Harold Jackson
Physics Department
Argonne National Laboratory
Argonne, IL 60439
Phone/Fax: (630) 252-4013/3903
Email: hal@anl.gov

Glenn R. Young
Physics Division
Oak Ridge National Laboratory
P.O. Box 2008, MS 6372
Oak Ridge, TN 37831-6372
Phone/Fax: (423) 576-2770/2822
Email: young@orph01.phy.ornl.gov

APPENDIX B

THREATENED AND ENDANGERED SPECIES CONSULTATION

Department of Energy
Oak Ridge Operations Office
Thomas Jefferson National
Accelerator Facility Site Office
12000 Jefferson Avenue
Newport News, Virginia 23606

April 21, 1997

Ms. Cindy Schulz
U.S. Fish and Wildlife Service
P.O. Box 99
Gloucester, VA 23061

Dear Ms. Schulz:

U.S. DEPARTMENT OF ENERGY PROPOSAL TO CHANGE OPERATING PARAMETERS OF THE CONTINUOUS ELECTRON BEAM ACCELERATOR FACILITY

On behalf of the U.S. Department of Energy (DOE) I am writing to advise you of a proposal to change the operating parameters of the Continuous Electron Beam Accelerator Facility (CEBAF), which is located at the Thomas Jefferson National Accelerator Site (Jefferson Lab) in Newport News, Virginia (Figure 1 attached). The CEBAF is managed and operated by the Southeastern Universities Research Association, Inc. (SURA) under contract to DOE. The accelerator produces an electron beam for experiments in medium energy physics, in particular, for the study of the quark and gluon sub-structure in the atomic nucleus.

The proposed changes in the operating parameters of the CEBAF would require only minor modifications to the accelerator, its support systems, and onsite utility systems. In addition, the proposed action would involve the use of the Free Electron Laser (FEL) facility up to its maximum design power level of 500 kilowatts (kW) of radiofrequency. Operating parameters of the CEBAF would change as follows:

	Present Level		Proposed Level
	Physics Experiments	Accelerator Testing	All Operating Conditions
Maximum Beam Energy	4.0 GeV	6.0 GeV	8.0 GeV
Maximum Beam Power	1.0 megawatt(MW)	150kW	1000kW(1MW)

The operating beam current will vary depending on the experiment or tests up to the design value of 200 uA, but the product of beam current times beam energy (which is beam power) will not exceed the Maximum Beam Power Level.

To accomplish these changes, minor modifications and performance improvements would be made to the CEBAF and its support systems, primarily in the underground tunnels housing the accelerator. (Figure 1, inside the black fence area.).

In compliance with the National Environmental Policy Act of 1969 (NEPA), DOE issued an environmental assessment (DOE/EA-0057) and Finding of No Significant Impact in 1987 for the initial construction and operation of the CEBAF at 4.0 GeV maximum beam energy. With this proposal, DOE intends to increase the beam energy of the CEBAF to 8.0 GeV, its maximum attainable level without significant, costly equipment modifications. DOE has initiated an EA to address this action because of the potential for increased radiological activation products from CEBAF operation.

Information presented in the 1987 EA concerning federally listed protected species and habitat and potential ecological impacts is obviously outdated. In the spirit of Section 7 of the Endangered Species Act, informal consultation requirements, we would appreciate your assistance in the preparation of this EA. We request that you provide to us any current information about threatened and endangered species and protected habitat at and near the Jefferson Lab site for inclusion in our EA.

If you have any questions or concerns about this request or our EA proposal, please contact Ms. Barbara Morgan, DOE Site Office at (757) 269-7139 or e-mail at: bmorgan@cebaf.gov. Thank you in advance for your assistance in this endeavor.

Sincerely,

K. Dean Helms, Manager
Jefferson Lab Site Office

cc:
J. Rothrock, ORO/SE -31
H. Monroe, ORNL Site Office
D.R. Allen, ORO Acting NCO/SE-32

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
P.O. Box 99
6669 Short Lane
Gloucester, Virginia 23061

June 17, 1997

Mr. K. Dean Helms
Department of Energy
Thomas Jefferson National
Accelerator Facility Site Office
12000 Jefferson Avenue
Newport News, Virginia 23606

Re: Continuous Electron Beam
Accelerator Facility, Jefferson Lab,
Newport News, Virginia

Dear Mr. Helms:

We have reviewed your request for information on endangered and threatened species and their habitats for the above referenced project. Based on the project description and location, it appears that no impacts to federally listed species will occur. Should project plans change, or if additional information on the distribution of listed or proposed species becomes available, this determination may be reconsidered.

Sincerely,

Karen L. Mayne

Karen L. Mayne
Supervisor
Virginia Field Office

Department of Energy
Oak Ridge Operations Office
Thomas Jefferson National
Accelerator Facility Site Office
12000 Jefferson Avenue
Newport News, Virginia 23606

April 21, 1997

Mr. Ray Fernald
Chief, Wildlife Information and Management
Department of Game and Inland Fisheries
4010 W. Broad Street
Richmond, VA 23230

Dear Mr. Fernald:

U.S. DEPARTMENT OF ENERGY PROPOSAL TO CHANGE OPERATING PARAMETERS OF THE CONTINUOUS ELECTRON BEAM ACCELERATOR FACILITY

On behalf of the U.S. Department of Energy (DOE) I am writing to advise you of a proposal to change the operating parameters of the Continuous Electron Beam Accelerator Facility (CEBAF), which is located at the Thomas Jefferson National Accelerator Site (Jefferson Lab) in Newport News, Virginia (Figure 1 attached). The CEBAF is managed and operated by the Southeastern Universities Research Association, Inc. (SURA) under contract to DOE. The accelerator produces an electron beam for experiments in medium energy physics, in particular, for the study of the quark and gluon sub-structure in the atomic nucleus.

The proposed changes in the operating parameters of the CEBAF would require only minor modifications to the accelerator, its support systems, and onsite utility systems. In addition, the proposed action would involve the use of the Free Electron Laser (FEL) facility up to its maximum design power level of 500 kilowatts (kW) of radiofrequency. Operating parameters of the CEBAF would change as follows:

	Present Level		Proposed Level
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Maximum Beam Energy	4.0 GeV	6.0 GeV	8.0 GeV
Maximum Beam Power	1.0 megawatt(MW)	150kW	1000kW(1MW)

The operating beam current will vary depending on the experiment or tests up to the design value of 200 uA, but the product of beam current times beam energy (which is beam power) will not exceed the Maximum Beam Power Level.

To accomplish these changes, minor modifications and performance improvements would be made to the CEBAF and its support systems, primarily in the underground tunnels housing the accelerator. (Figure 1, inside the black fenced-in area.)

In compliance with the National Environmental Policy Act of 1969 (NEPA), DOE issued an environmental assessment (DOE/EA-0057) and Finding of No Significant Impact in 1987 for the initial construction and operation of the CEBAF at 4.0 GeV maximum beam energy. With this proposal, DOE intends to increase the beam energy of the CEBAF to 8.0 GeV, its maximum attainable level without significant, costly equipment modifications. DOE has initiated an EA to address this action because of the potential for increased radiological activation products from CEBAF operation.

Information presented in the 1987 EA concerning federally listed protected species and habitat and potential ecological impacts is obviously outdated. We would appreciate your assistance in the preparation of this EA. We request that you provide to us any current information about species and habitats at and near the Jefferson Lab site that are protected by the Commonwealth of Virginia for inclusion in our EA.

If you have any questions or concerns about this request or our EA proposal, please contact Ms. Barbara Morgan, DOE Site Office at (757) 269-7139 or e-mail at: bmorgan@cebaf.gov. Thank you in advance for your assistance in this endeavor.

Sincerely,

K. Dean Helms, Manager
Jefferson Lab Site Office

cc:
J. Rothrock, ORO/SE -31
H. Monroe, ORNL Site Office
D.R. Allen, ORO Acting NCO/SE-32

COMMONWEALTH of VIRGINIA

George Allen
Governor
Becky Norton Dunlop
Secretary of Natural Resources

Department of Game and Inland Fisheries

William L. Woodfin, Jr.
Director

June 18, 1997

K. Dean Helms, Manager
Department of Energy
Jefferson Lab Office
12000 Jefferson Avenue
Newport News, Virginia 23606

RE: Department of Energy
Electron Beam Accelerator Facility
City of Newport News
ESSLOG# 10136

Dear Mr. Helms:

Thank you for your letter dated 21 April 1997 to Ray Fernald, DGIF, regarding the project referenced above. The Department of Game and Inland Fisheries, under Title 29.1 of the Code of Virginia, is the primary wildlife and freshwater fish management agency in the Commonwealth. We have full law enforcement and regulatory jurisdiction over those resources, inclusive of state or federally *endangered* or *threatened* species, but excluding listed insects. We are a consulting agency under the U.S. Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et *seq.*), and we provide environmental analysis of projects or permit applications coordinated through the Virginia Department of Environmental Quality, the Virginia Marine Resources Commission, the Virginia Department of Transportation, the U.S. Army Corps of Engineers, the Federal Energy Regulatory Commission, and other state or federal agencies. Our role in these procedures is to determine likely impacts upon fish and wildlife resources and habitats, and to recommend appropriate measures to avoid, reduce, or compensate for those impacts.

Primary issues of concern to our agency include impacts upon upland, wetland, and aquatic fish and wildlife resources and habitats; instream flow management; *endangered* or *threatened* species management; and impacts upon streams or other surface waters and interconnected groundwaters. Sediment and erosion control, water quality protection, and proper disposal or handling of hazardous or toxic materials also are of concern when these issues may impact fish and wildlife resources.

The applicant proposes modifications to the operating parameters at the Continuous Electron Beam Accelerator Facility which include minor changes to the accelerator, support systems, and onsite utility systems. Based on a review of our wildlife databases and the limited scope of the project, we do not anticipate significant adverse impacts upon wildlife resources under our jurisdiction to result from this

project. We recommend strict erosion and sediment control as outlined in the *Virginia Erosion and Sediment Control Handbook*, 1992, Virginia Department of Conservation and Recreation.

Thank you for the opportunity to comment on this proposed project. Please call me at (804) 367-8999 if I may be of further assistance.

Sincerely,

Thomas F. Wilcox, Biologist
Environmental Services Section

Department of Energy
Oak Ridge Operations Office
Thomas Jefferson National
Accelerator Facility Site Office
12000 Jefferson Avenue
Newport News, Virginia 23606

June 20, 1997

Mr. John Tate
Virginia Department of Agriculture
& Consumer Services,
Bureau of Plant Protection
P.O. Box 1163
Richmond, VA 23218

Dear Mr. Tate:

U.S. DEPARTMENT OF ENERGY PROPOSAL TO CHANGE OPERATING PARAMETERS OF THE CONTINUOUS ELECTRON BEAM ACCELERATOR FACILITY

In accordance with the telephone conversation between yourself and Barbara Morgan of my staff, I am writing this letter on behalf of the U.S. Department of Energy (DOE) to advise you of a proposal to change the operating parameters of the Continuous Electron Beam Accelerator Facility (CEBAF), which is located at the Thomas Jefferson National Accelerator Site (Jefferson Lab) in Newport News, Virginia (Figure 1 attached). The CEBAF is managed and operated by the Southeastern Universities Research Association, Inc. (SURA) under contract to DOE. The accelerator produces an electron beam for experiments in medium energy physics, in particular, for the study of the quark and gluon sub-structure in the atomic nucleus.

The proposed changes in the operating parameters of the CEBAF involve work that will be performed primarily inside existing buildings or structures. There will be minor work in outside areas, and any ground disturbance would be performed adjacent to existing structures or utilities on land previously disturbed. In addition, the proposed action would involve the use of the Free Electron Laser (FEL) facility up to its maximum design power level of 500 kilowatts (kW) of radiofrequency.

In compliance with the National Environmental Policy Act of 1969 (NEPA), DOE issued an environmental assessment (DOE/EA-0057) and Finding of No Significant Impact in 1987 for the initial construction and operation of the CEBAF at 4.0 GeV maximum beam energy. With this proposal, DOE intends to increase the beam energy of the CEBAF to 8.0 GeV, its maximum attainable level without significant, costly equipment modifications. DOE has initiated an EA to address this action to fully investigate the potential for increased radiological activation products from CEBAF operation.

Information presented in the 1987 EA concerning federally and Commonwealth of Virginia listed protected species and habitat and potential ecological impacts is obviously outdated. We would appreciate your assistance during the preparation of this EA. We request that you provide to us any current information about species and habitats at and near the Jefferson Lab site that your Department anticipates would be affected by the proposed change in operating parameters that are protected by the Commonwealth of Virginia for inclusion in our EA.

If you have any questions or concerns about this request or our EA proposal, please contact Ms. Barbara Morgan, DOE Site Office at (757) 269-7139 or e-mail at: bmorgan@cebaf.gov. Thank you in advance for your assistance in this endeavor.

Sincerely,

Jerry M. Conley

Jerry M. Conley, Deputy Manager
TJNAF Site Office

Enclosure

cc:
R. Rothrock
H. Monroe, ORNL Site Office
D.R. Allen, ORO Acting NCO, SE-32

BAG4:STATE INSECT:6/20/97:

J. Carlton Courter, III
Commissioner

COMMONWEALTH of VIRGINIA

Department of Agriculture and Consumer Services
Division of Consumer Protection
Office of Plant & Pest Services
PO Box 1163, Richmond, Virginia 23218
Phone: 804/786-3515 • Fax: 804/371-7793 • Hearing Impaired: 800/828-1120
http://www.state.va.us/~vdacs/vdacs.htm

June 25, 1997

Mr. Jerry M. Conley
Department of Energy
Oak Ridge Operations Office
1200 Jefferson Avenue
Newport News, VA 23606

RE: Operating Parameters of the Continuous Electron Beam Accelerator Facility

Dear Mr. Conley:

This letter is in response to your request for information on listed threatened or endangered plant or insect species in the vicinity of the Continuous Electron Beam Accelerator Facility in Newport News, Virginia. To date, Virginia Department of Agriculture and Consumer Services records indicate that no threatened or endangered plant or insect species have been documented in the area outlined on the map that you provided. The absence of data does not necessarily mean that no listed species occur in the area, but that our files do not currently contain information to document their presence.

The Virginia Department of Agriculture and Consumer Services has jurisdiction over listed plant and insect species only. The Virginia Department of Game and Inland Fisheries has jurisdiction over all other listed threatened or endangered species. Additional information on unique geologic formations, rare or critical habitat, rare and candidate species can be obtained from the Virginia Department of Conservation and Recreation, Division of Natural Heritage.

Thank you for your interest in the endangered or threatened plant and insect species in Virginia. If you have any questions or need any additional information, please contact me.

Sincerely,

John R. Tate
Endangered Species Coordinator

APPENDIX C

CULTURAL AND HISTORIC RESOURCES CONSULTATION

COMMONWEALTH of VIRGINIA

Hugh C. Miller, Director

Department of Historic Resources
221 Governor Street
Richmond, Virginia 23219

TDD: (804) 786-1934
Telephone (804) 786-3143
FAX: (804) 225-4261

October 16, 1992

K. Dean Helms
Manager, CEBAF Site Office
Department of Energy
Oak Ridge Operations
Continuous Electron Beam
Accelerator Facility Site Office
12000 Jefferson Avenue
Newport News, Virginia 23606

Re: Proposed Continuous Electron Beam Accelerator Facility
City of Newport News, Virginia
VDHR File No. 92-2142-F (formerly 997-NN)

Dear Mr. Helms:

Thank you for your letter of September 16, 1992 requesting updated comments on the proposed facility.

We have previously reviewed the environmental assessment for the proposed project. We understand that the selected site is in the City of Newport News. Our comments on this site remain the same as in our correspondence dated April 1, 1987. No historic districts or structures will be affected by this project. An archeological assessment was prepared for this property in May, 1985 by Daniel V. Mouer, Ph.D. of Virginia Commonwealth University's Archaeological Research Center. As a result of his study, we concurred with his opinion that the property has been extensively disturbed and has a low potential to contain contact archeological levels and features. No archeological investigations are warranted in connection with this project.

Our comments remain the same. Construction of the proposed facility will have no effect on historic properties. The requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, have been met for this particular project.

If you have any questions, please contact Ethel R. Eaton of our staff.

We look forward to working with you on future projects.

Sincerely,

John E. Fox

Bruce J. Larson
Project Review Supervisor

cc. Barbara Morgan