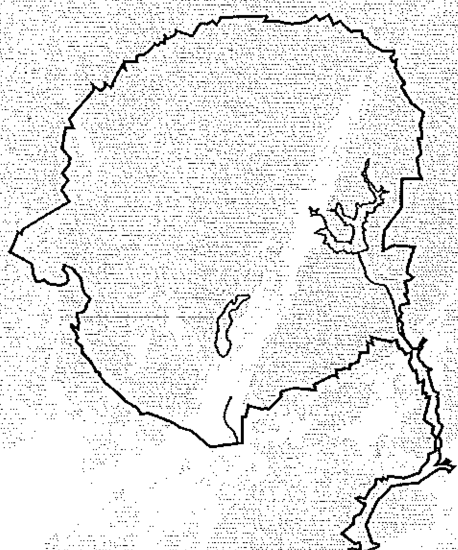
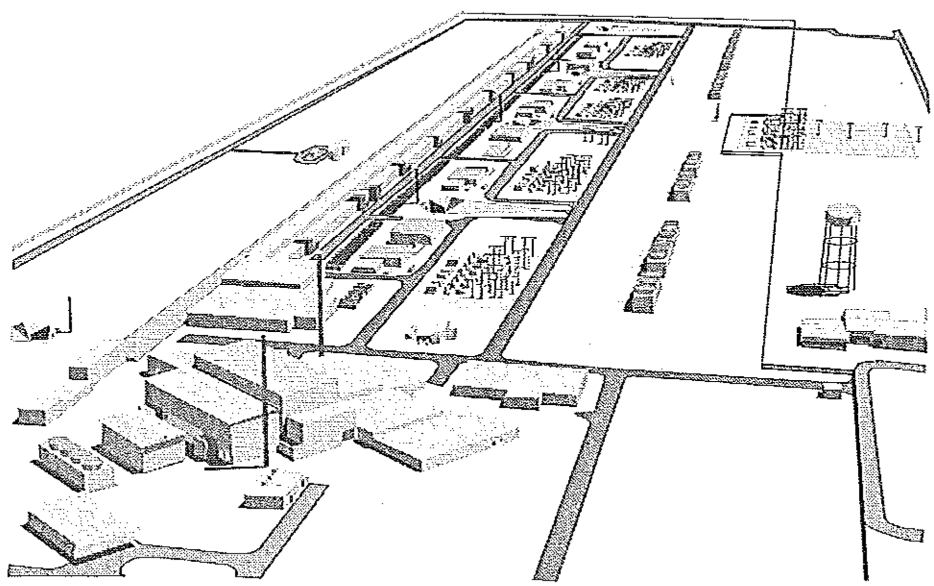
DOE/EIS-0270

Environmental Impact Statement



Accelerator Production of Tritium at the Savannah River Site



U.S. Department of Energy
Savannah River Operations Office
Aiken, South Carolina

Final
March 1999

COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy (DOE)

TITLE: Final Environmental Impact Statement: Accelerator Production of Tritium at the Savannah River Site (DOE/EIS-0270)

LOCATION: Aiken and Barnwell Counties, South Carolina

CONTACT: For additional information on this environmental impact statement, write or call:

Andrew R. Grainger, NEPA Compliance Officer
U.S. Department of Energy, Savannah River Operations Office
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Aiken, South Carolina 29802
Attention: Accelerator Production of Tritium EIS
Local and Nationwide Telephone: (800) 881-7292
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The EIS is also available on the internet at: http://www.srs.gov/general/sci-tech/apt/index.htm and http://tis-nt.eh.doe.gov/nepa/docs/docs.htm

For general information on the DOE National Environmental Policy Act (NEPA) process, write or call:

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1000 Independence Avenue, S.W.
Washington, D.C. 20585
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ABSTRACT: The action proposed in this environmental impact statement (EIS) is to construct and operate a linear accelerator that would produce tritium, which is a gaseous radioactive isotope of hydrogen essential to the operation of the weapons in the nation's nuclear arsenal. This EIS is tiered (linked) to the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (DOE/EIS-0161; October 1995), from which DOE determined that it would produce tritium either in an accelerator as described in this EIS or in a commercial light-water reactor as described in *Production of Tritium in a Commercial Light Water Reactor* (CLWR) (DOE/EIS-0288). This EIS evaluates the alternatives for the siting, construction, and operation of an accelerator on the Savannah River Site and the impacts of those alternatives on the Site's physical and manmade environment, its human and biological environment, and the regional economic and social environment.

PUBLIC COMMENTS: In preparing the Draft EIS, DOE considered comments received by letter and voice mail, and comments given at public meetings in Savannah, Georgia and Aiken, South Carolina on December 3 and 5, 1996, respectively. [NOTE: These were joint meetings held by DOE to discuss the scopes of two related EISs: this one for the accelerator production of tritium and the EIS *Construction and Operation of a Tritium Extraction Facility at the Savannah River Site* (DOE/EIS-0271D). A summary of public comments was made available on April 28, 1997, and may be obtained by contacting Andrew R. Grainger as shown above.

A 45-day comment period on the Draft APT EIS began with publication of a Notice of Availability in the *Federal Register* on December 19, 1997. A public meeting to discuss and receive comments on the Draft EIS was held on January 13, 1998, at the North Augusta Community Center, 101 Brookside Drive, North Augusta, South Carolina. The Draft EIS public comment period ended February 2, 1998. Comments were submitted by voice, e-mail, and regular mail at the address provided above. All comments received were carefully considered in the preparation of this Final EIS.

Preface

The Tritium Supply and Recycling Final Programmatic Environmental Impact Statement (PEIS) (DOE/EIS-0161), which was completed in October 1995, assessed the potential environmental impacts of technology and siting alternatives for the production of tritium for national security purposes. On December 5, 1995, DOE issued a Record of Decision (ROD) for the Tritium Supply and Recycling PEIS that selected the two most promising alternative technologies for tritium production and established a dual-track strategy that would, within 3 years, select one of those technologies to become the primary tritium supply technology. The other technology, if feasible, would be developed as a backup tritium source. Under the dual-track strategy, DOE would: (1) initiate the purchase of an existing commercial reactor (operating or partially complete) or irradiation services with an option to purchase the reactor for conversion to a defense facility; and (2) design, build, and test critical components of an accelerator system for tritium production. Under the PEIS ROD, any new facilities that might be required, i.e., an accelerator and/or a Tritium Extraction Facility to support the commercial reactor alternative, would be constructed at DOE's Savannah River Site (SRS) in South Carolina.

The PEIS described a two-phase strategy for compliance with the National Environmental Policy Act (NEPA). The first phase included completion of the PEIS and subsequent ROD. The second phase included the preparation of site-specific NEPA documents tiered from the PEIS. These EISs address the environmental impacts of specific project proposals. As a result of the PEIS and the ROD, DOE determined to prepare three site specific EISs: the Accelerator Production of Tritium at the Savannah River Site (APT) (DOE/EIS-0270), the Production of Tritium in a Commercial Light Water Reactor (CLWR) (DOE/EIS-0288), and the Tritium Extraction Facility at Savannah River Site (TEF) (DOE/EIS-0271). Each of these EISs presents an analysis of alternatives which do not affect the alternatives in the other EISs with one exception. This exception is one alternative in the TEF EIS which would require the use of space in the APT. For this alternative to be viable, the APT would have to be selected as the primary source of tritium.

On December 22, 1998, Secretary of Energy Bill Richardson announced that commercial light water reactors (CLWR) will be the primary tritium supply technology. The Secretary designated the Watts Bar Unit 1 reactor near Spring City, Tennessee, and Sequoyah Unit 1 and 2 reactors near Soddy-Daisy, Tennessee as the preferred commercial light water reactors for tritium production. These reactors are operated by the Tennessee Valley Authority (TVA), an independent government agency. The Secretary designated the APT as the "backup" technology for tritium supply. As a backup, DOE will continue with developmental activities and preliminary design, but will not construct the accelerator. Finally, selection of the CLWR reaffirms the December 1995 Tritium Supply and Recycling PEIS ROD to construct and operate a new tritium extraction capability at the SRS.

DOE has completed the final EISs for the APT, CLWR, and TEF. No sooner than 30 days after publication in the Federal Register of the Environmental Protection Agency’s Notice of Availability of the final EISs for CLWR, APT, and TEF, DOE intends to issue a consolidated Record of Decision to: (1) formalize the programmatic announcement made on December 22, 1998; and (2) announce project-specific decisions for the three EISs. These decisions will include, for the selected CLWR technology, the selection of specific CLWRs to be used for tritium supply, and the location of a new tritium extraction capability at the SRS. For the backup APT technology, technical and siting decisions consistent with its backup role will be made.

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ACRONYMS AND ABBREVIATIONS

AGNS	Allied-General Nuclear Services
APT	Accelerator Production of Tritium
BA	Biological Assessment
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CLWR	Commercial Light-Water Reactor
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
FR	Federal Register
GTCC	Greater-Than-Class-C
LCF	Latent Cancer Fatalities
MEI	Maximally Exposed Individual
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NSG	Nuclear Suppliers Group
OSHA	Occupational Safety and Health Administration
PEIS	Programmatic Environmental Impact Statement
RCRA	Resource Conservation and Recovery Act
RF	Radio Frequency
ROD	Record of Decision
SCDHEC	South Carolina Department of Health and Environmental Control
SCE&G	South Carolina Electric and Gas Company
SNM	Special Nuclear Material
SRS	Savannah River Site
TEF	Tritium Extraction Facility
TPBARS	Tritium Producing Burnable Absorber Rods
TWA	Time-Weighted Average

METRIC CONVERSION CHART

To convert into metric			To convert out of metric		
If you know	**Multiply by**	**To get**	**If you know**	**Multiply by**	**To get**
Length					
inches	2.54	Centimeters	centimeters	0.3937	inches
feet	30.48	Centimeters	centimeters	0.0328	feet
feet	0.3048	meters	meters	3.281	feet
yards	0.9144	meters	meters	1.0936	yards
miles	1.60934	Kilometers	kilometers	0.6214	miles
Area					
sq. inches	6.4516	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.092903	sq. meters	sq. meters	10.7639	sq. feet
sq. yards	0.8361	sq. meters	sq. meters	1.196	sq. yards
acres	0.0040469	sq. kilometers	sq. kilometers	247.1	acres
sq. miles	2.58999	sq. kilometers	sq. kilometers	0.3861	sq. miles
Volume					
fluid ounces	29.574	Milliliters	milliliters	0.0338	fluid ounces
gallons	3.7854	liters	liters	0.26417	gallons
cubic feet	0.028317	cubic meters	cubic meters	35.315	cubic feet
cubic yards	0.76455	cubic meters	cubic meters	1.308	cubic yards
Weight					
ounces	28.3495	grams	grams	0.03527	ounces
pounds	0.4536	Kilograms	kilograms	2.2046	pounds
short tons	0.90718	Metric tons	metric tons	1.1023	short tons
Temperature					
Fahrenheit	Subtract 32 then multiply by 5/9ths	Celsius	Celsius	Multiply by 9/5ths, then add 32	Fahrenheit

Metric Prefixes

Prefix	Symbol	Multiplication Factor
exa-	E	1 000 000 000 000 000 000 = 10^{18}
peta-	P	1 000 000 000 000 000 = 10^{15}
tera-	T	1 000 000 000 000 = 10^{12}
giga-	G	1 000 000 000 = 10^{9}
mega-	M	1 000 000 = 10^{6}
kilo-	k	1 000 = 10^{3}
centi-	c	0.01 = 10^{-2}
milli-	m	0.001 = 10^{-3}
micro-	µ	0.000 001 = 10^{-6}
nano-	n	0.000 000 001 = 10^{-9}
pico-	p	0.000 000 000 001 = 10^{-12}
femto-	f	0.000 000 000 000 001 = 10^{-15}
atto-	a	0.000 000 000 000 000 001 = 10^{-18}

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SUMMARY

On September 5, 1996, the U.S. Department of Energy (DOE) published the "Notice of Intent to Prepare an Environmental Impact Statement for the Construction and Operation of an Accelerator for the Production of Tritium at the Savannah River Site" (61 FR 46787). As stated in the Notice of Intent, this EIS is to evaluate technology and site options for the use of an accelerator for the production of tritium (APT) and to assess the impacts of accelerator construction and operation at SRS.

The Notice of Availability for the Draft APT EIS was in the *Federal Register* on December 19, 1997. A 45-day public comment period began on that date and ended on February 2, 1998. A public meeting was held on January 13, 1998, at the North Augusta Community Center.

DOE is not reprinting a revised draft as the Final EIS, as is typically done. Rather, DOE is finalizing the APT EIS by reference to the Draft EIS and is issuing this document as a record of changes made pursuant to 40 CFR Part 1503.4.

The U.S. Department of Energy (DOE) is responsible for ensuring that the nation has a supply of materials for the operation of its stockpile of nuclear weapons -- even though a series of treaties has reduced that stockpile to a fraction of what it was during the Cold War. One of these materials is tritium, a gaseous isotope of hydrogen that increases the yield of nuclear weapons. None of the weapons in the nuclear arsenal would function as designed without tritium. As long as the United States chooses to maintain a nuclear deterrent -- of any size -- it will need tritium.

There are two issues related to the United States' need for tritium. The first is that the U.S. no longer has operating facilities to produce this material. DOE has shut down the reactors that irradiated the base material from which the gas was derived -- and will not restart them. The second issue is that tritium decays at a rate of about 5.5 percent per year. This means that present supplies will be cut nearly in half before 2010, and that the United States will essentially run out in about 2040. Therefore, the United States must have a new source of tritium.

For the past several years, DOE has been evaluating ways to produce tritium. Following the requirements of the National Environmental Policy Act (NEPA), the Department took its first step toward a solution when the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (Tritium Supply PEIS) (DOE/EIS-0161, October 1995) evaluated both the need for a new tritium source and the alternatives to provide that source. Continuing the NEPA process, on December 12, 1995, DOE published a Record of Decision (ROD; 60 FR 63878) for the Tritium Supply PEIS in which it announced that it would pursue a dual-track approach to the two most promising alternatives:

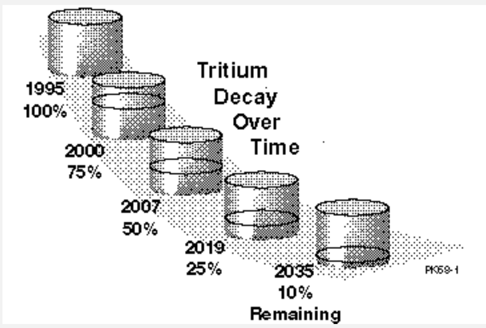
- To design, build, and test critical components of an accelerator system for tritium production

- To initiate the purchase of an existing commercial light-water reactor (operating or partially complete) for conversion to a defense facility, or the purchase of irradiation services with an option to purchase the reactor

In the 1995 ROD, DOE committed that by late 1998, it would select one of these approaches as the primary source of tritium. In addition, the Department would, if possible, continue to develop the other alternative as a backup tritium source. Further, the ROD announced DOE's selection of the Savannah River Site (SRS) in South Carolina as the location for an accelerator, if the Department decided to build one, and its decision to upgrade and consolidate the existing SRS tritium recycling facilities and to construct a Tritium Extraction Facility at the SRS to support either dual-track alternative.

WHAT IS TRITIUM?

Tritium is a radioactive isotope of hydrogen that occurs naturally in small quantities. It must be manmade to obtain useful quantities. It is an essential component of every warhead in the current U.S. nuclear weapons stockpile. These warheads depend on tritium so they can perform as designed. Tritium decays at about 5.5 percent per year and, therefore, requires periodic replacement.



DOE developed the following strategy for compliance with the NEPA process: (1) make decisions on the alternatives described and evaluated in the Tritium Supply PEIS, and (2) follow with site-specific assessments that implement those decisions. Thus, DOE is preparing three EISs tiered to the programmatic EIS: this EIS on the construction and operation of an Accelerator for the Production of Tritium (APT), an EIS on the construction and operation of a Tritium Extraction Facility at the SRS, and an EIS on the use of a Commercial Light-Water Reactor to produce tritium.

PUBLIC COMMENTS

During the 45-day public comment period, DOE received input in two public meeting sessions held on January 13, 1998 at the North Augusta Community Center, by telephone, by letter, and by electronic mail.

Each comment was carefully considered and responses to those comments can be found in Part B of the Final APT EIS. In some cases, the comments resulted in DOE making modifications to the Draft EIS.

Six individuals made public statements or comments at the two public meeting sessions. Additionally, the Department has received 7 letters from individuals and organizations and received comments from two individuals via DOE's telephone message line.

Comments ranged from expressions of support for the APT projects to comments concerning the use of non-renewable resources, waste production, worker safety and health, project cost, proliferation, and the use of American products and technical talent.

EVENTS SINCE THE DRAFT APT EIS

Since issuance of the Draft EIS in December 1997, several events have occurred and decisions have been made that influenced the preparation of the Final APT EIS. Two other draft EISs related to the tritium supply mission were issued, the Tritium Extraction Facility (TEF) EIS and the Commercial Light-Water Reactor (CLWR) EIS. These three documents are closely interrelated. The proposed action described in the CLWR EIS is now the "No-Action" alternative in this EIS. Conversely, the APT is the "No-Action" alternative in the CLWR EIS.

In August 1998, the Department decided to make its primary technology decision prior to issuing the Final EISs. On December 22, 1998, Secretary of Energy Bill Richardson announced that CLWRs would be the primary tritium supply technology. The Secretary designated the Watts Bar Unit 1 reactor near Spring City, Tennessee, and Sequoyah Unit 1 and 2 reactors near Soddy-Daisy, Tennessee as the preferred CLWRs for tritium production. The Secretary designated the APT as the backup technology for tritium supply. Selection of the CLWR option reaffirms the December 1995 Tritium Supply and Recycling PEIS ROD to construct and operate a new tritium extraction capability at the SRS. The preferred alternative is the No Action alternative, consistent with its role as the backup technology. Under No Action, DOE would complete key research and development milestones for the accelerator at SRS (but not construct the facility) with the following design and support features: klystron radiofrequency power tubes, the use of superconducting equipment, helium-3 feedstock material, and mechanical draft cooling towers with river water makeup.

FORMAT FOR THE FINAL APT EIS

The Department is not reprinting a revised draft as the Final EIS, as is typically done. Rather, DOE is finalizing the EIS by reference to the Draft EIS and is issuing this document as a record of changes made pursuant to 10 CFR Part 1503.4.

Modifications to the Draft EIS are presented in two ways: (1) complete sections, tables, and figures have been replaced or added with specific references to the Draft EIS and (2) text or elements of tables in the Draft EIS have been modified and shown as **bolded text**. The modifications were made for the following reasons:

- To incorporate responses to comments received during the public comment period
- To Update or clarify factual information presented in the Draft EIS
- To reflect the evolution of APT design work that has progressed since the Draft EIS was issued

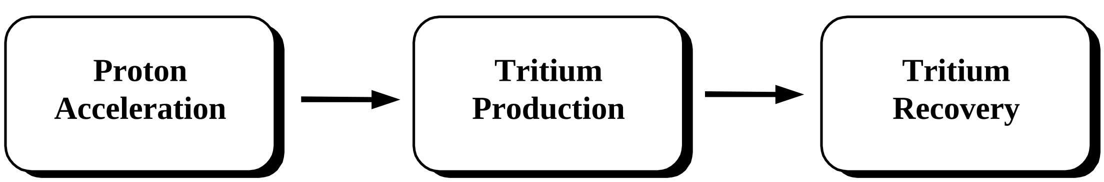
The Final EIS has four main parts. Part A is the introduction and describes the methodology used in preparing the document. Part B summarizes the comments received during the public comment period and provide responses to those comments. Part C presents the modifications to the Draft EIS (Chapters 1 to 7) as previously described. Part D focuses on the three design variations described later in this summary and provides this information as an addendum to Chapter 4 of the Draft EIS.

Table S-1 summarizes what modifications have been made to the Draft APT EIS. Exact locations in the Draft and Final for each modification are shown.

PURPOSE AND NEED FOR ACTION

The purpose and need for the Department's action is described in the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling*. The Tritium Supply PEIS identified the 1994 Nuclear Weapons Stockpile Plan as the guidance document the Department must follow. Since the issuance of the Tritium Supply PEIS, the President has approved the 1996 Nuclear Weapons Stockpile Plan. The change between the two Nuclear Weapons Stockpile Plans was to change the projection of when a new tritium source is needed from approximately 2011 used in the PEIS to 2005. However, the need for tritium for the nuclear weapons stockpile, as discussed in the Tritium Supply PEIS, remains unchanged.

HOW DOES AN ACCELERATOR FOR TRITIUM PRODUCTION WORK?



- Uses linear accelerator
- Radiofrequency power provides energy for acceleration
- Room-temperature or superconducting operation

- Protons produce neutrons through spallation
- Neutrons are absorbed in feedstock material (Helium-3 or Lithium-6)

- Separate tritium from impurities
- Package and transport to Tritium Loading Facility

Table S-1. Modifications to Chapters 1 - 7 of the Draft APT EIS.

Sections of the Draft APT EIS Modified	Location in the Draft EIS	Location in the Final EIS	Link to comment (if applicable)	Subject of change
Chapter 1, Section 1.5	Page 1-5, 2nd column, 2nd through 4th paragraphs	Page C-1	L1-02	Tritium supply implementing strategy
	Page 1-6, 1st column, 1st through 2nd paragraphs	Page C-2		TEF No Action alternative
	Page 1-7, 1st column, after 2nd paragraph	Page C-2		Plutonium residues and scrub alloys management
	Page 1-7, 1st column after 2nd paragraph	Page C-3		Surplus plutonium disposition
Chapter 2, Section 2.1	Page 2-2, 1st column, 3rd through 4th paragraphs	Page C-3		APT No Action alternative
Chapter 2, Section 2.3.5	Page 2-15, 1st column, 1st and 2nd paragraphs	Page C-4	L2-04	APT site selection
Chapter 2, Section 2.5	Page 2-21, 2nd column through page 2-25, 2nd column, 3rd paragraph	Page C-5		APT design variations
Chapter 2, Section 2.7	Page 2-26, 1st column, 1st paragraph through 2-39	Page C-5		Comparison of environmental impacts
Chapter 3, Sections 3.3.1.1, 3.3.1.2, 3.4.2	Page 3-6, 1st column, 3rd paragraph and Figure 3-4 on page 3-7	Page C-26		APT footprint
	Page 3-8, 1st Column, 1st paragraph, 5th through 9th lines, Figure 3-5 on page 3-9, and Table 3-1 on page 3-10	Page C-26		APT footprint
	Page 3-44, 1st Column, 1st paragraph, lines 2 through 15, and Figures 3-16 and 3-17 on pages 3-47 and 3-48	Page C-26		Savannah River water quality
Chapter 3, Section 3.3.2.1	Page 3-18, 2nd column, 2nd paragraph and Table 3-5, page 3-21	Page C-33		Non-radiological air quality
Chapter 3, Section 3.3.4.1	Page 3-28, 2nd column, 2nd paragraph and Table 3-8, page 3-29	Page C-33		Radiological air quality
Chapter 3, Section 3.3.4.2	Page 3-28, 2nd column, 4th paragraph and Table 3-9, page 3-29	Page C-33		Radiation doses at SRS
Chapter 3, Section 3.4.1	Page 3-43, 1st column, 1st paragraph and Table 3-11, page 3-43	Page C-33		Radiation doses at SRS
Chapter 3, Section 3.4.5	Page 3-54, 2nd column, 2nd paragraph, line 8 through line 3 in the 1st column on page 3-55	Page C-36	L2-05 and L2-06	Threatened and endangered species
	Page 3-55, 1st column, 2nd paragraph	Page C-37	L2-05 and L2-06	Threatened and endangered species

Table S-1. (Continued).

Sections of the Draft APT EIS Modified	Location in the Draft EIS	Location in the Final EIS	Link to comment (if applicable)	Subject of change
Chapter 4	Page 4-1, 2nd column, 2nd and 3rd paragraphs	Page C-37		Concrete batch plants and construction debris landfill
	Page 4-2, 2nd column, 4th paragraph through page 4-3, 1st column, 1st paragraph	Page C-39		No Action impacts
Chapter 4, Section 4.1.1.2	Page 4-4, 2nd column, 4th paragraph through 1st paragraph on page 4-5	Page C-42	L4-03	Groundwater activation
Chapter 4, Section 4.1.2.1	Page 4-5, 2nd column, text box	Page C-43		Section 316(a) demonstration
Chapter 4, Section 4.1.2.2	Page 4-6, 2nd column, Tables 4-1 and 4-2, page 4-7	Page C-43		Water borne source terms
Chapter 4, Section 4.1.3.3	Page 4-16, 2nd column, 3rd paragraph and Table 4-11, page 4-18,	Page C-43		Maximum non-radiological concentrations
Chapter 4, Section 4.1.3.4	Page 4-19, 2nd column, 9th paragraph through page 4-22, 1st column, 4th paragraph, including Tables 4-12 and 4-13, pages 4-20 and 4-21	Page C-46		Accelerator source terms
Chapter 4, Section 4.1.4	Page 4-22, 2nd column, 3rd paragraph	Page C-48		Existing SRS River Water System
Chapter 4, Section 4.1.5	Page 4-25, 2nd column, text box	Page C-49	L3-05 and L4-04	APT waste categorization
	Page 4-25, 1st column, 1st paragraph and Tables 4-15 and 4-16, pages 4-26 and 4-27	Page C-49		APT waste generation estimates
Chapter 4, Section 4.1.5	Page 4-25, 2nd column, 4th paragraph through page 4-27, 1st column, 1st paragraph and Table 4-17, page 4-18	Page C-49		APT waste generation estimates
Chapter 4, Section 4.2.1.2	Page 4-36, 1st column, 4th paragraph and Table 4-22, page 4-37	Page C-49		Radioactive source terms
Chapter 4, Section 4.2.2.4	Page 4-56, 1st column, 3rd paragraph	Page C-51	L2-05 and L2-06	Threatened and endangered species
Chapter 4, Section 4.4.2.5	Page 4-74, 2nd column, 2nd paragraph, lines 16 through 28	Page C-53	L2-01 and L4-01	Coal-fired health risks
Chapter 5	Page 5-1, 1st column, 1st paragraph through page 5-2, 1st column	Page C-54		Cumulative impacts

Table S-1. (continued).

Sections of the Draft APT EIS Modified	Location in the Draft EIS	Location in the Final EIS	Link to comment (if applicable)	Subject of change
Chapter 5, Section 5.1	Page 5-2, 2nd column, 3rd and 4th paragraphs, and Table 5-1 on page 5-3	Page C-56		Radiological doses
Chapter 5, Section 5.2	Page 5-3, 2nd column, 1st paragraph and Table 5-2 on page 5-4	Page C-58		Non-radiological emissions
	Page 5-4, 1st column, sentences 1 and 2 and Table 5-3 on page 5-5	Page C-58		Radiological doses
	Page 5-4, 2nd column, after 1st paragraph	Page C-58	M1-03 and M1-10	Greenhouse effect
	Page 5-4, 2nd column, 2nd paragraph through page 5-6, 1st column, 1st paragraph and Table 5-4 on page 5-5	Page C-58		Cumulative waste volumes
Chapter 5, Section 5.4	Page 5-7, Table 5-5 and Table 5-5a added	Page C-61		Cumulative electricity generation
Chapter 5, Section 5.5	Page 5-9, Table 5-6	Page C-61		Cumulative health effects
Chapter 5, Section 5.7	Page 5-10, 1st column, 2nd paragraph through 2nd column, 2nd paragraph and Table 5-7 on page 5-11	Page C-64		Reasonably foreseeable actions
Chapter 6, Section 6.2	Page 6-2, 1st column, 2nd paragraph	Page C-64		Resource commitments
Chapter 7, Section 7.1	Page 7-6, 1st column, after 1st paragraph	Page C-66		SC solid waste Management act
Chapter 4, Sections 4.5.1, 4.5.2, 4.5.3, 4.6	Addendum	Page D-1		Design variations and mitigation actions
Miscellaneous modifications/additions to references				
Additions to Chapter 1 references	Page 1-10	Page C-66		
Additions to Chapter 2 references	Page 2-40	Page C-66		
Additions to Chapter 3 references	Page 3-65	Page C-66		
Additions to Chapter 4 references	Page 4-82	Page C-68		
Additions to Chapter 5 references	Page 5-12	Page C-69		

Table S-1. (continued).

Sections of the Draft APT EIS Modified	Location in the Draft EIS	Location in the Final EIS	Link to comment (if applicable)	Subject to change
Miscellaneous modifications/corrections				
Chapter 2, references	Page 2-40	Page C-69		
Chapter 3, references	Page 3-71	Page C-69		
Chapter 4, Section 4.1.1.1	Page 4-3	Page C-69		
Chapter 4, Section 4.1.5 references	Pages 4-23 through 4-29	Page C-69		
Chapter 4 Section 4.2.2.3	Page 4-54	Page C-69		
Chapter 4, references	Page 4-85	Page C-70		

PROPOSED ACTION AND ALTERNATIVES

DOE proposes to design, build, and operate a linear accelerator (linac) at the Savannah River Site. The Department will use the EIS and the NEPA process to inform decision makers and stakeholders about the potential environmental impacts of the proposed action and alternatives.

Preferred Alternative. Based on the research and development it has performed, DOE proposes the following preferred design and support features for the APT:

- Klystron radiofrequency power tubes
- Use of superconducting equipment
- Helium-3 feedstock material
- Mechanical-draft cooling towers with river water makeup
- Construction of the APT on a site 3 miles northeast of the Tritium Loading Facility
- Purchase of electricity from existing capacity through market transactions

No Action Alternative. In compliance with the regulations of the Council on Environmental Quality (CEQ) for implementing NEPA (40 CFR Part 1500-1508), this EIS also assesses a No Action alternative. If DOE chooses not to build and operate the APT, it would have to meet its tritium production requirements through other methods, or it would not be able to support the long-term defense policies of the United States, which is not acceptable. The No Action alternative for the proposed action in this EIS is to produce tritium in a commercial-light water reactor and to construct and operate a tritium extraction facility. Table S-2 compares the no-action impacts of APT, TEF, and CLWR.

Under the No Action alternative, SRS recycling and loading activities related to tritium would continue. Other actions determined in the Record of Decision for the Tritium Supply PEIS -- the potential modernization and consolidation of existing SRS tritium facilities -- would proceed as planned.

DESIGN FEATURES AND SYSTEM ALTERNATIVES

Radiofrequency Power Alternatives

APT would use radiofrequency waves to accelerate protons. Specially designed vacuum electron tubes would convert electric power to radiofrequency waves outside the accelerator beam, and waveguides (hollow metal conduits) would transmit them to cells along the beam path. The beam of electrically charged protons is affected by radiofrequency electric and magnetic fields. The accelerator design would enable the proton beam to intersect with the radiofrequency waves in the proper orientation to cause proton acceleration; in other words, the radiofrequency waves would push the protons down the beam tube faster and faster.

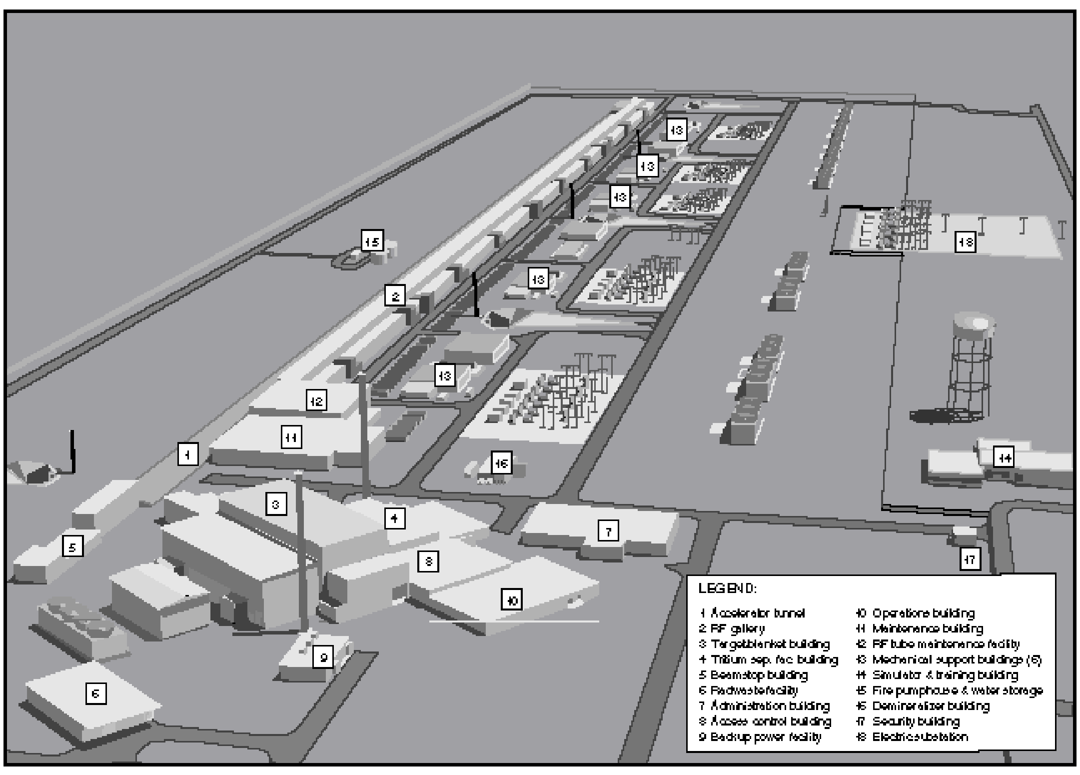
Two alternatives could supply radiofrequency power for the accelerator:

- Klystron radiofrequency power tubes (DOE's preference)
- Inductive output radiofrequency power tubes

Operating Temperature Alternatives

The operating temperature affects the electric components of an accelerator, depending on the type and intended use. Electrical resistance usually increases as temperature increases, causing the generation of more heat in the component and resulting in more electricity used. The converse is also true: electrical resistance usually decreases as temperature decreases, causing less heat generation and resulting in less electricity used. If the temperatures of some materials (e.g., niobium) fall to values very near absolute zero (-459°F), the electrical resistance becomes essentially zero, and the component uses much less electricity. This phenomenon is superconductivity.

WHAT WOULD A LINEAR ACCELERATOR FOR TRITIUM PRODUCTION LOOK LIKE?



There are two operating temperature alternatives for the design of the accelerator:

- Operating electric components at essentially room temperature
- Operating most components at superconducting temperatures and the rest at room temperature (DOE's preference)

Feedstock Material Alternatives

The accelerator would produce protons with an energy greater than 1,000 million electron Volts. To produce tritium, the protons would strike a target/blanket assembly of tungsten surrounded by lead. The high energy of the protons as they strike the tungsten atoms would cause a phenomenon called spallation in which the atoms would emit neutrons. The lead in the target/blanket would be an additional source of neutrons through more spallation events and other nuclear reactions. The neutrons freed during spallation would strike the feedstock material, and its atoms would absorb neutrons, resulting in the production of a tritium atom and a byproduct atom (feedstock dependent).

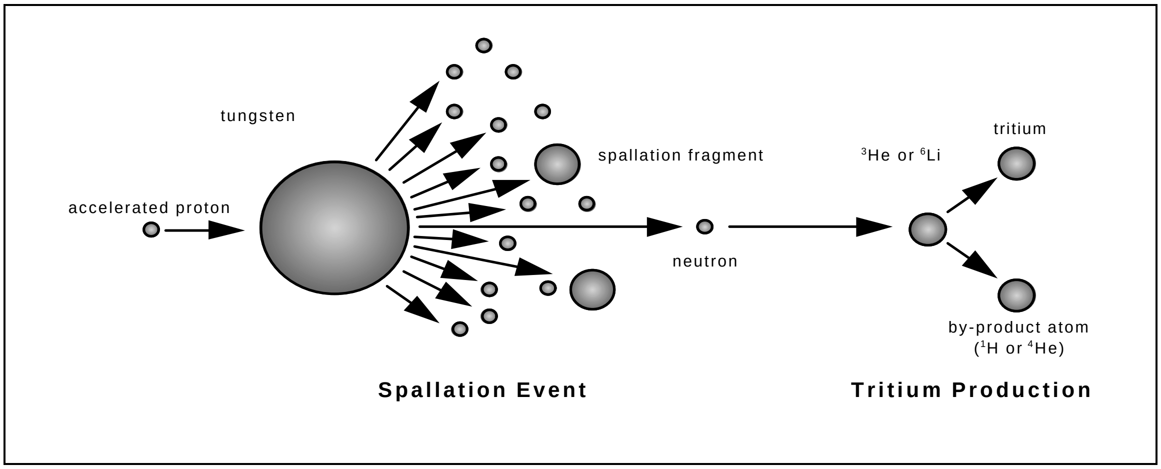
DOE could use the same target/blanket (lead and tungsten) as the neutron source regardless of the feedstock material. The Department has identified two feedstock materials that could produce tritium through the absorption of neutrons produced by spallation events:

- Helium-3 (DOE's preference)
- Lithium-6

Cooling Water System Alternatives

The equipment and activities in the APT would generate heat that would have to be removed to prevent the components from overheating. Air cooling would keep parts of the APT cool. Other areas would have high localized temperatures (e.g., the target and blanket regions due to the impingement of the proton beam on the target and the heat generated by spallation product absorption and radioactive decay in the target/blanket). Cooling water is required to keep the target/blanket components, radiation shielding, beamstops, and other components from overheating.

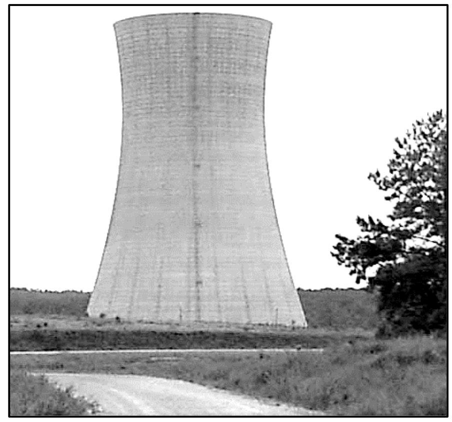
HOW DOES SPALLATION HAPPEN?



A pictorial representation of tritium production using neutrons generated by spallation. The proton strikes the target atom, which breaks into multiple fragments with the emission of neutrons. The neutrons then strike atoms (^{3}He or ^{6}Li), producing tritium and a byproduct atom (^{1}H or ^{4}He).

WHAT DO COOLING TOWERS LOOK LIKE?

Mechanical-Draft Cooling Tower



Natural-Draft Cooling Tower

Although these components would not necessarily all be connected to a single cooling system, DOE proposes to use a similar method -- a primary coolant loop isolated from the environment through heat exchangers -- to cool each component. The primary coolant loop would be the first system in contact with a component that required cooling, and heat would transfer from the component to the primary coolant loop. Components with the potential for radioactive contamination would require a secondary loop to cool the primary loop and isolate potential contamination from the environment. The final cooling for the systems, regardless of the number of cooling loops, would use a cooling water system to discharge heat to the environment.

Four cooling water system designs could provide the necessary cooling capacity for the APT:

- Mechanical-draft cooling towers with river water makeup (DOE's preference)
- Mechanical-draft cooling towers with groundwater makeup
- Once-through cooling using river water
- The existing K-Area cooling tower (i.e., natural draft) with river water makeup

APT Site Alternatives

DOE conducted a screening process to select potentially suitable sites for the APT. This multiple-phase process identified areas with a set of suitable features and minimal conflicts with onsite resources and operational areas.

Based on a weighing and balancing of the criteria, DOE selected two sites for further analysis:

- The preferred site 3 miles northeast of the Tritium Loading Facility, and approximately 6.5 miles from the SRS boundary
- The alternate site 2 miles northwest of the Tritium Loading Facility, and approximately 4 miles from the SRS boundary

Electric Power Supply Alternatives

The APT will require large amounts of electricity (a peak load as high as 600 megawatts-electric for the room temperature alternative) to operate. At present, the SRS obtains its electric power from South Carolina Electric and Gas Company (SCE&G) through existing transmission lines and substations. Both the preferred and alternate APT sites are close to existing electric power supply lines. Due to the projected magnitude of the electrical power usage; however, DOE is studying alternatives for the source of electricity for the APT, and has identified the following two:

- Obtain electricity from existing commercial capacity and through market transactions (DOE's preference)
- Obtain electricity from the construction and operation of a new coal-fired or a natural-gas-fired generating plant

APT Design Variations

There are three potential design variations which could enhance DOE's flexibility in supplying the nation's future tritium needs. The first is a modular, or staged, accelerator configuration. The second is combining tritium separation and tritium extraction facilities. The third is discharge of cooling water to an existing canal between Pond 5 and Pond C.

The modular design variation would use the same accelerator architecture as the baseline (linear) accelerator, but would be constructed in stages. In this EIS, the term "staged accelerator" refers to a design that would produce less tritium than the baseline APT, but would be capable of producing as much tritium as the baseline APT, with the addition of a second stage. The combined tritium separation and tritium extraction facilities would take advantage of common process systems and would be capable of handling both Helium-3 and Lithium-6 (CLWR or APT) feedstock material.

The third design variation would involve a new cooling system configuration. If this design variation were selected, the heated discharge water would be piped south from the APT facility to the head of Pond C (the canal entering Pond C) along existing roads and rights-of-way. This would prevent potential impacts to the biota of pre-cooler Ponds 2 and 5 because the heated water would bypass them. Impacts to the biota in Pond C would be less than those that would have occurred in Ponds 2 and 5 because the heated water would be entering a larger, deeper impoundment with more heat dissipating capacity.

The variations described in the EIS are based on the best information available. Based on current design information, DOE expects potential impacts of the design variations would vary little from those identified for the baseline accelerator.

AFFECTED ENVIRONMENT

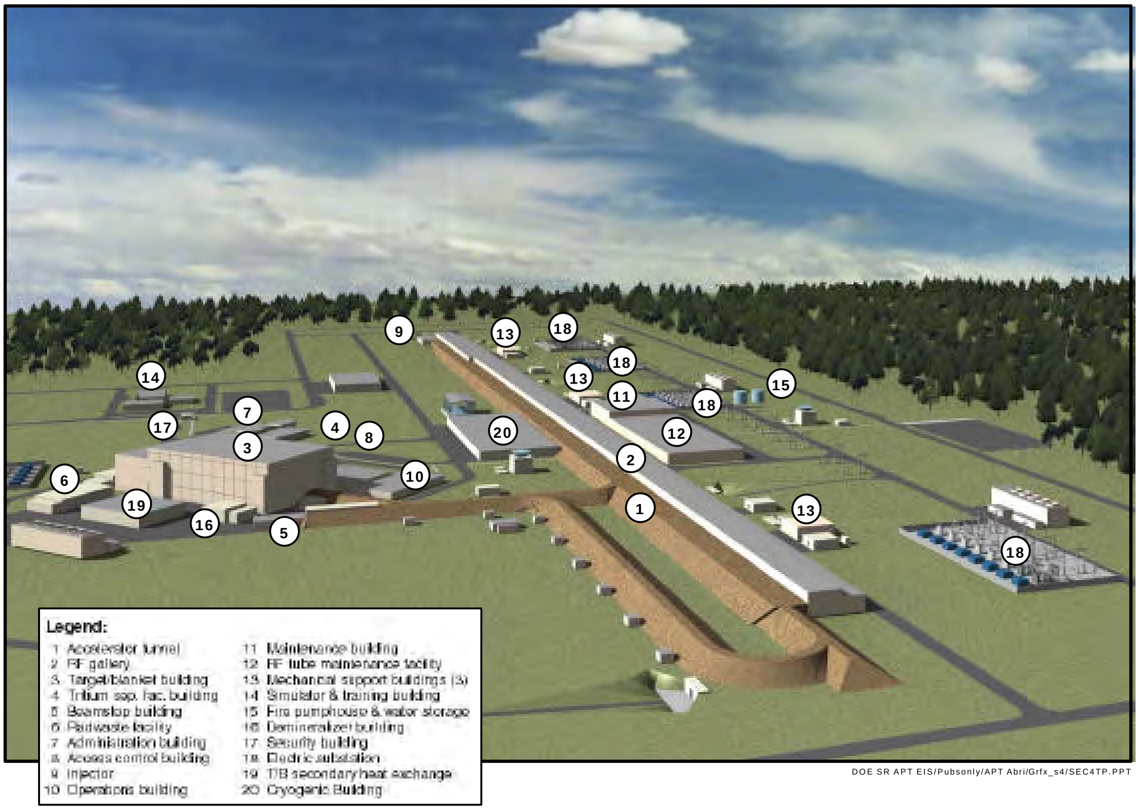
DOE would locate the APT on either the preferred or alternate site. Both sites are 250-acre forested tracts largely dominated by stands of loblolly and slash pine. No threatened or endangered species are known to exist at either site.

Most support activities not located at the APT site would be in M- or H-Areas. The following sections describe the proposed APT sites, M-Area, and H-Area.

APT Sites. As previously mentioned, DOE used a multiphase screening process to find suitable sites for the APT. This process identified areas with suitable features and minimal conflicts with onsite resources and operational areas.

The first phase involved the identification of land requirements based on the sizes of the proposed facilities. Next exclusionary criteria were developed to identify areas that could present operational or environmental conflicts with the APT (e.g., locations of threatened or endangered species or seismic faults). The third phase involved a more detailed comparison of potential sites, weighing and balancing the sites in four categories: ecology, geology and hydrology, human health, and engineering. DOE evaluated each site against the exclusionary criteria using either quantitative analyses or, if quantitative information was not available, the professional judgment of experts. The site screening process led DOE to the selection of the preferred and alternate sites.

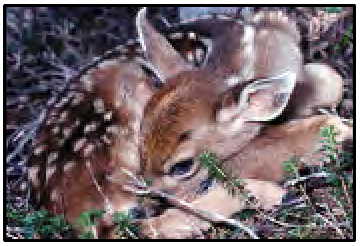
WHAT WOULD THE MODULAR ACCELERATOR FOR TRITIUM PRODUCTION LOOK LIKE?

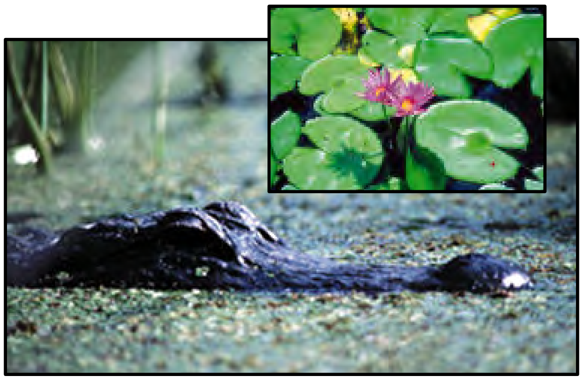


DOE SR APT EIS/Pubsonly/APT Abri/Grfx_s4/SEC4TP.PPT

M-Area. M-Area, an industrialized area on the SRS, is the proposed host for a number of APT support functions. DOE has declared that several M-Area facilities are surplus and potentially available for new uses such as training, accelerator experimentation and testing. Historically, DOE used M-Area to fabricate fuel, special targets, and components for irradiation in the SRS production reactors. The facilities contained furnaces, extrusion presses, lathes, handling equipment, and storage racks for melting, casting, and shaping metal.

H-Area. H-Area also is an industrialized area. At present, the H-Area tritium facilities consist of four buildings, three of which have been part of the historic SRS tritium mission and are second-generation tritium structures. The fourth building, the Tritium Loading Facility (called the Replacement Tritium Facility during its construction and startup) is a third-generation facility that became operational in 1994. Operations in this building include unloading gases from reservoirs returned from the Department of Defense, separating and purifying useful hydrogen





isotopes, mixing the gases to exact specifications, and loading the reservoirs.

POTENTIAL ENVIRONMENTAL IMPACTS

The preferred technology alternatives, as previously described, were evaluated and compared to a suite of other technology components and design variations. Differences in impacts could occur if different technology alternatives or design variations are implemented. Based on current design information, the potential environmental impacts of the three design variations (the stage one modular APT, combining tritium extraction with the APT, and discharge to Pond C via a discharge canal) are bounded by the baseline APT. Table S-4 summarizes the impacts.

In general, DOE considers the expected impacts on the biological, human, and socioeconomic environment of construction and operation of an accelerator for production of tritium at the SRS to be minor and consistent with what might be expected for any industrial facility. Construction and operation of the Preferred alternative would result in the loss of about 250 acres of mixed pine/hardwood upland forest. Waste would be generated during both the construction and operation phases but in quantities that would have negligible impacts on SRS waste management facilities. No high-level waste or transuranic waste would be generated during construction or operation.

Some small impacts from discharge of cooling water to SRS streams and from nonradiological emissions to air and water would occur. Radiological releases during normal operation of the facility are expected to result in minor latent cancer fatalities in workers or the public. Because no high or adverse impacts are expected, no disproportionately high or adverse impacts on minority or low-income communities are expected.

Implementation of certain of the technology alternatives could result in impacts different from those resulting from construction and operation of the Preferred alternative. Most notable would be the impacts from implementation of cooling water system alternatives and electric power supply alternatives. Once-Through Cooling Using River Water would result in withdrawal from the Savannah River of about 125,000 gallons per minute of river water and discharge of hot water to the Par Pond system during operation. Thermal impacts would be restricted to the upper portions of the Par Pond system and would not affect Par Pond discharges to Lower Three Runs. There would be a small increase in Lower Three Runs flows, however. Bypassing precooler ponds 2 and 5 and discharging directly to Pond C via a discharge canal would eliminate the potential impacts to the precooler ponds. The implementation of the Mechanical-Draft Cooling Towers with Groundwater Makeup alternative would result in the withdrawal of 6,000 gallons per minute of groundwater. Total groundwater withdrawal at SRS could therefore exceed the estimated groundwater production capacity of the aquifer. This could affect groundwater flow to site streams.

The Preferred alternative includes buying electricity from the commercial grid to support APT operation. In the case of commercial electricity purchases, the environmental impacts attributed to the APT load would be decentralized. In the case of the construction of a new electricity generating plant to support the APT, the environmental impacts would be localized at the site selected for the plant. Construction and operation of such a facility could require about 290 acres for a coal-fired plant and about 110 acres for a gas-fired plant.

Under the No Action alternative, the Department would obtain required tritium from the irradiation of rods in a commercial light-water reactor. The potential impacts of utilizing a commercial light-water reactor are consistent with the operation of a reactor to generate electricity.

Because Secretary Richardson selected the CLWR as DOE's primary source for tritium, the tritium extraction facility will be constructed at SRS. In that its construction would either be at an existing facility near the SRS or in a currently industrial area of the SRS, construction impacts would be nominal. Likewise, operational impacts have been estimated to be small. APT will not be constructed at the preferred site and the land could be used for other missions. On-going SRS missions would continue. Incremental amounts of waste generation and electricity consumption that would have been attributable to the APT will not occur. Site employment will be a function of on-going missions and funding levels.

POTENTIAL MITIGATION ACTIONS

Once a primary technology decision has been made, specific mitigation measures that may be required will be identified in the Record of Decision and, if warranted, a mitigation action plan.

In general, the Department estimates the potential environmental impacts of the APT to be small. Two categories of potential impacts, however, are more notable than the others; the use of electricity and water. In the case of electricity use, preliminary discussions with the South Carolina Gas and Electric Company have indicated that it could provide sufficient electricity through wholesale agreements and consequently new generating capacity would not be required. Additionally, continuing design work is ongoing to add additional energy saving features to the APT design.

Water requirements for the APT are small in comparison to historic SRS usage. However, the withdrawal and discharge of water is a sensitive issue. DOE could mitigate the potential impacts to groundwater by using the Savannah River and mitigate the thermal discharge and flow impacts to Par Pond by utilizing cooling towers. As mentioned earlier, the Department is investigating bypassing precooler Ponds 2 and 5. This would eliminate the potential impacts to those water bodies.

Other potential mitigation actions could include:

- Incorporating engineered barriers into the APT design to minimize exposure to workers and the public
- Installing a system of monitoring wells
- Instituting best available engineering techniques to control erosion and sedimentation during the construction process
- Conducting site-specific reviews of utility corridors prior to construction to ensure the protection of sensitive plant and animal species and cultural resources
- Implementing any actions resulting from consultations with the U.S. Fish and Wildlife Service.

Table S-2. Comparison of No Action impacts.[a]

Potential impacts at the Savannah River Site		Potential impacts away from the Savannah River Site Commercial Light-Water Reactor		
APT Preferred alternative	TEF Preferred alternative **AND**	Bellefonte Nuclear Plant **OR**	Watts Bar Nuclear Plant **OR**	Sequoyah Nuclear Plant
Construction Impacts				
About 250 acres of land would be graded and leveled. Additional roads, bridge upgrades, rail lines and utility upgrades would be required. No geologically significant formations or soils occur. Dewatering would be necessary and could result in short-term increases in solids to receiving water bodies. No surface faulting on site. Air emission from fugitive dust, exhaust emissions, and batch plants would be negligible. Small construction landfill required. Most waste generated would be solid waste and sanitary waste. Increases in the work force for APT construction would not result in a boom situation. Peak employment would be about 1,400 jobs.	Construct facility in already industrialized H-Area. No geologically significant formations or soils occur. Dewatering would be necessary and could result in short-term increases in solids to receiving water bodies. No surface faulting on site. Air emission from fugitive dust, exhaust emissions, and batch plants would be negligible. Increases in the work force for TEF construction would not result in a boom situation. Peak employment would be about 740 jobs.	Activities would largely consist of internal modifications to existing structures. Spent fuel storage facilities would require about 5 acres of land and about 50 construction workers. Construction waste: Small amounts of hazardous and nonhazardous wastes generated; no change from EPA designation as small Quantity Generator. Direct and indirect construction jobs peak at 9,000 for Bellefonte 1 or Bellefonte 1 and 2, reducing the unemployment rate to about 3 percent from the current 7.9 percent.	No modifications or construction activities required. Spent fuel storage facilities same as Bellefonte and Sequoyah. Construction jobs for the spent storage facility: 50 Construction waste: None	Same as Watts Bar Spent fuel storage facilities same as Bellefonte and Watts Bar. Construction jobs for the spent storage facility: 50 Construction waste: None
Impacts from Operation on Nonradiological Air Emissions				
Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations. Plumes would be visible off-site under certain meteorological conditions.	Negligible impacts from nonradioactive airborne effluent.	Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations. Plumes would be visible off-site under certain meteorological conditions.	Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations. Plumes would be visible off-site under certain meteorological conditions.	Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations. Plumes would be visible off-site under certain meteorological conditions.

a. No Action includes TEF impacts at SRS and one or more reactor impacts away from SRS.

Table S-2. (Continued).

Potential impacts at the Savannah River Site		Potential impacts away from the Savannah River Site Commercial Light-Water Reactor		
APT Preferred alternative	TEF Preferred alternative **AND**	Bellefonte Nuclear Plant **OR**	Watts Bar Nuclear Plant **OR**	Sequoyah Nuclear Plant
Impacts from Operation on Radiological Air Emissions				
Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0008	Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.00039	Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0014	Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0014	Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0015
Impacts from Operation on Land Use and Infrastructure				
Land converted to industrial use. Electricity use: 3.1 terawatt-hrs/year	Land converted to industrial use. Electricity use: 0.021 terrawatt hrs/year	No land impacts. Electricity generation: approximately 1,300 MWe per Bellefonte reactor	No land use impacts. Electricity generation: approximately 1,300 MWe	No land use impacts. Electricity generation: approximately 1,300 MWe per Sequoyah reactor
Impacts from Operation on Waste Management				
Would generate solid and liquid wastes, but no high-level or transuranic waste; waste volumes would have negligible impact on capacities of waste facilities. Generation of electricity will generate various types of waste including fly ash, bottom ash, and scrubber sludge. <u>Annual Values</u> Sanitary solid: 1,800 metric tons Industrial: 3,800 metric tons Radioactive wastewater: 140,000 gallons Low-level radioactive waste: 1,400 cubic meters High concentration waste under evaluation: 12 cubic meters Sanitary wastewater: 3.2 million gallons Nonradioactive process wastewater: 920 million gallons	Would generate solid and liquid wastes, but no high-level or transuranic waste; waste volumes would have negligible impact on capacities of waste facilities. <u>Annual Values</u> Sanitary solid: 230 cubic meters Industrial: 33 cubic meters Low-level radioactive waste: 230 cubic meters Hazardous/mixed waste: 3.3 cubic meters Sanitary wastewater: 770,000 gallons Nonradioactive process wastewater: 11,000 gallons	Would generate solid and liquid wastes; waste volumes would have negligible impact on capacities of waste facilities. <u>Annual Values</u> Low-level radioactive waste: 40 cubic meters Mixed waste: <1 cubic meter Hazardous waste: 1.0 cubic meters Nonhazardous waste: 850,000 cubic meters 141 spent fuel assemblies per 18 month cycle	Would generate solid and liquid wastes; waste volumes would have negligible impact on capacities of waste facilities. <u>Annual Values</u> Low-level radioactive waste: 0.43 cubic meter No additional spent fuel if less than 2,000 TPBARs irradiated per 18 month cycle. Up to 60 additional spent fuel assemblies for 3,400 TPBARs per 18 month cycle.	Would generate solid and liquid wastes; waste volumes would have negligible impact on capacities of waste facilities. <u>Annual Values</u> Low-level radioactive waste: 0.43 cubic meter No additional spent fuel if less than 2,000 TPBARs irradiated per 18 month cycle. Up to 60 additional spent fuel assemblies for 3,400 TPBARs per 18 month cycle.

a. No Action includes TEF impacts at SRS and one or more reactor impacts away from SRS.

Table S-2. (Continued).

Potential impacts at the Savannah River Site		Potential impacts away from the Savannah River Site Commercial Light-Water Reactor		
APT Preferred alternative	TEF Preferred alternative **AND**	Bellefonte Nuclear Plant **OR**	Watts Bar Nuclear Plant **OR**	Sequoyah Nuclear Plant
Impacts from Operation on Human Health				
Public would receive radiation exposure from APT emissions and transportation of radioactive material; workers would receive radiation exposure from facility operations and transportation of radioactive material and from electromagnetic fields. Estimated fatal cancers: 0.0016	Public would receive radiation exposures from gaseous effluents. Estimated fatal cancers: 0.00039	Public would receive radiation exposures from gaseous and liquid effluents. Estimated fatal cancers: 0.0033	Public would receive radiation exposures from gaseous and liquid effluents. Estimated fatal cancers: 0.0032	Public would receive radiation exposures from gaseous and liquid effluents. Estimated fatal cancers: 0.0053
Impacts from Operation on Surface Water				
Blowdown rates (about 2,000 gpm) would cause negligible impact on surface water levels. Using Par Pond and pre-cooler ponds as discharge point for cooling water, temperatures would not exceed 90°F. Contaminated sediments would be resuspended in addition to radiological releases from APT. Estimated fatal cancers: 0.00021	Sanitary and industrial wastewater streams would be routed to existing SRS treatment facilities prior to release. Released water would be negligible compared to existing SRS releases.	Less than 1 percent of river flow. Water quality within regulatory limits. Public would receive radiation exposures from liquid effluents. Estimated fatal cancers: 0.0019	No change from existing operations. Public would receive radiation exposures from liquid effluents. Estimated fatal cancers: 0.0018	No change from existing operations. Public would receive radiation exposures from liquid effluents. Estimated fatal cancers: 0.0038
Impacts from Operation on Socioeconomics				
Operational work force about 500. No regional impacts.	Operational work force about 108. No regional impacts.	Operational work force: Operational work force about 800 for Bellefonte 1; about 1,000 for Bellefonte 1 and 2. Minor regional impacts.	Operational work force: 10 additional workers.	Operational work force: 10 additional workers.
Impacts from Transportation				
Negligible during operations period. During construction could expect about two fatalities to the public and workers due to increased traffic levels.	Vehicle emissions and less than one fatality per year. Routine and accidental doses.	Vehicle emissions and less than one fatality per year. Routine and accidental doses.	Same as for Bellefonte and Sequoyah.	Same as for Bellefonte and Watts Bar.

a. No Action includes TEF impacts at SRS and one or more reactor impacts away from SRS.

Table S-3. Comparison of impacts among APT alternatives.

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Construction on Landforms, Soils, Geology, and Hydrology								
Negligible impacts. Some 250 acres of land would be graded or leveled. No geologically significant formations or soils occur. Dewatering necessary. No surface faulting on site. Sites for electricity generation exist.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Water table is deeper and would require less dewatering; no other changes estimated from Preferred alternative.	Impacts would depend upon the specific location of a new facility. Could require about 110 acres for natural gas or 290 acres for coal.
Impacts from Operation on Landforms, Soils, Geology, and Hydrology								
No impacts No dewatering required for operations.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Removal of 6,000 gpm on a sustained basis could impact groundwater flow to streams and compact clay layers	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility
Impacts from Construction on Surface Water								
Negligible impacts. Dewatering of construction site could result in short - term increases in solids to the receiving water bodies.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	**Discharges would be similar to the Preferred alternative, although they would go to Pen Branch via Indian Grave Branch. Water levels in the upper reaches of the**	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
						stream system would be raised.		
Impacts from Operation on Surface Water								
Blowdown rates (about 2,000 gpm) would cause negligible impact on surface water levels. Using Par Pond and pre-cooler ponds as discharge point for cooling water, temperatures would not exceed 90°F. Contaminated sediments could be resuspended in addition to radiological releases from APT resulting in offsite population radiation exposure. Estimated fatal cancers: **0.00021**	Would require 7% less cooling water than Preferred due to lower waste heat generation; no other changes estimated from Preferred alternative	Would require 33% more cooling water than Preferred; no other changes from Preferred alternative	No change estimated from Preferred alternative	Blowdown rates (about 125,000 gpm) would result in higher temperatures to water bodies (about 100° F). A slight increase in "pre-cooler" pond water levels would occur. No other changes estimated from Preferred alternative.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Discharges would be similar to the Preferred alternative, although concentrations would vary and be localized.
Impacts from Construction on Nonradiological Air Emissions								
Air emissions (fugitive dust and exhaust emissions) would be negligible, well below the applicable regulatory standards. Impacts from electricity purchases, would be dispersed.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Emission types would be similar to the Preferred alternative, although concentrations would vary and be localized.

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Operation on Nonradiological Air Emissions								
Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Nonradiological emissions would be well within applicable regulatory standards.
Impacts from Construction on Radiological Air Emissions								
No impacts; no radioactive materials stored during construction.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative
Impacts from Operation on Radiological Air Emissions								
Negligible impacts from radioactive airborne effluents Latent Cancer Fatalities (LCFs) expected: **0.0008**	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Slightly increased doses from airborne emissions LCFs expected: **0.00086**	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Higher doses from airborne emissions due to closer distance to SRS boundary. LCFs expected: **0.00089**	Impacts would depend upon the specific location of a new facility. However, the dose from radioactive effluents would be negligible.
Impacts from Construction on Land Use and Infrastructure								
Conversion of 250 acres of forested land to industrial use. Additional roads, bridge upgrades, rail lines and utility upgrades would be required.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Additional cooling water piping to K-area needed.	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility. Could require conversion of up to 290 acres to industrial use.

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Operation on Land Use and Infrastructure								
No land use changes beyond construction. Electricity use: 3.1 terawatt-hrs/year	No change estimated from Preferred alternative	No change estimated from Preferred alternative Electricity use 23% higher than Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative
Impacts from Construction on Waste Management								
Some landfill construction required. Most waste generated would be solid waste and sanitary solid and liquid waste. Waste disposed at SRS. (Annual Values) Sanitary solid: 560 cubic meters Construction debris: 30,000 cubic meters **Industrial wastewater: 3.6 million gallons**	No change estimated from Preferred alternative	9% **less sanitary** waste generated due to smaller construction workforce required.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Additional construction waste generated from construction of facility.
Impacts from Operation on Waste Management								
Would generate solid and liquid wastes, but no high-level or transuranic waste; waste volumes would have negligible impact on capacities of waste facilities.	No change estimated from Preferred alternative	37% more nonradioactive process wastewater required.	**8%** more low-level and **25%** more high concentration mixed waste generated than Preferred	2,000% greater flow of nonradioactive process wastewater required.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Impacts would depend upon the type of power plant selected. However, waste rates for new power plant would not be very different than for

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Generation of electricity will generate various types of waste including fly ash, bottom ash, and scrubber sludge. (Annual Values) Sanitary solid: 1,800 metric tons Industrial: 3,800 metric tons Radioactive wastewater: 140,000 gallons High concentration low-level radioactive waste under evaluation: 2.5 cubic meters High concentration waste under evaluation: 12 cubic meters Sanitary wastewater: **3.3** million gallons Low-level radioactive waste: 1,400 cubic meters Nonradioactive process wastewater: 920 million gallons			alternative.					the Preferred alternative.

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Construction on Visual Resources								
Negligible, facilities far from SRS boundaries and not visible to offsite traffic; facilities would look like other industrial areas at SRS.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility.
Impacts from Operation on Visual Resources								
Negligible, plumes from mechanical-draft cooling towers would be visible under certain meteorological conditions.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Negligible, would not generate visible plumes.	No change estimated from Preferred alternative	Plume from K-area cooling tower would likely be more visible.	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility.
Impacts from Construction on Noise								
Noise primarily from construction equipment at APT site. Not audible at SRS boundaries; however, construction workers could encounter noise levels that would require administrative controls or protective equipment.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Noise would be similar to Preferred alternative, but specific impacts would depend upon the location of a new facility.
Impacts from Operation on Noise								
Noise from APT equipment operation and traffic; mechanical-draft cooling towers largest single source, not audible at SRS boundary.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No mechanical - draft cooling tower noise at APT site. Pump noise could be occasionally audible to river traffic.	No change estimated from Preferred alternative	No mechanical-draft-cooling tower noise at APT site. Pump and cooling tower noise at K-area.	No change estimated from Preferred alternative	Noise would be similar to Preferred alternative, but specific impacts would depend upon the location of a new facility.

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Construction on Human Health								
Concentrations of nonradiological constituents would be less than applicable limits for workers and public. Traffic-related accidents resulting in about 2 fatalities to the public and workers due to increased local traffic would be reduced with finish of construction. Occupational injuries to workers would be due to industrial activities and would have the following impacts for the construction period: Number requiring First Aid: 1,100 Number requiring medical attention: 280 Number resulting in lost work time: 93	No change estimated from Preferred alternative	Occupational injuries 6% less than Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Traffic fatalities 20% less than Preferred alternative No changes in occupational injuries estimated from Preferred alternative	Impacts would be similar to Preferred alternative, but specific impacts would depend upon the location of a new facility.

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Operation on Human Health								
Public would receive source radiation exposure from APT emissions and transportation of radioactive material; workers would receive radiation exposure from facility operations and transportation of radioactive material and from electromagnetic fields. Total LCFs to population (air, water, and transport) **0.0016**	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Slightly increased doses from resuspension of contaminated material Total LCFs 0.0017	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Slightly increased doses due to decreased distance to public Total LCFs 0.0017	No change estimated from Preferred alternative. Impacts would be local vs. dispersed for electricity generation.
Impacts from Accidents on Human Health								
Negligible consequences for accidents with frequency of less than once in operating lifetime of facility.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Minor decreases in accident doses for low probability events.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	**No change estimated from Preferred alternative**
Impacts from Construction on Terrestrial Ecology								
Would result in the loss of up to 250 acres of forested land; no marked reduction in plant/animal abundance or diversity.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative; specific impacts would depend upon the location of a new facility.

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Operation on Terrestrial Ecology								
Negligible impacts. Mechanical-draft cooling towers would result in salt deposition on vegetation; however, maximum rates (60 lb/acres/yr) are below threshold levels (180 lb/acres/yr).	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	**No salt deposition, otherwise** no change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.
Impacts from Construction on Wetlands Ecology								
No impacts are projected from construction activities.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.
Impacts from Operation on Wetlands Ecology								
Would result in minor impacts to wetlands. Temperature of the blowdown would be marginally higher than the ambient maximum temperature. During cooler months the warmth could have a positive impact by lengthening the growing season for some aquatic vegetation.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Would raise water level in Ponds 2 and 5 by 1.5 feet, possibly affecting wetland plant communities.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Construction on Aquatic Ecology								
Impacts to aquatic organisms in Upper Three Runs and tributaries would be minor due to use of soil and erosion control measures.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No changes estimated from Preferred alternative.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.
Impacts from Operation on Aquatic Ecology								
Impingement (132 fish) and entrainment (173,000 fish eggs and 326,000 larvae annually) would not substantially affect Savannah River fisheries. Solids in blowdown would have no impacts on aquatic ecology. Discharge temperatures would have only small localized effects on aquatic communities.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Impingement (2,600 fish) and entrainment (3.4 million fish eggs and 6.4 million larvae annually) would be increased. Discharge temperatures would be high enough to adversely affect aquatic communities.	**No impingement and entrain-ment, otherwise** no change estimated from Preferred alternative.	**Discharge to Pen Branch via Indian Grave Branch, otherwise** no change estimated from Preferred alternative.	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.
Impacts from Construction on Threatened or Endangered Species								
Negligible, no threatened or endangered species at preferred site.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Negligible, no threatened or endangered species at alternate site.	Specific impacts would depend upon the location of a new facility.

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Operation on Threatened or Endangered Species								
Negligible impacts to threatened and endangered species.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Fish kills in pre-cooler ponds could be beneficial to bald eagles. Heated discharges could force alligators to leave pre-cooler ponds in late summer.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No threatened or endangered species at alternate site.	Impacts would depend upon the specific location.
Impacts from Construction on Socioeconomics								
Increases in the work force for APT construction would not result in large regional impacts. Nominal impacts would be positive. Peak employment is about 1,400 jobs.	No change estimated from Preferred alternative	Employment would be lower with about 100 fewer jobs	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Peak workforce would be about 1,100 additional jobs. Impacts would vary by location.
Impacts from Operations on Socioeconomics								
Operational work force about 500. Work force would not result in large regional impacts. Nominal impacts would be positive.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Additional operational workforce about 200. Impacts would vary by location.
Impacts from Construction on Environmental Justice								
No adverse impacts on minority or low-income populations expected.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.

Table S-3. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Operations on Environmental Justice								
No adverse impact on minority or low-income populations expected.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.

Table S-4. Comparison of impacts among design variations.[a]

Preferred alternative (Baseline APT)	Modular APT (3 kg/year)	Modular APT (1030 MeV)	APT/TEF Combination	Cooling Water bypass Ponds 2 and 5
Impacts from Operation on Surface Water				
Blowdown rates (about 2,000 gpm) would cause negligible impact on surface water levels. Using Par Pond and the pre-cooler ponds as discharge point for cooling water, temperatures would not exceed 90°F. Contaminated sediments would be resuspended in addition to radiological releases from APT resulting in offsite population radiation exposure. Estimated fatal cancers: 0.00021	No change estimated from Baseline APT.	Blowdown rates would be 10 percent lower than the Baseline APT. Radiological releases would be the same as the Baseline APT.	No change estimated from Baseline APT.	No impact to Ponds 2 and 5.
Impacts from Operation on Nonradiological Air Emissions				
Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations.	No change estimated from Baseline APT.	Nonradiological releases would be 10 percent lower than the Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.
Impacts from Operation on Radiological Air Emissions				
Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0008	No change estimated from Baseline APT.	No change estimated from Baseline APT.	Increased doses from airborne emissions. LCFs expected: 0.0009	No change estimated from Baseline APT.
Impacts from Operation on Land Use and Infrastructure				
No land use changes beyond construction. Electricity use: 3.1 terawatt-hrs/year	No change estimated from Baseline APT.	Electricity use would be 32 percent lower than the Baseline APT. Electricity use: 2.0 terawatt-hrs/ year	No change estimated from Baseline APT.	No change estimated from Baseline APT.

a. Table S-4 only summarizes the potential construction and operational impacts for those factors that could be different from what is described for the baseline accelerator.

Table S-4. (Continued).

Preferred alternative (Baseline APT)	Modular APT (3 kg/year)	Modular APT (1030 MeV)	APT/TEF Combination	Cooling Water bypass Ponds 2 and 5
Impacts from Construction on Waste Management				
Some landfill construction required. Most waste generated would be solid waste and sanitary solid and liquid waste. Waste disposed at SRS. <u>Annual Values</u> Sanitary solid: 560 cubic meters Construction debris: 30,000 cubic meters Industrial wastewater: 3.6 million gallons	No change estimated from Baseline APT.	Construction wastes would be 10 percent lower than the Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.
Impacts from Operation on Waste Management				
Would generate solid and liquid wastes, but no high-level or transuranic waste; waste volumes would have negligible impact on capacities of waste facilities. Generation of electricity will generate various types of waste including fly ash, bottom ash, and scrubber sludge. <u>Annual Values</u> Sanitary solid: 1,800 metric tons Industrial: 3,800 metric tons Radioactive wastewater: 140,000 gallons Low-level radioactive waste: 1,400 cubic meters High concentration low-level radioactive waste under evaluation: 2.5 cubic meters High concentration mixed waste under evaluation: 12 cubic meters Sanitary wastewater: 3.3 million gallons Nonradioactive process wastewater: 920 million gallons	No change estimated from Baseline APT.	Operations wastes would be 10 percent lower than the Baseline APT. <u>Annual Values</u> Radioactive wastewater: 130,000 gallons Low-level radioactive waste: 1,300 cubic meters Sanitary wastewater: 3 million gallons Nonradioactive process wastewater: 830 million gallons	Some waste categories slightly higher than Baseline APT. Differences from Baseline APT <u>Annual Values</u> Radioactive wastewater: 150,000 gallons Low-level radioactive waste: 1,700 cubic meters	No change estimated from Baseline APT.

a. Table S-4 only summarizes the potential construction and operational impacts for those factors that could be different from what is described for the baseline accelerator.

Table S-4. (Continued).

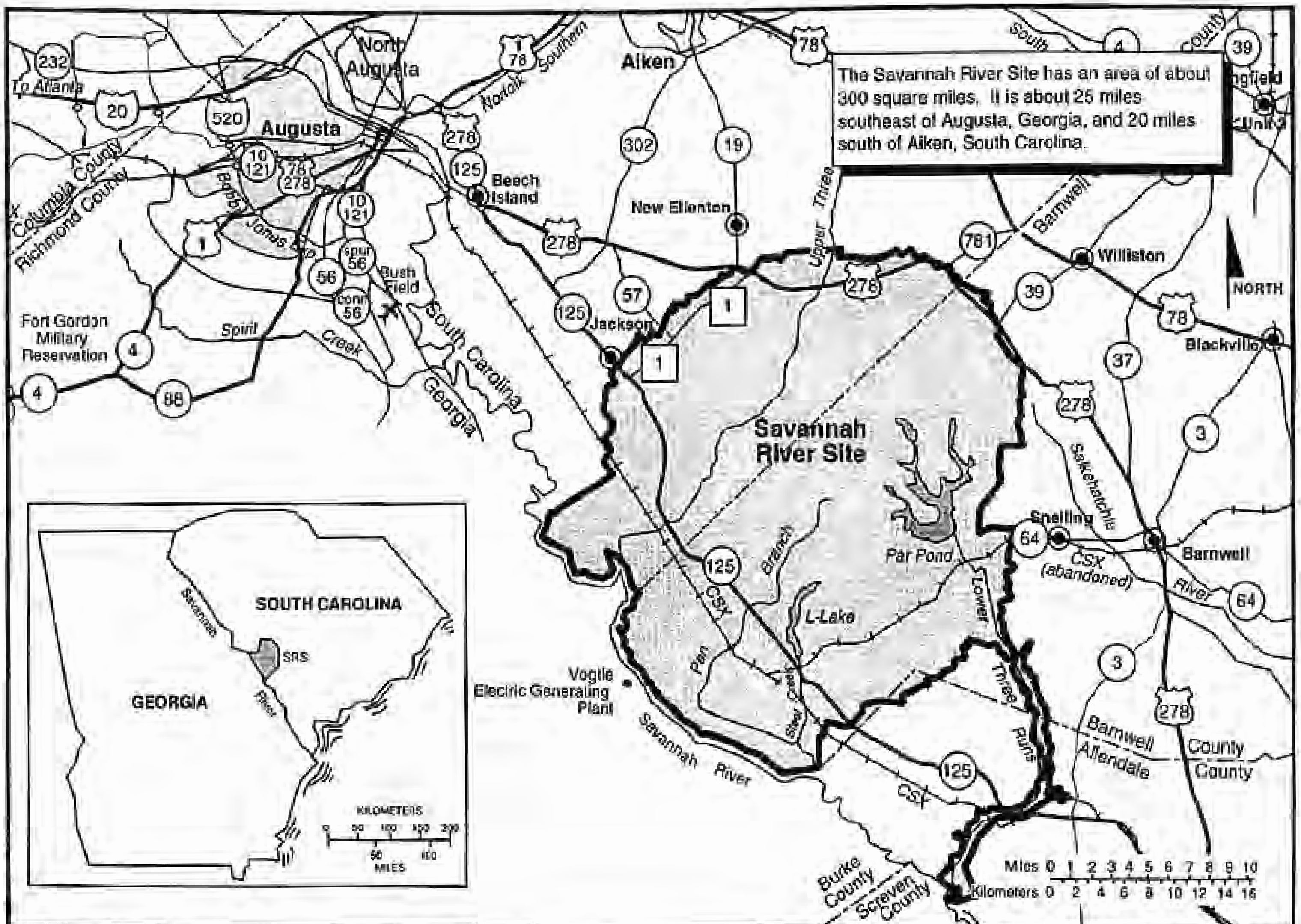
Preferred alternative (Baseline APT)	Modular APT (3 kg/year)	Modular APT (1030 MeV)	APT/TEF Combination	Cooling Water bypass Ponds 2 and 5
Impacts from Construction on Human Health				
Concentrations of nonradiological constituents would be less than applicable limits for workers and public. Traffic -related accidents resulting in about 2 fatalities to the public and workers due to increased local traffic would be reduced with finish of construction. Occupational injuries to workers would be due to industrial activities and would have the following impacts for the construction period: Number requiring First Aid: 1,100 Number requiring medical attention: 280 Number resulting in lost work time: 93	No change estimated from Baseline APT.	Construction health impacts would be 10 percent lower than the Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.
Impacts from Operation on Human Health				
Public would receive radiation exposure from APT emissions and transportation of radioactive material. Workers would receive radiation exposure from facility operations, transportation of radioactive material, and from electromagnetic fields. Total LCFs to population (air, water, and transport): 0.0016	No change estimated from Baseline APT.	No change estimated from Baseline APT.	Radiation exposures to the public would be 10 percent higher due to higher air emissions as compared to the Baseline APT. Total LCFs to population (air, water, and transport): 0.0017	No change estimated from Baseline APT.
Impacts from Operation on Wetlands Ecology				
Would result in minor impacts to wetlands. Temperature of the blowdown would be marginally higher than the ambient maximum temperature. During cooler months the warmth could have a positive impact by lengthening the growing season for some aquatic vegetation.	No change estimated from Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.	No heated blowdown to Ponds 2 or 5. Minor impact for heated water only in Pond C.

a. Table S-4 only summarizes the potential construction and operational impacts for those factors that could be different from what is described for the baseline accelerator.

Table S-4. (Continued).

Preferred alternative (Baseline APT)	Modular APT (3 kg/year)	Modular APT (1030 MeV)	APT/TEF Combination	Cooling Water bypass Ponds 2 and 5
Impacts from Construction on Socioeconomics				
Increases in the work force for APT construction would not result in a boom situation. Peak employment is about 1,400 jobs.	No change estimated from Baseline APT.	Peak employment would be 10 percent lower than the Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.

a. Table S-4 only summarizes the potential construction and operational impacts for those factors that could be different from what is described for the baseline accelerator.


The Savannah River Site has an area of about 300 square miles. It is about 25 miles southeast of Augusta, Georgia, and 20 miles south of Aiken, South Carolina.
Savannah River Site
Augusta
North Augusta
Aiken
New Ellenton
Beech Island
Jackson
Williston
Blackville
Barnwell
Snelling
NORTH
To Atlanta
Columbia County
Richmond County
Fort Gordon Military Reservation
Bush Field
Spirit Creek
Norfolk Southern
South Carolina
Georgia
Upper Three
Par Pond
L-Lake
Pen Branch
Steel Creek
Lower Three Runs
Salkehatchie River
CSX
CSX (abandoned)
Vogtle Electric Generating Plant
Savannah River
Burke County
Screven County
Barnwell County
Allendale County
Miles 0 1 2 3 4 5 6 7 8 9 10
Kilometers 0 2 4 6 8 10 12 14 16
SOUTH CAROLINA
GEORGIA
SRS
Savannah River
KILOMETERS
MILES
DOE-SR APT EIS/Pubsonly/APT-Abr/Grfx_A/Pt-Alp.ai

PART A. INTRODUCTION AND FORMAT

In its Draft EIS, the U.S. Department of Energy (DOE) assessed the potential environmental impacts of constructing and operating an accelerator at the Savannah River Site. This document finalizes the assessment of potential environmental impacts and will be one of the tools DOE utilizes to make the ultimate decision on the primary technology for producing tritium. This document is a record of the changes made to the Draft EIS, which is not being reprinted. All changes can be found in Part C. An explanation of how changes are incorporated follows:

Modifications to the Draft EIS are presented in two ways: (1) complete sections, tables, and figures have been replaced or added with specific references to the Draft EIS, and (2) text or elements of tables in the Draft EIS have been modified and shown as **bolded text**. In both cases the change is preceded by a text box that explains the change, why the change was made, and references the pertinent section of the Draft EIS. The text box is followed by the applicable modification. As mentioned, changes to text and table information are **bolded** and reproduced with an adequate amount of the applicable material in the Draft EIS to place the change in context. As a result, the reader should not have to refer to the Draft EIS to understand the change. In the case of text and tables that replace corresponding sections of the Draft EIS, bolding is not used. An example of change is presented in Section A.1 below.

A.1 Introduction

EVENTS SINCE THE DRAFT APT EIS

Since issuance of the Draft EIS in December 1997, several events have occurred and decisions have been made that influenced the preparation of the Final APT EIS. Two other draft EISs related to the tritium supply mission were issued, the Tritium Extraction Facility (TEF) EIS and the Commercial Light-Water Reactor (CLWR) EIS. These three documents are closely interrelated. The proposed action described in the CLWR EIS is now the "No-Action" alternative in this EIS. Conversely, the APT is the "No-Action" alternative in the CLWR EIS.

In August 1998, the Department decided to make its primary technology decision prior to issuing the Final EISs. On December 22, 1998, Secretary of Energy Bill Richardson announced that CLWRs would be the primary tritium supply technology. The Secretary designated the Watts Bar Unit 1 reactor near Spring City, Tennessee, and Sequoyah Unit 1 and 2 reactors near Soddy-Daisy, Tennessee as the preferred CLWRs for tritium production. The Secretary designated the APT as the backup technology for tritium supply. Selection of the CLWR option reaffirms the December 1995 Tritium Supply and Recycling PEIS ROD to construct and operate a new tritium extraction capability at the SRS. The preferred alternative is the No Action alternative, consistent with its role as the backup technology. Under No Action, DOE would complete key research and development milestones for the accelerator at SRS (but not construct the facility) with the following design and support features: klystron radiofrequency power tubes, the use of superconducting equipment, helium-3 feedstock material, and mechanical draft cooling towers with river water makeup.

The *Final Accelerator Production of Tritium at the Savannah River Site Environmental Impact Statement* (APT EIS) has been prepared consistent with the President's Council on Environmental Quality regulations (40 CFR Part 1500-1508) and Department of Energy Procedures (10 CFR Part 1021). Because DOE received few comments on the Draft EIS (DOE/EIS-0270D), it is not reprinting a revised draft as the Final EIS, as is typically done. Rather, DOE is finalizing the APT EIS by reference to the Draft EIS and is issuing this document as a record of changes made pursuant to 10 CFR Part 1503.4.

This EIS presents the assessment of potential environmental impacts of siting and technology alternatives of an APT facility at the Savannah River Site. The EIS also provides more environmental information on the APT than was presented in the Tritium Supply and Recycling

PEIS. A complete revised Summary has also been prepared and is included in this Final EIS.

Modifications to the Draft APT EIS were made for the following reasons:

- To incorporate responses to comments received during the public comment period
- To update or clarify factual information presented in the Draft EIS
- To reflect the evolution of APT design work that has progressed since the Draft EIS was issued

This document focuses on changes which are of importance to the decision maker and the public. It does not alter or correct minor editorial matters in the Draft, nor correct minor technical information, unless those changes are warranted because they would alter the meaning or change the conclusions drawn. Table A-1 summarizes the changes made and denotes which changes are in response to which comments.

Since issuance of the Draft EIS, the Department has investigated a design variation for the discharge of cooling water. This variation would result in mitigating potential ecological impacts described in the Draft EIS and responds to several comments received during the public comment period. Under this variation, the discharge of cooling water would go to Pond C, bypassing pre-cooler Ponds 2 and 5 via an existing discharge channel.

The Draft EIS introduced two other design variations, a modular or staged accelerator configuration, and combining tritium extraction facilities with the APT. The Draft EIS was based on the best available information for assessing the impacts of either design variation; this document uses additional information to quantify to the extent possible, the potential impacts associated with these designs pursuant to the commitment made in the Draft EIS.

A.2 Format

The following is an example of how the changes are presented.

[Chapter 2, Section 2.3.5 modification to the Draft APT EIS]

In comment L2-04, the commenter questioned why DOE did not investigate existing industrial areas as potential sites for the APT. In its response, the Department indicated it did not believe existing industrial sites are feasible for a number of reasons. Consequently, the Department is clarifying the description of its siting process.

<u>Page 2-15, 1st column, 1st through 2nd paragraphs are replaced with the following</u>:

DOE assumed the APT complex would require approximately 250 acres of land with a footprint 6,560 feet long by 1,640 feet wide. The area requirements would not vary much with any combination of technologies or design options described in this chapter.

With the land requirements established, the next phase of the screening process was to develop exclusionary criteria (disqualifying conditions). Examples of these criteria include avoiding adverse impacts to threatened and endangered species, avoiding impacts to wetlands and sensitive ecosystems, and proximity to seismic faults. Wike et al. (1996) contains a complete listing of these exclusionary criteria. Seven potential sites (numbered 1-7) were initially identified. Two sites (numbered 5 and 7) were subsequently eliminated due to the presence of disqualifying conditions (proximity to seismic faults). One site (number 8) was added based on a request to examine a site in the vicinity of **the industrialized A- and M- Areas**. Although not explicitly used as exclusionary criteria, existing industrially developed areas **were examined and dismissed** as feasible sites because the APT, **due to its space requirements, would conflict with** (1) the presence of existing structures, (2) the presence of non-operating structures that would require extensive decontamination and decommissioning (D&D) prior to site preparation, or (3) the presence of active environmental restoration activities.

Table A-1. Modifications to Chapters 1 - 7 of the Draft APT EIS.

Sections of the Draft APT EIS Modified	Location in the Draft EIS	Location in the Final EIS	Link to comment (if applicable)	Subject of change
Chapter 1, Section 1.5	Page 1-5, 2nd column, 2nd through 4th paragraphs	Page C-1	L1-02	Tritium supply implementing strategy
	Page 1-6, 1st column, 1st through 2nd paragraphs	Page C-2		TEF No Action alternative
	Page 1-7, 1st column, after 2nd paragraph	Page C-2		Plutonium residues and scrub alloys management
	Page 1-7, 1st column after 2nd paragraph	Page C-3		Surplus plutonium disposition
Chapter 2, Section 2.1	Page 2-2, 1st column, 3rd through 4th paragraphs	Page C-3		APT No Action alternative
Chapter 2, Section 2.3.5	Page 2-15, 1st column, 1st and 2nd paragraphs	Page C-4	L2-04	APT site selection
Chapter 2, Section 2.5	Page 2-21, 2nd column through page 2-25, 2nd column, 3rd paragraph	Page C-5		APT design variations
Chapter 2, Section 2.7	Page 2-26, 1st column, 1st paragraph through page 2-39	Page C-5		Comparison of environmental impacts
Chapter 3, Sections 3.3.1.1, 3.3.1.2, and 3.4.2	Page 3-6, 1st column, 3rd paragraph and Figure 3-4 on page 3-7	Page C-26		APT footprint
	Page 3-8, 1st Column, 1st paragraph, 5th through 9th lines, Figure 3-5 on page 3-9, and Table 3-1 on page 3-10	Page C-26		APT footprint
	Page 3-44, 1st Column, 1st paragraph, lines 2 through 15, and Figures 3-16 and 3-17 on pages 3-47 and 3-48	Page C-26		Savannah River water quality
Chapter 3, Section 3.3.2.1	Page 3-18, 2nd column, 2nd paragraph and Table 3-5, page 3-21	Page C-33		Non-radiological air quality
Chapter 3, Section 3.3.4.1	Page 3-28, 2nd column, 2nd paragraph and Table 3-8, page 3-29	Page C-33		Radiological air quality
Chapter 3, Section 3.3.4.2	Page 3-28, 2nd column, 4th paragraph and Table 3-9, page 3-29	Page C-33		Radiation doses at SRS
Chapter 3, Section 3.4.1	Page 3-43, 1st column, 1st paragraph and Table 3-11, page 3-43	Page C-33		Radiation doses at SRS
Chapter 3, Section 3.4.5	Page 3-54, 2nd column, 2nd paragraph, line 8 through line 3 in the 1st column on page 3-55	Page C-36	L2-05 and L2-06	Threatened and endangered species
	Page 3-55, 1st column, 2nd paragraph	Page C-37	L2-05 and L2-06	Threatened and endangered species

Table A-1. (Continued).

Sections of the Draft APT EIS Modified	Location in the Draft EIS	Location in the Final EIS	Link to comment (if applicable)	Subject of change
Chapter 4	Page 4-1, 2nd column, 2nd and 3rd paragraphs	Page C-37		Concrete batch plants and construction debris landfill
	Page 4-2, 2nd column, 4th paragraph through page 4-3, 1st column, 1st paragraph	Page C-39		No Action impacts
Chapter 4, Section 4.1.1.2	Page 4-4, 2nd column, 4th paragraph through 1st paragraph on page 4-5	Page C-42	L4-03	Groundwater activation
Chapter 4, Section 4.1.2.1	Page 4-5, 2nd column, text box	Page C-43		Section 316(a) demonstration
Chapter 4, Section 4.1.2.2	Page 4-6, 2nd column, Tables 4-1 and 4-2, page 4-7	Page C-43		Water borne source terms
Chapter 4, Section 4.1.3.3	Page 4-16, 2nd column, 3rd paragraph and Table 4-11, page 4-18,	Page C-43		Maximum non-radiological concentrations
Chapter 4, Section 4.1.3.4	Page 4-19, 2nd column, 9th paragraph through page 4-22, 1st column, 4th paragraph, including Tables 4-12 and 4-13, pages 4-20 and 4-21	Page C-46		Accelerator source terms
Chapter 4, Section 4.1.4	Page 4-22, 2nd column, 3rd paragraph	Page C-48		Existing SRS River Water System
Chapter 4, Section 4.1.5	Page 4-25, 2nd column, text box	Page C-49	L3-05 and L4-04	APT waste categorization
	Page 4-25, 1st column, 1st paragraph and Tables 4-15 and 4-16, pages 4-26 and 4-27	Page C-49		APT waste generation estimates
Chapter 4, Section 4.1.5	Page 4-25, 2nd column, 4th paragraph through page 4-27, 1st column, 1st paragraph and Table 4-17, page 4-18	Page C-49		APT waste generation estimates
Chapter 4, Section 4.2.1.2	Page 4-36, 1st column, 4th paragraph and Table 4-22, page 4-37	Page C-49		Radioactive source terms
Chapter 4, Section 4.2.2.4	Page 4-56, 1st column, 3rd paragraph	Page C-51	L2-05 and L2-06	Threatened and endangered species
Chapter 4, Section 4.4.2.5	Page 4-74, 2nd column, 2nd paragraph, lines 16 through 28	Page C-53	L2-01 and L4-01	Coal-fired health risks
Chapter 5	Page 5-1, 1st column, 1st paragraph through page 5-2, 1st column	Page C-54		Cumulative impacts
Chapter 5, Section 5.1	Page 5-2, 2nd column, 3rd and 4th paragraphs, and Table 5-1 on page 5-3	Page C-56		Radiological doses

Table A-1. (continued).

Sections of the Draft APT EIS Modified	Location in the Draft EIS	Location in the Final EIS	Link to comment (if applicable)	Subject of change
Chapter 5, Section 5.2	Page 5-3, 2nd column, 1st paragraph and Table 5-2 on page 5-4	Page C-58		Non-radiological emissions
	Page 5-4, 1st column, sentences 1 and 2 and Table 5-3 on page 5-5	Page C-58		Radiological doses
	Page 5-4, 2nd column, after 1st paragraph	Page C-58	M1-03 and M1-10	Greenhouse effect
	Page 5-4, 2nd column, 2nd paragraph through page 5-6, 1st column, 1st paragraph and Table 5-4 on page 5-5	Page C-58		Cumulative waste volumes
Chapter 5, Section 5.4	Page 5-7, Table 5-5 and Table 5-5a added	Page C-61		Cumulative electricity generation
Chapter 5, Section 5.5	Page 5-9, Table 5-6	Page C-61		Cumulative health effects
Chapter 5, Section 5.7	Page 5-10, 1st column, 2nd paragraph through 2nd column, 2nd paragraph and Table 5-7 on page 5-11	Page C-64		Reasonably foreseeable actions
Chapter 6, Section 6.2	Page 6-2, 1st column, 2nd paragraph	Page C-64		Resource commitments
Chapter 7, Section 7.1	Page 7-6, 1st column, after 1st paragraph	Page C-66		SC solid waste Management act
Chapter 4, Sections 4.5.1, 4.5.2, 4.5.3, and 4.6	Addendum	Page D-1		Design variations and mitigation actions
Miscellaneous modifications/additions to references				
Additions to Chapter 1 references	Page 1-10	Page C-66		
Additions to Chapter 2 references	Page 2-40	Page C-66		
Additions to Chapter 3 references	Page 3-65	Page C-66		
Additions to Chapter 4 references	Page 4-82	Page C-68		
Additions to Chapter 5 references	Page 5-12	Page C-69		

Table A-1. (continued).

Sections of the Draft APT EIS Modified	Location in the Draft EIS	Location in the Final EIS	Link to comment (if applicable)	Subject to change
Miscellaneous modifications/corrections				
Chapter 2, references	Page 2-40	Page C-69		
Chapter 3, references	Page 3-71	Page C-69		
Chapter 4, Section 4.1.1.1	Page 4-3	Page C-69		
Chapter 4, Section 4.1.5 references	Pages 4-23 through 4-29	Page C-69		
Chapter 4 Section 4.2.2.3	Page 4-54	Page C-69		
Chapter 4, references	Page 4-85	Page C-70		

A.3 Organization of the Final EIS

The Final EIS has four main parts. Part A, the introduction, is what you are now reading. Part B summarizes the comments received during the public comment period and provides responses to those comments. Part B also contains reproductions of the letters received, and transcriptions of the telephone comments left with the DOE message center. Part C presents the modifications to the Draft EIS in the format described previously. As mentioned, the changes are made to (1) incorporate responses to comments received during the public comment period and (2) update or clarify factual information. All changes to technical information in the Draft EIS, Chapters 1 through 7 can be found in Part C. Part D focuses on the three design variations described in Part A.1 and potential mitigation actions. The information is incorporated as Section 4.5 of Chapter 4 – Environmental Impacts – of the Draft EIS. The section also compares the design variations to the baseline accelerator (Preferred Alternative) described in the Draft EIS.

The final also contains the transcripts of the public meetings held on January 13, 1998, in North Augusta, South Carolina, and the South Carolina Clearing House forms.

> Interested persons may obtain a copy of this document or the Draft APT EIS by calling 1-800-881-7292, sending e-mail to nepa@SRS.gov, or writing to Andrew R. Grainger, U.S. Department of Energy, Savannah River Operations Office, Aiken, South Carolina 29802. Copies of both documents, as well as the *Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling (DOE/EIS-0161)*, can be found in DOE's public reading rooms. The reading room for the Savannah River Site is at the Gregg-Graniteville Library, University of South Carolina-Aiken Campus, Aiken, South Carolina 29801, telephone 803-641-3465.

PART B. PUBLIC COMMENTS AND DOE RESPONSES

This part gives DOE's response to comments received during the public comment period. Comments received during the public meetings held in North Augusta, South Carolina are summarized in this part. The transcripts from the meetings and forms received through the South Carolina State Clearing House can be found at the end of this document. Letters and the transcriptions of telephone comments received over DOE's message line are also reproduced in this part. The responses focus on comments specifically related to APT subject matter.

DOE published the *Draft Environmental Impact Statement for the Accelerator for the Production of Tritium* in December 1997. On January 13, 1998, DOE held public meetings on the Draft EIS in North Augusta, South Carolina. The public comment period officially ended on February 2, 1998. However, to the extent practicable, DOE has considered comments received after February 2. This Final EIS (FEIS) is available in DOE reading rooms in Washington, D.C. and Aiken, South Carolina. DOE has distributed copies to individuals, public agencies, Federal and State officials who requested a copy, and to persons and agencies who commented on the Draft EIS. A distribution list can be found starting on page DL-1.

Court reporters documented comments and statements made during the two public meeting sessions. In those two sessions, six individuals provided comments or made public statements. DOE also received eight letters (including one by electronic mail and the South Carolina Clearinghouse Forms) on the Draft EIS. Two individuals left three messages by telephone on DOE's message line.

This section presents the comments received and the DOE responses to those comments. It includes comments made both verbally and in writing. If a statement prompted a modification to the EIS, DOE has noted the change and directs the reader to that change.

Comments are noted by one of the following letter codes:

- M1 – M2 (comments submitted in either session 1 or 2 of the public meeting)
- L1 – L8 (comments received by letter or email)
- P1 – P3 (comments submitted by telephone to DOE's message line)

DOE numbered the specific comments in each letter or verbal presentation sequentially (01, 02, etc.) to provide unique identifiers. The meeting participants are listed in Table B-1. Comments are organized into categories, which are discussed below. Table B-2 lists the individuals and government agencies that submitted comments by letter or telephone and their unique identifiers.

The Department extends its gratitude to all the individuals and agencies who have shown the interest and taken the time to provide comments.

Public Meetings

The public meetings consisted primarily of informal discussions and questions and answers related to the APT. In this section, each public meeting speaker is identified and his or her statement paraphrased since some statements span several pages of the transcripts (found at end of this document). Because the commenters had common themes, some comments have been combined and the Department has prepared one response for that category of comment.

As can be seen from the following discussions, a number of public comments and concerns were raised and discussed with Department officials during the meetings. The responses in this document focus on those comments or questions which were not answered during the meeting, or need elaboration or clarification.

Table B-1. Public meeting comments on the Draft APT EIS.

Comment source number	Commenter	Transcript page number
Commenters at the public meetings		
M1-01	Mr. David Solki[a]	M1-2 to 3
M1-02	Mr. William Reinig	M1-3
M1-03 to M1-06	Mr. Bob Newman	M1-4 to 11, 16
M1-07 to M1-11	Mr. Peter Gray	M1-11 to 16, 20
M1-12 to M1-14	Mr. Ernie Chaput	M1-16 to 20
M2-01	Ms. Trish McCracken	M2-2 to 14

a. Name spelled incorrectly in meeting transcripts.

Table B-2. Public comments by letter and telephone on Draft APT EIS.

Comment source number	Commenter	Response page number
Comments received by letter		
L1	U.S. Department of Health and Human Services	B-8
L2	U.S. Department of Interior	B-12 to B-14
L3	Dr. David Moses	B-19 to B-23
L4	U.S. Environmental Protection Agency	B-26
L5	Mr. Russell Berry	B-28
L6	Dr. David Moses[a]	B-30
L7	Dr. David Moses	B-46
L8	South Carolina State Clearing House	Transcripts and State Clearing-house Forms
Comments received verbally to the DOE message line		
P1	Ms. Mary Barton	B-47
P2	Mr. Marvin Lewis	B-47
P3	Mr. Marvin Lewis	B-48

a. A letter submitted during the TEF EIS comment period by Dr. Moses and DOE's response are also included because some of the comments are related to the APT project. The letter is coded as TEF-01 starting on page B-34. The response starts on page B-39.

Most of the comments and issues discussed in the meetings fall into the following broad categories:

- Expression of support for the Accelerator Project - Mr. David Solki (M1-01), Session 1, page 3

  Mr. Solki, representing Carpenters Local 283, stated the building trade is supportive of the accelerator.

Response to Comment M1-01: The Department is grateful to the community for its continued support of Department of Energy missions.

- Selection of weighting factors for site selection - Mr. William Reinig (M1-02), Session 1, page 3

  Mr. Reinig asked why the weighting factor for health is less than the other factors considered.

Response to Comment M1-02: In the development of site selection criteria, human health issues were an inherent part of establishing exclusionary zones. Since human health was already considered, other considerations were given more weight. The weightings were developed by a multidisciplinary team of scientists and engineers.

- The use of non-renewable resources - Mr. Bob Newman (M1-03), Session 1, page 4; Mr. Peter Gray (M1-10), Session 1, pages 14-15

Two commenters, Mr. Newman and Mr. Gray, expressed concern over the electricity required to operate the APT, the consequent use of fossil fuels, and possible contribution to the greenhouse effect.

Mr. Newman stated: "…to select an alternative which is going to consume rather substantial quantities of fossil fuel compared to using a nuclear reactor which is producing energy, seems to fly in the face of NEPA dictates to conserve non-renewable resources, coal or gas, building materials and so forth."

Mr. Gray similarly stated that "electric power produced by fossil fuels…release greenhouse gases."

Response to Comments to M1-03 and M1-10: The Department acknowledges the large electricity requirements of the APT. Part of the ongoing design process is to investigate and introduce, if the APT is selected and built, as many energy-saving and resource-recovery features as possible. DOE and SCE&G (if they are ultimately the provider of electricity to the APT) recognizes that the use of renewable energy sources can be cost-effective, offer opportunities to reduce fuel imports and is a way to improve environmental quality. It is DOE's intent that it and the electricity provider would make a fixed known portion of the power supplied to the APT from renewable sources. DOE's Preferred alternative for supplying electricity is to use existing electricity sources from commercial providers. While this does not negate the incremental demands from servicing the APT load, it does offer a number of other advantages, including lower capital requirements to bring the facility online and no new land requirements. In the states of South Carolina and Georgia, the increased electrical demand that could be attributed to the APT is negligible. Likewise, the contribution to the greenhouse effect is negligible compared to the installed base of facilities using fossil fuels. The Chapter 5 (Cumulative Impacts) discussion on cumulative air quality impacts has been revised to show a comparison of greenhouse-contributing pollutants from a representative plant supplying power to the APT to that generated regionally and globally in the absence of the APT.

- Worker Health and Safety - Mr. Bob Newman (M1-04), Session 1, page 9

Mr. Newman, questioned why the EIS considered the impacts to an uninvolved worker at 640 meters from the APT site, but not workers at the APT.

Response to Comment M1-04: The Department has not quantified the potential impacts from accidents to involved workers (those at the facility) because it requires too many assumptions to make the analysis meaningful. Current state-of-the art models do not present valid results within 100 meters of a facility, so a hypothetical maximally exposed individual cannot be identified. The 640-meter distance is related to commercial reactor exclusionary zones and relates to uninvolved individuals. The Department, however, is concerned about worker health and safety and will continue to maximize worker protection through facility design, operational guidelines, and adherence to permit conditions and regulatory health and safety programs. Impacts to facility workers are described in Chapter 4, Section 4.2.1 of the Draft EIS.

- Project Cost - Mr. Bob Newman (M1-05), Session 1, page 9; Mr. Peter Gray (M1-10), Session 1, pages 14-15; Mr. Ernie Chaput (M1-13), Session 1, pages 17-18

Three individuals, Misters Newman, Gray, and Chaput, expressed concern over the cost of the proposed APT, questioned how it compares to the Commercial Light Water Reactor tritium production option, and expressed some skepticism that the project would be funded.

Mr. Newman questioned the accelerator cost of $3.5 to $4.5 billion and how that compares to the cost of a reactor.

Mr. Gray indicated that he didn't believe the accelerator will be built, in part, because it would cost $4.5 billion and Congress will never authorize that much money.

Mr. Chaput raised the issue of uncertainty between the costs of the APT versus a commercial light-water reactor. He indicated the cost information needs to be made available.

Response to Comments M1-05, M1-10, and M1-13: The APT EIS was prepared in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality's Regulations on Implementing NEPA (40 CFR Parts 1500 through 1508), and the Department of Energy's NEPA Implementation Procedures (10 CFR Part 1021). None of these require inclusion of a cost analysis in an EIS. The basic objective of this EIS is to provide the public and the Department's decision-makers with a description of the reasonable alternatives and their potential environmental impacts. While costs could be an important factor in the Department's decision regarding the production of tritium, the focus of an EIS is on the environmental consequences. Cost estimates for both the APT and the Commercial Light Water Reactor (CLWR) are refined as new information is developed. In December, 1998, total life cycle costs for the APT ranged from $7.5B to $9.2B. CLWR total life cycle costs ranged from $1.1B to $3.6B.

- The review of the APT EIS – Mr. Bob Newman (M1-06), Session 1, page 10.

  In his opening remarks, Mr. Clay Ramsey of DOE stated that the EIS had been peer reviewed. Mr. Newman, in his subsequent statements, indicated he did not think a review by Westinghouse on a Westinghouse operation or by DOE on a DOE operation is independent.

Response to Comment M1-06: The review group referred to was not the Westinghouse Savannah River Company (WSRC) or DOE, but rather the Environmental Advisory Committee (EAC). The EAC is a group of nationally renowned scientists and engineers who periodically review information and plans and provide SRS with independent evaluations. The EAC is totally independent of WSRC and DOE.

- Use of Reactor to Produce Tritium – Mr. Peter Gray (M1-07 through M1-09, M1-11), Session 1, pages 12-13, page 15

Mr. Gray stated that he invented a new concept for tritium production and he has been unable to make the information public or receive a patent because of DOE and WSRC interference. Mr. Gray also contends a site-specific analysis should be performed by DOE.

Response to Comments M1-07 through M1-09, M1-11: Mr. Gray's device is in fact a reactor. He published a paper in 1995, "Safe New Reactor for Radionuclide Production" in *Transactions of the American Nuclear Society* (TANSAO, 73, 1-552). This paper was reviewed by DOE and WSRC for classification and approval for publication. This refutes Mr. Gray's assertion that his concept had "been covered up by WSRC and DOE for the last six years."

DOE determined that Mr. Gray's patent application contained Unclassified Controlled Nuclear Information (UCNI) as defined in 42 U.S.C. 2168. The U.S. Patent Office does not recognize the UCNI designation. It recognizes only classified or unclassified patents. Therefore, DOE issued a secrecy order.

DOE has taken a second look at Mr. Gray's request, and still considers the patent application UCNI. A letter has been sent to Mr. Gray informing him of this result. DOE is also required to re-examine the patent application every year for possible declassification. If and when DOE determines that protection is no longer necessary, DOE will lift the secrecy order and UCNI classification and allow the patent to be processed.

Mr Gray's concept is a small advanced Heavy Water Reactor for tritium production that would be built at the SRS. He opined that such a device would be the least costly tritium production alternative, while also being safe, efficient, and environmentally-sound. As discussed in section 1.5 of the APT EIS, the APT EIS is a tiered document which follows the Record of Decision for the Tritium Supply and Recycling PEIS. As such, the scope of the APT EIS is limited to evaluating the environmental impacts of the reasonable APT alternatives for providing the tritium necessary to support the enduring stockpile.

Reactor alternatives such as the small advanced Heavy Water Reactor are not reasonable alternatives for the APT EIS. The Tritium Supply and Recycling PEIS (DOE/EIS-0161) evaluated the full range of reasonable technology alternatives for tritium supply. A Heavy Water Reactor was one of the reasonable alternatives evaluated. In addition, in Section A.3.1, the PEIS described potential technology innovations that might be incorporated into any of the reactor alternatives. For the Heavy Water Reactor, the PEIS described the potential technology innovations associated with a small advanced Heavy Water Reactor. As was explained in the Comment-Response Document (Volume III of the PEIS), if the Heavy Water Reactor were chosen in the Record of Decision (ROD), "site specific analysis would consider these types of improvements". However, in the ROD, DOE did not choose to build any new reactors, and did not choose the HWR technology. Consequently, no site-specific analysis of a small advanced Heavy Water Reactor has resulted.

- Proliferation - Mr. Peter Gray (M1-10), Session 1, pages 14-15; Mr. Ernie Chaput (M1-14), Session 1, pages 16-19

Two commenters, Mr. Gray and Mr. Chaput, expressed concern over how other nations will view the United States if it allows commercial nuclear facilities to participate in the making of materials for national defense.

Mr. Gray indicated that he did not believe the commercial light water reactor will ever be acceptable because such a use clearly violates the demarcation between swords and plowshares and that would set a dangerous precedent to international policy.

Mr. Chaput's comments were similar. Mr. Chaput stated that "the United States at this moment is jawboning North Korea, Iran, Iraq, other potential nuclear powers, to not make weapons materials in their commercial nuclear facilities. And for us to turn around and not practice what we preach, to be contrary to what we're asking these foreign countries do, I think would be a foreign policy disaster and would only serve to increase nuclear proliferation throughout the world."

<u>Response to Comments M1-10 and M1-14</u>: Dr. David Moses, Letter L3, raises the same issues as Mr. Gray and Mr. Chaput. Because of the length of the responses to these issues, all responses are consolidated under L3-14 to L3-18.

- Schedule for tritium production - Mr. Ernie Chaput (M1-12). Session 1, page 17

Mr. Chaput expressed concerns that the schedule described for construction of the APT does not meet the current approved nuclear stockpile requirements for tritium.

<u>Response to Comment M1-12</u>: The commenter is correct that under current stockpile direction and guidance, the selection and implementation of a tritium supply strategy will be required in the very near future. The relationship of current and projected tritium supply and the current and projected date for a new source to support the stockpile are described in Section 1.1 of the Draft EIS and the summary of this Final EIS.

- The use of American products and technical talent - Ms. Trish McCracken (M2-01), Session 2, pages 2-3

One commenter, Ms. Trish McCracken, expressed the opinion that all APT components and materials should be American made. The commenter also expressed the opinion that the APT should provide opportunity and training for employees who have been displaced by recent downsizing at the Savannah River Site.

<u>Response to Comment M2-01</u>: The Department is committed through its various contracts to "buy American" whenever possible, pursuant to The Buy American Act (FAR 25.202(a)(3)102) and the Department of Energy Acquisitions Regulation which implement Federal acquisition regulations. DOE is also interested in the employment of qualified individuals with Savannah

River Site experience. Some of the ongoing efforts include staffing by DOE's accelerator design and construction contractor, Burns and Roe Enterprises, Inc., and the programs being implemented by the Savannah River Regional Diversification Initiative and DOE and SRS outplacement programs. The transcript of session 2 of the public meeting (Transcripts at the end of this document) provides an extensive discussion of these issues. No changes were made to the document.

Letters:

The comment letters DOE received on the Draft APT EIS are reproduced in the following section with corresponding responses. The forms received from the South Carolina Clearing House (L7) are reproduced at the end of this document.

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control and Prevention
Atlanta GA 30333

January 30, 1998

Andrew R. Grainger
Savannah River NEPA Compliance Officer
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A, Code APT, Bldg. 773-42A, Room 212
Aiken, South Carolina 29808

Dear. Mr. Grainger:

We have completed our review of the Draft Environmental Impact Statement (DEIS) for Accelerator Production of Tritium (DOE/EIS-0270). Technical Assistance for this review was provided by the Radiation Studies Branch, Environmental Hazards and Health Effects Division, National Center for Environmental Health, Centers for Disease Control and Prevention (CDC). We are responding on behalf of the U.S. Public Health Service, Department of Health and Human Services.

This review focuses on the public health consequences associated with several proposed alternatives for Accelerated Production of Tritium (APT) at the Savannah River Site (SRS). General comments are provide in the following bullets for your consideration.

- This DEIS provides a very thorough analysis of potential impacts from the proposed accelerator. It is well written, documented, and referenced. This has greatly improved the usefulness of this document in conveying to the reader the information necessary to do a thorough review. The authors should be commended for providing this useful information.
- Public health impacts (especially doses to the public) from the proposed APT are quite low even with the substantial conservatism used in the forecast. This conservatism is especially apparent in summing doses from the liquid pathway and atmospheric pathway even though the maximum exposed individuals reside at almost opposite ends of the site (reference: Table 4-22, footnotes a and b).
- A minor change in format may improve the review of the document. For example, line numbering has been introduced in a draft EIS from the Hanford site (Draft Hanford Remedial Action Environmental Impact Statement and Comprehensive Land Use Plan, 1996). This addition greatly improved the reviewer's ability to do a thorough review. We recommend the DOE consider this approach for aiding reviewers of future draft reports. L1-01

- The DOE has published a Notice of Intent to prepare an EIS for the production of Tritium using Commercial Light Water Reactors (CLWR). The potential public health impacts from APT and the CLWR technologies will differ in several aspects; impacts will occur in different locations and impacts will come from different source terms. These differences will also result in different volumes and hazards of wastes generated, stored, and transported in and around these proposed sites. There should be some mechanism in place to evaluate the APT and CLWR technologies together to assess these widely varying impacts adequately. L1-02

Thank you for the opportunity to review and comment on this DEIS. We hope that these comments and suggestions will be helpful to the preparers. If you have questions about this review, you may contact Mr. Robert Whitcomb at (770) 488-7634, or me at (770) 488-7074. Please send me a copy of the Final EIS, and any future environmental impact statements which may indicate potential public health impact and are developed under the National Environmental Policy Act (NEPA).

Sincerely,

Kenneth W. Holt

Kenneth W. Holt, MSEH
Special Programs Group (F16)
National Center for Environmental Health

cc: Robert C. Whitcomb, Jr.

Response to Comment L1-01 (U.S. Department of Health and Human Services)

The Department agrees line numbering generally enhances the commenter's ability to respond to information presented in Draft EISs. In this particular case, however, line numbers were not used because of the double column format and the use of text boxes. The Department believed line numbering could result in a very cluttered page that could inhibit readability.

Response to Comment L1-02 (U.S. Department of Health and Human Services)

The Department assessed the commercial light-water reactor, other reactor technologies, and the accelerator for the production of tritium options in the *Final Programmatic EIS for Tritium Supply and Recycling* (DOE 1995). In its subsequent Record of Decision (60 FR 63898), the Department decided to pursue a dual track to determine the more viable primary technology, an accelerator or a CLWR. In January 1998, the Department issued a Notice of Intent (63 FR 3097) to prepare the CLWR EIS. The Draft EIS was issued August 1998. The relationship of the tritium supply EISs and the decisionmaking strategy is summarized in Part A.1 of this document.

As noted in this Final EIS, the No Action alternative for the APT is the CLWR. Thus, the two EISs (CLWR and APT) each provide information that allows the decisionmaker to compare environmental impacts of the alternative tritium production strategies. The potential environmental impacts of the CLWR are summarized in Part C of this document under the Chapter 2 changes on page C-3 and Chapter 4 modifications on pages C-37 through C-53.

On December 22, 1998, Secretary of Energy Bill Richardson announced that commercial light water reactors (CLWR) will be the primary tritium supply technology. The Secretary designated the Watts Bar Unit 1 reactor near Spring City, Tennessee, and Sequoyah Unit 1 and 2 reactors near Soddy-Daisy, Tennessee as the preferred commercial light water reactors for tritium production. These reactors are operated by the Tennessee Valley Authority (TVA), an independent government agency. The Secretary designated the APT as the "backup" technology for tritium supply. As a backup, DOE will continue with developmental activities and preliminary design, but will not construct the accelerator. Finally, selection of the CLWR reaffirms the December 1995 Tritium Supply and Recycling PEIS ROD to construct and operate a new tritium extraction capability at the SRS.

DOE has completed the final EISs for the APT, CLWR, and TEF. No sooner than 30 days after publication in the Federal Register of the Environmental Protection Agency's Notice of Availability of the final EISs for CLWR, APT, and TEF, DOE intends to issue a consolidated Record of Decision to: (1) formalize the programmatic announcement made on December 22, 1998; and (2) announce project-specific decisions for the three EISs. These decisions will include, for the selected CLWR technology, the selection of specific CLWRs to be used for tritium supply, and the location of a new tritium extraction capability at the SRS. For the backup APT technology, technical and siting decisions consistent with its backup role will be made.

United States Department of the Interior

OFFICE OF THE SECRETARY
OFFICE OF ENVIRONMENTAL POLICY AND COMPLIANCE
Richard B. Russell Federal Building
75 Spring Street, S.W.
Atlanta, Georgia 30303

January 26, 1998

ER-97/720

Andrew R. Grainger,
NEPA Compliance Officer
U. S.Department of Energy
Savannah River Operations Office
Building 773-42A, Room 212
Aiken, SC 29802

Dear Mr. Grainger:

The Department of the Interior has reviewed the Draft Environmental Impact Statement (DEIS) for Accelerator Production of Tritium at the Savannah River Site (SRS), Aiken and Barnwell Counties, South Carolina, as requested.

<u>General Comments</u>

The Draft Environmental Impact Statement (DEIS) presents several environmental impacts associated with each of the Cooling Water System alternatives. These proposed impacts include: modification of the hydro geology of the area through intensive groundwater utilization, impingement of adult and juvenile fish and entrainment of fish larvae and eggs through the intake of river water, reduced community diversity induced by thermal discharges, and toxicological impacts as a result of resuspension and transport of contaminants and enhanced availability of contaminated prey items (i.e., bald eagles foraging on a fish kill caused by thermal inputs). While some of the alternatives have fewer significant impacts, the DEIS fails to adequately present implementation of methods that would further reduce the remaining impacts associated with these alternatives.

L2-01

The mechanical-draft cooling towers with river water makeup alternative could lead to resuspension of contaminated sediments in the Par Pond system and facilitate the migration of contaminants into other wetland areas. In addition, continual mobilization of contaminants could lead to an increase in bioavailable forms of contaminants, enhancing contaminant uptake in aquatic species and potentially enhancing the trophic level transfer of contaminants within this system.

This alternative is also estimated to lead to the entrainment 173,000 fish eggs and 326,000 fish larvae, and the impingement of more than 100 fish at the river water intake structures. Current levels of endangered/threatened anadromous fish in the Savannah River basin have caused federal and state agencies to initiate efforts to reestablish their populations to historical numbers. These goals have not yet been achieved; therefore, actions leading to the loss of any individuals of these species are considered to be significant. Further evaluation of this cooling water alternative should be expanded in the DEIS. We suggest that methods for reducing the amount of sediment disturbance and designing intake structures to minimize fish entrainment and impingement should be become an integral part of this alternative.

L2-02

Implementing the mechanical-draft cooling towers with groundwater makeup alternative would eliminate the need for particular intake structure design. However, contaminant resuspension and transport issues should also be addressed for this proposed alternative. In addition, maintaining sustainable hydro geological conditions may not be feasible due to the combined demands of current groundwater use at the Savannah River Site (SRS) and Accelerator Production of Tritium (APT) groundwater makeup requirements. These combined groundwater demands may exceed the estimated production capacity of the aquifer and could lead to depletion of the aquifer. This could adversely impact wetland ecosystems by reducing stream flow, and potentially cause loss of some wetlands or a reduction in wetland community diversity. Altering groundwater flow may also influence sub-surface contaminant migration. Contaminate plumes identified in locations designated as "critical areas" may be leading to contaminant migration into areas which were previously at background levels. It is also predicted that groundwater could become contaminated as a direct result of the tritium accelerator operations. Migration of contaminated groundwater could lead to surface water discharges that would provide a route of exposure to wildlife receptors. Therefore, alternatives that would achieve sustainable hydro geological conditions and would not facilitate contaminant migration should be further developed for this alternative.

L2-03

The implementation of the Once-Through Cooling alternative could lead to resuspension and transport of contaminated sediment, reduced community diversity, thermal induced fish kills, enhanced trophic level contaminant transfer (as a result of the fish kills), and entrainment and impingement of fish. Based on the multitude of environmental impacts associated with this alternative suggest that it be eliminated from the DEIS as a viable alternative for the proposed project.

The K-area cooling tower with river water makeup alternative could also lead to the entrainment and impingement of fish of the Savannah River. In addition, thermal water discharges to Indian

Grave Branch and Pen Branch could potentially result in a reduction of community diversity in these recovering systems. Implementations that could reduce the potential for these impacts would not only benefit this proposed alternative, but also the others that incorporate river water as a cooling water source. L2-03

We believe that the proposed alternatives for the APT site location are not adequately developed. The selection of a site location to date appears to have been extensive, however, the exclusion of industrial sites from the site selection process is unacceptable. Both alternatives presented would involve the grading or leveling of approximately 250 forested acres. For the preferred site alternative, the land contains unoccupied habitat approaching suitable age for utilization by red-cockaded woodpeckers. We suggest the DEIS site selection process be reevaluated to incorporate industrial locations in the process.

Specific Comments

Paragraph 4.2-15. Industrially developed areas were not examined as potential APT sites based on the following three criteria: (1) the presence of existing operating structures, (2) the presence of non-operating structures that would require extensive decontamination and decommissioning prior to site preparation, or (3) the presence of active environmental restoration activities. These criteria do not justify the exclusion of industrial areas with non-operating structures at which contamination and environmental restoration are not issues. The DEIS should be modified to evaluate such sites as a component of the site selection process. The DEIS should also provide a list of all sites considered in the site selection process and the criteria for which they did not qualify. This would insure that no sites were excluded based on their industrial nature. L2-04

Paragraph 1.3-55. The presentation of a bald eagle habitat in the Affected Area is limited in the DEIS to only the ATP site. The incorporation of all the areas predicted to be impacted by any, or all, of the accelerator operation alternatives should also be included (i.e., bald eagle foraging habitats in the "Pre-cooler" Ponds and Par Pond). L2-05

Paragraph 1.3-56. The presentation of a short-nose sturgeon habitat in the Affected Area is limited in the DEIS to only the tributaries of the SRS. The incorporation of all the areas predicted to be impacted by accelerator operation alternatives, including the Savannah River, should also be included L2-06

Paragraph 6.4-3 The use of groundwater wells to supply cooling water to the APT site could lead to the depletion of aquifers

beyond their capacity to replenish. Alternative methods to reduce the requirements for ground water from the proposed aquifer should be evaluated. The implementation of more than one of the cooling water alternatives may reduce the groundwater demands of the APT site while potentially reducing the impacts associated with the river water alternatives. If this is a feasible alternative, it should be developed in the DEIS. If it is not feasible to combine cooling water alternatives this information should also be presented in the DEIS. L2-07

Paragraph 12.4-4 Accelerator operations could lead to the contamination of groundwater and soil with radioisotopes that could be transported via groundwater. The potential impacts to "real receptors," those other than humans, from this contaminated groundwater are assumed to be minimal based on dispersion of contaminants during movement, and a calculated dose for a human receptor compared to the EPA drinking water standards. It is inappropriate to use the term "real receptor" in place of the term wildlife receptor, if this was the intention of the DEIS. In addition, calculations to predict a dose for a wildlife receptor should be performed using a toxicity reference value applicable to wildlife receptors. L2-08

Paragraph 7.4-6. The increased water flow associated with the cooling water discharge is suspected to agitate contaminated sediments in Par pond and Pen Branch, re-suspending and transporting them toward the Savannah River. Since all of the cooling water alternatives presented would discharge to one of these water bodies the DEIS should present methods that could reduce the disturbance of sediment (i.e., reduced discharge velocities and placement of permanent silt screens) that would minimize contaminant transport. L2-09

Paragraph 6.4-47. Entrainment of fish eggs and larvae and impingement of adult fish has been estimated at 173,000, 326,000, and 132, respectively, for both the Mechanical-draft Cooling Tower with River Water alternative and the K-area Cooling Tower with River Water alternative. The estimated values for the Once-through Cooling alternative are significantly higher. The DEIS fails to present methods that would reduce these estimated values, nor do they present intake velocities for the intake structures. Entrainment and impingement at the river water intake could be reduced by providing intake structures with traveling screens and by minimizing the velocity of the intake water. The DEIS should be modified to include this information. L2-10

Thank you for the opportunity to comment on the Draft EIS. Any technical questions related to fish and wildlife resources may be directed to the U.S. Fish and Wildlife Service in Charleston, SC, at 803/727-4707.

Sincerely,

James H. Lee
Regional Environmental Officer

Response to Comment L2-01 (U.S. Department of the Interior)

The Draft EIS did not specify detailed mitigation measures, particularly where the potential for adverse impacts are not significant or are speculative. The Department will develop appropriate mitigative actions, including the possible installation of monitoring wells for this EIS as part of its building and operations plans, and, if warranted, a mitigation action plan (MAP). Specific mitigation measures in the MAP would be dependent upon the alternatives selected and would fully reflect relevant Federal and State regulations. Part D, Section 4.6 of this Final EIS has been added to clarify DOE's path forward with regard to potential mitigation actions.

Since the issuance of the Draft EIS, the Department has considered other methods of discharging cooling water. Section 4.5.3 has been added to consider the potential impacts of bypassing Ponds 2 and 5, therefore, discharging cooling water into Pond C via an existing discharge canal. This action would eliminate any impacts associated with discharging cooling water to Ponds 2 and 5, and further reduce the unlikely possibility of predators feeding on potentially contaminated fish killed by heated water from the Once-Through Cooling Water alternative. The doses from resuspension of contaminated sediment for the preferred alternative are shown in Table 4-2 (Section C, page C-44) to be less than 10 percent of dose to the maximally exposed individual from radiological discharges and less than 1 percent of the population dose from radiological discharges from the APT.

Response to Comment L2-02 (U.S. Department of the Interior)

The Department acknowledges that implementing any alternative utilizing river water may result in the loss of some fish. If DOE is to fulfill its designated missions, some level of impact will be unavoidable. Previous studies relating to reactor operations have shown, however, that the losses are negligible. Studies conducted in the 1980s, when three production reactors were operating (withdrawing nearly 400,000 gallons per minute (gpm) of water from the Savannah River), concluded that any impacts to Savannah River fisheries from entrainment of eggs and larvae would be small and limited to fish populations in the immediate vicinity of the intake structures. Therefore, the Department believes that impacts to fish populations from the withdrawal of up to 125,000 gpm (under the Once-Through Cooling Water alternative) would be very small and the impacts from the withdrawal of 6,000 gpm (under the preferred cooling water alternative, using mechanical draft cooling towers) would not be measurable. The Department is currently removing about 5,000 gpm to maintain L-Lake levels. DOE has prepared a Biological Assessment (BA) and is informally consulting with the U.S. Fish and Wildlife Service. The BA notes that the preferred cooling water alternative would have "negligible" impacts on the shortnose sturgeon because (1) less than 1 percent of the Savannah River flow would be withdrawn and (2) potential sturgeon spawning habitat is upstream and downstream of the SRS.

Response to Comment L2-03 (U.S. Department of the Interior)

As required by the National Environmental Policy Act, the Department has assessed a range of reasonable alternatives related to providing cooling water to the APT. The Department of the Interior's comment portrays the environmental tradeoffs involved in making a selection of the cooling water alternative. The environmental impacts of alternative cooling water systems have been assessed and presented in the EIS. As indicated in the Draft EIS, DOE is aware of the potentially serious impacts of supplying mechanical draft cooling towers with makeup from groundwater. The Department will carefully weigh these potential impacts with those of other alternatives prior to making a decision. As noted in the response to Comment L2-01, the Department will consider appropriate mitigative actions.

<u>Response to Comment L2-04 (U.S. Department of the Interior)</u>

DOE did examine developed areas of the SRS during the APT site selection study. However, given the size of the APT footprint, it would not be feasible to locate the facility within an existing industrial area without impacting on-going operations. Furthermore, it would not be feasible to site APT at a non-operating facility that would require extensive decontamination and decommissioning, or an environmental restoration cleanup site (due to impacts on costs and schedule). DOE has modified this section in the Draft EIS (see Part C, page C-4 of the FEIS). A total of eight potential sites were considered. Several of the sites were eliminated due to the presence of disqualifying conditions. The site selection process is described on pages 2-13 to 2-16 of Draft EIS and in the siting study -- *Site Selection for the Accelerator for Production of Tritium at the Savannah River Site* -- available in the DOE Reading Room.

<u>Response to Comment L2-05 (U.S. Department of the Interior)</u>

DOE has expanded Section 3.4.5 of the Draft EIS (see Part C, page C-36), Threatened and Endangered Species, to include a more thorough discussion of bald eagle usage of SRS aquatic habitats, focusing on the pre-cooler ponds and Par Pond. The discussion of possible impacts to bald eagles has also been expanded, with consideration given to the possible effects of ingestion of contaminated prey in the pre-cooler ponds.

<u>Response to Comment L2-06 (U.S. Department of the Interior)</u>

The Department has also expanded Section 3.4.5 of the Draft EIS (see Part C, page C-37), Threatened and Endangered Species, to include a discussion of the distribution and abundance of shortnose sturgeon in the Savannah River up- and downstream of the SRS.

<u>Response to Comment L2-07 (U.S. Department of the Interior)</u>

Pursuant to NEPA, DOE has looked at a reasonable range of cooling water alternatives. While the Department has not looked at every possible perturbation, it believes the potential impacts discussed in the Draft EIS would bound the impacts associated with any combined cooling water alternative. The Department does not believe it would be cost efficient to utilize two supply systems when one is sufficient. As mentioned in the response to Comment L2-03, the Department will carefully weigh the information prior to making a decision.

<u>Response to Comment L2-08 (U.S. Department of the Interior)</u>

The use of the phrase “real receptor” was misinterpreted by the commenter. The intended meaning was an “actual user of groundwater” rather than “wildlife receptor.” However, under no circumstances would groundwater at the APT site be used as a drinking water source. The discussion was included to illustrate the low levels of radioactivity that would be in groundwater. Human beings would not drink the water and therefore would not actually receive any radiation dose. Wildlife receptors, which could be exposed to radionuclides in APT groundwater would receive a considerably smaller dose than the theoretical human receptor because potential radioactivity in ground water would be reduced over time by dilution, dispersion, adsorption, and radioactive decay as the groundwater flows from the area of the APT sites to downgradient streams. The Department believes the potential impacts described bound the potential impacts to wildlife.

<u>Response to Comment L2-9 (U.S. Department of the Interior)</u>

See response to comment L2-01.

Response to Comment L2-10 (U.S. Department of the Interior)

See response to comment L2-02.

130 Clemson Drive
Oak Ridge, Tennessee 37830-7664
February 2, 1998

Andrew R. Granger
NEPA Compliance Officer
SR Operations Office
Building 773-42A, Room 212
Aiken, SC 29808

Dear Mr. Granger:

The following comments and recommendations are submitted on the Draft EIS for the APT at SRS:

1. **Radioactive Waste Classification and Management:**

Comment: The disposal of certain radioactive wastes from the APT involves complex statutory and regulatory matters that, if not properly addressed, leaves confusion as to what the proper path forward is to resolution. To a great extent, the confusion and complexity lie in the fact that DOE has failed to issue regulations providing for the classification of radioactive wastes in a manner equivalent to and analogous with regulations issued by the U.S. Nuclear Regulatory Commission (NRC) to address commercially-generated radioactive wastes. The APT EIS does an inadequate job of explaining these complexities. Section 4.1.5, "WASTE MANAGEMENT," p. 4-20, states the following:

> "The APT would generate several hundred cubic meters of high concentration radioactive waste (Greater-Than-Class-C Waste) over its 40-year operational life; most would be mixed waste. DOE is investigating material substitutions that would minimize or eliminate this waste stream; however, if the waste was generated, the Department has several potential disposal options, each requiring more investigation. The most likely options are the proposed Yucca Mountain Repository in Nevada, the Hanford Site, the Nevada Test Site, and the SRS."

As described in SECY-92-325, accelerator-generated radioactive wastes are judged by NRC not to be within the NRC's authorities for licensing and regulation under the Atomic Energy Act, the Nuclear Waste Policy Act, and the Low-Level Radioactive Waste Policy Act. The NRC definition of Greater-Than-Class-C Waste that appears in 10 CFR 61.55 was made by the NRC to classify radioactive wastes that have characteristics of high-level radioactive wastes (HLRW) but could not be so classified under the NRC's strict definition of HLRW stemming from definitions and provisions in the above-cited statutes. Per 10 CFR 61.55, Greater-Than-Class-C Waste requires disposal in a geologic repository the same as spent fuel and HLRW unless NRC approves an exception to dispose otherwise (namely, near-surface land disposal). DOE's Office of Environmental Management (EM) has at times in the recent past chosen to designate as "special case waste." those radioactive wastes that are analogous with or equivalent to Greater-Than-Class-C Waste but that are not specifically covered by the above-cited statutes. Under DOE/EM guidance issued over the last two to three years, the APT waste designated in the draft EIS as Greater-Than-Class-C Waste may also be designated as special case waste. L3-01

The Defense Nuclear Facilities Safety Board (DNFSB) charged DOE in DNFSB Recommendation 94-2 that "a comprehensive complex-wide review be made of the low-level waste issue similar to the review the Department conducted regarding spent nuclear fuel," that "a regularized program [be developed] for forecasting future burial needs relative to existing capacity," and that, with regard to this program, "guidance should [be issued to] reflect consideration of concepts of good practices in low-level waste management as applied in the commercial sector." The reference to the commercial sector is understood by inference to refer to the manner in which NRC would regulate such wastes. The DNFSB noted that the DOE directive for waste management invoked "the basic performance objectives of the Nuclear Regulatory Commission's 10 CFR 61." This directive instructs that Greater-Than-Class-C Waste be handled as a "special case" for which a separate EIS could be required for disposal. In the report of the DOE complex-wide review of low-level radioactive waste (LLRW), a commonly reported adverse finding is with regard to the storage or production of "special case waste with no clear path forward to disposal."

Suggesting in the draft EIS that "the most likely options [for disposal of these wastes] are the proposed Yucca Mountain Repository in Nevada, the Hanford Site, the Nevada Test Site, and the SRS" is judged not to be a "clear path forward." Other than at WIPP and ultimately at Yucca Mountain, there are no geologic disposal sites. Vault storage is judged not to be consistent with the standard of commercial practice as expected by the DNFSB, who refers to the vault option as simply storage not disposal. DOE/EM is responsible for setting the disposal requirements for both special case waste and Greater-Than-Class-C Waste.. However, special case waste is not addressed in the DOE/EM Waste Management Programmatic EIS (DOE/EIS-0200-F, May 1997). Section 5.4 of the DOE/EM's Office of Waste Management End State Plan, Initial Draft, February 1996, states the following with regard to Greater-Than-Class-C Waste:

> "The Program Management Plan recognizes that most GTCC [Greater-Than-Class-C] LLW [low-level radioactive waste] is utility activated metals and is similar to the fuel assembly hardware that will be disposed in the high-level waste repository. Since GTCC LLW requires licensed disposal, repository disposal is identified as the option for utility GTCC LLW. Stakeholders review of the Plan supports repository disposal of GTCC LLW."

Based upon the expectations of the DNFSB and the planning of DOE/EM, it is thus most likely that Yucca Mountain licensed disposal is the default primary "clear path forward to disposal" of APT wastes that are classified as either Greater-Than-Class-C Waste or special case waste. The APT EIS should reflect this. L3-02

Finally, the APT Project weekly Updates and monthly Highlights reports on the Los Alamos APT Project homepage indicate that several meetings have been held with the DNFSB in April, November and December 1997. The April report indicated that the DNFSB was to provide review comments on the APT Conceptual Design Report by the end of June 1997. There are no L3-03 equivalent reports of these meetings among the reports posted on the DNFSB homepage from among either trip reports, technical reports or SRS weekly reports. If the APT Project Office has received guidance from the DNFSB on matters related to waste management or associated radiation safety, such guidance should be reflected in the EIS. It is noted that it is unusual that DNFSB has failed to make public the information received and any comments on that information since the DNFSB enabling legislation does not define an informal consultation role for DNFSB and indicates that all findings except those covered by classification statutes are to be publicly available..

Recommendations:

1-1 Section 4.1.5 should be revised to acknowledge that geologic disposal at Yucca Mountain is the primary path forward for APT wastes that fall into the category/classification of being equivalent to or analogous with Greater-Than-Class-C Waste. A detailed plan should be L3-04 outlined by which such disposal will be achieved. Failure to do so represents a case in which DOE proposes a new project that produces "special case waste with no clear path forward to disposal." This is unacceptable.

1-2 If DOE/EM plans to continue to distinguish between highly-radioactive regulated waste and highly-radioactive unregulated wastes using the respective terminology for Greater-Than-Class-C Waste and special case waste, both sets of terminology should be introduced into L3-05 Section 4.1.5 and in the Glossary in Appendix A to the APT EIS. Also in Appendix A, the currently-given Sect B.1 definition of Greater-Than-Class-C Waste should be revised to reflect that the "special disposal considerations" are that geologic disposal is required.

1-3 A listing of all meetings with non-DOE regulatory authorities should be provided for meetings related to waste management or associated radiation safety. The listing should provide information about date, place, participating organizations, individual participants, L3-06 subjects discussed, summary of feedbacks or recommendation made, and summary of implementation of such feedbacks or recommendations. Such information will prove helpful to reviewers of the final EIS in assuring that there is a basis for project decisions on waste generation and disposal that is grounded in the regulatory review process.

2. <u>Environmental and Public Health Hazards from Accidents</u>:

Comment: Section B.1, "Analysis Methodology," Appendix B, "ACCIDENTS," states that the "tungsten neutron source is clad in Inconel, which has a high resistance to oxidation" and that "DOE used a conservative failure temperature of 1,250 [degrees] C in the calculation for this analysis" so that in "scenarios that would involve heating the target/blanket structure, the tubes would remain intact and no release would occur as long as structural temperatures were below 1,250 [degrees] C."

Section B.1 also states that "all the scenarios with the exception of the Beyond-Design-Basis Event described in Section B.2.13 assumed the quick termination of the accelerator beam because the design includes redundant sensors and shutdown systems to detect beam problems and terminate its operation before significant damage could occur."

Section B.2.13 indicates that, for the Beyond-Design-Basis Event with failure to trip the beam, the scenario is both incredible and has a low consequence (namely, limited releases of radioactive material inside the target cavity only). The assessment of the incredibility of occurrence is based on the redundancy and diversity of sensors. The consequence assessment is based upon assuming the failure of the cooling pipes occurs when the target assembly ladder rungs heat up to 1250 degrees C thus causing flooding of the target cavity with primary coolant water that will either activate beam-trip sensors in the cavity or cause moisture to enter the evacuated beam tunnel through an "always open" connecting vent pip again terminating the beam.

It is noted that:

(1) Termination of the beam due to target piping structural failure at 1,250 degrees C is not conservative if the delay to a higher temperature in the target causes higher releases. A higher temperature may be more appropriate if structural analyses are performed using materials data at the other end of the uncertainty range Also the entry of coolant into the target cavity may be delayed or significantly minimized because, in a loss of coolant accident due to failure of external piping, there may be little to no water left to leak in when the ladder fails or because water leaking down the vertical header pipes will cool the metal on the ends of the ladder (but not necessarily the target tungsten) and continue to steam leading to over-pressurizing the L3-07 primary coolant so that the relief valve fails open allowing water and steam to chug out though the valve. Delayed water flooding of the cavity containing a molten tungsten-Inconel mixture or near molten tungsten mixed with molten Inconel could cause a steam explosion that could release significant quantities of radionuclides and compromise the integrity of the confinement. Such an accident should be either the design basis for the confinement or the basis of the source term for emergency planning consistent with the conservative assumptions under laying 10 CFR 50.47 which specifies emergency planning requirements for commercial nuclear facilities.

(2) With regard to redundancy of sensors, how many of the sensors used to terminate the beam are either classified as safety-related or constitute the "primary success path" for a technical specification or technical safety requirement? In deterministic accident analysis, the NRC requires that reliance only be given to safety-related items or those subject to technical specifications. Such sensors will have to be on the Quality List and subject to configuration management controls analogous to those for licensed reactors at 10 CFR 50.59. In theory, a L3-08 target facility blackout of all alternating current and direct current electricity could immobilize all sensors, pumps, and confinement fans. Maintaining configuration management as well as redundancy, diversity, independence and separation of beam shutdown systems is necessary to preclude the impact of target facility blackout not being communicated to the beam control facility in an automatic and effective manner.

(3) However, although the NRC-approved Standard Technical Specifications list multiple mechanisms to trip a reactor, NRC also requires in the Standard Review Plan at NUREG-0800 that deterministically-defined accident scenarios for reactors must consider consequences of the added failure to insert control rods, that is, the anticipated-transient-without-scram. (ATWS). Failure to trip the beam in accelerators is the functional analogy for ATWS in reactors. The EIS presentation suffers from an optimistic, non-conservative rendition of the ATWS analogy that should be made worse in an accelerator-driven target because accelerator-target systems lack inherent negative power feedbacks that are required in reactors. L3-09

(4) The always open vent pipe between the accelerator beam tunnel and the target cavity will require manual isolation when the target vessel is open to avoid unwarranted in-leakage of volatile materials into the beam tunnel. Technical specifications will be required for any isolation valve and surveillance requirements will have to be imposed to verify that no foreign objects enter the vent pipe during maintenance activities on either end such that the safety function could be defeated. L3-10

(5) At this juncture in the stage of the design for the APT, it is imprudent to base consequence analysis on hypothesized favorable operations of structure, systems and components that do not exist, that have not been classified with regard to importance to safety, and for which no data are provided from experience to defend assumptions. During a presentation on Japan's program for accelerator-driven waste transmutation at the American Nuclear Society 1997 Winter Meeting Embedded Topical Meeting on Nuclear Applications of Accelerator Technologies, Dr. Takehiko Mukaiyama, Director of the Center for Neutron Science at the Japan Atomic Energy Research Institute, presented experiential data comparing the unexpected shutdown frequencies for current accelerators to that for commercial reactors. His presentation indicated that current research accelerators average about 100 inadvertent shutdowns per week whereas commercial reactors experience at most only one or two unanticipated trips per year. His message is that accelerator control and protection systems will have to evolve to an equivalent level of reliability as commercial reactors. Without a detailed design and a supporting experience base, the beyond-design-basis accident for APT should assume the worst possible damage to the target and the events which would maximize dispersion of radioactive materials rather than optimistically diagraming a minimal consequence event by selectively tailoring choices of advantageous assumptions. The draft EIS does not serve the public by being disingenuous about serious safety concerns. L3-11

Recommendations:

2-1 Section B.1 and B.2 should be revised to indicate that equipment relied upon to perform safety functions will be classified as safety-related and subject to both technical safety requirements and configuration management controls. Consistent with NRC's approach to accident analysis, no accounting should be allowed for the actuation of investment protection equipment in the accident analysis unless that actuation in fact worsens the consequences of the accident. Consistent with NRC's treatment of ATWS, the failure to trip the beam should be applied to all events in which cooling is lost to the target both loss of coolant and loss of flow. The treatment of the accident upon which emergency planning is to be based should be as conservative as the NRC assumption underlaying 10 CFR 10.47 (namely, total loss of target integrity and loss of confinement). L3-12

2-2 The accident scenario for the beyond-design-basis event should address both the consequences of the untripped beam (up to 10 minutes) without either flooding or beam shutdown due to ladder failure and the consequences of the untripped beam causing a molten target (up to 10 minutes into the transient) leading to a steam explosion in the target cavity when flooded. L3-13

3. Recommendations based on Other Considerations:

Comment: Section 1.6, "Nonproliferation," raises several issues that go beyond DOE actions. There are both international and interagency implications to the proliferation concern raised by pursuing APT. Section 1.6 asserts that "accelerator technology has been in use for more than 75 years," that "the possibility of producing special nuclear material (i.e., plutonium) using an accelerator was recognized several decades ago," and that the "APT is the first known accelerator proposed for a mission to produce weapons materials in a sustained production operating mode." The section also indicates that using "an accelerator to produce special nuclear materials in quantities which could be a proliferation concern requires a particle beam power of approximately 1 megawatt or greater" and that "research accelerators with beam powers in the 1 megawatt range have been viable for at least 20 years."

The above quotes raise serious issues such as:

(1) As a signatory of the Nonproliferation Treaty, why has the U.S. delayed regulating trade in a device that can be used to produce special nuclear materials as required by Article III(2) of the Treaty? Why would the U.S. propose to construct such a device for producing weapons materials without first assuring that the Treaty obligations are met on both a national and international basis? What are the factors involved in arriving at the current situation- ineptitude on the part of DOE or politics? The public trust appears to be violated by DOE's current actions and overdue lack of mitigating action. DOE's proposal to take a world wide technology that has long been applied to commercial and peaceful missions such as neutron scattering research and medical isotope production and to convert that technology before the eyes of the world for the purpose of fueling nuclear weapons without any export controls or safeguards in place is beyond comprehension. The alleged proliferation risk of using commercial reactors to produce tritium pales before this proposal. L3-14

(2) DOE is not the only agency with responsibility for nonproliferation. DOE regulates the export of information and technology in a broad sense; NRC regulates the export of production and utilization facilities and equipment thereof; the Department of Commerce regulates dual use items. What plan of actions is being taken to coordinate the fall-out of the APT proposal across the U.S. government? L3-15

(3) The U.S. is a member of an international body called the Nuclear Suppliers Group (NSG) composed of signatories of the Nonproliferation Treaty. The guidance formulated by the

NSG on issues of export controls includes the "Trigger List," which triggers safeguards, and the "Dual Use List." The Trigger Lists starts with reactor equipment for a facility that can produce as little as 100 grams of plutonium annually. This has implications for accelerators operating with beam powers much, much less than 1 megawatt. These guidelines and lists are published by the International Atomic Energy Agency (IAEA). What plan of actions is being taken to coordinate the fall-out of the APT proposal internationally? L3-16

Finally, in a somewhat related matter, Section 1.6 states that, in the past, "using [accelerators] for large scale production was more costly than production in nuclear reactors." From the cost analyses of the APT that were not discussed in the upper tier Programmatic EIS for Tritium Supply and Recycling, this appears to be still true today. This needs to be addressed elsewhere in the EIS or in a supplement to the Programmatic EIS. L3-17

Recommendations:

3-1 In Section 1.6 or equivalent in the final EIS, DOE should describe the actions being taken to satisfy proliferation concerns at both the interagency (NRC, Commerce) and international (NSG, IAEA) levels. An independent review of the options for tritium production should be performed by the DOE Office of Nonproliferation and National Security consistent with that performed for the Fissile Materials Disposition Program. These issues should also be elevated for discussion in the Summary of the EIS. L3-18

3-2 The issue of cost impact and comparison to the reactor option should be addressed elsewhere in the EIS or in a supplement to the Programmatic EIS. L3-19

Respectfully submitted,

David L. Moses, Ph.D., P.E.
Nuclear Engineer

RESPONSES TO COMMENTS L3-01 THROUGH L3-06 CONCERNING RADIOACTIVE WASTE CLASSIFICATION AND MANAGEMENT

Response to Comment L3-01 (Dr. David Moses)

The designation of some waste in the Draft APT EIS as Greater-Than-Class-C waste was an oversimplification and not technically accurate. DOE has recently issued Draft DOE Order 435.1, "Radioactive Waste Management," which only contains three waste classifications; high-level waste, transuranic waste, and low-level waste. The previously used term "special case" waste will no longer be valid when the new order is finalized. An evaluation of the more radioactive of APT's waste streams is currently under way to confirm that it can be disposed of at SRS within existing requirements. This evaluation is anticipated to be completed by the end of 1998. However, it should be noted that DOE will not proceed with the generation of waste products without a clear path forward for disposition of the wastes.

Response to Comment L3-02 (Dr. David Moses)

As noted in the response to comment L3-01, DOE is completing an update to the SRS Low-Level Radioactive Waste Performance Assessment and will determine the disposal of all APT wastes after this assessment is completed. As stated above, DOE will not proceed with the generation of waste products without a clear path forward.

Response to Comment L3-03 (Dr. David Moses)

The APT Program has provided the Defense Nuclear Facilities Safety Board (DNFSB) with copies of the APT Conceptual Design and the EIS. In addition, several informational sessions have been held with the staff of the DNFSB to provide additional background information on the APT project and design. The objective of this information is to ensure the DNFSB understands the concepts and the APT design so they can provide the best design and safety review possible. The DOE anticipates that the DNFSB will participate in design reviews of the preliminary and final design and the Preliminary and Final Safety Analysis Reports. However, no formal comments from DNFSB have been received to date. Formal interactions with the Board will be documented.

Response to Comment L3-04 (Dr. David Moses

As noted in the response to comment L3-01, DOE is completing an update to the SRS Low-Level Radioactive Waste Performance Assessment and will determine the disposal of the high concentration or special case wastes after this assessment is completed. However, DOE will not proceed with the generation of any waste without a clear path forward.

Response to Comment L3-05 (Dr. David Moses)

Appropriate modifications have been made to Section 4.1.5 of the Draft EIS (see Part C, page C-49) and the Glossary. The focus of Appendix A of the Draft EIS is SRS facilities and processes. Specific details, including volumes of waste streams, are discussed in Chapter 4 of the Draft EIS.

Response to Comment L3-06 (Dr. David Moses)

As noted in response to comment L3-03, informational meetings have been held with DNFSB. These meetings have included a discussion of the wastes to be generated by the APT and their radiation characteristics. In addition, the treatment, storage, and disposal of radioactive waste is subject to regulatory control by the South Carolina Department of Health and Environmental Control and the U.S. Environmental Protection Agency (EPA). The APT project has established coordination with these agencies to insure that all regulatory requirements are met.

RESPONSE TO COMMENTS L3-04 THROUGH L3-13 CONCERNING ENVIRONMENTAL AND PUBLIC HEALTH HAZARDS FROM ACCIDENTS

DOE has considered the environmental impacts of pertinent potential APT accidents. Technical issues raised by the author of Letter 3 will be taken into account, as appropriate, as the APT design envelope develops and safety analysis reports are completed.

Response to Comment L3-07 (Dr. David Moses)

Guidance for emergency preparedness activities at DOE facilities is given in DOE Order 151.1. There is no reason to believe that structural failure temperatures of greater than 1250°C would result in any greater consequences than those postulated at 1250°C, as both temperatures are substantially above the normal boiling point of the cooling water. The only accident scenario in which the failure temperature of the cladding comes into consideration is the beyond-design-basis seismic event. In this case, the cladding is assumed to fail at 1250°C and release all of its contents.

Response to Comment L3-08 (Dr. David Moses)

The beam shutdown system is designated safety-class and will be controlled through appropriate technical safety requirements. In addition, the acceleration of the beam is dependent upon the receipt of a feedback signal from the target/blanket facility. Should power be lost to the target/blanket facility, the feedback signal also would be lost, terminating acceleration of the beam.

Response to Comment L3-09 (Dr. David Moses)

There is no functional analogy between an Anticipated Transient Without Scram (ATWS) for a nuclear reactor and a beam trip failure for an accelerator. In a reactor, the nuclear chain reaction is self-sustaining; in an accelerator, the propagation of the beam from origin to target is not. In a reactor, equipment malfunctions could result in the reactor not shutting down; in an accelerator, equipment malfunctions inevitably result in beam shutdown. Because of the potential consequences of a reactor accident, inadvertent reactor shutdowns must be analyzed to determine the cause of the shutdown prior to restart. In accelerators, inadvertent shutdowns as a result of transients are a matter of routine operation, and in most cases an accelerator is automatically restarted in less than 1 second.

A description of a thermalhydraulic transient coincident with the failure to trip the beam is included in Section B.2.13 of Appendix B of the Draft EIS.

Response to Comment L3-10 (Dr. David Moses)

The design of the Target/Blanket Building and Accelerator is evolving and the referenced open vent path may or may not survive as a design element in the final design. Should this vent path be relied upon in the design safety analysis, appropriate administrative controls would be used to ensure the vent path could perform its function.

Response to Comment L3-11 (Dr. David Moses)

It is inappropriate to compare research accelerators that are not necessarily designed for continuous duty with commercial nuclear reactors that are designed to operate in a baseline mode. The design of the accelerator has on-line spare equipment to allow for full operation even with some of the equipment out of service. Section B.2.12 of Appendix B of the Draft EIS describes the assumptions used in the determination of the beyond-design-basis seismic event. While substantial damage is postulated in this beyond-extremely-unlikely event to tritium separation and support facilities at APT, it is not necessary to discount the mitigating effects of the physical form of the hazardous material or postulate a dispersion mechanism where one does not credibly exist. Additionally, the EIS is not the safety design basis document for APT and that applicable DOE guidance will be applied to the design and construction of APT, such that the safety of workers at the public is assumed.

Response to Comment L3-12 (Dr. David Moses)

The beam shutdown system is classified as a safety class system and as such, appropriate technical safety requirements and configuration management controls would be used to ensure the system functioned as designed. The consequences of a thermalhydraulic transient coincident with a failure to trip the accelerator beam is considered in Section B.2.13 of Appendix B of the Draft EIS.

Response to Comment L3-13 (Dr. David Moses)

It is not credible that a beyond-design-basis seismic event that destroys the target/blanket cooling capability would leave the non-seismically-qualified power transmission system and all accelerator components intact and functioning. A seismic event of that magnitude would likely throw the beam out of alignment and thus dissipate the beam before it reached the target/blanket building. The seismic event is the only initiator that could cause the incident described.

RESPONSE TO COMMENTS L3-14 THROUGH L3-19 CONCERNING RECOMMENDATIONS BASED ON OTHER CONSIDERATIONS

Response to Comment L3-14 (Dr. David Moses)

Under the Atomic Energy Act and its implementing regulations, the U.S. Government ensures that its Nonproliferation Treaty Obligations are met. The Atomic Energy Act empowers DOE and the Nuclear Regulatory Commission (NRC) to control exports of technology or services and equipment or facilities for the production, development or utilization of special nuclear material (SNM). To export technology for an accelerator for the production of significant quantities of SNM, the authorization of the Secretary is required under DOE regulations 10 CFR Part 810. To export equipment or facilities specially designed or prepared for an accelerator to produce significant quantities of SNM, an NRC license is required under NRC regulations at 10 CFR Part 110.

Until now DOE control over technology for accelerator production of SNM has been implicit. But to ensure that the public is aware of the restrictions on the transfer of the technology, DOE is in the process of amending its nuclear technology export regulations to explicitly cover accelerator technology for the production of SNM. Also, accelerators for basic scientific research are controlled by the Department of Commerce, and tritium, as well as SNM, is controlled by NRC.

Response to Comments L3-15 (Dr. David Moses); M1-01 (Mr. Peter Gray); and M1-14 (Mr. Ernie Chaput

The Nuclear Non-Proliferation Act of 1978 (NPT) established formal procedures for reviewing nuclear exports and for coordinating U.S. agency positions on the addition of new technologies to the nuclear export control lists. With each change to the nuclear export control lists, DOE initiates a nonproliferation study to consider questions of significance to the nuclear fuel cycle or to nuclear explosive activity, risk of diversion to clandestine programs, foreign availability, and related information of interest. DOE has initiated such a study for accelerator production of SNM. The results of the study will be shared with all agencies and appropriate measures will be taken as called for in the Nuclear Non-Proliferation Act procedures.

Response to Comments L3-16 (Dr. David Moses); M1-01 (Mr. Peter Gray); and M1-14 (Mr. Ernie Chaput

The President's nuclear nonproliferation and export control policy calls for the coordination of all U.S. unilateral export controls with multilateral regimes [e.g. the Nuclear Suppliers Group (NSG) and the NPT Exporters Committee]. Therefore, policy calls for the U.S. to coordinate its views and practices with other nuclear suppliers and within the nuclear export control regimes. In May 1997, the U.S. Government informed its fellow NSG members in a formal briefing of the technical capabilities of using accelerators to produce SNM. Further NSG discussion will take place as necessary.

Response to Comments L3-17 (Dr. David Moses); M1-01 (Mr. Peter Gray); and M1-14 (Mr. Ernie Chaput

The APT EIS was prepared in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality's Regulations on Implementing NEPA (40 CFR Parts 1500 through 1508), and the Department of Energy's NEPA Implementation Procedures (10 CFR Part 1021). None of these require inclusion of a cost analysis in an EIS. The basic objective of this EIS is to provide the public and the Department's decision-makers with a description of the reasonable alternatives and their potential environmental impacts. While costs could be an important factor in the Department's decision regarding the production of tritium, the focus of an EIS is on the environmental consequences. Cost estimates for both the APT and the Commercial Light Water Reactor (CLWR) are refined as new information is developed. In December, 1998, total life cycle costs for the APT ranged from $7.5B to $9.2B. CLWR total life cycle costs ranged from $1.1B to $3.6B.

Response to Comments L3-18 (Dr. David Moses); M1-01 (Mr. Peter Gray); and M1-14 (Mr. Ernie Chaput

On July 14, 1998, a high-level government task force issued to Congress a report "Interagency Review of Nonproliferation Implications of Alternative Tritium Production Technologies Under Consideration by the Department of Energy". This report, conducted by top Administration officials from various Departments, including the Department of Defense, the Department of State, and the Department of Energy, concluded that the APT project does not pose proliferation risks. It also concluded that any nonproliferation issues associated with the use of a CLWR to produce tritium were manageable and that DOE should continue to pursue the CLWR option. The review further concluded that there are no legal or treaty prohibitions against tritium production in a CLWR, reactors making tritium could remain on the IAEA Safeguards List, and that no bilateral "peaceful uses" agreements would be violated. This report is available upon request. In addition, the commentors are directed to the CLWR EIS (DOE/EIS-0288) for additional information regarding the nonproliferation issues associated with tritium production in a CLWR.

Response to Comment L3-19 (Dr. David Moses)

The APT EIS was prepared in accordance with the National Environmental Policy Act (NEPA), the Council on Environmental Quality's Regulations on Implementing NEPA (40 CFR Parts 1500 through 1508), and the Department of Energy's NEPA Implementation Procedures (10 CFR Part 1021). None of these require inclusion of a cost analysis in an EIS. The basic objective of this EIS is to provide the public and the Department's decision-makers with a description of the reasonable alternatives and their potential environmental impacts. While costs could be an important factor in the Department's decision regarding the production of tritium, the focus of an EIS is on the environmental consequences. Cost estimates for both the APT and the Commercial Light Water Reactor (CLWR) are refined as new information is developed. In December, 1998, total life cycle costs for the APT ranged from $7.5B to $9.2B. CLWR total life cycle costs ranged from $1.1B to $3.6B.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW
ATLANTA, GEORGIA 30303-8909

February 9, 1998

Mr. Andrew R. Grainger
Savannah River NEPA Compliance Officer
U.S. Department of Energy
Savannah River Operations Office
P.O. Box A, Code APT
Building 773-42A, Room 212
Aiken, SC 29808

RE: EPA Review of Draft Environmental Impact Statement (DEIS)
Accelerator Production of Tritium at the Savannah River Site

Dear Mr. Grainger:

Pursuant to Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the subject Draft Environmental Impact Statement(DEIS). The document provides information to educate the public regarding general and project-specific environmental impacts and analysis procedures. We appreciate your consistency with the public review and disclosure aspects of the NEPA process. We also note that the Department of Energy(DOE) held a meeting on January 13, 1998, to receive comments from the public.

DOE proposes to build and operate a linear accelerator to produce tritium, a gaseous radioactive isotope of hydrogen, and component in the operation of weapons in the nation's nuclear arsenal. This EIS is linked to the *DOE Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling* (October 1995). DOE determined that it will produce tritium either in an accelerator as described in this EIS (at the preferred or alternate location at SRS), or in a commercial reactor, as described in a separate EIS.

Based on our review, we rate this DEIS "EC-2", that is, we have environmental concerns about the proposed project, and more information is needed to fully assess the impacts. In particular, groundwater and surface water impact mitigation warrant further discussion in the Final EIS (FEIS).

Thank you for the opportunity to comment on this project. If you have any questions or require technical assistance you may contact Ramona McConney of my staff at(404)562-9615.

Sincerely,

For Gerald J. Miller

Heinz J. Mueller, Chief
Office of Environmental Assessment

Attachment

EPA Comments on Proposed
Accelerator Production of Tritium at the Savannah River Site
(DEIS December 1997)

General Comments

The DEIS is a well-organized document that clearly describes the proposed action and alternatives. Generally, the Accelerator Production of Tritium (APT) technology generates less radioactive and other wastes than alternative methods of tritium production. While EPA recognizes the advantages of APT technology, we also see the potential downside of placing this type of facility at SRS. The proposed project would have varied effects upon natural resources at SRS. EPA is concerned about issues regarding loss and alteration of wetlands and surface water bodies. Other issues of concern include the potential for groundwater flow changes, depletion of aquifers, and creation of radioactive material in groundwater as a result of neutron activation.

The need for excavation, construction, and dewatering to support the APT technology, as well as cooling towers, may lead to alteration of natural surface water and groundwater flow. The proposed site would need rigorous monitoring to ensure that there is no potential for significant migration of contaminants. Stringent preventative measures, monitoring, and mitigative planning will be required for this activity at SRS, to prevent contamination of soils, groundwater, and surface water. Further details about these activities should be included in the FEIS. L4-01

Potential environmental impacts include the discharge of heated wastewater, with non-radioactive constituents, to onsite surface water bodies that empty into the Savannah River. The DEIS also states that removal of large volumes of water from the Savannah River could change its present condition, particularly under the Once-Through Cooling Water alternative scenario. Page 6-1 states that this alternative would cause loss of wetlands and adverse impacts on the aquatic ecosystem, due to increased flow and the rise of water level. The preferred alternative of mechanical-draft cooling towers would have less dramatic impact on wetlands and surface water.

Section 4.3.5, Environmental Justice, examines whether minorities or low-income communities could receive disproportionately high and adverse human health and environmental impacts. DOE states in this section that they expect little or no adverse health impacts from any of the alternatives. Potential noise impacts, and impacts on aesthetic settings in the SRS vicinity, are addressed in Section 3.3.7 of the DEIS.

Although the DEIS contains information regarding estimated power plant emissions, it does not specifically describe the proposed action's cumulative impact on global climate change. If fossil fuels are used as a power source for this technology, would there be a significant impact on global warming? L4-02

Technology Comments

This DEIS does not address in adequate detail how waste and activation products generated as a result of operations to produce tritium will be handled. For example, on pages 4-4 and 4-5 it is stated that some neutrons could penetrate the accelerator shielding and be available for absorption by stable atoms in the soil and groundwater to form radioactive atoms that groundwater could transport off-site. There is additional text that says the groundwater standard of 4 millirem will not be exceeded. However, there is no mention of the activation products that will be formed in soil and their likely concentrations, solubility and other properties. L4-03

The operational definition of high concentration radioactive waste that appears on page 4-25 of this document does not stand alone and is ambiguous. The definition reads "the classification of radioactive wastes is based on the concentration of short- and long-lived radionuclides. High concentration wastes contain long-lived radionuclides. Classes A and B include radioactive wastes with concentrations of short-lived and perhaps some long-lived radionuclides." This definition is less than adequate. DOE should use definitions consistent with those found in 10CFR part 61 or other appropriate sections which refer to various radioactive waste classifications. The Applicable or Relevant and Appropriate Requirements (ARARs); from which definitions of radioactive wastes comes, are found in part 10 of the CFRs. There are no definitions in the glossary of Class A, B, or C wastes. Additionally, many of the definitions in the glossary are less than adequate. L4-04

A 30-year projected low-level waste volume of 42,000 cubic meters was presented in this document. However, an explanation of how this number was determined is not apparent. Were other similarly designed accelerators with an operating history surveyed to get an idea of how much waste could be generated over this period of time? L4-05

The document states that primarily low level radioactive and mixed wastes are being generated. However, page A-38 of Appendix A states that some failed or spent APT components could require "special casks" to meet transportation and disposal requirements because of "higher levels of radioactivity". If this reference is to so-called "high concentration wastes", it should be clearly stated in the FEIS. L4-06

Response to Comment L4-01 (U.S. Environmental Protection Agency)

See response to comment L2-01. DOE is committed to performing appropriate mitigating measures, including the possible installation of monitoring wells.

Response to Comment L4-02 (U.S. Environmental Protection Agency)

See response to comments M1-03 and M1-10.

Response to Comment L4-03 (U.S. Environmental Protection Agency)

The Department has clarified the discussion of activation products in modifications to Chapter 4 (see Part C, page C-42). The dominant activation product would be tritium. Also, please see the response to comment L2-01.

Response to Comment L4-04 (U.S. Environmental Protection Agency)

The commenter is correct that technical definitions can be found in 10 CFR Part 61. The Department has attempted to simplify this discussion to help understanding among the widest range of stakeholders. Modification to the text box on page 4-25 of the Draft EIS (see Part C, page C-49 of this document) has been made.

Response to Comment L4-05 (U.S. Environmental Protection Agency)

The projected low-level radioactive waste (LLW) volume for APT is based upon the Pollution Prevention Design Assessment for the Project (England et al., 1997, *Accelerator Production of Tritium*, Pollution Prevention Design Assessment, WSRC-TR-97-02-60, Westinghouse Savannah River Company, Aiken, South Carolina). This document analyzes all of the potential waste streams for APT and identifies methods and materials that could reduce the amount of waste. The largest components of the estimated 1,400 cubic meters of LLW are job control waste and non-hazardous process equipment. These estimates are based upon the design of the facility and expected waste generation rates.

Response to Comment L4-06 (U.S. Environmental Protection Agency)

The reference is not exclusively to high concentration wastes. The statement in Appendix A of the Draft EIS indicates that some waste streams may require extra shielding during their transportation as the intrinsic radioactivity would be high.

Date: 2/10/98 10:28 AM
Priority: Normal
BCC: NEPA at SRCCA02
TO: nepa at Mailhub
CC: TAYLORGK
CORNETPA
Subject: Comments

I would like to submit the following comments/ questions for consideration:

1) I would suggest that both tritium supply alternative EISs be evaluated and compared before a decision is made on the method of supply. L5-01

2) For cooling water it is indicated that groundwater is not available in sufficient capactity to supply all of the cooling water. I would like to suggest that it be evaluated if the recovery and reinjection of tritiated groundwater be considered for a source of cooling water. If this could be used as a portion of the cooling water supply it may be worth while to consider as it could increase recovery of the tritiated groundwater, be used for a purpose and then be reinjected and hopefully reduce the levels of tritium in the Savannah River which is used for drinking water supply. L5-02

Thanks
Russell Berry
SCDHEC, Low Country EQC

Response to Comment L5-01 (Mr. Russell Berry)

See response to comment L1-02.

Response to Comment L5-02 (Mr. Russell Berry)

The Department does not believe it would be feasible to utilize tritiated water as a cooling source for the APT because of the excessive amounts of other contaminants in the water. Since discharge of water is required to keep salts from accumulating in the cooling lines, the use of tritiated water might result in more tritium being introduced into the environment. The Department is, however, investigating the possibility of using tritiated water for other purposes.

realname: David Moses

email: mosesa@aol.com

subject: ES&H regulatory questions on accelerators

telephone: 423-483-4300

comments: I follow the APT EIS process and I will follow the soon to emerge SNS EIS process. From the former, several questions and comments arise about DOE's regulatory process. These questions/comments are as follows:

o If APT were a reactor and not an accelerator-driven target, its radioactive inventory of spallation and activation products that is apparently equivalent to the fission product inventory in a 50 MWth reactor would make it a Hazard Category 1 facility under DOE 5480.30, but APT at the conceptual design and for purposes of the ROD apparently is classified only as a Hazard Category 2 facility. this seems to fly in the face of DNFSB recommendation 95-2 with regard to consistent application of standards based on the hazard posed. L6-01

o If APT were a reactor and not an accelerator-driven target, its would be required to have "safety-related" protection and engineered safety systems under DOE 5480.30 and to address anticpated transients without scram (ATWS) to meet the criteria for hazards analyses in Sects. 6 and 8.c of DOE 5480.23, but APT documents never mention "safety-related" systems including beam-trip, and apparently the APT project does not want to consider failure to trip the beam in the same conservative fashion as ATWS is considered in a reactor. Isn't the beam a source of energy that, as required to be considered in hazard analyses under DOE 5480.23, can lead to target failure the same as an unprotected/unmitigated reactivity excursion in a reactor? DOE 5480.23 and DOE-STD-1027 indicate that hazards analyses should not consider mitigation systems in making the hazard classification determination, but APT apparently always assumess beam trip for such determinations. Can't the reflood of a molten target be a potential source of steam explosion the same as the reflood of a molten reactor depending upon materials and temperatures? Reactors also are required to have inherent negative feedbacks per DOE 5480.30 but not targets for accelerators such as that in APT. Again, DOE does not appear to be taking DNFSB Recommendation 95-2 very seriously. L6-02

o If APT were a reactor and not an accelerator-driven target, its radioactive wastes from the core would be "high-level" and destined for the geologic repository for disposal, but, although just as radioactive as Greater-than- Class-C LLRW that NRC and DOE/EM indicate must go to the repository, APT wastes are per the APT Homepage reportedly destined for shallow land land disposal at SRS. This seems to be inconsistent with the thrust of DNFSB Recommendation 94-2 and the complex-wide review of LLRW that followed its issuance. In fact since legally APT wastes may not be classfied readily as Great-than-Class-C (although just a radioactive), under DOE/EM guidance, they appear to be special case waste and inherently hazardous special waste wherew the complex wide review found that the production or storage of special case waste with no clear path forward is a major concern at many sites. DOE seems to be playing word games - not calling APT wastes specail case while calling such wastes Greater-than-Class-C in the recent draft APT EIS for siting at SRS and then reporting that the stuff is being considered for disposal on site at SRS. L6-03

Response to Comment L6-01 (Dr. David Moses)

DOE-STD-1027 lists the radionuclide inventory necessary for the initial categorization of a facility as either category 1, 2, or 3. While many of the radionuclides that would be present at APT are not specifically listed, the standard makes provision for the evaluation of unlisted radionuclides and provides default values to be used. In addition, the requirement for performing a detailed safety analysis for the facility is not diminished by the initial hazard classification.

Response to Comment L6-02 (Dr. David Moses)

See responses to L3-08 and L3-09.

Response to Comment L6-03 (Dr. David Moses)

See response to L3-01.

Additional DOE response is provided in the following letter from Dr. Paul Lisowsky.

Los Alamos
NATIONAL LABORATORY

Accelerator Production of Tritium Project Office
P. O. Box 1663, MS H813
Los Alamos, New Mexico 87545
Phone: (505) 665-5523 Fax: (505) 667-4344

Date: July 14, 1998
Reference: APT/PDO-98-059

Dr. David Moses
Oak Ridge National Laboratory
Bethel Valley Road
Oak Ridge, TN 37831

Dear Dr. Moses:

I am responding to the email message you sent to DOE headquarters on April 22, 1998, in which you asked three ES&H-related questions about APT. In order to ensure accurate and consistent responses to your questions, the DOE forwarded them to the APT National Project Director's Office here at Los Alamos. Our responses to your questions are attached.

Because APT Project Members have been directed to forward any future questions you might have to my Office, in order to ensure the responses are consistent and correct, you may wish to submit them directly to my office. We appreciate the acute interest you have in the APT and other accelerator projects and will try to be responsive.

I am taking the liberty of copying your management at Oak Ridge National Laboratory in this response. You indicated in your message to the DOE that you expected to raise questions regarding the Spallation Neutron Source project that will be ramping up next year. If possible, we like to be copied (for our records) on your interactions regarding the SNS.

Thank you for your continuing interest in the APT Project.

Sincerely,

Paul W. Lisowski

Paul W. Lisowski
APT National Project Director

Encl.: a/s

Cc: Dr. William R. Appleton, ORNL, SNS
Dr. William P. Bishop, DOE/DP-61
Dr. Gordon Michaels, ORNL
APT/PDO Project Files

Question/Comment:

If APT were a reactor and not an accelerator-driven target, its radioactive inventory of spallation and activation products that is apparently equivalent to the fission product inventory in a 50 MWth reactor would make it a Hazard Category 1 facility under DOE 5480.30, but APT at the conceptual design and for purposes of the ROD apparently is classified only as a Hazard Category 2 facility. This seems to fly in the face of DNFSB recommendation 95-2 with regard to consistent application of standards based on the hazard posed.

Response:

APT is categorized for hazard and safety analysis purposes in full compliance with the appropriate DOE Orders and Standards. DOE disagrees with the initial context of the comment; that is, given the clear and well-documented differences between the APT accelerator and target/blanket, versus a reactor facility, it is not relevant to apply DOE nuclear reactor safety standards such as DOE Order 5480.30 to the APT Facility. The APT Facility is properly categorized according to the requirements of DOE Orders 5480.23 (the principal nuclear safety Order for non-reactor nuclear facilities) and DOE Order 5480.25 (the principal safety Order for accelerators). Both of these Orders require that hazard categorization be conducted in accordance with DOE Standard DOE-STD-1027-92, "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports." The APT facility is properly categorized in accordance with DOE-STD-1027-92. More specifically, the accelerator portion of APT is a "below Hazard Category 3" facility segment, the target/blanket and tritium separation facility portions are "Hazard Category 2" facility segments, and the high-power beam stop portion of APT is a "Hazard Category 3" facility segment. Each independent facility segment has been categorized based on a maximum-credible release of the entire radionuclide inventory present.

DOE disagrees strongly with the comments dealing with the program's adherence to DNFSB Recommendation 95-2. The hazard categorization process used in the APT Program, which has been in place for more than two years, is fully responsive to DNFSB Recommendation 95-2 with respect to a hazards-based approach to the application of standards. Our hazard categorization process has been reviewed by DNFSB on several occasions and has received their concurrence.

Question/Comment:

If APT were a reactor and not an accelerator-driven target, its would be required to have "safety-related" protection and engineered safety systems under DOE 5480.30 and to address anticipated transients without scram (ATWS) to meet the criteria for hazards analyses in Sects. 6 and 8.c of DOE 5480.23, but APT documents never mention "safety-related" systems including beam-trip, and apparently the APT project does not want to consider failure to trip the beam in the same conservative fashion as ATWS is considered in a reactor. Isn't the beam a source of energy that, as required to be considered in hazard analyses under DOE 5480.23, can lead to target failure the same as an unprotected/ unmitigated reactivity excursion in a reactor? DOE 5480.23 and DOE-STD-1027 indicate that hazards analyses should not consider mitigation systems in making the hazard classification determination, but APT apparently always assumes beam trip for such determinations. Can't the reflood of a molten target be a potential source of steam explosion the same as the reflood of a molten reactor depending upon materials and temperatures? Reactors also are required to have inherent negative feedbacks per DOE 5480.30 but not targets for accelerators such as that in APT. Again, DOE does not appear to be taking DNFSB Recommendation 95-2 very seriously.

Response:

APT is categorized for hazard and safety analysis purposes in full compliance with the appropriate DOE Orders and Standards, as they apply to non-reactor nuclear facilities. These orders implement a hazards-based approach to facility safety in which the first step is to identify the hazards. And the second step is to perform accident analysis to show that DOE safety requirements are met. APT has completed a hazards analysis and is now performing the accident analyses. The results of the accident analyses are that for all of the design basis accidents the APT releases are negligible. In the process of doing these analyses the "failure to trip the beam" is considered as an unmitigated event. In the analysis it is subsequently shown that the initiating event is mitigated assuming the worst case single failure in the mitigation system. The beam shutdown system is designated a Safety Class system and will be built with the same rigor as a reactor protection system. For reactors a class of accidents known as Anticipated Transients Without Scram (ATWS) are analyzed. One of the reasons these accidents are analyzed is because reactors have only one shutdown mechanism and that is to insert the control rods. Poisons can be put in but they are to slow to interrupt a transient. In an accelerator there are dozens of ways it can be shut down so the shut down systems are highly reliable. In the reactor ATWS it is the reliability of the mechanical shutdown mechanisms that cause the concern. The detection elements can be made as reliable as necessary through the use of redundancy. This is not true for the final shutdown element. In APT, we will have reliability in the detection system comparable to equivalent systems

in reactors, but because we have multiple ways of executing the final shutdown we will have much higher reliability.

The question alleges that DOE is not taking serious the requirements of DNFSB Recommendation 95-2. This recommendation requires the implementation of Integrated Safety Management. According to the recommendation assessment of the hazards is a key step in this process. APT has done this. In addition, APT has presented its safety implementation plans to the DNFSB, where they commented that we clearly showed that we were implementing the ISM process required by Recommendation 95-2.

The orders for reactors require them to have negative feedback because it has long been recognized that positive feed back in reactors can be catastrophic, e.g., the Chernobyl-4 accident in 1986. The concept of "inherent negative feedbacks" in the APT target does not make sense technically, as the target does not contain uranium, plutonium, or any of the other materials that make reactivity control a safety issue in nuclear reactors.

The possibility of an energetic melt-water interaction (also known as an energetic steam
explosion) in the APT target under conditions analogous to an ATWS event in a reactor has
been considered in APT safety analyses. The only remotely plausible way that an energetic melt-water interaction might occur in the APT target would be for the supply of coolant to the target to be interrupted while the beam diagnostic and beam shutdown systems failed to terminate the beam. Due to the reliability of the systems involved, this would be an incredible event. If this unprotected transient continued, the target would boil off all the available coolant and the tungsten targets within the 12 ladders would overheat. While still at full power, the target cylinders (tungsten clad in Inconel-718) in the first six ladders would heat up at rates ranging from 250 C/s to 400 C/s. The downstream ladders would heat up at slower rates, from 150 C/s for ladder 7, to 50 C/s for ladder 12. The outer structure of the rungs would heat up slower than the targets. These staggered heat-up rates and the disconnected spatial distribution of the Inconel throughout so many rungs and internal flow channels would make any potential melt-water interaction both temporally and spatially incoherent, conditions that have proven unfavorable for energetic explosive interactions in large-scale experiments. It is clear that APT is to a large degree immune to such events as a result of inherent features such as design and materials.

Question/Comment:

If APT were a reactor and not an accelerator-driven target, its radioactive wastes from the core would be "high-level" and destined for the geologic repository for disposal, but, although just as radioactive as Greater-than- Class-C LLRW that NRC and DOE/EM indicate must go to the repository, APT wastes are per the APT Homepage reportedly destined for shallow land disposal at SRS. This seems to be inconsistent with the thrust of DNFSB Recommendation 94-2 and the complex-wide review of LLRW that followed its issuance. In fact since legally APT wastes may not be classified readily as Great-than-Class-C (although just a radioactive), under DOE/EM guidance, they appear to be special case waste and inherently hazardous special waste where the complex wide review found that the production or storage of special case waste with no clear path forward is a major concern at many sites. DOE seems to be playing word games -- not calling APT wastes special case while calling such wastes Greater-than-Class-C in the recent draft APT EIS for siting at SRS and then reporting that the stuff is being considered for disposal on site at SRS.

The Greater-than-Class-C classification (a NRC term) does not preclude disposal at SRS. The current DOE Waste Management Order, DOE 5820.2A, requires a "special performance assessment" for disposal of wastes that exceed the NRC Greater Than Class C (GTCC) classification. Waste streams were classified in the draft APT EIS in error as "Greater-than-Class-C" (being corrected in the final APT EIS). The true classification would be "special case waste" under the current order. DOE is now revising this Order. The revised Order, DOE 435.1, is not expected to retain the treatment of Greater-than-Class-C waste as a special case.

Under the new DOE Order, Low Level Waste disposal limits are based on the results of a disposal site specific Performance Assessment (PA) which sets Curies per cubic meter per radionuclide limits for that particular location. APT is currently funding an update of the SRS Low Level Waste (LLW) disposal site PA for the spallation sources expected to be generated by APT. APT is preparing plans for alternate disposal locations and options to be considered should the revised PA determine that disposal in the SRS LLRW vaults is not technically feasible.

The results are expected to be complete by the end of FY 98. Results are expected to show that few, if any, APT wastes will be unacceptable for disposal at SRS.

Note: The following was submitted during the comment period for the Tritium Extraction Facility EIS. It is reproduced here because there were some comments related to APT.

130 Clemson Drive
Oak Ridge, Tennessee 37830-7664
Electronic Mail: mosesa@aol.com
June 2, 1998

Andrew R. Grainger
NEPA Compliance Officer
SR Operations Office
Building 773-42A, Room 212
Aiken, SC 29808

Dear Mr. Grainger:

Ref: My letter to you with comments and recommendations on the draft EIS for the APT at SRS, February 2, 1998.

The following comments and recommendations are submitted on the Draft EIS for the Tritium Extraction Facility (TEF) at SRS:

1. Designation of TEF as a Department of Energy defense nuclear facility:

Comment: As described in the enabling legislation for the Defense Nuclear Facility Safety Board (DNFSB), as codified in Title 42 of the *United States Code* (USC) and specifically at 42 USC 2286a, the functions of the DNFSB are restricted to and focused on assuring the safety at each existing or new "Department of Energy defense nuclear facility."

As described in activity reports issued by the DNFSB, where such reports can be found and retrieved on the Internet either on the DNFSB homepage (http://www.dnfsb.gov/trip.html) or in the archives of the DOE Departmental Representative to the DNFSB (http://dr.tis.doe.gov/archive/default.htm), the DNFSB has taken an active role in reviewing the safety of operations at existing DOE tritium facilities at both Mound and Savannah River. As also reported both by the Accelerator Production of Tritium (APT) Project in its monthly and weekly reports on the project homepage (http://apt.lanl.gov/) and by the DNFSB SRS Representatives 1998 Weekly Activities Reports (http://www.dnfsb.gov/weekly/sr/sr1998.htm), the DNFSB staff is also taking an active role in reviewing the conceptual design of the proposed APT. These activities by the DNFSB are noted to be prudent and appropriate in assuring the independent oversight of the health and safety both of workers involved in nuclear materials activities at DOE tritium facilities and of the public who may be living in areas near DOE tritium facilities. DNFSB's active oversight of these DOE nuclear activities is to be praised and must continue as the public expects and apparently as Congress intended.

Unfortunately, such actions by the DNFSB appear to have no legal basis since the definition for a "Department of Energy defense nuclear facility" as given in 42 USC 2286g restricts the term to apply to a production facility or utilization facility as defined in 42 USC 2014 or to a DOE-owned nuclear waste storage facility that is not otherwise regulated. Since the definitions for a production facility and a utilization facility at 42 USC 2014(v) and (cc) are restricted to facilities that use, produce, or process "special nuclear material" (SNM) and since tritium is not designated to be

SNM, legally the DNFSB has no current authority from Congress for reviewing the APT or the TEF. For purposes of planning work force restructuring and tracking worker exposures at Mound and SRS tritium facilities, certain DOE tritium facilities at these two sites had to be specially and individually designated as "Department of Energy defense nuclear facilities" in the Defense Authorization Act of 1993 as codified at 42 USC 7274j, but this restrictive definition does not apply to DNFSB safety oversight functions at these tritium facilities.

It is noted that, in reference to its own regulatory functions for emergency planning and response under the *Atomic Energy Act of 1954*, as amended, as given in Sect. 7.2.2 (p. 7-8) of the draft TEF EIS, DOE alludes to the issue of tritium not being a SNM; however, DOE's presentation of its statutory authority is a bit confusing as given in the draft EIS and lacks a specific reference to a document in which "DOE has determined...that DOE regulations apply to tritium-related activities." It is assumed that the unspecified reference is not an interpretation of "Section 57(b) of the Act," that is, 42 USC 2077(b), as cited by DOE in the discussion in the draft EIS, but rather the unprovided reference is to the DOE General Counsel's interpretation of 42 USC 2201(I)(3) as given at Sect. B.1, *Federal Register, 61*, pp. 4209-4910, February 5, 1996, where it is stated that "the requirements in [10 *CFR*] Parts 830 and 835 cover all activities under DOE's auspices with the potential to cause radiological harm." 42 USC 2201(i)(3) has nothing to do with SNM but does provide DOE with broad regulatory authority, which DOE uses to claim exemption from regulation by outside regulators such as the Occupational Safety and Health Administration (OSHA), to "prescribe such regulations or orders as it may deem necessary...to govern any activity authorized pursuant to this chapter, including standards and restrictions governing the design, location, and operation of facilities used in the conduct of such activity, in order to protect health and to minimize danger to life or property." Unfortunately Congress was not equally generous in equivalently granting similar authority to the DNFSB, which unlike DOE remains legally constrained by tritium not being determined to be an SNM or by the definition at 42 USC 2286g not being expanded to cover tritium facilities.

Thus, this situation raises serious questions as to the efficacy of the DNFSB's oversight at DOE tritium facilities, since DOE or its contractors can apparently halt or suborn any investigation or review of a tritium facility with legal impunity, and of DOE's ability to impose civil penalties for violations of DOE safety requirements that may be uncovered by DNFSB's "illegal" investigations or reviews. How can a contractor or contractor employee be held liable for violations discovered in a tainted investigation? Petty criminals are protected against illegal searches and seizures by law enforcement officers that are prohibited from introducing illegally-obtained evidence in courts of law. Can a DOE civil penalty withstand a challenge in Federal court if the law is violated or exceeded in uncovering an alleged offense?

This situation begs to be corrected either by DOE and DNFSB jointly seeking Congressional action to rectify the legal shortfall before it gets tested in an embarrassing or dangerous precedent or by DOE taking appropriate actions already authorized by law. The two alternatives that could be used to rectify this situation are (1) to have Congress revise the definition of "Department of Energy defense nuclear facility" at 42 USC 2286g in the DNFSB enabling legislation to include all DOE tritium facilities that are used for defense purposes or (2) to make the determination that tritium is SNM under the existing authority at 42 USC 2071. A broader version of the first option would be to expand the definition of "Department of Energy defense nuclear facility" at 42 USC 2286g to include all defense nuclear facilities that are regulated by DOE pursuant to 42 USC 2201(i)(3) or other pertinent law. The second option requires both Presidential assent and an opportunity for the Congressional Energy Committees to express dissent. Otherwise if the DOE and DNFSB General

Counsels have a consensus reason to believe that there is already a legal basis for DNFSB oversight of DOE tritium facilities, such a finding should be published jointly in the *Federal Register* so that the public and the DOE contractors can readily understand why further action is not necessary when reading the current law as written implies otherwise.

Recommendation: The Final EIS for the TEF and, for that matter, the Final EIS for the APT at SRS should include a detailed description of the actions that DOE proposes to take to assure that the TEF and the APT are each legally designated to be a "Department of Energy defense nuclear facility." Failure to mitigate this situation and to explain to the public how the situation will be mitigated would be irresponsible. DOE should not proceed with the preliminary design of the TEF or APT until this situation is rectified so that the public can be assured that timely design reviews under 42 USC 2286a for considering safety issues are being performed properly and without question of the legality of the independent safety oversight. DOE should also provide precise descriptive discussions of and clear references to documented determinations such as the one alluded to in Sect. 7.2.2 (p. 7-8) of the draft TEF EIS. TEF-01

2. Need for DNFSB review of the EIS sections on TEF accident analysis and waste management and of the accident analysis documented in Appendix B of the TEF EIS:

In the licensing of commercial production or utilization facilities under the *Atomic Energy Act of 1954*, as amended, the U.S. Nuclear Regulatory Commission (NRC) does not begin the EIS process until the applicant submits the license application, which contains both the preliminary safety analysis report (PSAR) and the environmental report, for NRC staff review. Thus, for licensed commercial nuclear facilities, the preliminary or final EIS is issued contemporaneously with NRC issuing the preliminary or final safety evaluation of the respective PSAR or final safety analysis report (FSAR). Therefore, consistent with the level of license being issued for a commercial nuclear facility, that is, either a construction permit or an operating license, an equivalently mature safety analysis report and its independent safety evaluation exist to support and supplement the EIS. However, as can be noted in the DOE EIS process for the TEF and the APT, the DOE EIS precedes the completion of the PSAR and the performance of any independent review or evaluation of the existing safety analysis documentation.

So while the NRC EIS is two step and is ultimately based on simultaneous NRC reviews of a mature safety analysis and a mature design basis, the DOE EIS process for its new nuclear facilities may be associated with little more than a cursory and internal safety assessment of an immature pre-conceptual or point design subject to no independent review and evaluation. DOE has made no attempt to correlate its EIS responsibilities under the *National Environmental Policy Act* as regulated upon DOE itself at 10 CFR Part 1021 either with its own nuclear safety oversight functions under 48 USC 2201(i)(3) and 2282a as regulated on its contractors at 10 CFR Parts 820 and 830 or with the DNFSB's independent oversight functions chartered by Congress at 42 USC 2286a. Included in DNFSB's legal mandate, subject of course to the restrictive definition at 42 USC 4486g , are the functions to "review the design of a new Department of Energy defense nuclear facility before construction of such facility begins and [to] recommend to the Secretary, within a reasonable time, such modifications of the design as the Board considers necessary to ensure adequate protection of public health and safety" and "in making its recommendations...[to] consider the technical and economic feasibility of implementing the recommended measures." As most experts in design and construction recognize, the early identification of problems leads to the most technically satisfactory and cost effective solutions. The EIS should be an integral part of a

timely and economic assurance of "adequate protection of public health and safety," which is a key function of the DNFSB review process.

DOE's internal review process for recent EISs raises serious questions in this commenter's mind as to the adequacy of such reviews. DOE's current approach to issuing an EIS allows unbridled promotion and marketing by its own staff and contractors without a prescribed outside objective review by technical and safety experts.

When this commenter previously reviewed and commented on the Programmatic EIS for Tritium Supply and Recycle, numerous examples were noted where the internal review process apparently failed to address obvious health and safety regulatory issues especially for the APT option, and, as noted in the above-cited reference set of comments on the draft EIS for the APT at SRS, many of these issues were still not resolved as of a few months ago. In the past, this commenter has made inquires informally to DOE's cognizant nuclear safety enforcement and investigative staff with regard to their roles in reviewing EISs. These inquiries revealed that staff management in DOE's Office of Environment, Safety and Health (DOE/EH) routinely signed off on an EIS without a detailed review by the DOE/EH enforcement and investigative staff because such reviews were reportedly found to delay the process by raising technical or safety questions and thus prevented the obtaining of financial incentive bonuses by DOE managers for their timely processing of EIS paperwork. It is also apparent that DOE's Office of Environmental Management (DOE/EM) has had little or no impact on the Programmatic EIS for Tritium Supply and Recycle since APT's hottest radioactive wastes were characterized in that document as "routine low-level or mixed radioactive wastes" when under DOE/EM's guidance documents these wastes should have been characterized as "special case wastes" or "inherently hazardous special wastes." Similarly, the classification of these wastes as Greater-than-Class-C in the draft EIS for the APT at SRS, while more appropriate, is still inconsistent with both Federal law and the DOE/EM guidance documents for such wastes. One questions why DOE/EM bothers publishing guidance documents and policy statements on waste classifications since DOE staff and contractors apparently ignore them as evidenced by the recent record of EISs; this should be a matter of some interest to DNFSB, which is charged with oversight of DOE's implementation of standards. Similarly, the DOE Office of General Counsel apparently does not review the EISs since obvious statutory and regulatory issues such as those raised previously for the APT were not addressed. Perhaps, this is evidence of a lack of cognizant staff review or possibly of the provision of inadequate time for a detailed review by cognizant and knowledgeable staff since it is understood from at least one senior DOE manager in the DOE Office of Fissile Material Disposition that his office was given less than a day to review and sign off on the three volumes of the Programmatic EIS for Tritium Supply and Recycle. It appears that the velocity of DOE's internal review process for an EIS is more important than the validation of its veracity. If my understanding and description of this situation is indeed still a correct characterization, the need for an independent review of the waste management and safety assessments is true for the TEF draft EIS as well as also for other recent EISs, but my current focus is on the draft EIS for the TEF.

The situation described above can be rectified by requesting a DNFSB review of the TEF draft EIS waste management and accident analysis documentation and then publishing the results of the DNFSB review within the Final EIS. Even if that result is nothing more than a list of unanswered questions, it is important that the public know what the questions by the independent safety reviewer are and how DOE intends to address the questions. Such actions will go a long way toward making the DOE EIS process for a new nuclear facility more consistent with that used by the NRC for licensed nuclear facilities and will prevent DOE EISs from resembling marketing brochures for DOE staff or contractor proponents. This independent review can only better serve the interests of the American public and taxpayers.

Recommendation: DOE should request a DNFSB review of the TEF draft EIS waste management and accident analysis documentation, publish the results of the DNFSB review within the Final EIS, and describe how DOE intends to resolve any questions raised by the DNFSB review. TEF-02

3. NRC licensing of commercial sales of tritium recovered in TEF or DOE prohibiting all commercial sales for tritium produced in the APT:

Comment: Under 42 USC 2141(a), NRC is authorized to license DOE's domestic commercial sales of tritium as a byproduct material as defined at 42 USC 2014(e)(1) and subject to the licensing provisions of 42 USC 2111 and 2114 as regulated at 10 CFR Part 20 and Parts 30-39 and for purposes of commercial exports at 10 CFR 110.9(c). Unfortunately, under the definition given at 42 USC 2014(e)(1), tritium is an NRC-regulated "byproduct material" only if it is produced in a reactor. This comment does not apply to the TEF for the recovery of tritium from CLWR irradiations.

Thus, if DOE's new source of tritium is the APT, then quantities of tritium recovered in the TEF, unlike the tritium recovered in older DOE tritium facilities from inventories produced in the now shutdown production reactors, are no longer subject to NRC regulation if sold for commercial purposes by DOE. In this case APT-produced tritium falls into the category of accelerator-produced radioactive material (ARM) that NRC claims to have no authority to license and regulate based upon the findings last reported by the NRC in the Policy Issue documented in SECY-92-325, James M. Taylor, Executive Director for Operations, to the Commissioners, "Characterization of discrete NARM and evaluation of the need to seek legislation extending NRC authority to discrete NARM," September 22, 1992 (NRC Public Document Room Accession No. 9204290244A). This policy issue document was issued by the NRC staff at the request of the Commission because a report on the subject requested by Commission Chairman Lando Zech from the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC) was never issued. CIRRPC ceased to exist in 1992, and its replacement, the Interagency Steering Committee on Radiation Standards (ISCORS), which was formed about two years ago, is reportedly not considering ARM regulation on an active basis. Per SECY-92-325, NRC regulation of ARM is not authorized by the *Atomic Energy Act of 1954*, as amended, and therefore ARM falls under the regulatory authority of the States granted under the *U.S. Constitution* and under the regulatory authority of the Environmental Protection Agency (EPA) under the *Toxic Substances Control Act* (TSCA).

It should be noted that SECY-92-325 and several preceding NRC documents cited therein on the subject of regulating both ARM and naturally-occurring radioactive material (NORM) are a little less than clear on the statutory provisions with regard to the licensing and regulation of ARM. Although not directly addressed in SECY-92-325, there is an apparent legal basis for regulating ARM that can be found within the *Atomic Energy Act of 1954*, as amended, but there is no readily clear basis for issuing a license for the ownership, possession, use, production, transfer, or disposal of ARM. NRC would need licensing authority in order to exercise its authorities for requiring financial protection under 42 USC 2210 and for issuing civil penalties under 42 USC 2282. The bases for regulating ARM under the *Atomic Energy Act of 1954*, as amended, stem from 42 USC 2011, 2013(c), 2014(c), and 2201(p) where these statutory provisions provide that (1) NRC can issue any regulation needed to carry out the purposes of the Act, (2) the purposes of the Act are stated to be "to effectuate the policies set forth above [in 42 USC 2011] by providing for...a program for Government control of the possession, use, and production of atomic energy," and (3)

atomic energy is defined to mean "all forms of energy released in the course of nuclear fission or nuclear transformation." Since ARM is created by machine-induced nuclear transformations and since ARM releases other energetic radiations by the process of nuclear transformation involved in radioactive decay, it is technically self-evident that the authority to regulate ARM exists within the *Atomic Energy Act of 1954*, as amended. However, as indicated above, there is no statutory authority given to license any activity associated with the production or use of ARM, as long as the ARM is not also SNM. Since NRC was granted only the "licensing and related regulatory functions of the Atomic Energy Commission" in the *Energy Reorganization Act of 1974* as codified at 42 USC 5841(f) and since NRC is also limited by the "consistent with existing law" provisions of 42 USC 2021b(9)(B) and 10101(12)(B) and (16)(B) with regard to classification authority for nuclear wastes, NRC does not regulate ARM as a radioactive product in use or as a radioactive material being disposed because NRC has no authority under current law to license the production, possession, and use of ARM.

In addition, if a domestic third party were to purchase from DOE tritium that had been produced in the APT and recovered for use in the TEF, since under current law that tritium is not byproduct material, there are no NRC nor Department of Commerce export licensing regulations to preclude its sale to a foreign government seeking tritium for use in a nuclear weapons program. As indicated at 15 CFR Part 774, for Commerce Commodity Control List Item 1B231, "Tritium facilities, plants and equipment," under related controls: "This entry does not control tritium, tritium compounds, and mixtures containing tritium, or products or devices thereof. See 10 CFR Part 110 for tritium subject to the export licensing authority of the Nuclear Regulatory Commission." Thus, the Department of Commerce regulations defer to the NRC regulations to control the export of tritium, but NRC controls tritium only if it is classified as byproduct material as defined in the law. It is noted however that the *Nonproliferation Treaty Act of 1978* modified 42 USC 2139 to add the following words:

> "After consulting with the Secretaries of State, Energy, and Commerce and the Director, the Commission is authorized and directed to determine which component parts as defined in section 2014(v)(2) or 2014(cc)(2) of this title and *which other* items or *substances are especially relevant from the standpoint of export control because of their significance for nuclear explosive purposes*. Except as provided in section 2155(b)(2) of this title, no such component, *substance*, or item which is so determined by the Commission shall be exported unless the Commission issues a general or specific license for its export after finding, based on a reasonable judgment of the assurances provided and other information available to the Federal Government, including the Commission, that the following criteria or their equivalent are met:...(2) no such component, *substance*, or item will be used for any nuclear explosive device or for research on or development of any nuclear explosive device..."

Although this addition to the law appears to imply that NRC has the requisite authority to regulate the export of commercially-sold APT-produced tritium, which could be used in a nuclear explosive device, the current NRC export regulations at 10 CFR Part 110 continue to limit its licensing and regulatory authority only to materials and substances that are defined to be subject to licensing in the *Atomic Energy Act of 1954*, as amended, and to those reactor materials covered in the export control guidelines issued by the Nuclear Suppliers Group (NSG). The NSG export control guidelines that are published by the International Atomic Energy Agency address heavy-water, deuterium and reactor-grade graphite but do not address tritium. Since tritium is also not listed as a dual use item by NSG guidelines, the Department of Commerce has no basis for its regulation as such on the Commodity Control List.

The only regulatory safety net in this unfortunate situation is the exception cited in 10 CFR 110.1(b)(2) for "persons who export...U.S. Munitions List nuclear items." Under Department of State regulations issued under the *Arms Export Control Act*, as authorized under the *International Security and Development Cooperation Act of 1980*, 22 CFR 121.1, Article XVI(a) should be sufficiently broad enough to cover APT-produced, TEF-extracted tritium although 22 CFR 123.20(a) implies that the controls do not apply to items that should be regulated by either DOE or NRC. If this is the only regulatory safety net, then DOE is obligated to tighten the mesh of the net somewhat compared to what it appears to be now.

Therefore, for purposes of DOE domestic commercial sales of any tritium produced in the APT and recovered in the TEF, DOE should not permit such sales unless and until a clear and adequate regulatory regime is in place to control the material being sold with regard to both radiation safety and export prevention. DOE has several options that may be considered to mitigate this problem; these options include:

- Declaring in the *Federal Register* as DOE official policy that no tritium produced in APT and recovered in the TEF will be sold commercially.
- Obtaining an Executive Branch determination under 42 USC 2071 that tritium is SNM subject to NRC regulation.
- Obtaining, with NRC concurrence and assistance, Congressional action to amend the *Atomic Energy Act of 1954*, as amended, either to declare ARM to be byproduct material subject to NRC regulation or to declare that the production, possession and use of ARM is subject to licensing by the NRC.
- Securing EPA regulation of ARM under TSCA as considered in SECY-92-325 and either securing NRC regulation of tritium as a substance usable in a nuclear weapon under 42 USC 2139(b), securing Department of Commerce regulation of tritium as a dual use item (the latter may require action by the NSG), or issuing an official public policy statement that all tritium produced in APT and recovered in the TEF is covered solely for export control purposes by Department of State regulations under 22 CFR 121.1, Article XVI(a).

If DOE were to consider the alternative of mixing APT-produced tritium with existing inventories of previously-produced reactor-generated tritium as a means to effect the mixture's legal status as byproduct material, DOE needs to consider how records would have to be generated and maintained to prove its or the NRC's case in court for alleged violations of the *Atomic Energy Act of 1954*, as amended, in handling materials sold commercially. This alternative is judged to be an unnecessary risk and cost simply to avoid dealing with a legitimate problem in an open and professional manner that warrants public trust.

Recommendation: With regard to the potential of DOE domestic commercial sales of any tritium produced in the APT and recovered in the TEF, DOE should indicate in the final TEF EIS that DOE will not permit commercial sales of APT-produced, TEF-recovered tritium unless and until an adequate regulatory regime is in place to control the material being sold with regard to both radiation safety and export prevention. DOE should describe in detail the possible options, the adequacy of those options, and its specific plans to prevent such sales or to put in place the necessary regulatory controls. Failure to indicate in the TEF EIS how DOE intends to resolve this problem is unacceptable. The public needs to be assured that DOE is planning to act in a responsible manner to mitigate a serious legal question that could adversely effect both public health on a small scale and national defense on a much more serious scale. TEF-03

4. Inapplicability of 10 CFR Part 962 to the regulation of TEF radioactive wastes when contaminated with tritium produced in APT:

For the same reasons as described above for NRC's claimed inability to regulate tritium sold commercially if produced in the APT, DOE's regulations for byproduct materials at 10 CFR Part 962, which are "for use only in determining the Department of Energy's obligations under the Resource Conservation and Recovery Act (42 U.S.C. 6901 et seq.) with regard to radioactive waste substances owned or produced by the Department of Energy pursuant to the exercise of its responsibilities under the Atomic Energy Act of 1954," are invalid for APT radioactive wastes and for TEF radioactive wastes when processing APT-produced tritium.

This inapplicability could be interpreted to imply that all APT and associated TEF radioactive wastes fall under the full regulatory authority of the States and the EPA and are therefore fully subject to any DOE-state compliance agreements with regard to compliance with the *Resource Conservation and Recovery Act* (RCRA) and the *Federal Facilities Compliance Act* (FFCA). Given this interpretation, it appears that for such radioactive wastes DOE would not legally be able separate out the tritium content from other hazardous constituents as its sole regulatory responsibility for treatment and disposal.

As discussed previously, DOE would still be able to regulate occupational radiation exposures during handling of such wastes consistent with the DOE's General Counsel's interpretation of 42 USC 2201(i)(3) as given at Sect. B.1, *Federal Register, 61*, pp. 4209-4910, February 5, 1996, where it is stated that "the requirements in [10 *CFR*] Parts 830 and 835 cover all activities under DOE's auspices with the potential to cause radiological harm."

However, for military applications of atomic energy, 42 USC 2121(a)(3) authorizes DOE to "provide for safe storage, processing, transportation, and disposal of hazardous waste (including radioactive waste) resulting from nuclear materials production, weapons production and surveillance programs." Further, 42 USC 2011, 2013(c), 2014(c), and 2201(p), which were previously argued to provide a basis for NRC to regulate ARM, provide DOE with broad authority not currently reflected in 10 CFR Part 962.

Unless DOE has no objections to the regulation of the treatment and disposal of TEF and APT radioactive wastes by the State of South Carolina under RCRA and FFCA and by the EPA under RCRA/TSCA, the most direct means to avoid any future dispute over regulatory authorities in this situation, if viewed as a potential problem by DOE, would be either to obtain an Executive Branch determination under 42 USC 2071 that tritium is SNM subject to DOE and NRC regulation or to promulgate DOE rulemaking to amend 10 CFR Part 962 to extend DOE's regulatory authority over ARM including tritium produced in the APT and subsequently recovered in the TEF. The latter option would also clarify the issue of DOE regulation of ARM for the public in the upcoming EIS for the Spallation Neutron Source at Oak Ridge and provide a basis to preempt any intervenors from interceding through the states and EPA in the regulation of ARM wastes at DOE's other major accelerator facilities such as Argonne, Brookhaven, Fermi, and Los Alamos.

Recommendation: For the case in which TEF processes APT-produced tritium, DOE should explain in the Final EIS for TEF exactly how it intends to deal with TEF radioactive wastes in light of the current inapplicability of 10 CFR Part 962 in clearly defining the line between DOE authority TEF-04 and EPA/state authority under RCRA/FFCA. DOE should promulgate rulemaking to amend 10 CFR Part 962 or to add other rules to clarify its authority over ARM. This intent should be made clear in the Final EIS discussions of RCRA, FFCA and TSCA as currently given in Chapter 7 of the draft EIS. TEF-04

Respectfully submitted,

David L. Moses, Ph.D., P.E.
Nuclear Engineer

These responses to the June 2 letter from Dr. David Moses commenting on the TEF EIS are reproduced from the TEF EIS.

Response to Comment TEF-01 (Dr. David Moses)

The Defense Nuclear Facilities Safety Board (**DNFSB**) has the authority, under legislation establishing the **DNFSB** and its mission, to provide independent safety oversight to DOE in regard to the operation of defense nuclear facilities. The **DNFSB** from time to time provides recommendations to the Department. As the commenter points out, ambiguities may exist in the Board's authority to provide oversight to TEF and other DOE tritium programs because tritium is not a special nuclear material as defined by the Atomic Energy Act of 1954. As the commenter also points out, DOE cooperates fully with the Board on matters concerning existing and proposed DOE tritium facilities.

As indicated in the draft EIS, because of its radiological characteristics DOE has chosen to apply to tritium operations a number of regulations and standards which also apply to special nuclear material operations. DOE believes this is a conservative approach to safety management for tritium facilities. The regulations (including 10 CFR Parts 830 and 835) and DOE Orders are discussed and listed in Section 7.4 of the Draft EIS. DOE has evaluated the NRC Isotope Facility requirements; those facility NRC requirements that are more conservative and not covered in DOE Orders will be included in the final design of the TEF. DOE has a rigorous regulatory system in place for tritium facilities. Because of this, it is not likely that changes in the definition of DOE nuclear facilities or the designation of tritium as a special nuclear material would change the safety posture of these facilities or of the TEF. Therefore, DOE has not modified the Draft EIS in this regard.

Response to Comment TEF-02 (Dr. David Moses)

The Defense Nuclear Facilities Safety Board (DNFSB) is an independent agency that freely conducts oversight activities of DOE facilities. DOE's Tritium Program has cooperated fully with Board and Board staff requests for information on the TEF. Board and Board staff have been provided briefings on TEF issues, at their request. As the commenter suggests, DOE submitted a copy of the TEF Draft EIS to the Board for review and comment. No comments were received from the DNFSB or DNFSB staff. DOE prepared the TEF EIS early in the facility decision process as mandated by NEPA; implicit in this objective of obtaining early public input is the fact that detailed design information is not available to support the EIS. Assuming that the Department decides to proceed with development of the TEF, detailed design and safety reviews (including independent review and oversight by DNFSB) will be conducted according to DOE policy and established safety practices at appropriate stages of design.

Response to Comment TEF-03 (Dr. David Moses)

The purpose of the proposed action and alternatives evaluated in the TEF EIS is to provide the capability to extract tritium from tritium producing burnable absorber rods irradiated in a commercial nuclear reactor, or targets of similar design, for the sole purpose of supplying tritium to the Department of Defense to support the nuclear weapons stockpile of the United States. Commercial sale of tritium extracted in the TEF, regardless of the source (CLWR or APT), is not contemplated at this time. However, it should be noted that tritium produced in a CLWR does fall within the scope of existing regulations. The commenter points out that it is unclear where regulatory authority rests in regard to accelerator-produced tritium. DOE does not consider "targets of similar design" the preferred target alternative for the proposed accelerator. The preferred alternative, as described in the APT EIS, is to produce tritium in a helium target and extract the tritium at the accelerator facility; the TEF would not be required if the accelerator was chosen as the primary source of tritium and the helium target technology was implemented. Thus it is unlikely for a number of reasons that commercial sale of accelerator-produced tritium from the TEF will become an issue.

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August 1, 1998

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Dear Madam and Sir:

Ref: Letter, P. W. Lisowski (LANL) to D. L. Moses (ORNL), APT/PDO-98-059, July 14, 1998.

My letter to both of you is in regard to actions by DOE that I, as a citizen and as a registered professional (nuclear) engineer in the State of Tennessee, find very disturbing. Although the following is rather long and technically tedious to read, I respectfully ask that you do read it since I believe your timely and appropriate response is vital to re-establishing and maintaining the integrity of DOE's independent oversight of environment, safety, and health activities. As the saying goes, the devil is in the details, and the devils I see lurking are a possible cavalier attitude in some parts of DOE or its contractors about adhering to nuclear safety requirements and a possible disregard for the legal and regulatory requirements for providing complete and accurate information in this regard. Please be aware that, as a registered professional engineer in Tennessee in order to maintain my license to practice in my area of expertise, I am required to be technically competent to recognize situations adverse to public health and safety, to be cognizant of the laws and regulations that apply to assuring public health and safety in my area of practice, and to assure that all pertinent and relevant information is included in the professional documents I write. I do my very best to comply with these regulated standards of conduct.

On or about April 22, 1998, I submitted via the Comment page on the DOE/EH Homepage, three comments related to the application of DOE's hierarchy of nuclear safety regulations, orders, and technical standards to the Accelerator Production of Tritium (APT) in comparison to the manner in which such nuclear safety requirements are understood to be applied to nuclear reactors. My comments were based on the incomplete safety case for the APT as presented both in the completed Programmatic Environmental Impact Statement (PEIS) for Tritium Supply and Recycle and in the APT's draft Environmental Impact Statement (EIS) for siting at Savannah River. In the past, I have been the author of public comments that DOE had solicited on both of these EISs. I also had an opportunity over a year ago to review one draft document as part of my job. Although I understand that DOE has an Openness Policy on issues of health and safety, any access to other relevant APT project safety documents, including archives of weekly and monthly reports, is severely limited due to password protection on the APT homepage. So basically my access to current design and safety information is limited to the EISs and a few open literature documents.

On July 24, 1998, I received a reply to the comments that I had submitted on the DOE/EH homepage. However, instead of receiving a reply from the independent safety oversight organization (DOE/EH) sent to my home address or to my America-On-Line e-mail address given with my comments, I received the reference letter from the DOE-contractor proponent sent to my place of work with senior management on distribution. Dr. Bill Bishop at DP-61 was also on distribution, but no one from DOE/EH was included. I assume that each of your offices can obtain a copy of the reference letter from Dr. Bishop; otherwise I will be glad to send a copy to each of you. Although the manner in which my comments were answered raises serious questions in my mind about how Federal laws relating to privacy were handled in the actions taken by both DOE and the proponent, my concern is now not how the letter was sent to me and my management but what the method employed implies about the attitude within DOE to persons who raise questions about regulatory compliance relating to public health and safety and environmental protection.

The LANL letter indicates that DOE/EH forwarded my comments to the APT proponent organization within DOE for their response "to ensure accurate and consistent answers." The responses given in the attachment to the reference letter imply that DOE endorses the positions documented therein since such wording as "DOE disagrees with..." and "DOE disagrees strongly with..." is used.

I am quite surprised by this situation since I expected an answer to my comments to come to my home for my personal edification and to be issued from DOE/EH as the independent safety oversight organization to whom my questions had been addressed. My understanding of the law as given at 42 USC 7274m(a) is that "The Secretary of Energy shall take appropriate actions to ensure that --

(1) officials of the Department of Energy who are responsible for independent

oversight of matters relating to nuclear safety at defense nuclear
facilities
and enforcement of nuclear safety standards at such facilities maintain independence from officials who are engaged in, or who are advising persons who are engaged in, management of such facilities." My understanding from
the
Mission Statement on the DOE/EH Homepage is that DOE/EH strives for "strong and independent oversight of environment, safety, health,..." and that
DOE/EH
has as a "specific function" the role of conducting "independent oversight activities that provide a comprehensive, accurate understanding of the state of environment, safety, health,..." I note that DOE/EH is also charged at
10
CFR 1021.105 with oversight of DOE activities for implementing compliance
with
the National Environmental Policy Act (NEPA). Since my comments were about the nuclear safety aspects of the proposed APT as presented to the public in the EISs for a new defense nuclear facility that DOE/EH is charged with reviewing, I am left wondering as to whom I should seek satisfaction about
the
manner in which my inquiry has been handled with regard to adherence to
letter
and the intent of 42 USC 7274m as well as NEPA and other laws. Is this the way DOE/EH meets the requirement at 40 CFR 1500.1(b) that the environmental information presented in the EIS "must be of high quality?" No independent oversight, simply defer to the proponent? My understanding is that this is not the public's nor Congress' expectation of how DOE is supposed to comply with NEPA.

I note that, if an applicant for a license to construct or operate a commercial nuclear reactor deliberately provides inaccurate or incomplete information in the Safety Analysis Report or Environmental Report submitted with the license application to the U.S. Nuclear Regulatory Commission (NRC) and thereby causes the NRC's EIS to be in error, the applicant is subject to the NRC's regulatory provisions relating to completeness and accuracy of information and to deliberate misconduct and would thereby be subject to
both
civil and criminal penalties. Since the reference letter from a DOE contractor purports to reflect official DOE positions on matters of
compliance
with nuclear safety requirements, may I assume that the provisions of 10 CFR 820.11 apply to this letter with respect to the completeness and accuracy of information relating to a DOE nuclear activity? Or, does LANL's exception granted under 42 USC 2282a(d)(2) provide cover for both the letter's author and the DOE officials, if any, who sponsor his actions? However, do I also understand correctly that the authors of this letter may be held accountable to one or more of the provisions at 18 USC 371, 912, 1001, 1018, 1031(a), or 2071(b)? Is an EIS for a nuclear facility subject to 10 CFR 820.11? Is the provision of information to an EIS subject to any of the provisions of
Federal
law as cited above? My assumption is that the answer at least to the last question is "yes."

I would prefer that technical differences of opinion between professionals
be
resolved by personal interactions and discussion or at least be made well-defined by public debate in open forum among peers. The problem with technical differences of opinion that may be interesting to debate on the telephone or at a meeting of a technical society is that they grow into
harsh
and very real legal issues when they deal with the legal and regulatory aspects of providing official information regarding public health, safety
and
environmental protection that is to be presented in public documents issued
to
address official decision-making by the government. This is when a
technical
professional like me has to recognize himself to be and to act accordingly
as
a state-licensed professional engineer with a mandated obligation to place public welfare above other considerations. In this respect, please consider the following differences of opinion with regard to accuracy and
completeness
of some of the "official" positions taken by "DOE" in the reference letter which was prompted by may asking the same questions of DOE/EH about the EIS:

o The reference letter states that "The APT facility is properly categorized in accordance with DOE-STD-1027-92." Please note that, although not acknowledged in the letter, the radionuclides listed in Table A.1 of DOE-STD-1027-92 and for that matter (to the best that I can determine) in the various references listed in Attachment 1 of the standard include "no" radioactive isotopes of tungsten. Such radioactive isotopes would be
expected
to exist in substantial quantities as activation products in the APT target
as
the result of irradiation by the proton beam and by resulting neutron flux. In fact, all the radioisotopes listed in DOE-STD-1027-92 appear to be
fission
products, activation products, and actinides that one would expect to encounter primarily in nuclear reactors and associated fuel cycle facilities.

It is generally recognized that spallation and activation products in an accelerator-driven target-blanket composed of non-fissionable heavy metals will have a substantially different mass distribution than fission products. L7-01
Thus stating that the "APT facility is properly categorized in accordance
with
DOE-STD-1027-92" begs the question of whether the statement is both complete and accurate since the cited standard fails to address many of the radionuclides (20-30 million Curies per the draft PEIS) that are predicted
to
exist within the target-blanket of the APT during and following operation.

The high radiation hazard posed by irradiated accelerator targets made of materials such as tungsten is also a matter of record for accelerators that are orders of magnitude smaller than the APT (See Occurrence Report Number ALO-LA-LANL-RADCHEM-1996-0010, "Unposted High Radiation Area on the Roofto above TA-49-1 Hot Cells," 10/11/1996). How can one apply a standard that is technically either not applicable or insufficient to be applied without additional qualification? The interim guidance in Attachment 1 to DOE 5480.
23
states that the hazard analysis "should identify the inventory of hazardous materials (type and amount), including radioactive materials" and make a

"hazard classification in keeping with the requirements of paragraph 8c of this Order." So, if the APT target-blanket contains about 20-30 million Curies of radionuclides that are known to pose a high radiation hazard and are generally comparable to the activity level in a 50 MWth reactor, and if reactors exceeding 20 MWth are classified in Attachment 2 to DOE 5480.30 as being Category A that is recognized to be equivalent to a Category 1 Hazard facility in DOE 5480.23, by simple engineering analogy, why is the APT target-blanket a Category 2 Hazard facility? It does not make engineering sense, so what other technically defensible reasons are there?

o As indicated above, the reference letter states that "The APT facility is properly categorized in accordance with DOE-STD-1027-92." The letter also states that "Each independent facility segment has been based on a maximum-credible release of the entire radionuclide inventory present." What is "maximum-credible?" These words are not used anywhere in DOE 5480.23 including Attachment 1 nor in DOE-STD-1027-92. "Credible" is used in Sect. 3.1.2 of DOE-STD-1027-92 only in connection with considering chemical and physical forms of materials and dispersive energy sources for facilities that are initially found to be Category 2 Hazards without making such considerations at the beginning of the analysis. Sect. 8.c of DOE 5480.23 states that the hazard analysis "shall identify energy sources or processes that might contribute to the generation or uncontrolled release of hazardous materials" and "shall estimate the consequences of accidents in which the facility or process and/or materials in the inventory are assumed to interact, react, or be released in a manner to produce a threat or challenge to the health and safety of individuals on site and off site." Further, Sect. 3.1.2 of DOE-STD-1027-92 states that the final hazard categorization is "not to consider safety features (e.g.,ventilation system, fire suppression, etc.) which will prevent or mitigate a release," and Sect. 4.1.1 of DOE-STD-1027-92 states that "preventive and mitigative features are not to be considered in hazard categorization." Yet from the reference letter it is stated that loss of target cooling with failure to trip the beam is "due to the reliability of systems involved...an incredible event," that "failure to trip the beam' is considered an unmitigated event," and that "in these analysis it is subsequently shown that the initiating event is mitigated assuming the worst case single failure in the mitigation system." Thus, the APT project staff apparently ignore the precise wording of the DOE order and standard. The order and standard indicate that the hazard categorization is to be based on unmitigated and interactive failures and that credible release fractions are allowed to be considered only for facilities that are initially found to be Hazard Category 2. The reference letter implies that the APT hazard categorization assumes mitigation (that is, tripping the beam) presumably for the sole purpose of moving the Hazard Category rating from 1 to 2. L7-02

What goes on here? It is not my impression that DOE issues nuclear safety requirements documents for broad public consumption and then allows its program offices and contractors to modify the intent of the stated requirement to allow themselves flexibility in meeting program objectives (such as winning public acceptance in an EIS?) without providing the public with complete and accurate information about what is actually being done and why. This simply cannot be official DOE policy. No one I know in DOE would think of suggesting let alone defending such an approach to Congress.

o Why does APT need to assume the beam always trips? The answer to this question is not given in the reference letter but can be deduced from the letter by a competent engineering professional with a commitment to public safety, so I am sure that DOE/EH either has not been presented with all the facts by the proponents or has not had time to evaluate the proponents' submittals in sufficient detail. L7-03

In the reference letter, the Inconel-clad tungsten target cylinders are stated to heat up at full power in the beam without cooling at heat-up rates varying from 150 degrees C per second to 450 degrees C per second. Assuming that the Inconel and tungsten are at an initial temperature of about 100 degrees C and assuming from a handbook that the melting and boiling temperatures of tungsten are 3410 degrees C and 5660 degrees C respectively, the heat-up rates given in the letter, ignoring physical relocation and any change in density and specific heat with temperature or change in phase, imply that the tungsten will melt in less than 7.5 seconds and boil in less than 12.5 seconds when cooling is lost in the highest power sections of the target with no beam trip. Under the same conditions and using higher-end handbook values for major metals in the alloy, the Inconel clad would melt at less than 1600 degrees C and boil at less than 2800 degrees C and would have a time delay in sensing the heat deposited in the tungsten of a few seconds at most.

The clad would thus likely melt or boil before the tungsten but not by much. In the lower power regions, the heat-up rate quoted in the letter implies that tungsten target melting would occur in less than 23 seconds and boiling in less than 38 seconds. Thus, if the structural integrity of the high-power region of the target fails so it melts and slumps down and away from the beam, the heat-up rate in the remaining initial low-power regions would increase thereby accelerating progressive structural failure as the whole target becomes molten most likely in much less than 20 seconds. What would happen if the target lost cooling and the beam did not trip for about 10 seconds at which time a malfunctioning automatic system or an operator in the target station, not knowing that there was no beam trip, restarted full coolant flow. What happens if this occurs at 20 seconds? At 30 seconds? Can you imagine a flood of water pumped into a cavity filled with molten metal and metal vapor?

The letter would have the reader believe that steam explosion is not possible due to uneven heating in the target under beam irradiation, but the letter fails to indicate how long a delay in beam trip was considered in their analysis of the target condition at the time cavity flooding would occur.

The NRC often requires assuming a ten minute delay before the operator takes any action or takes the proper action. APT cannot tolerate ten minutes of the beam on with no cooling and probably cannot tolerate 5 seconds without active mitigation by the beam trip. For an assumed delay in beam trip of only 5 seconds with no cooling, the degree of damage in the higher power regions of the target would most likely be comparable to what occurred in the center of the core during the Three Mile Island Accident many minutes into the transient after the operators took the wrong actions by throttling the emergency core cooling system.

The reference letter alludes to the Chernobyl accident as the reason why reactors must have negative feedbacks that are argued in the letter to make no sense in APT. However, the core design was only part of the root cause at Chernobyl. Human error played the dominant role in both the design flaws and the operator errors. At APT, human performance will dominate the design, construction, testing, operations, maintenance, and inspection of the trip system for the beam. Demands for high-availability to produce tritium will require immunity from spurious trips thus forcing the simplification of channels that can actually actuate a trip and adding pressure to management to allow jumpering-out of nuisance trip signals. Minimizing unwarranted trips while maintaining high safety margins in commercial reactors has been no easy trick and has taken many years to achieve under the ever-present oversight of the regulator. The reference letter asserts that there are multiple ways to trip the beam. I note that many applicants to the NRC have indicated that there are multiple ways of accomplishing safety functions, but NRC has adopted the "primary success path" approach for technical specifications to assure that a minimum set of redundant and diverse safety mechanisms are assured to be operable when the plant is operating. In addition, the NRC standard review plan still requires accident analyses of anticipated transients without scram no matter what the initiating event or transient and regardless of the fact that there are multiple ways to trip the reactor most of which are addressed in the limiting conditions for operation in the technical specifications. This is defense in depth where inherent mitigative features of the design play an important role in making the deterministic safety case as the degree of postulated challenge posed by the regulator moves through the design basis and beyond. APT lacks such mitigative features and must always rely on active mitigation to trip the beam and avoid catastrophic loss of target integrity that can occur in seconds. But the reference letter indicates that full compliance with the DOE nuclear safety requirements has been met in defining APT to be a Hazard Category 2 facility. I cannot believe that any DOE manager would knowingly countenance such claims if he or she had been presented all the pertinent and relevant information.

So, why does APT need to assume the beam always trips? The proposed project costs a lot of money. To win political advantage with the public who must pay for the project, any proponent would be very hesitant to admit that the facility will always operate just seconds away from a catastrophic loss of investment if not a smaller scale but very expensive repeat of the lessons that were supposed to have been learned at Chernobyl. Apparently, if DOE safety requirements stand in the way of making the facility appear much less safe than the proponent would like in order to sell the proposal, he may be tempted to massage their application until he gets the result he wants. Is this Integrated Safety Management (ISM)? Not in the DOE I know! Redefining ISM to have the double meaning "I See Money" therefore "I Sell Misinformation" is not the DOE I know in Oak Ridge. This may be much more than merely putting the best foot forward; once knowingly obfuscated in an official document, this may be a criminal act.

o Finally, the letter provides a discussion of DOE's purported plans to dispose of APT radioactive wastes indicating that the expectation is for near-surface land disposal at the Savannah River Site. The letter acknowledges that the current DOE 5820.2A requires a "special (sic) performance assessment"for Greater-than-Class-C radioactive wastes without acknowledging that this assessment requires action under NEPA. The reference letter then indicates that APT radioactive waste disposal will fall under the new DOE O 435.1 (now only in draft) and that DOE is going to address the disposal of APT radioactive wastes as special case waste, which the letter indicates is the better classification for APT radioactive waste than NRC's Greater-than-Class-C as used in the draft EIS. This assertion is very interesting since I cannot find, using electronic searches on DOE's homepages, that the words "special case waste" are defined or even mentioned in draft DOE O 435.1 and its accompanying draft guidance document (DOE G 435.1) and draft manual (DOE M 435.1). The assessment mentioned in the draft DOE G 435.1 does not appear to require an EIS and apparently is based upon using guidance documents that do not seem to exist yet. I also cannot find in the draft DOE O 435.1 any correlation of the term "radioactive waste" with the demarcation between the Atomic Energy Act and the Resource Conservation and Recovery Act as it appears in 10 CFR Part 962; such a demarcation appears in the definition for "radioactive waste" as given in DOE 5820.2A. L7-04

In reality, radioactive wastes generated in APT do not contain special nuclear material, source material, or byproduct material as defined in the

Atomic Energy Act of 1954, as amended, and as codified at 42 USC 2014. Therefore, consistent with 10 CFR Part 962 and the official positions taken by NRC (NUREG-1310 and SECY-92-325), APT radioactive wastes will fall under the Resource Conservation and Recovery Act as meeting the definition for "solid waste" codified at 42 USC 6903(27) and should be regulated as "hazardous waste" under the definition at 42 USC 6903(5) by the Environmental Protection Agency (EPA) and by the State of South Carolina under the Federal Facilities Compliance Act. Thus in this case, APT high-hazard radioactive wastes will be subject to listing as hazardous waste under 42 USC 6921 and subject to all the standards and permitting requirements at 42 USC 6922, 6924, and 6925. Since EPA has not promulgated land disposal restrictions previously for this type waste, it is expected that rulemaking, EISs and public meetings will be required.

However, as I have suggested before in public comments on DOE EISs, it would appear to be easier if DOE and NRC would either take a public position on rulemaking to cover this type of radioactive waste under various existing provisions of the Atomic Energy Act or have Congress amend the Atomic Energy Act to include accelerator-produced radioactive materials within the Act and then DOE could issue regulations analogous to NRC's at 10 CFR Part 61 to classify its wastes equivalently to commercial practice for NRC-licensed facilities. Accounting for the equivalent hazard posed by APT radioactive wastes, this latter approach would most likely make APT's most radioactive wastes Greater-than-Class-C Low-Level Radioactive Wastes, which currently must be disposed in a geologic repository per the NRC regulations unless NRC approves another method. The DOE EIS for APT should reflect the proper legal requirements.

The reference letter's explanation of how DOE intends to achieve land disposal at Savannah River for APT's radioactive wastes seems a bit confused or maybe disingenuous. Is the APT proponent trying to bypass EPA's statutory authority in this matter without going to Congress, without public rulemaking in conjunction with NRC, and without having to perform an additional EIS? Clarity is needed here. How can one assert that a path forward exists when the path indicated is based on draft and non-existent guidance documents and appears to be at odds with statutory realities? Does the reference letter meet its reported DOE requirement "to ensure accurate and consistent answers?"

Thank you for reading my differences of opinion with the information provided in the reference letter. I hope that my sharing these with you is more productive and handled more discretely within DOE than my previous attempt to use the DOE/EH Comment page. I would hope that you can find a resolution to my concerns both about how my previous inquiry has been handled and about how the technical and legal issues that still remain for the APT safety case as presented in the EIS can be resolved satisfactorily for DOE, for the proponent, for the public, and for me. Please contact me if you have any questions or other needs. The comments and clarifications given above are in my professional judgment important issues that call into question the integrity of DOE as a self-regulating agency. I would prefer that DOE make the changes necessary to continue self-regulation at least for existing facilities, but, if there have already been decisions made that this role is to be given up, then please feel free to forward my comments to the appropriate official within the U.S. Nuclear Regulatory Commission. I sincerely appreciate your time and attention, and I look forward to your response.

Sincerely and respectfully submitted,

David L. Moses, Ph.D., P.E.

cc: Dr. Elizabeth A. Moler, Acting Secretary of Energy

Response to Comment L7-01 (Dr. David Moses)

See response to L6-01.

Response to Comment L7-02 (Dr. David Moses)

The credible and incredible releases from APT were determined based on DOE-STD-1027 considering material quantity, form, location, dispensability, and interaction with available energy sources. No credit has been taken in these analyses for mitigation from active safety features (e.g., pumps starting, valves opening or closing). However, mitigation of releases based upon passive safety features relying upon natural laws was considered. See also response to L6-01 regarding hazard categories.

Response to Comment L7-03 (Dr. David Moses)

See response to L3-08.

Response to Comment L7-04 (Dr. David Moses)

See response to L3-01.

Verbal Comments:

Transcripts of the messages left on the DOE message line:

Ms. Mary Barton (Comment P1-01)

I had gotten a letter from you about a meeting in North Augusta on January 13, 1998 at the Community Center. And I would just like to give my opinion on what I think of the situation in the backup Tritium Production Technology. I am fully aware that we need this plant down here and these situations. But I am fully aware of the environmental impact and what it's had on people in the area, the illness, the sickness that has been ignored because Westinghouse is one of the worst polluters that we have ever had here and their management and everything. We can not stand another year of this kind of stuff in this area. The people's health will not permit it. And I want to know what's going to be done to make it safe because Westinghouse is the worst we've ever had of the abuse of their employees not only medically and physically neglect and everything out there. And I am one citizen that is concerned about it and I want to know what's going to be done about it. Thank you.

Response to Comment P1-01 (Ms. Mary Barton)

The Department is committed to providing a safe work place for its employees and to being a good corporate neighbor. The Department strives to operate within permit conditions and adheres to all applicable laws and regulations. Historic SRS accident rates have been low and are discussed on page 3-44 of the Draft EIS. The safety and health of SRS workers and the public continue to be of paramount concern to the Department of Energy. The APT would be designed, constructed, and operated with the highest degree of safety.

Mr. Marvin Lewis (Comment P2-01)

I wish to voice my comments into the record on the Draft EIS which I have just received the *Environmental Impact Statement Summary Accelerator Production of Tritium at the Savannah River Site*. Please do not send me this entire EIS, the summary is sufficient.

I would say from the summary that this is another ridiculous project for a product that is totally unnecessary. There is plenty of recycled tritium available on the market from various other sources. And there's also recycled tritium on the market from Russian nuclear bombs and materials. And there's plenty of extractable tritium from various uses including commercial and military. The idea that we have to put in this gold-plated monstrosity called an accelerator at the Savannah River is just another boondoggle having no real reason except to distribute money to the educated and friends of the DOE or DOD or DOI or whatever or South Carolina or whatever. I'm sure there are plenty of people with their hands out for that money. That doesn't mean we should go ahead with this ridiculous project. I hope I am making it clear that I am not, repeat NOT, that's negative, in favor of this ridiculous project. There are many other good things to do with money. We don't have to throw it away in a hole in the ground. Thank you.

Response to Comment P2-01 (Mr. Marvin Lewis)

Section 1.1 of the Draft EIS describes the stockpile requirements, existing tritium supplies, and the projected need date for a new tritium source. The U.S. Department of Energy is accountable to the Congress for the expenditure of funds appropriated by the Congress for all of the Department's activities, including the tritium program. The amount of tritium that could be expected to be recovered from retired weapons would not sustain the long-term need under current stockpile requirements. A safe, reliable, domestic supply is required to maintain levels determined by national defense policies. DOE also considered the purchase of tritium from other sources, including foreign nations as part of the process for the Tritium Supply PEIS. Conceptually, the purchase of tritium from foreign governments could fulfill the tritium requirement. However, while there is no national policy against purchase of defense materials from foreign sources, DOE has determined that the uncertainties associated with obtaining tritium from foreign sources render that alternative unreasonable for an assured long-term supply.

Mr. Marvin Lewis (Comment P3-01)

I've got further comments on this idiotic DOE EIS-0270D, *Environmental Impact Statement Accelerator Production of Tritium at the Savannah River Plant*. If you will notice in the NRC's documentation, U.S. Nuclear Regulatory Commission, Office of Public Affairs, Washington, DC 20555, week ending September 19, 1997, Volume 17 Number 38, News Releases. And you can also get it over the Internet opa@nrc.gov or telephone 301/415-8200. This is release number 97-133 September 15, 1997. NRC amends operating license of what part is to permit limited production of tritium for Department of Energy. Yes, tritium is being produced in the United States. Yes, it is being produced at commercial sites. It is being produced in any quantity you would care to produce it in since it arises from lithium. Now the idea of then having to put billions of dollars into a hole in the ground for an accelerator becomes more and more stupid even though I thought it couldn't get any stupider. Thank you.

Response to Comment P3-01 (Mr. Marvin Lewis)

DOE is the sponsor of the commercial light water reactor tritium production research currently underway at the Tennessee Valley Authority's Watts Bar reactor. The purpose of this research is to evaluate the design of a target assembly for use in a commercial light water reactor, and to test related NRC licensing requirements. The Watts Bar experiment, which will produce about an ounce of tritium, is the only extractable tritium production occurring in the United States.

On December 22, 1998, Secretary of Energy Bill Richardson announced that commercial light water reactors (CLWR) will be the primary tritium supply technology. The Secretary designated the Watts Bar Unit 1 reactor near Spring City, Tennessee, and Sequoyah Unit 1 and 2 reactors near Soddy-Daisy, Tennessee as the preferred commercial light water reactors for tritium production. These reactors are operated by the Tennessee Valley Authority (TVA), an independent government agency. The Secretary designated the APT as the "backup" technology for tritium supply. As a backup, DOE will continue with developmental activities and preliminary design, but will not construct the accelerator. The selection of the CLWR reaffirms the December 1995 Tritium Supply and Recycling PEIS ROD to construct and operate a new tritium extraction capability at the SRS.

PART C. MODIFICATIONS TO CHAPTERS 1 THROUGH 7 OF THE DRAFT APT EIS

As discussed in Part A, modifications of the Draft EIS are presented in two ways: (1) complete sections, tables, and figures have been replaced or added with specific references to the Draft EIS, and (2) text or elements of tables in the Draft EIS which have been modified are shown as **bolded** text. In both cases, the change is preceded by a text box that explains the change and references the pertinent section of the Draft EIS. Following the text box is a specific reference to locations in the Draft EIS the change affects.

This section presents the technical modifications to Chapters 1 through 7 of the Draft APT EIS in the format described above. The changes are made to (1) incorporate responses to comments received during the public comment period and (2) update or clarify factual information. The changes are presented in the same order (by chapter) the information was presented in the Draft EIS. Transcripts and South Carolina Clearing House Forms can be found at the end of this document. Appendixes A, B, and C of the Draft EIS have not been modified and are not reproduced in this document. The assessment of the potential impacts associated with the No Action alternative can be found starting on page C-38 of this document.

Because DOE received few comments on the Draft APT EIS, it is not reprinting a revised draft as the Final EIS, as is typically done. Rather, DOE is finalizing the APT EIS by reference to the Draft EIS and is issuing this document as a record of changes made.

Chapter modifications are in the order of the Draft EIS. Each modification is preceded by a text box that describes the change, explains why the change was made, and references the applicable location in the Draft EIS. Modifications to text and tables that were in the Draft EIS are indicated by **bolded text**. In cases where modifications "replace" portions of the Draft EIS, the changes are not bolded.

Chapter 1. Modifications – Background and Purpose and Need for Action

[Chapter 1, Section 1.5 modification to the Draft APT EIS]

The Draft EIS described the implementing strategy associated with providing a safe and reliable supply of tritium. The following paragraphs replace text in Section 1.5 of the Draft EIS.

Page 1-5, 2nd column, 2nd through 4th paragraphs replace with:

DOE proposes to make one or more Record(s) of Decision (ROD) to select technology alternatives and a site for the APT. These decisions would be based on the environmental analysis contained in this EIS and other policy, technical, cost, and schedule information.

DOE prepared a draft EIS on the construction of a tritium extraction facility (TEF) (DOE 1998a). The APT EIS presents the analysis of one of the TEF alternatives, combining TEF into the APT [see Part D, Section 4.5.2 of this document]. A Record of Decision could be based on both these EISs. Other policy, technical, cost, and schedule information would also be used in this decision.

DOE has also issued a draft EIS (DOE/EIS-0288D) which analyzes the impacts of using an existing or partially built commercial light-water reactor to produce tritium. DOE proposes to make one or more Record(s) of Decision based on that EIS. The upgrade and consolidation of tritium facilities was evaluated in an environmental assessment followed by a Finding of No Significant Impact. The key milestones and status of each of these documents is presented in Figure 1-3.

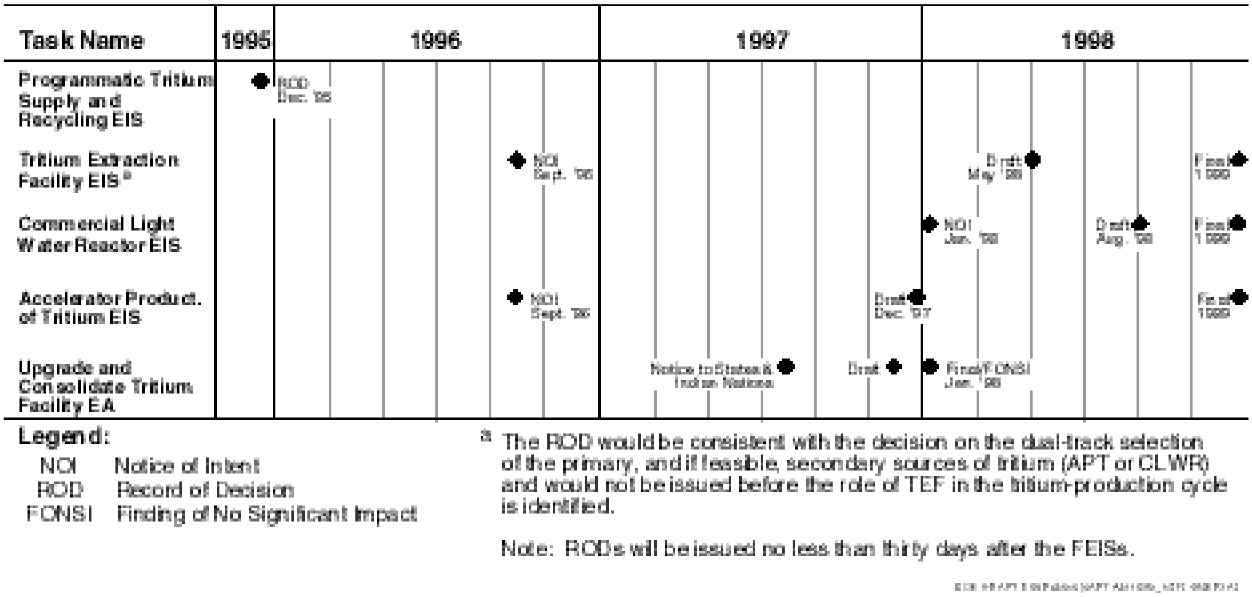


Figure 1-3. NEPA documentation for related DOE actions.

[Chapter 1, Section 1.5 modification to the Draft APT EIS]

In the Draft APT EIS, the Department reported that a Notice of Intent (NOI) had been issued for the preparation of an EIS to assess the potential environmental impacts of constructing and operating a tritium extraction facility at the Savannah River Site. Since the Draft APT EIS was issued, the Department issued a draft EIS on tritium extraction. This EIS identifies as its No Action alternative combining tritium extraction capabilities in the APT facility. The following text replaces the discussion of tritium extraction on page 1-6 of the Draft APT EIS.

Page 1-6, 1st column, 1st through 2nd paragraphs replace with:

Tritium Extraction. In May 1998, DOE issued the *Draft Environmental Impact Statement for the Construction and Operation of a Tritium Extraction Facility at the Savannah River Site* (DOE 1998a). In this draft, the Department proposes to construct and operate a Tritium Extraction Facility (TEF) at H Area on the Savannah River Site to provide the capability to extract tritium from commercial-light water reactor targets and from targets of similar design.

An alternative is to construct and operate TEF at the Allied General Nuclear Services facility, which is adjacent to the eastern side of the SRS. The No Action alternative for TEF would incorporate tritium extraction capabilities in the accelerator for production of tritium should the APT be selected as the primary source of tritium. The purpose of the proposed TEF action and alternatives evaluated is to provide extraction capability to support either tritium production technology (CLWR or APT).

[Chapter 1, Section 1.5 modification to the Draft APT EIS]

In November 1997, DOE issued a draft environmental impact statement on the *Management of Certain Plutonium Residues and Scrub Alloys Stored at the Rocky Flats Environmental Technology Site* (DOE/EIS-0277D). The Final was issued on August 28, 1998. The Savannah Site is one of the possible locations that could be utilized to manage the Rocky Flats material. This potential action has been added to Section 1.5 of the Draft APT EIS as a related DOE action.

Page 1-7, 1st column, after 2nd paragraph, insert the following:

Management of Certain Plutonium Residues and Scrub Alloys. In November 1997, the Department issued the *Draft Environmental Impact Statement on Management of Certain Residues* *and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site* (DOE 1997c). The Final was issued on August 28, 1998. In this EIS, DOE proposes to process certain plutonium-bearing materials being stored at the Rocky Flats Environmental Technology Site (Rocky Flats) near Golden, Colorado. These materials are plutonium residues and scrub alloy remaining from nuclear weapons manufacturing operations formerly conducted by DOE at Rocky Flats. In their present forms, these materials cannot be disposed of or otherwise dispositioned because they contain plutonium in concentrations exceeding DOE safeguards termination requirements.

DOE has identified and assessed three technical alternatives for processing these plutonium-bearing materials: (1) No Action, (2) Processing without Plutonium Separation, and (3) Processing with Plutonium Separation. Under the Processing with Plutonium Separation Alternative, DOE would remove most of the plutonium from the plutonium-bearing materials in preparation for disposal or other disposition. The Savannah River Site is the preferred site for hosting this activity. If separation is conducted at the Savannah River Site, it would be done utilizing a chemical process in F and H Canyons. Any plutonium resulting from separation processes would be placed in safe and secure storage pending disposition in accordance with decisions to be reached after completion of the *Surplus Plutonium Disposition EIS* (DOE 1998b). The remaining material would be prepared for disposal.

Chapter 1, Section 1.5 modification to the Draft APT EIS]

In July 1997, DOE issued the *Surplus Plutonium Disposition Draft Environmental Impact Statement* (DOE/EIS-0283D). Any plutonium resulting from separation processes at the Savannah River Site would be dispositioned in accordance with decisions to be reached after completion of the Surplus Plutonium Disposition EIS. This potential action has been added to Section 1.5 of the Draft APT EIS as a related DOE action.

Page 1-7, 1st column, after 2nd paragraph, insert the following:

Surplus Plutonium Disposition Draft Environmental Impact Statement. In July 1997, the Department issued the *Surplus Plutonium Disposition Draft Environmental Impact Statement* (DOE 1998b). DOE's disposition strategy allows for the immobilization of surplus plutonium and/or its use as mixed oxide (MOX) fuel in existing domestic commercial reactors, and involves eventual disposal in a geologic repository. The EIS analyzes alternatives that would immobilize some of the surplus plutonium and use some as MOX fuel; alternatives that would immobilize all of the surplus plutonium; and a No Action Alternative. The design of three disposition facilities are include in the alternatives (pit disassembly & conversion, MOX facility, and immobilization).

Chapter 2. Modifications – Proposed Action and Alternatives

[Chapter 2, Section 2.1 modification to the Draft APT EIS]

DOE has modified its description of the No Action alternative. In the Record of Decision (60 FR 63877) for the *Final Programmatic Environmental Impact Statement on Tritium Supply and Recycling,* the Department decided to pursue a dual-track option for providing a new source of tritium. In this Final APT EIS the Department has established the commercial-light water reactor as the No Action alternative for the accelerator production of tritium. The description of the No Action alternative in the Draft EIS is replaced with the following text.

Page 2-2, 1st column, 3rd through 4th paragraphs, replace with:

No Action Alternative. In compliance with the regulations of the Council on Environmental Quality (CEQ) for implementing NEPA (40 CFR Part 1500-1508), this EIS also assesses a No Action alternative. **The interpretation of no action varies, depending upon circumstances. Typically, no action means that the**

proposed activity would not be initiated. No action may also be defined in terms of no change in a current agency program. Because DOE has the responsibility to provide tritium for the nation's nuclear weapons stockpile and no longer operates nuclear material production facilities, DOE has completed a programmatic analysis on how to meet its responsibilities.

In October 1995, DOE issued the Final Programmatic Environmental Impact Statement for Tritium Supply and Recycling. This was followed on December 12, 1995, by a Record of Decision (ROD) which selected a dual-track path for tritium production. In this dual-track decision, the Department decided to pursue two tritium production technologies: Accelerator Production of Tritium and the supply of tritium using a commercial light-water reactor. The ROD further stipulated that one alternative would be selected as the primary source of tritium and that the other alternative, if feasible, would be developed as a back-up tritium source. Based on that ROD, if tritium is not produced in the APT, it will be produced in the commercial light-water reactor. Accordingly, for purposes of this EIS analysis, the No Action alternative for the Accelerator Production of Tritium at the Savannah River Site entails the production of tritium in the commercial light-water reactor. A summary of the environmental impacts associated with the production of tritium in the commercial light-water reactor is presented starting on page C-39 of this EIS.

Under the APT No Action alternative it is likely the Department would proceed with the construction and operation of a Tritium Extraction Facility (TEF) at the Savannah River Site for which a Draft EIS has already been issued (DOE 1998a). In that document, the Department has identified the APT with tritium extraction capabilities as the No Action alternative for the TEF.

SRS recycling and loading activities related to tritium would continue. In addition, other actions determined in the ROD for the Tritium Supply PEIS – the modernization and consolidation of existing SRS tritium facilities – would proceed as planned.

[Chapter 2, Section 2.3.5 modification to the Draft APT EIS]

In comment L2-04, the commenter questioned why DOE did not investigate existing industrial areas as potential sites for the APT. In its response, the Department indicates it did not believe existing industrial sites are feasible for a number of reasons. Consequently, the Department is clarifying the description of its siting process.

<u>Page 2-15, 1st column, 1st and 2nd paragraphs, replaced with the following</u>:

DOE assumed the APT complex would require approximately 250 acres of land with a footprint 6,560 feet long by 1,640 wide. The area requirements would not vary much with any combination of the technology or design options described in this chapter.

With the land requirements established, the next phase of the screening process was to develop exclusionary criteria (disqualifying conditions). Examples of these criteria include avoiding adverse impacts to threatened and endangered species, avoiding impacts to wetlands and sensitive ecosystems, and proximity to seismic faults. Wike et al. (1996) contains a complete listing of these exclusionary criteria. Seven potential sites (numbered 1-7) were initially identified. Two sites (numbered 5 and 7) were subsequently eliminated due to the presence of disqualifying conditions (proximity to seismic faults). One site (number 8) was added based on a request to examine a site in the vicinity of **the industrialized A- and M–Areas**. Although not explicitly used as exclusionary criteria, existing industrially developed areas **were examined and dismissed** as feasible sites because the APT, **due to its space requirements, would conflict with** (1) the presence of existing structures, (2) the presence of non-operating structures that would require extensive decontamination and decommissioning (D&D) prior to site preparation, or (3) the presence of active environmental activities.

[Chapter 2, Section 2.5 modification to the Draft APT EIS]

Section 2.5 of the Draft EIS described two potential design variations to the baseline accelerator: a modular or staged accelerator configuration, and combining tritium extraction capabilities with the APT. A third design variation has been identified that would serve to mitigate the potential impacts identified for precooler ponds 2 and 5 and responds to several issues raised by the Department of Interior (L2) and the Environmental Protection Agency (L4). The information in Section 2.5 has been modified and combined with information regarding impacts from the design variations. This modified section is being inserted as Section 4.5 of Chapter 4. The information presented in Section 2.5 is consequently reduced to a very brief introduction with references to the expanded section. Sections 2.5.1, 2.5.2, and 2.5.3 of the Draft EIS are therefore superseded by the modification presented in Part D, Section 4.5 of this document.

2.5 APT Design Variations

Page 2-21, 2nd column through page 2-25, 2nd column, 3rd paragraph is replaced with the following:

Three design variations that could enhance the Department's flexibility to supply the nation's future tritium needs have been evaluated. The first would retain the inherent operational and equipment characteristics of the baseline, but allow construction to proceed in stages (modular APT) (Section 4.5.1 of the Draft APT EIS). The second design variation would incorporate the functions of the Tritium Extraction Facility within the APT facility. The third design variation would still route cooling water blowdown to Pond C, but bypass precooler Ponds 2 and 5. These design variations along with their corresponding impacts on the environment are described in detail in the added Section 4.5 of Chapter 4 of the Draft APT EIS.

[Chapter 2, Section 2.7 modification to the Draft EIS]

Section 2.7 of the Draft EIS presented a comparison of environmental impacts. Table 2-3 provided a side by side comparison of each alternative to the preferred APT design. Section 2.7 has been modified to capture the potential impacts associated with the revised No Action alternative, the production of tritium in a commercial light-water reactor. Two new tables have been created to provide additional impact comparisons. Table 2-3 now presents the impacts of the No Action alternative. The original Table 2-3 in the Draft EIS is now Table 2-4 and is modified to reflect information developed for the Final EIS. The new Table 2-5 compares the potential impacts of the design variations described in Part D of this document to the preferred APT design. To facilitate readability, Section 2.7, as modified, is presented in this Final EIS.

Page 2-26, 1st column, 1st paragraph through page 2-39 is replaced with the following:

This section presents a comparison of the environmental impacts **associated with the No Action alternative (Table 2-3);** construction and operation of the baseline APT as a function of the differences with the preferred alternative **(Table 2-4); and three design variations (Table 2-5): the modular APT design, combining tritium extraction, and discharge of cooling water to Pond C**.

For each technical discipline, the impacts of the Preferred alternative are discussed. The Preferred alternative is composed of the following:

- ***Klystron radiofrequency tubes***
- ***Superconducting operation of accelerator structures***
- ***Helium-3 feedstock material***

Table 2-3. Comparison of No Action impacts.[a]

Potential impacts at the Savannah River Site		Potential impacts away from the Savannah River Site Commercial Light-Water Reactor		
APT Preferred alternative	TEF Preferred alternative **AND**	Bellefonte Nuclear Plant **OR**	Watts Bar Nuclear Plant **OR**	Sequoyah Nuclear Plant
Construction Impacts				
About 250 acres of land would be graded and leveled. Additional roads, bridge upgrades, rail lines and utility upgrades would be required. No geologically significant formations or soils occur. Dewatering would be necessary and could result in short-term increases in solids to receiving water bodies. No surface faulting on site. Air emission from fugitive dust, exhaust emissions, and batch plants would be negligible. Small construction landfill required. Most waste generated would be solid waste and sanitary waste. Increases in the work force for APT construction would not result in a boom situation. Peak employment would be about 1,400 jobs.	Construct facility in already industrialized H-Area. No geologically significant formations or soils occur. Dewatering would be necessary and could result in short-term increases in solids to receiving water bodies. No surface faulting on site. Air emission from fugitive dust, exhaust emissions, and batch plants would be negligible. Increases in the work force for TEF construction would not result in a boom situation. Peak employment would be about 740 jobs.	Activities would largely consist of internal modifications to existing structures. Spent fuel storage facilities would require about 5 acres of land and about 50 construction workers. Construction waste: Small amounts of hazardous and nonhazardous wastes generated; no change from EPA designation as small Quantity Generator. Direct and indirect construction jobs peak at 9,000 for Bellefonte 1 or Bellefonte 1 and 2, reducing the unemployment rate to about 3 percent from the current 7.9 percent.	No modifications or construction activities required. Spent fuel storage facilities same as Bellefonte and Sequoyah. Construction jobs for the spent storage facility: 50 Construction waste: None	Same as Watts Bar Spent fuel storage facilities same as Bellefonte and Watts Bar. Construction jobs for the spent storage facility: 50 Construction waste: None
Impacts from Operation on Nonradiological Air Emissions				
Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations. Plumes would be visible off-site under certain meteorological conditions.	Negligible impacts from nonradioactive airborne effluent.	Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations. Plumes would be visible off-site under certain meteorological conditions.	Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations. Plumes would be visible off-site under certain meteorological conditions.	Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations. Plumes would be visible off-site under certain meteorological conditions.

a. No Action includes TEF impacts at SRS and one or more reactor impacts away from SRS.

Table 2-3. (Continued).

Potential impacts at the Savannah River Site		Potential impacts away from the Savannah River Site Commercial Light-Water Reactor		
APT Preferred alternative	TEF Preferred alternative **AND**	Bellefonte Nuclear Plant **OR**	Watts Bar Nuclear Plant **OR**	Sequoyah Nuclear Plant
Impacts from Operation on Radiological Air Emissions				
Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0008	Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.00039	Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0014	Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0014	Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0015
Impacts from Operation on Land Use and Infrastructure				
Land converted to industrial use. Electricity use: 3.1 terawatt-hrs/year	Land converted to industrial use. Electricity use: 0.021 terrawatt hrs/year	No land impacts. Electricity generation: approximately 1,300 MWe per Bellefonte reactor	No land use impacts. Electricity generation: approximately 1,300 MWe	No land use impacts. Electricity generation: approximately 1,300 MWe per Sequoyah reactor
Impacts from Operation on Waste Management				
Would generate solid and liquid wastes, but no high-level or transuranic waste; waste volumes would have negligible impact on capacities of waste facilities. Generation of electricity will generate various types of waste including fly ash, bottom ash, and scrubber sludge. <u>Annual Values</u> Sanitary solid: 1,800 metric tons Industrial: 3,800 metric tons Radioactive wastewater: 140,000 gallons Low-level radioactive waste: 1,400 cubic meters High concentration waste under evaluation: 12 cubic meters Sanitary wastewater: 3.2 million gallons Nonradioactive process wastewater: 920 million gallons	Would generate solid and liquid wastes, but no high-level or transuranic waste; waste volumes would have negligible impact on capacities of waste facilities. <u>Annual Values</u> Sanitary solid: 230 cubic meters Industrial: 33 cubic meters Low-level radioactive waste: 230 cubic meters Hazardous/mixed waste: 3.3 cubic meters Sanitary wastewater: 770,000 gallons Nonradioactive process wastewater: 11,000 gallons	Would generate solid and liquid wastes; waste volumes would have negligible impact on capacities of waste facilities. <u>Annual Values</u> Low-level radioactive waste: 40 cubic meters Mixed waste: <1 cubic meter Hazardous waste: 1.0 cubic meters Nonhazardous waste: 850,000 cubic meters 141 spent fuel assemblies per 18 month cycle	Would generate solid and liquid wastes; waste volumes would have negligible impact on capacities of waste facilities. <u>Annual Values</u> Low-level radioactive waste: 0.43 cubic meter No additional spent fuel if less than 2,000 TPBARs irradiated per 18 month cycle. Up to 60 additional spent fuel assemblies for 3,400 TPBARs per 18 month cycle.	Would generate solid and liquid wastes; waste volumes would have negligible impact on capacities of waste facilities. <u>Annual Values</u> Low-level radioactive waste: 0.43 cubic meter No additional spent fuel if less than 2,000 TPBARs irradiated per 18 month cycle. Up to 60 additional spent fuel assemblies for 3,400 TPBARs per 18 month cycle.

a. No Action includes TEF impacts at SRS and one or more reactor impacts away from SRS.

Table 2-3. (Continued).

Potential impacts at the Savannah River Site		Potential impacts away from the Savannah River Site Commercial Light-Water Reactor		
APT Preferred alternative	TEF Preferred alternative **AND**	Bellefonte Nuclear Plant **OR**	Watts Bar Nuclear Plant **OR**	Sequoyah Nuclear Plant
Impacts from Operation on Human Health				
Public would receive radiation exposure from APT emissions and transportation of radioactive material; workers would receive radiation exposure from facility operations and transportation of radioactive material and from electromagnetic fields. Estimated fatal cancers: 0.0016	Public would receive radiation exposures from gaseous effluents. Estimated fatal cancers: 0.00039	Public would receive radiation exposures from gaseous and liquid effluents. Estimated fatal cancers: 0.0033	Public would receive radiation exposures from gaseous and liquid effluents. Estimated fatal cancers: 0.0032	Public would receive radiation exposures from gaseous and liquid effluents. Estimated fatal cancers: 0.0053
Impacts from Operation on Surface Water				
Blowdown rates (about 2,000 gpm) would cause negligible impact on surface water levels. Using Par Pond and pre-cooler ponds as discharge point for cooling water, temperatures would not exceed 90°F. Contaminated sediments would be resuspended in addition to radiological releases from APT. Estimated fatal cancers: 0.00021	Sanitary and industrial wastewater streams would be routed to existing SRS treatment facilities prior to release. Released water would be negligible compared to existing SRS releases.	Less than 1 percent of river flow. Water quality within regulatory limits. Public would receive radiation exposures from liquid effluents. Estimated fatal cancers: 0.0019	No change from existing operations. Public would receive radiation exposures from liquid effluents. Estimated fatal cancers: 0.0018	No change from existing operations. Public would receive radiation exposures from liquid effluents. Estimated fatal cancers: 0.0038
Impacts from Operation on Socioeconomics				
Operational work force about 500. No regional impacts.	Operational work force about 108. No regional impacts.	Operational work force: Operational work force about 800 for Bellefonte 1; about 1,000 for Bellefonte 1 and 2. Minor regional impacts.	Operational work force: 10 additional workers.	Operational work force: 10 additional workers.
Impacts from Transportation				
Negligible during operations period. During construction could expect about two fatalities to the public and workers due to increased traffic levels.	Vehicle emissions and less than one fatality per year. Routine and accidental doses.	Vehicle emissions and less than one fatality per year. Routine and accidental doses.	Same as for Bellefonte and Sequoyah.	Same as for Bellefonte and Watts Bar.

a. No Action includes TEF impacts at SRS and one or more reactor impacts away from SRS.

Table 2-4. Comparison of impacts among APT alternatives.

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Construction on Landforms, Soils, Geology, and Hydrology								
Negligible impacts. Some 250 acres of land would be graded or leveled. No geologically significant formations or soils occur. Dewatering necessary. No surface faulting on site. Sites for electricity generation exist.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Water table is deeper and would require less dewatering; no other changes estimated from Preferred alternative.	Impacts would depend upon the specific location of a new facility. Could require about 110 acres for natural gas or 290 acres for coal.
Impacts from Operation on Landforms, Soils, Geology, and Hydrology								
No impacts No dewatering required for operations.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Removal of 6,000 gpm on a sustained basis could impact groundwater flow to streams and compact clay layers	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility
Impacts from Construction on Surface Water								
Negligible impacts. Dewatering of construction site could result in short - term increases in solids to the receiving water bodies.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	**Discharges would be similar to the Preferred alternative, although they would go to Pen Branch via Indian Grave Branch. Water levels in**	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
						the upper reaches of the stream system would be raised.		
Impacts from Operation on Surface Water								
Blowdown rates (about 2,000 gpm) would cause negligible impact on surface water levels. Using Par Pond and pre-cooler ponds as discharge point for cooling water, temperatures would not exceed 90°F. Contaminated sediments could be resuspended in addition to radiological releases from APT resulting in offsite population radiation exposure. Estimated fatal cancers: **0.00021**	Would require 7% less cooling water than Preferred due to lower waste heat generation; no other changes estimated from Preferred alternative	Would require 33% more cooling water than Preferred; no other changes from Preferred alternative	No change estimated from Preferred alternative	Blowdown rates (about 125,000 gpm) would result in higher temperatures to water bodies (about 100° F). A slight increase in “pre-cooler” pond water levels would occur. No other changes estimated from Preferred alternative.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Discharges would be similar to the Preferred alternative, although concentrations would vary and be localized.
Impacts from Construction on Nonradiological Air Emissions								
Air emissions (fugitive dust and exhaust emissions) would be negligible, well below the applicable regulatory standards. Impacts from electricity purchases,	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Emission types would be similar to the Preferred alternative, although concentrations would vary and be

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
would be dispersed.								localized.
Impacts from Operation on Nonradiological Air Emissions								
Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Nonradiological emissions would be well within applicable regulatory standards.
Impacts from Construction on Radiological Air Emissions								
No impacts; no radioactive materials stored during construction.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative
Impacts from Operation on Radiological Air Emissions								
Negligible impacts from radioactive airborne effluents Latent Cancer Fatalities (LCFs) expected: **0.0008**	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Slightly increased doses from airborne emissions LCFs expected: **0.00086**	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Higher doses from airborne emissions due to closer distance to SRS boundary. LCFs expected: **0.00089**	Impacts would depend upon the specific location of a new facility. However, the dose from radioactive effluents would be negligible.
Impacts from Construction on Land Use and Infrastructure								
Conversion of 250 acres of forested land to industrial use. Additional roads, bridge upgrades, rail lines and utility upgrades would	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Additional cooling water piping to K-area needed.	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility. Could require conversion of up to

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
be required.								290 acres to industrial use.
Impacts from Operation on Land Use and Infrastructure								
No land use changes beyond construction. Electricity use: 3.1 terawatt-hrs/year	No change estimated from Preferred alternative	No change estimated from Preferred alternative Electricity use 23% higher than Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative
Impacts from Construction on Waste Management								
Some landfill construction required. Most waste generated would be solid waste and sanitary solid and liquid waste. Waste disposed at SRS. (Annual Values) Sanitary solid: 560 cubic meters Construction debris: 30,000 cubic meters **Industrial wastewater: 3.6 million gallons**	No change estimated from Preferred alternative	9% **less sanitary** waste generated due to smaller construction workforce required.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Additional construction waste generated from construction of facility.
Impacts from Operation on Waste Management								
Would generate solid and liquid wastes, but no high-level or transuranic waste; waste volumes would have	No change estimated from Preferred	37% more nonradioactive process wastewater	**8%** more low-level and **25%** more high concentration	2,000% greater flow of nonradioactive process	No change estimated from Preferred	No change estimated from Preferred	No change estimated from Preferred	Impacts would depend upon the type of power plant selected. However,

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
negligible impact on capacities of waste facilities. Generation of electricity will generate various types of waste including fly ash, bottom ash, and scrubber sludge. (Annual Values) Sanitary solid: 1,800 metric tons Industrial: 3,800 metric tons Radioactive wastewater: 140,000 gallons High concentration low-level radioactive waste under evaluation: 2.5 cubic meters High concentration waste under evaluation: 12 cubic meters Sanitary wastewater: **3.3** million gallons Low-level radioactive waste: 1,400 cubic meters Nonradioactive process wastewater: 920 million gallons	alternative	required.	mixed waste generated than Preferred alternative.	wastewater required.	alternative	alternative	alternative	waste rates for new power plant would not be very different than for the Preferred alternative.

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Construction on Visual Resources								
Negligible, facilities far from SRS boundaries and not visible to offsite traffic; facilities would look like other industrial areas at SRS.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility.
Impacts from Operation on Visual Resources								
Negligible, plumes from mechanical-draft cooling towers would be visible under certain meteorological conditions.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Negligible, would not generate visible plumes.	No change estimated from Preferred alternative	Plume from K-area cooling tower would likely be more visible.	No change estimated from Preferred alternative	Impacts would depend upon the specific location of a new facility.
Impacts from Construction on Noise								
Noise primarily from construction equipment at APT site. Not audible at SRS boundaries; however, construction workers could encounter noise levels that would require administrative controls or protective equipment.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Noise would be similar to Preferred alternative, but specific impacts would depend upon the location of a new facility.
Impacts from Operation on Noise								
Noise from APT equipment operation and traffic; mechanical-draft cooling towers largest single source, not audible at SRS boundary.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No mechanical -draft cooling tower noise at APT site. Pump noise could be occasionally audible to river	No change estimated from Preferred alternative	No mechanical-draft-cooling tower noise at APT site. Pump and cooling tower noise at K-area.	No change estimated from Preferred alternative	Noise would be similar to Preferred alternative, but specific impacts would depend upon the location of a new facility.

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
				traffic.				
Impacts from Construction on Human Health								
Concentrations of nonradiological constituents would be less than applicable limits for workers and public. Traffic-related accidents resulting in about 2 fatalities to the public and workers due to increased local traffic would be reduced with finish of construction. Occupational injuries to workers would be due to industrial activities and would have the following impacts for the construction period: Number requiring First Aid: 1,100 Number requiring medical attention: 280 Number resulting in lost work time: 93	No change estimated from Preferred alternative	Occupational injuries 6% less than Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Traffic fatalities 20% less than Preferred alternative No changes in occupational injuries estimated from Preferred alternative	Impacts would be similar to Preferred alternative, but specific impacts would depend upon the location of a new facility.
Impacts from Operation on Human Health								
Public would receive source radiation exposure from APT emissions and transportation of	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Slightly increased doses from resuspension of	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Slightly increased doses due to decreased	No change estimated from Preferred alternative.

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
radioactive material; workers would receive radiation exposure from facility operations and transportation of radioactive material and from electromagnetic fields. Total LCFs to population (air, water, and transport) **0.0016**				contaminated material Total LCFs 0.0017			distance to public Total LCFs 0.0017	Impacts would be local vs. dispersed for electricity generation.
Impacts from Accidents on Human Health								
Negligible consequences for accidents with frequency of less than once in operating lifetime of facility.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Minor decreases in accident doses for low probability events.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	**No change estimated from Preferred alternative**
Impacts from Construction on Terrestrial Ecology								
Would result in the loss of up to 250 acres of forested land; no marked reduction in plant/animal abundance or diversity.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative; specific impacts would depend upon the location of a new facility.

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Operation on Terrestrial Ecology								
Negligible impacts. Mechanical-draft cooling towers would result in salt deposition on vegetation; however, maximum rates (60 lb/acres/yr) are below threshold levels (180 lb/acres/yr).	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	**No salt deposition, otherwise** no change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.
Impacts from Construction on Wetlands Ecology								
No impacts are projected from construction activities.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.
Impacts from Operation on Wetlands Ecology								
Would result in minor impacts to wetlands. Temperature of the blowdown would be marginally higher than the ambient maximum temperature. During cooler months the warmth could have a positive impact by lengthening the growing season for some aquatic vegetation.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Would raise water level in Ponds 2 and 5 by 1.5 feet, possibly affecting wetland plant communities.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Construction on Aquatic Ecology								
Impacts to aquatic organisms in Upper Three Runs and tributaries would be minor due to use of soil and erosion control measures.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No changes estimated from Preferred alternative.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.
Impacts from Operation on Aquatic Ecology								
Impingement (132 fish) and entrainment (173,000 fish eggs and 326,000 larvae annually) would not substantially affect Savannah River fisheries. Solids in blowdown would have no impacts on aquatic ecology. Discharge temperatures would have only small localized effects on aquatic communities.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Impingement (2,600 fish) and entrainment (3.4 million fish eggs and 6.4 million larvae annually) would be increased. Discharge temperatures would be high enough to adversely affect aquatic communities.	**No impingement and entrain-ment, otherwise** no change estimated from Preferred alternative.	**Discharge to Pen Branch via Indian Grave Branch, otherwise** no change estimated from Preferred alternative.	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.
Impacts from Construction on Threatened or Endangered Species								
Negligible, no threatened or endangered species at preferred site.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Negligible, no threatened or endangered species at alternate site.	Specific impacts would depend upon the location of a new facility.

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
Impacts from Operation on Threatened or Endangered Species								
Negligible impacts to threatened and endangered species.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Fish kills in pre-cooler ponds could be beneficial to bald eagles. Heated discharges could force alligators to leave pre-cooler ponds in late summer.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No threatened or endangered species at alternate site.	Impacts would depend upon the specific location.
Impacts from Construction on Socioeconomics								
Increases in the work force for APT construction would not result in large regional impacts. Nominal impacts would be positive. Peak employment is about 1,400 jobs.	No change estimated from Preferred alternative	Employment would be lower with about 100 fewer jobs	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Peak workforce would be about 1,100 additional jobs. Impacts would vary by location.
Impacts from Operations on Socioeconomics								
Operational work force about 500. Work force would not result in large regional impacts. Nominal impacts would be positive.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Additional operational workforce about 200. Impacts would vary by location.
Impacts from Construction on Environmental Justice								
No adverse impacts on minority or low-income	No change estimated from Preferred	No change estimated from Preferred	No change estimated from Preferred	No change estimated from Preferred	No change estimated from Preferred	No change estimated from Preferred	No change estimated from Preferred	Specific impacts would depend upon the location of a

Table 2-4. (Continued).

Preferred alternative	Radio frequency power alternative	Operating temperature alternative	Feedstock material alternative	Cooling water system alternatives			Site location alternative	Electric power supply alternative
Described in text	**Inductive output tube**	**Room temperature**	**Lithium-6**	**Once-through using river water as makeup**	**Mechanical-draft using groundwater as makeup**	**K-Area cooling tower using river water as makeup**	**Alternate site**	**Construct new plant**
populations expected.	alternative	alternative	alternative	alternative	alternative	alternative	alternative	new facility.
Impacts from Operations on Environmental Justice								
No adverse impact on minority or low-income populations expected.	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	No change estimated from Preferred alternative	Specific impacts would depend upon the location of a new facility.

Table 2-5. Comparison of impacts among design variations.[a]

Preferred alternative (Baseline APT)	Modular APT (3 kg/year)	Modular APT (1030 MeV)	APT/TEF Combination	Cooling Water bypass Ponds 2 and 5
Impacts from Operation on Surface Water				
Blowdown rates (about 2,000 gpm) would cause negligible impact on surface water levels. Using Par Pond and the pre-cooler ponds as discharge point for cooling water, temperatures would not exceed 90°F. Contaminated sediments would be resuspended in addition to radiological releases from APT resulting in offsite population radiation exposure. Estimated fatal cancers: 0.00021	No change estimated from Baseline APT.	Blowdown rates would be 10 percent lower than the Baseline APT. Radiological releases would be the same as the Baseline APT.	No change estimated from Baseline APT.	No impact to Ponds 2 and 5.
Impacts from Operation on Nonradiological Air Emissions				
Nonradiological emissions would be well within the applicable regulatory standards. Operations would result in small amounts of salt deposition and plumes from cooling-tower operations.	No change estimated from Baseline APT.	Nonradiological releases would be 10 percent lower than the Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.
Impacts from Operation on Radiological Air Emissions				
Negligible impacts from radioactive airborne effluents. Latent Cancer Fatalities (LCFs) expected: 0.0008	No change estimated from Baseline APT.	No change estimated from Baseline APT.	Increased doses from airborne emissions. LCFs expected: 0.0009	No change estimated from Baseline APT.
Impacts from Operation on Land Use and Infrastructure				
No land use changes beyond construction. Electricity use: 3.1 terawatt-hrs/year	No change estimated from Baseline APT.	Electricity use would be 32 percent lower than the Baseline APT. Electricity use: 2.0 terawatt-hrs/ year	No change estimated from Baseline APT.	No change estimated from Baseline APT.

a. Table 2-5 only summarizes the potential construction and operational impacts for those factors that could be different from what is described for the baseline accelerator.

Table 2-5. (Continued).

Preferred alternative (Baseline APT)	Modular APT (3 kg/year)	Modular APT (1030 MeV)	APT/TEF Combination	Cooling Water bypass Ponds 2 and 5
Impacts from Construction on Waste Management				
Some landfill construction required. Most waste generated would be solid waste and sanitary solid and liquid waste. Waste disposed at SRS. Annual Values Sanitary solid: 560 cubic meters Construction debris: 30,000 cubic meters Industrial wastewater: 3.6 million gallons	No change estimated from Baseline APT.	Construction wastes would be 10 percent lower than the Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.
Impacts from Operation on Waste Management				
Would generate solid and liquid wastes, but no high-level or transuranic waste; waste volumes would have negligible impact on capacities of waste facilities. Generation of electricity will generate various types of waste including fly ash, bottom ash, and scrubber sludge. Annual Values Sanitary solid: 1,800 metric tons Industrial: 3,800 metric tons Radioactive wastewater: 140,000 gallons Low-level radioactive waste: 1,400 cubic meters High concentration low-level radioactive waste under evaluation: 2.5 cubic meters High concentration mixed waste under evaluation: 12 cubic meters Sanitary wastewater: 3.3 million gallons Nonradioactive process wastewater: 920 million gallons	No change estimated from Baseline APT.	Operations wastes would be 10 percent lower than the Baseline APT. Annual Values Radioactive wastewater: 130,000 gallons Low-level radioactive waste: 1,300 cubic meters Sanitary wastewater: 3 million gallons Nonradioactive process wastewater: 830 million gallons	Some waste categories slightly higher than Baseline APT. Differences from Baseline APT Annual Values Radioactive wastewater: 150,000 gallons Low-level radioactive waste: 1,700 cubic meters	No change estimated from Baseline APT.

a. Table 2-5 only summarizes the potential construction and operational impacts for those factors that could be different from what is described for the baseline accelerator.

Table 2-5. (Continued).

Preferred alternative (Baseline APT)	Modular APT (3 kg/year)	Modular APT (1030 MeV)	APT/TEF Combination	Cooling Water bypass Ponds 2 and 5
Impacts from Construction on Human Health				
Concentrations of nonradiological constituents would be less than applicable limits for workers and public. Traffic -related accidents resulting in about 2 fatalities to the public and workers due to increased local traffic would be reduced with finish of construction. Occupational injuries to workers would be due to industrial activities and would have the following impacts for the construction period: Number requiring First Aid: 1,100 Number requiring medical attention: 280 Number resulting in lost work time: 93	No change estimated from Baseline APT.	Construction health impacts would be 10 percent lower than the Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.
Impacts from Operation on Human Health				
Public would receive radiation exposure from APT emissions and transportation of radioactive material. Workers would receive radiation exposure from facility operations, transportation of radioactive material, and from electromagnetic fields. Total LCFs to population (air, water, and transport): 0.0016	No change estimated from Baseline APT.	No change estimated from Baseline APT.	Radiation exposures to the public would be 10 percent higher due to higher air emissions as compared to the Baseline APT. Total LCFs to population (air, water, and transport): 0.0017	No change estimated from Baseline APT.
Impacts from Operation on Wetlands Ecology				
Would result in minor impacts to wetlands. Temperature of the blowdown would be marginally higher than the ambient maximum temperature. During cooler months the warmth could have a positive impact by lengthening the growing season for some aquatic vegetation.	No change estimated from Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.	No heated blowdown to Ponds 2 or 5. Minor impact for heated water only in Pond C.

a. Table 2-5 only summarizes the potential construction and operational impacts for those factors that could be different from what is described for the baseline accelerator.

Table 2-5. (Continued).

Preferred alternative (Baseline APT)	Modular APT (3 kg/year)	Modular APT (1030 MeV)	APT/TEF Combination	Cooling Water bypass Ponds 2 and 5
Impacts from Construction on Socioeconomics				
Increases in the work force for APT construction would not result in a boom situation. Peak employment is about 1,400 jobs.	No change estimated from Baseline APT.	Peak employment would be 10 percent lower than the Baseline APT.	No change estimated from Baseline APT.	No change estimated from Baseline APT.

a. Table 2-5 only summarizes the potential construction and operational impacts for those factors that could be different from what is described for the baseline accelerator.

- ***Mechanical-draft cooling towers with river water makeup***
- ***Electricity from existing capacity and market transactions***
- ***Use of the preferred APT site***

Differences in impacts that could occur if different alternatives **or design variations** (see Table 2-5) were implemented are also presented. **Table 2-5 only summarizes the potential construction and operational impacts for those factors that could be different from what is described for the baseline accelerator.**

Based on current design information, the potential environmental impacts of the **three** design variations (the **stage one** modular APT design, combining tritium extraction, **and discharge to Pond C)** are generally bounded by the baseline APT.

DOE considers the expected impacts on the biological, human, and socioeconomic environment of construction and operation of an accelerator for production of tritium at the SRS to be minor and consistent with what might be expected for any industrial facility. Construction and operation of the Preferred alternative would result in the loss of about 250 acres of mixed pine/hardwood upland forest. Waste would be generated during both the construction and operation phases but in quantities that would have negligible impacts on SRS waste management facilities. No high-level waste or transuranic waste would be generated during construction or operation.

Some small impacts from discharge of cooling water to SRS streams and from nonradiological emissions to air and water would occur. Radiological releases during normal operation of the facility are expected to result in small latent cancer fatalities in workers or the public. Because no high or adverse impacts are expected, no disproportionately high or adverse impacts on minority or low-income communities are expected.

Implementation of certain of the technology alternatives could result in impacts different from those resulting from construction and operation of the Preferred alternative. Most notable would be the impacts from implementation of cooling water system alternatives and electric power supply alternatives. Once-Through Cooling Using River Water would result in withdrawal from the Savannah River of about 125,000 gallons per minute of river water and discharge of hot water to the Par Pond system during operation. Thermal impacts would be restricted to the upper portions of the Par Pond system and would not affect Par Pond discharges to Lower Three Runs. There would be a small increase in Lower Three Runs flows, however. **Bypassing precooler ponds 2 and 5 and discharging directly to Pond C via a discharge canal would eliminate the potential impacts to the precooler ponds.** The implementation of the Mechanical-Draft Cooling Towers with Groundwater Makeup alternative would result in the withdrawal of 6,000 gallons per minute of groundwater. Total groundwater withdrawal at SRS could therefore exceed the estimated groundwater production capacity of the aquifer. This could affect groundwater flow to site streams.

The Preferred alternative includes buying electricity from the commercial grid to support APT operation. In the case of commercial electricity purchases, the environmental impacts attributed to the APT load would be decentralized. In the case of the construction of a new electricity generating plant to support the APT, the environmental impacts would be localized at the site selected for the plant. Construction and operation of such a facility could require about 290 acres for a coal-fired plant and about 110 acres for a gas-fired plant.

Under the No Action alternative, **the Department would obtain required tritium from the irradiation of rods in a commercial light-water reactor. The potential impacts of utilizing a commercial light-water reactor are presented in the No Action impacts discussed under the Chapter 4 modifications to the Draft APT EIS and summarized in Table 2-3.**

With the selection of the CLWR as DOE's primary source for tritium, a tritium extraction facility will also be constructed at SRS. The potential environmental impacts are

summarized in this document and discussed in detail in the *Draft Tritium Extraction Facility Environmental Impact Statement* (DOE 1998).

The APT would not be constructed at the preferred site and the land would be released for use by other missions. On-going SRS missions would continue. Incremental amounts of waste generation and electricity consumption that would have been attributable to the APT would not occur. Employment would be a function of on-going missions and funding levels.

Chapter 3. Modifications – Affected Environment

[Chapter 3, Sections 3.3.1.1, 3.3.1.2, and 3.4.2 modifications to the Draft APT EIS]

The modular or staged accelerator design variation would result in a small modification of the APT footprint. The overall area would be slightly less than that of the baseline accelerator. Text changes have been made in Section 3.3.1.1, 3.3.1.2, and 3.4.2. Figures 3-4, 3-5, 3-5a, 3-16, and 3-17 and Table 3-1 have been revised to show the modular footprint and its relationship to the footprint for the baseline design.

Page 3-6, 1st column, 3rd paragraph and Figure 3-4 on page 3-7 are replaced by the following:

Both the preferred and alternate APT sites are on relatively flat, broad and sandy upland areas typical of the Aiken Plateau portion of the Savannah River Site that formed in deep beds of marine sediments (Wike et al. 1994). The orientation of the APT footprint on the preferred site is from southeast to northwest; the footprint orientation on the alternate site from southwest to northeast. Figure 3-4 shows the locations of the sites and their surface features (topography and nearby surface waters). **The footprint variation for the modular or staged accelerator design is also shown. As can be seen, the modular design variation would result in a slight widening of the footprint and a slight decrease in area.**

Page 3-8, 1st Column, 1st paragraph, 5th through 9th lines, Figure 3-5 on page 3-9, and Table 3-1 on page 3-10 are replaced with the following:

Figure 3-5 and 3-5a, soil maps for the preferred and alternate sites, show the boundaries of the soil mapping units. **The footprint variation for the modular or staged accelerator design is also shown. In the case of the modular design footprint, the preferred site would have predominantly Blanton and Fuquay sands.**

The alternative site would include roughly the same mix of soils for both footprints. Table 3-1 lists the physical, chemical, and engineering features of Fuquay sand and other surface soils at the sites.

Page 3-44, 1st Column, 1st paragraph, lines 2 through 15, and Figures 3-16 and 3-17 on pages 3-47 and 3-48 are replaced with the following:

Both sites also have small pockets of 40- and 60-year old upland hardwood stands of white oak, red oak, and hickory ranging in size from 8 to 12 inches in diameter (SRFS 1997). Understory species found on the preferred site include vacciniums (blueberries), sparkleberry, hickories, laurel oak, water oak, southern red oak, sweetgum, black cherry, persimmon, sassafras, and winged sumac. Ground cover includes Japanese honeysuckle, yellow jessamine, greenbrier, muscadine grape, spotted wintergreen, various grasses, legumes, and composites (SRI 1998). Figures 3-16 and 3-17 show the forest cover types of each site. **The footprint variation for the modular or staged accelerator design is also shown. In the case of the modular design footprint, forest cover of the preferred site will be virtually the same as with the baseline footprint. On the alternate site, more acres of longleaf pine and mixed loblolly pine hardwood stands will be included in the modular design footprint.**

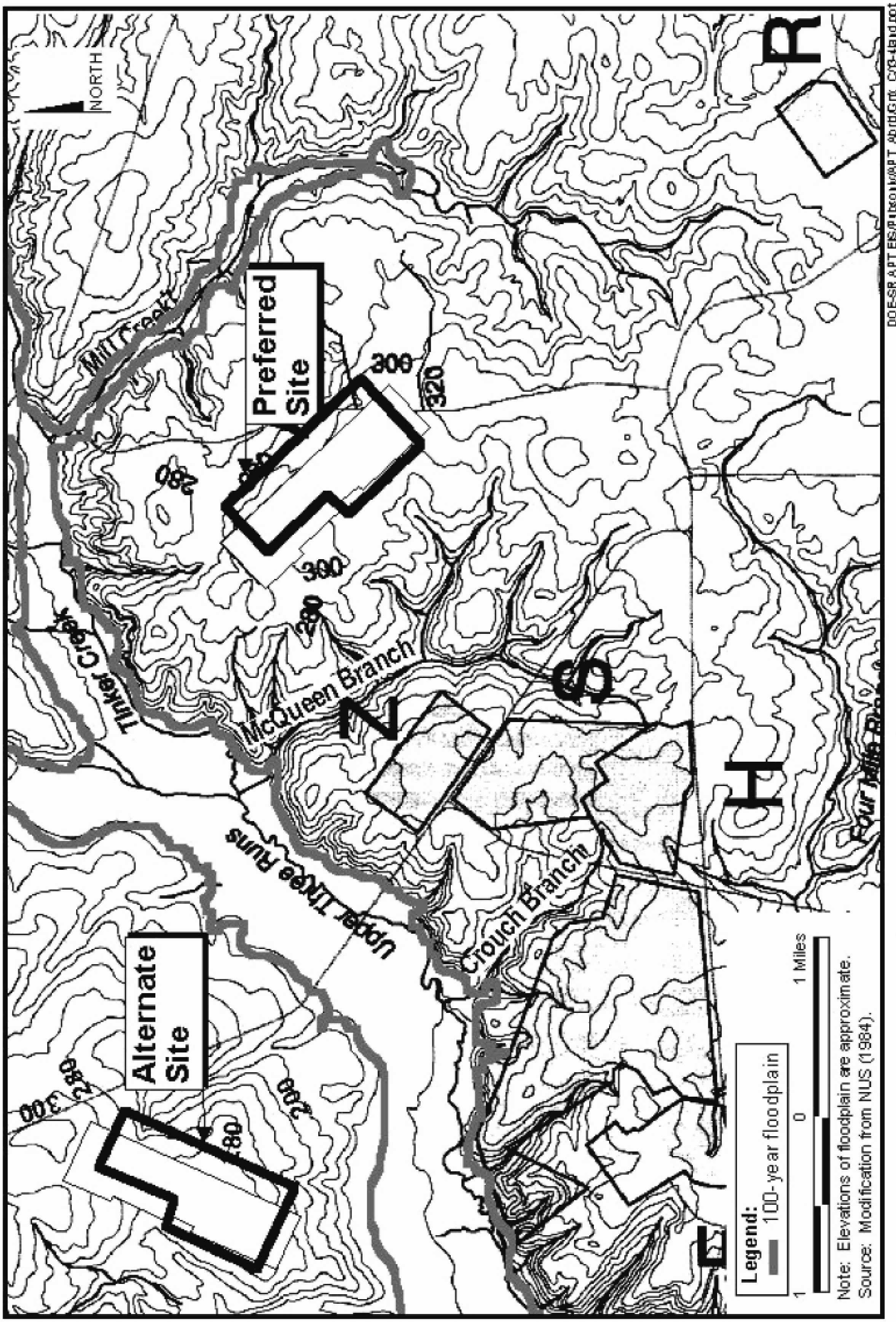


Figure 3-4. Land forms, topography, and 100-year floodplain of the preferred and alternate sites. The footprint of the modular design variation is superimposed over the baseline APT footprint at each site.

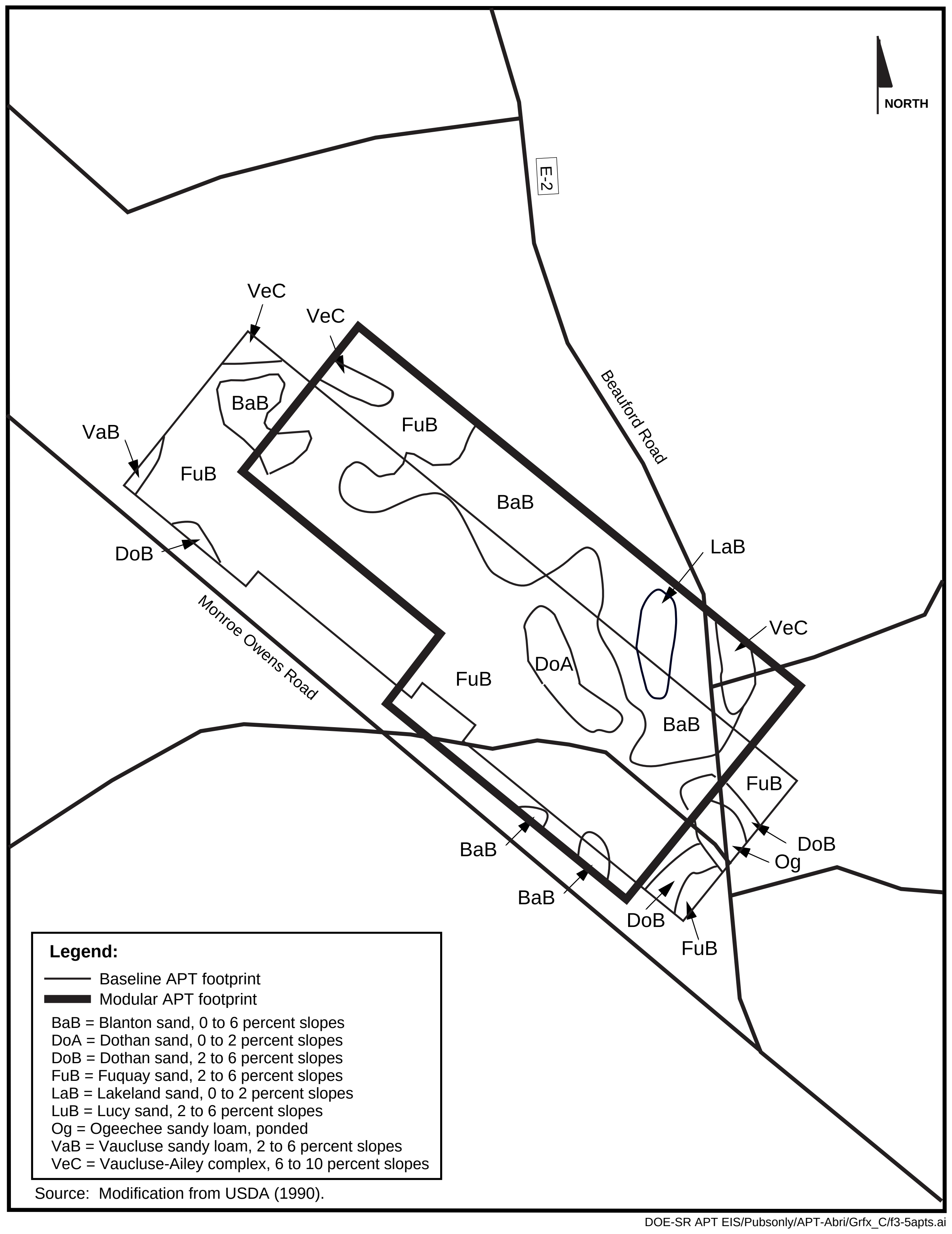


Figure 3-5. Soil types at the preferred APT site.

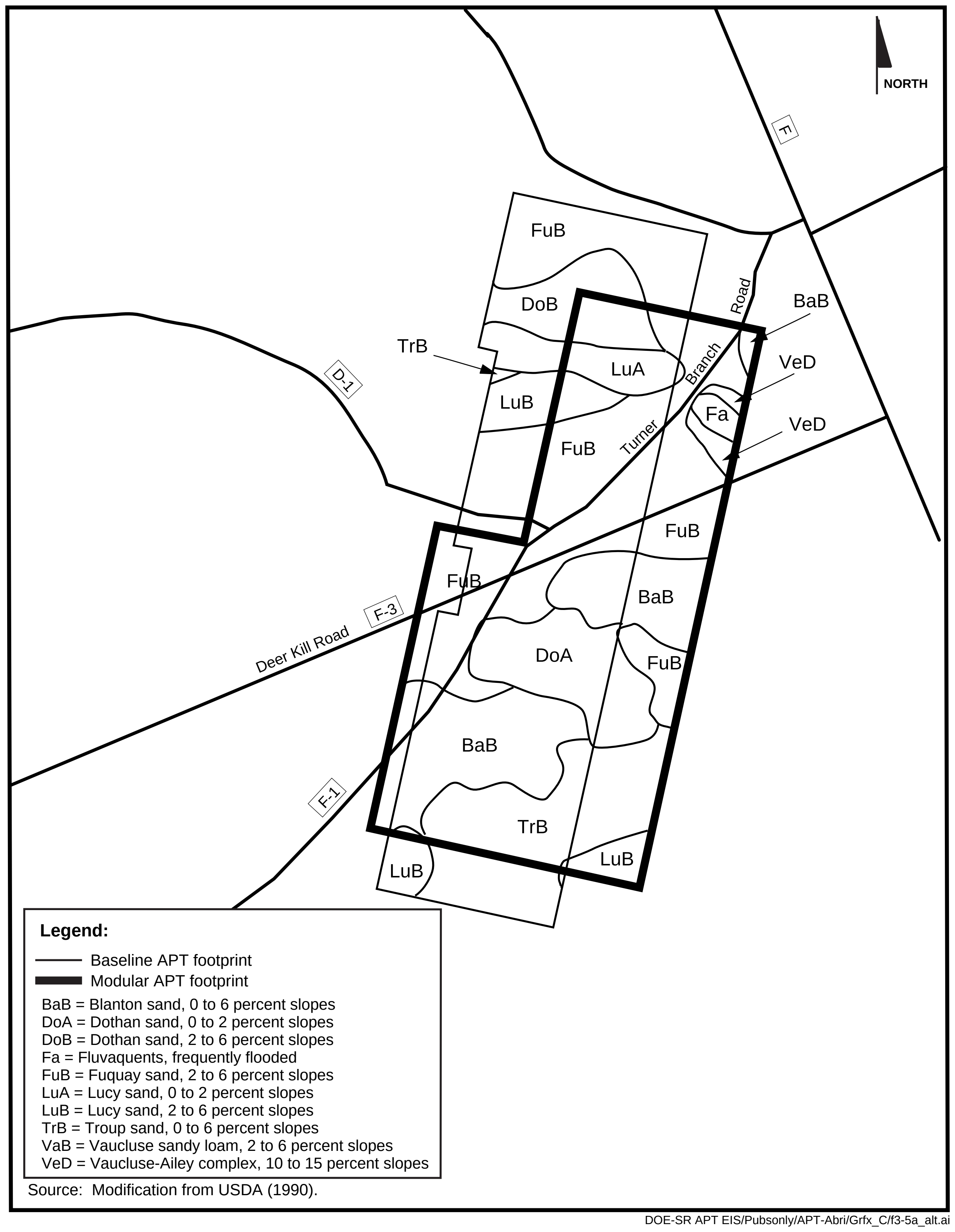


Figure 3-5a. Soil types at the alternate APT site.

Table 3-1. Summary of soils covering the APT sites.[a]

Soil Name (soil mapping unit designation)	Relative surface area at APT sites (percent)		Erosion hazard	Soil texture		Drainage class	Soil reaction (pH)	Risk of corrosion	
	Preferred	Alternate		Surface	Subsoil			Uncovered steel	Concrete
Blanton sand, 0 to 6 percent slopes (BaB)	13	16	Slight[b]	Sandy	Loamy	Somewhat excessively drained[c]	4.5 - 6.0	High	High
Dothan sand, 0 to 2 percent slopes (DoA)	4	9	Slight	Sandy	Loamy and clayey	Well drained[d]	3.6 - 6.0	Moderate	Moderate
Dothan sand, 2 to 6 percent slopes (DoB)	3	8	Slight	Sandy	Loamy and clayey	Well drained	3.6 - 6.0	Moderate	Moderate
Fluvaquents, frequently flooded (Fa)	0	0	**NA**	**Loamy**	**Loamy and sandy**	**Poorly drained**	**4.5-5.5**	**High**	**High**
Fuquay sand, 2 to 6 percent slopes (FuB)	73	38	Slight	Sandy	Loamy	Well drained	4.5 - 6.0	Low	High
Lakeland sand, 0 to 2 percent slopes (LaB)	4	0	**Slight**	**Sandy**	**Sandy**	**Excessively drained**	**4.5 - 6.0**	**Low**	**Moderate**
Lucy sand, 0 to 2 percent slopes (LuA)	0	6	Slight	Sandy	Loamy and clayey	Well drained	4.5 - 6.0	Low	High
Lucy sand, 2 to 6 percent slopes (LuB)	0	7	Slight	Sandy	Loamy and clayey	Well drained	4.5 - 6.0	Low	High
Ogeechee sandy loam, ponded (Og)	2	0	Slight	Loamy	Loamy	Poorly drained[e]	4.5 - 5.5	High	High
Troup sand, 0 to 6 percent slopes (TrB)	0	16	Slight	Sandy	Loamy	Well drained	4.5 - 6.0	Low	Moderate
Vaucluse sandy loam, 2 to 6 percent slopes (VaB)	<1	0	Moderate[f]	Loamy	Loamy and sandy	Well drained	3.6 - 5.5	Low	High
Vaucluse - Ailey complex, 6 to 10 percent slopes (VeC)	<1	0	Moderate	Loamy	Sandy, loamy, and clayey	Well drained	3.6 - 5.5	Low	High
Vaucluse - Ailey complex, 10 to 15 percent slopes (VeD)	0	0	**Moderate**	**Loamy**	**Sandy, loamy, and clayey**	**Well drained**	**3.6 - 5.5**	**Low**	**High**

a. Source: USDA 1990.
b. Slight = No particular erosion preventive measures are needed under ordinary farming practices.
c. Excessively drained = Water is removed from the soil very rapidly.
d. Well drained = Water is readily removed from a well drained soil, but not rapidly. It is available to plants throughout most of the growing season and wetness does not inhibit growth of roots for significant periods during the growing seasons.
e. Poorly drained = Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods.
f. Moderate = Erosion control measures are needed for particular silvicultural activities.

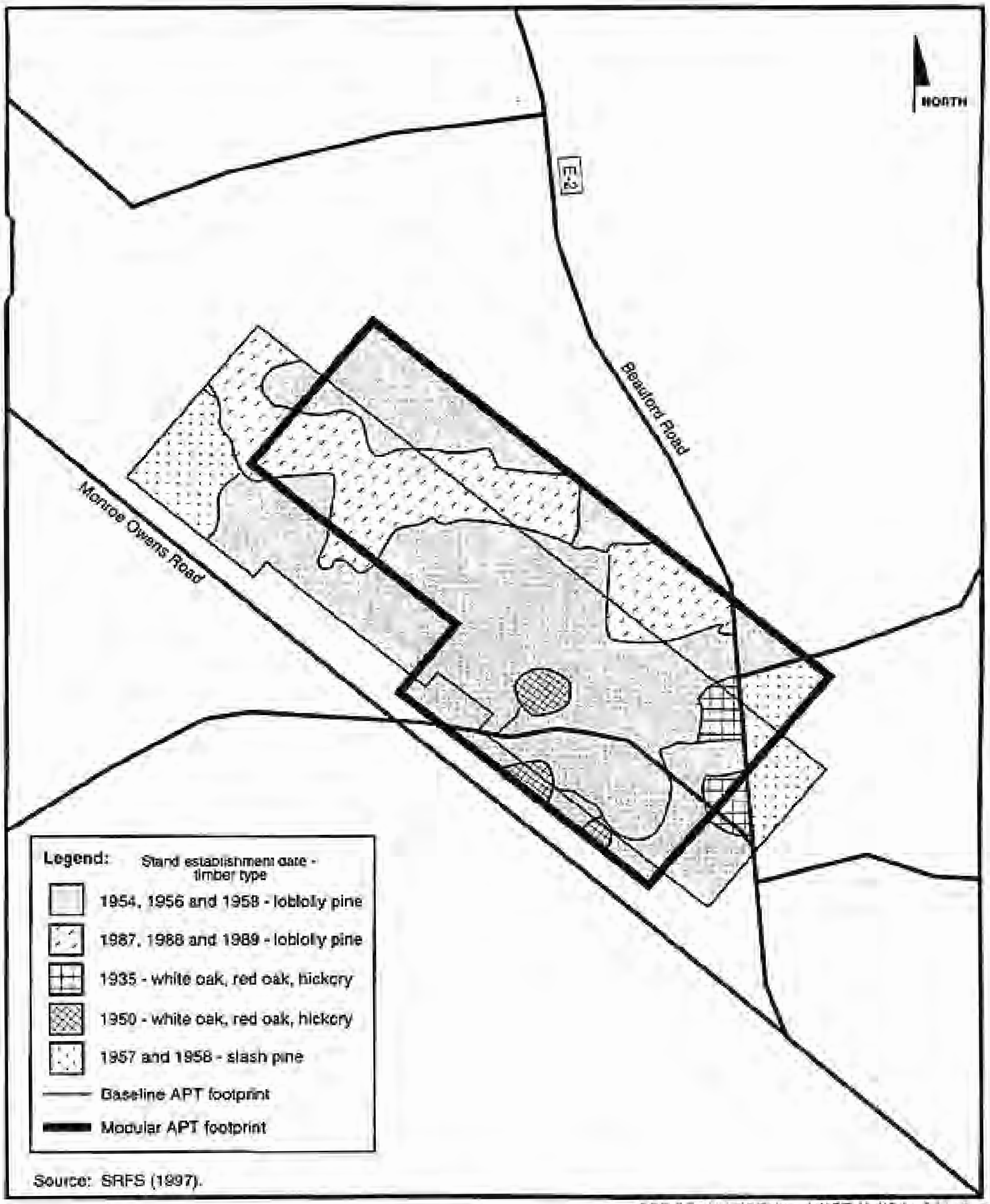
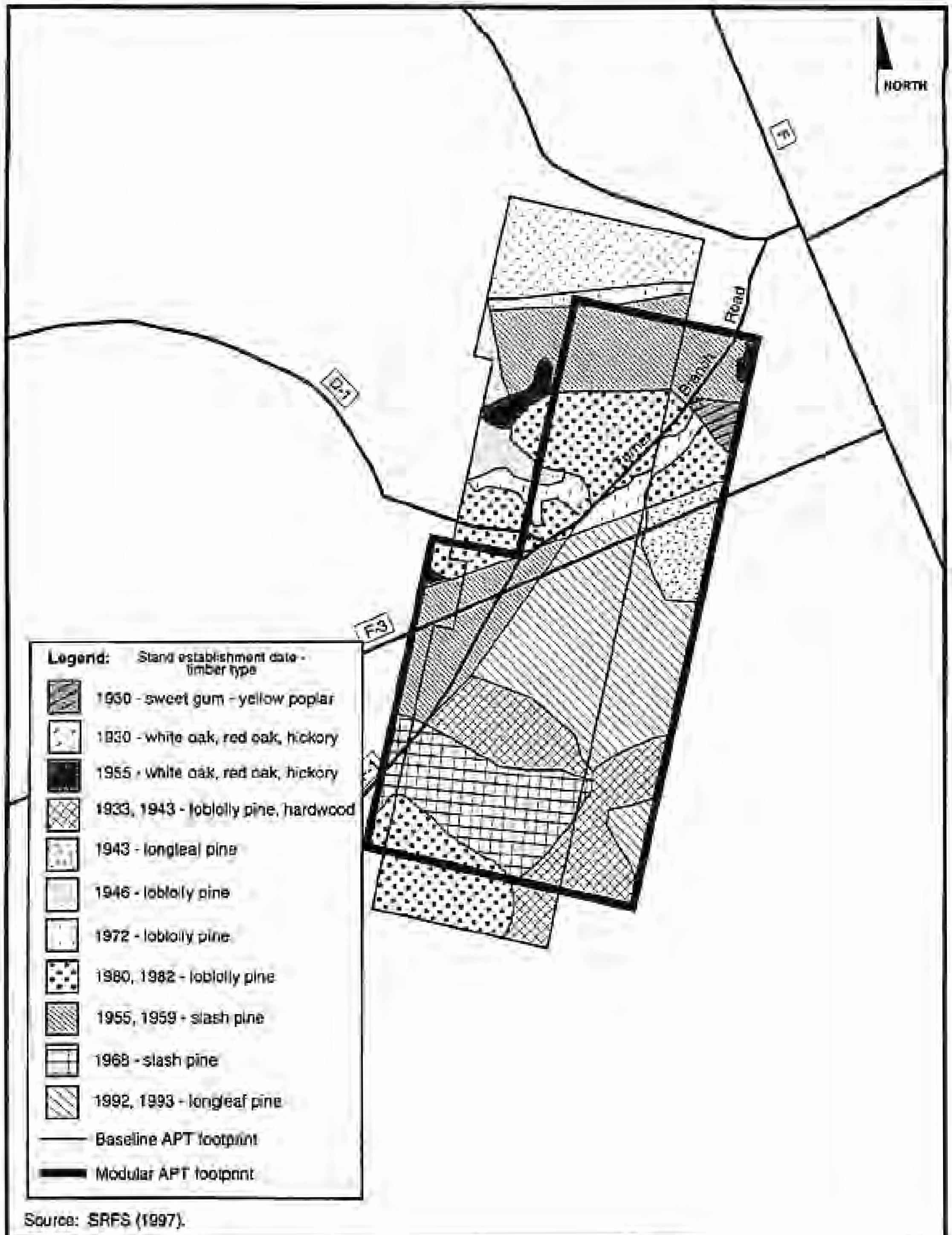


Figure 3-16. Forest cover of preferred APT site.



DOE-SR APT EIS/Pubsonly/APT-Aon/Grfx_CA3-17.ai

Figure 3-17. Forest cover of alternate APT site.

[Chapter 3, Section 3.3.2.1 modification to the Draft APT EIS]

Table 3-5 of the EIS presents water quality information for the Savannah River both upstream and downstream of the Savannah River Site. The table and associated text have been modified to reflect the most recent information found in the *Savannah River Site Environmental Report for 1997*.

Page 3-18, 2nd column, 2nd paragraph and Table 3-5, page 3-21 are replaced with the following:

The South Carolina Department of Health and Environmental Control (SCDHEC) regulates the physical properties and concentrations of chemicals and metals in SRS effluents under the National Pollutant Discharge Elimination System (NPDES) program. This agency also regulates chemical and biological water quality standards for SRS waters. Table 3-5 lists the water quality characteristics of the Savannah River upstream and downstream of the site.

[Chapter 3, Section 3.3.4.1 modification to the Draft APT EIS]

Table 3-8 of the EIS presents average and maximum atmospheric concentrations of radioactivity at the SRS boundary and at 25- and 100-mile radii. The table and associated text have been modified to reflect the most recent information found in the Savannah River Site Environmental Report for 1997.

Page 3-28, 2nd column, 2nd paragraph and Table 3-8, page 3-29 are replaced with the following:

Table 3-8 lists average and maximum atmospheric concentrations of radioactivity at the SRS boundary, at a 25-mile radius, and at background monitoring locations (100-mile radius) during **1997**. Tritium is the only radionuclide of SRS origin detected routinely in offsite air samples above background concentrations (Arnett and Mamatey **1998**). Most of the radionuclides cannot be measured in the environment around the Site due to their extremely low concentrations. However, DOE used SRS-specific computer models such as MAXIGASP and POPGASP to calculate radiological doses for members of the public for the **1997** releases based on the amount released and the estimated concentrations in the environment.

[Chapter 3, Section 3.3.4.2 modification to the Draft APT EIS]

Table 3-9 of the Draft EIS presented the SRS baseline values for nonradiological air quality. The revised table and text reflect the most recent available information.

Page 3-28, 2nd column, 4th paragraph and Table 3-9, page 3-29 are replaced with the following:

DOE models the atmospheric dispersion of both maximum potential and actual emissions of regulated pollutants using the U.S. Environmental Protection Agency (EPA) *Industrial Source Complex Short Term Model* (EPA 1992). Table 3-9 lists estimated ambient concentrations of these regulated air pollutants.

[Chapter 3, Section 3.4.1 modification to the Draft APT EIS]

Table 3-11 presents information on individual and collective radiation doses at the SRS. It and the associated text have been modified to reflect the most recent information available.

Page 3-43, 1st column, 1st paragraph and Table 3-11, page 3-43 are replaced with the following:

Table 3-11 lists the maximum and average individual doses and SRS collective dose from 1989 to **1997**.

Table 3-5. Water quality in the Savannah River upstream and downstream from SRS (calendar year 1997).[a,b]

Parameter	Unit of measure[c]	MCL[d,e] or DCG[f]	Upstream Minimum[g]	Upstream Maximum[g]	Downstream Minimum	Downstream Maximum
Aluminum	mg/L	0.05-0.2[h]	**ND[k]**	**1.1**	**0.17**	**1.8**
Cadmium	mg/L	0.005[d]	ND	ND	ND	ND
Chemical oxygen demand	mg/L	NA	ND	**ND**	ND	**20**
Chromium	mg/L	0.1[d]	ND	ND	ND	**ND**
Copper	mg/L	1.3[l]	ND	**0.11**	ND	**0.042**
Dissolved oxygen	mg/L	>5.0[m]	**7.3**	**11**	**6.5**	**12**
Gross alpha radioactivity	pCi/L	15[d]	**<0.80[j]**	**<0.80[j]**	**<0.80[j]**	**0.80[j]**
Lead	mg/L	0.015[l]	ND	0.012	ND	ND
Mercury	mg/L	0.002[d,e]	ND	**ND**	ND	**ND**
Nickel	mg/L	0.1[d]	ND	ND	ND	ND
Nitrite/Nitrate (as nitrogen)	mg/L	10[d]	**0.26**	**0.46**	**0.18**	**0.54**
Nonvolatile (dissolved) beta radioactivity	pCi/L	50[d]	**<1.4[j]**	**3.0**	**<1.4[j]**	**2.8**
pH	pH units	6.5-8.5[h]	**6.5**	**7.4**	**6.0**	**7.2**
Phosphate	mg/L	NA[i]	0.018	0.52	0.029	0.25
Suspended solids	mg/L	NA	**3**	**14**	**6**	**23**
Temperature	°F	90[m]	**49**	77	**49**	**80**
Tritium	pCi/L	20,000[d,e]	**<440[j]**	**<440[j]**	**<440[j]**	**2,600**
Zinc	mg/L	5[h]	ND	**0.22**	0.026	**0.34**

a. Source: Arnett and Mamatey(1998a,b).
b. Parameters are those DOE routinely measures as a regulatory requirement or as part of ongoing monitoring programs.
c. mg/L = milligrams per liter; a measure of concentration equivalent to the weight/volume ratio.
pCi/L = picocuries per liter; a picocurie is a unit of radioactivity; one trillionth of a curie.
d. Maximum Contaminant Level (MCL), EPA National Primary Drinking Water Standards (40 CFR Part 141).
e. Maximum Contaminant Level (MCL): SCDHEC (1976).
f. DOE Derived Concentration Guides (DCGs) for water (DOE Order 5400.5, "Radiation Protection for the Public and the Environment"). DCG values are based on committed effective dose of 100 millirem per year for consistency with drinking water MCL of 4 millirem per year.
g. Minimum concentrations of samples. The maximum listed concentration is the highest single result found during one sampling event.
h. Secondary Maximum Contaminant Level (SMCL). EPA National Secondary Drinking Water Regulations (40 CFR Part 143).
i. NA = none applicable.
j. Less than (<) indicates concentration below lower limit of detection (LLD).
k. ND = none detected.
l. Action level for lead and copper.
m. Shall not exceed weekly average of 90°F after mixing nor rise more than 5°F in 1 week unless appropriate temperature criterion mixing zone has been established.

Table 3-8. Radioactivity in air at the SRS boundary, at the 25-mile radius, and at the 100-mile radius during 1997 (picocuries per cubic meter).[a]

Location	Gross alpha	Nonvolatile beta	Tritium
Site boundary			
Average	<0.0011[b]	0.015	<49[b]
Maximum	0.0033	0.031	65
25-mile radius			
Average	<0.0011[b]	0.016	<49[b]
Maximum	0.0044	0.038	<49[b]
Background (100-mile radius)			
Average	0.0011	0.011	<49[b]
Maximum	0.0030	0.018	<49[b]

a. Sources: Arnett and Mamatey (1998); Arnett (1998).
b. Less than (<) indicates concentrations below lower limit of detection (LLD).

Table 3-9. Estimated ambient concentration contributions of air pollutants from existing SRS sources and sources planned for construction or operation through 1996 (micrograms per cubic meter of air).[a,b]

Pollutant[c]	Averaging time	SC ambient standard (μg/m^3)	Estimated SRS boundary conc. (μg/m^3)[c]	Percent of standard
Criteria pollutants				
Sulfur dioxide[d]	3-hr	1,300[e,f]	690	53
	24-hr	365[e,f]	215	59
	Annual	80[e]	16	20
Total suspended particulate	Annual	75[e]	43	58
Particulate matter (≤10 μm)	24-hr	150[e]	81	54
	Annual	50[e]	4.8	9.6
Carbon monoxide	1-hr	40,000[e]	5,000	13
	8-hr	10,000[e]	630	6.3
Oxides of Nitrogen[f]	Annual	100[e]	8.8	8.8
Lead	Max. quarter	1.5[g]	<0.01	<0.67
Ozone	1-hr	235[e,j]	NA[l]	NA
Toxic air pollutants[l]				
Hydrochloric Acid	24-hr	175[k]	24	14
Benzene	24-hr	150[k]	28	19
Formaldehyde	24-hr	7.5[k]	0.5	6.7
Hexane	24-hr	200[k]	3.7	1.9
Nickel	24-hr	0.5[k]	0.12	24

a. Source: DOE (1998).
b. The concentrations are the maximum values at the SRS boundary.
c. Based on maximum potential emissions for 1996 for all SRS sources on the indicated pollutant.
d. Based on emissions for all oxides of sulfur (So_x).
e. Source: SCDHEC Standard No. 2.
f. Concentration not to be exceeded more than once a year.
g. Source: SCDHEC (1976). New NAAQS for particulate matter ≤2.5 microns (24-hour limit of 65 μg/m^3 and an annual average limit of 15 μg/m^3) will become enforceable during the life cycle of this facility.
h. Based on emissions for all oxides of nitrogen (NO_x).
i. Modeling was conducted for 137 toxic air pollutants; listed are those air toxics with site boundary concentrations estimated to be greater than 1 percent of the ambient standard.
j. New NAAQS for ozone (8 hours - 0.08 parts per million) will become enforceable during the life cycle of this facility.
k. Source: SCDHEC Standard No. 8.
l. NA = not available.

Table 3-11. SRS annual individual and collective radiation doses.[a]

Year	Number with measurable dose	Average individual worker dose (rem)[b]	Site worker collective dose (person-rem)
1989	12,363	0.070	863
1990	11,659	0.065	753
1991	8,391	0.055	459
1992	6,510	0.054	352
1993	5,202	0.051	264
1994	6,284	0.050	315
1995	4,846	0.053	256
1996	4,736	0.053	252
1997[c]		**N/A**[d]	**164**

a. Sources: **DOE (1996), WSRC (1998).**
b. The average dose includes only workers who received a measurable dose during the year.
c. 1997 data is incomplete and does not include the average individual worker dose.
d. N/A = Not applicable.

[Chapter 3, Section 3.4.5 modification to the Draft APT EIS]

Section 3.4.5, Threatened and Endangered Species, has been revised in response to comments L2-05 and L2-06. The description of eagle use of the SRS has been added to provide a more comprehensive assessment of the current status of eagles in the potentially affected areas.

Page 3-54, 2nd column, 2nd paragraph, line 8 through line 3 in the 1st column on page 3-55 are replaced with the following new paragraphs:

Bald eagles nest near Par Pond and L Lake and forage in both reservoirs (Bryan et al. 1996; Lemaster 1996). Par Pond was the center of eagle activity on the SRS until 1985, when L Lake was built. Bald eagle use of L Lake has increased since 1987, with the highest number of sightings occurring in the fall and winter of 1992-1993 (Bryan et al. 1996). Eagle use of Par Pond over the same period has remained at a constant but fairly low level. In the winters of 1991-1992 and 1992-1993, when Par Pond was drawn down for repairs, bald eagles were frequently observed foraging in the area (Bryan et al. 1996). After the reservoir was refilled, bald eagles were seen less frequently in the Par Pond area, but the reservoir continues to be used as a foraging area by nesting, over-wintering, and transient juvenile and adult bald eagles (SRI 1998). In 1984-1985, when bald eagle use of the Par Pond system was last studied, the largest number of sightings (66.7 percent) were at Par Pond, followed by Pond C (24.2 percent), Pond B (6.1 percent), and Pond 2 (3.0 percent) (Mayer et al. 1986). In recent years, eagles have been observed on a regular basis foraging around Pond C and Pond B, and have been seen occasionally at Pond 2 (Brooks 1998).

Although eagles are found on the SRS in all months of the year, most sightings are in winter and spring months (November through May) (Mayer et al. 1986). This is the time of the year when the birds are nesting and wintering in South Carolina. Eagles seen during the summer and early fall are most likely transients migrating either north or south (Sprunt and Chamberlain 1970; Mayer et al. 1986).

There are three bald eagle nesting territories on the Savannah River Site (DOE 1997). The Eagle Bay nest, discovered in 1986, is approximately 1 mile southwest of the Par Pond dam. The Pen Branch nest, discovered in 1990, is approximately 1 mile west of L Lake. The recently-discovered Road G nest is approximately 0.25 mile east of Par Pond (LeMaster 1996). Eagles have nested intermittently at the Eagle Bay location since its discovery in 1986 (Hart et al. 1996). Chicks hatched at the Pen Branch nest every year from 1990 to 1996. To date, no young have been observed at the Road G nest. In the winter of 1997-1998, this nest was in a state of disrepair and was not used by eagles (Brooks 1998).

[Chapter 3, Section 3.4.5 modification to the Draft APT EIS]

Section 3.4.5, Threatened Endangered Species, has been revised in response to comments L2-05 and L2-06. The description has been added to provide a more comprehensive assessment of the current status of shortnose sturgeon in the area and is replaced by the following paragraph.

<u>Page 3-55, 1st column, 2nd paragraph is replaced with the following</u>:

Shortnose sturgeon have not been collected in the tributaries of the Savannah River that drain the SRS, but do occur in the Savannah River up- and downstream of the Site. Before 1982, shortnose sturgeon were not known to occur in the middle reaches of the Savannah River. However, 12 shortnose sturgeon larvae were collected near SRS during a 4-year (1982 through 1985) DOE study of ichthyoplankton abundance and entrainment in reactor cooling water systems (DOE 1987). A South Carolina Wildlife and Marine Resources Division (now South Carolina Department of Natural Resources) study of seasonal movement and spawning habitat preferences of Savannah River shortnose sturgeon found two probable spawning sites, one upstream of the SRS at river mile 177-179 and the other downstream of the Site at river mile 115-121 (Hall et al. 1991). Collins et al. (1992) tentatively identified three spawning locations in the Savannah River: river mile 111-118 (downstream of the Site), river mile 136-143 (adjacent to the Site), and river mile 171-172 (upstream of the Site). Sturgeon spawn in the main channel of the Savannah River in areas where current velocities and turbulence are high, maintaining a scoured clay-gravel bottom (Hall et al. 1991; Collins et al. 1992).

Chapter 4. Modifications – Environmental Impacts

[Chapter 4 introduction, modifications to the Draft APT EIS]

Since the Draft APT EIS was issued, the Department has determined the probable location of concrete batch plants and construction debris disposal areas. The batch plants would be located within the APT site; construction debris would be discarded in the existing Burma Road landfill on the Savannah River Site or at one of three other possible locations on SRS. The information supercedes the batch plant and construction landfill discussions in Section 4.1.5, Waste Management, of the Draft EIS.

<u>Page 4-1, 2nd column, 2nd and 3rd paragraphs are replaced with the following</u>:

In addition to the construction activities described in Chapter 2, DOE could build two temporary facilities – concrete batch plants and a construction debris landfill.

<u>Concrete Batch Plants</u>: The planned location of the batching facilities (batch plant, associated sand and aggregate storage areas, and washdown basins) would be near the target blanket building and within the areas that would be cleared for the APT. About 10 acres of land is expected to be required. The exact location and area requirements for these facilities would be established on the basis of final decisions regarding APT layout (baseline accelerator or modular design).

Estimated water requirements for the batch plant are based on the need to produce approximately 340,000 cubic yards of concrete. About 30 gallons of water per cubic yard is needed for batching, and an additional 30 gallons of water per cubic yard is required for washout. Consequently total water requirements are estimated to be 21 million gallons; about 7.2 million gallons in the peak year of construction (DeCamp 1998).

Process water for the concrete batch operations would likely come from existing wells in H-Area or from the SRS domestic water supply system. Both of these sources would be reliable supplies of water for which supply pipelines can be readily installed early in the construction phase. River water is unlikely to be used because of potential variability in quality (e.g. suspended solids) and the fact that the supply pipeline to the Savannah River (to support cooling water needs should that alternative be selected) would not be installed until relatively late in the construction phase of the project. The washout water from batch plant operations would be routed to basins for the removal of suspended solids, then either reused or discharged via an NPDES outfall (DeCamp 1998).

Particulate matter, consisting primarily of cement dust, is the only pollutant of concern generated in the concrete mixing process. Emissions occur at the point of transfer of cement to the silo; however, filter bags with control effectiveness as high as 99 percent are typically used to remove particulate emissions. Particulate emissions limits for the operation of a concrete batch plant would be set in a construction permit granted by SCDHEC. Any fugitive dust emissions from sand and aggregate piles around the batch plant would be controlled by wet suppression, chemical dust suppressants, or other approved method.

<u>Construction Debris Landfill</u>. Construction debris would be disposed of at either the existing Burma Road landfill on the Savannah River Site, a future landfill to be developed at the Central Shops Borrow Pit, or on the selected APT site. The Burma Road landfill (which would require expansion to support APT generated waste) or any new landfill constructed would comply with all applicable SCDHEC siting criteria for Type III construction debris landfills (SCDHEC R.61-107.11, Part III) including a 100-year flood obstruction prohibition, compliance with wetland regulations, and be designed to ensure the landfill bottom is at minimum 2 feet above the seasonal high groundwater table. Based on the estimated amount of nonrecyclable construction debris that would be generated, and a 10-foot depth for uncompacted fill, approximately 14 acres would be required for the landfill (DeCamp 1998).

Surface water management for any new landfill or expansion of the Burma Road landfill would be in accordance with those guidelines set forth in an approved Stormwater Management and Sediment Reduction/Pollution Prevention Plan. Controls would be established for landfill operations to ensure that applicable SCDHEC requirements are met (e.g., controls to minimize run-off into active disposal areas, placement of interim cover, final grading to ensure positive drainage, and other requirements) as specified in R.61-107.11.

Integrity of the final soil cover (minimum of 2 feet) would be maintained as specified in R.61-107.11, Part III.B.5, and would include periodically inspecting the cover, repairing and re-establishing vegetation on those areas damaged by erosion, and similar activities.

[Chapter 4 introduction, modification to the Draft APT EIS]

In the Draft EIS, the Department indicated the No Action alternative would result in the design, but not the construction of the APT facilities. Based on that description of No Action, the Department expected no incremental impacts beyond the current baseline at the SRS. However, since the issuance of the Draft EIS, DOE has modified the APT No Action alternative (see page C-3 of this document).

If the department decides to not construct and operate the APT, it would pursue tritium production in one or more commercial light-water reactors. This action would change the estimates of the No Action impacts presented in the Draft EIS. Under this scenario, the No Action alternative impacts would include the construction and operation of the Tritium Extraction Facility at SRS, the possible completion of a partially constructed commercial light water reactor, the irradiation of targets in a commercial light-water reactor, and the transportation of those targets to the SRS. Impacts for these actions are covered in DOE/EIS-0271 and DOE/EIS-0288. The following summary replaces the text under "Impacts of the No Action Alternative" as found in the Draft EIS.

Page 4-2, 2nd column, 4th paragraph through page 4-3, 1st column, 1st paragraph is replaced with the following:

POTENTIAL NO ACTION IMPACTS AT THE SAVANNAH RIVER SITE

The potential No Action impacts associated with APT could occur at both the Savannah River Site and at reactor sites in Tennessee and/or Alabama. Table 2-3 of this document compares the potential impacts of the No Action alternative (both at and away from the SRS) to the baseline accelerator.

Tritium Extraction

The environmental impacts of extracting tritium at the SRS are described in the Draft TEF EIS (DOE 1998a). The following discussion is based on that document. In general, DOE considers the expected impacts from extracting tritium in either the H-Area or the Allied General Nuclear Services (AGNS) facility (i.e., the two alternatives evaluated in the Draft EIS) on the physical, biological, and human environment to be minor and consistent with what might be expected for an industrial facility.

Compared to extracting tritium in H-Area, the AGNS alternative would have higher radiation doses at the site boundary (due to the close proximity of the facility to the property boundary), but lower collective population doses (due to lower population densities in the nearby communities).

Less construction waste would be produced at AGNS than H-Area because putting TEF in AGNS would involve refurbishing existing facilities, and some new construction. Slightly higher volumes of sanitary waste would be generated at AGNS during operations due to a larger workforce.

Neither of the alternative sites for TEF is known to contain hazardous, toxic, or radioactive materials. Nonetheless, the potential exists that excavation-related activities could result in the discovery of previously unknown and undocumented hazardous, toxic, or radioactive materials. DOE would remove and dispose of such material in accordance with all applicable laws and regulations.

The AGNS alternative would require less land than the H- Area alternative. DOE has not identified any significant historic or archaeological resources at either alternative site that construction or operation of TEF could effect. No threatened, endangered, or other sensitive biotic resources are believed to occur on either site. At the AGNS site, construction noise and activity could have localized, but temporary, adverse effects on wildlife.

For the AGNS alternative, the contributions of nonradiological air constituents would be 0.13 percent of the applicable standard, higher than the onsite H-Area alternative. The annual radiological dose for the offsite maximally exposed individual would be 0.13 millirem higher for AGNS than for H-Area, but both would be well below the regulatory limit of 10 millirem from airborne releases.

POTENTIAL NO ACTION IMPACTS AWAY FROM THE SAVANNAH RIVER SITE

Should the Department select the commercial light-water reactor option of the dual-track strategy for producing tritium, it could be done at either the Tennessee Valley Authority's Bellefonte facility near Hollywood, Alabama, or at the Watts Bar or Sequoyah plants, located near Spring City and Soddy-Daisy, Tennessee respectively. Impacts could include those related to the completion of the Bellefonte plant, the construction of dry spent fuel storage facilities at each plant, the irradiation of TPBARs in Bellefonte, Sequoyah, and/or Watts Bar, and the transportation of the irradiated material to the Savannah River Site. The *Draft EIS For the Production of Tritium in a Commercial Light Water Reactor* (DOE 1998b) provides descriptions of the proposed actions and their potential impacts. The following information is taken from that document.

Commercial Light-Water Reactor Construction Impacts

Watts Bar and Sequoyah. Because the Draft CLWR EIS assumes that long-term spent nuclear fuel storage would take place at each of the reactor plants, a dry cask spent fuel storage facility may be required for Watts Bar 1 and Sequoyah 1 or 2 to support tritium production. This would be the only construction necessary for tritium production. Such a facility would consist of three reinforced concrete slabs covering approximately 3.5 acres. Approximately 60-80 horizontal storage modules (HSMs), each made of reinforced concrete, could be housed on the slabs. These HSMs would have a hollow internal cavity to accommodate a stainless steel cylindrical cask that would contain the spent nuclear fuel. Constructing such a facility would disturb approximately 5 acres and require approximately 50 construction workers. Premixed concrete would be used and negligible impacts to air quality, water, and biotic resources are expected.

Bellefonte. For Bellefonte units 1 and 2, which are only partially completed nuclear plants, additional construction activities would be required in order to produce tritium. The impacts of such construction are described below.

At Bellefonte 1 and 2, all major structures (e.g., containment buildings, cooling towers, turbine buildings, and support facilities) have been constructed. Therefore, construction activities would largely consist of internal modifications to the existing structures. No additional land would be disturbed in completing construction and there would be no impacts on visual resources, biotic resources (including threatened and endangered species), geology and soils, and cultural resources. Because the Draft CLWR EIS assumes that long-term spent fuel storage would take place at each of the reactor plants, a dry cask spent fuel storage facility would eventually be required at Bellefonte. The impacts of constructing such a spent fuel storage facility would be similar to those described above for Watts Bar and Sequoyah.

Completing construction of Bellefonte 1 would have the greatest impact on socioeconomics. During the peak year of construction (2002), approximately 4,500 direct jobs would be created. Approximately 4,500 secondary jobs would also be created. The total new jobs (9,000) would cause the regional economic area unemployment rate to decrease to approximately 3 percent, from the current rate of 7.9 percent. Public finance expenditures/revenues would increase by over 30 percent in Scottsboro and about 15 percent in Jackson County. Rental vacancies would decline to near zero and demand for all types of housing would increase substantially.

If Bellefonte 2 also was selected for completion, construction activities at Bellefonte 1 and Bellefonte 2 would be extended. The peak year of construction would shift to 2003, but the total number of direct jobs would be the same. The effects on the regional economic area unemployment rate, housing/rental vacancies, and public finance expenditures/revenues would be the same as for the construction completion of Bellefonte 1.

Commercial Light-Water Reactor Operational Impacts

The impacts of tritium production are described below, first for the operating reactors, then for the partially completed reactors.

Watts Bar and Sequoyah. Tritium production would have minimal or no effect (see Table 2-3) on land use, visual resources, water use and quality, air quality, archaeological and historic resources, biotic resources (including threatened and endangered species), and socioeconomics. Tritium production could cause some impacts in the following areas: radiation exposure (worker and public), spent fuel generation, and low-level radioactive waste generation.

Tritium production could cause the average annual worker radiation exposure to slightly increase but the resultant dose would be well within regulatory limits of 5,000 millirem per year. Radiation exposure to the public from normal operations also could increase, but would still remain well within regulatory limits at each of the reactor sites.

As a result of the irradiation process (assuming a maximum 3,400 targets) additional spent fuel would be generated at Watts Bar and Sequoyah. In the average 18-month fuel cycle, spent fuel generation would increase from approximately 84 spent fuel assemblies to approximately 144 spent fuel assemblies. If less than approximately 2,000 targets were irradiated, there would be no change in the amount of spent fuel produced by the reactors. Storing the additional spent fuel is not expected to result in any discernible impacts. Radiation exposures would remain below regulatory limits for both workers and the public. There are no significant impacts from accidents associated with dry cask spent fuel storage.

Watts Bar and Sequoyah would generate approximately 0.43 additional cubic meters of low-level radioactive waste. Such an increase would amount to less than 1 percent of the low-level radioactive waste disposed of at the Barnwell, South Carolina low-level radioactive waste disposal facility.

Tritium production could change the potential risks associated with accidents at Watts Bar and Sequoyah. Potential impacts from accidents were determined using computer modeling. If a limiting design-basis accident occurred, tritium production would increase the individual risk of a fatal cancer by 7.5×10^{-9} to an individual living within 50 miles of Watts Bar. Statistically, the limiting design basis accident would create one additional fatal cancer approximately every 130 million years from tritium production in Watts Bar. For an individual living within 50 miles of Sequoyah 1 or 2, if a limiting design-basis accident occurred, tritium production would increase the risk of a fatal cancer by 1.2×10^{-8}. Statistically, the limiting design-basis accident would create one additional fatal cancer every 83 million years from tritium production in either of the Sequoyah reactors. For beyond-design basis accidents (accidents which have a probability of occurring approximately once in a million years), tritium production would not significantly change the consequences of an accident. This is due to the fact that the potential consequences of such an accident would be dominated by radionuclides other than tritium. For these types of accidents, the additional tritium would produce an estimated statistical risk of less than 1.0 fatal cancer to the 50-mile population surrounding the plants.

Bellefonte. Because neither Bellefonte 1 or 2 is currently operating, the CLWR EIS attributes all of the environmental impacts of operating these plants to the tritium production program. Consequently, environmental impacts would occur in the following areas: visual resources, water use, biotic resources, socioeconomics, radiation exposure (worker and public), spent fuel generation, and low-level radioactive waste generation. In addition, tritium production would also change the accident risks associated with these reactors.

During operation, the Bellefonte units would produce vapor plumes from cooling towers that would be visible up to ten miles away. These plumes could create an aesthetic impact on the towns of Pisgah, Hollywood, and Scottsboro, Alabama.

During operations, the Bellefonte units would each utilize less than 0.5 percent of the river flow from Guntersville Reservoir and would not cause any adverse impacts to other users. Discharges from the plants would be treated and monitored before release and would comply with National Pollutant Discharge Elimination System permits. Impacts to water quality would be minimal and no standards would be exceeded. Operation of either or both of the Bellefonte plants for tritium production would have a small impact on biotic resources, although there would be some fish losses from cooling water intake screens.

During operations, approximately 800 direct jobs would be created at Bellefonte 1 along with an approximately equal number of indirect jobs. The total new jobs (approximately 1,600) would cause the regional economic area unemployment rate to decrease to approximately 5.9 percent. Public finance expenditures/revenues would decline from the levels during construction but would remain 10 to 15 percent higher than they would be otherwise at Scottsboro and 5 to 10 percent higher in Jackson County. If Bellefonte 2 also were completed, a total of approximately 1,000 direct jobs would be created, along with approximately 1,000 indirect jobs.

Tritium production would result in worker radiation exposures but the resultant doses would be well within regulatory limits of 5,000 millirem per year. Radiation exposures to the public from normal operations also would increase but still remain well within regulatory limits. The population dose within 50 miles of the plant would increase from 0 person-rem to approximately 11 person-rem per year for Bellefonte 1.

Based on producing the maximum amount of tritium in the average 18 month fuel cycle, spent fuel generation would increase from 0 spent fuel assemblies to approximately 141 spent fuel assemblies. The impacts of storing the spent fuel in a dry cask spent fuel storage facility are the same as described above for the existing operating reactor plants.

Tritium production at Bellefonte 1 would generate approximately 40 cubic meters of low-level radioactive waste. This amount of waste would be a small fraction of the low-level radioactive waste disposed of at the Barnwell, South, Carolina low-level radioactive waste disposal facility.

Potential impacts from accidents were determined using computer modeling. If a limiting design-basis accident occurred, tritium production would increase the individual risk of a fatal cancer by 4.1×10^{-9} to an individual living 50 miles of Bellefonte. Statistically, this means that one additional fatal cancer would occur approximately every 240 million years from tritium production at either Bellefonte 1 or 2. For beyond-design basis accidents (accidents which have a probability of occurring approximately once in a million years), tritium production would not significantly change the consequences of an accident. This is due to the fact that the potential consequences of such an accident would be dominated by radionuclides other than tritium. For these types of accidents, the additional tritium would produce a statistical risk of less than one fatal cancer to the 50 mile population surrounding the plants.

Transportation Impacts

The potential impacts of transporting irradiated material to the Savannah River Site would be essentially the same for Watts Bar, Sequoyah, or Bellefonte. Impacts would be limited to toxic vehicle emissions and traffic fatalities. The transportation risks would be less than one fatality per year.

Radiological material transportation impacts could result in routine and accidental deaths. In all instances, the risks associated with this material would be much less than one fatality per year.

[Chapter 4, Section 4.1.1.2 modification to the Draft APT EIS]

Comment L4-03 questioned the information about potential groundwater activation discussed in Section 4.1.1.2. This section has been modified to clarify the discussion. The dominant activation product generated would be tritium.

Page 4-4, 2nd column, 4th paragraph through 1st paragraph on page 4-5 are replaced with the following:

During accelerator operations, some neutrons could penetrate the accelerator shielding and be available for absorption by stable (nonradioactive) atoms in the soil and groundwater to form radioactive atoms. The expected production of tritium beneath the facility would be less than 2×10^{-3} curies per year. **These radioactive atoms (tritium) would be expected to migrate with groundwater, but would take between 50 and 80 years to reach surface water outlets (Stephenson 1997). Transport modeling of these activation products show that groundwater tritium levels would at all times be below EPA drinking water standards away from the APT site.** The accelerator tunnel and target/blanket building shielding would be designed (Fikani 1997) so that the radiation dose from the calculated tritium concentration in groundwater, for a hypothetical individual drinking the APT site groundwater continuously throughout the year, would be less than one-eighth of the U.S. Environmental Protection Agency drinking water standard of 4 millirem per year. Dispersion during movement would produce even lower doses to a real receptor, therefore, there would be minimal impacts from the activation of groundwater.

[Chapter 4, Section 4.1.2.1 modification to the Draft APT EIS]

The text box in the Draft EIS discussing impacts from operations to surface water is revised to clarify the conditions under which a Clean Water Act Section 316 (a) Demonstration would be required.

Page 4-5, 2nd column, text box is revised to contain the following text:

Operation of the APT would result in thermal discharges from the cooling water system to a series of pre-cooler ponds and ultimately Par Pond. **Based on heat dissipation studies (see Section 4.5.3), low-volume cooling tower discharges would have little or no effect on temperatures in the receiving water bodies. In the case of the Once-Through Cooling Water alternative, however, discharges to the pre-cooler ponds would be in excess of 100°F. This could create a situation in which the average weekly temperature in the receiving water bodies is greater than 90°F, the SCDHEC standard for freshwaters. The once-through discharge also could be more than 5°F above ambient temperatures, exceeding the SCDHEC standard for discharges to lakes and reservoirs. DOE could be required to conduct a Clean Water Act Section 316(a) Demonstration.**

Under each cooling water alternative, cesium-137, trapped in the fine sediments of Par Pond, could be remobilized. The Once-Through Cooling Water alternative could resuspend the most cesium-137. Potential exposures to the public, in either case, would be small. Potential health impacts associated with water pathways are included in the totals reported in Section 4.2.1.

The Department is considering a design variation for the discharge of cooling water, bypassing precooler ponds 2 and 5 and discharges directly to Pond C via an existing discharge channel. Section 4.5.3 in Part D of this document describes this design variation and evaluates the potential impacts.

[Chapter 4, Section 4.1.2.2 modifications to the Draft APT EIS]

Based on evolving design work for the accelerator, waterborne source terms have been modified. Table 4-1 and 4-2 have been modified to reflect the revised information. Although the source term is higher than estimated in the Draft EIS, the expected dose to exposed individuals and the public is still small.

Page 4-6, 2nd column, Table 4-1 and Table 4-2, page 4-7 are replaced with the following:

Table 4-1. Estimated annual releases (curies) of major radionuclides in liquid discharges from the APT.[a]

Radionuclide	Annual releases[b]
Tritium	**3,000**
Cobalt-60	0.0001
Chromium-51	0.002
Sodium-22	0.001

a. Source: England (1997) **and England (1998a)**.
b. Annual releases will not change significantly with alternative.

[Chapter 4, Section 4.1.3.3 modifications to the Draft APT EIS]

Table 4-11 and associated text, which present information on OSHA-regulated nonradiological air pollutants at the preferred APT site for a hypothetical worker, are modified to reflect changes resulting from recalculation of the maximum concentrations.

Page 4-16, 2nd column, 3rd paragraph and Table 4-11, page 4-18, are replaced with the following:

Table 4-11 lists air quality impacts to a hypothetical worker in the vicinity of the APT facilities. For all the regulated pollutants emitted, exposures to the nearby worker would be below permissible exposure levels defined in 29 CFR Part 1910.100.

Table 4-2. Average annual doses from radiological and nonradiological constituents discharged in liquid effluents for the preferred configuration, and percent differences in alternatives to the Preferred alternative.

		Percentage difference of results for alternatives						
		Cooling water system			Accelerator technology	Feedstock Material	Radio-frequency power	Site location
Factor	Results for preferred alternative	Once-through cooling using river water	Cooling towers with groundwater makeup	K-Reactor cooling tower with river water makeup	Room temperature	Lithium-6 aluminum alloy	Inductive output tube	Alternate site
Annual MEI[a] dose from radiological discharges	**0.015** millirem	NC[b]	NC	NC	NC	NC	NC	NC
Annual MEI dose from resuspension of contaminated sediments	0.0013 millirem	+6,150%[d]	NC	-60%	NC	NC	NC	NC
Total annual MEI dose from liquid pathways	**0.016** millirem	**+49%**	NC	**NC**	NC	NC	NC	NC
Annual population dose from radiological discharges	**0.42** person-rem	NC	NC	NC	NC	NC	NC	NC
Annual population dose from resuspension of contaminated sediments	0.0035 person-rem	+6,150%[f]	NC	-60%	NC	NC	NC	NC
Total annual population dose from liquid pathways	**0.42** person-rem	+**51**%	NC	NC	NC	NC	NC	NC
Average annual temperature of liquid discharges	70°F	+18°F [g]	NC	NC	NC	NC	NC	NC
Maximum annual temperature of liquid discharges	88°F	+14°F	NC	+1°F	NC	NC	NC	NC
Average annual concentration of total dissolved solids in liquid discharges	190 milligrams per liter	-67%	-99%[c]	NC	NC	NC	NC	NC
Average annual concentration of total solids in liquid discharges	220 milligrams per liter	-67%	-99%	NC	NC	NC	NC	NC

a. MEI - maximally exposed individual.
b. NC = Difference in results between this alternative and the Preferred alternative is less than 5 percent.
c. Results for this alternative are several orders of magnitude less than that for the Preferred alternative, even though the designation “-99%” indicates only two orders of magnitude difference.
d. 0.081 millirem.
e. 0.096 millirem.
f. 0.22 person-rem.
g. Percent difference not meaningful for temperature.

Table 4-11. Estimated maximum concentrations at hypothetical worker location (640 meters) from APT operations of nonradiological air pollutants regulated by OSHA at the preferred APT site (milligrams per cubic meter).[a]

				Percentage difference of results for alternatives						
				Cooling water system			Accelerator technology	Feedstock Material	Radio-frequency power	Site location
Air emissions	Averaging time[b]	OSHA standard[b]	Results for Preferred alternative	Once-through cooling using river water	Cooling towers with groundwater makeup	K-Reactor cooling tower with river water makeup	Room temperature	Lithium-6 aluminum alloy	Inductive output tube	Alternate site[d]
Oxides of sulfur	8-hour TWA	13	0.0037	NC[c]	NC	NC	NC	NC	NC	NC
Total particulates	8-hour TWA	15	**0.0049**	NC	NC	NC	NC	-5%	NC	NC
Particulate matter (≤10 microns)	8-hour TWA	5	**0.0033**	NC	NC	NC	NC	NC	NC	NC
Carbon monoxide	8-hour TWA	55	0.060	NC	NC	NC	NC	NC	NC	NC
Oxides of nitrogen	Ceiling	9	**2.4**	NC	NC	NC	NC	NC	NC	NC
Lead	8-hour TWA	0.5	4.4×10^{-6}	NC	NC	NC	NC	NC	NC	NC
Beryllium	8-hour TWA	0.002	8.4×10^{-7}	NC	NC	NC	NC	NC	NC	NC
	Ceiling	0.005	$\mathbf{8.7 \times 10^{-6}}$	NC	NC	NC	NC	NC	NC	NC
Mercury	Ceiling	0.1	$\mathbf{1.1 \times 10^{-5}}$	NC	NC	NC	NC	NC	NC	NC
Ethyl Alcohol	8-hour TWA	1900	$\mathbf{4.5 \times 10^{-5}}$	NC	NC	NC	NC	-25%	NC	NC

a. Source: **Hunter (1997).**

b. Air pollutants regulated by OSHA under 29 CFR Part 1910. Averaging values listed are 8-hour time weighted averages (TWA) except those oxides of nitrogen that are not-to-be exceeded Ceiling Values. Beryllium has both an 8-hour TWA and a ceiling limit. Source: 29 CFR Part 1910.100.

[Chapter 4, Section 4.1.3.4 modifications to the Draft APT EIS]

Based on evolving design work for the accelerator, source terms have been modified. Section 4.1.3.4, Radiological Air Emissions, and Tables 4-12 and 4-13 have been modified to reflect the revised information. Although the source term is higher than estimated in the Draft EIS, the expected dose at the Site boundary is still small. In the Draft EIS, radiological dose was estimated at ground level; the revised calculations in the Final EIS assumes an 80 meter stack height.

Page 4-19, 2nd column, 9th paragraph through page 4-22, 1st column, 4th paragraph, including Tables 4-12 and 4-13, pages 4-20 and 4-21, are replaced with the following:

After determining the routine emission rates, DOE used the computer codes MAXIGASP and POPGASP to estimate radiological doses to the maximally exposed individual (MEI) and to the population surrounding the SRS. MAXIGASP and POPGASP are both site-specific computer programs, which means that meteorological parameters (e.g., wind speed and direction) and population distribution parameters (e.g., number of people surrounding the SRS, location of people in sectors around the Site) are integrated into the programs. Meteorology gathered at the SRS for the period from 1987 through 1991 (the most recent validated data set available) was used for the radiological dispersion model. Releases were assumed **to occur at a height of 80 meters, corresponding to the stack height.** The 1990 population census database was used to represent the population that lives within a 50-mile radius of the center of the SRS. For the APT airborne releases, the MEI would be at the SRS boundary in the north sector.

Although a large number of radionuclides would be emitted as a result of normal operations, a few would account for essentially all of the potential dose. For the Preferred alternative, radiological emissions are expected from the accelerator building, the target blanket building, and the Tritium Separation Facility. The APT facility is assumed to operate 24 hours a day, 365 days a year. Sources of radioactive emissions include activated air in the accelerator tunnel, which includes radionuclides such as argon-41 and carbon-11. A majority of the radionuclides emitted come from the target/blanket building, including some tritium and carbon-11, **and most of the argon-41**. Emissions also can result from fugitive sources such as minor leaks in system piping and other process leaks, as well as maintenance activities which require systems to be opened. Projected annual emissions for the radionuclides that are the major contributors to dose are presented in Table 4-12. **As can be seen in Table 4-12, APT operations would result in the release of tritium in both the elemental and oxide forms. Tritium oxide behaves like water and is easily absorbed into the human body while only a very small fraction of elemental tritium is absorbed. Therefore, when assessing the dose due to tritium, the effects of elemental tritium are negligible compared to tritium oxide.** Tritium emissions would produce the highest impact to the MEI, accounting for **87 percent** of the estimated dose, followed by argon-41, accounting for **12 percent** of the dose.

Table 4-12. Projected annual radionuclide emissions from routine operations of the APT facility (curies).[a]

Radionuclide	Annual emissions
Tritium (oxide)	**30,000**
Tritium (elemental)	**8,600**
Carbon-11	250
Argon-41	**2,000**

a. Source: Shedrow (1997a) **and England (1998a)**.

Table 4-13 presents the calculated maximum radiological doses from routine operations. According to these results, the calculated maximum committed effective dose equivalent to a hypothetical individual at the SRS boundary is **0.037 millirem** for each year of operations, which is well below the annual dose limit of 10 millirem from SRS atmospheric releases. None of the cooling water configurations con-

Table 4-13. Annual radiological doses from routine radiological air emissions from the APT.[a]

		Percentage differences of doses for alternatives						
		Cooling water system			Accelerator technology	Feedstock Material	Radio-frequency source	Site location
Receptor	Doses for Preferred alternative	Once-through cooling using with river water	Cooling towers with groundwater makeup	K-Reactor cooling tower with river water makeup	Room temperature	Lithium-6 aluminum alloy[c]	Inductive output tube	Alternate site
MEI dose (millirem)	**0.037**	NC[b]	NC	NC	NC	NC	NC	**+113%**
Population dose (person-rem)	**1.6**	NC	NC	NC	NC	**+7%**	NC	**+11%**
Worker dose (millirem)	**0.17**	NC	NC	NC	NC	**-40%**[d]	NC	**+7%**

a. **Derived from Simpkins (1998).**
b. NC = No change; difference in doses between this alternative and the Preferred alternative is less than 5 percent.
c. Includes radiological emissions from operation of the Tritium Extraction Facility.
d. Does not include dose from TEF operation to workers (0.24 millirem) as it is in a different location.

tribute to the annual dose; likewise, using room temperature operation or using inductive output tubes does not affect the dose results. The use of lithium-6 feedstock material would necessitate operation of the Tritium Extraction Facility which would have additional radiological emissions. The estimated dose to the MEI for the Lithium-6 Feedstock Material alternative is **0.041 millirem**, of which **34 percent** is attributable to the Tritium Extraction Facility.

Tritium is estimated to be the major contributor to the offsite population dose with a calculated dose of 1.6 person-rem per year for the preferred configuration. The population dose associated with the use of a lithium-6 feedstock material is **1.8 person-rem with 0.66 person-rem or 38 percent** attributable to the Tritium Extraction Facility in H-Area.

Table 4-13 also lists the onsite worker dose (hypothetical worker 640 meters downwind) resulting from radiological releases. The estimated maximum committed effective dose equivalent to the worker from annual releases is **0.17 millirem** for each year of operation. As with the MEI dose, using the lithium-6 feedstock material affects the radiological impacts. The dose for the Lithium-6 Feedstock Material alternative decreases the dose from the Preferred alternative by **40 percent**. Doses would decrease under this alternative because the Tritium Extraction Facility is likely to emit less Tritium oxide than the Tritium Separation Facility (5,000 curies per year versus **9,600 curies** per year) and is farther from the SRS boundary. In the event the Tritium Separation and Tritium Extraction Facilities are consolidated at the APT site, administrative controls would limit the curie content of the facilities.

As with the nonradiological impacts, radiological doses from the alternate site would be slightly greater due to the site's location in relation to the SRS site boundary. The calculated committed effective dose equivalent to the MEI residing at the SRS boundary **is 0.079 millirem** for each year of operation, which is well below the annual dose limit of 10 millirem from SRS atmospheric releases (Table 4-13). The offsite population does from APT operations at the alternate site would be **1.8 person-rem** per year.

For the alternate site, the onsite worker dose resulting from radiological releases would be 0.18 millirem per year. This dose is slightly greater than the dose reported in Table 4-13 because of terrain variations between the two sites.

None of the alternatives for either the preferred or alternate site would result in concentrations or radiological doses that would exceed the regulatory limits. Section 4.2 describes the potential health effects of these releases on members of the public and workers for the alternate site.

[Chapter 4, Section 4.1.4 modification to the Draft APT EIS]

Section 4.1.4 of the Draft EIS evaluated the potential impacts of the construction and operation of the APT on SRS land use and infrastructure (e.g., roads, powerlines, and piping). Text has been modified to describe the actions DOE could take if at some time in the future, because of age and condition, the existing river water system was found to be inadequate.

<u>Page 4-22, 2nd column, 3rd paragraph replaced with the following</u>:

Pipeline construction would be required to carry river water to the preferred site (approximately 18,000 feet); for the alternate site about 24,600 feet. The groundwater makeup alternative would require additional land disturbance activities to install a well system.

Each alternative cooling water design using water from the Savannah River would make use of either the existing river water system or a new water supply system. If a new supply system is required, the new system could be placed in the existing river water corridor or the existing system piping could be used as a sleeve for the new piping. Prior to installing any new system elements, DOE would evaluate the potentially affected areas for the presence of threatened or endangered species,

archaeological sites, and other sensitive resources.

> **[Chapter 4, Section 4.1.5 modification to the Draft APT EIS]**
>
> The discussion and definition of Greater-Than-Class-C (GTCC) Waste in the text box in Section 4.1.5 has been modified per comment L3-05 and L4-04 and to reflect current DOE waste guidance. The waste designated as GTCC in the Draft APT EIS will more accurately be referred to as APT special case or high concentration waste under evaluation.

Page 4-25, 2nd column, text box is revised to contain the following:

The Resource Conservation and Recovery Act (RCRA) is the Federal statute governing the management of hazardous waste from generation to disposal. Hazardous waste includes such materials as waste solvents, toxic metals, and industrial process waste products.

The classification of radioactive wastes is based on the concentration of short- and long-lived radionuclides. APT special case or high concentration wastes under evaluation contain long-lived radionuclides **and would remain hazardous for an extended period of time**. Classes A and B include radioactive wastes with concentrations of short-lived and perhaps some long-lived radionuclides.

> **[Chapter 4, Section 4.1.5 modification to the Draft APT EIS]**
>
> Tables 4-15 and 4-17, page 4-26 and 4-28, Waste Generation and Treatment, Storage, and Disposal, respectively of the Draft EIS, and the associated text have been modified to reflect revised waste generation estimates. Industrial wastewater estimates have been added to the revised Table 4-15. Waste generation estimates for the design variations can be found in Section 4.

Page 4-25, 1st column, 1st paragraph and Tables 4-15 and 4-16, pages 4-26 and 4-27 are replaced with the following:

Construction. The construction phase would generate nonhazardous, nonradioactive wastes, including sanitary solid wastes, construction debris (mixed rubble, metals, plastics), and sanitary wastewater. Table 4-15 lists estimated maximum annual quantities of waste for construction of the Preferred alternative and compares it with the other alternatives.

Page 4-25, 2nd column, 4th paragraph through page 4-27, 1st column, 1st paragraph and Table 4-17, page 4-18 are replaced with the following:

DOE would manage APT wastes for treatment and disposal according to waste type, using SRS and offsite waste treatment, storage, and disposal facilities. Table 4-17 lists the waste types and quantities destined for treatment, storage, and disposal facilities and the subsequent impact to the facility divided by preferred configuration and alternative.

> **[Chapter 4, Section 4.2.12 modifications to the Draft APT EIS]**
>
> Table 4-22 and associated text were revised to reflect the changes in radioactive source terms for both waterborne and airborne effluents discussed earlier in the text. Although the source terms and consequences are higher than estimated in the Draft EIS, the expected impacts are still small.

Page 4-36, 1st column, 4th paragraph and Table 4-22, page 4-37 are replaced with the following:

Table 4-22 lists projected health impacts from routine operation of the APT facilities. The table lists radiological dose information and traffic information for the preferred configuration; it also lists changes in the expected impacts for the alternatives.

Table 4-15. Waste generation and impacts comparison for preferred configuration and alternatives.[a]

Environmental factor (waste type)	Annual waste quantities for Preferred alternative	Percentage differences of waste quantities for alternatives						
		Cooling water system			Accelerator technology	Feedstock Material	Radio-frequency power	Site location
		Once-through cooling using river water	Cooling towers with groundwater makeup	K-Reactor cooling tower with river water makeup	Room temperature	Lithium-6 aluminum alloy	Inductive output tube	Alternate site
Construction wastes[a] maximum based on construction schedule								
Sanitary solid	560 cubic meters	NC[b]	NC	NC	-9%	NC	NC	NC
Construction debris	30,000 cubic meters	NC	NC	NC	NC	NC	NC	NC
Industrial wastewater	**3.6 million gallons**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**	**NC**
Sanitary wastewater	1.5 million gallons	NC	NC	NC	-9%	NC	NC	NC
Operations waste								
Sanitary solid	1,800 metric tons	NC	NC	NC	NC	NC	NC	NC
Industrial	3,800 metric tons	NC	NC	NC	NC	NC	NC	NC
RCRA hazardous	1.0 cubic meter	NC	NC	NC	NC	NC	NC	NC
Radioactive wastewater	140,000 gallons	NC	NC	NC	NC	NC	NC	NC
Low-level radioactive waste[c]	1,400 cubic meters	NC	NC	NC	NC	**+18%**	NC	NC
High concentration low-level radioactive waste under evaluation (special case waste)	2.5 cubic meters	NC	NC	NC	NC	NC	NC	NC
Mixed waste[c]	1.0 cubic meter	NC	NC	NC	NC	**-18%**	NC	NC
High concentration mixed waste under evaluation	12 cubic meters	NC	NC	NC	NC	+25%	NC	NC
Sanitary wastewater	**3.2 million gallons**	NC	NC	NC	**+5**	**NC**	NC	NC
Nonradioactive process wastewater	920 million gallons	+2,000%[d]	NC	NC	+37%	NC	-5%	NC

a. **Sources: England (1998b,c); DeCamp (1998).**
b. NC = Difference in impacts between this alternative and the Preferred alternative is less than 5 percent.
c. Excluding High concentration waste.
d. 19 billion gallons.

Table 4-17. Impacts on waste treatment, storage, and disposal facilities for operation of preferred configuration and alternatives.[a,b]

Waste facility[c]	Waste quantity (Preferred alternative)	Waste type[d]	Operating capacity	Impact for preferred configuration	Impact for room temperature	Impact for Lithium-6 Feedstock Material
CIF	500 m^3/yr	Incinerable LLRW, incinerable MW	9,500 m^3/yr[e,f]	5 percent of capacity	N/C[g]	N/C
Onsite compactor	75 m^3/yr	LLRW	1,600 m^3/yr	5 percent of capacity	N/C	**+24%**
E-Area LAW vault	33,000 m^3 total[h]	LLRW, compacted LLRW, LLRW ash	31,000 m^3/ vault[e]	1.1 vault	N/C	+8%
E-Area ILTV	2,100 m^3 total[h]	LLRW with Tritium	5,300 m^3/vault[e]	0.4 vault	N/C	+6%
Storage building	600 m^3 total[h]	**MW, MW ash, high concentration MW**	620 m^3/bldg.[e]	1 building	N/C	+20%
Three Rivers Landfill	5,600 metric tons per year	Sanitary solid, industrial solid	900 metric tons per day[i]	6.2 days per year	N/C	N/C
Central Sanitary WTF	**3.2 million gallons**	Sanitary wastewater	1 million gallons per day	**3.2 days**	N/C	N/C

a. Source: **England et al. (1997**) and **England (1998b,c)**.
b. Impacts for other alternatives would not vary from the Preferred alternative impacts.
c. Waste facilities: CIF = Consolidated Incineration Facility; LAW = Low Activity Waste; ILTV = Intermediate Level Tritium Vaults; WTF = Wastewater Treatment Facility.
d. Waste types: LLRW = low-level radioactive wastes; MW = mixed waste.
e. Source: DOE (1995b).
f. All waste considered as solid feed.
g. N/C = difference within 5 percent.
h. 40-year total.
i. Source: DOE (1995a).

[Chapter 4, Section 4.2.2.4 modification to the Draft APT EIS]

Section 4.2.2.4, Threatened and Endangered Species, is revised in response to comments L2-05 and L2-06. The analysis has been broadened to provide a more comprehensive assessment of the potential impacts on eagles.

DOE's evaluation of impingement and entrainment of shortnose sturgeon during times of large cooling water withdrawals in studies conducted in 1983 and 1990 indicated nominal impacts to this species. Consequently, APT operations at considerably lesser flow would not be expected to impact the species. No text changes are included.

Page 4-56, 1st column, 3rd paragraph is replaced with the following:

As noted in Section 3.4.5, bald eagles forage around Par Pond and the pre-cooler ponds. When P-Reactor was operational, thermal fish kills on Pond C attracted bald eagles (Mayer et al. 1986). Under the preferred cooling water alternative, Mechanical-Draft Cooling Towers with River Water Makeup, fish kills (beyond those that occur in any natural body of water) would not be expected. Operation of the APT facilities and discharge of cooling water under the Once-Through Cooling Water alternative could result in fish kills in Ponds 2 and 5 in late summer or in other seasons if the accelerator were restarted after an extended outage.

Table 4-22. Impacts on public health from normal operation of APT facilities.

Factor	Impacts for Preferred alternative	Percentage differences of impacts for alternatives						
		Cooling water system			Accelerator technology	Feedstock Material	Radio-frequency power	Site location
		Once-through cooling using river water	Cooling towers with groundwater makeup	K-Reactor cooling tower with river water makeup	Room temperature	Lithium-6 aluminum alloy	Inductive output tube	Alternate site
Annual radiation dose to MEI from APT emissions (millirem/year)[a,b]	**0.053**	**+150%**	NC	NC	NC	NC	NC	**+97%**
Annual radiation dose to MEI from transportation of radioactive material (millirem/year)	2.8×10^{-6}	NC[c]	NC	NC	NC	+11%	NC	NC
Total annual radiation dose to MEI from APT operations (millirem/year)	**0.053**	**+150%**	NC	NC	NC	NC	NC	**+97%**
Annual radiation dose to population from APT emissions (person-rem/year)	**2.0**	+11%	NC	NC	NC	**+6%**	NC	**+9%**
Annual radiation dose to population from transportation of radioactive material (person-rem/year)	1.1	NC	NC	NC	NC	NC	NC	NC
Total annual radiation dose to population from APT operations (person-rem/year)	**3.1**	**+7%**	NC	NC	NC	NC	NC	**+6%**
Estimated number of cancer fatalities from annual population dose	**0.0016**	**+7%**	NC	NC	NC	NC	NC	**+6%**
Estimated traffic accident fatalities per year on roads near SRS	0.12	NC	NC	NC	NC	NC	NC	-18%

a. Reported as the sum of the dose from air emissions and liquid emissions, even though the MEI for the two emissions are in different locations.
b. MEI - maximally exposed individual.

Based on Par Pond studies (DOE 1997), fish in the pre-cooler ponds are assumed to contain levels of mercury and cesium-137 that are somewhat higher than background. If thermal fish kills were to occur in Ponds 2 and 5, bald eagles would likely feed on the dead fish. However, potential harm to bald eagles from ingesting contaminated fish would be mitigated by the fact that these fish kills would be infrequent and would most likely occur in late summer, when eagles are least likely to be found on the SRS (SRI 1998).

Further, eagles foraging in the area would be feeding on dead, dying, and living fish from the pre-cooler ponds and Par Pond even in the absence of large-scale thermal fish kills. As a result, thermal kills would simply reduce the energy costs of capturing these fish. It's not clear that significantly more contaminated prey would be consumed. Eagles are known to gorge and fast, depending on the availability of food (Stalmaster 1987), thus gorging on easily obtainable dead fish might simply mean eating less contaminated fish in ensuing days than would have been consumed under normal circumstances.

An Ecological Risk Assessment (DOE 1997) examined potential risks to bald eagles from contaminants (mercury and radionuclides) in Par Pond fish and found a moderate level of risk from mercury, if a number of conservative assumptions were made. The risk assessment assumed that an eagle would: (1) forage on Par Pond year-round, (2) feed exclusively on Par Pond fish (bass) containing the maximum measured concentration of mercury, and (3) absorb 100 percent of the mercury ingested with fish. Using more realistic assumptions (an eagle is present for nine months and eats fish containing the average measured concentration of mercury), the risk assessment concluded that "it is unlikely that mercury in Par Pond fish poses a significant potential risk to the bald eagle." Similarly, the risk assessment concluded that the potential ecological risks to avian predators (specifically the bald eagle) from radiological contaminants in Par Pond "can be considered to be very small."

[Chapter 4, Section 4.4.2.5 modification to the Draft APT EIS]

The discussion of human health impacts associated with electricity generation, page 4-74, 2nd Column, contained a typographical error which results in a much higher potential health risk than is actually the case. The Draft EIS reported a "death from coal-fired electricity generation" coefficient of 100 deaths per gigawatt hour. The coefficient should be 100 deaths per gigawatt year.

<u>Page 4-74, 2nd column, 2nd paragraph, lines 16 through 28 are replaced with the following</u>:

Applying the result of previous studies conducted in the United States (which suggest that 70,000 persons die prematurely through air pollution), and assuming that one-third arise from coal-fired electricity generation, produces a coefficient of 100 deaths per gigawatt **year** (Wilson 1996). The health effects from the operation of a gas-fired facility would be less because the gaseous and particulate emissions would be much less than those from a coal-fired plant. The Polk EIS (EPA 1994) discusses health effects associated with natural-gas-fired turbines.

Chapter 5. Modifications – Cumulative Impacts

[Chapter 5 modifications to the Draft APT EIS]

Chapter 5, Cumulative Impacts, has been modified to reflect changes noted elsewhere in this document and includes potential new missions at the Savannah River Site, management of scrub alloys currently stored at the Rocky Flats Site and surplus plutonium disposition. It also removes the impacts associated with the River Water System to reflect the recent Record of Decision. Certain other enhancements to Chapter 5 of the Draft APT EIS have also been made in accordance with a handbook recently prepared by the Council on Environmental Quality providing guidance on the preparation of cumulative impacts assessments. The following text modifies the introduction to cumulative impacts starting on page 5-1 of the Draft APT EIS.

Page 5-1, 1st column, 1st paragraph through page 5-2, 1st column, last bullet is replaced with the following:

The Council on Environmental Quality (CEQ) regulations that implement the procedural provisions of the National Environmental Policy Act (NEPA) define cumulative effects as impacts on the environment that result from the addition of the incremental impact of the action to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes the actions (40 CFR **Part** 1508.7). The U.S. Department of Energy (DOE) based the cumulative impacts analysis in this chapter on actions associated with the construction and operation of a linear accelerator to produce tritium at the Savannah River Site (SRS), other actions associated with onsite activities, and offsite activities with the potential to cause **cumulative** environmental impacts.

Based on the examination of the potential direct and indirect impacts of APT actions coupled with other actions in the region, DOE determined that the cumulative impacts associated with the following disciplines are the most significant: (1) public and worker health, (2) air resources, (3) water resources, (4) waste generation, (5) utilities and energy consumption, (6) ecological resources, and (7) socioeconomics resources.

The cumulative impacts of past actions have either passed through the environment or are captured in existing baseline information. For example, Par Pond contamination levels exist due to past reactor operations. The potential impact of resuspending cesium due to APT water discharges is an incremental impact added to impacts associated with past operations.

Cumulative impact assessment is based on both geographic (spatial) and time (temporal) considerations. As mentioned above, past impacts are captured in the existing environmental baseline. Geographic boundaries vary by discipline depending upon the time an effect remains in the environment, the extent to which the effect can migrate, and the magnitude of the potential impact. Based on these factors, DOE has determined that for impacts to air, water, and waste generation, a 50-mile radius surrounding SRS is the potential impact zone. For water releases, the downstream population that uses the Savannah River as its source for drinking water is included in the project impact zone. The project impact zone for socioeconomic resources is a six county region in South Carolina and Georgia where approximately 90 percent of the SRS workforce lives: Aiken, Allendale, Bamberg, and Barnwell Counties in South Carolina, and Columbia and Richmond Counties in Georgia.

Nuclear facilities within a 50-mile radius of SRS include Georgia Power Company's Vogtle Electric Generating Plant across the Savannah River from SRS; Chem-Nuclear Services, Inc., a commercial low-level waste burial site just east of SRS; and Starment CMI, Inc. (formerly Carolina Metals, Inc.). Radiological impacts from the operation of the Vogtle Electric Generating Plant, a two-unit commercial nuclear power plant are minimal, but DOE has factored them into the analysis. The South Carolina Department of Health and Environmental Control Annual Report indicates that operation of the Chem-Nuclear Services facility and the Starment CMI facility do not noticeably impact radiation levels in air or liquid pathways in the vicinity of the SRS. Therefore, they are not included in this assessment.

The counties surrounding SRS have numerous existing (e.g. generating stations, textile mills, paper product mills, and manufacturing facilities) and planned (e.g., Bridgestone Tire and Hankook Polyester) industrial facilities with permitted, or to be permitted, air emissions and discharges to surface waters. Because of the distance between the SRS and the private industrial facilities there is little opportunity for interactions of plant emissions, and no notable cumulative impact or air or water quality. Construction and operation of Bridgestone Tire and Hankook Polyes-

ter could have some effect, cumulatively, on regional employment.

DOE has also evaluated the impacts from its own existing and future actions by examining impacts to resources and the human environment as described in Section 1.6. The analysis is based on information contained in the referenced documents for pertinent actions which are occurring, or could occur, at the SRS:

- *Savannah River Site Spent Nuclear Fuel Management Environmental Impact Statement (61 FR 69085).* Although a Notice of Intent has been prepared, this EIS has not yet been issued. Information used in this chapter is based on maximum values utilizing preliminary report data (Young 1997). The proposed action of this EIS is to provide additional capability at SRS to receive and prepare spent nuclear fuel for ultimate disposal at a Federal geologic repository. Specific actions needed to accomplish this include construction and operation of a Treatment and Storage Facility, a Treatment Facility, and additional dry storage capacity.

- *Defense Waste Processing Facility Supplemental Environmental Impact Statement (DOE 1994a).* **The selected alternative in the Record of Decision (ROD) is the completion and operation of the Defense Waste Processing Facility to immobilize high-level radioactive waste at the SRS. The facility is currently in operation.**

- *Savannah River Site Waste Management Final Environmental Impact Statement (DOE 1995a).* The selected alternative in the ROD involves the treatment and minimization of radioactive and hazardous wastes at the SRS.

- *Programmatic Environmental Impact Statement for Tritium Supply and Recycling (DOE 1995b).* DOE's decision is either to pursue the purchase of an existing commercial nuclear reactor or irradiation services, or to build an accelerator to produce tritium. DOE selected the SRS as the location for an accelerator, if it decides to build one. In addition, DOE would upgrade the tritium recycling facilities to support either option. **However, these issues are addressed separately in the following discussion on the Environment Assessment for the Tritium Facility Modernization and Consolidation Project at the Savannah River Site (DOE 1997c). This document has also summarized in Part C, Chapter 4, Section 4.0 modifications to the Draft APT EIS the potential on-site and off-site impacts associated with producing tritium at a commercial reactor site. As noted previously, the No Action alternative for this EIS is the commercial light-water reactor track. Consequently, the SRS impacts for No Action would include construction and operation of the tritium extraction facility (TEF), transport of material to the SRS, and impacts associated with reactor operations. The cumulative impacts of constructing and operating the TEF is captured in this document. The cumulative impacts of reactor operations are presented in the Draft CLWR EIS (DOE 1998b).**

- *Environmental Impact Statement – Interim Management of Nuclear Materials (DOE 1995c).* **DOE is implementing the selected scenarios for most of the nuclear materials discussed in that EIS with the exception of the "comparative management scenario" alternatives for H-Canyon Plutonium-239 solutions (process to metal), Mark-16 and –22 fuels (process and storage for vitrification in the Defense Waste Processing Facility), and other aluminum-clad fuel targets (processing and storage for vitrification).**

- *Disposition of Surplus Highly Enriched Uranium Final Environmental Impact Statement (DOE 1996).* The cumulative impacts analysis incorporates the Maximum Commercial Use-Blending Disposition at SRS Alternative.

- ***Construction and Operation of a Tritium Extraction Facility at the Savannah River***

Site Draft Environmental Impact Statement (DOE 1998a). **The cumulative impact analysis is based upon information in the Draft TEF EIS. For purposes of this document, the potential impacts associated with the Tritium Extraction Facility also would be factored in the No Action alternative impacts for the APT.**

- ***Draft Environmental Impact Statement on Management of Certain Residues and Scrub Alloy Stored at the Rocky Flats Environmental Technology Site (DOE 1997b).*** **If material separation is conducted at the SRS, it would be done utilizing a chemical process in F and H Canyons. Any plutonium resulting from separation processes would be placed in safe and secure storage pending disposition.**

- ***Environmental Assessment for the Tritium Facility Modernization and Consolidation Project at the Savannah River Site (DOE 1997c).*** **This environmental assessment addresses the potential impacts of consolidating the tritium activities currently performed in Building 232-H into the newer Building 234-H. Tritium extraction functions would be transferred to TEF, under the Preferred alternative. The overall impact would be to reduce emissions by up to 50 percent. Another effect would be to reduce the amount of low-level waste generated. Effects on other resources would be negligible. Therefore, impacts from these actions have not been included in this cumulative impacts analysis.**

- ***Surplus Plutonium Disposition Environmental Impact Statement (DOE 1998b).*** **This EIS analyzes the activities necessary to implement DOE's disposition strategy for site surplus plutonium. SRS is the preferred site for a mixed-oxide fuel production facility.**

[Chapter 5, Section 5.1 modifications to the Draft APT EIS]

The estimated cumulative radiological doses to human receptors from exposure to waterborne sources downstream from the SRS has been updated pursuant to the modifications presented elsewhere in this document. Additionally, information has been added to Table 5-1, page 5-3 of the Draft APT EIS, to include the potential impacts associated with the Rocky Flats scrub alloy and surplus plutonium disposition, and to remove the impacts associated with the River Water System. The ROD for the River Water EIS selected the No Action alternative. Consequently, the Department is maintaining L-Lake levels and the potential impacts identified with allowing lake levels to decline will not occur.

Page 5-2, 2nd column, 3rd and 4th paragraphs, and Table 5-1 on page 5-3 are replaced with the following:

Table 5-1 summarizes the estimated cumulative radiological doses to human receptors from exposure to waterborne sources downstream from the SRS. Liquid effluents from the Site could contain small quantities of radionuclides that would be released to SRS streams that are tributaries of the Savannah River. The exposure pathways considered in this analysis included drinking water, fish ingestion, shoreline exposure, swimming, and boating. As discussed in Section 4.1.2, the Preferred alternative would result in an annual radiological dose of **0.000015** rem (or **0.015** millirem) to the maximally exposed individual at the SRS boundary from liquid releases.

The estimated cumulative dose from all SRS activities to the maximally exposed member of the public from liquid releases would be **0.00029** rem (or **0.29** millirem) per year, well below the regulatory standard of 4 millirem per year (40 CFR Part 141). Adding the population doses associated with current and projected SRS ac-

Table 5-1. Estimated average annual cumulative radiological doses and resulting health effects to offsite population from liquid releases.

Activity	Offsite population: Maximally exposed individual – Dose[a]	Offsite population: Maximally exposed individual – Fatal cancer risk[b]	Offsite population: 50-mile population – Collective dose[c]	Offsite population: 50-mile population – Latent cancer fatalities[d]
Accelerator Production of Tritium	**1.5×10^{-5}**	**8.2×10^{-9}**	**0.42**	**2.1×10^{-4}**
Tritium Extraction Facility[e]	0	0	0	0
Defense Waste Processing Facility[g]	0	0	0	0
Plant Vogtle[h]	5.4×10^{-5}	2.7×10^{-8}	0.0025	1.3×10^{-6}
Surplus HEU disposition[i]	0	0	0	0
Interim Management of Nuclear Materials[k]	**2.4×10^{-5}**	**1.2**$\times10^{-8}$	**0.09**	**4.5×10^{-5}**
Management of Spent Nuclear Fuel[n]	5.7×10^{-5}	2.9×10^{-8}	0.19	9.5×10^{-5}
1995 SRS practices[m]	1.4×10^{-4}	7.0×10^{-8}	**2.2**	**1.1×10^{-3}**
Rocky Flats Pu Residue[o]	**0**	**0**	**0**	**0**
Surplus Plutonium Disposition[p]	**0**	**0**	**0**	**0**
Total	**2.9×10^{-4}**	**1.5×10^{-7}**	**2.9**	**1.4×10^{-3}**

a. Dose in rem.
b. Probability of fatal cancer.
c. Dose in person-rem.
d. Incidence of excess fatal cancers.
e. Source: DOE (1998a).
f. **Deleted**
g. Source: DOE (1994a).
h. Source: NRC (1996).
i. Source: DOE (1996a); HEU = highly enriched uranium.
j. **Deleted**
k. Source: DOE (1995c).
l. Deleted.
m. Source: Arnett and Mamatey (1996).
n. Source: Young (1997), maximum of options.
o. Source: DOE (1997b).
p. Source: DOE (1998b).

tivities would yield a cumulative annual dose of **2.9** person-rem from liquid sources. This translates into **0.0014** latent cancer fatality for each year of exposure of the 620,000-person population living within a 50-mile radius of the SRS.

[Chapter 5, Section 5.2 modifications to the Draft APT EIS]

The estimated cumulative concentrations of nonradiological air pollutants have been updated pursuant to the modifications presented elsewhere in this document. Additionally, information has been added to Table 5-2 and text modified the Draft APT EIS, to include the potential impacts associated with the Rocky Flats scrub alloy and surplus plutonium disposition, and to remove the impacts associated with the River Water System.

<u>Page 5-3, 2nd column, 1st paragraph and Table 5-2 on page 5-4 are replaced with the following</u>:

Table 5-2 compares the cumulative concentrations of nonradiological air pollutants from the SRS to Federal and state regulatory standards. The listed values are the maximum modeled concentrations that could occur at ground level at the Site boundary. The data demonstrates that total estimated concentrations of nonradiological air pollutants from the SRS, including the contributions from the SRS **as a whole and including APT,** would be below the regulatory standards at the Site boundary.

Table 5-2. Estimated maximum nonradiological cumulative ground-level concentrations of criteria and toxic pollutants (micrograms per cubic meter) at SRS boundary.

	Pollutant								
	Carbon monoxide	Carbon monoxide	Nitrogen oxides	Sulfur dioxide	Sulfur dioxide	Sulfur dioxide	Particulate matter (<10 microns)	Particulate matter (<10 microns)	Total supended particles
Averaging time	1 hr	8 hr	Annual	3 hr	24 hr	Annual	24 hr	Annual	Annual
Waste Management[a]	31	27	0.79	3.8	0.81	0.05	4.6	0.1	2.0
Interim Management of Nuclear Materials[b]	47	11	1.7	0.027	0.0061	0.00038			
Surplus HEU disposition[c]	0.14	0.07	0.01	0.71	0.32	0.02	<0.01	<0.01	0.05
SRS baseline[d]	5,000	630	8.8	690	220	16	81	4.8	43
Management of Spent Nuclear Fuel[e]	9.8	1.3	3.4	0.98	0.13	0.02	0.13	0.02	0.02
Tritium Supply and Recycling[f]	0.8	0.4	0.1	3.8	1.7	0.1	0.4	0.02	<0.01
Tritium Extraction Facility[d]	3.6	0.45	0.0055	0.088	0.001	0.00009	0.01	0.00009	0.00016
Rocky Flats Pu Residue[g]	NA	NA	NA	NA	NA	NA	NA	NA	NA
Accelerator Production of Tritium	6.1	0.76	0.0091	0.13	0.016	0.00014	0.016	0.0003	0.00057
Surplus Plutonium Disposition[h]	1.3	0.34	0.041	2.8	1.1	0.078	0.042	0.0026	0.0026
Total	5,100	670	15	700	220	16	86	4.9	45
Regulatory standard	40,000	10,000	100	1,300	365	80	150	50	75
Percent of standard	13	6.7	15	54	60	21	57	9.9	61

a. Source: DOE (1995a).
b. Source: DOE (1995c).
c. Source: DOE (1996a); HEU-highly enriched uranium.
d. Source: DOE (1998a).
e. Source: Young (1997).
f. Source: DOE (1995b).
g. Source: DOE (1997b).
h. Source: DOE (1998b).

[Chapter 5, Section 5.2 modification to the Draft APT EIS]

The estimated cumulative radiological doses have been updated pursuant to the modifications presented elsewhere in this document. Additionally, text has been modified and information has been added to Table 5-3 of the Draft APT EIS, to include the potential impacts associated with the Rocky Flats scrub alloy and surplus plutonium disposition, and to remove the impacts associated with the River Water System.

Page 5-4, 1st column, sentences 1 and 2 and Table 5-3 on page 5-5 have been replaced with the following:

DOE also evaluated the cumulative impacts of airborne radioactive releases in terms of dose to a maximally exposed individual at the SRS boundary. Table 5-3 lists the results of this analysis, using 1995 emissions (1992 for Plant Vogtle) as the SRS baseline.

[Chapter 5, Section 5.2 modification to the Draft APT EIS]

Two commenters, M1-03 and M1-10, expressed concern over the electricity required to operate the APT, the consequent use of fossil fuels, and the possible contribution to the greenhouse effect. As noted in the response, a discussion of the greenhouse effect has been added to end of Section 5.2 of the Draft APT EIS.

Page 5-4, 2nd column, after 1st paragraph insert the following:

In addition to these airborne releases, the generation of electricity to power the APT project would result in the release of greenhouse gases from the combustion of fossil fuels. It is estimated that the additional carbon dioxide released from power generation for APT would raise the total emissions for the United States by less than 0.07 percent and globally by less than 0.015 percent for all electricity alternatives analyzed.

[Chapter 5, Section 5.2 modification to the Draft APT EIS]

The estimated cumulative volumes of all classifications of waste that could be generated at the SRS have been updated pursuant to the modifications presented elsewhere in this document. Additionally, information has been added to Table 5-4 of the Draft APT EIS, to include the potential impacts associated with the Rocky Flats scrub alloy and surplus plutonium disposition.

Page 5-4, 2nd column, 2nd paragraph through page 5-6, 1st column, 1st paragraph and Table 5-4 on page 5-5 replaced with the following:

Table 5-4 lists cumulative volumes of high-level, low-level, transuranic, hazardous, and mixed wastes that the SRS would generate. The values are based on the SRS 30-year expected waste forecast (WSRC 1994). It also lists waste forecasts for the APT Preferred alternative. The 30-year waste forecast is based on operations waste **forecasted for** existing generators and the following assumptions: secondary waste from the Defense Waste Processing Facility, In-Tank Precipitation, and Extended Sludge Processing operations addressed in the DWPF EIS (DOE 1994a); high-level waste volumes based on the selected option for the F-Canyon Plutonium Solutions EIS (DOE 1994b) and the Interim Management of Nuclear Materials EIS (DOE 1995c); some investigation-derived wastes handled as hazardous waste in compliance with the Resource Conservation and Recovery Act; purge water from well sampling handled as hazardous waste, and continued receipt of small amounts of low-level waste from other DOE facilities and Naval nuclear operations. Waste generated from decontamination and decommissioning and planned environmental restoration projects are not included in the operations waste forecast.

The estimated quantity of waste from operations in this forecast during the next 30 years would be 600,000 cubic meters. In addition, waste associated with environmental restoration and de-

Table 5-3. Estimated average annual cumulative radiological doses and resulting health effects to offsite population from airborne releases.

Activity	Offsite population: Maximally exposed individual: Dose[a]	Fatal cancer risk[b]	50-mile population: Collective dose[c]	Latent cancer fatalities[d]
Accelerator Production of Tritium	3.**7**×10^{-5}	1.**9**×10^{-8}	1.**6**	**8**.0×10^{-4}
Tritium Extraction Facility[e]	**2.0**×10^{-5}	**1.0**×10^{-8}	0.**77**	**3**.9×10^{-4}
Defense Waste Processing Facility[g]	1.0×10^{-6}	5.0×10^{-10}	0.071	**3.6**×10^{-6}
Plant Vogtle[h]	**5.4×10^{-7}**	**2.7×10^{-10}**	0.042	2.1×10^{-5}
Surplus HEU disposition[i]	**2.5×10^{-6}**	**1.3×10^{-9}**	**0.16**	**8.0×10^{-5}**
Interim Management of Nuclear Materials[k]	**9.7**×10^{-4}	**4.9**×10^{-7}	**40**	**0.02**
Management of Spent Nuclear Fuel[n]	1.5×10^{-5}	7.5×10^{-9}	0.56	2.8×10^{-4}
1995 SRS activities[m]	**5.0**×10^{-5}	**2.5**×10^{-8}	**2.8**	**0.0014**
Rocky Flats Pu Residue[o]	**5.7×10^{-7}**	**2.8×10^{-10}**	**0.0062**	**3.1×10^{-6}**
Surplus Plutonium Disposition[p]	**4.0×10^{-6}**	**2.0×10^{-9}**	**1.6**	**8.0×10^{-4}**
Total	**1.1×10^{-3}**	**5.5×10^{-7}**	**48**	**0.024**

a. Dose in rem.
b. Probability of fatal cancer.
c. Dose in person-rem.
d. Incidence of excess fatal cancers.
e. Source: DOE (1998a).
f. Source: DOE (1995a).
g. Source: DOE (1994a).
h. Source: NRC (1996).
i. Source: DOE (1996a); HEU = highly enriched uranium.
j. **Deleted.**
k. Source: DOE (1995c).
l. **Deleted.**
m. Source: Arnett and Mamatey (1996).
n. Source: Young (1997, maximum of options.
o. Source: DOE (1997b).
p. Source: DOE (1998b).

Table 5-4. Estimated cumulative waste generation from SRS (cubic meters).

	High-level	Low-level	Hazardous/ mixed	Transuranic	Total
Waste Management[a]	150,000	340,000	90,000	18,000	600,000
Tritium Extraction Facility[b]	0	9,300	130	0	9,500
Surplus HEU disposition[d]	0	2,900	4,000	0	7,000
Rocky Flats Pu Residue[e]	32	200	0	300	530
Management of Spent Nuclear Fuel[f]	11,000	140,000	270	3,700	150,000
Accelerator Production of Tritium	0	42,000	390	0	42,000
Surplus Plutonium Disposition[g]	0	150	37	160	350
D&D wastes[h,i]	0	100,000	310	0	100,310
Total	160,000	530,000	95,000	22,000	1,500,000

a. Source: DOE (1995a).
b. Source: DOE (1998a).
c. Deleted.
d. Source: DOE (1996a); HEU = highly enriched uranium.
e. Source: DOE (1997).
f. Source: Young (1997b).
g. Source: DOE (1998b).
h. Decontamination and decommissioning (including environmental restoration.
i. Source: England et al. (1997).

contamination and decommissioning activities would have a 30-year expected forecast of 100,310 cubic meters (England et al. 1997). Therefore, the total amount of waste from SRS activities (exclusive of APT operation) is estimated to be approximately 1,300,000 cubic meters.

[Chapter 5, Section 5.4 modification to the Draft APT EIS]

The estimated cumulative consumption of electricity from activities at the SRS has been updated pursuant to the modifications presented elsewhere in this document. Additionally, information has been added to Table 5-5 of the Draft APT EIS, to include the potential impacts associated with the Rocky Flats scrub alloy and surplus plutonium disposition, and to remove the impacts associated with the River Water System. Table 5-5a has been added to summarize the projected environmental impacts from the generation of this electricity.

<u>Page 5-7, Table 5-5 is replaced with the following table as called out on page 5-6, 2nd column, 3rd paragraph and Table 5-5a is added</u>:

Table 5-5 lists the cumulative consumption of electricity from activities at the SRS. The values are based on annual consumption estimates. Of the SRS activities, accelerator production of tritium would place the largest demand on electricity resources.

Table 5-5a lists the projected environmental impacts from the generation of electricity required for the SRS activities listed in Table 5-5.

[Chapter 5, Section 5.5 modification to the Draft APT EIS]

The estimated cumulative radiological health effects of routine SRS operations has been updated pursuant to the modifications presented elsewhere in this document. Additionally, information has been added to Table 5-6 of the Draft APT EIS, to include the potential impacts associated with the Rocky Flats scrub alloy and surplus plutonium disposition, and to remove the impacts associated with the River Water System.

<u>Page 5-9, Table 5-6 is replaced with the following table as called out on page 5-8, 1st column, 2nd paragraph</u>:

Table 5-6 summarizes the cumulative radiological health effects of routine SRS operations based on 1995 data and proposed DOE actions. The EISs listed in this table describe the impacts resulting from proposed DOE actions. In addition to estimated radiological doses to the hypothetical maximally exposed individual and the offsite population, Table 5-6 lists potential latent cancer fatalities for the public and workers due to exposure to radiation. These data demonstrate that operation of APT will minimally increase cumulative radiation doses to the public and onsite workers.

[Chapter 5, Section 5.7 modifications to the Draft APT EIS]

Since the issuance of the Draft APT EIS, two additional reasonably foreseeable actions have been identified for the Savannah River Site. SRS has been identified as the preferred site for the disposition of surplus plutonium and is one of the alternative sites for the disposition of Rocky Flats plutonium and scrub alloy. The text in Section 5.7 and Table 5-7 have been modified to incorporate associated employment levels.

<u>Page 5-10, 1st column, 2nd paragraph through 2nd column, 2nd paragraph and Table 5-7 on page 5-11 are replaced with the following</u>:

Table 5-7 summarizes the estimated cumulative regional economic and population changes from construction and operation of the APT facility (Preferred alternative), a potential $200 million Treatment and Storage Facility that DOE could build at the SRS to manage spent nuclear fuel (Young 1997), the processing of Rocky Flats scrub alloy, the construction and operation of mixed-oxide processing facility, and the construction and operation in Aiken County of a $435 million tire factory by Bridgestone-

Table 5-5. Estimated average annual cumulative electrical consumption.

Activity	Electricity consumption (megawatt-hours)
Accelerator Production of Tritium	3,100,000
Tritium Extraction Facility[a]	**21,000**
Defense Waste Processing Facility[b]	32,000
Surplus HEU disposition[c]	5,000
Tritium supply and recycling[d]	24,000
Interim Management of Nuclear Materials[e]	140,000
Waste Management	N/A[f]
1993 SRS usage[h]	660,000
Management of Spent Nuclear Fuel[i]	24,000
Rocky Flats Pu Residue	**N/A[j]**
Surplus Plutonium Disposition[k]	**38,000**
Total	4,000,000

a. Source: DOE (1998sa).
b. Source: DOE (1994a).
c. Source: DOE (1996); HEU = highly enriched uranium.
d. Source: DOE (1995b); includes recycling upgrades only.
e. Source: DOE (1995c).
f. Not available in Waste Management EIS.
g. Deleted.
h. Source: DOE (1995e).
i. Source: Young (1997).
j. Source: DOE (1997b), information not available on annual basis. However, maximum value of options at SRS is 7,200 MWh spread over a multi-year processing campaign.
k. Source: DOE (1998b).

Table 5-5a. Environmental impacts from electricity generation required for SRS projected activities.

Factor	Value
Air emissions (pounds per year)	
Carbon dioxide	8,900,000,000
Sulfur oxides as SO_2	2,800,000
Nitrogen oxides as NO_2	10,000,000
Volatile organic compounds	2,700,000
Carbon monoxide	8,600,000
Particulate matter (PM_{10})	1,800,000
Radioactive emissions (curies)	2,600
Water consumption (acre-feet)	2,700
Liquid radioactive effluent (curies)	25,000
Solid waste (pounds per year)	
Ash	41,000,000
Total metals	400,000
Nuclear solid waste	13,000
Additional land use (acres)	N/A
Construction employees (work-years)	N/A
Operations (employees per year)	290

N/A = Not applicable.

Table 5-6. Estimated average annual cumulative radiological doses and resulting health effects to offsite population and facility workers.

	Maximally exposed individual				Offsite population[a]				Workers	
Activity	Dose from airborne releases[b]	Dose from liquid releases[b]	Total Dose[b]	Fatal Cancer risk[c]	Collective dose from airborne releases[d]	Collective dose from liquid releases[d]	Total collective dose[d]	Latent cancer fatalities[e]	Collective dose[d]	Latent cancer fatalities[e]
Management of Spent Nuclear Fuel[f]	1.5×10^{-5}	5.7×10^{-5}	7.2×10^{-5}	3.6×10^{-8}	0.56	0.19	0.75	3.8×10^{-4}	55	0.022
Defense Waste Processing Facility[h]	1.0×10^{-6}	0	1.0×10^{-6}	5.0×10^{-10}	0.071	0	0.071	3.6×10^{-5}	120	**0.048**
Surplus HEU Disposition[i]	2.5×10^{-6}	0	2.5×10^{-6}	1.3×10^{-9}	**0.16**	0	**0.16**	8.0×10^{-5}	**11**	**0.0044**
Interim Mgmt of Nuclear Materials[k]	9.7×10^{-4}	2.4×10^{-5}	9.9×10^{-4}	5.0×10^{-7}	**40**	**0.09**	**40**	**0.02**	**127**	**0.051**
Plant Vogtle[m]	5.4×10^{-7}	5.4×10^{-5}	5.5×10^{-5}	2.7×10^{-8}	0.042	0.0025	0.045	2.2×10^{-5}	NA	NA
1995 SRS Activities[n]	5.0×10^{-5}	1.4×10^{-4}	1.9×10^{-4}	9.5×10^{-8}	**2.8**	**2.2**	**5.0**	**0.0025**	**160**	**0.64**
Tritium Extraction Facility[o]	2.0×10^{-5}	0	2.0×10^{-5}	1.0×10^{-8}	0.77	0	0.77	3.9×10^{-4}	**4**	1.6×10^{-3}
Accelerator Production of Tritium	3.7×10^{-5}	1.5×10^{-5}	5.3×10^{-5}	2.7×10^{-8}	1.6	0.42	**2.0**	**0.0010**	**88**	3.5×10^{-2}
Rocky Flats Pu Residue[p]	5.7×10^{-7}	**0**	5.7×10^{-7}	2.8×10^{-10}	**0.0062**	**0**	**0.0062**	3.1×10^{-6}	**7.6**	**0.003**
Surplus Plutonium Disposition[q]	4.0×10^{-6}	**0**	4.0×10^{-6}	2.0×10^{-9}	**1.6**	**0**	**1.6**	**0.0008**	**561**	**0.22**
Total	1.1×10^{-3}	2.9×10^{-4}	1.4×10^{-3}	7.0×10^{-7}	**48**	**2.9**	**51**	**0.025**	**1,134**	**1.0**

a. Collective dose to the 50-mile (80-kilometer) population for atmospheric releases and to the downstream users of the Savannah River for liquid releases.
b. Dose in rem.
c. Probability of fatal cancer.
d. Dose in person-rem.
e. Incidence of excess fatal cancers.
f. Source: Maximum of options Young (1997).
g. **Deleted.**
h. Source: DOE (1994a).
i. Source: DOE (1996a); HEU = highly enriched uranium.
j. **Deleted.**
k. Source: DOE (1995c).
l. Deleted.
m. Source: NRC (1996).
n. Source: Arnett and Mamatey (1996).
o. Source: DOE (1998a).
p. Source: DOE (1997b).
q. Source: DOE (1998b).

Table 5-7. Cumulative economic and population measures.[a]

Year	Total employment	Population	Personal income[b]	Gross regional product[b]	State and local government expenditures[b]
1	93	26	2.8	4.4	0.0
2	1,422	447	43.5	74.5	1.3
3	3,191	1,489	99.6	181.7	4.6
4	**4,936**	2,931	1,43.1	275.2	9.2
5	**5,593**	4,036	1,27.6	249.7	12.8
6	**5,692**	4,758	1,25.4	246.5	15.4
7	**3,996**	5,292	1,22.2	242.1	17.3
8	**3,162**	5,613	1,14.4	234.5	18.7
9	**2,767**	5,752	1,06.8	237.4	19.3
10	**4,992**	5,761	1,02.0	244.8	19.6
11	**4,815**	5,672	97.7	244.0	19.5
12	**4,815**	5,554	97.9	247.3	19.2
13	**4,822**	5,449	98.6	250.3	19.0
14	**4,869**	5,370	100.8	257.3	19.0
15	**4,914**	5,318	103.1	264.1	18.9
16	**4,955**	5,276	105.1	270.7	18.9
17	**4,999**	5,245	107.4	277.6	19.0
18	**5,044**	5,224	109.9	284.9	19.0
19	**5,038**	5,208	112.4	291.8	19.0
20	2,342	5,193	114.7	298.7	19.0
21	2,379	5,184	117.3	306.1	19.1
22	2,410	5,180	119.1	313.4	19.2
23	2,444	5,183	121.3	321.4	19.3
24	2,474	5,196	123.3	329.4	19.3
25	2,500	5,219	125.4	337.3	19.6
26	2,525	5,253	127.6	345.2	19.9
27	2,546	5,298	129.7	353.0	20.1
28	2,566	5,354	131.9	360.9	20.4
29	2,585	5,420	134.1	368.5	20.7
30	2,603	5,495	136.4	376.4	21.1
31	2,621	5,578	139.0	384.5	21.6
32	2,639	5,667	141.6	392.8	22.0
33	2,656	5,758	144.2	401.0	22.5
34	2,675	5,851	147.0	409.5	22.9
35	2,698	5,949	150.3	418.1	23.6
36	2,722	6,053	154.0	427.3	24.3
37	2,747	6,159	157.9	436.6	24.9
38	2,773	6,267	161.8	446.1	25.4
39	2,800	6,373	165.9	455.8	26.1

a. Source: REMI (1996); DOE (1998b).
b. All dollar amounts are millions of 1996 dollars.

Firestone, Inc., which will employ 800 when fully operational.

In the case of the scrub alloy activities, no new facilities would be required. Operations would be handled by the existing SRS workforce (DOE 1997b). The existing chemical processing canyons would be utilized. The mixed-oxide processing facility, however, could require a peak workforce of 1,212 employees and could add an additional 973 indirect jobs. The operational work force is estimated to be 996; additional indirect jobs could total 1,781 (DOE 1998b).

During the construction period, average annual rates of growth for the five economic and population measures (Table 5-7) are less than during the 4-year historical period discussed in Section 4.3.2.1. The average annual growth rates during the construction period for these projects are 0.47%, 0.7%, and 1.62% for employment, population, and total personal income, respectively. The growth rates for GRP and state and local government expenditures are 1.21% and 1.9%. Potential impacts to the regional construction industry would be less than discussed in Section 4.4.2.6 for the coal-fired electricity generating plant, as the tire factory will be completed and operational before the SRS construction work force reaches its peak. During the operational phase of the APT facility, the growth rates for these measures would be less than the historical rates.

Chapter 6. Modifications – Resource Commitments

[Chapter 6, Section 6.2 modification to the Draft APT EIS]

Since the Draft APT EIS was issued, the Department has advanced potential plans for concrete batch plants and a construction debris landfill as described in Part C, modifications to Chapter 4 (page C-36) of this document. Additionally, as described in this document, the modular design variation would require slightly less land. Based on these plans, the text has been modified to reflect the commitment of resources associated with these actions.

Page 6-2, 1st column, 2nd paragraph is replaced with the following:

In addition to the 250 acres identified above, construction of the APT could result in the construction of two temporary **construction support** facilities: concrete batch plants and a construction debris landfill. **The concrete batch plant would require about 10 acres within either of the APT sites. Total land requirements for the landfill would be about 14 acres. The batch plants would utilize approximately 21 million gallons of water during construction.** At the end of the operational life of the temporary facilities, DOE would close or remove infrastructure in accordance with permit and regulatory requirements.

Chapter 7. Modifications – Applicable Laws, Regulations, and Other Requirements

[Chapter 7, Section 7.1 modification to the Draft APT EIS]

Since the issuance of the Draft APT EIS, DOE has determined that a construction debris landfill, as discussed starting on page C-36 of this document, could be required. Table 7-1 has been modified to include the South Carolina Solid Waste Management Act. A description of the Act is added to Section 7.1.1.

Page 7-6, 1st column, after 1st paragraph insert the following:

The South Carolina Solid Waste Policy and Management Act of 1991, (Section 44-96-10 et seq.), (SCDHEC Regulation R.61-107 et set) SCDHEC has received authorization to implement a non-hazardous solid waste management program in the State of South Carolina. EPA and SCDHEC regulations (40 CFR Part 258; SCDHEC R.61-107 et seq) implement RCRA requirements for the management and disposal of non-hazardous solid waste. The regulations include siting criteria and operating requirements for solid waste landfills. DOE would be required to obtain a

Table 7.1. Environmental permits and consultations required by regulation.

Activity/Topic	Regulation	Requirements	Agency
Site Preparation	Federal Clean Water Act (Section 404 and Section 401)	Wetlands 404 Permit (determination pending), Stormwater Pollution Prevention Plan for Industrial Activity, Water Quality Certification	USACOE/[a] SCDHEC[b]
		Stormwater Pollution Prevention/Erosion Control Plan for construction activity	SCDHEC WSRC/EPD[c]
Wastewater Discharges	Federal Clean Water Act S.C. Pollution Control Act	NPDES Permit(s) for Dewatering Basin Discharge, Cooling Water, and Balance of Plant Process Wastewater Discharges	SCDHEC
		Process Wastewater Treatment Systems Construction and Operation Permits	SCDHEC
		Sanitary Waste Water Pumping Station Tie-in Construction Permit; Permit to Operate	SCDHEC WSRC/EPD
Cooling Water Discharges	Federal Clean Water Act [Section 316(a)]	316(a) thermal effects study (determination pending)	SCDHEC
	Federal Clean Water Act [Section316(b)]	316(b) impingement and entrainment study (determination pending)	SCDHEC
Air	Clean Air Act - NESHAP;	Rad Emissions - Permit to construct new emission source (if needed)	EPA[d]
		Air Construction and Operation permits – as required. Fire Water Pumps; Diesel Generators	SCDHEC
		General source - Stacks, Vents, Concrete batch plant	SCDHEC
		Air Permit - Prevention of Significant Deterioration (PSD)	SCDHEC
Domestic Water	Safe Drinking Water Act	Construction and operation permits for line to domestic water system and Construction of APT Water Tower	WSRC/EPD SCDHEC
Waste Management	Resource Conservation and Recover Act (RCRA)	RCRA Permit – Radiological Waste Storage Facility	SCDHEC
	S.C. Solid Waste Management Act	**Construction debris landfill permit**	**SCDHEC**
Structures over 200 feet	Federal Aviation Administration (FAA)	Permit for Structures over 200 feet; APT construction cranes, stacks, water tower	FAA
Historic Preservation	Archaeological Resource Protection Act; National Historic Preservation Act	Excavation or Removal Permit (determination pending); Consultation)	Advisory Council on Historic Preservation; State Historic Preservation Officer
Endangered Species	Endangered Species Act	Consultation	U. S. Fish and Wildlife Service National Marine Fisheries Service
Migratory Birds	Migratory Bird Treaty Act	Consultation	U. S. Fish and Wildlife Service

a. USACOE - United States Army Corps of Engineers.
b. South Carolina Department of Health and Environmental Control.
c. WSRC/EPD Westinghouse Savannah River Company Environmental Protection Department.
d. Environmental Protection Agency.

permit to construct and operate a construction debris landfill at the APT site, or to expand the existing Burma Road Landfill for disposal of APT generated waste.

Miscellaneous Modifications in the Draft EIS

Items 2 through 7 note modifications to correct figure or table call outs and correct several references used in the Draft EIS. References cited in Part C of the Final EIS but not called out in the Draft EIS are listed below in item number 1. If the reference has not changed from the Draft EIS, it is not included in this listing.

Additional Part C References by chapter

Chapter 1

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Chapter 2

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<u>Chapter 4</u>

DeCamp, G., 1998, APT-Burns & Roe, Aiken, South Carolina, Response to APT Final EIS - Request for Technical Data, AI98-ESH-0005, memorandum to R. Reynolds, Westinghouse Savannah River Company, January 28.

DOE (U.S. Department of Energy), 1998a, *Draft Environmental Impact Statement for the Construction & Operation of a Tritium Extraction Facility at the Savannah River Site*, DOE/EIS-0271D, Savannah River Operations Office, Aiken, South Carolina.

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Corrections

- Correction to Chapter 2 reference: WSRC (1996b) to Wike et al. (1996). Wike, L. D., D. B. Moore-Shedrow, C B. Shedrow, 1996, Site Selection for the Accelerator for Production of Tritium at the Savannah River Site, **Rev. 1,** WSRC-TR-96-0279, Westinghouse Savannah River Company, Aiken, South Carolina, **October**.

- Correction to Chapter 3 reference: change WSRC (1996b) to Wike et al. (1996). Wike, L. D., D. B. Moore-Shedrow, C B. Shedrow, 1996, Site Selection for the Accelerator for Production of Tritium at the Savannah River Site, Rev. 1, WSRC-TR-96-0279, Westinghouse Savannah River Company, Aiken, South Carolina, **October**.

- In the text box on page 4-3 the EPA drinking water standard is 4 millirem **per year.**

- Correction to Chapter 4, Section 4.1.5 reference: Shedrow (1997a) should be England et al. (1997).

- The section callout in the second paragraph, page 4-54, 2^{nd} Column, should be **3.3.2** rather than 3.2.2.

- Correction to Chapter 4 Reference: Hunter, C.H., 1997, "Nonradiological Air Quality Calculations for the Accelerator Production of Tritium (APT) Environmental Impact Statement (EIS)," SRT-NTS-97/**0277**, inter-office memorandum to C. B. Shedrow, Westinghouse Savannah River Company, Aiken, South Carolina, **September 10**.

PART D. POTENTIAL APT DESIGN VARIATIONS AND MITIGATION ACTIONS (ADDITIONS TO CHAPTER 4 OF THE DRAFT APT EIS)

Part D evaluates potential impacts from the construction and operation of the APT design variations at the Savannah River Site and presents new sections to be appended to Chapter 4 of the Draft APT EIS. The Draft APT introduced two design variations: a modular or staged accelerator and a combined Tritium Extraction Facility (TEF)-APT. The Draft EIS committed to further analyzing the design variations in the Final EIS based on information that was being developed. Since the Draft EIS was issued, a third design variation, the discharge of cooling water to Pond C via an existing discharge canal, was conceived. This variation was developed in partial response to comments L2-01 and L4-01 of the Draft EIS and would mitigate some of the potential impacts identified for the discharge of cooling water. In general, the potential impacts of the design variations would be bounded by the baseline accelerator impacts. This part also clarifies the Department's path forward with regard to potential mitigation actions.

The following sections present the estimated environmental impacts for three potential design variations that could enhance the Department's flexibility to supply the nation's future tritium needs and potential mitigation actions. The following are new sections to be added to Chapter 4 of the Draft APT EIS: Sections 4.5 and 4.6.

Page 4-81, add after Table 4-43.

4.5 Potential Environmental Impacts of the APT Design Variations

4.5.1 Modular or Staged APT Configuration

DESCRIPTION OF DESIGN VARIATION

The modular accelerator could be developed in two stages: the first stage could support tritium production levels less than the 3 kg production goal quantity and provide a beam energy of about 1,030 MeV; the second stage could support production levels the same as the baseline accelerator and provide a beam energy of about 1,700 MeV. The Department could stop construction after completion of the first stage and produce less than the current 3 kg production goal quantity. This would allow DOE to support reduced production requirements, yet provide the potential for increased production by completing stage two of the accelerator.

The same accelerator architecture would be used: a normal-conducting low-energy linac injecting into a superconducting high-energy linac (described in Section 2.3.2 of the Draft EIS). The accelerator current would be 100 mA for both stages. As with the baseline APT, the modular accelerator (both stage one and two) would be comprised of the following preferred design features:

- Klystron radiofrequency power tubes
- Super conducting operation of accelerator structures
- Helium-3 feedstock material
- Mechanical-draft cooling towers with river water makeup
- Construction of the modular APT on a 250-acre site 3 miles northeast of the Tritium Loading Facility
- Purchase of electricity from existing capacity and market transactions

Also as with the baseline APT, alternative design and support systems for both the stage one and stage two modular APT include:

- Inductive output radiofrequency power tubes
- Room-temperature operation of some electrical components
- Lithium-6 feedstock material

- Once-through cooling using river water; mechanical-draft cooling towers with groundwater makeup; K-Area cooling tower with river water makeup
- Construction of the modular APT on a site 2 miles northeast of the Tritium Loading Facility
- Construction of a new generating plant for electricity

In the first stage, after being accelerated to design levels, the beam would be steered through a 90-degree angle in the direction of the high-energy beamstop, and then bent into the target/blanket building. This is conceptually shown in Figure 4-14. The target/blanket building would be sized to handle the full goal quantity production level of 3 kg, but the equipment actually installed could be sized to accommodate whatever production level is selected. The high energy beam stop would be designed to accommodate 2 percent of the beam power at full production levels (the same as the baseline accelerator). The target, decoupler, and blanket would be designed to optimize tritium production at the corresponding beam energy. The modular design would include a full production-capacity tritium separation facility (WSRC 1997).

INCREASING TRITIUM PRODUCTION

As previously mentioned, under the modular concept, development and operation could be at a production level less than 3 kg per year (stage one). Should national defense requirements increase, additional tritium production could be supported by the second stage of construction and operation.

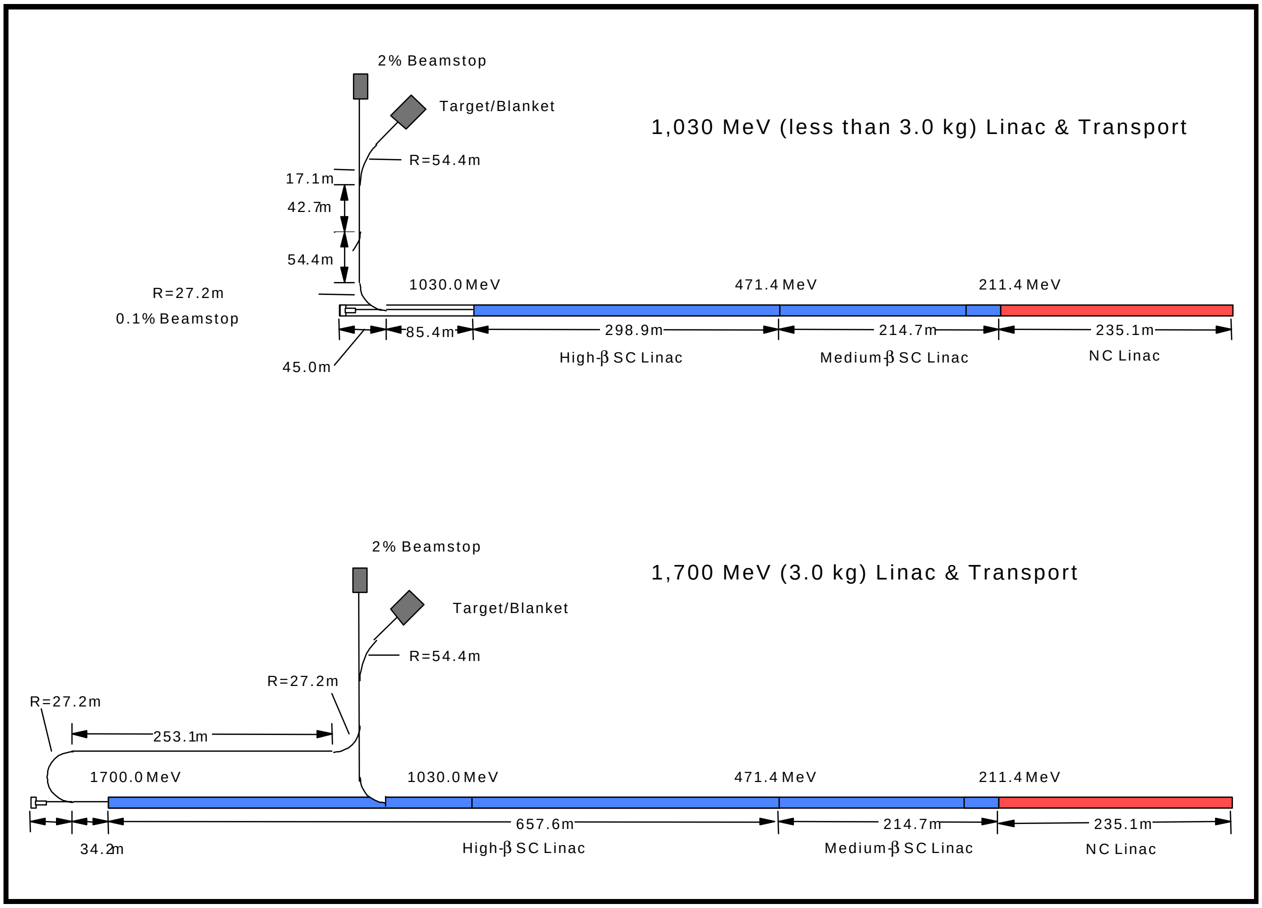

Figure 4-14. Conceptual design of modular APT.

In the second stage, the beam tunnel could be extended and additional cryomodules could be installed to reach the desired beam energy level. After the last of the cryomodules, the beam would be bent 180 degrees and travel down a parallel beam transport tunnel until joining the first stage beam line to the beamstop and first stage target blanket building (see Figure 4-14). Increasing the production level beyond the first stage would require the installation of an appropriately sized target/blanket and supporting equipment in the target/blanket building. Since it only has to contain magnets, vacuum system, and beam diagnostics, this offset transport tunnel would have a much smaller cross section than the baseline linac tunnel.

IMPACTS FROM MODULAR OR STAGED CONSTRUCTION

This section describes representative environmental impacts that could occur from constructing and operating the APT in a modular or staged manner. The following sections provide an estimate of how environmental impacts for the baseline APT would vary for both stage one and stage two, if the modular approach is implemented.

From a construction impacts standpoint, the stage one accelerator would have less impacts than the baseline accelerator because there would initially be one less cryogen and mechanical building and the tunnel would be about 1,000 feet shorter than for the baseline accelerator. The differences are, however, relatively small since the stage one design would need to support adding the second stage. Consequently, the target/blanket, tritium separation, operations, module staging, waste, and maintenance buildings would be built to the 3 kg goal quantity.

The equipment used in the stage one or stage two accelerator would be identical to that used for the baseline accelerator. This includes the injector, beam tube components, radiofrequency generating equipment, beam focusing and feedback equipment, cryogenic equipment, and beam stops. The only differences would be in quantity and physical layout. For example, upgrading of the stage one accelerator to stage two would add additional acceleration modules at the high energy end with associated power, control, and cooling equipment for the new sections of the facility.

On the operational side, all waste and emission streams would also be less for the stage one accelerator because of the reduced amount of material being produced. Operating at the stage one level would reduce electricity consumption, rely on a smaller cooling system, and consequently result in less heated water discharges.

Adding stage two for most construction and operational factors considered would be the same as, or in some instances exceed, the potential impacts estimated for the baseline APT. The tunnel would require expansion, equipment would be added, and more tritium would be produced.

Table 4-43 compares the stage one and two accelerator to the baseline APT for the preferred configuration described on page D-1 of the Final APT EIS. Table 4-44 summarizes the principal differences between alternatives. The potential environmental effects of replacing a preferred design feature with one of its alternatives are the same regardless of which modular approach is taken (stage one and stage two). Since the modular or staged accelerator would use the same technology options as the baseline accelerator, the relationship of the impacts of alternative design features to the preferred design features do not change. The potential impacts associated with the design alternatives (e.g., exchanging super conducting for room temperature) are independent of the impacts associated with other elements comprising the Preferred alternative. This approach enables a comparison of impacts, and enables the decisionmaker to evaluate the impacts of combining the relative percentage increases or decreases for selected alternatives.

While exchanging a preferred alternative for one of its alternatives in the modular or staged accelerator is no different than doing so for the

Table 4-43. Differences between the baseline APT and the modular APT.

Resource	Baseline APT	Stage one Modular APT[a] (1,030 MeV)	Stage two Modular APT[a] (1,700 MeV)
Construction impacts			
Land use	Land clearing and grading of 250 acres	NC[b]	NC
Construction debris	30,000 cubic meters	-10%	+10%
Groundwater	Dewatering required	Less	NC
Industrial wastewater	3.6 million gallons	NC	+10%
Sanitary waste	560 cubic meters	NC	NC
Peak work force	1,400	-10% [c]	NC
Operational impacts			
Landforms, soils, geology	Negligible impacts	NC	NC
Groundwater	May use some groundwater	NC	NC
Surface water needs	6,000 gallons/minute	-10%	NC
Surface water releases	2,000 gallons/minute	-10%	NC
Air			
Radiological emissions			
Tritium oxide	30,000 curies/year	NC	NC
Carbon-11	250 curies/year	NC	NC
Argon-41	2,000 curies/year	NC	NC
Beryllium-7	0.02 curies/year	NC	NC
Iodine-125	2.7×10^{-3} curies/year	NC	NC
Waste Management (annual production)			
Radioactive wastewater	140,000 gallons/ year	-10%	+10%
Nonradioactive process wastewater	920 million gallons/year	-10%	+10%
Sanitary wastewater	3.3 million gallons/year	-10%	+10%
Hazardous waste	1.0 cubic meter/year	-10%	+10%
Low-level waste	1,400 cubic meters/year	-10%	+10%
Public and Worker Health			
Annual radiation dose to the MEI	0.052 mrem/year	NC	NC
Annual collective radiation dose to the population	2.0 person-rem/year	NC	NC
Population latent cancer fatalities	1.0×10^{-3}	NC	NC
Uninvolved worker dose	1.7×10^{-3} rem/year	NC`	NC
Collective involved worker dose	72 person rem/year	NC	NC
Ecology	Some habitat disturbance	NC	NC
Workforce	500	NC	NC
Electricity	3,100,000 megawatt-hours/year	-32%	NC

a. Source: England (1998b).
b. NC = No change.
c. Source: Morris (1998).
Note: The design features which comprise the Preferred alternative for the baseline accelerator are the same for either the stage one or two modular accelerator. The difference in potential impacts described on Table 2-4 would equally apply to either the stage one or stage two APT.

baseline accelerator, there are some noted variations in potential impacts based upon tritium production levels (stage one and stage two).

The following sections describe how the potential environmental impacts of operating a modular APT would differ from those estimated for the baseline APT. Each section also includes a discussion of how the potential environmental impacts would vary among each of the alternatives considered.

Landforms, Soils, Geology, and Hydrogeology

Construction

Differences from baseline APT: The layout of the buildings for the modular APT is somewhat different from the baseline APT (see Figures 4-15 and 4-16). The modular APT footprint would be slightly wider than the baseline footprint; however, the total area required would remain less than the 250 acres needed for the baseline footprint. This change in footprint shape brings into the APT site both soil and forest areas that were not described in the Draft APT EIS. These areas have the same characteristics as the areas previously described in the Draft EIS. The impacts would be the same as for the baseline APT.

In terms of groundwater effects, the stage one accelerator would result in less dewatering because of the shorter tunnel length. Conversely, adding stage two would increase the tunnel length and require more dewatering than for the baseline APT.

Differences between modular APT alternatives: Other than less dewatering required for the alternative site, none of the alternatives for the modular APT would result in different impacts from those expected for the Preferred alternative.

Operations

Differences from baseline APT: The Draft APT EIS identified two actions during operations that could affect geologic resources: extraction of groundwater for cooling and creation of radioactive material in the groundwater. Since the cooling requirements for the stage two accelerator would be the same as the baseline APT, the potential impacts would be the same. The stage one accelerator, however, would require about 10 percent less cooling water (for the groundwater makeup alternative) and commensurately lower impacts than the baseline or stage two APT. Similarly, because the groundwater activation is from beam leakage, a lower beam energy would also result in less groundwater activation potential.

Differences between modular APT alternatives: Other than the potential impact on groundwater flow and clay compaction from using groundwater as a cooling water source, none of the alternatives for the modular APT would result in different impacts from those expected for the Preferred alternative.

Surface Water Resources

Construction

Differences from baseline APT: As was described in the Draft APT EIS, surface water would not be used in the construction of the facility. Likewise, surface water would not be used in construction of the modular APT. Therefore, there would be no change from the impact of the baseline APT.

Discharge of construction runoff to nearby streams for either the baseline APT or the modular APT could result in short-term increases in solids to the receiving water bodies, but over all should result in negligible impacts.

Differences between modular alternatives: Other than discharges to Pen Branch via Indian Grave Branch, none of the alternatives for the modular APT would result in different impacts from those expected for the Preferred alternative.

Figure 4-15. Comparison of modular APT footprints to baseline footprint.

Figure 4-16. Conceptual layout of the stage two accelerator APT.

Operations

Differences from baseline APT: Potential surface water effects that were analyzed for the baseline APT were withdrawal and discharge of volumes of water that could affect ambient conditions or remobilize sediments, and discharge of wastewater or heated effluent. As the heat dissipation requirements for the stage two APT are the same as for the baseline APT, there would be no change in the surface water effects beyond those already analyzed in the Draft APT EIS. The stage one accelerator would have water withdrawal requirements that are about 10 percent less than for the baseline APT, and would also result in comparable reductions of radioactive and nonradioactive effluents to surface water. The reductions would result in lower heat dissipation requirements because of smaller operational requirements.

Differences between modular APT alternatives: As with the baseline APT, potential impacts would vary by alternative. Selection of the inductive output tube alternative would require 7 percent less cooling water than the Preferred alternative. Conversely, selection of the Room Temperature alternative would require 33 percent more cooling water than the Preferred alternative. Selection of the Once-Through-Cooling alternative would result in higher temperatures and water levels in surrounding water bodies. No other alternatives would differ from the Preferred alternative in terms of potential impacts.

Air Resources

Construction

Differences from baseline APT: Construction of the modular APT would generate dust and release exhaust gases from construction equipment just as for the baseline APT. While the amount of construction for the stage two APT would be marginally higher due to the construction of the parallel beam transport tunnel, the construction would be spread out over a longer construction period. Since the stage one APT would have fewer structures and a shorter tunnel length, the generation of fugitive dust and vehicle emissions would also be less. As a result, the impacts on air resources from construction are not expected to exceed those impacts already analyzed for the baseline APT.

Differences between modular APT alternatives: None of the alternatives for the modular APT would result in different impacts from those expected for the Preferred alternative.

Operations

Differences from baseline APT: Operational releases from APT are dominated by releases from the full-scale tritium separation facility. As this facility would be included in the design of both the stage one and stage two accelerator, releases of radiological effluents from both the stage one and stage two APT would not differ from those projected for the baseline APT (see Table 4-43). As a result, corresponding offsite and onsite consequences also would not differ from those for the baseline APT.

Differences between modular APT alternatives: As with the baseline APT, potential environmental impacts by alternative would vary. Selection of the Lithium-6 Feedstock alternative would result in 7 percent more radiation exposure and associated latent cancer fatalities. Selection of the alternate site would result in 11 percent more radiation exposure and associated latent cancer fatalities. None of the other alternatives would differ from what is expected for the Preferred alternative.

Land use and Infrastructure

Construction

Differences from baseline APT: Land use changes, including road access, water lines, cooling water blowdown discharge lines, and rail lines would not differ from the baseline APT. The unused land in the baseline APT footprint after stage one construction would be reserved for future expansion and would not be available for other uses.

Differences between modular APT alternatives: Other than the construction of piping to K-Area for the cooling of APT using the K-Reactor cooling tower, none of the other modular APT alternatives would differ from what would be expected for the Preferred alternative.

Operations

Differences from baseline APT: Utility requirements (water and electricity) for the stage two APT would not differ from the baseline APT. Utility requirements for the stage one accelerator would be reduced (by about 135 MWe) due to the smaller number of acceleration modules and magnets required. Cooling water requirements for the stage one accelerator would be about 10 percent less than the baseline APT as less electricity use corresponds to less heat that needs to be dissipated.

Differences between modular APT alternatives: Other than the increased electricity use (23 percent) for the Room Temperature alternative, the impacts of the other modular APT alternatives would not differ from the Preferred alternative.

Waste Generation

Construction

Differences from baseline APT: The stage two APT would require slightly more material to construct than the baseline APT would due to the construction of beam transport tunnels not required for the baseline APT. Corresponding construction wastes and industrial wastewater are expected to be about 10 percent higher than the baseline APT. Sanitary solids and sanitary wastewater generated during construction of the stage two APT would be no more than 5 percent greater than for the baseline APT. Construction of the stage one accelerator would result in decreases from the baseline APT for sanitary wastes (solids and wastewater) and construction debris of 10 percent due to construction of fewer and smaller facilities.

Differences between modular APT alternatives: Other than the decreased sanitary waste (9 percent) from construction of the Room Temperature alternative, the impacts of other modular alternatives would not differ from the Preferred alternative.

Operations

Differences from baseline APT: Operational wastes (excluding sanitary wastes but including process wastewater) from the stage two APT are expected to be about 10 percent higher than the baseline APT. This is based upon increased facility size. Sanitary wastes are related to the size of facility staff and would be unchanged for the stage two accelerator. Operational wastes from the stage one accelerator would be 10 percent lower due to the lower production level.

Differences between modular APT alternatives: As with the baseline APT, the potential impacts would vary by alternative. Selection of the Room Temperature alternative or the Once-Through-Cooling alternative would increase non-radioactive process wastewater by 37 and 2000 percent over the Preferred alternative respectively. Selection of the Lithium-6 Feedstock alternative would increase low-level radioactive waste by 8 percent over the Preferred alternative as well as increasing special case or high concentration waste under evaluation by 25 percent. All other impacts would not differ from the Preferred alternative.

Human Health

Construction

Differences from baseline APT: The impacts analyzed in the Draft APT EIS were the projected increase in fatal traffic accidents from the construction traffic, the exposure to nonradiological constituents, and the projected increase in occupational injuries. Traffic accidents and occupational injuries are assumed to be proportional to workforce size. As the total work effort (person-years) in constructing the stage two APT is about the same as for the baseline APT, fatal traffic accidents and occupational injuries are also projected to be about the same.

The construction effort would be approximately the same as for the baseline APT, and thus would not change the effect from nonradiological constituents from that analyzed for the baseline APT. Construction of the stage one accelerator would require less worker time than the baseline APT, with corresponding reductions in expected traffic accidents and occupational injuries.

Differences between modular APT alternatives: As with the baseline APT, the potential impacts of the modular APT would vary by alternative. Selection of the Room Temperature alternative would result in 6 percent fewer occupational injuries than the Preferred alternative. Also, construction at the alternate site would result in 20 percent fewer traffic fatalities. None of the other alternatives would result in impacts different from those expected for the Preferred alternative.

Operations

Differences from baseline APT: As discussed previously under air resources, the annual effluents for either the stage one or stage two APT would be the same as for the baseline APT. As a result, human health consequences from releases from the stage one or stage two APT would be the same as the baseline APT.

Differences between modular APT alternatives: None of the alternatives differ in potential impacts from those expected for the Preferred alternative.

Accidents

Differences from baseline APT: Accident impacts depend upon the amount of radioactive or hazardous material available to be released to the environment. As the stage two APT would have the same source term for accidental release, there would be no difference in accident consequences from the accidents postulated for the baseline APT. The stage one accelerator would have a full-sized Tritium Separation Facility (TSF). Since the largest contributors to offsite consequences would be releases from the TSF, there would be no change in the postulated accident consequences for the stage one accelerator from the baseline APT.

Differences between modular APT alternatives: Other than minor decreases in accident doses for low probability events for the Lithium-6 Feedstock alternative, the potential impacts of the other alternatives would not differ from the Preferred alternative.

Ecology

Construction

Differences from baseline APT: There would be essentially no differences in the potential impacts to ecological resources for either the stage one or stage two APT. Habitat disturbance areas would vary very little.

Differences between modular APT alternatives: None of the alternatives for the modular APT would differ from those expected for the Preferred alternative.

Operations

Differences from baseline APT: There would be no differences in the potential impacts to ecological resources for either the stage one or stage two APT.

Differences between modular APT alternatives: Other than the impact of higher water levels and water temperatures and some fish impingement and entrainment in the Savannah River for the Once-Through-Cooling alternative, none of the other alternatives would result in impacts different from what would be expected for the Preferred alternative.

Socioeconomics

Construction

Differences from baseline APT: The construction of the stage two APT would not change the socioeconomic impacts from those already analyzed for the baseline APT. The socioeconomic impacts of the stage one accelerator would be less than for the baseline APT by about 10 percent because of a smaller construction work force.

Differences between modular APT alternatives: As with the baseline APT, potential impacts would vary by alternative. Selection of the Room Temperature alternative would result in about 100 fewer jobs. Construction of a power plant for APT electricity needs would result in about 1,100 additional jobs. None of the other alternatives would result in impacts different from what would be expected for the Preferred alternative.

Operations

Differences from baseline APT: The operational workforce would be the same for both the stage one and stage two accelerator. There would therefore be no difference from the baseline APT.

Differences between modular APT alternatives: Other than about 200 additional jobs from a constructed power plant for APT, none of the alternatives on the modular APT would not differ from the Preferred alternative.

Environmental Justice

Differences from baseline APT: As with the baseline APT, differential impacts to minority and low-income communities from either the stage one or two APT or the baseline accelerator are not expected.

Differences between modular APT alternatives: None of the alternatives differ from the Preferred alternative.

4.5.2 Tritium Extraction Within the APT

The following sections summarize the tritium extraction within the APT design variation and the potential environmental impacts. Unless otherwise noted, the information is taken from the Draft Environmental Impact Statement *Construction and Operation of a Tritium Extraction Facility at the Savannah River Site* (DOE 1998).

The impacts described would apply equally to the baseline APT and the stage one and stage two modular APT.

Description of Design Variation

If APT is selected as the primary source of tritium and commercial light-water reactor (CLWR) is selected as the backup technology, the ability to extract tritium from CLWR targets (and from targets of similar design that could be irradiated in APT) still would be required. A reasonable approach would be to incorporate the tritium extraction capabilities with APT. This section describes structural modifications to APT that would be necessary to incorporate the furnaces and processes to extract tritium from CLWR targets or targets of similar design. The initial discussion of this option appeared in the draft APT EIS.

The Draft APT EIS stated that "the two processes – target rod extraction and helium-3 tritium extraction – could not operate concurrently." This statement was based on preliminary discussions between the two project groups, administrative limits of tritium production based on expected impacts, and a lack of complete data on the combined facility. Since the draft EIS was published, DOE has further refined the combo design and now believes that both processes could be operated simultaneously. However, in no case would DOE exceed 3 kilograms of tritium per year production, regardless of the method or combination of methods of production.

The most significant difference between the two extraction processes that would necessitate modification of the Tritium Separation Facility is that the helium-3 feedstock process would extract small amounts of tritium along with other gases while CLWR targets would be processed in batches that would generate larger amounts of tritium-containing gases. Whenever the APT is operating, the helium/hydrogen/ tritium mixture would be piped to the Tritium Separation Facility. CLWR targets would be processed through an extraction furnace in batches of 300 and the tritium-containing gases would be pulled out of the furnace and piped to the separation facility. Other modifications would be storage space for as many as 4,200 targets and two extraction furnaces because high temperatures are required to drive the tritium-containing gases from the CLWR targets (CLWR target-processing to extract tritium described in Appendix A of the Draft TEF EIS).

To accommodate extracting tritium from CLWR targets, the Target Blanket Building would be expanded 48 feet along the length of its canyon. This extension would house all activities related to CLWR target receiving, storage, preparation, and heating. Because the targets are highly radioactive, all handling would be done remotely and the remote-handling areas would be shielded for worker protection.

All separation/purification processes would be done in the Tritium Separation Facility, regardless of the source of the tritium. To accommodate larger amounts of tritium-containing gases from CLWR targets, the capacity of several processes would require expansion. More nonradioactive helium-4 would require a bigger offgas system. A larger water cracking system would be needed to separate the larger amounts of tritium from other hydrogen isotopes, and the greater amount of tritiated water generated would require larger zeolite beds for storage.

The environmental impacts of operating APT while extracting tritium from CLWR targets are presented in this section. Impacts of the combined facility are compared to the impacts of APT alone. The analysis of incremental impacts from extracting tritium from CLWR targets at the same location and time that APT is operating was first presented in the *Draft EIS Construction and Operation of a Tritium Extraction Facility at the Savannah River Site* (DOE 1998).

POTENTIAL ENVIRONMENTAL IMPACTS OF CONSTRUCTING THE COMBINED FACILITY

The additional construction required for a combined facility would not necessitate an earlier start date or a longer period of construction. As a result of design efficiencies, the combined facility would be constructed with approximately the same work force as the APT alone. Materials and the construction workforce would increase by less than 5 percent of APT alone. Construction would involve no hazards beyond those already identified for APT. Therefore, no change in the number of traffic fatalities or occupational injuries as a result of construction would be expected. No changes in socioeconomics impacts would be expected.

The original footprint of APT would remain unchanged. Therefore, DOE would not expect the construction of the combined facility to incur effects greater than 5 percent above construction of APT alone on the following resources: landforms, soils, geology, groundwater, surface water, air, infrastructure, waste management, cultural or aesthetic resources, or noise. Because the combined facility would be a small addition to the entire APT project, DOE would expect no impacts beyond those already identified for ecological resources (terrestrial resources, aquatic resources, wetland resources, and threatened and endangered species).

POTENTIAL ENVIRONMENTAL IMPACTS OF OPERATING THE COMBINED FACILITY

Combining the two facilities would not require large changes in the operational envelope originally presented for APT. No additional land would be required. No effects on landforms, soils, noise, or aesthetics beyond those identified for APT would occur. Permitted non-radiological emissions to air would be within limits for APT alone. The combined facility would not require a larger workforce than APT alone, therefore, there would be no increased demand for potable water or wastewater treatment capacity, and no increase in sanitary waste discharges beyond that already identified for APT alone (Table 4-45).

Extracting 3 kilograms per year of tritium from CLWR targets would require a slight increase in radioactive process wastewater. Radioactive process wastewater would increase by 8 percent over the baseline APT. Electricity use at the combined facility would be no more than the baseline APT.

Releases of radioactive gases would increase. The annual releases from the combined facility would be no more than 35,000 curies of tritium oxide, 4.2×10^{-5} curies of carbon-14, and small amounts of other radioactive isotopes, including iodine-125 and beryllium-7, based on a maximum of 3 kilograms of tritium produced per year. This represents an increase of 17 percent for tritium. All carbon-14 and cobalt-60 releases would be the result of processing CLWR targets (Table 4-45).

These increases would increase doses to the uninvolved worker by 15 percent to the maximally exposed offsite individual (MEI) by 12 percent and to the population by 10 percent. Doses to the involved worker are administratively controlled and would not increase with the expanded facility, however the collective worker dose would increase by 4 person-rem per year. Population latent cancer fatalities would increase by 10 percent (Table 4-45).

The combined facility would produce similar waste streams, but there would be an additional 330 cubic meters of radioactive low-level solid waste and an additional 2 cubic meters of hazardous waste produced annually (Table 4-45).

Greater accident consequences would be expected from the combined facility because of the additional tritium in the stored CLWR targets (Table 4-46).

4.5.3 Direct Discharge of Cooling Water

In the Draft EIS, DOE evaluated the potential impacts of discharging once-through cooling water (under the Once-Through Cooling Water alternative) and cooling tower blowdown (under the Mechanical-Draft Cooling Tower alternative) to the Par Pond system. Under these alternatives, the heated discharge would flow first into Pond 2, and then through engineered canals to Pond 5 and Pond C, and finally enter Par Pond. In response to concerns voiced by agency commenters about possible impacts to plant and animal communities in Ponds 2 and 5, DOE has evaluated a new cooling water system design variation. Under this new "Discharge to Pond C" design variation, the heated discharge would be piped south from the APT facility along existing Roads E-2, E, and 6, then east along Road G, ultimately discharging to the canal between Pond 5 and Pond C (Figure 4-17).

Construction

Because the "Discharge to Pond C" design variation would route pipelines down existing roads and rights-of-way, minimal land clearing would be required for pipeline corridors. As a result, there would be minimal loss of wildlife habitat and no habitat fragmentation associated with building the discharge pipeline. Impacts to air quality, soils, and surface water from pipeline construction would be minor and mitigated to the extent practicable by employing appropriate dust control, soil conservation, and erosion control measures. Construction impacts from the "Discharge to Pond C" design variation would be small, essentially the same as those expected under the Preferred Configuration.

Operations

To analyze the operational impacts of discharging cooling tower blowdown to Pond C rather than Pond 2, DOE performed calculations to estimate the heat rejection capacity of Pond C (Willison 1998b). The analysis indicated that

Table 4-45. Differences between operating APT alone and in combination with CLWR extraction furnaces.[a]

Resource	APT	Combination Facility
Landforms, soils, geology	No impacts	NC[b]
Groundwater	May use some groundwater	NC
Surface water needs	6,000 gallons/minute	NC
Surface water releases	2,000 gallons/minute	NC
Waste Management (annual production)		
Radioactive wastewater	140,000 gallons/year	+8%
Nonradioactive process wastewater	920 million gallons/year	NC
Sanitary wastewater	3.3 million gallons/year	NC
Hazardous waste	1.0 cubic meter/ year	+200%
Low-level waste	1,400 cubic meters/year	+23%
Air		
Nonradiological emissions	Within regulatory limits	NC
Radiological emissions		
Tritium oxide	30,000 curies/year	+17%
Carbon-11	250 curies/year	NC
Carbon-14	NA[c]	4.2×10^{-5} curies/year[d]
Argon-41	2,000 curies/year	NC
Beryllium-7	0.02 curies/year	NC
Iodine-125	2.7×10^{-3} curies/year	NC
Public and Worker Health		
Annual radiation dose to the MEI	0.053 mrem/year	+12%
Annual collective radiation dose to the population	3.1 person-rem/year	+6%
Population latent cancer fatalities	1.6×10^{-3}	+6%
Uninvolved worker dose	1.7×10^{-3} rem/year	+15%
Collective involved worker dose	88 person-rem/year	+5%
Electricity	3,100,000 megawatt-hours/year	NC

a. Source: England (1998a) and Willison (1998a).
b. NC = No change.
c. NA = Not applicable.
d. Values for combination facility releases have been presented instead of percent differences where no releases occur for the baseline APT in that category. In these cases, percent differences would be meaningless.

Table 4-46. Consequences from bounding accidents at APT and the combined facility.[a]

Accident and Receptor	APT	Combination Facility
Design-basis seismic event		
Maximally exposed offsite individual (rem)	2.9	3.3
Total dose to the population (person-rem)	5,100	5,857
Total latent cancer fatalities to population	2.6	2.9
Uninvolved worker dose (rem)	150	152
Beyond design-basis seismic event		
Maximally exposed offsite individual (rem)	3.0	5.8
Total dose to the population (person-rem)	5,500	10,577
Total latent cancer fatalities to population	2.7	5.3
Uninvolved worker dose (rem)	168	180

a. Source: DOE (1998).

88°F/2,000 gallons per minute (gpm) cooling tower blowdown would have no detrimental effect on Pond C temperatures during summer months (June-August), when surface temperatures in Pond C routinely approach or exceed the 88°F blowdown temperature. The analysis indicated that the maximum effect on Pond C temperatures would occur in mid-winter, when the difference between the blowdown temperature (88°F) and ambient water temperatures is expected to be greatest. Based on historical data, this would occur in December-February, when Pond C surface temperatures are approximately 63°F. Calculations showed that the area required to dissipate the blowdown waste heat in the most restrictive months would be less than 20 acres (Willison 1998b).

Because Pond C is 165 acres in surface area, the area required to dissipate the blowdown heat in winter months would be a small fraction of Pond C's total surface area. Less than 20 acres would be affected. As noted earlier, the 88°F blowdown would have no discernible impact on Pond C temperatures in summer. The introduction of a 88°F/2,000 gpm discharge to Pond C would have no effect on temperatures in down stream Par Pond, regardless of time of year and ambient conditions in Par Pond. Thus, thermal impacts to aquatic plants, benthic organisms, or fish would be small and limited to the portion of Pond C immediately downstream of the discharge canal.

Operational impacts to land use, air resources, human health, and socioeconomics would be the same whether the Preferred (cooling system) Configuration or the "Discharge to Pond C" design variation is selected.

4.6 Potential Mitigation Actions

> In the Draft APT EIS potential classes of mitigation actions were discussed in various places throughout the document. In response to several comments (L2-01 and L4-01) and to clarify DOE's path forward regarding potential mitigation actions, a new section 4.6 is added to Chapter 4 of the Draft APT EIS.

Once a primary technology decision has been made, specific mitigation measures that may be required will be identified in the Record of Decision and, if required, a mitigation action plan.

In general, the Department estimates the potential environmental impacts of the APT to be small. Two categories of potential impacts, however, are more notable than the others; the use of electricity and water. In the case of electricity use, preliminary discussions with the South Carolina Gas and Electric Company have

Figure 4-17. Infrastructure options for the APT preferred site.

indicated that it could provide sufficient electricity through wholesale agreements and consequently new generating capacity would not be required. Additionally, continuing design work is ongoing to add additional energy saving features to the APT design.

Water requirements for the APT are small in comparison to historic SRS usage. However, the withdrawal and discharge of water is a sensitive point. DOE could mitigate the potential impacts to groundwater by using the Savannah River and mitigate the thermal discharge and flow impacts to Par Pond by utilizing cooling towers. As mentioned earlier, the Department is investigating bypassing precooler Ponds 2 and 5. This would eliminate the potential impacts to those water bodies.

Other potential mitigation actions could include:

- Incorporating engineered barriers into the APT design to minimize exposure to workers and the public
- Installing a system of monitoring wells
- Instituting best available engineering techniques to control erosion and sedimentation during the construction process
- Conducting site-specific reviews of utility corridors prior to construction to ensure the protection of sensitive plant and animal species and cultural resources.
- Implementing any actions resulting from consultations with the U.S. Fish and Wildlife Service

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GLOSSARY

Note: Glossary terms have been retained in this document only when relating to topics changed in this final APT EIS.

accelerator
A device that accelerates charged particles (e.g., electrons or protons) to high velocities so they have high kinetic energy (i.e., the energy associated with motion); it focuses the charged particles into a beam and directs them against a *target*.

blanket
That part of an *accelerator* that contains feedstock atoms that undergo a nuclear reaction to absorb *neutrons*, resulting (in the case of this EIS) in the production of a *tritium* atom and another (byproduct) atom.

blowdown
Water discharged intentionally from a cooling tower system because of relatively high concentrations of salts.

commercial light-water reactor
A reactor that uses regular water as the neutron moderator. Commercial reactors are owned and operated by utilities to produce electricity for consumers.

committed dose equivalent
The calculated dose equivalent received by a tissue or organ during the 50-year period after a *radionuclide* is introduced in the body.

committed effective dose equivalent
The sum of the *committed dose equivalents* to various tissues/organs in the body multiplied by their appropriate tissue weighting factor. Equivalent in effect to a uniform external dose of the same value.

conceptual design
Name for the process to develop a facility that will meet program goals while ensuring feasible and attainable performance levels; develop project criteria and design parameters for all engineering disciplines; and identify applicable codes and standards, quality assurance requirements, environmental studies, construction materials, space allowances, energy conservation features, health and safety safeguards, security requirements, and other features or requirements necessary to describe the project.

cooling water
Water pumped into a nuclear reactor or *accelerator* to cool components and prevent damage from the intense heat generated when the reactor or accelerator is operating.

cryogenics
The science of physical phenomena at very low temperatures, approaching absolute zero.

cumulative impacts

Impacts on the environment, including additive ecological, health, or socioeconomic effects that result from the addition of the impact of the proposed action to impacts from other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes the other actions (40 CFR 1508.7).

cryogenic distillation

A process where differences in the boiling points of hydrogen and tritium are used to separate the two isotopes. The process takes place at extremely cold temperatures. See also *cryogenics*.

decay (radioactive)

The spontaneous transformation of one *nuclide* into a different nuclide or into a different energy state of the same nuclide. The process results in the emission of nuclear *radiation*.

decisionmaker

Group or individual responsible for making a decision on constructing and operating an *accelerator* to produce *tritium* at the Savannah River Site. Decisionmakers include DOE officials specified in DOE Order 451.1A; elected officials; Federal, state, and local agency representatives; and the public.

decoupler

That part of an *accelerator* between the high-energy neutron source and the moderating blanket that contains *feedstock material* that will absorb low-energy *neutrons* and help protect the neutron source.

deinventory

Packaging unused nuclear materials and placing them in storage on the SRS or at their source.

design-basis accident

For nuclear facilities, a postulated abnormal event used to establish the performance requirements of structures, systems, and components to (1) maintain them in a safe shutdown condition indefinitely or (2) prevent or mitigate the consequences of an accident so that the general public and operating staff are not exposed to radiation in excess of appropriate guideline values. Normally, a design-basis accident is the accident that causes the most severe consequences when engineered safety features function as intended.

design-basis events

Postulated disturbances in process variables that can potentially lead to *design-basis accidents*.

dose

The energy imparted to matter by *ionizing radiation*. The unit of absorbed dose is the *rad*, which is equal to 0.01 joule per kilogram of irradiated material in any medium.

dose equivalent

A term used to express the amount of effective *radiation* when modifying factors have been considered. It is the product of absorbed dose (*rads*) multiplied by a quality factor and other modifying factors. It is measured in *rem* (Roentgen equivalent man).

drift

Mist or spray carried into the atmosphere with the effluent air vapor from a cooling tower.

ecosystem
The community of living things and the physical environment in which they live.

effluent
A liquid or airborne material released to the environment; in common usage, a liquid release.

effluent monitoring
The collection and analysis of samples or measurements of liquid and gaseous effluents to characterize and quantify contaminants, assess *radiation exposure* to members of the public, and demonstrate compliance with applicable standards; occurs at the point of discharge, such as an air stack or drainage pipe.

EIS (environmental impact statement)
A legal document required by the National Environmental Policy Act (NEPA) of 1969, as amended, for Federal actions involving significant or potentially significant environmental impacts. A tool for decisionmaking, it describes the positive and negative impacts of the proposed action and the alternative actions.

emission standards
Legally enforceable limits on the quantities and kinds of air contaminants that may be emitted to the atmosphere.

entrainment
The capture and inclusion of organisms in the cooling water systems of such facilities as *reactors* and *accelerators*. The organisms involved, which would depend on size of the intake screen opening, include phyto- and zooplankton, fish eggs and larvae (ichthyoplankton), shellfish larvae, and other forms of aquatic life.

environmental surveillance
The collection and analysis of samples of air, water, soil, foodstuffs, biota, and other media and the measurement of external *radiation* to demonstrate compliance with applicable standards, assess radiation exposures to members of the public, and assess effects, if any, on the local environment.

exposure (to radiation)
The incidence of *radiation* on living or inanimate material by accident or intent. Background exposure is the exposure to natural background ionizing radiation. Occupational exposure is the exposure to ionizing radiation that occurs during a person's working hours. Population exposure is the exposure to a number of persons who inhabit an area.

extrusion press
A device in which heated or unheated material is forced through a shaping orifice to become one continuously formed piece.

fallout
The descent to earth and deposition on the ground of particulate matter (usually *radioactive*) from the atmosphere.

feedstock material
Neutron-absorbing material in the target/blanket structure that is transformed by neutron absorption into the desired product (e.g., tritium).

getter

The material that collects the tritium produced by neutron absorption.

greater-than-Class-C waste

See *waste classifications*.

grid

A transmission and distribution system for electric power.

half-life (radiological)

The time in which half the atoms of a *radioactive* substance disintegrate to another nuclear form. Half-lives vary from millionths of a second to billions of years.

hazardous waste

See *waste classifications*.

heavy-water

Water in which the hydrogen of the water molecule consists entirely of the heavy hydrogen isotope having a mass number of 2; also called deuterium oxide (D_2O).

heavy water reactor

A nuclear reactor in which *heavy water* serves as a neutron moderator and sometimes as a coolant.

high-level waste

See *waste classifications*.

impingement

The process by which aquatic organisms too large to pass through the screen of a water intake system become trapped against the screens and are unable to escape.

inductive output tube

A device designed to amplify microwaves in a manner different from that in a *klystron*. The *electron* beam current varies depending on the microwave signal. In addition, it is typically smaller than a *klystron* and has greater efficiency, providing the same microwave amplification with less energy.

infrastructure

The system of public works of a county, state, or region; also, the resources (buildings or equipment) required for an activity.

in situ

In or at the natural or original position or location.

ion

An atom or molecule that has gained or lost one or more electrons to become electrically charged.

ionizing radiation

Radiation capable of displacing electrons from atoms or molecules to produce ions.

irradiation
Exposure to *radiation*.

isotope
An atom of a chemical element with a specific atomic number and atomic mass. Isotopes of the same element have the same number of *protons* but different number of *neutrons*. Isotopes are identified by the name of the element and the total number of protons and neutrons in the nucleus. For example, plutonium-239 is a plutonium atom (94 protons) with 145 neutrons, for a total of 239.

klystron
An electron tube used for the amplification of microwaves (see *radiofrequency power tube*).

latent cancer fatalities
Deaths resulting from cancer that became active sometime after the exposure to the carcinogen that induced the cancer. The delay between exposure and cancer development is known as the latent period.

laydown
Area of construction site used to sort and store construction materials.

light water
Ordinary water containing hydrogen atoms with no neutrons in their nucleus.

light-water reactor
A nuclear *reactor* that uses ordinary water to cool the reactor core and to moderate (reduce the energy of) the *neutrons* created in the core by fission reactions.

Linac
Linear accelerator.

low-income community
A community in which 25 percent or more of the population is identified as living in poverty.

low-level waste
See *waste classifications*.

makeup water
Replacement for water lost through *drift*, blowdown, or evaporation (as in a cooling tower).

maximally exposed individual
A hypothetical member of the public who receives the maximum possible *dose equivalent* from a given exposure scenario.

MeV (million electron-volts)
A unit used to quantify energy. In this EIS, it describes a particle's kinetic energy, which is an indicator of particle speed.

millirem
One thousandth of a *rem*. (See *rem*.)

mixed waste

See *waste classifications*.

National Ambient Air Quality Standards

Air quality standards established by the Clean Air Act, as amended. The primary National Ambient Air Quality Standards are intended to provide the public with an adequate margin of safety, and the secondary National Ambient Air Quality Standards are intended to protect the public from known or anticipated adverse impacts of a pollutant.

National Pollutant Discharge Elimination System

Federal system that permits for liquid effluents regulated through the Clean Water Act, as amended.

neutron

An uncharged nuclear particle that has a mass approximately the same as that of a *proton*; it is present in all atomic nuclei except that of hydrogen-1. A free neutron is unstable and decays with a half-life of about 13 minutes into an electron and a proton.

nuclide

An atomic *nucleus* specified by atomic weight, atomic number, and energy state; a *radionuclide* is a radioactive nuclide.

Occupational Safety and Health Administration

Federal agency responsible for oversight and regulation of workplace health and safety.

oxides of nitrogen (NO_x)

Primarily nitrogen oxide (NO) and nitrogen dioxide (NO_2), these compounds are produced in the combustion of fossil fuels, and can constitute an air pollution problem.

ozone

A compound of oxygen in which three oxygen atoms are chemically attached to each other. Ozone is an air pollutant.

person-rem

The measure of radiation dose commitment to a specific population; the sum of the individual doses received by a population segment.

pH

A measure of the hydrogen ion concentration in aqueous (made from, with, or by water) solution. Pure water has a pH of 7, acidic solutions have a pH less than 7, and basic solutions have a pH greater than 7.

proton

A nuclear particle with a positive charge equal in magnitude to the negative charge of the electron; it is a constituent of all atomic nuclei, and the atomic number of an element indicates the number of protons in the nucleus of each atom of that element.

radiation

The emitted particles and photons from the nuclei of *radioactive* atoms; a short term for *ionizing radiation* or nuclear radiation, which are different from nonionizing radiation such as microwaves, ultraviolet rays, etc.

radioactivity

The spontaneous decay of unstable atomic nuclei accompanied by the emission of *radiation*.

radiofrequency power tube

An established technology that radar installations and television broadcast stations use to generate broadcast signals. It uses a beam of electrons to amplify a microwave signal.

radiological

Related to *ionizing radiation*.

radionuclide

See *nuclide*.

reactor

A device or apparatus in which a chain reaction of fissionable material is initiated and controlled; a nuclear reactor.

Record of Decision (ROD)

A document that provides a concise public record of an agency decision on a proposed action for which it prepared an EIS. An ROD identifies the alternatives considered in reaching the decision, the environmentally preferable alternative(s), factors the agency balanced in making the decision, and whether the agency has adopted all practicable means to avoid or minimize environmental harm and if not, why not.

rem (Roentgen equivalent man)

The unit of dose equivalent for human radiation exposure. It is equal to the product of the absorbed dose in rads and a quality factor.

Resource Conservation and Recovery Act

The Act that provides a “cradle to grave” program for hazardous waste, which established, among other things, a system for managing hazardous waste from its generation until its ultimate disposal.

River Water System

A system of large concrete pipes built to provide secondary cooling water to the five SRS production *reactors*. The system pumped water from the Savannah River to the reactor areas, where the water passed through *heat exchangers* to absorb heat from the primary reactor core cooling system. Heated discharge water returned to the river via onsite streams.

sanitary waste

See *waste classifications*.

spallation

A nuclear reaction in which the energy of the incident particle is so high that when it strikes the target nucleus, more than two or three particles are ejected from the target nucleus, and both its mass number and atomic number are changed.

special case waste
See *waste classifications*.

special nuclear materials
Plutonium, uranium-233, uranium enriched in the isotope 233 or 235, and any other material DOE determines to be special nuclear material.

spent nuclear fuel
Fuel that has been withdrawn from a nuclear reactor following irradiation, the constituent elements of which have not been separated.

sulfur dioxide
A heavy, pungent, toxic gas, used as a preservative or refrigerant, that is a major air pollutant.

superconducting
Exhibiting a complete disappearance of electrical resistance in various metals at temperatures near absolute zero.

Superfund
A trust fund established by the Comprehensive Environmental Response, Compensation, and Liability Act and amended by the Superfund Amendment and Reauthorization Act that finances long-term remedial action for hazardous waste sites.

supply
For this EIS, the production of tritium in a reactor or an accelerator and the subsequent extraction of the tritium in pure form for use in weapons.

target
In broad terms, a tube, rod, or other form containing material that, on being irradiated in a *nuclear reactor* or an *accelerator* would produce a desired end product.

tier
To link to another in a hierarchical chain. An upper-tier document might be programmatic to the entire DOE complex of sites; a lower-tier document might be specific to one site or process.

total particulate matter
Fine liquid or solid particles such as dust, smoke, mist, fumes, or smog found in air or emissions.

tritium
A *radioactive isotope* of hydrogen and an essential component of every warhead in the current and projected U.S. nuclear weapons stockpile. The tritium enables warheads to perform as designed.

Tritium Extraction Facility
A proposed facility at the Savannah River Site that would extract tritium from *target* material irradiated in either an *accelerator* or a commercial light-water *reactor*.

Tritium Loading Facility (formerly known as Replacement Tritium Facility)
Underground SRS facility in which gases are drawn off of weapons, separated and purified into useful hydrogen isotopes (tritium), mixed to exact specifications, and reloaded into the reservoirs.

Tritium Producing Burnable Absorber Rods (TPBARS)

A highly radioactive target rod which contains recoverable tritium after irradiation in a reactor.

Tritium Separation Facility

A portion of the proposed APT at the Savannah River Site that would separate hydrogen isotopes (protium, deuterium, and tritium) from helium using metal getter beds that would absorb hydrogen while allowing helium to pass through, and would separate tritium from the other hydrogen isotopes using cryogenic distillation.

uninvolved worker

For this EIS, an SRS worker who is not involved in the operation of the *accelerator*, and who is assumed to be at least 640 meters from the point of release.

volatile organic compound

An organic compound with a vapor pressure greater than 0.44 pound per square inch at standard temperature and pressure.

waste classifications

Waste products are defined by statutes and DOE Orders based on origin, content, type of hazard and magnitude of hazard. In this document. the description of waste products may include the following definitions:

greater-than-Class-C waste

Low-level radioactive waste that is generated by the commercial sector and that exceeds U.S. Nuclear Regulatory Commission concentration limits for Class-C Low-Level Radioactive Waste as specified in 10 CFR Part 61. DOE is responsible for the disposal of Greater-Than-Class-C wastes from the DOE Nondefense Program. (Note: This term applies only to radioactive waste under the authority of the U.S. Nuclear Regulatory Commission and is included in this EIS only for clarity.)

hazardous waste

Waste (solid, semisolid, or liquid) with the characteristics of ignitability, corrosivity, toxicity, or reactivity, as defined by the Resource Conservation and Recovery Act and identified or listed in 40 CFR 261 or the Toxic Substances Control Act.

high-level waste

The highly *radioactive* wastes that result from the chemical processing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid. High-level waste contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

low-level waste

Radioactive waste not classified as *high-level waste*, transuranic waste, *spent nuclear fuel*, or byproduct material.

mixed waste

Waste material that contains both *hazardous waste* and *radioactive* source, special nuclear, or byproduct material (subject to the Atomic Energy Act of 1954).

sanitary waste
Solid waste that is neither hazardous as defined by the *Resource Conservation and Recovery Act* nor *radioactive*; sanitary waste streams include paper, glass, discarded office material, and construction debris.

special case waste
A temporary waste classification defined in DOE Order 5820.2A, "Radioactive Waste Management," but eliminated from Draft DOE Order 435.1. Waste in this temporary classification must be evaluated to determine appropriate burial requirements.

water quality standards
Provisions of Federal or state law that consist of a designated use or uses for the waters of the United States and water quality standards for such waters based on their uses. Water quality standards are used to protect the public health or welfare, enhance the quality of water, and serve the purposes of the Clean Water Act.

wetlands
Land exhibiting the following: hydric soil conditions, saturated or inundated soil during some portion of the year, and plant species tolerant of such conditions; also, areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

DISTRIBUTION LIST

DOE is providing copies of the final EIS to Federal, state, and local elected and appointed officials and agencies of government; Native American groups; Federal, state, and local environmental and public interest groups; and other organizations and individuals listed below. Copies will be provided to other interested parties upon request.

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The Honorable Ernest F. Hollings
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The Honorable Strom Thurmond
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