# 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.

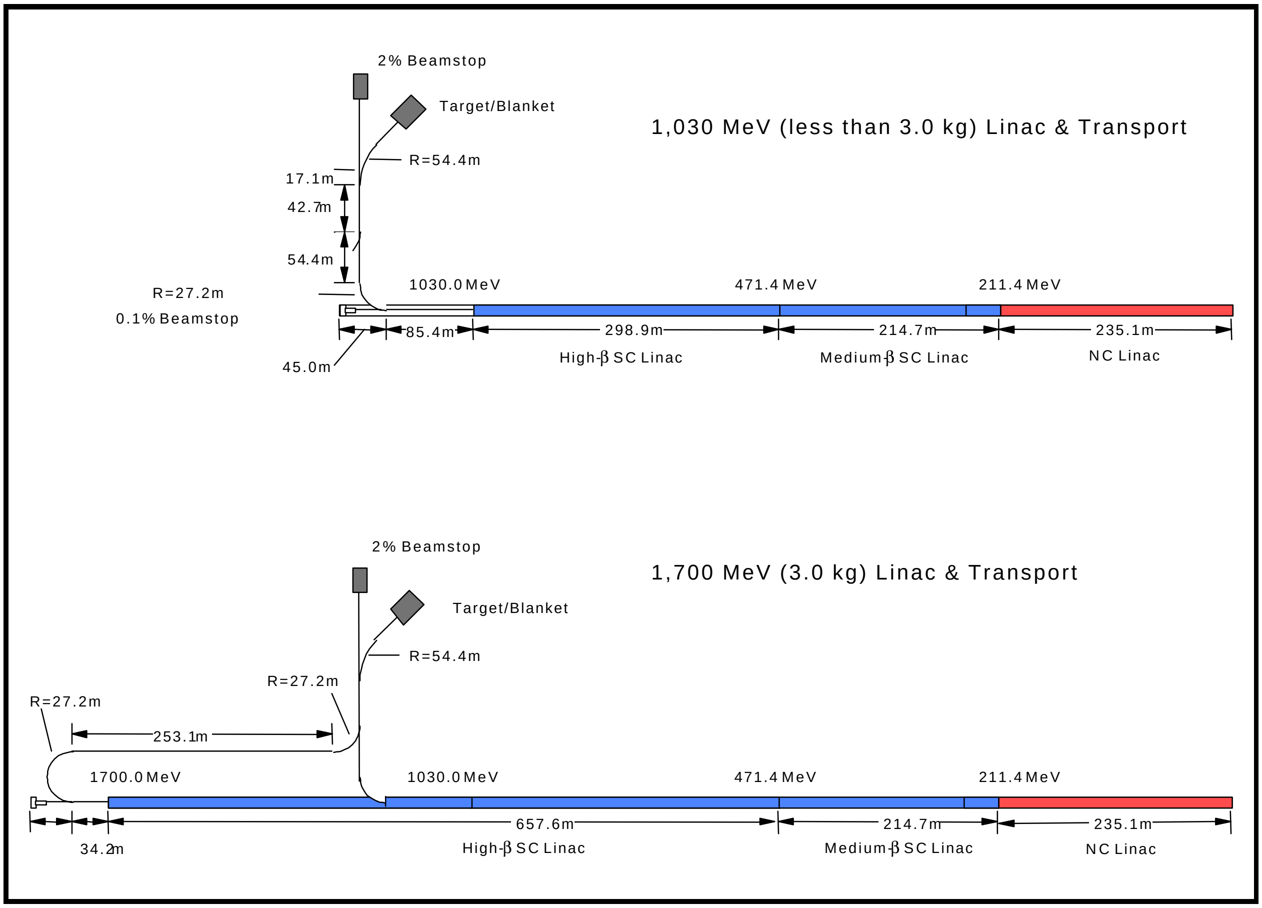


**Figure 4-14.** Conceptual design of modular APT.

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 | $2.7\times10^{-3}$ 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 | $1.0\times10^{-3}$ | NC | NC |
| Uninvolved worker dose | $1.7\times10^{-3}$ 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, $4.2\times10^{-5}$ 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] | $4.2\times10^{-5}$ curies/year[d] |
| Argon-41 | 2,000 curies/year | NC |
| Beryllium-7 | 0.02 curies/year | NC |
| Iodine-125 | $2.7\times10^{-3}$ 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 | $1.6\times10^{-3}$ | +6% |
| Uninvolved worker dose | $1.7\times10^{-3}$ 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

# References

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