#### 4.4.3.2 Discharge to seepage basin

DOE is conducting continuing studies of the detritiation of all SRP reactor moderator, the discontinued use of seepage basins, and related cleanup and remedial actions (Section F.6). Table 4-57 lists the expected annual releases of radionuclides to the L-Area seepage basin and the releases of radionuclides to Steel Creek by ground-water transport from the seepage basin.

Approximately 30 percent of the tritium entering the seepage basin would evaporate, and the remainder would seep into the ground, entering the uppermost water-table aquifer, the Barnwell Formation. The water is then expected to move horizontally, outcropping in Steel Creek approximately 4.4 years later. The quantity of tritium reaching Steel Creek is reduced to about 50 percent of that discharged to the seepage basin by evaporation and radioactive decay.

#### 4.4.3.3 Discharge to Steel Creek

Direct discharge to Steel Creek would lose the advantage of radioactive decay found in the seepage basin disposal method. Also, concentrations of tritium and other radionuclides in Steel Creek and the Savannah River would reach maximums during purges and drop to lower levels afterward. If discharged to Steel Creek, the purge water would be diluted with cooling water and evaporative losses to the atmosphere would be small.

#### 4.4.3.4 Evaporation

The purge water from the disassembly basin could be evaporated using a small commercially available boiler, vent stack, and dispersion fan. All the tritium would be dispersed in the atmosphere while other radionuclides would be retained in the evaporator bottoms and removed by ion change. No radioactive materials would enter Steel Creek under this alternative.

The estimated installation cost of such a unit would be $2-3 million and the operating cost would be $300,000 per year at $22 per thousand kilograms of steam.

#### 4.4.3.5 Detritiation

As discussed in Section 4.4.5, detritiation of reactor moderator in a central facility is being considered for all four SRP reactors. The moderator detritiation plant is expected to reduce equilibrium moderator tritium levels by a factor of ten. Inasmuch as the moderator would be the source of the tritium that contaminates the disassembly-basin water, a corresponding factor of ten reduction in the basin water tritium concentrations and releases from this source is expected.

4.4.3.6 Comparison of alternatives

The contribution to offsite dose of disassembly-basin discharge to the seepage basin, of direct discharge to Steel Creek, and of evaporation were calculated for the purpose of comparing these alternatives. Calculations of total dose from L-Reactor operation with discharge to the seepage basin and with direct discharge to Steel Creek can be found in Appendix B.

The amounts of tritium entering the atmosphere and liquid pathways as a result of discharge to the seepage basin, discharge to Steel Creek, and evaporation are listed in Table 4-58. These releases are predicted to occur after the tenth year of L-Reactor operation. During the first year, about one-tenth of these amounts would be released. Some radionuclides other than tritium would be released to Steel Creek, from both seepage-basin disposal and direct discharge to Steel Creek. The values listed in Table 4-57 are only those associated with disassembly-basin purge water and do not include releases from other sources such as heat exchanger leakage, process sumps, and evaporative loss from process water leaks.

Table 4-58. Tritium releases from disassembly-basin water disposal alternatives--tenth year

| Release pathway | Tritium releases (Ci) With seepage basin | Tritium releases (Ci) Direct to Steel Creek | Evaporation |
|---|---|---|---|
| Atmosphere | 3,200 | -- | 11,000 |
| Steel Creek | 6,000 | 11,000 | -- |

Table 4-59 lists offsite doses from the tritium and other radionuclides. Doses to the maximum individual from seepage-basin disposal would be about half of those from a direct discharge to Steel Creek and twice those expected from the use of an evaporator. Estimated population doses from an evaporator would be slightly lower than those from either a discharge to the seepage basin or a direct discharge to Steel Creek. However, these differences would be small.

There would be little difference in cost between a discharge to the seepage basin and a direct discharge to Steel Creek; the cost of either method would be small. Considering only operating costs, the cost-benefit ratio for installing an evaporator system would be $42,000 per person-rem avoided in the offsite population doses; this is a costly alternative. The cost-benefit ratio for detritiation of the moderator would be even greater per person-rem avoided (Section 4.4.5). TE

Thus, DOE has selected the discharge to seepage basin as its preferred alternative; at the same time, research and development activities for detritiation are continuing for potential general application at the Savannah River Plant. TC

Table 4-59. Offsite doses from disassembly-basin water disposal alternatives--tenth year

| Exposure pathway | With seepage basin | Direct to Steel Creek | Evaporator |
|---|---|---|---|
| MAXIMUM INDIVIDUAL (CHILD) DOSE (mrem/yr) | | | |
| Atmosphere[a] | 0.013 | -- | 0.044 |
| Liquid[b] | 0.074 | 0.15 | -- |
| Total | 0.087 | 0.15 | 0.044 |
| POPULATION DOSE (person-rem/yr) | | | |
| Atmosphere[a] | | | |
| 80-kilometer radius | 0.5 | -- | 1.9 |
| Liquid[b] | 8.6 | 15.9 | -- |
| Total | 9.1 | 15.9 | 1.9 |

[a]Tritium only released by atmospheric pathway.
[b]Radionuclides other than tritium also enter liquid exposure pathway.

### 4.4.4 186-Basin sludge removal

#### 4.4.4.1 Background

L-Area is equipped with a 95-million-liter reservoir (186-Basin) to hold cooling water for the reactor. The reservoir is divided into three separate basins, which are connected by sluice gates. All the water that comes from the Savannah River, which is used to cool the reactor during periods of normal operation and shutdown, would pass through the 186-Basin. The basins would also be used as settling basins to remove suspended solids from the water, thereby preventing their accumulation in the heat exchangers.

The average suspended solids concentration of the water drawn from the Savannah River is 21 milligrams per liter. The primary source of the suspended solids in the Savannah River is from the erosion of Piedmont soils above the fall line. About 2 percent of the suspended solids that enter the 186-Basin are actually deposited in the basin, amounting to about 110 metric tons of sediment on an annual basis.

The sediment that accumulates in the 186-Basin has been found to be a habitat suitable for growth for the Asiatic clam, *Corbicula*. Clams, which would be swept up by the water flowing to and through the reactor heat exchangers, would attach themselves to the piping and heat exchangers and continue to thrive. Eventually, the piping and heat exchangers could become fouled, or even plugged, and their ability to transmit the heat generated by the nuclear fission process in the reactor to the secondary cooling water would be impaired. To reduce the potential for Asiatic clam growth and development, the sediment in the 186-Basin would be removed on a periodic basis.

The following is a discussion of four alternative methods that could be employed to eliminate the sediment accumulation problem in the 186-Basin. They are compared on the basis of relative effort to implement each alternative. These alternatives are as follows:

1. Batch discharge to Steel Creek
2. Land application
3. Borrow pit application
4. Continuous sediment suspension

4.4.4.2 Batch discharge to Steel Creek

During periods of reactor shutdown and after the basins have been drained, this alternative would flush the sludge to the process sewer and eventually to an onsite stream. This procedure would take about 2 weeks.

With EPA's establishment of the National Pollutant Discharge Elimination System (NPDES) permit, a daily maximum limit of 50 milligrams per liter for total suspended solids was established for discharges to surface-water streams. During the periods in which the basins were cleaned of sediment, the suspended solids concentration in the effluent to the onsite streams exceeded this limit by 10 to 110 milligrams per liter. An exemption from the suspended solids limits has been obtained for the basin-cleaning activities at C-, K-, and P-Reactors under the January 1, 1984, NPDES permit for SRP (Section 7.4). Daily composite samples for total suspended solids are required during the cleaning period, and the results must be reported annually to SCDHEC. TC

Batch discharge would allow sediments flushed from the 186-Basin in L-Area to be discharged to Steel Creek. The resuspended sediments discharged to Steel Creek would be deposited in the creek before they reach the Savannah River swamp. These sediments could possibly be resuspended and transported when the water flow in Steel Creek increases due to storms or reactor startup.

Since 1968, when L-Reactor was placed on standby status, daily maximum suspended solids concentrations in Steel Creek and in the Savannah River have been observed to exceed EPA NPDES limits due to natural causes, and are comparable to the values anticipated with the draining and cleaning of the L-Area 186-Basin. The draining and cleaning of the L-Area 186-Basin would be carried out over a period of several days to 2 weeks on an annual basis.

4.4.4.3 Land application

The sediments that need to be removed from the L-Area 186-Basin could be applied to the land to enhance growth of a vegetative cover. The sediment is essentially topsoil from the Piedmont region above the fall line that has been eroded and washed away by storm runoff into the Savannah River.

To be able to handle it in an efficient and economical manner for land application, the sediment would have to be dried to a high solids content (sludge). This could be accomplished during a scheduled extended reactor shutdown by decanting the water from the basin, leaving the sediment. This water could be discarded in the process sewer line that discharges to Steel Creek.

The remaining sediment and water (sludge) could then be transferred to a sludge-drying basin, via (1) another process sewer line or (2) truck transport. On completion of the transfer, the 186-Basin could be returned to service, with no effect on reactor restart. The sludge would dry, or thicken, under natural conditions. On reaching a solids content suitable for handling, the sludge would be trucked to a site designated for the application.

This alternative would require the construction of a basin for sludge drying and the installation of an additional process sewer line connecting the 186-Basin to the new basin, if the process sewer line option identified above were selected.

#### 4.4.4.4 Borrow pit application

Another alternative to batch discharge to Steel Creek would be to place the material in retired borrow pits on the SRP site. These pits were sources of earth-fill material for various construction projects on the SRP.

This alternative would also require the construction of a sludge-drying basin and the additional process sewer line connecting the 186-Basin with the sludge-drying basin. The time requirements for this alternative would be similar to those for land application, and would not have an effect on reactor restart. This alternative, though, would be limited to the number of retired borrow pits on the SRP and their capacity.

#### 4.4.4.5 Continuous sediment suspension

A means to prevent sediment accumulation in the 186-Basin would be to keep solids in suspension in the water as it transits the basin. Agitation and turbulence of the basin water would accomplish this objective.

If implemented, the suspended solids concentration of the effluent stream discharged to Steel Creek would be essentially the same as that of the water drawn from the Savannah River. The total amount of sediment discharged to Steel Creek under this alternative would be the same amount discharged under the "batch discharge to Steel Creek" alternative described above. Continuous suspension of the sediment in the 186-Basin, however, would not prevent the accumulation of sediment in the L-Reactor heat exchangers and secondary cooling piping and might improve the habitat for the Asiatic clam.

4.4.4.6 Comparison of alternatives

None of the alternatives described above would have an impact on L-Reactor restarts following a scheduled extended shutdown. The "batch discharge to Steel Creek" and "continuous sediment suspension" alternatives would have no land use requirements, but could contribute to delta growth in the Savannah River swamp. The "borrow pit application" alternative would be limited to the number and capacity of retired borrow pits on the SRP.

The "batch discharge to Steel Creek" alternative would not require funds for construction activities, while the other three alternatives would require funds for construction, equipment procurement, maintenance, and additional operating expenses.

DOE has selected the batch discharge to Steel Creek as its preferred alternative. Batch discharge is presently allowed by the SRP NPDES permit issued by the South Carolina Department of Health and Environmental Control. This permit requires the performance of a 1-year study to determine the potential environmental effects of batch discharge. TC

## 4.4.5 Moderator detritiation

The possibility of a detritiation plant to remove tritium from heavy-water moderators in all SRP reactors is being studied. The moderator detritiation plant (MDP) would reduce moderator tritium content by a factor of ten to 1.7 curies per liter.

Tritium is formed in the heavy-water moderator by neutron irradiation of deuterium. Tritium reaches the environment through both liquid and gaseous pathways. Table 4-60 presents data for reactor tritium releases from all SRP operations. Operation of an MDP is expected to reduce reactor releases, including the contribution from L-Reactor operation, to 13 percent of the tabulated values.

Evaluation of the MDP is underway. The concept envisions the use of a central facility processing water from all four SRP reactors. The process being considered is based on catalytic exchange between heavy-water feed and detritiated deuterium gas. Tritium is extracted into the deuterium gas stream, which is cryogenically distilled to separate the tritium from the deuterium. The purified deuterium gas stream is returned to the catalytic exchange.

Two process variations are under consideration. In the first, which has been demonstrated and operated since 1972 on a scale about 1/7 of that required for SRP, a vapor phase exchange is employed. The heavy-water feed is first converted to steam, which is then mixed with the deuterium gas in contact with the catalyst. In the second variation, which has only been demonstrated on a laboratory scale, the heavy water is maintained in the liquid phase during contact with the deuterium gas stream in the presence of the catalyst. This latter variation offers the potential for significant cost savings compared to the former.

Table 4-60. Reactor tritium releases from SRP operation

| Releases | Curies for 3 reactors (annual) |
|---|---|
| **LIQUID** | |
| Direct reactor releases to river | 8,800 |
| Indirect to K-Basin and Par Pond | 9,800 |
| From heavy-water rework to river | 2,000 |
| Total | 20,600 |
| **ATMOSPHERIC** | |
| From reactor stacks | 146,000 |
| Evaporation from disassembly and seepage basins | 6,000 |
| Total | 152,000 |

Current estimates are based on a start of detailed design of the MDP in 1986, start of construction in 1987, and operation in 1992. By 1992, the estimated moderator tritium level will be 9 curies per liter, increasing at a rate of 0.7 curie per liter per year. Tritium releases from L-Reactor will represent about 15 percent of all SRP reactor tritium releases.

Capital costs of the MDP (escalated to the time of expenditure) are estimated to be in the order of $125 million. Estimated annual operating cost for the first year of operation is $6.2 million. These estimates place the cost-benefit of the MDP in excess of $1 million per person-rem exposure averted.

## 4.5 PREFERRED ALTERNATIVES*

This section presents the potential environmental effects of L-Reactor operation with the implementation of the preferred mitigation alternatives (described in Section 4.4). This alternative is discussed in more detail in Appendix L.

*Because this section is new, vertical change bars are not required.

### 4.5.1 Preferred mitigation alternatives

#### 4.5.1.1 Safety-system alternative

The existing confinement system is the preferred alternative. The safety-system alternatives discussed in Section 4.4.1 would mitigate the potential consequences from hypothetical reactor accidents, which have a very low estimated probability of occurrence and associated risk. Based on benefit, cost, and technical feasibility, the reference-case confinement system has been identified as the preferred safety-system alternative.

Of the six alternatives, including the reference case, only three were found to be technically feasible. Two of these feasible systems were associated with very large costs per person-rem averted, based on a postulated 3-percent core-melt accident. Again, the existing system is the preferred safety-system alternative.

As agreed in the Memorandum of Understanding between DOE and the State of South Carolina of April 27, 1983 (Congressional Record, July 14, 1983, p.S1000), DOE will, within the limits of classification, provide the State a discussion paper describing the differences between SRP production reactors and commercial power reactors and the reasons why a containment is neither feasible nor necessary on the existing SRP production reactors.

#### 4.5.1.2 Cooling-water alternative

The preferred cooling-water alternative of the Department of Energy is to construct a 1000-acre lake before L-Reactor resumes operation, to redesign the reactor outfall, and to operate L-Reactor in a way that assures a balanced biological community in the lake as specified in an NPDES permit to be issued by the State of South Carolina.

The lake will require at least 3 to 5 years to establish and develop a balanced biological community. Initially, L-Reactor will be operated to maintain 32.2°C or less in about 50 percent of the lake. Studies will be conducted to confirm the biological characteristics and the cooling effectiveness of the lake. Following the results of these studies, L-Reactor operations will be adjusted as necessary to assure the continued maintenance of a balanced biological community.

This alternative is discussed in Section 4.4.2.2.9; it is one of 33 alternatives analyzed in Section 4.4.2. Based on discussions with the South Carolina Department of Health and Environmental Control, DOE has determined that L-Reactor operation can be modified so the 1000-acre lake would comply with South Carolina water-quality standards. Also, the Corps of Engineers has agreed to construct the embankment to form the 1000-acre lake on a much faster schedule. Because DOE has to restart L-Reactor operation as soon as practicable to produce the needed defense nuclear materials and because the schedule for constructing such environmentally preferable alternatives as a closed-cycle cooling tower cannot be greatly improved (design, construction, and long-lead-time procurement of special pumps), DOE decided to identify the 1000-acre lake as its preferred cooling-water mitigation alternative.

In addition to complying with the NPDES permit, DOE:

- Will comply with provisions of Section 404 of the Clean Water Act with regard to the construction of the cooling lake, including the required SCDHEC 401 certification.

- Will prepare a predictive 316(a) demonstration.

- Will complete a consultation process with the U.S. Fish and Wildlife Service (FWS) on the impacts of the preferred alternative.

- Will, in accordance with FWS personnel, use the Habitat Evaluation Procedures (46 FR 7644) to determine further mitigation needs. Based on this program, DOE will implement additional mitigation measures (depending on Congressional authorization and appropriations).

- Will perform an archeological survey, assessment, and data recovery, if required, of the affected area not previously studied, as required by the National Historic Preservation Act.

- Will perform safety analyses of the design of the cooling lake.

#### 4.5.1.2.1 Description

The 1000-acre lake would be about 1200 meters wide at its widest point, would average approximately 600 meters wide, and would extend about 7000 meters along the Steel Creek valley from the embankment to just beyond Road B (Figure 4-44). The normal pool elevation of the lake would be 58 meters above mean sea level (MSL); the present elevation of Steel Creek at the dam site is 35 meters. The storage volume at the normal pool elevation would be about 31 million cubic meters.

The embankment for the 1000-acre lake would be at the same location as that for either the 500- or the 1300-acre lake. Figure 4-45 shows the relationships between these lake designs. The embankment would be approximately 800 meters upstream from the Seaboard Coast Line Railroad Bridge across Steel Creek or 1700 meters upstream from Road A. It would be 1200 meters long at the crest (Figure 4-46). The main embankment would be a maximum of about 26 meters high, 12 meters wide at the top, and 200 meters wide at the base. The elevation at the top of the embankment would be 61 meters above mean sea level to allow 3 meters freeboard for flood pool, wave action, and earthquake settlement.

An outlet structure with gates would control the discharge from the lake to a conduit running 220 meters under the embankment. This conduit would discharge into a stilling basin to reduce the velocity before the water is released into Steel Creek (Figure 4-47).

#### 4.5.1.2.2 Lake temperatures

L-Reactor would be operated at the highest allowed power level consistent with the maintenance of the balanced biological community in the lake, as specified in the NPDES permit that is expected to be issued by the State of South Carolina. Initially, L-Reactor would be operated to maintain 32.2°C or less in about 50 percent of the lake.

Hourly meteorological data for the years 1953 through 1982 and the cooling-lake thermal performance model described in Section L.2.2.1 was used in an iterative fashion to determine reactor power levels that would be required to meet the temperature criterion. The resulting average reactor power reduction was approximately 7 percent.

The heated water would be discharged into the lake through a specially designed outfall canal; it would spread over the cooler water present in the lake, enhancing the cooling efficiency (Section L.2.4.4). The surface layer would tend to exist throughout most of the lake due to the relatively small advective transport of the discharge, the depth of the lake, and the large temperature difference (between the influent and the effluent) within the lake. In addition, the discharge into the lake would be accomplished such that mixing of the discharge and resident lake water would be kept low (a desirable condition to maximize the heat flux through the water surface). Based on observations in Par Pond, as well as theoretical considerations, the surface layer in the L-Reactor cooling lake is expected to be about 1.5 meters thick. This layer would be vertically well mixed due to wind-induced turbulence. A cooler sublayer would exist beneath the surface layer. This layer would be fed by lake water returning from the cold end to satisfy the continuity requirements of discharge mixing and lake withdrawal. Accordingly, the temperatures in the deeper portions of the lake would approximate the cold end temperatures. That is, the colder sublayer temperature would range between approximately 17° and 31°C throughout the year (although some winter temperatures might be as low as 14°C, as inferred from the 30-year data base and thermal modeling).

Thermal modeling was also performed to calculate the percentage of the lake surface area having a given temperature for each season of the year. Water in the coldest 50 percent of the lake area is expected to exhibit temperatures that range from about 14°C to 23°C in the winter and from about 31°C to 32°C in the summer. Figure 4-48 shows the estimated summer isotherms in the surface layer of the 1000-acre lake. The shaded zone represents the area of the lake's surface that will be below 32.2°C.

#### 4.5.1.2.3 Lake operation

During construction of the embankment, streamflow would be carried through the work area in a temporary metal conduit laid parallel to the outlet works conduit. An upstream cofferdam, with a crest at elevation 43 meters above mean sea level, would divert the water into the metal conduit and protect the work site. A low downstream cofferdam would protect the site from rising tailwater. This diversion configuration would provide protection from a storm with a recurrence interval of between 25 and 50 years.

Following completion of the reconfigured discharge canal, outlet works, and embankment, the outlet gates would be closed and the pool elevation of the lake would be allowed to rise to the design elevation of 58 meters above mean sea level. Assuming a constant inflow of about 11 cubic meters per second of Savannah River water from L-Reactor, 0.45 cubic meter per second from P-Reactor, and 0.62 cubic meter per second Steel Creek base flow, approximately 30 days would be required to fill the lake. As impoundment of the lake occurred, the response of the embankment would be monitored to verify design. Flow would be maintained down Steel Creek below the embankment during filling. Lake filling would be completed before startup of L-Reactor.

Cooling-water and lake discharge flows, typically entering the outlet works at a depth of 2 to 4 meters below the lake surface, would be managed to maintain a balanced biological community in the lake and in Steel Creek and swamp. Reactor cooling-water flow variations and lake discharge management would restrict water level fluctuations to assure a healthy aquatic macrophyte population in the lake. The development of shoreline refuge areas would also enhance this macrophyte population, which would provide the necessary habitat for growth and reproduction of certain fish and macroinvertebrates necessary to maintain a balanced biological community (see Section L.4.1.1.2).

Downstream flows would be maintained constant throughout reactor operating periods, except during periods of extreme rainfall. During short reactor outages occurring within the spring spawning period, the flow at Road A would be controlled to about 3 cubic meters per second, thereby maintaining good spawning habitat. The remainder of the year, flow in Steel Creek at Road A during shutdown periods would be maintained at about 1.5 cubic meters per second, providing opportunities for fish to move freely from the base of the embankment to the Savannah River swamp.

If long reactor outages should occur during the spawning period, flow would be maintained at a rate of about 3 cubic meters per second. For long outages at other times, only base flow conditions would occur in Steel Creek.

4.5.1.2.4 Relocation of existing facilities

The construction of the 1000-acre lake would require the relocation of a 115-kilovolt electric transmission line belonging to the South Carolina Electric and Gas Company (SCE&G) and two 115-kilovolt electric transmission lines and buried supervisor control and relay cable lines that serve the L- and P-Areas. The SCE&G line could be raised from existing wooden poles onto two new tall towers in its present alignment. However, the two SRP lines would have to be rerouted around the lake because of the buried cable and the width of the lake at those points. Also, two new SCE&G transmission lines presently being designed by that company would be constructed such that they would not interfere with the 1000-acre lake.

Road A-14 would be abandoned wherever it would become inundated by the lake. The access road across the embankment would begin at Road A west of the lake and be extended northeast from the east end of the embankment along a ridge to connect with Road A-14 east of the lake. This road would parallel one of the relocated SRP transmission and buried cable lines. Approximately 600 meters of Road B and 100 meters of Road C would be raised a maximum of 3 meters on their existing roadbeds at their intersection.

4.5.1.3 *Disassembly-basin water purge*

The use of the L-Reactor seepage basin is the preferred alternative. As noted in Section 4.4.3, deionized and filtered purge water from the disassembly basin can be disposed of by discharge to the L-Reactor seepage basin, by evaporation, or by direct discharge to Steel Creek. Another alternative would be to detritiate the moderator (Section 4.4.5). On the bases of person-rem avoided and of the cost per person-rem avoided, the use of the L-Reactor seepage basin is the preferred alternative for the disposal of disassembly purge water. DOE will continue to study and evaluate moderator detritiation.

The use of the L-Reactor seepage basin would result in eventual discharges to the cooling lake, not Steel Creek. The use of the cooling lake is expected to increase the ground-water travel time from about 18 years (direct discharge) to about 21 years. The radiological effects from the discharge of radionuclides, principally tritium (Table 4-11), from the seepage basin to the cooling lake are listed in Table 4-61 and in Section 4.4.6.2.

In accordance with the DOE and State of South Carolina Memorandum of Understanding of April 27, 1983, DOE will, on a continuing basis, provide the State with data showing its compliance with EPA radionuclide standards, and will continue an expanded program of monitoring and study of ground-water impacts at SRP. Sections 6.1.6 and F.6 describe DOE's commitments on SRP ground-water protection, the evaluation of seepage-basin use on a sitewide base, and a separate NEPA review of the SRP ground-water protection plan.

#### 4.5.1.4 186-Basin sludge disposal

Batch discharge to the 1000-acre lake is the preferred alternative. Section 4.4.4 evaluates several methods for the disposal of sediment that settles from Savannah River water as it passes through the 186-Basin at L-Reactor. Methods considered included batch discharge (the reference case), land application, borrow-pit application, and continuous sediment suspension. Batch discharge is the preferred 186-Basin sludge disposal alternative on the basis of cost. It has been used in the past at L-Area and is currently being used at the other operating reactor sites. DOE will continue to study this method, in accordance with the December 15, 1983, NPDES permit issued by the State of South Carolina. During the batch discharge of settled sediment at L-Reactor and other reactor sites, composite samples of the effluent would be measured daily for total suspended sediment concentrations; the results of these measurements would be reported to SCDHEC in early 1985.

In combination with the preferred cooling-water alternative, some suspended sediment from the batch discharge of 186-Basin sludge would settle out and deposit on the bottom of the cooling lake. This deposition is expected to be a small fraction of the sediment that would be deposited in the basin from the stream flow above L-Reactor and from suspended material carried in the cooling water after it has passed through the 186-Basin and reactor heat exchangers. Siltation from these sources is not expected to have appreciable effects on the performance of the cooling lake.

### 4.5.2 Impacts due to construction and mitigation

This section characterizes the expected effects due to construction of the 1000-acre lake. No construction activities are required by the other preferred alternatives.

4.5.2.1 Socioeconomics and land use

For the preferred alternative, an additional 550 temporary construction workers would be required for the earth moving and dam building necessary to construct the 1000-acre lake. This estimate is based on a comparison with similar projects and on the assumption that a normal construction schedule would be followed. Minor impacts to local communities and services could be expected from inmigrating workers; economic benefits are expected to be minor in comparison to those caused by the L-Reactor and the total SRP operating workforce.

The total economic benefit of the L-Reactor restart using the reference case is 400 direct and indirect job opportunities, about $25 million in direct and indirect annual income and payroll, and $3 million in direct annual expenditures on materials and services. The preferred cooling-water alternative case would increase these benefits in the short term during embankment construction.

The 1000-acre cooling lake would be entirely within the present SRP area boundaries. Land use within the SRP area would be altered, in that 1000 acres would be inundated to become a cooling lake and the previous land uses as forest land and bottom land would be interrupted. The 1000 acres would include 225 acres of wetlands in the Steel Creek Corridor and 775 acres of uplands. Timber of commercial value would be harvested and removed from the site in accordance with SRP Forest Management Program. An additional area (about 133 acres) would be cleared for road and utility access relocation.

The timber which would be harvested consists of pine saw timber, pine pulp wood, hardwood saw timber, and hardwood pulp wood. The timber value and annual growth are summarized in Table 4-62. The anticipated value from harvesting the timber is $950,000. The annual loss in timber productivity is projected to be $44,000. This impact is not amenable to mitigation.

Table 4-62. Timber value and annual growth

| | Present volume/value | | | Annual growth | |
|---|---|---|---|---|---|
| Type of timber | Volume (1000 board feet) | Cords | Value ($1000) | Volume (%) | Value ($1000) |
| Pine, saw timber | 5058 | -- | 715 | 4 | 28 |
| Pine, pulp wood | -- | 4326 | 102 | 8 | 12 |
| Hardwood, saw timber | 2550 | -- | 128 | 3 | 4 |
| Hardwood, pulp wood | -- | 3384 | 5 | 6 | .3 |
| Totals | -- | -- | 950 | -- | 44 |

#### 4.5.2.2 Relocation of existing facilities

SCE&G would design and relocate its own transmission lines. The design and construction of the relocation of the SRP roads and transmission and control cable lines would be performed by the Du Pont Engineering Department. The U.S. Forest Service would administer all clearing for these relocations as well as clearing for the lake area.

#### 4.5.2.3 Site preparation

Clearing

All areas upstream from the embankment and less than 58 meters above mean sea level would be cleared of second growth pine and hardwood to provide for the 1000-acre lake area. All marketable timber from this area and from the road and transmission corridors would be cut, removed, and sold under the supervision of the Forest Service. Timber and vegetation in any area flooded by Steel Creek waters since 1954 might contain low-level radioactivity and would not be marketable. Procedures for the removal and disposition of such material would be developed and approved before construction started. Underbrush and scrap, except from timber cutting outside the area flooded by Steel Creek since 1954 except around some of the shoreline area would be piled and burned. Stumps would be removed under all embankment areas but not from the area within the lake.

Foundation preparation

Areas to be covered by the embankment, inlet and outlet works, or roadways would be grubbed and stumps would be removed and burned. All topsoil would be stripped and stockpiled for use on the finished grade for turf establishment. It might be necessary to excavate unconsolidated sediments from the area under the dam to a depth of between 3 and 15 meters to expose a tight clay formation to which the embankment could be sealed. Approximately 600,000 cubic meters of unsuitable material could be removed from the embankment site before 1.2 million cubic meters of borrow fill and rip-rap would be placed to form the embankment. Spoil from the surface portion of the embankment foundation in the Steel Creek floodplain, estimated to contain a total of 0.2 curie of cesium-137 and 0.02 curie of cobalt-60, would be separated, contained, replaced outside the jurisdictional wetlands upstream of the embankment, and covered with subsurface spoil to prevent erosion during the construction period. This relocation would have no effect on net cesium transport estimates. All other material would be removed and used for backfill in the borrow areas.

Abandoned well survey and sealing

Research is currently underway to determine how many wells were constructed within the lake area before Government acquisition of the SRP property. All of these wells would be sealed before the lake begins filling to reduce the chance of affecting ground-water quality.

In March 1984, a survey team from the Furman University Department of Geology performed a field survey of this portion of the Steel Creek watershed. Twenty old possible well sites were identified in this area, 11 of which were found to lie within the boundaries of the 1000-acre lake. The sites vary from shallow open depressions to deep cased and screened wells. Several of these might be grave sites or archeological sites rather than wells.

Each site identified, as well as any others drilled or located during construction of the 1000-acre lake, would be sealed by filling from bottom to top with sand-cement or concrete in accordance with the South Carolina Primary Drinking Water Regulations, Section R 61-58.2 C (14), "Permanent Well and Test Hole Abandonment." All information relative to each site (e.g., exact plant coordinate location, depth, diameter) would be recorded and submitted to SCDHEC.

#### 4.5.2.4 Embankment construction

The construction of the earthen embankment and water diversion system for the lake would cause some temporary increases in suspended solids in Steel Creek. Suitable precautions would be taken (1) during the construction operations necessary to establish a foundation for the embankment, and (2) during emplacement of the fill to ensure that undue silt and debris loads do not move downstream from the construction site. Turbidity screens could minimize impacts to downstream areas.

Borrow pits for similar quantities of suitable materials have been identified in the past for construction at the Savannah River Plant, and have been controlled in an environmentally acceptable manner. About 90 percent of the fill material for the embankment would probably come from a borrow pit that would be submerged when the lake is filled (Section L.2.4.7). A second potential borrow site would not be inundated. A small volume of material might be taken from this location, which would result in the loss of about 5 acres of upland habitat.

The number and routing of access roads for construction have been carefully considered to minimize adverse environmental impacts. An estimated 33 acres of upland habitat outside the area to be inundated would be altered by the construction of access roads. The reconstruction of existing roads would not result in the alteration of any uplands because they would utilize the existing roadbed. The rerouting of powerline and buried cable rights-of-way would cause the loss of an additional 100 acres of upland habitat.

Spoil piles of the size expected for this alternative have been developed for past construction activities at the Savannah River Plant and have met the necessary environmental control requirements. Spoil from any excavation in the former floodplain of Steel Creek would be monitored for radioactive materials; any spoil containing radioactivity would be disposed of as discussed in Section L.2.4.2.2.

#### 4.5.2.5 Ecology

There would be two principal sources of potential impact to the ecology of the area: (1) the construction of the embankment and associated appurtenances, and (2) the inundation by the lake.

The filling of the cooling lake would inundate between 225 acres of wetlands and 775 acres of uplands in the Steel Creek corridor. The vegetation in this area consists primarily of forested (73 percent) and scrub-shrub (24 percent). The wetland areas are classified as Resource Category 2 by the U.S. Fish and Wildlife Service. This category and its designation criteria include "high value for evaluation species and scarce or becoming scarce." The mitigation planning goal specifies that there be "no net loss of inkind habitat value" (USDOI, 1981). TC

#### 4.5.2.6 Water quality

The potential impacts to water quality from construction would be erosion and sedimentation; these potential impacts would be mitigated as described in Section 4.5.2.9.

#### 4.5.2.7 Air quality and noise

About 400 to 550 acres of upland forest would be cleared. Trees of commercial value would be harvested and removed from the site in accordance with the SRP Forest Management Program. Open burning would be employed for disposal of forest slash cleared from the site. Clearing and burning would progress in reasonably sized units of a few acres to minimize local dust and smoke. The nearest roadways to the lake would be SRP Road B (less than 30 meters) and Highway 125 (1 kilometer). Traffic could be rerouted from Road B if necessary during the burning of slash material. Because of its distance from the construction site, Highway 125 would not be affected. Burning would result in some releases of particulates and gases into the atmosphere, but releases would be local and generally short-lived. Offsite effects are not expected since the nearest location to the SRP site boundary from the lake would be approximately 8 kilometers.

Not all the lake would be grubbed and burned. About 200 acres of lake bottom near the shoreline would be maintained with the stumps in place as habitat for aquatic organisms. Other burnable slash might also be used to construct submerged habitat attraction structures, thus reducing the need to burn all material at the site. Temporary construction roads, laydown areas, and spoil areas would be graded, grassed, wetted, or sprayed with tackifiers as needed to reduce local dust. As much as possible, the roads would be designed to become permanent access roads when the project was completed, thus reducing the impacts of temporary haul roads.

The cooling lake construction site is in a forest area that is relatively remote from human habitation. Noise from construction, primarily from tree-cutting and earth-moving equipment, would have insignificant offsite environmental effects because of the remoteness of the site and the muffling effect of intervening forests. Members of the public using SC Highway 125 would not be in the immediate vicinity of noisy equipment and would have only brief exposure. Effects of this exposure would be insignificant. Noise levels from lake-site construction in nearby L-Area, the nearest occupied onsite facility, are expected to be well within clearly acceptable standards (62 decibels). Operators of noisy construction equipment would wear protective equipment in accordance with Du Pont standards (where applicable) and OSHA regulations. Most other workers in the area would be exposed to high noise levels only intermittently, but protective equipment would be provided when the exposure could be expected to be sustained. No impulsive or impact noises in excess of acceptable standards would be expected.

#### 4.5.2.8 Historic/archeological

Four historic sites and one prehistoric site in the Steel Creek terrace and floodplain system (Figure 3-3) have been determined to be eligible for inclusion in the National Register of Historic Places. No direct impacts are expected to the prehistoric site or to three of the historic sites because they would be below the embankment and outside the area affected by high-water flow conditions. One historic site area would be inundated when the lake was filled. These impacts would be mitigated as described in Section 4.5.2.9.

In March 1984, an intensive survey of the proposed excavation areas (embankment and borrow pit areas) was made (Brooks, 1984). This survey identified seven sites described as of ephemeral quality and not eligible for nomination to the National Register of Historic Places.

Archeological surveying and testing are presently being conducted in the proposed lake area by the University of South Carolina Institute of Archeology and Anthropology. It is anticipated that several sites associated with the Ashley Plantation would be affected. As of May 7, 1984, two potentially significant sites had been identified. DOE is developing data recovery plans and continuing the consultation process with SHPO and ACHP. The schedule for completion of the requirements under the National Historic Preservation Act, including data recovery, is consistent with the construction schedule for the embankment, and all mitigation would be completed prior to restart (Hanson, 1984). The study results, determination of the eligibility of potential sites, and the development of a mitigation plan are being coordinated with the SHPO and ACHP.

#### 4.5.2.9 Construction impact mitigation

Historic/archeological site mitigation

A monitoring and mitigation plan has been developed to ensure the preservation of the resources at the four sites below the dam, and the plan has been approved by the South Carolina State Historic Preservation Officer (SHPO) (Du Pont, 1983).

A resource recovery plan has been developed by the University of South Carolina Institute of Archeology and Anthropology for the one historic site (38 BR 288) located within the proposed lake area. This mitigation plan has been approved by the SHPO and the Advisory Council on Historic Preservation (ACHP) (Lee, 1982), which concurred that this mitigation plan would result in no adverse impacts to National Register properties.

Ecological mitigation

The Department of Energy is working with the Department of the Interior to perform a Habitat Evaluation Procedure (HEP). The HEP will identify the value of habitat to be gained or lost with implementation of the preferred cooling-water mitigation alternative for use in assessing further mitigation. If required, DOE will implement additional mitigative measures that might be identified through the HEP process, dependent on Congressional authorization and appropriation.

The endangered wood stork forages at the Savannah River Plant but does not breed on the site. The feeding individuals have been observed to be from the Birdsville Rookery, some 50 kilometers away. Feeding occurs in the swamp away from the proposed lake; it could be affected by raised water levels of the Steel Creek delta if the L-Reactor cooling-water flow is discharged through the proposed lake. DOE initiated informal consultation with the Fish and Wildlife Service (FWS) in July 1983 and in March 1984 as required by Section 7 of the Endangered Species Act. DOE has also initiated the formal consultation process by providing a Biological Assessment to FWS for a Biological Opinion (Sires, 1984a). While DOE concludes that the operation of L-Reactor would affect foraging habitat near the Steel Creek delta, the construction activities associated with Phase II of the NPDES permit to control the acidity of releases from the 400-area powerhouse ash basins would improve the quality of the foraging habitat in the Beaver Dam Creek area, assuring the continued availability of this habitat. Therefore, the loss of foraging habitat in the Steel Creek area would not jeopardize the continued existence of the wood stork. Any additional mitigation measures needed would be determined either as part of the HEP study or as part of this consultation process.

Water-quality mitigation

The lake construction activity would include an Environmental Protection Plan, which would include several measures designed to mitigate water-quality impacts.

Earthwork brought to final grade would be protected as soon as practicable. All earthwork would be planned and conducted to minimize the duration of exposure of unprotected soils. Except in instances where the constructed feature obscures borrow areas and waste material areas, these areas would not initially be cleared in total. Clearing of such areas would progress in reasonably sized increments as needed.

Such methods as necessary would be utilized to effectively prevent erosion and control sedimentation, including but not limited to the following:

1. Retardation and control of runoff. Runoff from the construction site would be controlled by construction of diversion ditches, benches, and berms to retard and divert runoff to protected drainage courses.

2. Sediment basins. Sediment from construction areas would be trapped in temporary or permanent sediment basins in accordance with design plans. The basins would accommodate the runoff of anticipated storms. After each storm the basins would be pumped dry and accumulated sediment would be removed as necessary to maintain basin effectiveness.

Overflow would be controlled by paved weir or by vertical overflow pipe, draining from the surface. The collected topsoil sediment would be reused for fill on the construction site, and/or conserved (stockpiled) for use elsewhere. Effluent quality monitoring programs would be required.

Temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching would be used until permanent drainage and erosion control facilities were complete and operative.

Borrow areas and spoil-storage areas would be managed to minimize erosion and to prevent sediment from entering nearby water courses or lakes. Temporary excavations and embankments for work areas would be controlled to protect adjacent areas from despoilment.

Solid wastes (excluding clearing debris) would be placed in containers which would be emptied on a regular schedule. All handling and disposal would be conducted to prevent contamination. Chemical waste would be stored in corrosion-resistant containers, removed from the work area, and disposed of in accordance with Federal, State and local regulations.

Construction activities would be kept under surveillance, management, and control to avoid pollution of surface and ground waters. The following special management techniques would be implemented to control water pollution: (1) wastewaters derived from construction activities would not be allowed to leave the site; these wastewaters would be collected in retention ponds where suspended material could be settled out or the water evaporated so pollutants would be separated from the water; (2) the operation would be planned to minimize adverse impacts of dewatering, removal of cofferdams, and excavation, and to limit the impact of water turbidity on the habitat for wildlife and impacts on water quality for downstream use; (3) stream crossings would be controlled during construction; crossings would provide for movement of materials or equipment which do not violate water pollution control standards of the Federal, State, or local government; (4) all water areas affected by construction activities would be monitored; (5) construction activities would be kept under surveillance, management, and control to minimize interference with, disturbance to, and damage of fish and wildlife.

Air emissions and noise control

The construction Environmental Protection Plan would also require measures to mitigate air emissions and noise. Construction activities would be kept under surveillance, management, and control to minimize pollution of air resources. All activities, equipment, processes, and work performed would be in strict accordance with applicable requirements.

The following special management techniques would be implemented to control air pollution by the construction activities:

1. Dust particles, aerosols, and gaseous byproducts from all construction activities, processing and preparation of materials would be controlled at all times, including weekends, holidays, and hours when work is not in progress.

2. Particulates that could cause the air pollution standards to be exceeded or that could cause a hazard or a nuisance would be controlled at all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries. Sprinkling, chemical treatment of an approved type, light bituminous treatment, or other methods would be utilized to control particulates in the work area. Sprinkling would be repeated at such intervals as to keep the disturbed area damp. Particulate control would be performed as the work proceeded and whenever a particulate nuisance or hazard occurred.

3. Hydrocarbons and carbon monoxide emissions from equipment would be controlled to Federal and State allowable limits at all times.

4. Odors would be controlled at all times for all construction activities, processing and preparation of materials.

5. Air at all areas affected by the construction activities would be monitored.

Construction activities would be kept under surveillance and control to minimize damage to the environment by noise. Methods and devices would be used to control noise emitted by equipment to the levels shown in the COE, Savannah District Safety Manual (COE, Savannah District, 1981a).

### 4.5.3 Nonradiological impacts due to normal L-Reactor operation

This section characterizes the expected nonradiological and radiological effects due to the normal operation of L-Reactor with the system of preferred mitigation alternatives. Nonradiological effects include those that might result from changes in land use, an increased workforce, the withdrawal and discharge of cooling water, the discharge of liquid and atmospheric chemical effluents, and the disposal of solid nonradioactive wastes. Radiological effects include those that might result from airborne and liquid radionuclide releases, the disposal of radioactive wastes, and the resuspension and transport of radiocesium and cobalt-60 in Steel Creek.

#### 4.5.3.1 Land use and socioeconomics

The resumption of L-Reactor operation with the preferred alternatives is not expected to produce any additional land-use impacts. Operational employment for L-Reactor, which began in 1981, peaked at about 400 employees in mid-1983 and is expected to decrease to 350 by mid-1984, or about 4 percent of the current workforce at the Savannah River Plant (Du Pont, 1982b). Essentially all the operating workforce for L-Reactor has been hired and resides in the SRP area; therefore, no additional impacts are expected to local communities and services due to in-migrating workers.

L-Reactor operation is expected to have annual total local expenditures on materials and services of approximately $3 million and a total payroll and overhead expenditure of about $21 million. These expenditures are expected to result in the creation of about 50 regional job opportunities. In addition, these expected expenditures are anticipated to produce an additional direct and indirect income of another $3 million. The total economic benefit to the SRP region during L-Reactor operation would amount to at least 400 direct and indirect job opportunities, about $25 million in direct and indirect annual income and payroll, and $3 million in direct annual expenditures on materials and services.

These contributions to the local economy would help pay for public services directly through income, property, and license taxes and user fees and help indirectly through sales taxes on goods and services. The benefits provided by the project would help offset the small increase in demands for local services that it generates.

A supplement to the approved mitigation plan protecting the four historic and one prehistoric sites shown in Figure 3-3 will be developed by DOE and submitted to the SHPO and ACHP for approval. This supplement would protect new sites eligible for nomination to the National Register of Historic Places.

#### 4.5.3.2 Surface-water usage

With the 1000-acre once-through cooling lake, L-Reactor operation would withdraw about 11 cubic meters of water per second from the Savannah River. This would be less than 4 percent of the average flow and 7 percent of the 7-day, 10-year low flow of 295 and 159 cubic meters per second, respectively. Because little L-Reactor cooling water would be consumed, essentially all water withdrawn from the river would be returned to the river after passing through the L-Reactor heat exchangers and the Steel Creek system. According to Neill and Babcock (1971), the estimated consumptive water use by L-Reactor is expected to be about 1.25 cubic meters per second.

Withdrawal of cooling water for L-Reactor operation would affect the aquatic ecology of the Savannah River by (1) the entrainment in the cooling water of aquatic organisms (predominantly fish eggs and larvae) smaller than the screen mesh in the intake system, and (2) the impingement of aquatic organisms (primarily fish) on the intake screens. The impacts due to entrainment are estimated to be $7.7 \times 10^6$ additional fish eggs and $11.9 \times 10^6$ additional fish larvae annually. The impingement impact is estimated to be 16 fish per day (Section 4.1.1.2).

#### 4.5.3.3 Ground water

The withdrawal of ground water for L-Reactor would be about 0.94 cubic meter per minute. The ground-water withdrawal from the Tuscaloosa is projected to decrease when L-Reactor operation resumes (excluding incremental pumping in support of L-Reactor) compared to 1982 pumping; water levels are expected to rise as a new equilibrium piezometric surface is established at SRP and neighboring areas. At Jackson and Talatha, water levels are projected to increase by about 0.5 and 0.4 meter, respectively, if sitewide pumping decreases to 20.5 cubic meters per minute. However, pumping at L-Area would draw down the water in the Tuscaloosa locally, and thereby reduce the upward head difference between the Tuscaloosa and Congaree to about 1.4 meters beneath the L-Reactor seepage basin. The withdrawal of ground water from the Tuscaloosa will not affect water levels in overlying aquifers because of the thick Ellenton clay unit and the basal Congaree clay. Important clay layers, principally the green clay, beneath the L-Reactor seepage basin will tend to protect the Congaree and Tuscaloosa Aquifers; any contaminants that might reach these aquifers would flow beneath the SRP to the Savannah River in 76 to 250 years, respectively, and will not affect offsite ground-water users (Section 4.1.1.3).

Impounded water for a cooling lake would cause a local ground-water mound in the water-table aquifer, which would tend to increase the travel time from the L-Reactor seepage basin to seepline springs near the lake's shore from about 18 years to 21 years. This effect of the lake would dissipate with depth and would be expected to have a small effect on water levels in the McBean Formation. The green clay confining unit separates the McBean from the underlying Congaree Formation. It would prevent the increased head associated with a cooling lake from impacting the head differential between the Tuscaloosa and Congaree Formations. It is also an important barrier to the migration of contaminants from near-surface to lower hydrostratigraphic units. In the Separations Areas and near the Central Shops, the green clay (about 2 to 3 meters thick) supports a head difference of about 21 to 24 meters between the McBean and Congaree Formations. Based on water samples obtained for tritium analysis from the Congaree near the H-Area seepage basin, the green clay has effectively protected the Congaree ground water from contamination seeping into the ground (Marine, 1965). In the L-Area, the green clay is about 7 meters thick. At the Par Pond pumphouse, along the strike of the McBean and Congaree Formations, the green clay also supports a large head difference; the water pumped from the Congaree Formation shows no evidence of tritium contamination, even though tritium concentrations in Par Pond were measured at 27,000 picocuries per liter.

Due to the sandy soil in the area of the natural saddle that would serve as the emergency spillway (Figure 4-44), some seepage could occur from the 1000-acre lake to Pen Branch. A cut-off wall would be constructed in this area if seepage is a problem.

#### 4.5.3.4 Thermal discharge

Thermal discharge from the reactor would flow into the 1000-acre lake at temperatures of 73°C or less, depending on reactor power and river intake temperatures. Reactor power, in turn, would be established by lake temperatures and meteorological conditions. As noted in Section 4.5.1.2.2, L-Reactor would be operated at the highest allowable power level consistent with the maintenance of a balanced biological community, as specified in the NPDES permit expected to be issued by SCDHEC. Initially, L-Reactor would operate to maintain 32.2°C or less in about 50 percent of the lake. Isotherms calculated for summer conditions and an average reactor power level of 1080 megawatts are shown in Figure 4-47. Similar diagrams for the other seasons are presented in Appendix L. The expected composition of the balanced biological community is described in Appendix L.

Table 4-63 lists the estimated temperatures in Steel Creek below the lake's discharge structures for summer, spring, and winter. Projected water temperatures in the summer (5-day, worst-case) at the Steel Creek delta, mid-swamp and the mouth of Steel Creek would be within about 1°C of ambient. In the spring, water temperatures at the Steel Creek delta would be 3°C above ambient. Water temperatures would be near ambient at the mouth of Steel Creek. These conditions would not pose any adverse impacts to aquatic and semiaquatic biota. In the winter, however, projected temperatures at Road A and points downstream would be 7°C and 9°C above historical ambient. These warmer conditions could concentrate fish at the mouth of Steel Creek. Reactor shutdowns during the winter would result in gradual heat loss in this area, which would minimize any cold shock effects. This alternative would not adversely impact access to, and the spawning of riverine and anadromous fishes in, the Savannah River swamp below the Steel Creek delta.

Table 4-63. Temperatures (°C) downstream in Steel Creek below the 1000-acre lake

| Location | Summer[a] | Spring[b] | Winter[b] |
|---|---|---|---|
| Discharge temperature[c] | 31 | 26 | 17 |
| Road A | 31 | 26 | 17 |
| Swamp | 31 | 25 | 15 |
| Mid-swamp | 30 | 22 | 13 |
| Mouth of creek at river | 30 | 22 | 13 |

[a]Based on worst 5-day meteorological conditions (July 11-15, 1980) and estimated operating power of reactor. Five-day worst-case meteorological conditions provide the basis for a conservatively high estimate of discharge and downstream temperatures that are likely to result from the implementation of a thermal mitigation alternative. The selection of 5-day worst-case meteorology is also based on a typical cycle of consecutive meteorological conditions; it is considered to be representative of extreme temperatures for which the maintenance of a balanced biological community can be measured under Section 316(a) of the Federal Water Pollution Control Act.

[b]Based on 30-year average values for meteorological conditions and actual power of an operating reactor.

[c]The temperature entering Steel Creek from the lake.

There would be minimal impacts in Steel Creek below the embankment. However, the flow of discharge water would have adverse impacts on between 215 and 335 acres of wetlands in the Steel Creek delta and swamp. This area, which is dominated by forested (45 percent) and scrub-shrub (36 percent) wetlands, provides foraging habitat for the endangered wood stork and American alligator. These wetlands also represent important feeding and roosting habitat for as many as 1200 mallard and 400 wood duck. Impacts on the American alligator, mallard, and wood duck are expected to be minimal. A delta growth rate of about 1 to 2 acres per year is anticipated.

Of the 4800 breeding pairs of wood storks sighted in the United States in 1980, approximately 100 pairs were observed at the Birdsville Rookery near Millen, Georgia. The Steel Creek delta area is one of the 50 foraging sites used by the wood stork; in 1983, 100 wood storks were observed feeding in the delta, which is an important foraging habitat (Meyers, 1984). Higher water levels at the delta could potentially make this area less desirable as a foraging habitat. The total elimination of the Steel Creek delta area as a foraging habitat for the wood stork would represent the displacement of food required for fledglings. As observed in 1983, when the delta area was not available for foraging, the wood storks moved to other available foraging habitats; 1983 was a successful year for the Birdsville Rookery wood storks. The Department is going through the consultation process with the U.S. Fish and Wildlife Service, as required by the Endangered Species Act (Sires, 1981). The biological opinion to be issued by the Fish and Wildlife Service will indicate the needed mitigation measures and should agree with DOE's conclusion that the operation of L-Reactor would not affect the continued existence of this species.

Thermal impacts on the biota in the river would be minimal because water temperatures would be very close to ambient at the point the discharge flow enters the river. There would be a zone of passage for the movement of fish up and down the river past the SRP site.

The embankment and cooling lake would prevent access by riverine and anadromous fish to about 100 acres of wetlands along Steel Creek above L-Reactor. However, the only migratory fish in this reach of Steel Creek would be the American eel. Also, access to Meyers Branch would not be affected by the embankment.

Preliminary results of investigations in upper Steel Creek indicate that the macroinvertebrate community is self-sustaining and therefore unlikely to undergo significant changes as a result of the creation of the 1000-acre lake. Sixteen species of fish have also been collected in this reach of Steel Creek during two recent surveys. Most of the species are small fish that prefer stream habitats. However, because all but one of the species collected has been reported in thermal refugia (backwater or tributary stream areas) peripheral to reactor effluent streams on SRP, it is anticipated that the fish populations in upper Steel Creek would be capable of maintaining their present status in the 3- to 4-kilometer reach that would, when the reactor is operating, be isolated above the cooling lake. There would, however, undoubtedly be shifts in patterns of relative abundance. For example, the thermally tolerant mosquitofish would probably increase in abundance, and those species that prefer or can utilize lake habitats could thrive in the upper portions of the lake, where temperatures would be moderated by the inflow from Steel Creek.

#### 4.5.3.5 Wastewater discharges

Liquid effluent discharges

With the preferred alternatives, liquid effluents to the Savannah River would have chemical characteristics similar to those of the river and would, therefore, produce no impacts.

Sanitary discharges

Sanitary wastewater would be chlorinated at a packaged treatment plant and discharged through the L-Area wastewater sewer to Steel Creek. The sanitary wastewater-treatment plant is designed for a maximum flow of 132 cubic meters per day. The treatment-plant size was selected to be adequate for the expected operating workforce. The discharge would meet NPDES permit (Du Pont, 1981a) requirements and would have not major impact on Steel Creek (Du Pont, 1982b). Sewage sludge would be transported to an existing basin near the Central Shops. Samples of sludge from similar treatment facilities indicate that it is not hazardous (Du Pont, 1982b).

Cooling-water reservoir (186-Basin)

The 95-million-liter cooling-water processing basin (186-Basin) would be cleaned annually during periods of reactor shutdown to remove accumulated solids. About 110 metric tons of the 5530 metric tons of suspended solids that would enter the 186-Basin annually would be deposited in the basin. This sediment would be flushed to Steel Creek over a period of several days. During flushing, the suspended solids concentrations in the effluent would be about 60 to 160 parts per million. This annual operation has been performed many times at the other reactors with no evidence of detrimental impact. Most of the suspended solids released from the 186-Basin would settle in the streambed before reaching the swamp (Kiser, 1977; Geisy and Briese, 1978; Du Pont, 1981a; Ruby et al., 1981). When L-Reactor discharges resume (at about 11 cubic meters per second), the resuspension of some of this settled sediment could contribute a small amount of material to the delta, which is expected to grow at a rate of about 1 to 2 acres per year with direct discharge.

During the flushing of the sediment from the basin, the concentrations of total suspended solids would be monitored and reported to SCDHEC in accordance with the NPDES permit.

#### 4.5.3.6 Atmospheric releases

Nonradiological pollutants emitted into the atmosphere as a direct result of the operation of L-Reactor would come primarily from the K-Area coal-fired steam plant and the diesel generators at the L-Area. The steam demands for L-Reactor would require an additional 6400 metric tons of coal to be burned annually at the K-Area steam plant. Emissions of particulates, sulfur oxides, nitrogen oxides, carbon monoxide, and volatile organic compounds from the steam plant would increase 15 percent, as illustrated in Table 4-7.

Fourteen emergency diesel generators are located in L-Area; six would operate continuously. The estimated annual diesel fuel consumption rate would be 940 cubic meters for all generators. The emissions from these generators are listed in Table 4-7.

The operation of the L-Reactor would not violate any ambient air quality standard.

#### 4.5.3.7 Solid wastes

Solid nonradioactive wastes generated by the resumption of L-Reactor operation would consist of trash and sanitary waste sludge. Trash would be generated at a rate comparable to those experienced by other SRP reactors; it would be disposed of in the SRP sanitary landfill. This landfill will be expanded from about 0.04 to 0.13 square kilometer. This expansion, which will occur in any event, ensures an adequate capacity for SRP operation, including L-Reactor, for many years (Du Pont, 1982b). Ten wells monitor the effluent from the landfill to the ground water of the McBean Formation. Quarterly analyses of water from these wells have shown little impact on the McBean ground water.

Periodically, treated sludge would be pumped from the sanitary waste treatment plant sludge holding tank to a mobile tank and transported to the sludge pit near the Central Shops area. Approximately 48,000 liters (50 percent water) of the sludge from L-Area would be disposed of in the sludge pit annually. No impact is expected on the operation of the sludge pit.

#### 4.5.3.8 Noise

During the normal operation of L-Reactor with the preferred alternatives, any noise external to buildings would be associated primarily with the movement of motor vehicles; it would be undetectable at the nearest offsite residence, about 10 kilometers away.

### 4.5.4 Radiological impacts of normal L-Reactor operation

#### 4.5.4.1 Atmospheric releases of radioactivity

Table 4-64 lists the atmospheric releases from L-Reactor operation with the reference case system. For the preferred alternatives, tritium, which otherwise would be discharged to Steel Creek from L-Reactor (directly or via a groundwater path from the L-Reactor seepage basin), would be released to the cooling lake. Evaporation and molecular exchange are expected to increase the releases to the atmosphere and thus, decrease liquid releases to the Savannah River. Tritium releases to the atmosphere are expected to increase by about 1 percent on the first year and about 3 percent in the tenth year in relation to those from the reference case, direct discharge.

Table 4-64. Expected annual atmospheric releases from L-Reactor operation[a] (curies per year)

| Radionuclide | 1st-year operation | 10th-year operation |
|---|---|---|
| H-3[b] | 5,540 | 56,500 |
| C-14 | 12 | 12 |
| Ar-41 | 19,500 | 19,500 |
| Kr-85m | 600 | 600 |
| Kr-87 | 540 | 540 |
| Kr-88 | 790 | 790 |
| I-131 | 0.00414 | 0.00414 |
| Xe-133 | 1,700 | 1,700 |
| Xe-135 | 1,400 | 1,400 |
| Unidentified beta-gamma[c] | 0.0002 | 0.0002 |
| Unidentified alpha[d] | 0.000001 | 0.000001 |

[a]The expected annual average concentrations at the SRP site boundary would be well within the DOE concentration guides for uncontrolled areas (DOE, 1981b).

[b]Includes evaporative and molecular losses at ground level from the disassembly basin, the seepage basin, and the cooling lake.

[c]Assumed to be strontium-90.

[d]Assumed to be plutonium-239.

4.5.4.2 Wastewater discharges of radioactivity

Table 4-61 lists wastewater discharges of radioactivity for the reference case. For the preferred alternatives, tritium releases to the Savannah River are less (because the atmospheric releases cover more); they are expected to comprise about 85 percent of the values for the reference case.

4.5.4.3 Cesium-137 and cobalt-60 remobilization

Section 4.1.2.4 describes the estimated cesium-137 and cobalt-60 releases due to the remobilization of these materials in the Steel Creek channel and floodplain. Most of this radioactivity is cesium-137. It is conservatively estimated that the remobilization of cesium-137 and cobalt-60 would be no more than 4.4 ± 2.2 curies and 0.25 ± 0.13 curie, respectively.

#### 4.5.4.4 Offsite dose commitments

The maximum individual and population dose commitments for the preferred alternatives are presented in Table 4-65. These doses are nearly identical to those of L-Reactor operation under the reference case (see Table 4-17). However, the tenth-year population doses within 80-kilometers are slightly higher and the population doses to downstream water users are slightly lower than those in Table 4-17, because of the greater vaporization of tritium from the 1000-acre lake surface.

Table 4-65. Summary of total-body dose commitments from the operation of L-Reactor (preferred alternatives)

| Source of exposure | 1st-year dose | 10th-year dose |
|---|---|---|
| MAXIMUM INDIVIDUAL ADULT DOSE (millirem per year) | | |
| Atmospheric release | 0.052 | 0.22 |
| Liquid releases | 0.0066 | 0.072 |
| Radiocesium and cobalt transport | 3.5 | 0.31 |
| Total | 3.6 | 0.60 |

| Source of exposure | Dose within 80 kilometers of SRP | | Port Wentworth and Beaufort-Jasper dose | |
|---|---|---|---|---|
| | 1st year | 10th year | 1st year | 10th year |
| REGIONAL POPULATION DOSE (person-rem per year) | | | | |
| Atmospheric releases | 3.0 | 13.9 | -- | -- |
| Liquid releases | 0.0087 | 0.017 | 0.66 | 10.8 |
| Radiocesium and cobalt transport | 9.0 | 0.80 | 0.80 | 0.067 |
| Total | 12.0 | 14.7 | 1.5 | 10.9 |

#### 4.5.4.5 Health effects

For the preferred alternative, there would be a maximum of 0.001 and 0.002 excess cancer fatality in the population within 80 kilometers of the SRP from the first- and tenth-year operation, respectively, and 0.003 and 0.004 genetic disorder from the first- and tenth-year operation. Similarly, for the downstream Savannah River water-consuming populations at Port Wentworth and Beaufort-Jasper, either alternative is projected to result in a maximum of 0.0004 excess cancer fatality from the first year and 0.002 from the tenth year, and 0.004 genetic disorder from the first year and 0.003 from the tenth year.

A panel of experts, including representatives of the Centers for Disease Control and the South Carolina Department of Health and Environmental Control, is reviewing the results of ongoing health effects and epidemiological studies (see Section 6.1.5). DOE will conduct public hearings on the panel's findings and initiate any required epidemiological study as a result of this process. In addition, DOE will take appropriate mitigative actions on an implementation schedule that is mutually agreed on with the State, if further study indicates such actions are warranted (Memorandum of Understanding of April 27, 1983).

#### 4.5.4.6 Occupational dose

Occupational doses would be the same for the preferred alternatives and the reference case; the doses are expected to be similar to those experienced in the past in P-, K-, and C-Areas, as listed on Table 4-66.

Table 4-66. Total doses to workers in P-, K-, and C-Areas

| Year | Dose (person-rem) |
|---|---|
| 1976 | 217.2 |
| 1977 | 231.2 |
| 1978 | 202.0 |
| 1979 | 184.4 |
| 1980 | 203.7 |
| Average | 207.7 |
| Average per reactor-year | 69.2 |

#### 4.5.4.7 Solid radioactive waste

Low-level solid radioactive waste (about 570 cubic meters annually) would be generated by either the reference case or the preferred alternatives. These wastes would be buried in the SRP low-level waste burial ground. Offsite radiological effects of these operations would be negligible.

### 4.5.5 Accidents

#### 4.5.5.1 Reactor accidents

The two types of reactor accidents of primary concern at SRP are a release of fission products or other radionuclides from irradiated reactor fuel and targets, and a release of activation tritium from the reactor moderator. The release of fission products is most likely to occur due to fuel or target melting, which might result from either power surges or cooling-system failures.

The release of activation tritium from the reactor heavy water is most likely to occur from spills or pipe breaks.

The principal hazard of these accidents is that the released radionuclides become airborne and are carried either to the onsite plant worker or to the offsite population. Radionuclides can also be dispersed by the reactor liquid effluent streams, but the hazards of such dispersal are several orders of magnitude lower than those of airborne dispersal in an accident situation.

Because the principal hazards are derived from possible airborne releases and because the existing confinement system is both the reference case and the preferred alternative safety system, therefore, the potential effects of reactor accidents will be the same for both cases. To provide a perspective on the overall accident risk of L-Reactor operation, Figure 4-49 shows the annual probability of an individual living at the SRP site boundary receiving more than a certain dose from postulated accidents. Additional details are provided in Section 4.2 and Appendix G.

#### 4.5.5.2 Non-nuclear hazards and natural phenomena

Risks associated with (1) toxic-gas release, (2) fire, (3) earthquakes, (4) tornados and hurricanes, and (5) floods are considered in relation to the reference case (in Section 4.2.2); in all instances the risks are small both in terms of technical assessment and judgment and in terms of experience.

The preferred alternatives include a 1000-acre lake behind an embankment; there would be, therefore, the very small risk of dam failure due to non-nuclear hazards and natural phenomena.

The probability of an embankment failure is extremely low. As indicated in Section L.2.3.2, a conservative approach to earthquake design has been used. Similarly, the embankment, outlet works, and emergency spillway are designed to control the runoff (Section L.2.3.1) from the U.S. Army Corps of Engineers' "standard project flood." At SRP this flood is the result of a 96-hour rainfall of 51 centimeters. The standard project flood does not have a direct correspondence to a recurrence interval. However, 51 centimeters in 96 hours is nearly twice the 100-year recurrence interval depth for the area. Extrapolation of the depth-versus-recurrence-interval relationship for the 96-hour duration at the site would imply a recurrence interval of over 10,000 years. An even rarer flood, the probable maximum flood, was also included in the design basis. The embankment is designed to withstand these events.

The consequence analyses of embankment failure indicate that any loss of life would be unlikely because no SRP facilities or offsite residences exist in the expected path of the resulting flood wave. However, severe economic loss and environmental impacts would occur.

The consequence analyses of embankment failure were based on a reservoir water-surface elevation of 61 meters. This would be the elevation at the top of the embankment, 1.2 meters above the emergency spillway and 1.6 meters above the peak pool level for the standard project flood. Results of the analyses indicate that a failure with the water at the 61-meter elevation would produce a

14-meter-high flood wave. The wave height would decrease as it proceeded downstream. At a distance of 3.7 kilometers downstream from the embankment, the wave height would be about half the initial height, or 7 meters. This station is below the Seaboard Coast Line Railroad bridge and the bridge over Road A (SC Highway 125). These bridges would be overtopped and probably destroyed, and their debris would be carried by the flood wave.

At a distance of 5.2 kilometers downstream from the embankment, the wave would have a height of approximately 3.5 meters and be fully into the Savannah River swamp, both on and off the site. This is downstream from the second Seaboard Coast Line Railroad bridge, which is about 900 meters above Cypress Bridge. This railroad bridge would probably be destroyed or severely damaged. The swamp is not deep enough to sustain a wave height of 3.5 meters, and the trees and shrubs would also attenuate the wave. However, as the wave broke and scattered through the swamp, it would uproot trees and vegetation and then deposit the entrained debris, including earth from the embankment, scoured sediment, and bridge debris. The effect on the Savannah River itself is expected to be minor.

## 4.6 NO-ACTION ALTERNATIVE

This section describes the expected nonradiological and radiological effects due to maintaining L-Reactor in a ready-for-operation standby mode. Nonradiological effects include those that might result from a decreased work force, the periodic withdrawal and discharge of water for hydraulic testing and flushing of the secondary cooling system, the discharge of liquid and atmospheric effluents, and the disposal of solid nonradioactive wastes. Radiological effects include those that might result from the resuspension and transport of radiocesium in Steel Creek as a result of the periodic hydraulic testing and flushing of the secondary cooling system.

Maintaining L-Reactor in a standby mode would have no direct land-use impacts. A work force of only about 100 would be required to maintain L-Reactor, thus necessitating the loss of approximately 300 jobs.

The four historic sites and one prehistoric site in the Steel Creek terrace and floodplain system that are eligible for inclusion in the National Register of Historic Places have shown erosion effects from high-water flow conditions during periodic hydraulic testing and flushing of the secondary cooling system. Phase 2 of the Archeological Mitigation Plan is being implemented to protect these sites. TC

Direct expenditures on materials and services to maintain L-Reactor in a standby mode ($10-12 million) would be less than the expenditures for operating of L-Reactor. Contributions to the local economy would also be less than those from L-Reactor operation.

The secondary cooling system, a once-through cooling-water system, would be hydraulically tested and flushed approximately 1 day per month; flow rates as high as 6.2 cubic meters per second would be experienced. During hydraulic testing, about 6.2 cubic meters per second of water would be withdrawn from the

Savannah River, about 2 percent of the average river flow and 4 percent of the 7-day, 10-year low flow of 295 and 159 cubic meters per second, respectively. Essentially all of the water withdrawn from the river would be returned to the river after passing through the secondary cooling system and the Steel Creek system.

Based on the results of 1982 and 1983 studies and predicted L-Reactor water withdrawal rates during periodic testing and flushing of the secondary cooling system, fewer than $1.2 \times 10^5$ fish eggs and $2.0 \times 10^5$ fish larvae would be entrained during the spawning season and an additional 9 fish would be impinged per day of testing and flushing.

Two deep wells in L-Area would continue to provide a total of 0.94 cubic meter per minute from the Tuscaloosa Formation; however, there would be no pumping at other facilities in support of L-Reactor. The total drawdown near the center of the cone of depression is estimated to be about 4.3 meters. The upward head differential between the Tuscaloosa and Congaree Formations in L-Area is about 3.7 meters. Thus, near the center of the cone of depression, the head differential would be approximately 0.6 meter downward. The withdrawal of ground water from the Tuscaloosa aquifer in L-Area would not be expected to affect the quality of the ground water. TC

No liquid thermal effluents would be discharged from L-Area into the Steel Creek system. There would be no thermal impact on the Savannah River; however, during periodic hydraulic testing and flushing of the secondary cooling system, water would be discharged to the Steel Creek system at the ambient river water temperature at approximately 6.1 cubic meters per second. Flooding and minor amounts of siltation associated with the discharge would be expected to temporarily modify the aquatic habitat in the Steel Creek floodplain and delta. These discharges would also temporarily eliminate the feeding habitat for the wood stork and other waterfowl that have been observed in the Steel Creek delta.

The nonthermal liquid effluent from L-Area would have chemical compositions that are similar to those from other SRP reactor areas. Some of the chemicals discharged to Steel Creek would originate from the Savannah River during the periodic hydraulic testing and flushing of the secondary cooling system. Sanitary waste water would be chlorinated at a package treatment plant and discharged through the L-Reactor sewer to Steel Creek. No impacts on the water quality of the swamp or the Savannah River would be expected.

The L-Area cooling-water basin (186-Basin) would be cleaned annually to remove accumulated solids. This sediment would be flushed to Steel Creek over a period of several days, and would settle in the streambed before reaching the swamp. A variance on total suspended solids from the NPDES permit might be required for this activity.

Nonradiological pollutants would be emitted from the K-Area coal-fired steam plant (used to supply L-Area with steam) and the L-Area diesel generators.

Solid nonradioactive wastes would consist of trash and sanitary sewage sludge. Trash would be disposed of in the SRP sanitary landfill, which is operated in accordance with guidelines of the South Carolina Department of Health and Environmental Control. Sewage sludge would be disposed in an existing sludge basin near the Central Shops.

Technological improvements would be incorporated into the L-Reactor concurrently with similar improvements made for the other SRP reactors.

The periodic hydraulic testing and flushing of the secondary cooling system would resuspend and transport only a very small amount of the radiocesium and radiocobalt presently in the Steel Creek system to the Savannah River and the swamp. The resulting maximum individual dose per day of testing/flushing would be approximately 0.003 millirem, the dose per day of testing/flushing to the regional population within 80 kilometers of Savannah River Plant would be 0.008 person-rem, and the dose to the the water consumers in the Port Wentworth, Georgia, and Beaufort-Jasper Counties, South Carolina, areas would be 0.0007 person-rem per day of testing/flushing of the secondary cooling-water system.

## 4.7 DECONTAMINATION AND DECOMMISSIONING

Whether it is restarted or not, L-Reactor will ultimately be subject to decontamination and decommissioning. The decontamination and decommissioning plan adopted will be subject to environmental and public review before implementation. The options listed below are based on the following studies:

1. NRC Program Status Paper (Calkins, 1980)

2. The decommissioning description for the Defense Waste Processing Facility (DOE, 1981a)

3. The Decommissioning Handbook (Manion and LaGuardia, 1976)

4. The decommissioning plan for the 100-F production reactor at Hanford (DOE, 1979)

5. The shutdown plan used for L-Area in 1968

Three basic decommissioning options are defined according to the NRC Program Status Paper (Calkins, 1980). These options are DECON, SAFSTOR, and ENTOMB. Depending on the results of the later NEPA review, L-Area decommissioning is expected to follow the SAFSTOR option.

DECON is defined as the immediate removal of all radioactive materials to levels that are considered acceptable to permit the property to be released for unrestricted use (NRC, 1981). This option uses a chemical decontamination of the structure and the internals. Decontamination is followed by dismantlement, transportation, and burial of the internals. In a final step, the outer structure is demolished, and the site is restored to its precommissioning status.

ENTOMB is the encasement of the facility in a material possessing long-lived structural integrity until such a time when the dose level is amenable to unrestricted use. This option is intended for sites where the radioactivity will decrease the acceptable limits within a reasonable time period. A reasonable time period for ENTOMB is approximately 100 years (NRC, 1981).

SAFSTOR involves placing a facility in temporary storage within acceptable risk levels for subsequent decontamination and unrestricted facility use. The SAFSTOR option is divided into six major phases:

1. Chemical decontamination
2. Mechanical decontamination and fixing of residual radioactivity
3. Equipment deactivation
4. Preparation for interim care
5. Interim care (surveillance and maintenance)
6. Final dismantlement

Chemical decontamination involves rinsing, chemical cleaning, and flushing of internal surfaces of process lines, vessels, and equipment. External surfaces or process equipment, lines, and structures are sprayed remotely with a series of chemical solutions or steam.

Next, all equipment and systems not needed during this interim-care period are deactivated. Typical activities include final draining of process lines, closing or opening valves depending upon the function, blanking flanges, and disconnecting utilities. Cooling-water systems for diesels are drained and fuel oil is removed from tanks.

During preparation for the interim-care period, security locks are installed on all exterior doors and on doors leading to highly contaminated areas. Intrusion alarms, fire detection systems, radiation monitoring equipment, and ventilation systems are inspected to assure safety during the interim-care period.

During interim care, the facility and the total site are kept inaccessible to the public and unavailable for other than nuclear use. Surveillance, maintenance, certain operations such as ventilation, and security activities are conducted to assure safe confinement of the radioactivity. Scheduled programs of periodic inspections and monitoring are continued.

Final dismantlement begins with a planning phase. The equipment that is necessary for dismantlement but was previously made inoperable is activated and refurbished as necessary. The other phases of final dismantlement are removal of contaminated equipment, mechanical decontamination of structures, demolition of structures, and restoration of the site.

Removal of contaminated equipment involves disconnecting and cutting where necessary for volume reduction; packaging, loading, and transporting the equipment to a waste disposal facility; and final disposal. A remote operational capability is added to accomplish equipment removal where high radiation levels prohibit contact operations.

In the demolition and restoration phase, all above-grade portions of the plant structures are demolished by conventional methods, such as explosive and impact balls. The site is then graded and revegetated.

The impacts from decontamination and decommissioning are very small. Projections of these impacts specific to L-Reactor have not been made; estimates, however, have been made (Marion and LaGuardia, 1976) for the decontamination and decommissioning of commercial power reactors of the PWR design. The estimated population dose for the DECON option was 3.0 x $10^{-5}$ millirem per year (lung) during the period of the decontamination and decommissioning operation. Both the ENTOMB and the SAFSTOR were projected to result in an even lower dose.

The decommissioning of currently operating facilities receiving hazardous and radioactive mixed wastes will be discussed in a separate NEPA review of the "SRP Groundwater Protection Implementation Plan" (see Section F.6). DA-3

In the case of the preferred cooling-water alternative, the 1000-acre lake would be left intact as a balanced biological community after the decommissioning of L-Reactor. TC

## 4.8 SAFEGUARDS AND SECURITY

Safeguards considerations for L-Reactor include physical security and materials control and accountability. The principal requirements are contained in the following DOE orders:

1. DOE Order 5630.1, "Control and Accountability of Nuclear Materials." This order provides guidance in the development of material control and accountability systems for special nuclear material and other designated materials.

2. DOE Order 5630.2, "Control and Accountability of Nuclear Materials, Basic Principles." This order provides specific requirements for the control and accountability of nuclear materials.

3. DOE Order 5632.1, "Physical Protection of Classified Matter." This order prescribes DOE policies and objectives for the physical protection of classified security interests.

4. DOE Order 5632.2, "Physical Protection of Special Nuclear Materials." This order establishes minimum physical protection standards for special nuclear materials.

Access to the site is controlled at primary roads by permanently manned barricades. Other roads are closed to travel by gates or other barriers. The site, except along the Savannah River, is fenced. The entire site is posted against trespass under State of South Carolina and Federal statutes. The operating areas are separately fenced; the fence is continuously patrolled by armed security personnel. Primary responses to safeguards and security incidents are from area patrol personnel who are engaged in roving patrols and/or access control activities. Inter-area security personnel are supplemented by armed responders from other SRP facilities. Responders are equipped with sidearms, shotguns, and automatic weapons. Armored vehicles are assigned to each area and are used in response. Onsite security forces are provided backup by off-duty security personnel and Federal, state, and county law enforcement agencies.

Materials control and accountability procedures are applied to special nuclear materials, such as: enriched uranium, plutonium-239, neptunium, tritium, and deuterium. Stringent controls are used throughout the manufacturing, storage, and shipment cycles to protect against unauthorized diversions of these materials. Proven measurement and analytical procedures and equipment are used as part of the materials control and accountability system at Savannah River Plant.

L-Area is defined as a material balance area; it is, in turn, divided into material balance sections (e.g., reactor section, disassembly section). Similar material balance areas have been established at the other SRP facilities that will handle the special nuclear materials to support resumed L-Reactor operation. Within each material balance area or section, the accountable materials are kept separate, and identifiable material quantities that enter or leave the area are accurately determined; responsibility for the material is assigned to one individual.