APPENDIX F

ASSESSMENT OF ACTIONS AT EXISTING WASTE SITES

This appendix describes removal, remedial, and closure actions considered feasible for the existing waste sites characterized in Appendix B and listed in Table B-2. Cumulative (i.e., over all the sites) environmental consequences of the actions are presented in Section 4.2 and summarized in Section 2.2. The assessments in this appendix are presented by individual waste site and are based largely on the results of contaminant transport modeling. TE TE

This appendix consists of 11 major sections, each of which covers existing waste sites in a particular geographic group (see Section B.1.2 in Appendix B). For example, Section F.1 assesses the actions at the waste sites in the first geographic grouping (i.e., the A- and M-Areas). Each geographic-grouping section is further divided into a section for each waste site. For example, Sections F.1.1-F.1.13 deal with the 13 waste sites in the A- and M-Areas. These sections discuss the actions, releases, and other impacts associated with the waste sites for each of the three project-specific alternatives (no action, closure with no removal of waste, and closure with removal of waste). Finally, for each alternative at each waste site, three major topics (description of action, comparison of expected releases to applicable standards, and impacts other than releases) are presented. TE TE

To accommodate this extensive scope, many essentially equivalent discussions of similar sites and groups of sites have been combined. Similarly, to minimize repetition, the specific waste site sections are usually followed by a section that discusses those factors related to biological impacts that apply generically to all the waste sites within a particular geographic group.

The assessments in this appendix are supported by detailed modeling of contaminant transport and health risk analyses; the models used are described in Appendixes H and I.

Appendix I also presents criteria for the selection of chemical and radioactive constituents and sites for evaluation based on risks to human health. These selection criteria, corresponding to maximum contaminant levels (MCLs) or less, or to proposed de minimis radioactivity values, have been applied to chemical and radioactive constituents found in the waste sites, soil, and groundwater at the Savannah River Plant (SRP). If the quantities or concentrations are below the selection criteria values, no pathway modeling calculations and, consequently, no environmental assessments are made. Such cases will be noted in those sections of this appendix addressing sites with insignificant or no measurable concentrations of constituents in groundwater or soil at and near the waste sites. TE

Environmental assessments of alternative actions at existing waste sites are based on data and methodologies presented in the Environmental Information Documents (EIDs) referenced herein. The methodologies employ several pathway models for assessing the effects of releases on human health and the environment (aquatic and terrestrial ecology, endangered species, and wetlands).

Water pathways include groundwater movement to water wells, groundwater movement to surface streams, erosion of waste materials and movement to a surface stream, consumption of food produced from farmland reclaimed over a waste site, consumption of crops produced through natural biointrusion of land over a waste site, and direct exposure to gamma radiation. Atmospheric pathways for human exposure are inhalation of waste particulates or gases in air, ingestion of foods containing waste materials from deposition of air particulates on the ground surface. Additionally, a direct gamma radiation exposure to occupant of reclaimed land over a waste site is evaluated. Detailed descriptions of the pathway analysis methodology are included in the EIDs and Appendix H of this document.

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Two assumptions are made regarding the time periods of analysis for potential environmental consequences. First, it is assumed that the Department of Energy (DOE) will maintain institutional control over the SRP site for 100 years beyond 1985. This is a reasonable assumption, in light of current production planning and projected scheduling for site decommissioning. Second, the basic time period for the long-term analyses extends up to 1000 years beyond 1985. Guidelines issued by the U.S. Environmental Protection Agency (EPA) and the U.S. Nuclear Regulatory Commission (NRC) specify 1000 years as a reasonable time for calculations of projected effects of waste disposal activities.

Public exposures attributed to the surface and subsurface pathways for various waste sites are based on exposure assessments for the years in which peak concentrations occur in surface water and groundwater, and for future years (100, 200, 300, 400, 500, 700, and 1000 years from 1985). Results are reported at hypothetical wells assumed to be located 1 and 100 meters downgradient from each waste site and in the Savannah River.

Groundwater concentrations of constituents that exceed health-based regulatory standards are identified in this appendix. These exceedances are reported for measured concentrations at downgradient monitoring wells and modeling predictions at the hypothetical 1- and 100-meter wells. Some constituents that were modeled are not reported because applicable standards are not available or because the standard is not based on risk to human health and the environment. These include miscellaneous organic compounds, sodium, and phosphate.

The evaluations of alternatives in this appendix are based on groundwater and surface-water concentrations at individual waste sites that are predicted by the PATHRAE code. These results are not directly comparable to monitoring results for these sites. Predicted exceedance of standards for all closure actions indicates that further action may be required. This could range from taking remedial action (e.g., groundwater cleanup) to monitoring and assuring protection of human health and the environment in close cooperation with regulatory agencies [e.g., the South Carolina Department of Health and Environmental Control (SCDHEC)]. Also, any action would be designed to ensure compliance with applicable regulations. These modeling predictions represent a very preliminary indication that some action may be required. In practice, implementation of any action would be based on this work and additional site-specific modeling and actual monitoring results.

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Public exposure and risk attributed to the atmospheric pathway for various waste sites include risk assessment for every year for the period 1986-1990, for every fifth year for the period 1990-2085, and for every one-hundredth year for the period 2085-2985. Risks for a maximally exposed individual are estimated for 3 selected years: 1985 (assumed start of closure actions), 2085 (assumed start of public occupation of the SRP area), and 2985 (end of 1000-year period).

Risk assessments are presented in this appendix in their originally calculated form (King et al., 1987) as follows:

- Carcinogenic risks from radioactive and nonradioactive waste constituents are the product of exposure (either chemical or radioactive) and the cancer risk per unit exposure [unit cancer risk (UCR)]. These risk estimates are expressed as the increase in probability of fatal cancer in an individual (with a value between 0 and 1). In these evaluations, risks from chemical carcinogens have been determined as lifetime risks from exposure over a period of 50 years that encompasses the year of peak exposure. Radiological risks, however, were calculated for an exposure period of the peak year only. The radiological risk values presented in this appendix are multiplied by 50 in Chapter 4 to produce a conservative estimate of lifetime-exposure risks comparable to those originally calculated for chemical carcinogens. TE

- Noncarcinogenic risks from chemical constituents are presented as the ratio of the average daily dose to the acceptable daily intake (ADI) for chronic exposure. Because noncarcinogenic effects are assumed to occur only if the exposure exceeds a threshold value defined by the ADI, any value of calculated risk less than 1 means that no health effect is likely; the smaller the value, the greater the margin of safety. Individual noncarcinogenic risk values are summed to form a Hazard Index that also is compared conservatively to a threshold of 1.

F.1 <u>ASSESSMENT OF ACTIONS AT A- AND M-AREA WASTE SITES</u>

This geographic grouping of waste sites is located along the northwest edge of the SRP where Road 1 leads to the Administration Area (700-A). Figure F-1 shows the boundaries of this geographic grouping and the locations of the waste sites within it.

Sections F.1.1 through F.1.13 contain (or reference the section that contains) a discussion of sites 1-1 through 1-13, respectively. Section F.1.14 discusses biological impacts that are generically applicable to the A- and M-Area geographic grouping.

F.1.1 716-A MOTOR SHOP SEEPAGE BASIN, BUILDING 904-101G*

F.1.1.1 <u>Assessment of No Action (No Removal of Waste, and No Remedial or Closure Actions)</u>

Under no action, the motor shop seepage basin would remain uncovered and open to receive rainwater. Groundwater monitoring would continue on a quarterly TC

*The reference source for the information in this section is Huber, Johnson, and Bledsoe, 1987.

TC basis for the first year, then annually for 29 years. Site maintenance would continue for the entire 30-year period.

Expected Environmental Releases

No environmental releases are expected at this site for this action.

Comparison of Expected Environmental Releases with Applicable Standards

The environmental impact and health risks associated with the motor shop seepage basin were not determined because chemical constituents at the site were below the threshold selection criteria.

Potential Impacts (Other Than Releases)

TE Section F.1.14.1 describes general impacts to biological resources from no action. Aquatic impacts would be unlikely.

The 716-A motor shop seepage basin might have an impact on the wildlife and vegetation that come into contact with its standing surface waters. Based on the available chemical analysis data on the standing surface water of the seepage basin, pH, cadmium, lead, and mercury do not fall within the EPA freshwater aquatic life criteria. However, cadmium, lead, and mercury meet TC EPA drinking-water criteria. Thus, wildlife that consume the water should not receive adverse impacts.

In addition, food-chain uptake calculations based on the bioconcentration of heavy metals from the standing water by nonrooted aquatic macrophytes indicate that the predicted concentrations of heavy metals would be well below the concentrations considered toxic to herbivorous wildlife.

F.1.1.2 Assessment of No Removal of Waste and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

TE Under the no-removal-and-closure action, the motor shop seepage basin would be backfilled to grade and seeded. This action would require approximately 1350 cubic meters of soil. Groundwater would continue to be monitored on a quarTC terly basis for 1 year, then annually for 29 years. Site maintenance would continue for the entire 30-year period.

Comparison of Expected Environmental Releases with Applicable Standards

No chemical constituents at or above threshold selection criteria were identified for this waste site; thus, expected environmental releases were not determined. However, closure of the basin by backfilling would reduce the possibility that the free liquid might be transported by surface runoff or flooding.

No environmental risks due to atmospheric chemical releases from the motor shop seepage basin are expected for this action.

Potential Impacts (Other Than Releases)

Section F.1.14.2 describes general impacts to biological resources. Aquatic impacts resulting from the discharge of standing basin water should be minimal because the water would be drained through a permitted discharge. This action would eliminate any potential for impacts on wildlife coming into contact with basin water.

F.1.1.3 Assessment of Removal of Waste to the Extent Practicable, and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

Under the waste-removal-and-closure action, all waste would be removed from the motor shop seepage basin. The liquid would be drummed and removed to a waste storage/disposal facility. The basin would be excavated to a depth of 1 meter. Approximately 675 cubic meters of soil would be removed to the SRP sanitary landfill. The basin would be backfilled to grade, requiring approximately 2025 cubic meters of soil, and seeded. Groundwater monitoring would continue on a quarterly basis for 1 year and thereafter on an annual basis for 29 years. Site maintenance would continue for the entire 30-year period. TC

Comparison of Expected Environmental Releases with Applicable Standards

As stated above, no chemical constituents at or above threshold criteria were identified for this waste site; therefore, no environmental releases were determined. However, removal of the waste and backfilling of the basin should reduce the possibility of future environmental releases.

Potential Impacts (Other Than Releases)

Section F.1.14.3 describes general impacts to biological resources. No aquatic impacts are expected, as discussed in Section F.1.1.2. Potential impacts on wildlife as a result of coming into contact with basin water would be eliminated.

F.1.2 METALS BURNING PIT, BUILDING 731-4A*

F.1.2.1 Assessment of No Action (No Removal of Waste, and No Remedial or Closure Actions)

Description of Action

Under no action, the site would be left in its present condition, and a site identification sign would be installed. Groundwater monitoring at the existing wells would occur quarterly for 1 year, then annually for 29 years. Upkeep would include maintaining the groundwater monitoring wells. A U.S. Forest Service experimental study would continue, with weed and underbrush control conducted consistent with the pine tree growth study. Site maintenance would continue for the entire 30-year period. TC

*The reference source of the information in this section is Pickett, Muska, and Marine, 1987.

Comparison of Expected Environmental Releases with Applicable Standards

The waste constituents selected for assessment of the environmental impacts and health risks at the metals burning pit are tetrachloroethylene and trichloroethylene. Both of these compounds were found in the groundwater at levels higher than the selection criteria (Looney et al., 1987).

Table F-1 lists the predicted maximum concentrations of tetrachloroethylene and trichloroethylene based on results of constituent transport modeling for all of the closure actions and for no action. The table also lists the applicable standard, criterion or proposed MCL for each constituent and, in parentheses, the years in which the maximum concentration is expected to be reached. For no action, the table indicates maximum concentrations of tetrachloroethylene and trichloroethylene at levels in excess of the applicable standards at the 1- and 100-meter wells. Table F-1 also shows monitoring data for these two organics and for cadmium, which slightly exceeded its applicable standard but was not selected for the modeling assessment. Surface-water quality would not be significantly affected by the addition of potential contaminants from the groundwater pathway from this site, as the resulting concentrations of constituents in the Savannah River are projected to be below drinking-water standards.

Environmental risks due to atmospheric chemical releases from the metals burning pit were calculated. The risk values are conservative because they are based on emissions from two sites: the metals burning pit and the miscellaneous chemical basin. The carcinogenic risks are very low (the highest risk to the maximally exposed individual is less than 10^{-14} excess cancers) and are not considered significant. Non-carcinogenic atmospheric releases are predicted to produce insignificant risks (i.e., EPA Hazard Index is less than 1×10^{-2}).

The expected concentrations for the erosion, reclaimed farmland, and biointrusion pathways are zero. That is, the erosion rate is such that no waste erodes during the first 1000 years of the simulation; waste materials are leached from the zone of excavation before a farming operation could begin, due to the 100 years of institutional control; and the 1 meter of existing soil cover equals or exceeds the root penetration assumed for the biointrusion pathway.

Potential Impacts (Other Than Releases)

Section F.1.14.1 describes the ecological impacts of no action. PATHRAE modeling was performed on tetrachloroethylene and trichloroethylene, which were considered to have a potential impact on the aquatic system. The results of this analysis indicate that these particular constituents should not cause significant impacts to water quality. Neither aquatic species nor terrestrial wildlife, which could consume water at the outcrop, should be affected
TE adversely under closure actions. Because of rapid leaching of mobile contaminants at the site, uptake by vegetation is not expected to be a problem. Thus, impacts to vegetation and herbivorous wildlife are not expected.

F.1.2.2 Assessment of No Removal of Waste and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

TE Under the no-removal-and-closure action, a low-permeability cap (Figure F-2) would be placed atop the existing backfill. The exact location of the area involved in the burning and disposal of the metal and debris is not known, but soil sampling to define the specific location of the metals and/or organically contaminated soil is planned to occur before closure. This could significantly reduce the amount of area requiring capping. For the purpose of this document, however, the cost analysis will be made on the assumption that the entire waste site, about 3.6 acres, would be capped. The cap would be graded and revegetated in a manner similar to the current status of the site. Because the materials that were disposed of at the site would be left in place, groundwater monitoring would continue quarterly for 1 year, and then TE annually for 29 years. Site maintenance would continue for the entire 30-year period.

Additional corrective actions, such as groundwater extraction and treatment, might be needed to reduce the levels of trichloroethylene and tetrachloroethylene in the groundwater (see Table F-1).

Comparison of Expected Environmental Releases with Applicable Standards

The consequences of environmental releases include the relative risk to human health and the potential impact on aquatic and terrestrial ecosystems of tetrachloroethylene and trichloroethylene. The pathways that might have an TE impact on human health are the same as those described in Section F.1.2.1.

Table F-1 lists the predicted maximum concentrations of the chemical constituents based on results of groundwater modeling. The table also lists the applicable standard for each constituent and, in parentheses, the years in which the maximum concentration is expected to be reached. For the no-removal-and-closure action, the table indicates maximum concentrations of trichloroethylene and tetrachloroethylene at levels in excess of the applicable standards in the future at the 1- and 100-meter wells. Surface-water quality would not be significantly affected by the addition of potential contaminants from the groundwater pathway from this site, as the resulting concentrations of constituents in the Savannah River are projected to be below drinking-water standards.

TC Additional corrective actions might be needed to reduce the levels of constituents already in the groundwater. Decisions regarding the precise actions to be taken would be based on site-specific studies and discussions with the regulatory agencies concerned.

The expected concentrations for the erosion, reclaimed farmland, and biointru-TE sion pathways are zero. Maximum concentrations were not developed for the other pathways.

Environmental risks due to atmospheric releases from the metals burning pit TE are conservative for the reason discussed in Section F.1.2.1. Carcinogenic risks would be zero for 1986 and the same as those for no action 100 years later, due to the diffusion of the volatile contaminants through the backfill soil. The carcinogenic risk value is calculated to be very low (the highest risk to the maximally exposed individual is less than 10^{-8} excess cancers) and is considered not significant. The non-carcinogenic risk value is also calculated to be low (i.e., the EPA Hazard Index is less than 1×10^{-2}).

Potential Impacts (Other Than Releases)

The potential ecological impacts of no waste removal and closure for the metals burning pit are similar to those addressed in Sections F.1.2.1 and F.1.14.2.

F.1.2.3 Assessment of Removal of Waste to the Extent Practicable, and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

TE Under the waste-removal-and-closure action, soil sampling to define the specific location of the metals and/or organics would be performed prior to closure. It is expected that this would significantly reduce the amount of soil to be excavated and/or treated. However, for the purposes of this document, the cost analysis will be made on the total volume of soil which could contain these constituents.

Photographs taken in 1974 indicate that the total pit depth was 1.0 to 1.5 meters. To remove the waste materials, therefore, an assumed depth of 1.5 meters over the 120 meter by 120 meter area would have to be excavated and
TE backfilled (21,700 cubic meters). The excavated materials would be transported in metal boxes or containers and disposed of in a waste storage/ disposal facility. The site would be backfilled with clean material, regraded, vegetated, and allowed to return to its natural state. Groundwater monitoring would continue quarterly for 1 year and then annually for 29 years. Site maintenance would continue for the entire 30-year period.

Additional corrective actions, such as groundwater extraction and treatment, might be needed to reduce the levels of tetrachloroethylene and trichloroethylene in the groundwater (see Table F-1).

Comparison of Expected Environmental Releases with Applicable Standards

The consequences of environmental releases include the relative risk to human health and the potential impact on aquatic and terrestrial ecosystems. The pathways that may have an impact on human health are the same as those for no action.

Closure was not modeled because the constituents of concern were assumed to have leached beyond the zone of excavation by the time remedial actions would occur. Therefore, this site would behave in the same manner as it would for no action. Table F-1 lists the predicted maximum concentrations of the chemical constituents based on results of groundwater modeling for this action and for no action.

Additional actions might be required to reduce the constituent levels in the groundwater to meet applicable standards. The exact measures to be initiated would be defined on the basis of site-specific studies and interaction with regulatory agencies.

Environmental risks due to atmospheric releases from the metals burning pit are conservative for the reason discussed in Section F.1.2.1. The carcinogenic risk value is calculated to be very low (the highest risk to the maximally exposed individual is less than 10^{-8} excess cancers) and is considered not significant. The noncarcinogenic risk value is also calculated to be low (i.e., the EPA Hazard Index is less than 1×10^{-2}).

Estimated environmental risks due to atmospheric chemical releases from the metals burning pit for this action are very low (the highest public and occupational risks to the maximally exposed individual are, respectively, less than 10^{-14} and 10^{-16} excess cancers) and are considered not significant.

The expected concentrations for the erosion, reclaimed farmland, and biointrusion pathways are zero for closure. Maximum concentrations for the other pathways were not developed.

The occupational risks to protected workers due to excavation is less than 1×10^{-8} health effects per lifetime. This level is considered to be insignificant.

Potential Impacts (Other Than Releases)

The potential ecological impacts of waste removal and closure for the metals burning pit would be similar to those addressed in Sections F.1.2.1 and F.1.14.3.

F.1.3 SILVERTON ROAD WASTE SITE, BUILDING 731-3A*

F.1.3.1 Assessment of No Action (No Removal of Waste, and No Remedial or Closure Actions)

Description of Action

Under no action, the site would be left in its present condition; groundwater would be monitored quarterly for 1 year, then annually for 29 years. Site maintenance would consist of installing and maintaining a fence and signs around the basin, cutting weeds periodically, and filling depressions at the site with topsoil and seeding for the entire 30-year period.

Comparison of Expected Environmental Releases with Applicable Standards

The chemical constituents selected for assessment of environmental impact and health risks associated with the Silverton Road waste site are lead, tetrachloroethylene, trichloroethylene, and trichloromethane. These were selected because they were found in the groundwater at levels higher than the threshold selection criteria.

*The reference source of the information in this section is Scott, Killian, Kolb, Corbo, and Bledsoe, 1987.

Table F-2 lists the predicted maximum concentrations of those constituents predicted to exceed applicable standards based on groundwater modeling for no action. The table also lists the applicable standard for each constituent and, in parentheses, the year in which the maximum concentration is estimated to occur. A comparison of predicted maximum concentrations to applicable standards for no action indicates that the peaks have already occurred at the 1- and 100-meter wells. However, recent sampling data at the site indicate that trichloroethylene and tetrachloroethylene remain in excess of applicable standards.

Surface-water quality would not be significantly affected by the addition of potential contaminants from the groundwater pathway from this site, as the resulting concentrations of constituents in the Savannah River are projected to be below drinking-water standards.

Estimated environmental risks due to atmospheric releases from the Silverton Road waste site are very low and are considered not significant. For example, the highest carcinogenic risk to the maximally exposed individual is less than 10^{-15} excess cancer. The EPA Hazard Index for noncarcinogens is 1.4×10^{-6}.

The expected concentrations for the erosion pathways are zero because the length of time that it takes for the contaminants to start eroding is well over 1000 years. Maximum concentrations for the other pathways were not developed.

Potential Impacts (Other Than Releases)

Section F.1.14.1 describes ecological impacts of no action. Modeling was performed on lead, tetrachloroethylene, trichloroethylene, and trichloromethane, which were considered to have potential impacts on the aquatic system. The results indicate that these waste materials would not alter the present water quality of the receiving stream under any closure actions. However, lead in the Savannah River is presently above the EPA criteria for aquatic life. The levels of groundwater outcrop contamination predicted by the PATHRAE model are ecologically insignificant for all closure actions, indicating no potential for adverse effects on the aquatic biota of the Savannah River or adjacent wetlands and no adverse effects on wildlife consuming the undiluted groundwater at the outcrop.

Based on the available data, no adverse terrestrial impacts are expected for any closure action. The PATHRAE model predicts that all constituents, with the exception of lead, have moved out of the unsaturated zone by Year 1, making them unavailable for uptake by vegetation. No soil monitoring data are currently available; therefore, the potential terrestrial effects due to lead concentrations cannot be evaluated. However, the relatively small amounts of lead disposed of at the site, the length of time the site has been out of service (since 1974), and the low groundwater concentrations for lead indicate that any effects should be negligible. If terrestrial impacts due to elevated lead concentrations should occur, they would be limited to the area of the waste site.

F.1.3.2 Assessment of No Removal of Waste and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

TE Under the no-removal-and-closure action, the 3.25-acre site would be covered with 0.6 meter of borrow fill (7,890 cubic meters) and capped as described in Section F.1.2. The cap would be covered with topsoil and seeded with grass. Groundwater would be monitored quarterly for 1 year, then annually for 29 years. Site maintenance would be provided for the entire 30-year period.

Additional corrective actions, such as groundwater extraction and treatment, might be needed to reduce the constituent levels in the groundwater.

Comparison of Expected Environmental Releases with Applicable Standards

The chemical constituents, the consequences of environmental releases, the exposure pathways, and the potential human health risks would be the same as those described under Section F.1.3.1. Table F-2 presents the predicted maximum concentrations for the chemical constituents of concern at this site. It lists predicted maximum concentrations of contaminants that peaked prior to 1985 at the 1- and 100-meter wells and that appear to be receding. However, recent sampling data at the site indicate concentrations in excess of applicable standards.

Additional actions might be required to reduce the concentrations of constituents in the groundwater to meet the applicable standards. The precise actions to be taken would be decided on the basis of site-specific investigations and interactions with the regulatory agencies concerned.

Environmental risks due to atmospheric releases from the Silverton Road waste site for this action are estimated to be very low (the highest carcinogenic risk to the maximally exposed individual is less than 10^{-15} excess cancers)
TC and are considered not significant. The EPA Hazard Index for noncarcinogens is zero.

Potential Impacts (Other Than Releases)

The potential ecological impacts of no waste removal and closure for the Silverton Road waste site are similar to those addressed in Sections F.1.3.1 and F.1.14.2.

F.1.3.3 Assessment of Removal of Waste to the Extent Practicable, and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

TE Under the waste-removal-and-closure action, the waste would be excavated and treated in an approved incinerator and the residual ash disposed of in a waste storage/disposal facility. The volume to be excavated is 26,288 cubic meters. The area would be backfilled with the same quantity of borrow fill and covered with a low-permeability cap (see Figure F-2). Rainwater infiltration would be reduced at least 99 percent. The cap would be covered with topsoil and seeded with grass. Groundwater would be monitored quarterly for 1 year, then annually for 29 years. Site maintenance would be provided for the entire 30-year period.

Additional corrective actions, such as groundwater extraction and treatment, might be needed to reduce the levels of constituents in the groundwater.

Comparison of Expected Environmental Releases with Applicable Standards

Closure was not modeled, as the contaminants of concern were assumed to have leached beyond the zone of excavation by the time remedial actions would occur. Therefore, the concentrations are expected to be similar to those associated with no action and discussed in Section F.1.3.1.

Estimated environmental and occupational risks due to atmospheric releases from the Silverton Road waste site for this action are very low and are considered not significant. For example, the highest public and occupational risks to the maximally exposed individual both are estimated to be less than 10^{-15} excess cancers. Except for 1986, the excavation year, the EPA Hazard Index due to noncarcinogenics would be less than 10^{-19}. The occupational noncarcinogenic Hazard Index to the maximally exposed individual has a maximum value of 3×10^{-5}, and there are less than 10^{-15} health effect per lifetime, which is considered to be insignificant. TC

Potential Impacts (Other Than Releases)

The potential ecological impacts of waste removal and closure for the Silverton Road waste site would be similar to those addressed in Sections F.1.3.1 and F.1.14.3.

F.1.4 METALLURGICAL LABORATORY BASIN, BUILDING 904-110G*

F.1.4.1 Assessment of No Action (No Removal of Waste, and No Remedial or Closure Actions)

Description of Action

Under no action, groundwater monitoring would continue quarterly for 1 year, then annually for 29 years. Site maintenance would be provided for the entire 30-year period. TE

Comparison of Expected Environmental Releases with Applicable Standards

Several chemical constituents were evaluated at this site because they were identified in groundwater sampling or were implicated as potentially significant in available records. The chemical constituents selected for evaluation of the environmental impacts and health risks associated with the metallurgical laboratory basin were chromium, lead, mercury, tetrachloromethane, 1,1,1,-trichloroethane, and trichloroethylene.

*The reference source of the information in this section is Michael, Johnson, and Bledsoe, 1987.

Table F-3 summarizes the predicted maximum concentrations of tetrachloromethane, 1,1,1-trichloroethane, and trichloroethylene based on groundwater modeling for all the closure actions and for no action. The table also lists the applicable standard for each of these constituents and, in parentheses, the year in which the maximum concentration is expected to be reached. For no action, the table indicates maximum concentrations of tetrachloromethane, 1,1,1-trichloroethane, and trichloroethylene at levels in excess of the applicable standards at the 1- and 100-meter wells. Table F-3 also lists monitoring data for tetrachloroethylene, nickel, gross alpha, gross beta, and radium, which exceeded applicable standards but were not modeled.

Surface-water quality is not significantly affected by the addition of potential contaminants from the groundwater pathway from this site, as the resulting concentrations of constituents in the Savannah River are projected to be below drinking-water standards.

Expected atmospheric releases of chemicals from the metallurgical laboratory basin for this action are minimal. For example, lead and mercury releases are less than 1 percent of the significant emission rates under the Prevention of Significant Deterioration (PSD) regulations and are considered insignificant.

TC Estimated environmental risks due to atmospheric chemical releases from the metallurgical laboratory basin for this action are small and are not considered significant. The highest carcinogenic risks to the maximally exposed individual are less than 10^{-9}. The peak EPA Hazard Index for noncarcinogens is less than 10^{-5}.

The concentrations for the erosion pathway are zero, because the length of time for the constituents to start eroding is well over 1000 years. Maximum concentrations for other pathways were not developed.

Potential Impacts (Other Than Releases)

TE TE A general description of the ecological impacts of no action is provided in Section F.1.14.1. Chromium, lead, mercury, tetrachloromethane, 1,1,1-trichloroethane, and trichloroethylene were identified as having a potential impact on aquatic systems. The PATHRAE modeling results indicate that these waste materials would not alter the present water quality of the Savannah River under any closure action. Because the levels of modeled contaminants are ecologically insignificant, impacts to aquatic biota of the Savannah River or adjacent wetlands should not occur. In addition, impacts to wildlife consuming undiluted groundwater at the outcrop should not occur. However, the levels of lead and mercury from unknown sources in the Savannah River, both upriver and downriver from the SRP, are presently above the aquatic biota criteria.

Because the metallurgical laboratory basin contains contaminated standing surface water and soil, there could be impacts on the wildlife and vegetation that come into contact with the waters. However, contaminant levels in the water are below drinking-water standards; thus, consumption by wildlife should not cause adverse impacts. In addition, the contaminants in basin soils are below levels considered toxic to vascular plants. Food-chain calculations indicate that predicted vegetation concentrations are below levels considered toxic to herbivorous wildlife.

F.1.4.2 Assessment of No Removal of Waste and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

TE The waste-removal-and-closure action for the metallurgical laboratory basin includes batch neutralization of the 453,072 liters of basin water with caustic soda, hydrated lime, or limestone, release of the water to Tims Branch through NPDES Outfall A-11, backfill of the basin, and continuation of groundwater monitoring.

Following the release of the water to Outfall A-11, the basin would be backfilled with approximately 550 cubic meters of soil, covered with a low-permeability cap (see Figure F-2), and seeded. Groundwater monitoring would continue quarterly for 1 year and then annually for 29 years. Site maintenance would be provided for the entire 30-year period.

Additional corrective actions might be needed to reduce concentrations of constituents already in the groundwater.

Comparison of Expected Environmental Releases with Applicable Standards

The chemical constituents, the consequences of environmental releases, and the pathways are the same as those discussed in Section F.1.4.1.

Table F-3 presents the applicable standards and the predicted maximum concentrations for the chemical constituents for the groundwater-to-river pathway and the groundwater-to-wells pathway. For the no removal/closure action, the table indicates maximum concentrations of tetrachloromethane, 1,1,1-trichloroethane, and trichloroethylene at levels in excess of the applicable standards at the 1- and 100-meter wells.

Surface-water quality would not be significantly affected by the addition of potential contaminants from the groundwater pathway from this site, as the resulting concentrations of constituents in the Savannah River are projected to be below drinking-water standards.

Expected atmospheric releases of chemical constituents from the metallurgical laboratory basin for this action are very small (0 to 6.7×10^{-5} kilograms per year). They are considered insignificant for the reason discussed in Section F.1.4.1. Estimated environmental risks due to atmospheric releases of carcinogens from the metallurgical laboratory basin are equal to or less than TC the risks for no action. The risk values are extremely small and are considered not significant. The EPA Hazard Index value for noncarcinogens for the no-removal action is less than that for no action.

Potential Impacts (Other Than Releases)

Sections F.1.4.1 and F.1.14.2 describe the ecological impacts of the no-waste-removal-and-closure action. The liquid contents of the basin would be neutralized and released into Tims Branch, eliminating any uptake of basin-water by wildlife. All such releases would comply with National Pollutant Discharge Elimination System (NPDES) permit requirements; therefore, no impact to the stream environment is anticipated.

F.1.4.3 Assessment of Removal of Waste to the Extent Practicable, and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

The waste-removal-and-closure action for the metallurgical laboratory basin includes batch neutralization of the basin water as described above, release of the water through Outfall A-11, removal of approximately 1 meter of basin bottom sediment, backfill of the basin, and continuation of groundwater monitoring. TE

Following neutralization, the basin water would be sent to Outfall A-11. Approximately 340 cubic meters of the sediment would then be removed from the basin, placed in metal boxes, and sent to a waste storage/disposal facility. The basin would be backfilled with approximately 900 cubic meters of soil and seeded to complete closure. Groundwater monitoring would continue quarterly for 1 year and then annually for 29 years. Site maintenance would continue for the entire 30-year period.

Additional corrective actions might be needed to reduce the levels of groundwater constituents to meet applicable standards.

Comparison of Expected Environmental Releases with Applicable Standards

The chemical constituents of concern are tetrachloromethane, 1,1,1-trichloroethane, and trichloroethylene. The pathways that may have an impact on human health are the same as those for no action.

For closure with waste removal, Table F-3 lists the predicted maximum concentrations of the chemical constituents based on results of groundwater modeling. The table also lists the applicable standard for each contaminant and, in parentheses, the year in which the maximum concentration is expected to be reached. As in the case of no removal and closure, maximum concentrations of tetrachloromethane, 1,1,1-trichloroethane, and trichloroethylene are in excess of applicable standards at the 1- and 100-meter wells and below applicable standards at the river. TE

In all cases, the expected atmospheric releases of chemical contaminants from the metallurgical laboratory basin would be less than for no action. They are considered insignificant for the reason discussed under Section F.1.4.1 for no action. Estimated environmental and occupational risks due to atmospheric chemical releases from the metallurgical laboratory basin are extremely small and are considered not significant. The highest public and occupational carcinogenic risks to the maximally exposed individual would be, respectively, less than 10^{-12} and 10^{-9}. The EPA Hazard Index values for noncarcinogens are less than 10^{-9} for public exposure and 5.41×10^{-3} for occupational exposure. TC

The concentrations for the erosion and biointrusion pathways are estimated as zero because the cover thickness, erosion rate, and plant-root depth would be such that erosion of the waste material would never take place within the 1000-year study period, and the roots of the plants in the biointrusion pathway would never extend into the remaining waste material.

Potential Impacts (Other Than Releases)

Sections F.1.4.1 and F.1.14.3 describe the ecological impacts of waste removal and closure. The contents of the basin would be released into Tims Branch, eliminating any uptake of basin water by wildlife. All such releases would comply with NPDES permit requirements; therefore, no impact on the stream environment is anticipated. Closure would remove soils from the waste site and thus reduce the potential impact of plant uptake of wastes. In addition, it would eliminate the possibility of consumption of basin water by wildlife.

F.1.5 MISCELLANEOUS CHEMICAL BASIN, BUILDING 731-5A*

F.1.5.1 Assessment of No Action (No Removal of Waste, and No Remedial or Closure Actions)

TE

Description of Action

Under no action, five groundwater monitoring wells and a site identification sign would be installed. Otherwise, the site would be left in its present condition. The site would be mowed periodically and the groundwater monitoring wells would be maintained.

The groundwater would be monitored quarterly for the first year and then annually for 29 years. Site maintenance would continue for the entire 30-year period.

Comparison of Expected Environmental Releases with Applicable Standards

The chemical constituent selected for consideration of the environmental impact and health risks for the miscellaneous chemical basin is tetrachloroethylene. This compound was detected in soil gas samples at levels higher than the selection criteria.

The consequences of environmental releases include the relative risk to human health resulting from potential exposure to waste materials transported through groundwater or atmospheric pathways and the potential impact on the aquatic and terrestrial ecosystems due to transport of waste materials into these ecosystems.

Table F-4 lists the predicted maximum concentrations of tetrachloroethylene for all closure actions and for no action. These data indicate concentrations above the applicable standard at the 1- and 100-meter wells, but not at the river.

Surface-water quality would not be significantly affected by the addition of potential contaminants from the groundwater pathway from this site, as the resulting concentrations of constituents in the Savannah River are projected to be below drinking-water standards.

*The reference source of the information in this section is Pickett, Muska, and Marine, 1987.

Estimated environmental risks due to atmospheric chemical releases from the miscellaneous chemical basin are conservatively considered the same as for the metals burning pit (Section F.1.2.1). As discussed in that section, the risks are very low and are considered not significant.

The concentrations for the erosion, reclaimed farmland, and biointrusion pathways are expected to be zero.

Potential Impacts (Other Than Releases)

Section F.1.4.1 describes the ecological impacts of no action. Potential impacts on the aquatic biota of outcropping streams were determined for tetrachloroethylene and trichloroethylene, which were considered to have potential impacts on the aquatic system. The results of the PATHRAE model analysis indicate that these particular compounds should not cause adverse effects to the water quality in Tims Branch and to aquatic biota under any closure action. Due to the rapid leaching of the mobile contaminants and the low level of soil contamination, vegetation and herbivorous wildlife should not receive adverse impacts.

F.1.5.2 Assessment of No Removal of Waste and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

The 1974 photographs of this site indicated that it was a small, shallow depression - approximately 6 meters by 6 meters by 0.3 meter deep. The specific location would be confirmed by shallow soil core sampling. A low-permeability cap (Figure F-2) would be placed on top of the miscellaneous chemical basin. The area of the cap would be about 2000 square meters (approximately 45 by 45 meters) to cover the impacted area completely. The cap would be graded and revegetated in a manner similar to the current status of the site. Five new monitoring wells would be installed; they would be monitored quarterly for 1 year, and then annually for 29 years. Site maintenance would continue for the entire 30-year period.

To reduce the concentration of tetrachloroethylene in the groundwater to levels below the applicable standards in the vicinity of the basin, additional corrective actions, such as groundwater extraction and treatment, might be needed.

Comparison of Expected Environmental Releases with Applicable Standards

The chemical constituent of concern at this site is tetrachloroethylene. The concentrations of tetrachloroethylene in the groundwater are shown on Table F-4. This table lists the applicable standard for the contaminant, the predicted concentrations, and, in parentheses, the year in which the maximum concentration is expected to be reached. In the vicinity of the site wells at 1 and 100 meters, the concentrations exceed the applicable standard.

Surface-water quality would not be significantly affected by the addition of potential contaminants from the groundwater pathway from this site, as the resulting concentrations of constituents in the Savannah River are projected to be below drinking-water standards.

Estimated environmental risks due to atmospheric chemical releases from the miscellaneous chemical basin were added to those from the nearby metals burning pit (Section F.1.2.1). The risks are very low and are considered not significant.

The expected concentrations for the erosion, reclaimed farmland, and the biointrusion pathways are estimated as zero.

Potential Impacts (Other Than Releases)

The potential ecological impacts of waste removal and closure for the miscellaneous chemical basin are expected to be similar to those addressed in Sections F.1.5.1 and F.1.14.2.

F.1.5.3 Assessment of Removal of Waste to the Extent Practicable, and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

Analyses of soil samples collected during the installation of the proposed groundwater monitoring well (at the center of the site) would determine a depth-contamination profile. However, for purposes of estimating the disposal costs, the soil would be excavated to an assumed depth of 2 meters. The total excavated volume would be 72 cubic meters. The excavated material would be placed in metal boxes and transported to a waste storage/disposal facility. The site would be backfilled with clean material, regraded, vegetated, and then allowed to return to its natural state. Five new monitoring wells would be installed; they would be monitored quarterly for 1 year, then annually for 29 years. Site maintenance would continue for the entire 30-year period.

Additional corrective actions, such as groundwater extraction and treatment, might be needed to address the constituents already in the groundwater. The exact action to be taken would be determined by site-specific studies and by interactions with regulatory agencies.

Comparison of Expected Environmental Releases with Applicable Standards

This closure action was not modeled, as the constituent of concern was assumed to have leached beyond the zone of excavation by the time remedial actions would occur. Therefore, the site would behave in the manner as described in Section F.1.5.1. Table F-4 lists the estimated maximum concentrations of the chemical constituents based on results of groundwater modeling.

Estimated environmental and occupational risks due to atmospheric chemical releases from the miscellaneous chemical basin are conservatively considered the same as for the metals burning pit. As discussed in Section F.1.2.3, the risks are very low and are considered insignificant.

The expected concentrations for the erosion, reclaimed farmland, and biointrusion pathways are zero for this closure action.

Potential Impacts (Other Than Releases)

The potential ecological impacts of waste removal and closure for the miscellaneous chemical basin are expected to be similar to those addressed in Sections F.1.5.1 and F.1.14.3.

F.1.6 BURNING/RUBBLE PITS*

There are 15 burning/rubble pits on the SRP, located in A-, F-, R-, CS-, C-, D-, K-, L-, and P-Areas, as follows:

Area	Building	Area	Building
A	731-A	CS	631-6G
A	731-1A	C	131-C
F	231-F	D	431-D
F	231-1F	D	431-1D
R	131-R	K	131-K
R	131-1R	L	131-L
CS	631-1G	P	131-P
CS	631-5G		

TE All of these pits operated over essentially the same time period and received similar waste. Consequently, the closure actions, potential releases, and associated environmental effects would be expected to be similar. Therefore, the actions, releases, and impacts described in this section would be applicable to each of the burning/rubble pits.

The assessments of groundwater and surface-water releases presented here are based on the C-Area burning/rubble pit, which is assumed to be representative of groundwater and surface-water releases of all the burning/rubble pits at the SRP. To provide a relative scale for the burning/rubble pits, the estimated disposal mass of contaminants selected for environmental assessment is listed in Table F-5.

A similar scenario was developed for atmospheric releases. The two pits in A-Area (Buildings 731-A and 731-1A) and the pit in C-Area were analyzed as a single site for purposes of assessment of the atmospheric releases from the three pits. Atmospheric releases from each of the remaining 12 pits in F-, R-, CS-, D-, K-, L-, and P-Areas were assessed on the basis of a single site containing a combination of the wastes deposited in those 12 pits.

*The reference source of the information in this section is Huber, Johnson, and Marine, 1987.

Table F-5. Estimated Disposal Mass of Contaminants in the Burning/Rubble Pits

Area	Estimated Disposal Mass		
	Lead (kg)	Chromium (kg)	Chlorinated hydrocarbons (kg)
A	-	-	1.2[a]
F	-	-	16.4[a,b]
C	38	160	54[a]
CS	-	-	-
D	2.2	-	0.099[b]
K	-	-	3.71[a,b]
L			-
P	30	-	26.2[a,b,c]
R	-	-	1.5[b]

[a]Trichloroethylene.
[b]Tetrachloroethylene.
[c]1,1,1-trichloroethane, trans-1,2-dichloroethylene, 1,1-dichloroethylene.

TC

F.1.6.1 Assessment of No Action (No Removal of Waste, and No Remedial or Closure Actions)

Description of Action

Under no action, the burning/rubble pits would be left in their current status. Groundwater monitoring would continue quarterly for 1 year, then annually for 29 years. Site maintenance would continue for the entire 30-year period. TE

Comparison of Expected Environmental Releases with Applicable Standards

The chemical constituents and waste materials selected for consideration of the environmental impact and health risks associated with burning/rubble pits are chromium, lead, and trichloroethylene. These constituents were selected because they were found in the groundwater at the pit sites at levels higher than the threshold selection criteria.

The pathways associated with this site that may have an impact on human health include those cited in Subsection F.1.2.1 and, in addition, direct gamma radiation.

The groundwater contaminant transport analysis of the burning/rubble pits was performed only for the C-Area burning/rubble pit. The results of this analysis are summarized in Table F-6, which presents the expected maximum concentrations of trichloroethylene, based on results of groundwater modeling as TC

determined for the C-Area burning rubble pit for all of the closure actions and for no action. The table also lists the applicable standard and the year in which the maximum concentration is expected to occur. The table indicates that the maximum concentrations of trichloroethylene at the 1- and 100-meter wells are in excess of the applicable standard. Table F-6 also lists monitor- TC
ing data for cadmium, lead, mercury, nitrate, gross alpha, gross beta, and radium, which exceeded applicable standards. Peak values of chromium and lead are predicted to be below their applicable standards. Peak concentrations of the three modeled constituents (chromium, lead, and trichloroethylene) are predicted to be the same.

Surface-water quality would not be significantly affected by the addition of potential contaminants from the groundwater pathway from these sites, as the resulting concentrations of constituents in onsite streams and the Savannah River are projected to be below drinking-water standards.

As indicated above, estimated environmental risks due to atmospheric chemical releases from the burning/rubble pits within each geographic grouping are conservative because they are based on emissions from several burning/rubble pits. Risks are still quite low for these worst-case scenarios. For example, the highest reported chemical carcinogenic risk to the maximally exposed individual is less than 10^{-8}. The EPA Hazard Index for noncarcinogens is less than 10^{-5}. These risks are considered not significant. TC

The predicted maximum concentration for the erosion pathway is zero because the length of time that it takes the constituents to start eroding is well over 1000 years.

Potential Impacts (Other Than Releases)

Section F.1.14.1 describes the ecological impacts under no action. Results from the C-Area PATHRAE analysis indicate no impact on existing in-stream concentrations of chromium, lead, and trichloroethylene under any of the closure actions. Therefore, no aquatic impacts would be expected. Impacts from root uptake of wastes are expected to be negligible for all closure actions because PATHRAE modeling indicates that contaminants have already migrated vertically out of the soil profile. Because the C-Area burning/rubble pit has the largest estimated waste inventory, aquatic and biointrusion impacts are not expected at other burning/rubble pits.

F.1.6.2 Assessment of No Removal of Waste and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

Under the no-removal-and-closure action, all waste would be left in its present location. Since all burning/rubble pits have been backfilled, no further TE
backfill would be required. Groundwater monitoring would continue on a quarterly basis for 1 year, then annually for 29 years. Site maintenance would continue for the entire 30-year period.

Additional corrective actions, such as groundwater extraction and treatment, might be needed to reduce the concentration of chlorinated hydrocarbons in the groundwater.

Comparison of Expected Environmental Releases with Applicable Standards

The chemical constituents, the consequences of environmental releases, and the pathways associated with this action are the same as those for no action (see Section F.1.6.1) because the pit has been backfilled and is considered closed.

Potential Impacts (Other Than Releases)

Sections F.1.6.1 and F.1.14.2 describe the ecological impacts of no waste removal and closure for the A-Area burning/rubble pits.

F.1.6.3 Assessment of Removal of Waste to the Extent Practicable, and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

TE Under the waste-removal-and-closure action, all waste deposited in the burning/rubble pits would be excavated, as would any contaminated soil, to a depth of 1 meter below the base of the pits. The waste and contaminated material would be placed in metal boxes and sent to a waste storage/disposal facility. The pits would be backfilled with clean excavated backfill and additional clean soil, compacted as necessary to prevent settling, and seeded. The amount of soil required to backfill and the amount of waste to be removed at each pit are as follows:

Building	Soil (m^3)	Waste (m^3)	Building	Soil (m^3)	Waste (m^3)
731-A	22,140	5,460	631-6G	3,298	804
731-1A	6,683	1,630	131-C	3,325	811
231-F	6,494	1,584	431-D	5,166	1,260
231-1F	10,889	2,606	431-1D	3,510	856
131-R	1,902	466	131-K	2,615	638
131-1R	2,948	719	131-L	2,529	617
631-1G	2,276	555	131-P	4,802	1,171
631-5G	5,146	1,255			

Groundwater would continue to be monitored on a quarterly basis for 1 year, then annually for 29 years. The sites would be maintained on a basis similar to the surrounding grounds for 30 years.

Additional corrective actions, such as groundwater extraction and treatment, might be needed to reduce the concentration of chlorinated hydrocarbons in the groundwater.

Comparison of Expected Environmental Releases with Applicable Standards

The chemical constituents, the consequences of environmental releases, and the pathways are the same as those for no action. The predicted maximum concentrations of the chemical constituents for this action are the same as those for no action as the constituents are assumed to have leached beyond the zone of control (see Section F.1.6.1).

Expected environmental risks to the maximally exposed individual due to atmospheric releases of chemical carcinogens from these burning/rubble pits for this action are about 20 to 100 times less than those for no action and are considered not significant. The peak EPA Hazard Index value for noncarcinogens is 3.37×10^{-8}.

Occupational risks associated with this action were also calculated. They are very low (carcinogenic risk of 5.24×10^{-9}; EPA Hazard Index for noncarcinogens of 1.0×10^{-4}) and are considered not significant, particularly when the conservatism built into the emissions is accounted for. TC

The predicted maximum concentrations for the erosion pathways are zero for this closure action.

Potential Impacts (Other Than Releases)

The potential ecological impacts of waste removal and closure for the A-Area burning/rubble pits are discussed in Sections F.1.6.1 and F.1.14.3.

F.1.7 A-AREA BURNING/RUBBLE PIT, BUILDING 731-1A

This burning/rubble pit is discussed in conjunction with the other pits in Section F.1.6. The ecological effects of this site that relate specifically to the A- and M-Area geographic grouping are discussed in Section F.1.14.

F.1.8 SRL SEEPAGE BASINS*

The Savannah River Laboratory (SRL) seepage basins [Buildings 904-53G (Basins 1 and 2), 904-54G (Basin 3), and 904-55G (Basin 4)] stopped receiving wastes in October 1982. Background information on the history of waste disposal, waste characteristics, and evidence of contamination are presented in Appendix B, Section B.2.2.

F.1.8.1 Assessment of No Action (No Removal of Waste, and No Remedial or Closure Actions)

Description of Action

Under no action, the site would be left in its present condition. Groundwater monitoring at existing wells would continue quarterly for 1 year and then annually for 29 years. Upkeep would consist of maintaining a fence and signs around the basin area and cutting the weeds periodically for the entire 30-year period. TE

Comparison of Expected Environmental Releases with Applicable Standards

PATHRAE predicts that arsenic will exceed groundwater standards during the first 200 years of the modeled period. Table F-7 lists these parameters, the TC

*The reference source of the information in this section is Fowler et al., 1987.

corresponding regulatory standards, and the maximum concentrations predicted to be found in the groundwater near the basins. All other constituents modeled were predicted to be below applicable standards. Table F-7 also shows monitoring data for nickel, which exceeded the applicable standard but was not selected for modeling.

Surface-water quality would not be significantly affected by the addition of potential contaminants from the groundwater pathway from this site, as the resulting concentrations of constituents in the Savannah River are projected to be below drinking-water standards.

The nonradioactive constituents were analyzed, using the methodology discussed in the introduction to Appendix F and in Appendix I, to estimate public exposure and risk attributable to constituents released to the atmosphere from the SRL seepage basins. Releases to the maximally exposed individual are due to TC
the volatilization of the contaminants and wind erosion. Risks attributable to releases of carcinogens are less than 10^{-7}. Environmental risks due to atmospheric chemical releases were calculated. The carcinogenic risks to the maximally exposed individual are less than 1.0×10^{-7} with a value of TC
2.31×10^{-8} for 1985 and 1.61×10^{-8} for 2085. The EPA Hazard Index for noncarcinogens is 5.24×10^{-5}.

Environmental doses and risks to the maximally exposed individual due to radiological releases from SRL seepage basins were calculated using the methodology presented in the introduction to this appendix and in Appendix I. The calculated doses are less than 3 percent of the DOE limit of 25 millirem. The risks associated with these doses would be less than 2.0×10^{-7}.

Potential Impacts (Other Than Releases)

Section F.1.14.1 describes the ecological impacts of no action. PATHRAE modeling was performed on arsenic, cadmium, chromium, copper, fluoride, lead, mercury, nickel, phosphate, silver, zinc, sodium, tritium, cobalt-60, strontium-90, yttrium-90, cesium-137, uranium-235 and -238, plutonium-238 and -239, americium-241, and curium-244. The four SRL seepage basins were modeled as a single unit to estimate cumulative effects resulting from the closure actions. The results of the PATHRAE analysis indicate that these elements would not alter the present water quality of the Savannah River under any of the closure actions. Because the levels of groundwater outcrop contamination TE
are ecologically insignificant for all closure actions, no impacts are expected to aquatic biota of the river or the adjacent wetlands. In addition, wildlife consuming undiluted groundwater at the outcrop would not receive adverse effects.

Because the SRL seepage basins have standing surface water, there could be impacts on the wildlife that consume this water. Based on the available chemical analysis data on the standing surface water of the seepage basins, pH, iron, manganese, mercury, gross alpha, and gross beta exceed either primary or secondary drinking-water standards; thus, impacts are possible under no action.

No action would produce limited terrestrial impacts. The maximum concentrations in the basin soils for americium-241, curium-244, cobalt-60, cesium-137, tritium, plutonium-238, -239, and -240, strontium-90, and uranium-235 and -238 exceed DOE's Threshold Guidance Limits, which are based on human health concerns and are conservative. The maximum concentrations in the basin soils for cadmium, chromium, copper, mercury, nickel, and silver exceed the phytotoxic benchmarks, indicating that these concentrations could cause such vegetation impacts as reduced plant growth and increased plant mortalities via the biointrusion pathway. However, food-chain uptake calculations indicate that the predicted vegetation concentrations are below the levels considered toxic to consuming wildlife. Any terrestrial impacts would be limited to the area occupied by the basins (approximately 2.15 acres).

F.1.8.2 Assessment of No Removal of Waste and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

TE Under the no-removal-and-closure action, approximately 2500 cubic meters of standing water in basins 1, 2, and 3 would be moved to basin 4, where it would be removed by continuing seepage, supplemented by accelerated evaporation, if required. There would be no excavation. The basins would be backfilled and capped. The fill would consist of 61 to 122 centimeters of crushed stone or washed gravel covered by a geotextile filter fabric and a minimum of 61 centimeters of common borrow fill. This would be covered by a low-permeability cap (see Figure F-2). Basins 1, 2, and 3 would be restored to the original ground surface (Figure F-3). Basin 4 would be filled and graded to remain above the original ground surface to ensure that the bottom sediments were covered (Figure F-4). Groundwater would be monitored quarterly for 1 year and then annually for 29 years. Site maintenance would continue for the entire 30-year period.

TE Corrective action might be required since results of PATHRAE modeling predict that the concentrations in the groundwater of arsenic would remain above the MCLs (see Table F-7). The precise actions to be taken would be decided on the basis of site-specific studies and interactions with regulatory agencies. Appendix C describes some possible treatment technologies.

Groundwater cleanup would consist of the removal of water from wells placed to contain the contaminant plume, and the physical or chemical treatment of this water to remove contaminants to concentrations that meet applicable health-based standards. Possible treatment technologies are discussed in Appendix C.

Comparison of Expected Environmental Releases with Applicable Standards

TC The implementation of this closure action, plus remedial action, would reduce all environmental releases of arsenic to below MCLs or other health-based standards (see Table F-7 for a listing of applicable standards). All other environmental releases are projected to be below regulatory standards.

TC The analysis described in the air release portion of Section F.1.8.1 was also performed for the no waste removal and closure action. Risks attributable to the release of carcinogens were calculated to be less than 10^{-20}. The hazard index attributable to the release of noncarcinogens was calculated to be less than 1, with the maximum fraction of the ADI of less than 6.5×10^{-9}. The implementation of this closure action will reduce carcinogenic releases to zero. Noncarcinogenic risks to the maximally exposed individual are due to the volatilization of mercury. The associated EPA Hazard Index is less than

1.0×10^{-8}. The radionuclide dose is calculated to be 1.1×10^{-14} percent of the DOE limit of 25 millirem or less for each of the 3 years. The risk associated with this dose would be less than 8×10^{-22}.

Potential Impacts (Other Than Releases)

Sections F.1.8.1 and F.1.14.2 describe the ecological impacts of no waste removal and closure. The contaminated water would be processed to meet NPDES standards before discharge. Therefore, no significant biological impacts on surface waters are expected. This would also eliminate possible impacts due to wildlife consumption of basin waters. Closure of the basins would remove terrestrial impacts due to biointrusion.

F.1.8.3 Assessment of Removal of Waste to the Extent Practicable, and Implementation of Cost-Effective Remedial and Closure Actions as Required

Description of Action

Under the waste-removal-and-closure action, the basin water would be removed as described in Section F.1.8.2. The basins would be excavated of waste, and TE
the waste would be transported to a storage/disposal facility. Approximately 31 centimeters would be excavated each from basins 1 and 2, 16 centimeters would be excavated from basin 3, and 8 centimeters from basin 4. A total of 1900 cubic meters would be excavated from the four SRL seepage basins. The basins would be backfilled and the site would be capped as described in Section F.1.8.2. Groundwater would be monitored quarterly for 1 year and then annually for 29 years. Site maintenance would continue for the entire 30-year period.

Corrective actions might be required because the results of PATHRAE modeling indicate that the concentrations of arsenic in the groundwater would remain above the MCLs (see Table F-7). The exact actions to be taken would be determined after site-specific studies and interactions with regulatory agencies. Some of the possible treatment technologies are discussed in Appendix C.

Comparison of Expected Environmental Releases with Applicable Standards TE

The implementation of this closure action, plus remedial action, would reduce all environmental releases to below MCLs or other health-based standards (see Table F-7 for a listing of applicable standards). All other environmental releases are projected to be below regulatory standards.

The analysis of atmospheric releases described in Section F.1.8.1 was also performed for the waste-removal-and-closure action. Releases are due to the volatilization of the constituents and earth-moving activities in 1986 and to TC
volatilization in other years. Risks attributable to releases of carcinogens are less than 1.2×10^{-11}. The EPA Hazard Index for releases of noncarcinogens is less than 2.3×10^{-8}.

The calculated dose to the maximally exposed individual at the SRP boundary for each of the 3 years is less than 0.06 percent of the DOE limit of 25 millirem. The risk associated with this dose would be less than 3.8×10^{-9}.

TC An analysis of the average individual worker health risks attributable to occupational exposure to carcinogens (both nonradioactive and radioactive) and noncarcinogens was performed using the methodology presented in Appendix I. The risk to a worker from nonradioactive carcinogens was calculated as less than 1.8×10^{-7}. The Hazard Index from noncarcinogens to a worker would be 1.23×10^{-2}. The total dose to the worker was calculated as 9.9 millirem, which is equivalent to a risk of 2.8×10^{-6}. The total dose to the worker transporting the waste was calculated to be 18 millirem, equivalent to a risk of 5.1×10^{-6}.

Potential Impacts (Other Than Releases)

Impacts associated with waste removal and closure would be similar to those described in Sections F.1.8.2 and F.1.14.3.

F.1.9 SRL SEEPAGE BASIN, BUILDING 904-53G (BASIN 2)

This seepage basin is discussed in conjunction with the other SRL seepage basins in Section F.1.8.

F.1.10 SRL SEEPAGE BASIN, BUILDING 904-54G (BASIN 3)

This seepage basin is discussed in conjunction with the other SRL seepage basins in Section F.1.8.

F.1.11 SRL SEEPAGE BASIN, BUILDING 904-55G (BASIN 4)

This seepage basin is discussed in conjunction with the other SRL seepage basins in Section F.1.8.

F.1.12 M-AREA SETTLING BASIN AND VICINITY*

The M-Area settling basin (Building 904-51G) and its associated areas have been designated as the M-Area Hazardous Waste Management Facility (HWMF). The areas included in the HWMF include the settling basin, overflow ditch, natural seepage area, a Carolina bay known as "Lost Lake" (Building 904-112G), and the inlet process sewer line. The HWMF received process effluents between 1958 and 1985. Background information on the history of waste disposal, waste characteristics, and evidence of contamination are presented in Appendix B, Section B.2.3.

F.1.12.1 Assessment of No Action (No Removal of Waste, and No Remedial or Closure Actions)

Description of Action

TE Under no action, the liquid in the settling basin would be allowed to infiltrate or evaporate. The soils in the overflow ditch, seepage area, and Lost Lake would remain in place. General maintenance of the area around the basin, including vegetation control and maintenance of the exclusion fence, would continue. Monitoring of the groundwater would continue quarterly for 1 year,

*The reference source of the information in this section is Pickett, Colven, and Bledsoe, 1987.

then annually for 29 years. The existing groundwater treatment facility would continue to process recovered groundwater contaminated with varying amounts of chlorocarbons. The treatment facility consists of an air stripper that is supplied with feed water from 11 groundwater withdrawal wells. The system is capable of treating a maximum flow of 1250 liters per minute. Treated effluent from the air stripper is discharged to a tributary of Tims Branch Creek at existing NPDES Outfall A-14. No additional remedial action is planned for no action.

Comparison of Expected Environmental Releases with Applicable Standards

Current groundwater monitoring data indicate that concentrations of nitrate, nickel, gross alpha, gross beta, radium, tetrachloroethylene, 1,1,1-trichloroethane, and trichloroethylene exceed actual or proposed regulatory standards. PATHRAE modeling results indicate that groundwater concentrations of barium, cadmium, lead, nickel, nitrate, tetrachloroethylene, 1,1,1-trichloroethane, and trichloroethylene will exceed standards at various times in the future. However, the PATHRAE model does not account for removal of the chlorocarbons by the existing groundwater treatment facility. TC

Table F-8 lists all constituents in the groundwater that currently exceed or are projected to exceed regulatory standards for the no-action alternative. The PATHRAE simulation indicates that future concentrations of modeled constituents in Tims Branch (due to outcrop of contaminated groundwater) will be below drinking-water standards.

The nonradioactive constituents were analyzed, using the methodology discussed in the introduction to Appendix F and in Appendix I, to estimate public and maximum individual exposure and risk attributable to releases of constituents to the atmosphere from the M-Area HWMF. The analysis was performed for each of the subareas: M-Area settling basin, the overflow ditch and seepage area, Lost Lake, and the air stripper. TC TC

Releases are due to the volatilization of the constituents and to wind erosion. Risks to the maximally exposed individual attributable to releases of carcinogens are less than 5×10^{-8} for each subarea for each of the 3 selected years (the air stripper will operate for a period of 30 years). The Hazard Index attributable to releases of noncarcinogens are calculated to be below 1, with a maximum value less than 2×10^{-4} for each of the 3 years. TC

Environmental doses and risks to the maximally exposed individual due to radiological releases from the M-Area HWMF were calculated using the methodology presented in the introduction to this appendix and in Appendix I. The calculated doses are less than 1 percent of the DOE limit of 25 millirem for each of the 3 years. The risks associated with these doses would be less than 3×10^{-8}. TC

Potential Impacts (Other Than Releases)

Section F.1.14.1 describes the ecological impacts of no action. For the M-Area Settling Basin, PATHRAE modeling was performed on bis (2-ethylhexyl) phthalate, barium, cadmium, chromium, copper, cyanide, 1,1-dichloroethylene, lead, mercury, nickel, nitrate, tetrachlorobiphenyl, phosphate, silver, sodium, tetrachloroethylene, 1,1,1-trichloroethane, trichloroethylene, zinc, TE and uranium-238 because each was identified as having potential impacts on the aquatic system. The results indicate that none of these materials would, after mixing, alter the present water quality of Upper Three Runs Creek under any closure action; thus aquatic biota in the stream would not be affected. TE

Levels of lead, nitrate, and tetrachloroethylene would exceed EPA water-quality criteria under no action at year 200 in the relatively unmixed waters of wetlands adjacent to the groundwater outcrop, indicating the potential for aquatic impacts. The groundwater outcrop concentration of tetrachloroethylene would exceed drinking-water standards under all closure actions, indicating a potential for impacts to wildlife that consume the undiluted groundwater. However, a comparison of the outcrop concentration with that considered toxic for wildlife revealed that wildlife should not receive adverse impacts.

Based on available data, the contaminant levels in basin waters of cadmium, lead, nitrate, phosphate, sodium, tetrachloroethylene, trichloroethylene, and trichloroethane exceed EPA drinking-water standards. Comparisons of these levels with levels considered toxic to wildlife revealed that no adverse effects on wildlife are expected. Food-chain uptake calculations based on the bioconcentation by aquatic macrophytes of heavy metals from the standing water indicate that the predicted concentrations of heavy metals from the standing water are well below the concentrations considered toxic to herbivorous wildlife.

The maximum contaminant concentrations in the settling basin soil for chromium, copper, lead, mercury, nickel, silver, and zinc exceed the phytotoxic concentrations, indicating that such adverse impacts as reduced plant growth and increased plant mortalities are probable. The maximum contaminant concentration in the settling basin and Lost Lake soils for bis (2-ethylhexyl) phthalate exceeds the no-effect concentration, indicating the potential for adverse effects on vegetation. However, food-chain uptake calculations indicate that the predicted vegetation concentrations are below the levels considered toxic to herbivorous wildlife at both the settling basin and Lost Lake. Terrestrial impacts would be limited to the general area occupied by the settling basin and Lost Lake. TE

Although no endangered species have been observed at Lost Lake, an alligator has been observed living in the M-Area settling basin since 1985. No action would not displace this animal; the long-term impacts to the alligator from residing in the basin are not known. TE

Under no action, heavy metals and salts would be deposited in the soil of the M-Area settling basin and Lost Lake as the water evaporated. Small temporary pools would concentrate wastes, which could result in the pools being unsuitable habitat for the reproduction of amphibians and reptiles. Waste concentrations could also affect revegetation; thus, the utility of Lost Lake for reestablishment as a typical Carolina Bay is unlikely under no action. TE