

## CHAPTER 4

### ENVIRONMENTAL CONSEQUENCES

This chapter describes the potential environmental consequences of adopting several strategies for the modification of the management of existing waste sites, the construction of new storage/disposal facilities, and the management of disassembly-basin purge water for hazardous, low-level radioactive, and mixed wastes at the Savannah River Plant (SRP), and the consequences of considering the No-Action strategy, as required by the National Environmental Policy Act (NEPA). | TE

#### 4.1 ALTERNATIVE WASTE MANAGEMENT STRATEGIES

The alternative strategies for the modification of the SRP waste management program that have been identified involve combinations of various actions for the management of existing waste sites, the construction of new storage/disposal facilities, and the management of disassembly-basin purge water. These strategies also consider the implications for the long-term dedication of SRP land areas, institutional control, and monitoring. | TE

These waste management strategies are interrelated; modifications of one can affect another. For example, a modification that calls for the removal of waste from all existing waste sites for disposal elsewhere cannot be paired with the No-Action strategy for new disposal facilities. Thus, the alternative strategies listed in Table 2-1 and described throughout this environmental impact statement (EIS) as integral entities are logical outgrowths of needed SRP waste management actions and recently issued regulations.

This EIS characterizes these alternative strategies as:

- No Action - continuation of the present program for waste management to provide protection of the offsite environment
- Dedication - compliance with groundwater protection and other requirements by dedication of existing and new disposal areas | TE
- Elimination - compliance with groundwater protection and other requirements through the elimination of existing waste sites and the provision of retrievable storage of wastes | TE
- Combination - compliance with groundwater protection and other requirements by a combination of dedication of some and elimination of other waste sites, and of storage of some and disposal of other wastes | TE

This chapter treats, in turn, the environmental consequences of adopting alternative strategies for the modification of the waste management program. Section 4.2 describes alternative strategies for managing existing waste sites. These strategies are complex; they are represented in this analysis by

TE | preliminary field data and atmospheric, groundwater, and health effects modeling information presented to include the range of environmental consequences and costs. The implementation of specific actions at individual locations would be determined by interactions with regulatory agencies based on future site-specific modeling and monitoring results not currently available for the majority of the sites.

Section 4.3 presents the environmental consequences of the construction of new disposal/storage facilities; Section 4.4 describes the effects of modifications to the discharge of disassembly-basin purge water; and Section 4.5 presents the consequences of potential accidents associated with remedial, removal, and closure actions at existing waste sites. Section 4.6 presents the effects of the decontamination and decommissioning of potential new facilities; Section 4.7 describes cumulative effects; Section 4.8 describes mitigation measures; and Section 4.9 describes unavoidable/irreversible impacts. Section 4.10 summarizes the environmental consequences of the preferred strategy.

TC | Data and information related to environmental consequences, health effects, and costs of the alternative waste management strategies are taken from the Environmental Information Documents (EIDs) used as support documents for this EIS.

#### 4.2 ALTERNATIVE WASTE MANAGEMENT STRATEGIES AT EXISTING WASTE SITES

This section describes the environmental consequences of the implementation of four strategies for the management of existing waste sites that contain or might contain hazardous, low-level radioactive, or mixed waste. They represent the strategies described fully in Section 2.1; they consist of the following:

- No Action - No removal of waste at existing sites, and no closure or remedial actions
- Dedication - No removal of waste at existing waste sites, and implementation of cost-effective closure and remedial actions, as required
- Elimination - Removal of waste to the extent practicable from all existing waste sites, and implementation of cost-effective closure and remedial actions, as required
- Combination - Removal of waste to the extent practicable at selected existing waste sites, and implementation of cost-effective closure and remedial actions, as required

The following sections describe these strategies. The description of each strategy summarizes the range of actions that are considered feasible for the existing sites; identifies the predicted effects of these actions on contaminants in groundwater and surface water in each geographic grouping of sites (see Section 2.2) and compares them to relevant standards; assesses public exposures to and health risks from chemical and radioactive waste constituents; and presents impacts on aquatic, terrestrial, archaeological and historic, and socioeconomic resources.

The assessments in these sections are based on calculated groundwater and surface-water concentrations of waste constituents that are likely to be present at existing waste sites and that are predicted by computer codes to exceed applicable standards. | TE

The transport models used in these analyses (predominantly the PATHRAE code; see Appendix H) consider a variety of pathways from the waste source to the human environment, including the following:

- Contaminated groundwater movement to water wells (hypothetically assumed to be 1 meter and 100 meters downgradient from each waste site) and to actual surface streams | TE
- Erosion of waste materials from a site and movement to a surface stream
- Consumption of food produced from farmland reclaimed over a waste site and consumption of crops produced through natural biointrusion on land over a waste site
- For radioactive constituents, direct exposure to gamma radiation
- Inhalation of volatile gaseous or particulate material in the air
- Ingestion of foods containing waste materials deposited from the atmosphere on the ground surface

PATHRAE modeling is applied to an individual waste site (e.g., metallurgical laboratory basin), to contiguous sites modeled as a single group (e.g., SRL seepage basins), and as the worst-case impact analysis (based on hydrogeology and source conditions) of a class of sites that serve similar functions but are in several different SRP areas (e.g., acid/caustic basins).

The analyses in this section are based on individual waste site source-term information (Looney et al., 1987) and the 1- and 100-meter well concentrations presented in Appendix F. The initial emphasis is on potential cumulative groundwater effects within geographic groupings. Cumulative effects could occur if groundwater contaminated from an upgradient waste site travels beneath another waste site and receives additional leachate from the second site. | TE

Potential plume interaction is determined by summing the predicted peak concentrations at all 100-meter wells in a geographic grouping, regardless of the time of peak occurrence. This summation is used as a screening device to establish a hypothetical upper limit of potential cumulative effects. | TE  
Actually, as the groundwater travels slowly beyond the 100-meter well, the peak concentration would be attenuated by dilution with uncontaminated groundwater recharge and the spreading that occurs as a contaminant flows through the porous media. In addition, one site probably would not be located precisely downgradient from another, and the centroid of the original contaminant plume probably would not be under the second site at the same time the peak contaminant flux was entering the groundwater from that site.

Therefore, this method establishes a conservative upper limit to potential interactions because it does not consider the spatial or temporal nature of | TE

contaminant plumes or the decay and dilution that occur as they travel. If the sum (for each constituent) of the peak concentrations at each 100-meter well does not exceed standards, no further examination is made. If the sum exceeds standards, the specific pathways, time of occurrence, and source conditions of the affected waste sites are examined to see if realistic cumulative effects could occur. The 100-meter well concentrations were used in this analysis because they reflect at least the initial attenuation that occurs in this process.

TE | With the potential for plume interaction established in Section 4.2.1.1, Sections 4.2.2.1, 4.2.3.1, and 4.2.4.1 examine groundwater impacts under remedial and closure actions that are consistent with the Dedication, Elimination, and Combination strategies. Closure generally reduces predicted peak concentrations. However, in these sections the absolute peak concentrations at the 1-meter well are presented to identify the potential for postclosure groundwater remedial actions under each of these three waste management strategies.

TE | The time periods for analysis of potential environmental consequences are based on two assumptions: first, the U.S. Department of Energy (DOE) will not relinquish control of the SRP for 100 years beyond 1985, which is reasonable in light of current production planning and projected scheduling for site decommissioning; and second, analyses to 1000 years are sufficient to describe the long-term consequences, as suggested by guidelines of the U.S. Nuclear Regulatory Commission (NRC) and the U.S. Environmental Protection Agency (EPA).

The sites and constituents to be modeled for this EIS were determined as follows:

1. Available data were reviewed to determine the materials disposed of at each site and the constituents found in soil or groundwater.
2. Measured or predicted soil and groundwater concentrations were compared to threshold selection criteria established for each constituent, corresponding to or less than EPA maximum contaminant levels (MCLs). If the quantities or concentrations exceeded the selection criteria values, the material was selected for environmental assessment.
3. If large amounts of specific chemicals were believed to have been disposed of at the site, those materials were included for assessment, even if soil and groundwater characterization data did not indicate their presence.

TE | The following sections present predicted peak groundwater concentrations that exceed maximum contaminant limits (MCLs) or other standards for each strategy and waste site grouping. These sections contain tables (e.g., Table 4-3) that list the predicted peak concentrations and corresponding applicable standards of modeled constituents for combinations of strategy and waste site groupings. The "applicable standard" values in these tables are derived from several sources, primarily the National Primary Drinking Water Regulations (40 CFR 141; EPA, 1985a, 1987). Radiation dose calculation methodology of the International Commission on Radiological Protection (ICRP, 1978) was used to determine radionuclide concentrations that yield an effective whole-body dose of 4 millirem per year, calculated on a basis of 2 liters per day for

drinking-water intake. Drinking-water regulations based on this methodology are anticipated (EPA, 1986a). For consistency, all radionuclide MCLs were calculated in this manner. Current drinking-water regulations, however, use 1963 dose calculation models and assumption that yield different values (e.g., tritium and strontium-90 regulations are 20,000 and 8 picocuries per liter, respectively). In addition, if two or more radionuclides are present, MCLs are adjusted so that the sum of the doses does not exceed 4 millirem per year. | TE

The following sections also present risk assessments for each strategy and waste grouping in terms of carcinogenic risks from radioactive and nonradioactive wastes, and noncarcinogenic risks from other hazardous chemicals. Carcinogenic risks are the product of exposure (either chemical or radiological) and the unit cancer risk (UCR). These risks are additive; that is, the risks from chemical exposures can be summed and equivalent radiological risks added to obtain a combined risk estimate expressed as the increase in probability for 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 exposures over a period of 50 years, which encompasses the year of peak exposure. Radiological risks, however, were calculated for an exposure period of the peak year only. Thus, to produce a common risk basis for both chemical and radiological carcinogenesis, radiological risks calculated as lifetime risk per year of exposure are multiplied by 50 to produce a conservative estimate of lifetime-exposure risk comparable to that originally calculated for chemical carcinogenesis. This EIS considers lifetime carcinogenic risks calculated to be less than 1 in 100 million ( $1 \times 10^{-8}$ ) for individual constituents to be not significant.

As a perspective on carcinogenic risks, the average risk in the United States of a person dying from cancer is about  $1.9 \times 10^{-3}$  (or almost 2 chances in 1000) per year. However, rates in individual states range from a low of about  $0.76 \times 10^{-3}$  (in Alaska, with a very young population on average) to a high of  $2.4 \times 10^{-3}$  (in Florida, which has an older average population). The average risk of dying from lung cancer is about  $5 \times 10^{-4}$  per year; about one in four cancer deaths is due to this cause. The lifetime (age-adjusted) average risk of death by cancer is about  $9 \times 10^{-2}$  (or 9 chances in 100).

EPA has adopted a lifetime risk value of  $1 \times 10^{-6}$  as a reference point for the management and regulation of carcinogens in the environment. Thus, an incremental risk from an environmental carcinogen at the EPA guideline limit would raise the risk to an average U.S. resident of death by cancer from 0.09 to 0.090001. Similarly, at an incremental annual risk of  $1 \times 10^{-6}$  from a particular exposure, the total annual risk to an average individual of death by cancer would rise from 0.0019 to 0.001901. | TC

To provide a perspective on common risks, Table 4-1 gives a range of estimated risks of dying in a single year for some human activities that are based on various occupations, lifestyles, accidents, and environmental exposures, incidents, or situations. | TC  
E-137

A noncarcinogenic risk from chemical constituents is defined 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 less than 1 of calculated risk means that no health effect is likely; the smaller the

value, the greater the margin of safety. Individual noncarcinogenic risk values can be summed to form a hazard index that also is compared conservatively to a threshold of 1. Because SRP waste sites do not have more than (at most) several dozen waste constituents, individual constituent noncarcinogenic hazard index values of less than 1 in 100 ( $1 \times 10^{-2}$ ) are considered not significant in these assessments; that is, the sum of several dozen risks of 0.01 each would still be much less than 1, and hence no health effect would be expected.

Finally, the evaluations of alternatives in this section are based for the most part on preliminary information and simplified modeling assumptions, which predict groundwater and/or surface-water concentrations to exceed current standards at some time in the future (or at present). However, these concentrations cannot be compared directly to monitoring results at the sites described in this EIS. These predictions represent a preliminary indication of the probable need for, or benefit from, closure or remedial actions under defined circumstances, for providing estimates and comparisons in this EIS. In practice, the need for and types of closure or remedial actions will be determined by direct interaction with regulatory authorities, based on detailed site-specific data and evaluations and in conformance with the standards then in effect.

TE

#### 4.2.1 NO-ACTION STRATEGY (NO REMOVAL OF WASTE AND NO CLOSURE OR REMEDIAL ACTION)

Under no action, existing waste at all sites would remain in place and each site would be retained in its present condition; however, the addition of wastes to currently active sites would be discontinued as treatment facilities became available. Existing basins would not be backfilled and liquids contained in these basins, including periodic rainfall, would continue to dissipate by evaporation or infiltration into the soil.

Actions such as cleanup at M-Area would continue to be taken to protect the offsite environment. Additional groundwater monitoring wells would be installed at the sites listed in Table 4-2 to ensure the detection of contaminant plumes. All existing and new wells would be monitored as required.

TE

Fences, pylons, and signs would be installed to keep out terrestrial and aquatic animals and unauthorized persons, and all waste sites would be inspected periodically for erosion or subsidence. Weed control, grass mowing, and maintenance of signs and fences would be provided, as in other SRP areas.

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##### 4.2.1.1 Groundwater Impacts<sup>1</sup>

The primary impact posed by existing waste sites is on groundwater and its potential uses, either directly or after movement to surface waters. The following paragraphs discuss these impacts at various waste sites by geographic groups. The sites or parameters discussed (and included in the corresponding tables) are those for which the model predicts exceedances of appropriate MCLs or comparable health-based criteria.

<sup>1</sup>Data and information related to all environmental impacts are taken from the Environmental Information Documents (EIDs) used as supporting or background documents for this EIS.

Table 4-2. Additional Groundwater Monitoring Wells

Site Group Number	Site	Buildings	Number
1-5	Miscellaneous chemical basin	731-5A	5
2-2	H-Area acid/caustic basin	904-75G	4
2-5	H-Area retention basin	281-3H	2
2-6	F-Area retention basin	281-3F	4
3-4 to 6	R-Area Bingham pump outage pits	643-8G to 10G	4
TC   4-6	Ford Building waste site	643-11G	4
5-3	TNX burying ground	643-5G	16
8-3	K-Area Bingham pump outage pit	643-1G	4
9-10, 11	L-Area Bingham pump outage pits	643-2G, 3G	4
10-3	P-Area Bingham pump outage pit	643-4G	4
11-1	SRL oil test site	080-16G	4
11-2	Gunsite 720 rubble pit	N80,000: E27,350 <sup>a</sup>	4

<sup>a</sup>SRP map coordinates

Table 4-3 summarizes no-action peak 100-meter well constituent concentrations (and their respective years of occurrence) for the 12 modeled waste sites in the A- and M-Areas, with the corresponding MCLs. This table lists each constituent with a sum exceeding its MCL. These exceedances clearly are due to individual waste sites that exceed their MCLs, except for lead.

TC | An analysis of the specific pathways and inventory of the affected waste sites demonstrated that there is also little, if any, potential for cumulative effects from lead. Groundwater beneath the M-Area settling basin and Lost Lake is postulated to travel southeastward to outcrops in Upper Three Runs Creek while the water-table aquifer beneath the other sites in this area has a westward gradient. Therefore, the lead plumes from the M-Area settling basin and vicinity would not be expected to converge with those from the other sites. This results in a potential cumulative concentration from the other sites of 0.056 milligram per liter for lead.

TC | The peak concentrations listed for the A-Area burning/rubble pits are from modeling of the C-Area burning/rubble pit. However, the estimated disposal mass of lead at the A-Area pits is zero. When the burning/rubble pit values are subtracted from the above subtotals, the realistic potential cumulative concentration is 0.018 milligram per liter for lead. This is below the MCL of this constituent (0.05 milligram per liter).

TE | For the F- and H-Areas, a three-dimensional flow model (McDonald and Harbaugh, 1984) and the Sandia Waste Isolation and Flow Transport model (NRC, 1986), have been used to simulate the variable hydrostratigraphic and boundary conditions that exist throughout the F- and H-Areas (Killian et al., 1987).

TE | In general, the models predict that a contaminant released from the F-Area seepage basin would travel through the Barnwell and McBean aquifers before outcropping at Four Mile Creek. A contaminant released from the H-Area seepage basins would travel only through the Barnwell aquifer before reaching

Four Mile Creek. From the radioactive and mixed waste burial grounds (643-G, 643-7G, and 643-28G), most of the contaminant would travel through the Barnwell, McBean, and Congaree aquifers to an outcrop at Upper Three Runs Creek, although some of the contaminant would travel through the Barnwell and McBean aquifers and outcrop to Four Mile Creek.

Contaminants from other waste sites in F- and H-Areas travel in a direction influenced by the water-table divide that bisects the radioactive waste burial grounds. Groundwater in the northern part of the area travels toward Upper Three Runs Creek, and in the southern part of the area toward Four Mile Creek. The modeling results indicate a low potential for contaminants to enter the Middendorf/Black Creek (Tuscaloosa) aquifer from waste sites in F- and H-Areas. However, recent studies have shown that the upward head gradient near H-Area has declined from 1.5 meters to 0.61 meter between 1972 and 1986 (Bledsoe, 1987). Because the head differential is small, large volumes of water pumped from the Black Creek aquifer in portions of the H-Area potentially could reverse the upward gradient, thereby effectively eliminating the hydraulic barrier to downward flow. A modeling study (Duffield, Buss, and Spalding, 1987) indicates that a maximum downward potential of about 1.5 meters has developed in the eastern portion of H-Area. Future SRP actions will consider the need for preserving the upward head gradient and the implications of it being adversely affected.

TC | Table 4-4 lists the summation of peak constituent concentrations that exceed their applicable standards and the predicted contaminant concentrations associated with individual waste sites in the F- and H-Areas under no action. The radioactive waste burial grounds, F-Area seepage basins, and H-Area seepage basins are the primary sources of groundwater contaminants in F- and H-Areas. Of the 17 constituents identified in Table 4-4, an individual waste site is the primary source of 13. The four remaining constituents (nitrate, trichloroethylene, tetrachloroethylene, and iodine-129) arise from several waste sites in F- and H-Areas; however, the groundwater flows from these sites are unlikely to mix, considering their separation distances and different directions of groundwater flow before reaching onsite streams. Therefore, the individual contaminant concentrations associated with each waste site in Table 4-4 appropriately identify potential groundwater-quality impacts for no action.

There are 12 sites in the R-Area grouping; the three Bingham pump outage pits (sites 4 to 6) and the six reactor seepage basins (sites 7 to 12) are treated as single sites for analysis purposes, as are the two burning/rubble pits.

Table 4-5 lists peak 100-meter well concentrations (with the year of occurrence) and their sums for each contaminant exceeding its applicable standard in the R-Area group under no action. As indicated in the table, essentially all of the radioactive contamination derives from the seepage basins; tritium, strontium, and cesium-137 all exceed their standards. In addition, trichloroethylene exceeds the standard at the burning/rubble pits, and lead and tetrachloroethylene at the acid/caustic basin.

Of the seven sites considered in C-Area and the Central Shops (CS) Area, three have evidence of contamination: C-Area burning rubble pit (site 4), hydrofluoric acid spill area (site 5), and the Ford Building seepage basin (site 7).

Table 4-6 lists peak 100-meter well concentrations and their sums (over all sites) and regulatory standards for all contaminants reported in the C- and CS-Area under no action. Tritium exceeds the standards at the Ford Building seepage basin. Trichloroethylene exceeds the standard at the C-Area burning/rubble pit. The cumulative concentration for lead in C- and CS-Areas is above its MCL due to the summing of concentrations from several sites. The C-Area burning/rubble pit, however, is approximately 2 kilometers from the hydro-fluoric acid spill area and 3 kilometers from the Ford Building seepage basins. Beneath the Ford Building seepage basin, groundwater flows toward Pen Branch, and beneath the C-Area burning/rubble pit it flows toward Four Mile Creek. Therefore, the plume from the burning/rubble pit is not likely to interact with the plumes from the other waste sites. This fact, coupled with the marginal exceedance of the drinking water standard (0.054 milligram per liter versus a standard of 0.05 milligram per liter) suggests that the cumulative concentration of lead would not exceed the standard.

TC

Table 4-7 lists the summations of constituent concentrations that exceed applicable standards and the predicted contaminant concentrations associated with individual sites in the TNX-Area group. Concentrations of chromium, lead, nitrate, tetrachloromethane, and trichloroethylene are predicted to exceed applicable standards in groundwater at the TNX-Area. Individual waste sites are the primary source of contamination for these five constituents. Nitrate concentration is predicted to exceed standards at both the new and old TNX seepage basins. Potentially, nitrate plumes from these two sites could interact.

TC

TC

The direction of groundwater flow in the TNX-Area is toward the Savannah River. In this area, the potentiometric levels generally increase with depth, indicating that groundwater moves vertically upward from the Middendorf/Black Creek to the Congaree, and from the Congaree to the water-table aquifer (Dunaway et al., 1987). Therefore, there is a low potential for contaminants to enter the Middendorf/Black Creek and Congaree aquifers from waste sites in the TNX-Area.

The D-Area oil seepage basin (Building 631-G) is the only waste site in D-Area. PATHRAE simulations project that the concentration of tetrachloroethylene at the 100-meter well (0.017 milligrams per liter) exceeded its health-based standard (0.0007 milligrams per liter) in 1978 for all closure options including no action. As in the nearby TNX-Area, the direction of groundwater flow in D-Area is toward the Savannah River. Similarly, because of higher head in the Middendorf/Black Creek, contamination of this aquifer is unlikely.

TC

The Road A chemical basin is the only potential source of groundwater impacts in the Road A Area. Groundwater monitoring data for water-table wells at the Road A chemical basin indicate that lead, gross alpha, and radium were detected in June 1984 at levels above regulatory standards or guidelines. However, quarterly groundwater sampling since June 1984 has not detected levels of these constituents above the applicable standards (Pickett, Muska, and Bledsoe, 1987). PATHRAE simulations, based on estimated inventories for lead, and uranium-238, project that the concentrations of these constituents in the water-table aquifer for no action would remain within regulatory standards at a distance of 100 meters from the basin (see Appendix F).

The direction of flow in the water-table aquifer near the basin is to the west, toward the bottomland wetlands of Four Mile Creek approximately 200 meters from the basin and about 15 meters lower in elevation. Although there is a potential for a downward flow of water in the water-table aquifer to the Congaree Formation, the more probable discharge for the water-table aquifer is the wetlands.

Four sites are considered in K-Area: burning/rubble pit (site 1), acid/caustic basin (site 2), Bingham pump outage pit (site 3), and K-Area seepage basin (site 4). Table 4-8 lists for no action the peak 100-meter well concentrations, their sum over all the sites, and the applicable regulatory standards. Trichloroethylene exceeds its standard at the burning/rubble pit and lead and tetrachloroethylene at the acid/caustic basin. Tritium from the K-Area seepage basin exceeds its standard.

Table 4-9 lists the peak concentrations for constituents exceeding appropriate standards from the 12 waste sites in L-Area under no action. The cumulative concentrations in L-Area for the 12 constituents listed are all above their MCLs as the result of single waste site sources rather than cumulative effects.

Groundwater flow beneath the majority of the waste sites in this area is toward Pen Branch. However, the groundwater beneath the L-Area acid/caustic basin and the L-Area oil and chemical basin would travel to Steel Creek.

TE | There are three sites in P-Area: the burning/rubble pit (site 1), acid/caustic basin (site 2), and Bingham pump outage pit (site 3). Table 4-10 lists peak concentrations at the 100-meter well for no action, the sum for all sites of these concentrations, and the applicable health-based standards. Trichloroethylene from the burning/rubble pit, and lead and tetrachloroethylene from the acid/caustic basin, exceed applicable standards. Groundwater flow in P-Area is generally toward Lower Three Runs Creek except beneath the burning/rubble pit, where the groundwater flow is toward Steel Creek.

The SRL oil test site (Building 080-16G) and the Gunsite 720 rubble pit (at SRP coordinates N80,000:E27,350) are miscellaneous waste sites; Appendix F describes their environmental impacts and health effects in detail. Estimates of the environmental releases were not determined at either site because chemical constituents did not exceed threshold selection criteria. No adverse environmental impacts are anticipated from these facilities for any closure action.

#### Summary of Groundwater Impacts Under No-Action Strategy

TE | Based on the analyses described above for the No-Action strategy, and as indicated in Tables 4-3 through 4-10, health-based standards in groundwater at the hypothetical 100-meter wells are predicted to be exceeded at 66 of the 77 individual waste sites. The constituents predicted to exceed MCLs or other health based standards are:

- Radionuclides, principally tritium
- Organic chemicals, principally trichloroethylene and tetrachloroethylene
- Metals, principally lead
- Nitrate

Table 4-10. Peak Concentrations at 100-Meter Well for No Action, P-Area

Waste management facility	Site number	PATHRAE peak concentrations <sup>a</sup>		
		Chemicals (mg/L)		
		Pb	Trichloroethylene	Tetrachloroethylene
P-Area burning/rubble pit <sup>b</sup>	10-1	0.038 (1982)	1.8 <sup>c</sup> (1983)	(d)
P-Area acid/caustic basin <sup>b</sup>	10-2	0.054 <sup>c</sup> (1971)	(d)	0.094 <sup>c</sup> (1972)
Sum of concentration <sup>g</sup>		0.092 <sup>c</sup>	1.8 <sup>c</sup>	0.094 <sup>c</sup>
Standard <sup>e</sup>		0.05	0.005	0.0007

<sup>a</sup>Year of peak concentration shown in parentheses; years prior to 1985 are indications of present concentration.

<sup>b</sup>Concentrations are from PATHRAE modeling for largest inventory waste management unit in this functional grouping; actual peak concentrations are dependent on the inventory of this unit.

<sup>c</sup>Concentration exceeds regulatory standard.

<sup>d</sup>Constituent did not meet threshold selection criteria for PATHRAE modeling.

<sup>e</sup>Sources: Lead and trichloroethylene (EPA, 1985a, 1987). Tetrachloroethylene (EPA, 1985b).

TC

TE

#### 4.2.1.2 Surface-Water Impacts

The impacts evaluated by PATHRAE from surface-water pathways are (1) groundwater movement to the Savannah River via surface streams and (2) erosion of waste materials and movement to surface streams. PATHRAE contaminant releases for the erosion pathway were predicted to be zero for most sites and minimal releases for all others because of low erosion rates (approximately 0.2 millimeter per year). There is no direct discharge of existing waste to surface streams except for NPDES outfalls.

TC

The projected peak concentrations in the streams as a result of groundwater discharges were evaluated against the MCLs or criteria for protection of public health. The results of these assessments are summarized in Table 4-11

Table 4-11. Waste Constituents<sup>a</sup> in Surface Water for No Action

Stream	Contaminant	Current instream concentration <sup>b</sup>	Projected peak instream concentration	Maximum contaminant level <sup>c</sup>
Upper Three Runs Creek	Tetrachloroethylene	LLD <sup>d</sup>	0.0035	0.0007
TC Four Mile Creek	Nitrate	3.0	20	10
	Phosphate	0.020	0.022	NS <sup>f</sup>
	Naphthalene	LLD	0.0014	NS
	Trimethylbenzene	NA <sup>e</sup>	0.003	NS
	Tritium	8.5 x 10 <sup>5</sup>	8.7 x 10 <sup>5</sup>	8.7 x 10 <sup>4</sup>
	Cesium-137	LLD	140	110
Pen Branch	Phosphate	0.1	0.1	NS
	Freon <sup>®</sup>	NA	0.0067	NS

<sup>a</sup>Chemicals in mg/L, radionuclides in pCi/L.

<sup>b</sup>Sources: Upper Three Runs Creek (Pickett, Colven, and Bledsoe, 1987); Four Mile Creek (Killian et al., 1987); Pen Branch (Pekkala et al., 1987).

<sup>c</sup>Sources: 40 CFR 141, except as follows: tetrachloroethylene (EPA, 1985b). ICRP Publication 30 (ICRP, 1978) methodology was used to determine radionuclide concentrations that yield an annual effective whole-body dose of 4 millirem.

<sup>d</sup>LLD = instream concentration less than lower limit of detection.

<sup>e</sup>NA = instream concentration not available.

<sup>f</sup>NS = drinking water standard not available.

for Upper Three Runs Creek, Four Mile Creek, and Pen Branch. In a number of instances, constituents are listed for which there are no MCLs or comparable criteria.

TE Contaminants to be released via groundwater discharge under no action are predicted not to exceed their respective MCLs (or criteria) in Pen Branch, Steel Creek, Lower Three Runs Creek, or the Savannah River, although criteria do not exist for the constituents listed for Pen Branch. Tetrachloroethylene is the only contaminant predicted to exceed standards in Upper Three Runs Creek.

Contaminant releases to Four Mile Creek are projected to include 2 inorganic substances, 2 organic compounds, and 20 radionuclides, of which only 3 - nitrate, cesium 137, and tritium - are projected to exceed MCLs, although 2 constituents do not have comparable criteria. The nitrate concentration is projected to peak at 20 milligrams per liter. The current instream concentration and MCL are 3.0 and 10 parts per million, respectively. The concentration for cesium-137 is projected to peak at 140 picocuries per liter or 40 picocuries per liter above the standard of 100 picocuries per liter. The current instream concentration of tritium is 850,000 picocuries per liter, a concentration that exceeds the MCL (Killian et al., 1987). The projected peak concentration of tritium in Four Mile Creek is 870,000 picocuries per

liter. In addition, the release of other radionuclides (not listed in Table 4-11) to Four Mile Creek was projected. The sum of the projected instream concentrations for these radionuclides, excluding tritium, results in an annual dose of 6.6 millirem to a hypothetical consumer of drinking water from Four Mile Creek, which exceeds the EPA community drinking-water standard of 4 millirem per year.

#### 4.2.1.3 Radiological Doses

Table 4-12 lists peak annual doses to the maximally exposed individual resulting from releases from each of the 21 low-level radioactive and mixed waste sites, and their years of occurrence, under the No-Action strategy. These doses are based on the maximally exposed individual residing on the SRP after institutional control is relinquished, assumed to be in the year 2085. The groundwater-well pathway is the most significant, contributing at least 95 percent of the total dose at all those sites (except two), with peak annual doses of 25 millirem or more. The exceptions are the F-Area and H-Area seepage basins, where direct gamma contributes almost all the 1000-millirem and 440-millirem annual doses, respectively. The atmospheric pathway is responsible for the peak annual dose from the old TNX seepage basin, the SRL seepage basins, and the M-Area settling basin and Lost Lake. The reclaimed farm pathway is responsible for the entire dose from the TNX burying ground.

TC

Five sites would exceed both the DOE annual dose limit of 100 millirem from all pathways and the 4-millirem EPA annual drinking-water dose limit under no action: the R-Area reactor seepage basins (2900 millirem in 2094), the F-Area seepage basins (1000 millirem in 2085), the old F-Area seepage basin (400 millirem in 2312), the H-Area seepage basins (440-millirem in 2085), and the L-Area oil and chemical basin (190 millirem in 2098). All sites would comply individually with the 25-millirem DOE annual dose limit for the atmospheric pathway.

TC

TC

Three additional sites would exceed the 4-millirem EPA annual drinking-water dose limit: the H-Area retention basin (72 millirem from the 1-meter well in 2085), the radioactive waste burial grounds (27 millirem from the 1-meter well in 2420), and the Road A chemical basin (30 millirem from the 1-meter well in 2985).

The cumulative annual dose calculated to be received in 1985 from all pathways by the maximally exposed individual residing at the SRP boundary is 14.6 millirem; it would increase to 3920 millirem in 2085. This value is the sum of the 1000 millirem direct gamma dose from the F-Area seepage basin and the post-2085 (2900 millirem) dose from the R-Area seepage basins. The cumulative annual doses received by the population in the SRP region\* in 1985 and 2085 are 58 and 48 person-rem, respectively.

TC

\*The atmospheric pathway contribution to the population dose is based on an exposed population of 585,000 within an 80-kilometer radius of the SRP. The groundwater-to-river pathway contribution to the population dose is based on a user population of 100,000.

Table 4-12. Peak Annual Doses to Maximally Exposed Individual from Radiological Releases for No Action

TE

Low-level and mixed waste sites	Maximum annual individual dose (mrem) <sup>a</sup>	Year of peak dose
H-Area retention basin	73	2085
F-Area retention basin	0.37	2313
R-Area Bingham pump outage pits	0.20	2085
R-Area reactor seepage basins	2900	2094
Ford Building waste site	0	
TNX burying ground	1.4 x 10 <sup>-4</sup>	2085
K-Area Bingham pump outage pit	0.20	2085
K-Area reactor seepage basin	0.30	2085
L-Area Bingham pump outage pits	0.20	2085
P-Area Bingham pump outage pit	0.20	2085
SRL seepage basins	0.69	1985
M-Area settling basin and Lost Lake	0.16	1985
Radioactive waste burial ground, mixed waste management facility (new), and radioactive waste burial ground (old)	27	2420
F-Area seepage basins	1000	2085
F-Area seepage basin (old)	400	2312
H-Area seepage basins	440	2085
Ford Building seepage basin	1.4	2334
TNX seepage basin (old)	12.3	1985
TNX seepage basin (new)	3.2	2563
Road A chemical basin	30	2985
L-Area oil and chemical basin	190	2098

<sup>a</sup>All doses (in millirem) are not necessarily additive.

#### 4.2.1.4 Health Effects

This section discusses health effects resulting from no action, which are divided into effects from radiological and chemical releases. Appendix I describes the methodology employed for estimating and assessing health risks of the waste management strategies.

#### Radiological

Table 4-13 lists lifetime health risks to the maximally exposed individual resulting from the peak annual radioactive releases from 21 low-level and mixed waste sites for the No-Action strategy. The health risk is assumed eventually to total 280 radiation-induced excess fatal cancers and genetic disorders as a result of a collective dose of 1 million person-rem.

Table 4-13. Radiological Health Risks to the Maximally Exposed Individual from the Peak Annual Doses for No Action

Low-level and mixed waste sites	Maximum individual risk (HE for peak year dose)	Lifetime exposure risk <sup>a</sup>
H-Area retention basin	$2.1 \times 10^{-5}$	$1.1 \times 10^{-3}$
F-Area retention basin	$1.0 \times 10^{-7}$	$5.0 \times 10^{-6}$
R-Area Bingham pump outage pits	$5.6 \times 10^{-8}$	$2.8 \times 10^{-6}$
R-Area reactor seepage basins	$8.1 \times 10^{-4}$	$4.1 \times 10^{-2}$
Ford building waste site	0	0
TNX burying ground	$3.9 \times 10^{-11}$	$2.0 \times 10^{-9}$
K-Area Bingham pump outage pit	$5.6 \times 10^{-8}$	$2.8 \times 10^{-6}$
K-Area reactor seepage basin	$8.4 \times 10^{-8}$	$4.2 \times 10^{-6}$
L-Area Bingham pump outage pits	$5.6 \times 10^{-8}$	$2.8 \times 10^{-6}$
P-Area Bingham pump outage pit	$5.6 \times 10^{-8}$	$2.8 \times 10^{-6}$
SRL seepage basins	$1.9 \times 10^{-7}$	$9.5 \times 10^{-6}$
M-Area settling basin and Lost Lake	$4.5 \times 10^{-7}$	$2.3 \times 10^{-6}$
Radioactive waste burial ground, mixed waste management facility (new), and radioactive waste burial ground (old)	$7.6 \times 10^{-6}$	$3.8 \times 10^{-4}$
F-Area seepage basins	$2.8 \times 10^{-4}$	$1.4 \times 10^{-2}$
F-Area seepage basin (old)	$1.1 \times 10^{-4}$	$5.5 \times 10^{-3}$
H-Area seepage basins	$1.2 \times 10^{-4}$	$6.0 \times 10^{-3}$
Ford Building seepage basin	$3.9 \times 10^{-7}$	$2.0 \times 10^{-5}$
TNX seepage basin (old)	$3.4 \times 10^{-6}$	$1.7 \times 10^{-4}$
TNX seepage basin (new)	$9.0 \times 10^{-7}$	$4.5 \times 10^{-5}$
Road A chemical basin	$8.4 \times 10^{-6}$	$4.2 \times 10^{-4}$
L-Area oil and chemical basin	$5.3 \times 10^{-5}$	$2.7 \times 10^{-3}$

TC

<sup>a</sup>Assumes a 50-year exposure at peak year dose.

Under no action, health risks to the maximally exposed individual as a result of exposures during 1985 at the SRP boundary, and to an onsite resident during 2085, total  $4.1 \times 10^{-6}$  and  $1.1 \times 10^{-3}$ , respectively. The corresponding maximum lifetime risks from 50 years of exposure at the peak rate would be  $2.0 \times 10^{-4}$  and  $5.5 \times 10^{-2}$ , respectively.

The health effects predicted to occur in the population in the SRP region from the collective doses delivered in 1985 and 2085 under no action are  $1.6 \times 10^{-2}$  and  $1.3 \times 10^{-2}$  excess cancer deaths, respectively. Effects of lifetime exposure at the same rate in that population would total 0.81 and 0.67 excess cancer deaths, respectively.

#### Chemical

Total carcinogenic risk is the lifetime risk associated with concurrent exposure to multiple carcinogenic substances, assuming a whole-body additive model

TE | for carcinogenesis. Total noncarcinogenic risk, similarly, is defined by the EPA Hazard Index, which is the summation of the fractional ADIs for each substance at the receptor at a specified time (see Appendix I). The following paragraphs present groundwater/surface-water pathway risks in relation to geographic groupings. Atmospheric and occupational pathway risks are discussed on a facility-wide basis.

#### Groundwater and Surface-Water Pathway

Tables 4-14 and 4-15 summarize the risks posed under the No-Action strategy by the sites in each geographic group via the groundwater/surface-water pathway, assuming relinquishment of DOE control in 2085.

TC | A- and M-Area Geographic Grouping. The maximum total nonradiological carcinogenic risk for 50-year exposures peaking in 2085 is  $3.8 \times 10^{-4}$  at the 100-meter well in M-Area. The maximum risk for the dominant carcinogenic chemical is  $1.6 \times 10^{-1}$ , posed by tetrachloroethylene at the 1-meter well in 2021 and the 100-meter well in 2020.

TC | The M-Area settling basin also poses the maximum total noncarcinogenic hazard index for 2085 ( $2.3 \times 10^{-1}$  for the reclaimed farm pathway). The maximum hazard index for the dominant noncarcinogenic chemical ( $6.2 \times 10^2$ ) is due to nitrate at the 1-meter well in 1991 and the 100-meter well in 1990.

TC | F- and H-Area Geographic Grouping. The maximum total nonradiological carcinogenic risk from 50-year exposures peaking in 2085 for this grouping is posed by the 100-meter well at the F-Area burning/rubble pit ( $9.4 \times 10^{-10}$ ). The maximum risk for the dominant carcinogenic chemical is  $1.7 \times 10^{-4}$  from trichloroethylene at the 1-meter well, peaking in 1978. The risk from trichloroethylene at the 100-meter well peaked in 1983 at  $1.6 \times 10^{-4}$ .

TC | The highest total noncarcinogenic hazard index in 2085 is 4.6, posed by the mixed waste management facility and old radioactive waste burial grounds at the 100-meter well. The maximum hazard index ( $6.9 \times 10^1$ ) for the dominant noncarcinogenic chemical is presented by nitrates at both the 1- and 100-meter wells at the F-Area seepage basin in 1987. Mercury creates risks of 5.0 to the reclaimed farm receptors in 2085 at the F-Area seepage basin, 9.5 at the H-Area seepage basins, and 1.4 at the mixed waste management facility/radioactive waste burial grounds.

TC | R-Area Geographic Grouping. All strategies present the same carcinogenic risks for the groundwater/surface-water pathway. The R-Area burning/rubble pits total carcinogenic risks are not significant for exposures peaking in 2085. Trichloroethylene presented risks of  $1.7 \times 10^{-4}$  at the 1-meter well and  $1.6 \times 10^{-4}$  for the 100-meter well from exposures peaking in 1978 and 1983, respectively.

TC | The R-Area acid/caustic basin presents the highest noncarcinogenic hazard index of  $2.1 \times 10^{-2}$  in 2085 for the reclaimed farm pathway. Sulfate is the dominant noncarcinogenic chemical; it reached a peak hazard index of 2.9 at the 1-meter well and 100-meter well in 1971.

C-Area and CS-Area Geographic Grouping. The carcinogenic risks for the groundwater/surface-water pathway are identical for all four strategies. Carcinogenic risks for this pathway are predicted only for the burning/rubble pits (three in CS-Area and one in C-Area), which are identical. The total carcinogenic risks for 50-year exposures following 2085 are not significant. The dominant carcinogenic chemical is trichloroethylene, which created a peak risk in 1978 at the 1-meter well ( $1.7 \times 10^{-4}$ ), and in 1983 at the 100-meter well ( $1.6 \times 10^{-4}$ ).

TC

The highest total noncarcinogenic risk in 2085 is posed by the Ford Building seepage basin, with a maximum risk of  $1.2 \times 10^{-2}$  for the reclaimed farm pathway. The dominant noncarcinogenic chemical in the geographic grouping is fluoride, which posed a maximum hazard index of 4.5 at the hydrofluoric acid spill area 1-meter well in 1975.

TC

TC

TNX-Area Geographic Grouping. The highest total carcinogenic risk under no action for 50-year exposures following 2085 is  $4.8 \times 10^{-4}$  presented by the 100-meter well at the D-Area oil basin. The maximum risk for the dominant carcinogenic chemical was presented by trichloroethylene from hypothetical exposures at the D-Area burning/rubble pits 1-meter well ( $1.7 \times 10^{-4}$ ), peaking in 1978. These conditions are the same under all strategies. The only site in this grouping where risks varied is the new TNX seepage basin.

TC

The new TNX seepage basin presents the highest noncarcinogenic hazard index in this grouping. In 2085, this index peaks at the 1-meter well ( $2.4 \times 10^{-1}$ ). In the same year, mercury creates a hazard index of 1.8 at the assumed reclaimed farm receptor at the old TNX seepage basin. The risk for the dominant noncarcinogenic chemical, nitrate, will peak at the 1-meter well in 1987 (hazard index of  $2.5 \times 10^2$ ). The noncarcinogenic risks vary from option to option only for the new TNX seepage basin.

TC

Road A Chemical Basin. The carcinogenic and noncarcinogenic risks for all strategies are the same. The basin poses no carcinogenic risk.

The highest total noncarcinogenic risk in 2085 is not significant. The peak chemical-specific hazard index was posed by lead at the 1-meter well in 1975 ( $5.4 \times 10^{-1}$ ) and is predicted to reach  $4.1 \times 10^{-1}$  at the 100-meter well in 1980.

K-Area Geographic Grouping. The carcinogenic risks in this grouping are the same for all strategies. The highest total carcinogenic risk for 50-year exposures following 2085 is not significant. The maximum risks presented by trichloroethylene, the dominant carcinogenic chemical, were  $1.7 \times 10^{-4}$  in 1978 at the 1-meter well and  $1.6 \times 10^{-4}$  in 1983 at the 100-meter well.

TC

The only significant noncarcinogenic risk under no action for 2085 is  $2.1 \times 10^{-2}$  at the reclaimed farm pathway for the K-Area acid/caustic basin. Sulfate is the dominant noncarcinogenic chemical, with a hazard index of  $2.9 \times 10^0$  in 1971 at the 1-meter well and 100-meter well of the K-Area acid/caustic basin.

TC

L-Area Geographic Grouping. The carcinogenic risks are identical for all strategies. The CMP pits pose the highest total carcinogenic risk for 50-year exposures following 2085 at the 100-meter well ( $1.2 \times 10^{-6}$ ). The maximum

TC

TC risk for tetrachloroethylene, the dominant carcinogenic chemical, was  $1.0 \times 10^{-2}$ , posed at the 1-meter well in 1997.

TC Under no action, the L-Area oil and chemical basin poses the greatest noncarcinogenic hazard index for 2085 of 2.2 at the 1-meter well. This is the highest risk in that year for any strategy. The peak risk for the dominant noncarcinogenic chemical is from silvex, with a hazard index of 4.8 in 2012 at the 1-meter well at the CMP pits.

TC P-Area Geographic Grouping. The carcinogenic risks for the groundwater/surface-water pathway are identical for all four strategies. The P-Area burning/rubble pit presents the highest (but not significant) total carcinogenic risk for 50-year exposures following 2085. The highest chemical-specific carcinogenic risks were due to trichloroethylene at the 1-meter ( $1.1 \times 10^{-4}$ ) and 100-meter ( $1.6 \times 10^{-4}$ ) wells in 1978 and 1983, respectively.

TC The P-Area acid/caustic basin poses the highest noncarcinogenic risks, under no action. In 2085, the noncarcinogenic hazard index,  $2.1 \times 10^{-2}$ , is predicted to peak for the reclaimed farm pathway. The maximum hazard index for the dominant noncarcinogenic chemical is 2.9, created by sulfate in 1971 at the 1-meter well and the 100-meter well.

TE Atmospheric Pathways

Table 4-16 lists risks to the maximally exposed individual and to the population due to atmospheric carcinogens and the major chemical contributors. These risks are presented for each hazardous or mixed waste site for three selected exposure years: 1985 (start of remedial actions), 2085 (assumed start of public occupation of the SRP), and 2985 (end of 1000-year period). Noncarcinogenic atmospheric releases are all predicted to produce insignificant risks, both individually and collectively (i.e., hazard index less than  $1 \times 10^{-2}$ ).

The major contributors to total risk due to airborne carcinogens are associated with the SRL seepage basins, the M-Area air stripper, and the L-Area oil and chemical basin. The major chemical contributors to the risk are chromium-VI and trichloroethylene; Table 4-16 indicates that risks are generally higher for 2085 than for 1986 because the maximally exposed individual is assumed to be closer to the waste site. This results in higher exposures, even though the source strength might have decreased due to leaching over the previous 100 years.

4.2.1.5 Ecological Impacts

TC In order to assess the potential ecological impacts of the No-Action alternative, four pathways through which waste-site constituents can reach the environment were identified: (1) biointrusion, (2) surface erosion of waste constituents due to water and subsequent transport to surface waters, (3) movement of waste constituents through the unsaturated zone to the groundwater and subsequent transport to a surface outcrop, and (4) consumption of contaminated basin waters and, at some sites, aquatic plants.

The exposure concentrations were screened by comparing them to various ecological benchmark criteria. The first benchmark for each constituent, a lower screening level, represents an ecologically protective concentration (SAIC, 1987) and is based on EPA Water Quality Criteria for the Protection of Aquatic Life or equivalent numbers from the technical literature. Any constituent that exceeded the lower screening level by a factor of more than 10 was compared to additional ecological benchmarks to define further the extent (if any) of the potential ecological effects. These additional benchmarks are based on either (1) LC-50s and EC-50s for taxa specific to the SRP ecosystem to assess effects on the aquatic community; (2) the EPA National Interim Primary Drinking Water Standards (EPA, 1977) and, if these were exceeded, chronic no-effect concentrations of metal and organic (except volatile solvents) in mammalian diets to screen for possible effects from consumption of surface waters by terrestrial wildlife; or (3) dietary concentrations shown to be toxic to birds and mammals to assess consumption of contaminated aquatic biota. For those waste sites with radionuclide constituents, EPA National Interim Drinking Water Standards were used as first-level benchmarks for comparison of potential exposure concentrations in surface waters. For tritium, known no-effect concentrations in fish were used as second-level benchmarks. Benchmarks for soil are based on the Department of Energy's Threshold Guidance Limits (DOE, 1985) as presented in Looney et al. (1987a). These soil and water criteria are based on human health concerns and so are conservative. The various quotients (comparing calculated concentrations to benchmarks) form the basis for quantification of potential ecological impacts from each waste site.

TC

Potential impacts of no action on aquatic ecosystems could result from the contamination of groundwater and subsequent outcrop to SRP streams and wetlands. Results of PATHRAE analyses indicate that with certain exceptions no action would not significantly alter the quality of existing streams and wetlands of the SRP. Of these streams where water quality would be affected by no action: Four Mile Creek would be impacted by contaminants attributable to the Radioactive Waste Burial Grounds, Road A chemical basin, and the Fand H-Area seepage basins; Upper Three Runs Creek would be impacted by contaminants attributable to the M-Area Settling Basin; Indian Grave Branch would be impacted by contaminants attributable to the K-Reactor Seepage Basin; and Pen Branch would be impacted by contaminants attributable to the CMP Pits. A comparison of groundwater outcrop concentrations with tested aquatic organism toxicity benchmarks, however, indicates no adverse effects except possibly for iodine-129 from the F- and H-Area seepage basins. No toxicity information is available for iodine-129; therefore, the potential aquatic effects due to the groundwater outcrop and diluted stream concentrations of this constituent cannot be assessed. Thus, streams where impacts to the aquatic biota are likely to occur under no action are limited to Four Mile Creek.

TC

PATHRAE modeling indicates that the Savannah River could receive groundwater that contains contaminants attributable to the old TMX Area in concentrations which could be toxic to aquatic biota near the outcrop. However, impacts should be negligible because of the limited area of the outcrop and the rapid dilution of outcrop waters to non-toxic concentrations from mixing with Savannah River water.

TC

TC Potential impacts to terrestrial organisms from no action could result from consumption of contaminated standing water in open basins or contaminated undiluted groundwater at the outcrops and biointrusion. The SRP consists of numerous open basins with standing water, at least during wet periods, at various waste sites. Of the open basin waste sites at the SRP, the H-Area retention basin, the M-Area settling basin, the new TNX seepage basin, the SRL seepage basins, and the F- and H-Area seepage basins contain contaminants that exceed the EPA drinking water standards. However, the effects on wildlife that consume the contaminated standing water should be minimal in view of the conservative nature of the drinking water standards when applied to wildlife and the low probability that significant numbers of wildlife would consistently drink the water from the basins (Zeigler et al., 1987).

TC Contaminated groundwater that exceeds EPA drinking water quality would outcrop at Four Mile Creek, Pen Branch, Indian Grave Branch, Upper Three Runs Creek, and the Savannah River. The contaminants in the groundwater that outcrop at Four Mile Creek would be attributable to the radioactive waste burial grounds and F-Area seepage basins; at Pen Branch to the Ford Building seepage basin; at Indian Grave Branch to the K-Area seepage basin; at Upper Three Runs Creek to the M-Area settling basin; and at the Savannah River to the old TNX seepage basin. However, the effects on wildlife that consume the contaminated undiluted groundwater at the outcrop should be negligible in view of the conservative nature of human drinking water standards when applied to wildlife and the low probability that wildlife would consistently drink the undiluted groundwater at the outcrops.

TC Many waste sites on the SRP contain soil concentrations of contaminants that could be toxic to terrestrial organisms, primarily vegetation. These sites include the F- and H-Area retention basins, F- and H-Area seepage basins, K-Area seepage basin, Radioactive Waste Burial Grounds, old and new TNX seepage basins, M-Area settling basin, Lost Lake, L-Area oil and chemical basin, Ford Building seepage basin, R-Area seepage basins, and the SRL seepage basins. Impacts to vegetation could include reduced plant growth and increased plant mortality. In most cases, based on food chain uptake calculations, the predicted waste concentrations within vegetation would be below the levels considered to be toxic to herbivorous wildlife.

TC Endangered or threatened species reported on the SRP include the American alligator (Alligator mississippiensis), bald eagle (Haliaeetus leucocephalus), red-cockaded woodpecker (Picoides borealis), wood stork (Mycteria americana), and shortnose sturgeon (Acipenser brevirostrum). In addition to these species, a sand burrowing mayfly (Dolanio americana) is undergoing review for threatened or endangered status. Based on the surveys conducted on the SRP, habitat near waste sites is generally not suitable for endangered species and none of these species, except the sand burrowing mayfly and the American alligator, reside within the immediate vicinity of any of the waste sites. Populations of the sand burrowing mayfly have been collected in the section of Upper Three Runs Creek near the old F-Area seepage basin. An American alligator was located in the M-Area settling basin where it has resided since 1985. Bald eagles have been sighted in flight near the H-Area, the Road A chemical basin area, the Gunsite 720 Rubble Pit Area, and the L-Area. However, there were no active bald eagle nest sites near any of these areas. Available information on the shortnose sturgeon indicates little potential for its presence in onsite streams. The U.S. Fish and Wildlife Service has not designated any critical habitats on the SRP.

No impacts are expected to occur to either the sand burrowing mayfly or the American alligator under no action. Because no adverse impacts are expected to occur to the aquatic or terrestrial biota attributable to the old F-Area seepage basin, no impacts are likely to occur to the sand burrowing mayfly. Based on the fact that the American alligator residing in the M-Area settling basin for the last two years shows no obvious adverse effects from living within the basin, and because there will be no activities under no action, no impacts to this reptile are expected. However, due to a lack of specific data, this evaluation does not consider long-term effects.

TC

Potential impacts of no action on wetlands could result from contaminated groundwater outcropping into streams and/or their associated wetlands and adversely affecting the water quality, contaminated basin overflow during heavy rains of waste sites located near wetlands, and erosion of sediments from waste sites located near wetlands. Streams on the SRP whose water quality would be adversely affected by the outcropping of contaminated groundwater have been considered above. Most contaminated basins are sufficiently removed from wetlands so that basin overflow during heavy rains would not be a problem or the contaminants within the basins are not of ecological concern. However, where basins are near wetlands and have contamination of ecological concern, impacts could occur. Because no activities are planned under no action, impacts related to sedimentation are not applicable.

#### 4.2.1.6 Other Impacts

##### Archaeological Impacts

No significant archaeological or historic sites are known to exist within, or immediately adjacent to, the existing waste site areas (Brooks, 1986). However, during an intensive field survey, one prehistoric site was discovered adjacent to the P-Area burning/rubble pit. This site is represented by a single, isolated surface find. Two selective shovel tests in the vicinity of the find have confirmed that it was from an isolated, disturbed context. Insufficient content and integrity of deposits indicates little potential for yielding additional information to enhance understanding of the prehistory of the region. Consequently, this site is not considered eligible for inclusion in the National Register of Historic Places (Brooks, 1986). Therefore, (1) none of the proposed P-Area burning/rubble pit closure actions would have an adverse effect on this archaeological site, and (2) no further archaeological work is recommended, either at this site or at any existing waste site surveyed. A request was made to the South Carolina State Historical Preservation Officer (SHPO) for concurrence with a determination of "no effect" for the proposed actions at the 77 waste sites. Concurrence of "no effect" was received by DOE on October 6, 1986.

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##### Socioeconomic Impacts

The No-Action strategy would have no socioeconomic impacts because it would not require any additional workers for construction.