VIII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

Permanent commitments of natural resources to waste management operations are relatively small. The largest energy requirement is for volume reduction of high-level liquid wastes. Production of steam for the two tank farm evaporators consumes a total of about 3200 tons of coal per year, whereas about 520,000 tons per year are burned to supply steam and electrical power for all SRP uses.

Water, materials (such as chemicals or fuels which are burned, consumed, or altered during use), and labor (including both operating and construction personnel) are used during the operation and construction of waste storage facilities. Standard building materials are used in construction, primarily for high-level liquid wastes. About 550 tons of structural steel, 135 tons of reinforcing steel, and 3000 cubic yards of concrete are used in the construction of each waste storage tank.

Probably the most significant resource that is used for waste management is the land that must be committed for the foreseeable future. The plant areas that must be so committed are listed in Section VI. These areas represent only a small fraction of the total land area occupied by the plant. It is conceivable that even these areas could be reclaimed in the future, but it may not be technically or economically practical to do so. About 1 acre of land is committed for each waste storage tank for high-level liquid wastes, and a total of 195 acres is committed for storage of radioactive solid wastes.

The waste already existing at SRP, plus the waste to be generated will require resources of land for storage and manpower for surveillance wherever it is stored for the forseeable future.

IX. COST-BENEFIT ANALYSIS

This section presents a comparison of the future costs and environmental impacts associated with SRP waste management operations. The overall program objective is to accomplish waste management operations in a manner resulting in the best balance of costs and benefits. Although alternatives are evaluated in a manner to reducc the environmental impact from these operations, the impact is already small and in most cases below applicable guidelines.

A. EVALUATION OF BENEFITS FOR THE WASTE MANAGEMENT OPERATIONS

1. Minimum Radiation Dose

The current total radiation dose to the general public within a 100-km radius as a result of SRP waste management operations activities is estimated to be about 115 man-rem from atmospheric releases (to an estimated population of 668,000) and 15.5 man-rem from releases to the streams (to an estimated population of 70,000, and based on measured concentrations in the water treatment plants downstream of SRP). These doses are low when compared to the naturally occurring background doses of about 78,000 man-rem and 8,200 man-rem respectively, and artificially occurring doses of about 71,000 man-rem and 7,400 man-rem, respectively (Section IIIA3).

The maximum whole-body dose received by an individual from SRP atmospheric releases during 1975 was calculated to be about 0.92 mrem/yr, and the average individual whole body dose was about 0.66 mrem/yr. The maximum whole body dose received by an individual using treated water from the Savannah River was calculated at 0.24 mrem/yr, based on measured concentrations in the treated water. These individual doses are low when compared to the naturally occurring background dose to individuals of about 117 mrem/yr, and the dose from artificial sources (such as medical x-rays) of 106 mrem/yr.

No attempt was made to estimate the reduction in radiation dose to the general public that resulted from having the present waste management operations program. The alternative of not having some program for managing waste which already has been generated is considered unrealistic.

2. Minimum Chemical Pollution

The impact on the environment caused by chemical wastes produced at SRP are being minimized by the waste management programs. Net costs are minimal in terms of damage to the biota. Pollution from chemicals and other solid wastes is minimized by storing the wastes or by releasing the chemicals to controlled disposal sites. In comparison to the normal chemical content of the river, only relatively small amounts of chemicals are released to the Savannah River (Tables III-26 and III-27).

3. Increased Technical Knowledge

Research and development efforts are providing improved methods for handling radioactive waste and extending knowledge of the effects of radionuclides on terrestrial and aquatic biota. This knowledge helps establish the best balance between costs and environmental impacts for radioactive waste management programs.

4. Employment

The total employment at SRP is approximately 6000 persons. However, only about 5 to 10% of the work force would be directly or indirectly involved with the waste management portions of the total SRP operations.

B. EVALUATION OF COSTS FOR SRP WASTE MANAGEMENT OPERATIONS

1. Capital Costs

The capital costs of SRP facilities are in excess of $1.6 billion. In most cases, the waste management systems were included in total facility costs and are not identified separately. However, waste management systems are estimated to represent about 10% of the total.

2. Operating Costs

The total operating cost at SRP is approximately $193 million annually. Again, the waste management systems are included in total facility costs and are not identified separately. However, SRP waste management systems are estimated to represent about 10% of the total expenditure (about $15 million).

3. Land Use

Land use for waste management and process use at SRP are summarized in Table IX-1. Currently, approximately 550 acres are used for these purposes. Continuation of the SRP waste management operations program will result in occupancy of land by structures containing radionuclides and restricted use of land containing radionuclides. A portion of this land (approximately 345 acres) will remain committed for about 300 years because of the presence of ^{137}Cs and ^{90}Sr unless major recovery and cleanup programs are initiated. After 300 years, the quantity of dedicated land will decrease to 150 acres, which contain plutonium or other long-lived transuranics. Recovery of plutonium from stored waste would eliminate the need for long-term control and surveillance.

Commitment of some of the SRP lands to waste management makes that land unavailable for other uses. However, ample land is available nearby, or in uncommitted lands at SRP, for such unforeseen uses as residential or industrial uses.

4. Planned Capital Investments

Construction costs for planned waste management facility improvement for FY-1976 to FY-1978 are estimated to be about $117 million (Table IX-2).

C. COST-BENEFIT ANALYSIS OF ALTERNATIVES

The costs and benefits of the general alternatives described in Section V are compared qualitatively in this section. Estimated costs and benefits are compared for the specific options under alternative 4 (the Base Case) in Table IX-3.

1. General Alternatives

a. *Alternative 1 — Store no additional radioactive waste onsite.*

This alternative could be achieved by:

(1) Shutting down all operations at SRP.

(2) Processing SRP-irradiated fuel and targets at another site, and shipments offsite of wastes generated by SRP operations.

TABLE IX-1

Dedicated SRP Lands

Description of Land	*Approximate Area, acres*
Burial ground	195
F-Area tank farm	19
H-Area tank farm	27
Seepage basins and retention ponds	96
Abandoned seepage basins	5
Sanitary sewage septic tanks and tile fields	7
Ash piles and basins	143
Coal piles	25
Process buildings containing radionuclides	31
Process buildings containing long-lived transuranic radionuclides	21

TABLE IX-2

Planned Waste Management Improvements

Description	*Budgeted Cost, dollars*
Improvements to tritium facilities to reduce tritium releases	6,300,000
Improvements to reduce releases from fuel manufacturing	400,000
Improvements to reduce nonradioactive releases from coal-burning	12,200,000
New ash basin	1,500,000
Reduction of H_2S releases and improved monitoring	273,000
Improved flushing of discharged reactor components	500,000
Reduction of ^{41}Ar releases from reactors	600,000
Reduction of solvent releases	50,000
Construction of improved waste storage tanks and auxiliary equipment	102,000,000

(3) Shipping all wastes offsite as they are generated (with the exception of those wastes that can be released to the atmosphere or to plant streams under existing guidelines).

No benefits would result from options a(2) or a(3) unless the radioactive materials could be transported safely to a site with known superior properties over SRP with regard to protection of the population and the environment. Other ERDA studies are under way to identify such sites. Penalties of these options would be the cost of conversion and transportation of radioactive materials from SRP to another site. Costs would include: addition of facilities at another site for fuel processing or waste storage, or both; cost of shipping containers and transportation; and, for Alternative 1, option a(3), cost of converting liquid waste into a shippable form.

b. Alternative 2 — Store no radioactive waste onsite, and return waste management areas to their pre-plant condition.

This alternative would require offsite shipment of existing liquid and solid wastes as well as newly generated waste, with the attendant high cost of conversion to a solid form, shipping, and comparable cost of waste management at another site. As in Alternative 1, no benefits would result from this alternative which involved shipping wastes offsite. A penalty of this alternative would be the added risk of accidents and population exposures during transportation, not only of new waste but also of the 21 million gal of existing high-level liquid wastes and the 250,000 m^3 of existing radioactive solid wastes.

c. Alternative 3 — Indefinitely continue present waste management practices without additional improvements.

This alternative would call for management of existing and future wastes based on current technology. The annual cost of this alternative would remain at about the current level indicated in Alternative 4, thus the cost would be lower over the next few years than for the other alternatives considered. A benefit of this alternative would be that technology developed to date would be used to maintain the present low level of releases to the environment and the present low potential for releases from the waste storage facilities. However, a penalty would be that further improvements would be sacrificed, especially in the area of solidification and low mobility of stored high-level wastes.

d. Alternative 4 — Improve waste management practices in accordance with ERDA policies and standards.

This alternative is the base case described in this environmental statement.

The estimated cost of waste management and environmentally oriented activities is currently about $15 million per year, or about 10% of the SRP operating budget; this cost is expected to increase as improvements are developed and implemented. Capital costs for new facilities, such as storage tanks for high-level liquid wastes, are additional expenses.

Benefits of this alternative are protection of the population and the environment from adverse effects of radioactive and nonradioactive wastes by 1) reducing releases from production operations to values that are as low as practical from both technological and economical standpoints, and 2) continuing to develop better methods of waste storage, including reducing the volume and mobility of both radioactive liquid and solid wastes.

2. Conclusion

Based on the above discussion of the general alternatives available, and the information presented in this environmental statement, it is concluded that continued management of SRP wastes in accordance with present ERDA policies and standards is preferable to other alternatives and will not result in excessive adverse effects on the population or the environment. Continued study and consideration would be given to improvements.

3. Specific Options

Relative costs and benefits of the specific options under the base case (Table IX-3) are divided into the following categories:

- Scheduled or budgeted improvements, and recent improvements being evaluated.
- Alternatives under study.
- Alternatives studied and not adopted.

Costs given in approximate FY-1976 dollars are generally for equipment required to reduce releases. Benefits are expressed in terms of the population dose reduction in man-rem per year (based on calculated population doses for 1975 from SRP radioactive releases) or reduction in nonradioactive emissions that might be achieved by a given reduction method. Where numerical costs and benefits have not been estimated, a qualitative plus (+), minus (-), or question mark (?) is used to indicate a favorable, unfavorable, or undetermined effect. Costs for items under study and items not adopted are preliminary values for scoping purposes. Variations in process requirements in the future could cause observed reductions from adopted options to vary from the expected values.

TABLE IX-3

Analysis of Specific Alternatives to Present Practice

	Approximate Equipment Cost, $	*Estimated Benefits, Reductions*
A. Scheduled, Budgeted, or Recently Completed		
1) Improvements to control radioactive releases to the atmosphere (115 man-rem in 1975)		
Tritium absorption equipment, 232-H	165,000	4 man-rem/yr
Tritium release control facilities, 400-D D_2O rework	130,000	+
Tritium confinement system, 234-H	6,000,000	+[b]
Improved fuel element extrusion, 300-M	*400,000*[a]	*<0.5 man-rem/yr*
Argon-41 retention for decay, 100-P,K,C	600,000[c]	6 man-rem/yr
2) Improvements to control radioactive releases to Plant streams (15.5 man-rem in 1975)		
Improved fuel element extrusion, 300-M	400,000[a]	+
3) Improvements to control nonradioactive releases to atmosphere		
Electrostatic precipitators for 400-D power plant	4,700,000	$\sim 2 \times 10^7$ lb fly ash/yr
New mechanical dust collectors for 700-A power plant	810,000	$\sim 2 \times 10^5$ lb fly ash/yr
New mechanical dust collectors for remaining stoker-fired boilers (P,K,C,F,H Areas)	6,700,000	$\sim 4 \times 10^6$ lb fly ash/yr
Degreasers	50,000	+
H_2S flare system improvements, 400-D	38,000	+
H_2S monitoring, 400-D	180,000	+
4) Improvements to control nonradioactive releases to streams		
New ash basin, 400-D	1,500,000	Maintain effluent stream <30 ppm suspended solids; total releases $\sim 1 \times 10^8$ lb/yr
H_2S monitoring, 400-D	55,000	+
B. Under Study		
1) Improvements to control radioactive releases to the atmosphere (115 man-rem in 1975)		
Reduced losses of tritiated D_2O, 100-P,K,C	*c*	3 man-rem/yr
Tritium removal from D_2O by methods other than replacement or distillation	*d*	+
Tritium absorption, 234-H	250,000	10 man-rem/yr
Tritium confinement system, 232-H	7,000,000	+[b]
Improved flushing of tritiated D_2O from miscellaneous discharged components, 100-P,K,C	750,000	+
Degraded solvent incineration improvements burial ground	*d*	+

(Continued)

TABLE IX-3, Continued

	Approximate Equipment Cost, $	Estimated Benefits, Reductions
B. Under Study (cont'd)		
2) Improvements to control radioactive releases to plant streams (15.5 man-rem in 1975)		
Improved flushing of tritiated D_2O from miscellaneous discharged components, 100-P,K,C	*d*	+
Discharge to seepage basins	*d*	+
3) Improvements to control radioactive releases to seepage basins		
Reduce releases by improved process control	*d*	+
Water treatment facility alternative, F and H Areas	6,600,000	+
4) High-level liquid waste storage		
Conversion to inert forms	*d*	+
5) Improvements for radioactive solid waste storage		
Alpha decontamination and disassembly facility	5,000,000	+
Incinerator for alpha wastes	2,500,000	+
Incinerator for beta-gamma wastes	5,000,000	+
Concrete-lined trenches	*d*	?
Increased segregation by type of waste	*d*	+
6) Nonradioactive releases		
Corrosion inhibitors	*d*	+
C. Studied but not Adopted		
1) Improvements to control radioactive releases to the atmosphere (115 man-rem in 1975)		
Tritium recovery from stack gas, 200-H	4,000,000	50 man-rem/yr
Tritium removal from D_2O by distillation or replacement	300,000,000	65 man-rem/yr
Recovery of ^{85}Kr, 200 Areas	*d*	0.4 man-rem/yr
Delay volume for Kr-Xe, 100-P,K,C	250,000	0.1 man-rem/yr

(Continued)

TABLE IX-3, Continued

	Approximate Equipment Cost, $	*Estimated Benefits, Reductions*
C. Studied but not Adopted (cont'd)		
2) Improvements to control radioactive releases to seepage basins		
Direct release to streams if within guidelines	0	-0.2 man-rem/yr
Evaporation of effluents	13,000,000	+
3) High-level liquid waste storage		
Storage of acidic solutions	*d*	?
4) Improvements for radioactive solid waste storage		
Retrievable storage discontinued	*d*	-
5) Improvements to control nonradioactive releases		
Power production	*d*	+
NO_x releases	*d*	+
Chemical discharges	*d*	?
Cooling towers and ponds to reduce reactor thermal effects, 100-K,C	40,000,000	+

a. Improved fuel cladding reduces releases to atmosphere from reactors, and to streams from fuel storage basins. Same $400,000 in both references.

b. Would reduce tritium releases from leaks at tritium facilities (Appendix J).

c. Included in another project.

d. Cost evaluation not completed or not made.