XII. ENVIRONMENTAL TRADE-OFFS AMONG ALTERNATIVES

A summary of the quantifiable environmental impacts of each alternative is given in Table XII-1. The risk items shown in Table XII-1 are discussed more fully in Section V, and the costs are covered in Section X. Table XII-1 also shows the lifetime radiation dose commitment that the affected offsite population will receive from natural background.

Table XII-1 shows that there are no substantial environmental impacts arising from nuclear radiation for any of the three alternatives. The offsite population exposure risk from the alternative with highest risk (liquid waste stored in an SRP bedrock cavern) is about one-thousandfold lower than natural radiation exposure to the same population. It should be noted that there are large populated areas in this region that receive at least twice the average natural exposure and the public makes no attempt whatsoever to avoid these areas, indicating that there is no extensive public concern with exposures of this magnitude. The factor of 200 cancer deaths per million man-rem recommended by the EPA can be used to convert the exposures from Table XII-1 to possible health effects. This may overestimate the radiation effect, as explained in Reference 1. Based on the EPA factor, the difference between the alternatives with highest and lowest offsite risk amounts to 12 fatalities over a 300-year period, whereas under the same assumptions, the same population would experience about 46,000 fatalities over the 300-year period from natural radiation effects.

Non-nuclear fatalities to be expected from construction and operating activities related to each alternative are greater than those that would be expected from radiation effects, but are no larger than the risks voluntarily accepted by industrial workers.

The significant quantifiable differences between the alternatives are the differences in budgetary costs. The cost differences of as much as $3.2 billion among the alternatives are related to environmental trade-offs to the extent that environmental improvements are foregone in other areas by the expenditure of monies on radioactive waste management. Costs also influence the benefits left to future generations. Money spent now on radioactive waste management does not create productive assets that accrue to the benefit of the future, since such money must be taken from the mainstream of activities represented by the gross national product (GNP). The GNP includes many items that represent present day consumption of goods and services, but it also includes capital investment aimed at future productivity. Past experience has shown that the GNP includes enough investment in future productivity to grow at a rate of about 4% per year (corrected for inflation). This growth in productivity would be denied future generations for the money spent now on extra levels of risk reduction in the waste management area.

The difficult-to-quantify factors related to each alternative are shown with qualitative rankings in Table XII-2, and are a summary of discussions given in Sections V, VI, VII, VIII, and IX.

Cost considerations and how they are balanced in a judgmental manner with the unquantifiable factors listed in Table XII-2 are key elements in a decision process regarding which alternative should be implemented. Offsite radiation risks, occupational exposures, non-nuclear risks, and other environmental effects are relatively insignificant factors, because they are small in both absolute magnitude and when their monetary evaluation is compared with budgetary costs (see Section XI on cost-risk-benefit analysis).

A summary of long-term and short-term costs and nuclear risks is given in Table XII-3 Short-term risks are the sum of occupational and offsite risks until the waste is placed in storage or disposal (about 10 years after start of removal from tanks). Long-term risks are the sum of occupational and offsite risks for 300 years after the waste is placed in storage or disposal.

TABLE XII-1

Quantifiable Environmental Impacts

		Alternative 2			
	Alternative 1	*Subcase 1*	*Subcase 2*	*Subcase 3*	*Alternative 3*
	Continued Tank Farm Operation	*Glass Shipped to Offsite Repository*	*Glass in SRP Surface Storage*	*Glass in SRP Bedrock*	*Liquid in SRP Bedrock*
Occupational Radiation Exposures Based on SRP Experience, man-rem[a]	360	3,800	2,700	2,400	42
Occupational Radiation Exposures Based on DOE Standards, man-rem[a]	4,300	30,000	32,000	28,000	500
Offsite Population Dose Risk, man-rem[b] (300 yr)	1,400	650	220	340	62,000
Offsite Population Dose Risk, man-rem[b] (10,000 yr)	2,300	650	340	340	140,000
Offsite Population Dose, man-rem (300 years)	230,000,000	230,000,000[d]	230,000,000	230,000,000	230,000,000
From Natural Radiation, man-rem (10,000 years)[c]	7,700,000,000	7,700,000,000	7,700,000,000	7,700,000,000	7,700,000,000
Potential for Accidental Offsite Land Contamination (from Sabotage), acres	130,000	139,000	139,000	139,000	130,000
Non-Nuclear Accidental Fatalities from Construction and Operations	17.1	6.5	6.6	6.2	2.2
Budgetary Cost, millions of 1980 dollars	510	3,600	3,750	3,610	755

a. Campaign totals for all workers.

b. Consequences times probabilities, summed over all events and integrated for 300 years and 10,000 years.

c. For the same time period and population as above.

d. The natural radiation calculations assume the population distribution around the offsite repository would be the same as around the SRP site. This is conservative, because the offsite repository would probably be located in a sparsely populated region.

TABLE XII-2

Summary of Unquantifiable Factors

		Alternative 2			
	Alternative 1 *Continued Tank Farm Operation*	*Subcase 1* *Glass Shipped to Offsite Repository*	*Subcase 2* *Glass in SRP Surface Storage*	*Subcase 3* *Glass in SRP Bedrock*	*Alternative 3* *Liquid in SRP Bedrock*
Relative Degree of Action Required by Future Generations	High	Low	Moderate	Low	Low
Relative Compliance with Public Expectations[a]	Low	High	Moderate	High	Moderate
Conformance with Policies of SC and GA State Governments	Low	High	Moderate	Low	Low
Conformance with NRC Regulations for Commercially-Generated Waste	Low	High	Moderate	High	Low
Potential for Regrets if Future Economics or Technology Indicates a Better Method[b]	Low	High	Moderately High	High	High
Likelihood of Successful Attainment of Required Implementation Technology	Highest	High	Higher	Moderate	Moderate
Effect on Implementation Date Relative to Alternative 2 — Subcase 1	Shortens	-	None	Lengthens	Lengthens
Requires Additional Management of Decontaminated Salt	No	Yes	Yes	Yes	No

a. Based on pre-draft comments and proceedings of DOE and EPA meetings on public policy issues. Also documented in Reference 2.

b. This factor involves both the ease of retrievability from the storage or disposal site and the ease of separating the radioactive constituents from the waste form.

TABLE XII-3

Summary of Long-Term and Short-Term Costs and Nuclear Risks

		Alternative 2			
	Alternative 1 Continued Tank Farm Operation	*Subcase 1* Glass Shipped to Offsite Repository	*Subcase 2* Glass in SRP Surface Storage	*Subcase 3* Glass in SRP Bedrock	*Alternative 3* Liquid in SRP Bedrock
Short-Term Risks, man-rem	0[a]	4.60×10^3	2.57×10^3	2.57×10^3	2.19×10^2
Long-Term Risks,[b] man-rem	1.76×10^3 2.66×10^3	1.30×10^2 1.30×10^2	2.91 1.20×10^2	1.30×10^2 1.30×10^2	6.2×10^4 1.4×10^5
Short-Term Costs,[c] millions of 1980 dollars	0[a]	3600	3750	3610	755
Long-Term Costs,[b,c] millions of 1980 dollars	510[d] 3060[e] 102,000	175	175	175	175

a. Short-term risks are defined to be those that are incurred from activities additional to preparing the waste as salt cake and sludge in modern tanks, because such activities are common to all alternatives. Short-term costs are treated similarly.

b. Long-term risks and costs are integrated for 300 years and for 10,000 years.

c. All costs are in undiscounted 1980 dollars. Discounting of long-term costs would reduce their magnitudes to negligible fractions of short-term costs for any alternative.

d. This is enough for one cycle of tank replacement, and is more than enough to establish a trust fund for perpetual tank replacement.

e. This is enough to replace tanks every 50 years during the 300-year period or the 10,000-year period, undiscounted.

REFERENCES FOR SECTION XII

1. *Environmental Radiation Dose Commitment: An Application to the Nuclear Power Industry*. Report EPA-520/4-73-002, U. S. Environmental Protection Agency (1974).

2. B. D. Melber, S. M. Nealey, J. Hammersla, and W. L. Rankin, *Nuclear Power and the Public: Analysis of Collected Survey Research*. Battelle HARC Report, PNL-2430 (November 1977).