11.0 SUMMARY OF BENEFIT-COST ANALYSIS

11.1 GENERAL CONSIDERATIONS

It must be recognized that any act of man or nature has some effect upon the environment. It is also important to note that although adverse impact can be reduced by the allocation of additional resources for environmental protection, the law of diminishing returns applies to the resources expended. This point was recognized by the U. S. Congress in enacting the National Environmental Policy Act (NEPA) of 1969 and was further reinforced by the U. S. Court of Appeals for the District of Columbia in 1971 in the Calvert Cliffs decision. A benefit-cost analysis of the proposed project (the cost-effectiveness portion in particular) formalizes the accounting of environmental, social, economic and technical values of the proposed project and, therefore, assists in the implementation of both the letter and spirit of NEPA.

The proposed action is the construction and operation of a demonstration plant that will provide a vital step toward the achievement of the timely availability of the LMFBR as a power generation technology option for commercial use. Therefore, the objectives and benefits of the proposed project are broader in scope than is the case for nuclear power plants built for the specific purpose of generating electrical power. The methodology of benefit-cost analysis typically used[1] must then be somewhat altered to provide a meaningful evaluation of this particular case. The several areas where the benefit-cost analysis reflects significantly different perspectives are:

1. The identification and evaluation of benefits;
2. The balancing of benefits, which are largely qualitative in nature or cannot be reasonably presented on a common basis, with costs;

3. The balancing of benefits and costs on more than one level of evaluation,

   a. The primary benefits and economic costs are national in scope;

   b. The secondary benefits and environmental costs are mostly local in nature; and

4. The relationship between benefits and costs of this specific project and the broader scope breeder reactor economy.[2]

In the process of developing a project plan and designing the proposed plant, guidelines have been used by the participants with the intent of reducing the environmental costs as much as possible. In addition, the recommendations of environmental consultants[3] have been sought and incorporated for this purpose. Alternatives were evaluated (see Section 10) to improve systems and radwaste technologies. The result is a proposed plant with low environmental and social impacts; the differences between alternatives are sometimes minor and insignificant. In this regard, it must be borne in mind that cost-benefit analysis is one of many decision-making tools of importance to evaluation of the project. It provides no dispositive answers in itself and its results must be viewed with recognition of the uncertainties and qualitative values which are implicit in the analysis. Nevertheless, the evaluation has been conducted with thoroughness and concern for environmental values and directed toward defining the net benefits of the project. The detailed evaluation of need, benefits, costs, socioeconomic concerns and alternatives has been presented in other sections. This section will then summarize the evaluations from other sections and present the complete benefit-cost analysis in an integrated framework.

The methodology of benefit-cost analysis used here consists of the following steps:

1. Analysis of alternatives to the proposed CRBRP to affirm that the most cost-effective selections to satisfy project objectives have been made to minimize environmental and social costs on an economic cost basis. (Sections 1, 9 and 10);
2. Clear description of the need for the CRBRP in terms of the benefit of that project to society (Section 1);
3. Summarization of the cost-effective selections made from available alternatives in categories of:
   - alternatives to project (Section 11.3.1)
   - plant siting (Section 11.3.2)
   - plant design alternatives (Section 11.3.3)
4. Summarization of the environmental, economic and social costs of the proposed plant (Section 11.4 as evolved from Sections 4, 5 and 8);
5. Summarization of the benefits (Section 11.2 as evolved from Sections 1 and 8); and
6. Balancing the costs of the most cost-effective project, plant and selections, against the benefits to determine that a net benefit to society exists (Section 11.5) at both the national and local levels.

11.2 IMPORTANT BENEFITS OF THE PROPOSED FACILITY

The objectives of the proposed project have been discussed in Section 1 of this report. These objectives are focused on the development and demonstration of the LMFBR in a commercial setting. The primary benefits of the Clinch River Breeder Reactor Plant (CRBRP) will be those benefits attained by achieving those objectives. On this basis, the primary benefits consist of the contributions made by this demonstration project as a vital step in the development of the LMFBR as an option for the commercial generation of electricity.

In striving to attain these primary benefits, the project will also produce other benefits which are designated as secondary benefits. Secondary benefits are a corollary to achievement of the stated objectives and could be produced by other actions. This does not suggest however that the secondary benefits are not significant in the overall evaluation and balancing of benefits and costs of the proposed project. These secondary benefits are of real concern to the communities in the immediate vicinity of the Site and are thus included in the total benefit-cost analysis.

11.2.1 PRIMARY BENEFITS

The CRBRP is a crucial and valuable development and demonstration step toward the development of a commercial breeder reactor industry. Therefore, the primary benefits consist of (1) those technological, commercial and informational needs directly provided by the project; and (2) the benefits of the breeder reactor economy which can be attained by development through this project and are thus attributable on a longer term basis.

The direct primary benefit of the CRBRP will be the established viability of the LMFBR as a reliable, safe and environmentally acceptable source

of electrical energy and to provide a major contribution to the technical knowledge and industrial base that is necessary to establish a commercial LMFBR industry as an option for power generation. The CRBRP will produce the following benefits toward achieving the major objectives:

1. Demonstration that the necessary technology is indeed available to successfully scale up, construct and operate commercial-sized LMFBR's;
2. Technical basis for extending the technology to future commercial plants where improvements in fuel life, plant capacity and thermal efficiency will be made;
3. Operating data on the environmental impact of the LMFBR before large numbers of commercialized LMFBR's are constructed;
4. Demonstration of the nuclear parameters necessary for commercial development;
5. Demonstration of the minimal impact from disposal of radioactive waste materials;
6. Demonstration of the equipment on a large scale; and
7. Demonstration of the breeder concept in an industrial environment.

The LMFBR offers substantial benefits through its efficiency in the use of energy resources. This translates into savings of uranium ore and associated mining requirements, reduction in separative work requirements for enrichment and fuel costs for nuclear power generation. Thus, the availability of fissile fuels can be extended considerably and substantial economic benefits attained. These benefits are summarized in Sections 1 and 9 and presented in detail in the draft statement for the LMFBR program.[1] Since the CRBRP is a necessary step if these benefits are to be attained, these benefits will accrue beyond the terms of the proposed project.

11.2.2 SECONDARY BENEFITS

As a direct result of the commitment to construct and operate the CRBRP, a number of secondary benefits will be generated. These benefits will accrue to the local area for the most part and consist of the jobs created and the resultant income generation. A complete description of these benefits and the bases for estimation have been presented in Section 8.2.2 and are summarized in Table 11.2-1.

During the peak construction period, approximately 2,800 jobs will be created and will lead to the resultant direct income of $62.8 million in the year of maximum activity. Approximately 179 employees will be required for the long-term operation of the plant. This will generate annually about $5.2 million in direct and indirect income locally. The total direct income benefits (1974 dollars) generated over the construction and demonstration period will be $278.5 million. In addition, the direct income benefits (1974 dollars) of $4.4 million per year through the remaining potential 30-year life of the plant will be generated.

In addition to the employment and income benefits to the local region, a number of other secondary benefits will be generated. Those employees moving into the area from other areas will stimulate the construction of housing and the continued economic growth of the area. While the contribution of this project to the local economy will be small compared to the total existing economic activity, it will be a positive contribution as shown in Table 11.2-1. The increased population and economic activity will carry an appropriate portion of the tax revenue requirements on an equal basis with the existing residents and economy.

The power generating capacity of the plant will not supplant other generating capacity in the TVA system. However, the electrical output generated by the plant will be purchased by TVA as part of the project agreements. It is anticipated that about 9.6 billion kilowatt-hours of electricity valued at $71.8 million (1974 dollars) will be made available

to the TVA system as a result of operation of the CRBRP during the five-year demonstration period. When the plant is operating it will then effect a small reduction in the required generation to meet demand and associated environmental effects within the TVA system. G

In addition to the secondary benefits attained locally, it can be noted in Table 8.3-1 that fuel fabrication, materials, engineering and equipment of the reactor manufacturer and the architect-engineer, and development constitute significant expenditures. This in turn will maintain and generate jobs and income at a number of locations throughout the country. While none of this benefit is sufficiently concentrated or large in magnitude to impact on local economies, these do constitute significant benefits to the individuals and corporation directly involved.

In addition to the secondary benefits resulting directly from expenditures for the project, there are many other secondary benefits which are attributable to the CRBRP over the long term. Some of these are the secondary benefits of the timely development of the LMFBR as a commercially available power generation option. To the extent that the CRBRP is a vital step in that development, these secondary benefits accrue beyond the term of the project. Some of these secondary benefits are:

1. Reduction in environmental effects of mining;
2. Reduced dependence on enrichment facilities with the associated energy, environmental and capital costs;
3. Reduced strain on rapidly decreasing known supplies of petroleum and natural gas;
4. Reduced dependence of the United States on resources of other nations;
5. Improvement in the nation's balance of payments; and
6. The continued growth of the standard of living rather than forcing reductions due to a lack of energy resources.

TABLE 11.2-1

SECONDARY BENEFITS SUMMARY

Employment Benefits (Number)	
Direct peak employment	2,780
Direct permanent operations employment	179
Indirect permanent employment	141
Income Benefits (millions of dollars)	
Direct employment income (1974 dollars)	278.5
Through demonstration period	
Indirect employment income (1974 dollars)	
Through demonstration period	12.3
Annual employment income (1974 dollars)	
Direct peak employment income	50.0
Direct and indirect permanent employment income	5.2
Electrical generation benefits (1974 dollars)	
Value of electricity purchased through the demonstration period	71.8

11.3 PROJECT COST-EFFECTIVENESS

The development of sound benefit-cost analysis for a proposed project is dependent on a cost-effectiveness evaluation of alternatives that are available. The purpose is to demonstrate that the proposed action constitutes the most reasonable and responsible course of action of all available choices to meet the stated objectives. By evaluating alternatives on the basis of a specified project, the primary benefits associated with the alternatives are assumed to be equal. Thus, the benefit-cost analysis can, in essence, be reduced to a cost-effectiveness evaluation.

Several categories of alternatives have been considered in this benefit-cost analysis in order to assure a maximum benefit-to-cost balance. These categories are:

1. Strategic alternatives to the project;
2. Site alternatives; and
3. Plant design alternatives.

The consideration of alternatives in the cost-effectiveness evaluation of this project is presented in a hierarchical order as a means of narrowing the scope of alternatives. Thus, the basic strategic alternatives are presented first, followed by consideration of alternative sites for the plant. Alternative plant design options to improve the environmental and economic cost-effectiveness for the specific plant and location are then evaluated.

Summaries of the cost-effectiveness evaluation presented in other sections of this report are presented in the following subsections.

11.3.1 STRATEGIC ALTERNATIVES TO PROJECT

Strategic alternatives to the Clinch River Breeder Reactor Plant (CRBRP) are limited by the nature of the objectives of this project. Since the stated objective is the development and demonstration of the LMFBR and since alternative energy sources to the LMFBR have been evaluated, other energy sources are not a part of this consideration of alternatives. Building upon the base of the historical LMFBR program, with the Fast Flux Test Facility (FFTF) being the most advanced stage, the following strategic alternatives could be conceived:

1. All new LMFBR plant;
2. New LMFBR as steam supply hooked on to an existing balance of plant;
3. Modify existing reactors;
4. Change scope and modify FFTF; and
5. Eliminate demonstration size plant and proceed directly to commercial reactors.

Analysis of these alternatives reveals that only the first two warrant evaluation in detail. Plant sizing requirements are discussed in Section 1.3.6 where plants either smaller or larger than the 300-500 MWe range are shown to be impractical selections by not providing a reasonable advancement in the LMFBR technology without substantial risks and costs. Likewise, going directly from the FFTF to a commercial LMFBR would have increased costs and a lower probability of success. Existing reactors would not be compatible for modification because of basic design differences, major size differences and the lack of technical feasibility. Modification of the FFTF would require serious compromising of the objectives for which the FFTF was intended, design and economic costs comparable to the construction of new facilities and the loss of valuable testing and experimental data for the assurance of viable and safe design.

The two strategic alternatives considered worthy of detailed analysis (all new plant and the hook-on plant have been thoroughly evaluated as specific options in Section 9.2.

11.3.2 SITE ALTERNATIVES

The objective in evaluating site alternatives is to establish the preferred alternative for location of the plant. The criteria for site evaluation encompass relevant environmental, economic, social and technical considerations. These criteria provide a framework for selection of that site location which, on balance of relevant environmental, economic, social and technical factors, will enable achievement of the project objectives most effectively.

Site alternatives are evaluated in conjunction with plant alternatives (all new plant versus a hook-on plant) in Section 9.2. That evaluation reflects a systematic, step-wise consideration of

1. The screening of hook-on sites;
2. The evaluation of engineering and economic feasibility of hook-on arrangements at candidate hook-on sites;
3. The screening of new plant sites; and
4. The comparative evaluation of both hook-on and new candidate sites with respect to identifiable environmental, economic, social and technical factors.

Briefly summarized, the evaluation of site alternatives demonstrates that:

1. Upon analysis of factors such as plant size, steam conditions, seismic characteristics, population distribution and plant utilization patterns, TVA's existing Widows Creek and John Sevier steam plants were selected as acceptable candidate hook-on sites.

2. While acceptance of less than optimum steam conditions would be required, detailed evaluation indicated that hook-on arrangements at the candidate sites could be designed to accommodate an LMFBR NSSS. Hook-on arrangements at the candidate sites were considered to satisfy engineering and economic feasibility.

3. Upon analysis of factors such as the availability of cooling water, seismic conditions, access facilities, population distribution, site availability and future site usage for eleven new sites in the TVA service area, each of the sites was considered from a site suitability and environmental standpoint to be equivalent. However, only the Clinch River site met the site selection criteria of availability and future usage. Moreover, comparison of site physical, engineering and environmental characteristics indicated that there were no known reasons for precluding consideration of the Clinch River site. Therefore, the Clinch River site was selected for more detailed analysis as a candidate new site.

4. Upon detailed evaluation of the social, environmental and economic characteristics of the candidate hook-on and new sites, no strong overall advantage for any site was apparent. The candidate sites were considered to be environmentally equivalent and there were no known reasons why each would not be environmentally acceptable. In addition, each of the plant-site arrangements were considered to be economically equivalent within the limits of uncertainty in the analysis. However, further evaluation of plant characteristics for hook-on versus all new plant arrangement offered overriding technical advantages in terms of capability to meet project objectives. Therefore, on balance of all relevant environmental, economic, social

and technical considerations, the Clinch River site, with its all-new plant arrangement, was selected as the preferred alternative.

11.3.3 PLANT DESIGN ALTERNATIVES

Alternative plant design features were evaluated to demonstrate that the selected plant systems are the most cost-effective options available for minimizing the potential environmental impact. These evaluations are presented in detail in Section 10.

As demonstrated throughout this report, the proposed CRBRP is comprised of plant systems which will result in an insignificant impact on the environment. The magnitudes of potential further reductions are in all cases very small and in some cases do not exist with present technology. Where minor reductions in environmental costs of a particular type might be available, other environmental costs or economic costs outweigh the slight advantage. Therefore, the plant design alternatives selected have been demonstrated in Section 10 to be the most cost-effective available.

11.3.4 COST-EFFECTIVENESS OF PROPOSED PLANT

By considering all of the available alternatives for reduction of the environmental impacts of the proposed CRBRP, it has been demonstrated that the proposed plant is the cost-effective course of action to achieve the desired objectives.

11.4 SUMMARY COSTS OF PROPOSED PLANT

11.4.1 ENVIRONMENTAL COSTS

The environmental costs of the proposed plant have been discussed and evaluated in Sections 4, 5 and 10 and are summarized in Table 11.4-1. In addition to the environmental costs directly resulting from the construction and operation of the plant, there are remote and indirect environmental costs resulting from fuel cycle considerations. These costs, presented in Tables 5.7-1 and 5.7-2, estimate those remote impacts and show that the small incremental impacts attributable to the fuel cycle do not significantly increase the environmental costs of the project and in no way affect the conclusion of the cost-benefit analysis. In evaluating alternatives, selecting plant systems and arriving at specific designs, concern for the reduction of environmental impact potential has been exhibited. The result has been a proposed plant for which there will be negligible environmental impact.

11.4.2 ECONOMIC COSTS

The most important economic costs of this proposed CRBRP are the direct costs of construction and operation of the demonstration plant. These costs are presented in Section 8.3.1 and Table 8.3-1. The total plant investment is estimated at $1361.0* million. Development costs and operating costs over the five-year demonstration period will bring the total project cost in 1974 dollars to $1.9504 billion.* 6

*This figure includes escalation and contingency.

11.4.3 SOCIAL COSTS

The construction and operation of the CRBRP will lead to a number of social costs as discussed in Section 8. These are local in nature for the most part. Most important of these social costs are those resulting from the construction phase when a large number of temporary employees will have impacts on the local communities and the social services such as schools, housing and highways. Since all of these costs are relatively small in comparison to the ability of the communities to absorb them, no significant detrimental impact is expected. 6

TABLE 11.4-1

ENVIRONMENTAL COST SUMMARY

Environmental Cost Item	Cost Measure	Cost Magnitude	Report Location
AQUATIC IMPACT - PHYSICAL			
Water Use			
Maximum seasonal withdrawal	gal/min	6,685	Table 3.3-4
Maximum seasonal consumption	gal/min	4,089	Table 3.3-4
Proportion of Melton Hill Dam releases	percent	0.20	Table 10.1-10
Thermal Plume			
Typical Winter Condition (January/February/March)	Isotherm of maximum surface temperature rise (ΔF°)	1.5	
	Spatial extent (acre)	0.01	
Typical Summer Condition (July/August/September)	Isotherm of maximum surface temperature rise (ΔF°)	1.2	
	Spatial extent (acre)	<0.01	Table 5.1-2
Hypothetical Winter Extreme Condition (January)	Isotherm of maximum surface temperature rise (ΔF°)	2.3	
	Spatial extent (acre)	0.06	
Hypothetical Summer Extreme Condition (June)	Isotherm of maximum surface temperature rise (ΔF°)	0.7	
	Spatial extent (acre)	0.02	

(Continued)

6

TABLE 11.4-1 (Continued)

Environmental Cost Item	Cost Measure	Cost Magnitude	Report Location
Extended No Flow Worst Case--Winter	Isotherm of maximum surface temperature rise (ΔF°)	3.4	Figure 5.1-5
	Spatial extent (acres)	~25	
Extended No Flow Worst Case--Summer	Isotherm of maximum surface temperature rise (ΔF°)	1.3	Figure 5.1-6
	Spatial extent (acres)	~50	
Chemical Plumes			
Chemical Waste Treatment System Discharges (including cooling system blowdown)	Maximum increase in river TDS during extended period (up to 29 days) of zero flow (%)	44	Table 5.4-10
Biocide System Discharges	Maximum increase in complexed Cl_2 during extended period (up to 29 days) of zero flow (%)	76	p. 5.4-11
Sanitary Waste System Discharges	Increase in BOD during extended period (up to 29 days) of zero flow (%)	0.1	Tables 3.6-1 and 5.4-10
AQUATIC IMPACT - BIOLOGICAL			
Entrainment	%/yr of organisms	0.33	Table 10.1-10

(Continued)

TABLE 11.4-1 (Continued)

Environmental Cost Item	Cost Measure	Cost Magnitude	Report Location
Impingement	Water velocity 0.75 inch from screen surface	0.2 fps	
	% of river cross-sectional area occupied by intake structure	0.4	p. 10.2-17
Thermal Plume Biological Effects	No impact		Section 5.1.3
AIR IMPACT			
Drift Deposition	lbs/acre-month of chlorides	2	p. 5.1-20
	lbs/acre-month of TDS	89	Table 5.1-9
Ground Fog	Potential hrs/yr of <1/2 mile visibility	146	Table 5.1-7
	Percent of natural fog	2.3	Table 10.1-10
Visible Plume	Extent in miles fog C stability, 95% RH	1.8	Table 10.1-10
RADIOLOGICAL IMPACT			
Dose to Aquatic Species			
External total	Maximum, mrad/yr	1.5×10^{-5}	Table 5.2-5
Internal total	Maximum, mrad/yr	3.81	Table 5.2-5

(Continued)

6

TABLE 11.4-1 (Continued)

Environmental Cost Item	Cost Measure	Cost Magnitude	Report Location
Dose to Terrestrial Species			
External total	Maximum, mrad/yr	0.001	Table 5.2-5
Internal total	Maximum, mrad/yr	3.38	Table 5.2-5
Individual Dose to Man			
External total body	mrem/yr	0.63	Table 5.3-7
Internal whole body	mrem/yr	3.1×10^{-2}	Table 5.3-7
Population Dose to Man			
External total body	man-rem/yr	0.67	Table 5.3-7
Internal whole body	man-rem/yr	4.5×10^{-3}	Table 5.3-7
Exposure Compared to Natural Radiation			
Individual external total body	%	0.63	Table 5.3-7
Individual internal whole body	%	0.17	Table 5.3-7
Population external total body	%	6.7×10^{-4}	Table 5.3-7
Population internal whole body	%	2.6×10^{-5}	Table 5.3-7
TERRESTRIAL IMPACT			
Land Disturbance for Plant			
Forestland	acres	115	Section 4.1.1.6

6

(Continued)

TABLE 11.4-1 (Continued)

Environmental Cost Item	Cost Measure	Cost Magnitude	Report Location	
TERRESTRIAL IMPACT (Continued)				
Land Disturbance for Transmission Line				
Forested	acres	53.6	Table 4.2-7	6
Unforested	acres	4.6	Table 4.2-7	6
Site Biota Effects	--	minor	Section 4.1.1.6	
Rare and Endangered Plant Species	species	No impact	Section 4.1.1.6	6
Rare and Endangered Wildlife		No impact	Section 4.1.1.6	
Human Habitation		No impact	Section 4.1.1.7	
Construction Noise Levels Range	dBA at 500 feet	69-105	Table 4.1-4	

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11.5 BALANCE OF BENEFITS AND COSTS

As a result of the cost-effectiveness evaluation of alternatives to the project, site alternatives and plant design alternatives, a proposed project has been presented which meets regulations and protects indigenous values at minimum environmental, economic and social costs. The resulting costs, as summarized in Section 11.4 must then be balanced against the benefits summarized in Section 11.2 to demonstrate that a net benefit to society exists. Because of the unique character of the proposed Clinch River Breeder Reactor Plant (CRBRP), this balancing of benefits and costs can be evaluated at both the national and local levels.

11.5.1 NATIONAL-LEVEL BENEFIT-COST BALANCE

The CRBRP is proposed as a vital step toward the development of the LMFBR as a viable and commercially acceptable power generation option for operation in the late 1980's and beyond. As such, the LMFBR will offer substantial net benefits to the nation by extending the usefulness of available energy resources and reducing the environmental and economic costs of electrical power generation. These net benefits have been thoroughly evaluated on both quantitative and qualitative bases by the USAEC.[1] Since the CRBRP is an important development and demonstration step toward achievement of those benefits, the benefits will accrue beyond the term of the CRBRP project. They do constitute a strong incentive for proceeding along the path toward a breeder economy.

The direct primary benefit of the CRBRP will be the demonstration of the LMFBR as a reliable, safe and environmentally acceptable source of electrical energy and to provide a vital step toward a commercial LMFBR industry as a power generation option. These benefits have been discussed in detail in Section 1 and summarized in Section 11.2.1. In order to accomplish this objective, certain national level costs will be incurred. Foremost among these costs will be the economic costs for plant investments, development and operation through the five-year demonstration

period. These economic costs are presently estimated to be $1.9504 billion. In comparison, "the net cost saving over the period 1974-2020 is of the order of $50 billion on a discounted basis"[1] for the assumed breeder economy. Therefore, the economic value of providing this vital step in breeder development will more than pay for itself economically should the breeder economy be achieved. In any case, these economic costs represent an investment of substantially less than 1/10 of a percent of our federal budget (as a means of comparison), which is a small cost to pay for developing the option of the breeder for power generation. While the economic costs even at this low proportional level represent a substantial financial commitment, the significant extension of energy resources and reduction in environmental costs are well justified. The total of $1.9504 billion expended in the project will in turn maintain and generate jobs and income at numerous locations throughout the country. Similarly, minor secondary level environmental costs will be incurred in conjunction with the materials and fabrication components of these expenditures.

From a slightly different perspective, albeit less amenable to quantification, development of the breeder as an option for the generation of electrical energy can be justified on the basis of the benefits it provides as insurance or a means of risk aversion. Development of the breeder protects the nation's future interest in stable domestic energy supplies at reasonable cost. Should the breeder option be developed and future events prove that it is not needed, then the cost to the nation is that sunk cost of its development. Should, however, the breeder not be developed and should other presently nascent energy sources not be developed and available in time to meet energy demands, the societal cost to the nation would be immeasurably large. When the relatively minor risks of developing the breeder are balanced against the enormous risks which attend a failure to develop the breeder, the choice is clear. Timely completion of CRBRP will lead to timely availability of the breeder and

its benefits. On balance, the benefits to the nation of providing this vital step in developing the breeder option strongly outweigh the costs incurred on a national basis.

11.5.2 LOCAL LEVEL BENEFIT-COST BALANCE

The objectives of the CRBRP are directed toward serving national needs for a breeder power generation capability. Likewise, the major economic costs will be borne on a national level. However, the proposed CRBRP is to be specifically located at a site on the Clinch River in east central Tennessee. Those environmental and social costs directly resulting from the construction and operation of the CRBRP have been summarized in Section 11.4.1 and 11.4.3 and will be largely limited to the immediate region surrounding the site. These costs (1) are minimal in magnitude; (2) do not infringe upon indigenous environmental and social values; and (3) are favorably balanced with local benefits resulting from the project.

To balance with these environmental and social costs, there will be some local benefits as discussed in Section 11.2.2. Among the secondary benefits of the CRBRP are income and employment benefits expected to result from the construction and operation of the plant amounting to about 278.5 million in 1974 dollars of local income generation during the construction and demonstration periods. These benefits will stimulate economic growth and will provide a net benefit locally.

11.5.3 SUMMARY BENEFIT-COST BALANCE

The balance of benefits and costs has been evaluated for two constituencies of concern here - the national and the local. Favorable balances toward net benefits have been demonstrated in both cases. Because of the nature of this plant, a qualitative evaluation of benefits and costs has been necessary. On the national level, the significant benefits achievable in developing an optional power generator mode and the importance of the CRBRP to the program for attaining that goal strongly outweigh the primary

national cost - the economic cost. In addition, the local balance of benefits against environmental and social costs weighs in favor of the project.

12.0 ENVIRONMENTAL APPROVALS AND CONSIDERATIONS

The CRBRP will be titled in the United States and built on Government-owned land. The plant is subject to the comprehensive and broad-scale environmental procedures and Federal and State consultation requirements of the National Environmental Policy Act, 42 USC §§4331 et seq. (1976) (as implemented by E.O. 11991 [1977]); the regulations of the Council on Environmental Quality (40 CFR part 1500 [1979]); and Office of Management and Budget Circulars A-78 and A-81, relating to the prevention, control and abatement of air and water pollution in Federal facilities, as well as certain provisions of the Clean Air Act, as amended, (42 USC §§7401 et seq. [1977]) and the Clean Water Act, as amended, (33 USC §§1251 et seq. [1977]), which relate to the applicability of various Federal, State, interstate, or local air and water quality standards. In addition, the plant may be subject to certain requirements for the management and disposal of solid and hazardous wastes established under the Resource Conservation and Recovery Act of 1976 (42 USC §§6901 et seq. [1976]). Table 12.0-1 contains a detailed listing of sources for applicable Federal and State licenses, permits and approvals. This table is organized by project phase (construction only, construction and operation) environmental unit (land, air, water) and government level (federal, state). Individual entries specify the responsible governmental agency, summarize the actions covered, cite the legislation authorizing the approval and identify pertinent regulations. 9

Consistent with E.O. 12088, 3 CFR §243 (1979) on federal compliance with pollution control standards, the plant will be designed, constructed, managed, operated and maintained in compliance with applicable "substantive, procedural and other requirements that would apply to a private person" and in cooperation" with the Administrator of the Environmental Protection Agency, . . . State, interstate and local agencies" to prevent, control and abate environmental pollution. Gaseous and liquid effluents will not affect the quality of the air and waters, respectively, of other states.

The Nuclear Regulatory Commission has regulatory authority over the design, construction and operation of the facility. This Environmental Report constitutes a portion of the application for a construction permit for the CRBRP. It is prepared and submitted in compliance with 10 CFR 50 for review and analysis by the NRC. Contingent upon completion of this review and the receipt of a construction permit, an application will be filed for an operating license in adherence to the appropriate schedule.

As with any project of this magnitude, numerous contacts have been made with local and state officials and agencies. In keeping with current policy and practice, close coordination and cooperation with these officials and agencies will be maintained to insure that the project is implemented in accordance with applicable regulations and recommended practices.

TABLE 12.0-1

REQUIRED LICENSES, PERMITS, APPROVALS AND NOTIFICATIONS

	Agency	Purpose	Legislation	Regulations
CONSTRUCTION				
LAND				
Federal	Nuclear Regulatory Commission	Permit for construction of CRBRP	Atomic Energy Act 1954, as amended, 42 USC 2011	Domestic Licensing of Production and Utilization Facilities, 10 CFR 50
AIR				
State	Tennessee Department of Public Health, Bureau of Environmental Health Services, Division of Air Pollution Control	Permit for open burning of trees, limbs and brush during clearing	Tennessee Air Quality Act; Tennessee Code Annotated, Section 53-3408 et. seq.	Open Burning Tennessee Air Pollution Control Regulations, Chapter 1200-3-4
WATER				
Federal	United States Army Corps of Engineers	Army Corps Permit, covering all activities below normal water level (741' MSL): construction of water intake, wastewater discharge, barge facilities; fill placement for roadway and railroad bed; discharge of dredged or fill material	Clean Water Act, 33 USC 1344, Rivers and Harbors Act of 1899, 33 USC 403	Regulatory Program of the Corps of Engineers, 33 CFR 320-329,* Policy and Procedures for Implementing NEPA, 33 CFR 230 (45 Fed Reg 56761 Aug. 25, 1980)
	United States Environmental Protection Agency	Review and comment on Army Corps Permit	Clean Water Act, 33 USC 1344	Guidelines for Specification of Disposal Sites for Dredged or Fill Material, 40 CFR 230* (see 45 FR 85336, Dec. 24, 1980)
	Tennessee Valley Authority	Construction of intake and discharge structures and barge facilities; Access road and railroad fills (below maximum shoreline contour, elevation 750')	Tennessee Valley Authority Act of 1933, as amended, 16 USC 831y-1	Approval of Construction in the Tennessee River System and Regulation of Structures, 18 CFR 1304 (May 29, 1979)

(Continued)

TABLE 12.0-1 (Continued)

	Agency	Purpose of Approval	Legislation	Regulations
WATER (Continued)				
State	Tennessee Department of Public Health, Division of Water Quality Control	Water Quality Certification for Army Corps and TVA Permits	Clean Water Act, 33 USC 1341; Tennessee Water Quality Control Act, Tennessee Code Annotated, Section 70-324 et seq.	General Water Quality Criteria for the Definition and Control of Pollution in the Waters of Tennessee, Rules of the Tennessee Department of Public Health, Chapters 1200-4-3 and 1200-4-4
CONSTRUCTION AND OPERATION				
LAND				
Federal	United States Environmental Protection Agency**	Notification and manifests for generation or transportation of hazardous wastes; permits for storage, treatment or disposal of hazardous wastes	Resource Conservation and Recovery Act of 1976, 42 USC 6921-6931	Hazardous Waste Management System, 40 CFR 260-265; Consolidated Permit Regulations, 40 CFR 122-124
	United States Environmental Protection Agency	Compliance with EPA Guidelines for Disposal of Solid Waste	Solid Waste Disposal Act of 1965 as amended by Resource Recovery Act of 1970, 42 USC 3254(c), 42 USC 3254(e)	Guidelines for the Disposal of Solid Waste, 40 CRF 241 (1980)
State	Tennessee Department of Public Health, Division of Solid Waste Management	Permit to operate a solid waste disposal or processing operation	Tennessee Solid Waste Disposal Act of 1969, as amended, Tennessee Code Annotated, Section 53-4301, et. seq.	Regulations Governing Solid Waste Processing and Disposal Systems in Tennessee, Rules of the Tennessee Department of Public Health, Chapter 1200-1-7
	Tennessee Department of Public Health, Division of Solid Waste Management	Notification and manifests for generation or transportation of hazardous wastes; permits for storage, treatment or disposal of hazardous wastes	Tennessee Hazardous Wastes Management Act of 1977, Tennessee Code 53-6301	Emergency Rules Governing Hazardous Waste Management in Tennessee, Rules of the Tennessee Department of Public Health, Chapter 1200-1-11

(Continued)

TABLE 12.0-1 (Continued)

	Agency	Purpose of Approval	Legislation	Regulations
CONSTRUCTION AND OPERATION (Continued)				
AIR				
Federal	Federal Aviation Administration	Notice must be filed 30 days prior to construction of any structure 200 feet or more above ground (i.e., meteorological tower)	Federal Aviation Act of 1958, as amended, 49 USC 1301 et seq.	Objects Affecting Navigable Air Space, 14 CFR 77
	National Telecommunications and Information Administration	Frequency Authorization for U.S. Government station	Communications Act of 1934, as amended, 47 USC 305	Frequency Allocations and Radio Treaty Matters, General Rules and Regulations, 47 CFR 2; Executive Order 12046, March 27, 1978
	National Telecommunications and Information Administration	License for installing radio transmitters and associated towers	Communications Act of 1934, as amended, 47 USC 303	Construction, Marking and Lighting of Antenna Structures, 47 CFR 17
State	Tennessee Department of Public Health, Bureau of Environmental Health Services, Division of Air Pollution Control	Permits to construct and operate new air contamination source (fuel burning equipment, on-site concrete batch plant, fuel storage tanks and cooling tower)	Tennessee Air Quality Act; Tennessee Code Annotated, Section 53-3408 et seq.	Construction and Operating Permits Tennessee Air Pollution Control Regulations, Chapters 1200-3-9-.01 and 1200-3-9-.02
WATER				
Federal	United States Coast Guard	Authorization of private aids to navigation for structures in or over navigable waters of the United States (i.e., barge facility)	Laws and Regulations Governing Lands, 43 USC 1333; Aids to Navigation, 14 USC 81	Private Aids to Navigation, 33 CFR 66
	United States Coast Guard	Notification of discharge of oil or hazardous substances	Clean Water Act, 53 USC 1321	Control of Pollution by Oil and Hazardous Substances, Discharge Removal, 33 CFR 153
	United States Environmental Protection Agency**	Permit to discharge under National Pollutant Discharge Elimination System (NPDES), including review of cooling water intake	Clean Water Act, 33 USC 1342	NPDES Consolidated Permit Regulations, 40 CFR 122-125, 45 Fed Reg 33290, 5/19/80, Effluent Guide-lines and Standards for Steam Electric Power Generating, 40 CFR 423*

(Continued)

TABLE 12.0-1 (Continued)

	Agency	Purpose of Approval	Legislation	Regulations
CONSTRUCTION AND OPERATION (Continued)				
WATER (Continued)				
Federal (Continued)	United States Environmental Protection Agency	Spill Prevention Control and Countermeasure Plan	Clean Water Act, 33 USC 1321	Oil Pollution Prevention, 40 CFR 112, 116 and 117
	Council for Environmental Quality	Oil Pollution Control Measures	Clean Water Act, 33 USC 1321	National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR 1510
State	Tennessee Department of Conservation	Notification of withdrawal of 50,000 or more gallons of water per day from Clinch River	Water Rights in Tennessee, Tennessee Code Annotated, Section 70-2005	None
	Tennessee Department of Public Health, Division of Water Quality Control	Water Quality Certification of NPDES Permit if issued by U.S. EPA	Clean Water Act, 33 USC 1341; Tennessee Water Quality Control Act, Tennessee Code Annotated, Section 70-324 et seq.	General Water Quality Criteria for the Definition and Control of Pollution in the waters of Tennessee, Rules of the Tennessee Department of Public Health, Chapter 1200-4-3
	Tennessee Department of Public Health, Division of Water Quality Control	State Discharge Permit	Tennessee Water Quality Control Act, Tennessee Code Annotated, Section 70-330	Rules of Tennessee Department of Public Health, Chapters 1200-4-1, 1200-4-2, 1200-4-3 and 1200-4-5
	Tennessee Department of Public Health, Division of Water Quality Control	Approval of Engineering Report and Plans for wastewater treatment works, from intake to discharge	Tennessee Water Quality Control Act, Tennessee Code Annotated, Section 70-330	Rules of Tennessee Department of Public Health, Chapters 1200-4-1, 1200-4-2, 1200-4-3, 1200-4-5 and 1200-5-7*
RADIOACTIVE MATERIALS				
Federal	Nuclear Regulatory Commission	License for source material not covered by the plant Operating License	Atomic Energy Act of 1954, as amended, 42 USC 2073	Domestic Licensing of Source Material, 10 CFR 40
	Nuclear Regulatory Commission	License for special nuclear material not covered by the plant Operating License	Atomic Energy Act of 1954, as amended, 42 USC 2073	Domestic Licensing of Special Nuclear Material, 10 CFR 70

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TABLE 12.0-1 (Continued)

	Agency	Purpose of Approval	Legislation	Regulations
RADIOACTIVE MATERIALS				
Federal	Nuclear Regulatory Commission	License for by-product material	Atomic Energy Act of 1954, as amended, 42 USC 2111	General Domestic Licenses for By-product Material, 10 CFR 31
	Nuclear Regulatory Commission	General requirements for shipment of radioactive materials	Atomic Energy Act of 1954, as amended, 42 USC 2111	Packaging of Radioactive Materials for Transport, 10 CFR 71
	Department of Transportation	Transportation of radioactive materials	Department of Transportation Act, 49 USC 1801 et. seq.	Radioactive Materials, 49 CFR 173.389 et. seq.
	Department of Transportation	Permit for transportation of metallic sodium	Department of Transportation Act, 49 USC 1801 et. seq.	Metallic Sodium, 49 CFR 173.206
OTHER PERMITS				
Federal	Nuclear Regulatory Commission	Operating license to load fuel and to operate the CRBRP	Atomic Energy Act of 1954, as amended, 42 USC 2131-2133, 2138, 2232	Domestic Licensing of Production and Utilization Facilities, 10 CFR 50
	Nuclear Regulatory Commission	Reactor Operator License	Atomic Energy Act of 1954, as amended, 42 USC 2137	Operators' Licenses, 10 CFR 55

* Regulations or revisions of regulations have been proposed but not finalized as of 1/15/81.

** It is anticipated that the U.S. EPA will authorize the State of Tennessee to administer these programs.

SECTION 13.0 - REFERENCES

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