Final

environmental statement

related to construction of

BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2

TENNESSEE VALLEY AUTHORITY

DOCKET NOS. 50-438 and 50-439

ATOMIC ENERGY COMMISSION • UNITED STATES OF AMERICA •

JUNE 1974

UNITED STATES ATOMIC ENERGY COMMISSION

DIRECTORATE OF LICENSING

SUMMARY AND CONCLUSIONS

This Final Environmental Statement was prepared by the U.S. Atomic Energy Commission, Directorate of Licensing.

1. This action is administrative.

2. The proposed action is the issuance of construction permits to the Tennessee Valley Authority for the construction of the Bellefonte Nuclear Plant, Units 1 and 2 located on the Tennessee River in Jackson County, Alabama (Docket Nos. 50-438 and 50-439).

   The Bellefonte Nuclear Plant will employ two identical pressurized water reactors to produce 3600 megawatts thermal (MWt) each. A steam turbine-generator will use this heat to provide 1221 MWe (net) of electrical power capacity. A design power level of 3763 MWt, 1269 MWe (net), is anticipated at a future date and is considered in the assessments contained in this statement. The exhaust steam will be cooled by natural-draft cooling towers with water obtained from the Tennessee River.

3. Summary of environmental impact and adverse effects:

   a. The biota in the water taken from the reservoir will be killed upon passage through the plant. If cooling water is taken from the shore region as presently planned, a large number of ichthyoplankton and small fish will be destroyed. (Section 5.4.2.2)

   b. The design of the thermal discharge for the plant has not been finalized; however, with the assumption that a well-designed multiport submerged jet diffuser will be used, preliminary studies indicate that the adverse impacts will be small. (Section 5.4.2.3.1)

   c. Discharge of chemicals will not create a hazard. Biocide usage in the plant has not been completely formulated; when these details are complete, technical specifications will be written to assure that allowable concentrations are not exceeded. (Section 5.4.2)

   d. No significant environmental impacts are anticipated from normal operational releases of radioactive materials. The estimated dose to the public within 50 miles from operation of the plant is about 2 man-rem/year, less than the normal fluctuations in the 144,000 man-rems/year background dose this population would received. (Section 5.3)

e. The operation of the generating units will consume nuclear fuel, U_3O_8, and produce radioactive wastes. The transportation of the fuel and of the wastes will result in a dose impact of 14 man-rem/year to the population within and beyond the 50-mile radius from the plant. (Section 5.3)

f. The public risk associated with accidental radiation exposure is small. (Section 7)

g. Land use for the 1500-acre site is primarily agriculture and forestry. About 150 acres will be removed from natural production where buildings, parking lots, roads, etc., are built, although about 400 acres will be disturbed. Because of exclusion requirements, the past use of the land for farming will change. (Section 4.1)

   Land needed for new right-of-way easements to construct and operate the 73 miles of transmission lines is about 1550 acres. Only about 775 acres that are in woodland will have a significantly changed use because all other land, except for actual area used by the towers and permanent access roads, can continue in past use. (Section 4.1)

h. It is not anticipated that the adverse social impacts will be large. The applicant states that it will take mitigating action and aid local political bodies should a need arise. Individual displacements from the site and surrounding area are expected to be few. (Sections 4.3 and 5.5)

i. Turbidity and siltation resulting from soil erosion and dredging may harm aquatic organisms. This turbidity and siltation can be kept to a minimum with good construction practices. (Sections 4.2 and 6.2)

j. There will be some erosion of the soil on site and on the transmission line rights-of-way. The clearing of vegetation on rights-of-way may not be beneficial to wildlife. If broadcast application of herbicides is used, the possibility of unintended damage to vegetation and fauna exists. (Sections 4.1, 5.4, and Appendix B)

k. The two 500-foot natural-draft cooling towers will become a dominant landscape feature. Ground fog on Sand Mountain Plateau from the operation of the cooling towers may occur one or two days per year; icing frequencies will be less than for fogging. (Section 5.4.1)

Terrestrial vegetation, animal and microbial communities may be altered by cooling-tower operation because of increased moisture, decreased incoming solar radiation or chemicals contained in drift. However, such effects, if they occur, may not be measurable. (Section 5.4.1)

4. Principal alternatives considered:

   a. Alternative sites
   b. Alternative fuels
   c. Heat dissipation facilities
   d. Cooling-water intake design and location
   e. Transmission line routes, construction, and maintenance
   f. Site access

5. The following Federal, State and local agencies were requested to comment on the Draft Environmental Statement:

   Advisory Council on Historic Preservation
   Department of Agriculture
   Department of the Army, Corps of Engineers
   Department of Commerce
   Department of Health, Education and Welfare
   Department of Housing and Urban Development
   Department of the Interior
   Department of Transportation
   Environmental Protection Agency
   Federal Power Commission
   Alabama Department of Conservation and Natural Resources
   Alabama Development Office
   Alabama State Board of Education
   Alabama Historical Commission
   Alabama State Department of Public Health
   Top of Alabama Regional Council of Governments
   Alabama Water Improvement Commission
   Georgia Office of Planning and Budget
   Tennessee Office of Urban and Federal Affairs
   Tennessee Department of Public Health
   Mayor of the City of Hollywood, Alabama
   Mayor of the City of Scottsboro, Alabama
   Board of Education, Jackson County
   Board of Education, City of Scottsboro

6. The Final Environmental Statement was made available to the public, to the Council on Environmental Quality, and to the agencies noted above in June 1974.

7. On the basis of the analysis and evaluation set forth in this statement, after weighing the environmental, economic, technical and other benefits of the Bellefonte Nuclear Plant against environmental and other costs and considering available alternatives, it is concluded that the action called for under the National Environmental Policy Act of 1969 (NEPA) and Appendix D to 10 CFR Part 50 is the issuance of a construction permit for the facility subject to the following conditions for the protection of the environment.

   a. An approved one year sampling program, as outlined in Section 5.4.2.5 and 6.2.1.1 will be implemented to obtain data necessary for assessment of the significance of the loss of icthyoplankton through entrainment in the proposed intake.

   b. Prior to commencement of construction activities which would foreclose options for alternate intake designs and/or locations, the data resulting from the program specified in (a) above shall be submitted to the staff for review and shall form the basis for a final decision on the acceptability of the proposed intake. Key decision points will be:

      (1) Five percent loss of icthyoplankton, below which the impact will be judged insignificant and the proposed intake acceptable, and

      (2) Twenty-five percent loss of icthyoplankton, above which the loss will be judged unacceptable and require redesign or relocation of the intake to minimize impact.

   Estimates ranging between 5 percent and 25 percent will be subjected to intensive evaluation and a decision concerning intake acceptability will be made on the basis of severity of impact on key species, absolute magnitude of loss, characteristics of entrained population, and other such factors having a bearing on impact significance.

   c. The applicant shall not use the broadcast application of herbicides on the right-of-way covered under Step One (Section 3.3) of the transmission line construction plan. (Section 5.4.1 and Appendix B).

   The applicant shall conduct studies which will assess the impacts of various alternative methods of transmission line construction and maintenance, and prior to any construction of Steps Two and Three (Section 3.3), the applicant shall submit (1) for staff evaluation the results of these studies and (2) an updated version of its proposed clearing and maintenance methods for staff approval. This submittal should include analysis of cost experience factors as well as environmental impacts such as the effects on vegetation, wildlife and soil stability. (Sections 4.1.2 and 9.2.4)

d. Prior to initiating construction of the discharge facility, the applicant shall provide the results of thermal-hydraulic analytical studies and plans for physical modelling experiments to be conducted in support of the final design and location of the plant cooling water discharge. (Sections 5.4.2.2.1 and 9.2.5)

e. The applicant shall take the necessary mitigating actions, including those summarized in Section 4.4 of this Environmental Statement, during construction of the plant and associated transmission lines to avoid unnecessary adverse environmental impacts from construction activities.

f. A control program shall be established by the applicant to provide for a periodic review of all construction activities to assure that those activities conform to the environmental conditions set forth in the construction permit.

g. Before engaging in a construction activity which may result in a significant adverse environmental impact that was not evaluated or that is significantly greater than that evaluated in this Environmental Statement, the applicant shall provide written notification to the Director of Licensing.

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FOREWORD

This environmental statement was prepared by the U. S. Atomic Energy Commission, Directorate of Licensing (the staff) in accordance with the Commission's regulation, 10 CFR 50, Appendix D, which implements the requirements of the National Environmental Policy Act of 1969 (NEPA).

The NEPA states, among other things, that it is the continuing responsibility of the Federal Government to use all practicable means, consistent with other essential considerations of national policy, to improve and coordinate Federal plans, functions, programs, and resources to the end that the Nation may:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations.
- Assure for all Americans safe healthful, productive, and esthetically and culturally pleasing surroundings.
- Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences.
- Preserve important historic, cultural, and natural aspects of our national heritage, and maintain wherever possible, an environment which supports diversity and variety of individual choice.
- Achieve a balance between population and resource use which will permit high standards of living and a wide sharing of life's amenities.
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

Futher, with respect to major Federal actions significantly affecting the quality of the haman environment, Section 102(2)(C) of the NEPA calls for preparation of a detailed statement on:

(i) the environmental impact of the proposed action;

(ii) any adverse environmental effects which cannot be avoided should the proposal be implemented;

(iii) alternatives to the proposed action;

(iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity; and,

(v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented.

An environmental report accompanies each application for a construction permit or a full-power operating license. A public announcement of the availability of the report is made. Any comments by interested persons on the report are considered by the staff. In conducting the required NEPA review, the staff meets with the applicant to discuss items of information in the environmental report, to seek new information from the applicant that might be needed for an adequate assessment, and generally to ensure that the staff has a thorough understanding of the proposed project. In addition, the staff seeks information from other sources that will assist in the evaluation and visits and inspects the project site and surrounding vicinity. Members of the staff may meet with State and local officials who are charged with protecting State and local interests. On the basis of all the foregoing and other such activities or inquiries as are deemed useful and appropriate, the staff makes an independent assessment of the considerations specified in Section 102(2)(C) of the NEPA and Appendix D of 10 CFR 50.

This evaluation leads to the publication of a draft environmental statement, prepared by the Directorate of Licensing, which is then circulated to Federal, State and local governmental agencies for comment. A summary notice is published in the Federal Register of the availability of the applicant's environmental report and the draft environmental statement. Interested persons are requested to comment on the proposed action and the draft statement.

After receipt and consideration of comments on the draft statement, the staff prepares a final environmental statement, which includes a discussion of questions and objections raised by the comments and the disposition thereof; a final benefit-cost analysis, which considers and balances the environmental effects of the facility and the alternatives available for reducing or avoiding adverse environmental effects with the environmental, economic, technical, and other benefits of the facility; and a conclusion as to whether--after the environmental, economic, technical, and other benefits are weighed against environmental costs and after available alternatives have been considered, the action called for, with respect to environmental issues, is the issuance or denial of the proposed permit or license or its appropriate conditioning to protect environmental values. This final environmental statement and the safety evaluation report prepared by the staff are submitted to the Atomic Safety and Licensing Board for its consideration in reaching a decision on the application.

Single copies of this statement may be obtained by writing the Deputy Director for Reactor Projects, Directorate of Licensing, U. S. Atomic Energy Commission, Washington, D. C. 20545. Mr. Gerald L. Dittman is the AEC Environmental Project Manager for this statement. (301-443-6990).

1. INTRODUCTION

1.1 THE PROPOSED PROJECT

The Tennessee Valley Authority (TVA) is a corporate agency of the United States created by the Tennessee Valley Authority Act of 1933.[1] In addition to its programs of flood control, navigation, and regional development, TVA operates a power system supplying the power requirements for an area of approximately 80,000 square miles containing about six million people. Except for direct service by TVA to certain industrial customers and Federal installations with large or unusual power requirements, TVA power is supplied to the ultimate consumer by 160 municipalities and rural electric cooperatives which purchase their power from TVA. TVA is interconnected at 26 points with neighboring utility systems.

The TVA generating system consists of 30 hydro generating plants, one nuclear and 12 fossil-fueled steam generating plants now in operation; also, gas turbines are located at two of the steam plants. In addition, power from the Corps of Engineers' dams in the Cumberland River basin and dams owned by the Aluminum Company of America on Tennessee River tributaries is made available to TVA under long-term contracts.

The Bellefonte Nuclear Plant is proposed to satisfy in part TVA's obligation to supply an ample amount of electricity to the area which TVA serves. The decision on the granting of a construction permit is scheduled for February 1975.

Construction is scheduled to start soon thereafter. The Final Safety Analysis Report will be submitted to the Atomic Energy Commission (AEC) at a later date, with a request for authorization to operate both units of the plant at the designed power level. Under the current schedule, TVA expects to start loading nuclear fuel in Unit 1 in March 1979. Full-power operation of Unit 1 is expected in September 1979; Unit 2 is expected to go into operation in June 1980. It should be noted that although the two units will begin operation at different times, this environmental statement assesses the plant with both units in operation.

The proposed site is located on a tract of land consisting of approximately 1500 acres on a peninsula at Tennessee River mile (TRM) 392 on the west shore of Guntersville Reservoir about six miles east-northeast of Scottsboro, Alabama. The site lies on the southeast side of Browns Valley. The main land-use activities are forestry and agriculture; however, urban-industrial development is planned along Guntersville Reservoir in the vicinity of the site.

The proposed plant will have the following principal structures on the site: two reactor containment buildings, turbine building, auxiliary building, service building, condenser circulating water pumping station, two diesel-generator buildings, river intake pumping station, two natural-draft cooling towers, transformer yard, 500-kV and 161-kV switchyards, and sewage treatment facilities. Each reactor containment building houses an identical pressurized water reactor designed and manufactured by Babcock & Wilcox. The proposed two-unit plant will have a total electrical generator nameplate rating of 2664 megawatts. Figure 1.1 shows the preliminary arrangement of these facilities; however, the arrangement may change as design of the plant progresses.

Heat is rejected from the steam cycle through a condenser cooled with recirculated water. This water in turn is cooled by passage through natural-draft evaporative-cooling towers. Although the cooling system is of the so-called closed type, makeup water from the Tennessee River (Guntersville Lake) is needed to replace water losses due to evaporation, drift and blowdown.

1.2 STATUS OF REVIEWS AND APPROVALS

As a Federal agency, TVA is subject to the requirements of the National Environmental Policy Act of 1969 (NEPA). In addition to filing their Draft Environmental Statement, which is contained in two volumes, TVA has submitted in response to AEC questions three documents:

1. TVA Responses to AEC's Comments on Bellefonte Draft Environmental Statement - July 12, 1973.

2. TVA Responses to Second Set of AEC Comments on Bellefonte Draft Environmental Statement - Oct. 5, 1973.

3. Additional TVA Responses to Second Set of AEC Comments on Bellefonte Draft Environmental Statement - Oct. 25, 1973.

In this statement the staff uses the convention of referring to TVA's original statement and three responses as the TVA DES.

In addition to meeting the requirements of NEPA, TVA is also required to obtain a permit under Section 402, National Pollutant Discharge Elimination System, of the "Federal Water Pollution Control Act Amendment of 1972." At the present time, there is no application for a permit under this act. TVA can file separately, at least 180 days before discharge, an application for a permit allowing discharge from the temporary construction sewage treatment plant.

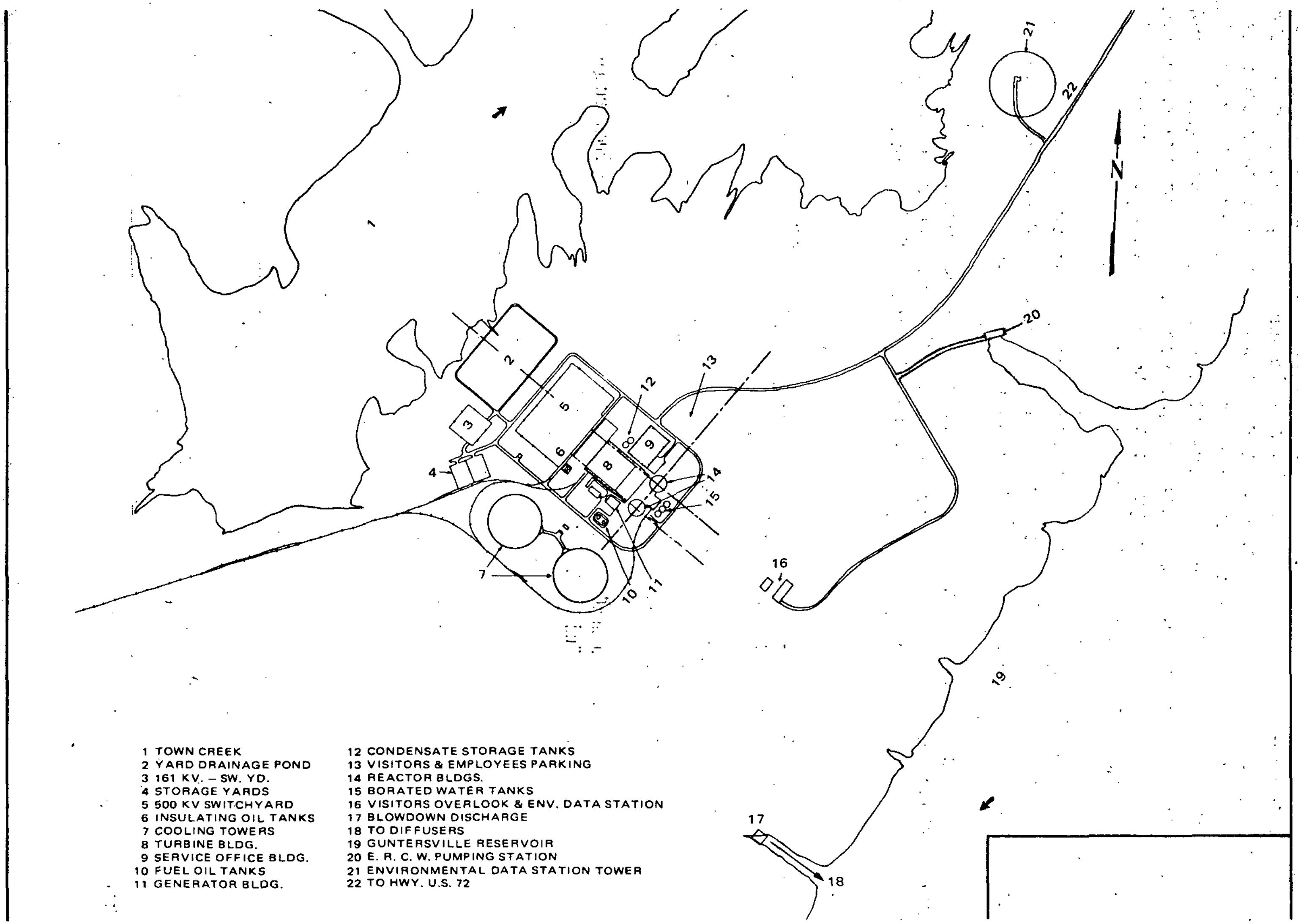

Fig. 1.1. Preliminary Layout of Bellefonte Plant. From TVA DES.

In addition, TVA is subject to Executive Orders 11593[2] and 11752[2] and Office of Management and Budget Circulars A-78 and A-81, relating to the prevention, control, and abatement of air and water pollution from Federal facilities, as well as certain provisions of the Clean Air Act as amended.[3] Also, TVA is subject to the requirements of the Office of Management and Budget Circular A-95 which insure that major generating and transmission projects are coordinated from the point of view of community impact and land use planning with State and local agencies.

The TVA has been consulting with State and regional organizations since January 1971 about the possibility of a nuclear plant at the Bellefonte site and its implications on the development of the area.

On January 19, 1971, TVA's regional planning staff met with the Top of Alabama Regional Council of Governments (TARCOG) staff to discuss the sites in northern Alabama which might be the location for a nuclear plant.

References

1. Tennessee Valley Authority Act of 1933, 48 Stat. 58, as amended, 16 U. S. C. § 831-313 dd. 1970.

2. 36 Fed. Reg. 8921 and 38 Fed. Reg. 34793.

3. 42 U. S. C. A § 1857, 1970.

2. THE SITE

The information contained in this section is largely based on the TVA's DES. Additional information may be found in that document and the other references cited.

2.1 HISTORY

The Bellefonte site is in Jackson County in the northeastern corner of Alabama. When the county was formed in 1819, Santa Cave was made the temporary county seat, but in 1821 Bellefonte was chosen. In 1850, the county seat was moved to Scottsboro, where it has remained.[1]

2.2 TOPOGRAPHY

Figure 2.1 shows the geographical location of the plant and the Tennessee Valley region. The tract of land selected for the Bellefonte site is moderately wooded with steep hills on the eastern portion. The plant will be located west of these hills. On the site, the land rises from the water surface (normal maximum level elevation 595 feet above mean sea level) to a hill crest approximately 800 feet. Across the Tennessee River, the west escarpment of Sand Mountain rises to approximately 1400 feet. The topographic features of the site are shown in Fig. 2.2.

2.3 GEOLOGY

The site lies on the southeast side of Browns Valley, which separates Sand Mountain on the southeast from the rest of the Cumberland Plateau to the northwest. Browns Valley in Alabama and its northeastward extension in Tennessee -- Sequatchie Valley -- were formed by the erosion of an anticlinal structure which extends for over 150 miles from Blount Springs, Alabama, northeastward to Crab Orchard, Tennessee. The rock strata exposed by the anticline varies from Cambro-Ordovician dolomite in the core up through Ordovician limestone; Silurian limestone, shale, and sandstone; Mississippian limestone and shale; to Pennsylvanian sandstone and shale on Sand Mountain and the Cumberland Plateau.

Structures at the Bellefonte site will be founded on Chickamauga limestone of Middle Ordovician Age. Such limestone strata occur along the entire length of the eastern side of the anticlinal valley and along most of the western side.

There is no mining of minerals in the site area. Studies of potential iron ore deposits in the Guntersville Reservoir area disclosed no commercially mineable ore. There is a coal stripmine covering more than two square miles

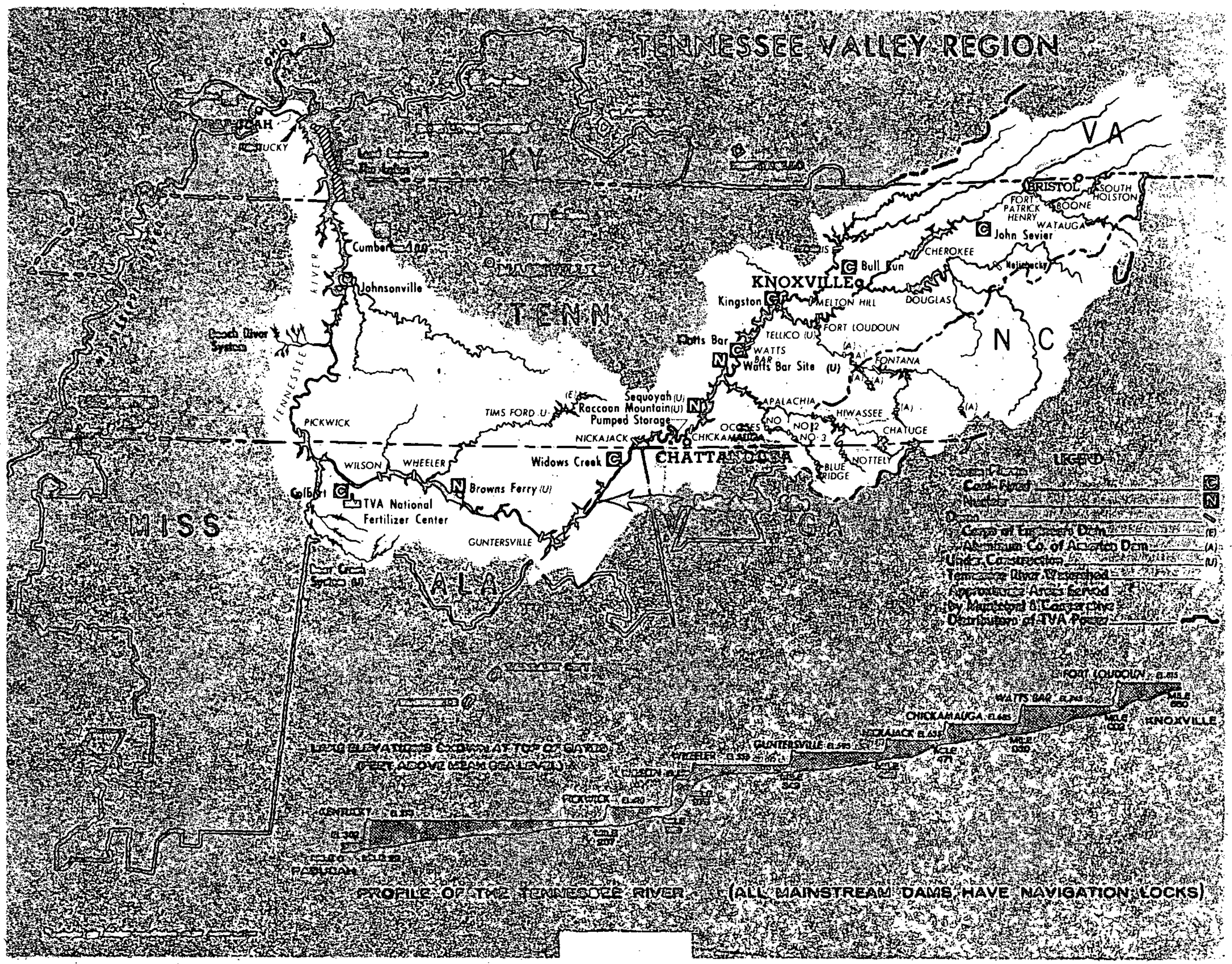

Fig. 2.1. Location of the Bellefonte Site. From TVA DES.

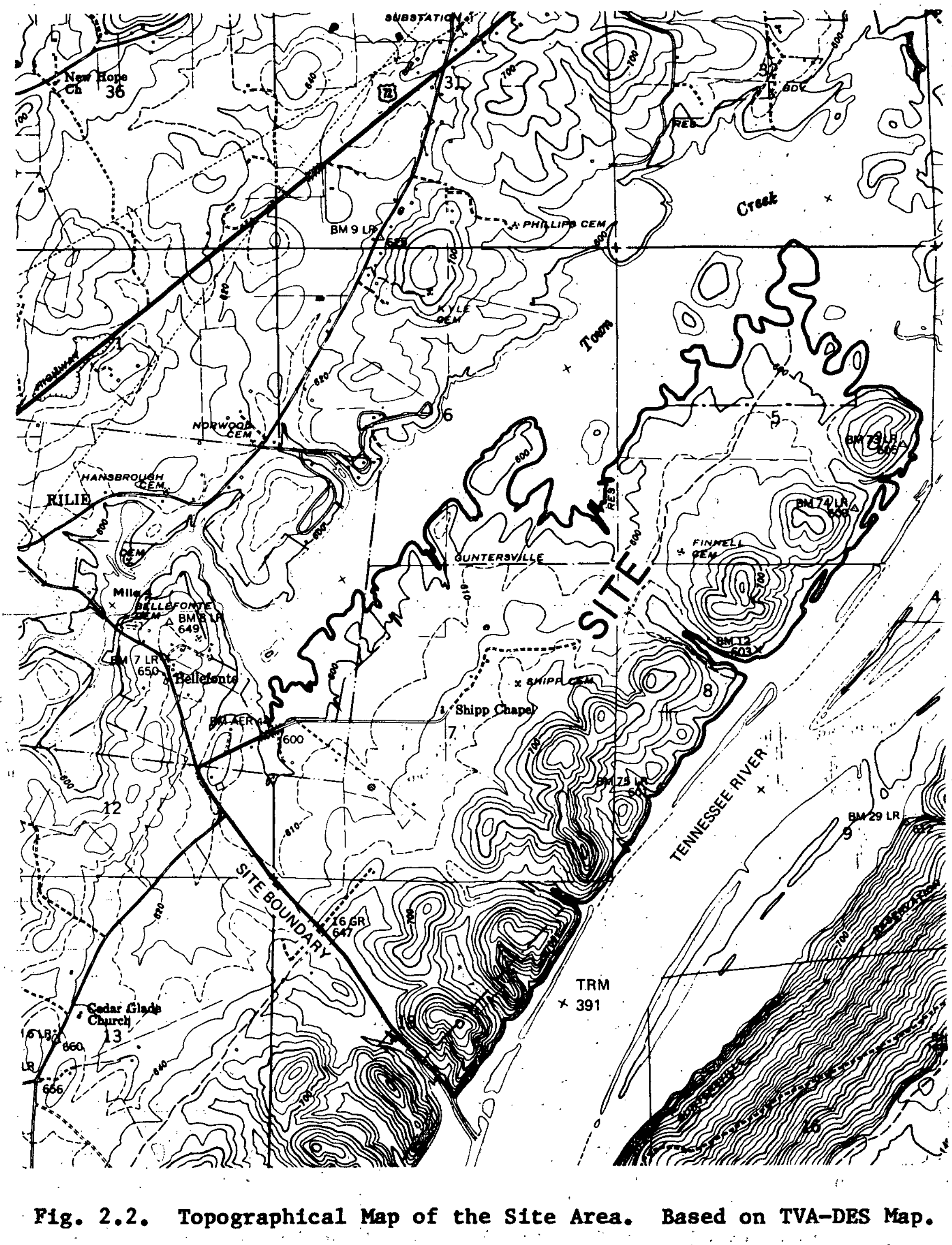

Fig. 2.2. Topographical Map of the Site Area. Based on TVA-DES Map.

about ten miles northeast of the site on the left side of the reservoir. There is some potential for oil and gas production in the area. Only two exploratory holes have been drilled in Jackson County, both in 1913.[2] One was near Stevenson and the other near Bridgeport. Both were non-productive; however, a comment from the Geological Survey of Alabama to the Alabama Development Office contained this observation:

> "It is the opinion of the Alabama Geological Survey that the Cambro-Ordovician sediments which underline this area do possess good potential for the production of oil or gas."[3]

The development of the site for nuclear power does not preclude recovery of these possible resources.

2.4 SEISMOLOGY

The Southern Appalachian seismotectonic province encompasses the site. The nearest local quake which had a Modified Mercalli intensity of V, was centered five miles west of the site, and the nearest known epicenter of a damaging quake (MM VII) was approximately 50 miles south of the site. The maximum intensity felt at the site from the latter quake was probably no higher than MM IV. In the recorded history of the area, the maximum intensity felt at the site is probably MM V, certainly no more than MM VI. The seismic history of the Bellefonte area is similar to that for the Sequoyah Nuclear Plant.[4]

2.5 METEOROLOGY[5-18]

2.5.1 Regional Climatology

Topography in the area of the Bellefonte site is complex, and can result in marked variations in local wind characteristics. The wind pattern within the Tennessee River valley in the area of the site is distinctly bimodal, northeasterly down-valley and southwesterly up-valley. The climate is generally moderate, influenced during much of the year by the anticyclonic circulation of the Azores-Bermuda high pressure system. The site lies near the path of winter cyclones generated along the western edge of the Appalachian Mountains. This circulation pattern results in cold and dry continental air masses predominating during the winter, with the cool periods occasionally broken by warm, moist air from the Gulf of Mexico pressing northward. As a result of the winter storm track and the contrasts between the alternating air masses, over 40% of the normal annual precipitation occurs from December through March.

Spring is characterized by the more frequent appearance of warm, moist air masses and the resulting severe weather phenomena usually generated during periods of transition. Spring-season thunderstorms are likely to be more severe than those in other seasons.

As the Azores-Bermuda high pressure system exerts its influence on the summer circulation pattern, conditions become generally warm and more humid with temperatures usually in the high eighties and low nineties and afternoon thunderstorms are quite frequent.

Fall is usually dry and pleasant, since the air masses affecting the area are generally cooler, and the thunderstorm activity of summer decreases sharply. The first freeze usually occurs around the first of November.

2.5.2 Local Meteorology

Based on meteorological measurements at Scottsboro, Alabama, and Chattanooga, Tennessee (seven miles west-southwest, and 45 miles east-northeast of the site, respectively), mean monthly temperatures at the site may be expected to range from about 43°F in January to about 80°F in July.[15,17] The record minimum temperature recorded in the region is -16°F at Scottsboro in February 1905. The record maximum temperature at Scottsboro is 109° in July 1930. At Chattanooga, temperatures may be expected to reach 90°F or higher on about 53 days per year and fall below 32°F on about 53 days.

Precipitation is primarily associated with the winter and spring seasons, with December through May accounting for nearly 60% of the normal annual precipitation. Data from the Widows Creek Steam Plant (about 15 miles northeast of the site) indicates a maximum monthly average of 6.06 inches in March and a minimum monthly average of 2.44 inches in October.[17] Chattanooga data indicate the maximum monthly average of 5.64 inches in March, and a minimum monthly average of 3.02 inches in October. The maximum monthly precipitation value recorded at the Widows Creek Station was 15.47 inches, while the maximum monthly precipitation at Chattanooga was 13.68 inches in December 1961. Minimum monthly values have been 0.27 inches at Widows Creek and 0.20 inches at Chattanooga. Average annual snowfall in the area ranges from 2.8 inches at Scottsboro to 4.5 inches at Chattanooga. Maximum monthly snowfall reported was 10.0 inches at Scottsboro and 10.4 inches at Chattanooga.

Limited wind data are available from a 130-ft tower, 2.2 miles north-northeast of the plant site, and a 33-ft tower at the proposed location of the reactor structures. The offsite tower data, for the period August 1972-July 1973, indicate the distinctive bimodal wind characteristics of the river valley site location. Winds from the north-northeast and northeast directions occur almost 27% of the time, while winds from the south-southwest and southwest occur about 21% of the time. Wind data from the 10m onsite tower for the period November-July 1973 indicates winds from the NNE and NE directions occur about 24% of the time, and winds from the SSW and SW occur about 23% of the time. Figure 2.3 shows the wind rose for the offsite tower and Fig. 2.4 shows the wind rose for the onsite tower. The "fastest mile" of wind recorded at Chattanooga was 82 mph.[15]

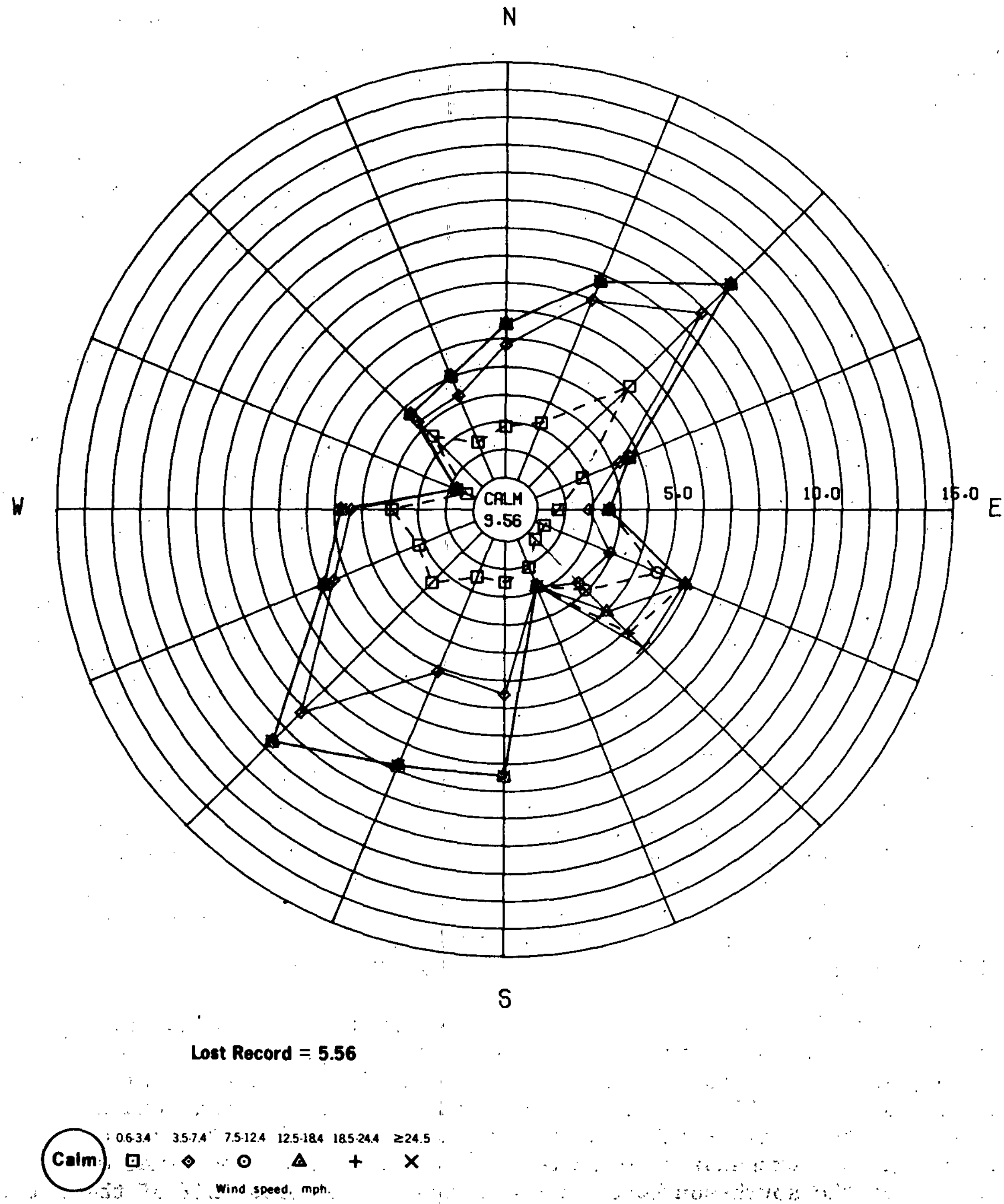

Fig. 2.3. Offsite Windrose for May 12-December 13, 1972. The facility is 2.2 mi. NNE of the Bellefonte Site, 610 ft MSL. The wind instrument is 130 ft above ground. Wind speed is extrapolated to 33 ft above ground. From Fig. 2.3-17, Bellefonte PSAR.

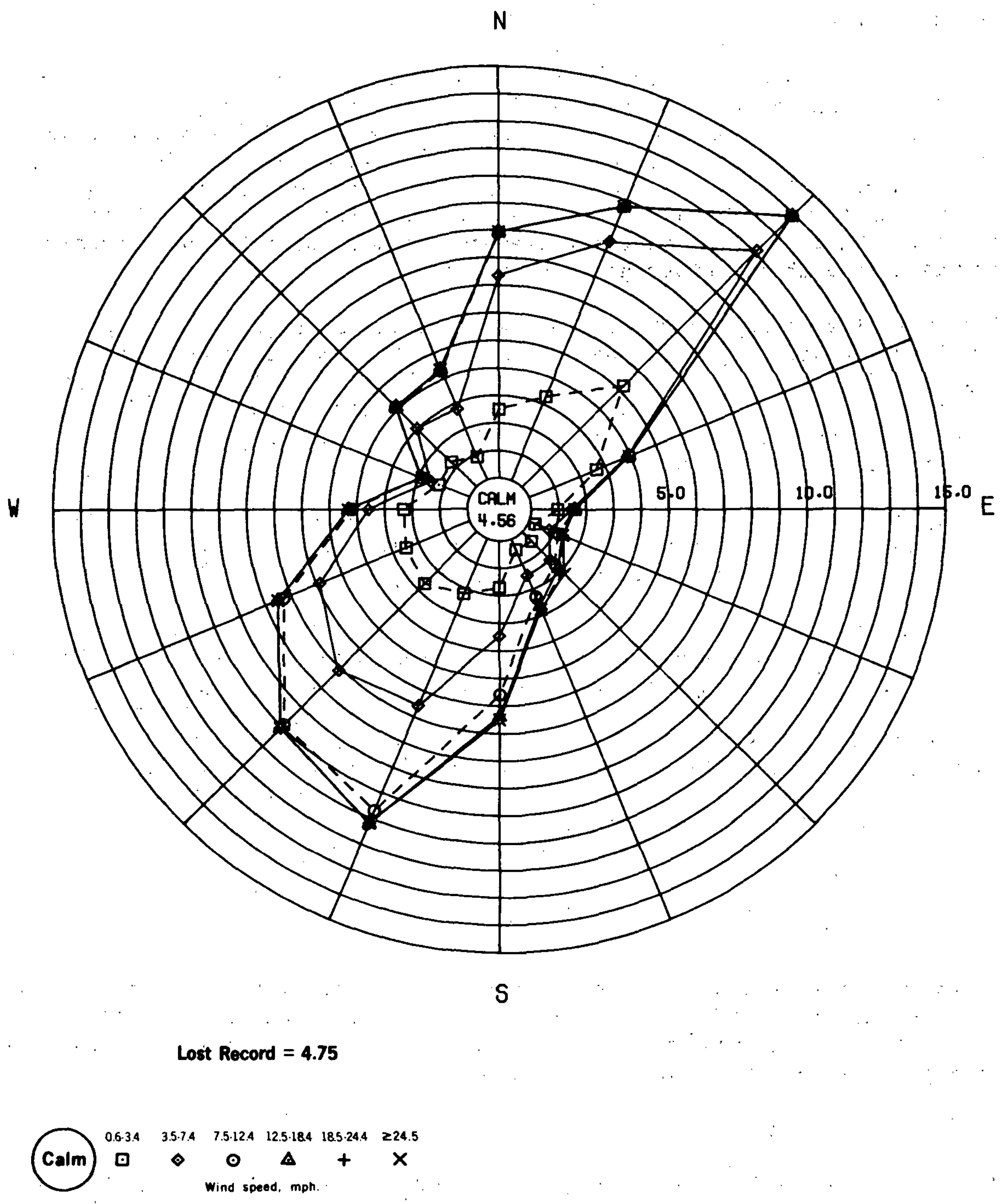

Fig. 2.4. Onsite Windrose for October 20-December 31, 1972. Facility is on site at 620 ft MSL. The wind instrument is 33 ft above ground. From Fig. 2.3-26, Bellefonte PSAR.

2.5.3 Severe Weather

The primary cause of severe weather conditions at the site is from warm, moist unstable air masses from the Gulf of Mexico contacting cold, dry continental air masses pressing southward and eastward. Thunderstorms can be expected to occur about 55 days per year, being most frequent in June, July, and August.[17] These three months account for an average of 31 thunderstorm days. The most severe thunderstorms occur during the spring. Thunderstorms are least frequent from October through January, averaging one thunderstorm day each month.

The site lies nearly on the border between two one-degree latitude-longitude squares. During the period 1955-1967, 38 tornadoes were reported in the one-degree square west of the site while 18 were reported in the one-degree square east of the site. A mean annual tornado frequency representative of the site is about 2.2, giving a computed recurrence interval of about 640 years.

During the period of 1955-1967, an average of 14 reports of hail 3/4 inch or larger and 31 windstorms of 50 knots or greater were estimated for the one-degree latitude-longitude square containing the site.

Ice storms of freezing rain or glaze are not uncommon; occasionally mid-winter icing becomes severe enough to do some damage in the area. No quantitative statistics on icing are available to the staff at this time.

The potential for high air pollution (atmospheric stagnation) exists on about 30 days every five years. In the period 1936-1965, there were 70 cases of atmospheric stagnation of four days or more. October had the most (about 20) cases reported.

2.6 HYDROLOGY AND WATER QUALITY

2.6.1 Ground Water

Ground water at the site comes principally from local precipitation. There is no distinct aquifer in the Chickamauga limestone at the Bellefonte site, and most of the ground water flow moves through the residual soil overlying rock paralleling the topographic surface.

2.6.2 Surface Water

The site is located 43 miles upstream of Guntersville Dam on the Guntersville Reservoir. At normal pool elevation of 595 feet, the reservoir is 75.7 miles long with an area of 67,900 acres, a volume of 1,000,000 acre-feet, a shoreline length of 949 miles, and a width which ranges from 900 feet to 2.5 miles.

At the site the river is about 3400 feet wide, with depths up to 30 feet at normal pool elevation. Navigation is provided by maintaining a minimum channel depth of 11 feet. Flow is in general toward the southwest.

Records of the Tennessee River maintained at South Pittsburg, Tennessee, and Hales Bar Dam for the period 1931 through 1970 show an average discharge of 35,300 cfs at South Pittsburg. The flow at Bellefonte would be about three percent greater. During the summer months (May-October) the flow averages 27,100 cfs and during the winter months (November-April), 44,200 cfs. Since 1874 until 1940, the lowest daily flow at the plant site was 3400 cfs in 1925. Beginning in 1940, it has been possible to regulate flow by operation of the upstream dams and Guntersville Dam.

Channel velocities at the plant site average 1.1 fps under normal winter flow conditions and 0.6 fps under normal summer flow conditions. Reversals of flow into the embayments and the river occur as a result of water management practices.

The sanitary-chemical and mineral quality of Guntersville Reservoir is good. The mineral quality of the water is satisfactory for almost any municipal or industrial use. The radiological quality of the water is indicated by samples collected at two stations slightly downstream from the site. Alpha activities ranged from 0 to 2 picocuries per liter, while beta activity ranged from 7 to 233 picocuries per liter, which are well below allowable limits.

Water use in the area is not limited to reservoir water, since several public and private water supplies are taken from ground water sources, but these withdrawals are small compared with reservoir uses.

There are seven public water systems that take their water from Guntersville Reservoir and its tributary embayments. The nearest downstream ones are the Scottsboro and the Sand Mountain Water Authorities, 6.2 and 9.9 miles below the site. Thirteen public waterworks using ground water are within a 20-mile radius of the site. The one nearest the site is 3.4 miles west at Hollywood, serving 485 people. In addition, two public water companies (Bridgeport and Arab, Alabama) use both surface waters of Guntersville Reservoir and wells as their source of supply.

There are four industrial waterworks taking water from Guntersville Reservoir and its tributary embayments. Only one -- the TVA Widows Creek Steam Plant -- is within 20 miles of the site. The nearest downstream industrial water intake is for the Monsanto synthetic fiber plant (TRM 365) 27 miles downstream. Water from this intake is also used for potable water within the plant. All other industries in the vicinity of the site purchase their process and potable water from public systems.

The Tennessee River supplies water for many power plants. Besides the previously mentioned Widows Creek Steam Plant, there is the Raccoon Mountain pumped storage and the Sequoyah Nuclear Plant short distances upstream. Downstream on the Wheeler Reservoir is the Browns Ferry Nuclear Plant.

The reservoir supports both recreational and commercial fisheries of some magnitude. The total commercial catch from Guntersville Reservoir for 1971 is estimated to be 816,000 kilograms.[19] A survey made by the applicant estimated that Mud Creek embayment produced 1349 kg of sport fish for 4362 hours of fishing between April 16 and July 1, 1972.[20]

2.7 LAND USE

2.7.1 General

For many years, the relative isolation due to the topography associated with the Cumberland Plateau has kept the towns within the Sequatchie Valley and its extension into northern Alabama from the mainstream of industrialization and urbanization occurring in the Great Valley (Chattanooga and Gadsden) and on the Highland Rim (Tullahoma and Huntsville). However, in recent years, several urban-industrial nodes have been developing along the Guntersville Reservoir within the Sequatchie Valley extension (Guntersville, Scottsboro, Stevenson, Bridgeport, and South Pittsburg). Better road access, ample labor and available waterfront sites have all contributed to the gradual extension of urban-industrial development into the valley. Scottsboro, about six miles west-southwest of the site, is the nearest and most important emerging center with a 1970 population of 9324.

Surrounding these urban-industrial nodes in the bottomland are extensive agricultural areas. On the Cumberland Plateau to the east, very low-density residential development is scattered among farms specializing in high-value cultivated crops. To the west, the plateau is more suitable for forestry and forest-related activities.

2.7.2 Industrial Operations

Several manufacturing plants are located in and around Scottsboro. The two most important ones are the Revere Copper and Brass Corporation and the Goodyear Tire and Rubber Company.

2.7.3 Farming

Jackson County, according to the 1969 Census of Agriculture, had about 44 percent of its land area in farms. The average size of the 2044 farms was 145 acres, with only 85 being 200 acres or larger. Farm sales were derived principally from livestock, poultry, and their products, with the major farm sales in poultry and poultry products (about 34.8 percent of gross farm sales). The average value of farmland in Jackson County was $200 per acre in 1969. Since then, land values in Alabama have risen from an index of 117 on March 1, 1969 to 200 in November 1973. If land values in Jackson County rose at the same rate as those in Alabama as a whole, the current value of farmland in Jackson County would be $342 per acre.

If gross sales of farm products increased at a rate similar to that of real estate values, the gross sales would be about $11,600 per farm or $80 per acre.

2.7.4 Land Transportation

U. S. Highway 72, connecting Chattanooga, Tennessee, and Huntsville, Alabama, passes about two miles to the northwest of the proposed site. Interstate Highway 59 is approximately 20 miles to the southeast of the site. The Southern Railway line between Chattanooga and Huntsville passes about three miles northwest of the site. The site is accessible by good local roads, but a new access road must be constructed or the existing roads upgraded for a short distance. A spur line will be built from the Southern Railroad to the site.

2.7.5 Recreation

Guntersville Reservoir is especially attractive for water-based recreation. With an average annual use level of over five million visits, it ranks second in popularity among all TVA reservoirs. Reservoir use is concentrated primarily in the seven-month period from April through October.

Recreation developments on the reservoir include a state park, three county parks, five municipal parks, three wildlife management areas, 26 public access areas, 28 commercial docks or resorts, and several private group camps and club sites. TVA and the State of Alabama plan to augment the system of public access areas on the reservoir, and several of the public parks will be expanded over the next few years.

Away from Guntersville Reservoir a variety of recreational attractions exist within a 60-mile radius of the Bellefonte site. Included within this area are all or parts of several federal or private reservoirs, a portion of the Chattahoochee National Forest, the Wheeler National Wildlife Refuge, Russell Cave National Monument, several State parks and forests, and several commercial recreation attractions.

2.7.6 Wildlife Areas

Several wildlife management areas are located in the vicinity of the site. Three, primarily for waterfowl, are located on North Sauty Creek, Mud Creek, and Crow Creek embayments. An upland game area, Skyline Game Management Area, is about 13 miles north of the site.

2.7.7 Population Distribution

Jackson County is sparsely settled, having a 1970 population of 39,202. Net population growth in the county between 1960 and 1970 totaled 2521, a 6.9 percent increase. Scottsboro is the largest city in the area with a 1970 population of 9324. The remainder of the population is scattered among farms, rural nonfarm residences, and small towns of less than 3000 people. The population centers in the vicinity of the Bellefonte site are shown in Fig. 2.5. Figures 2.6 and 2.7 show the 1970 population distributions within 10 miles and 50 miles respectively of the site. Figure 2.8 shows projected year 2020 population distributions. For the year 2020 the estimated population within 50 miles of the site is 1,650,000.

2.7.8 Waterways

Recent figures on barge and recreational traffic use of the river both upstream at Nickajack Lock and downstream at Guntersville Lock are given below:

		Guntersville Lock	*Nickajack Lock*
Tons	1971	4,955,888	2,808,638
	1972	4,057,000	2,526,000
Number of barges	1971	7,227	4,701
	1972	6,009	5,253
Number of tows	1971	1,158	1,057
	1972	1,011	1,261
Number of recreational craft	1971	3,127	1,098
	1972	3,847	1,427

TVA estimates indicate that Tennessee River traffic will experience an average growth rate of about 4.8 percent annually to 1980.

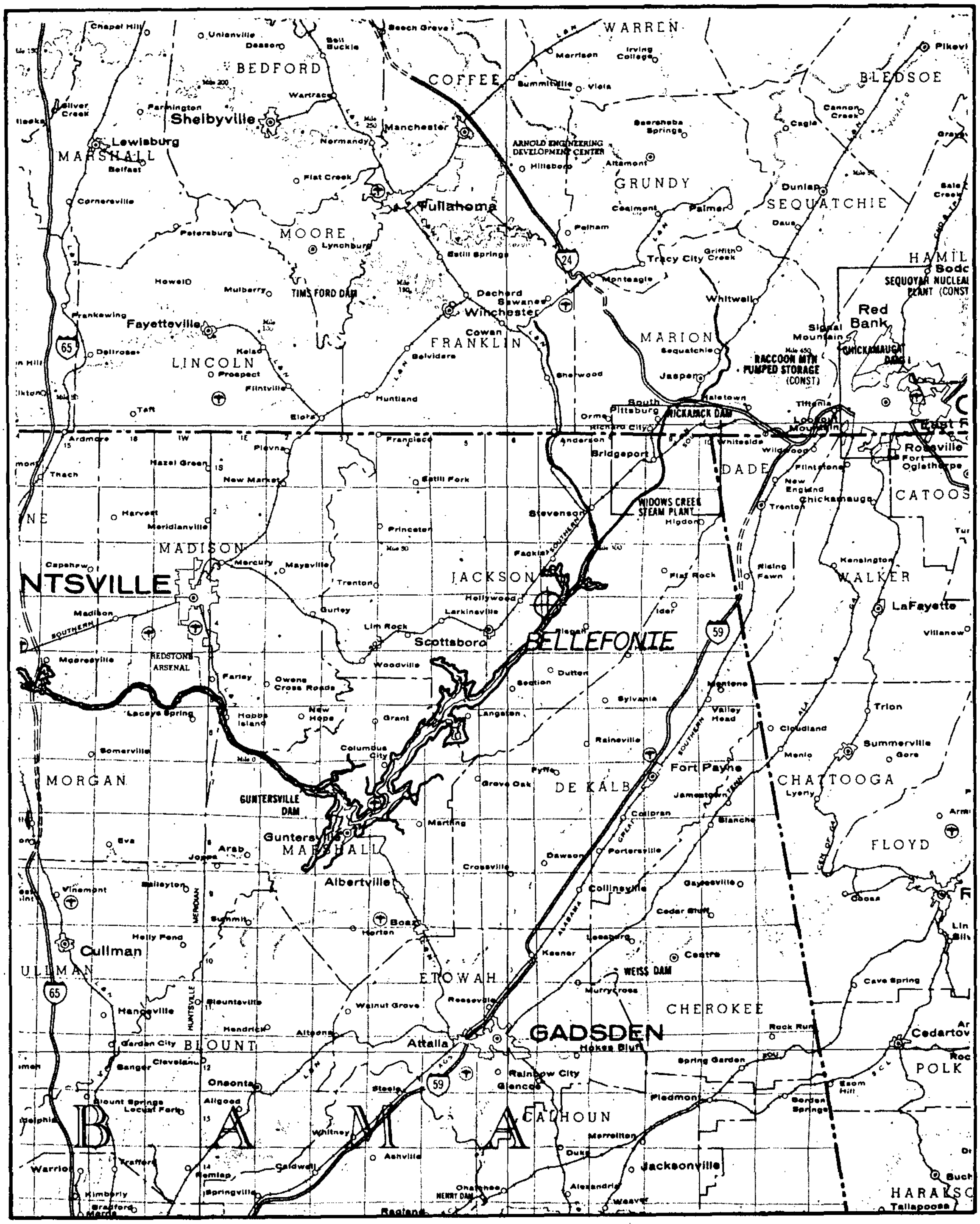

Fig. 2.5. Map of the Vicinity of the Site. From TVA DES.

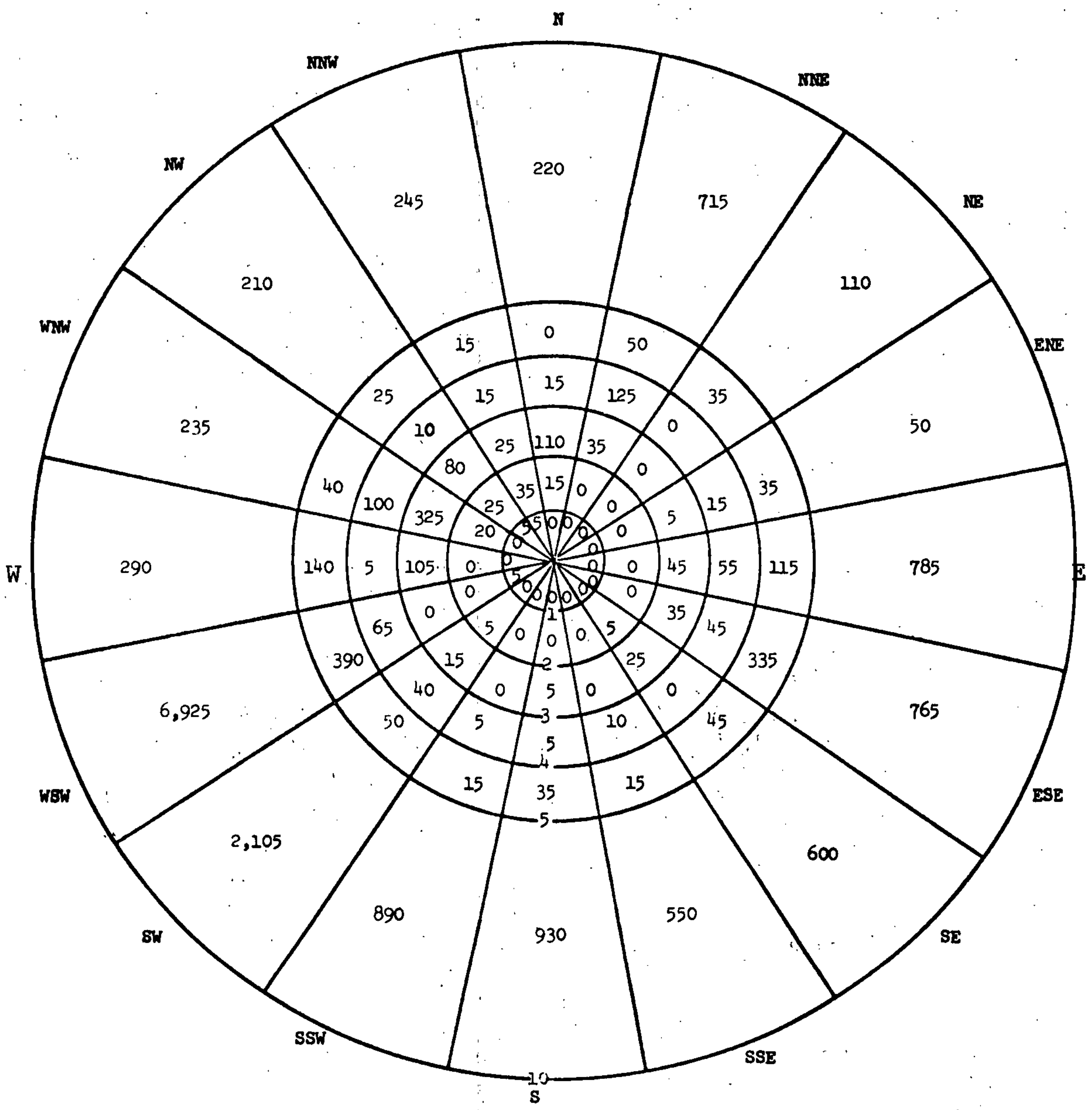

Fig. 2.6. **Population Distribution within 10 Miles for 1970. From TVA DES.**

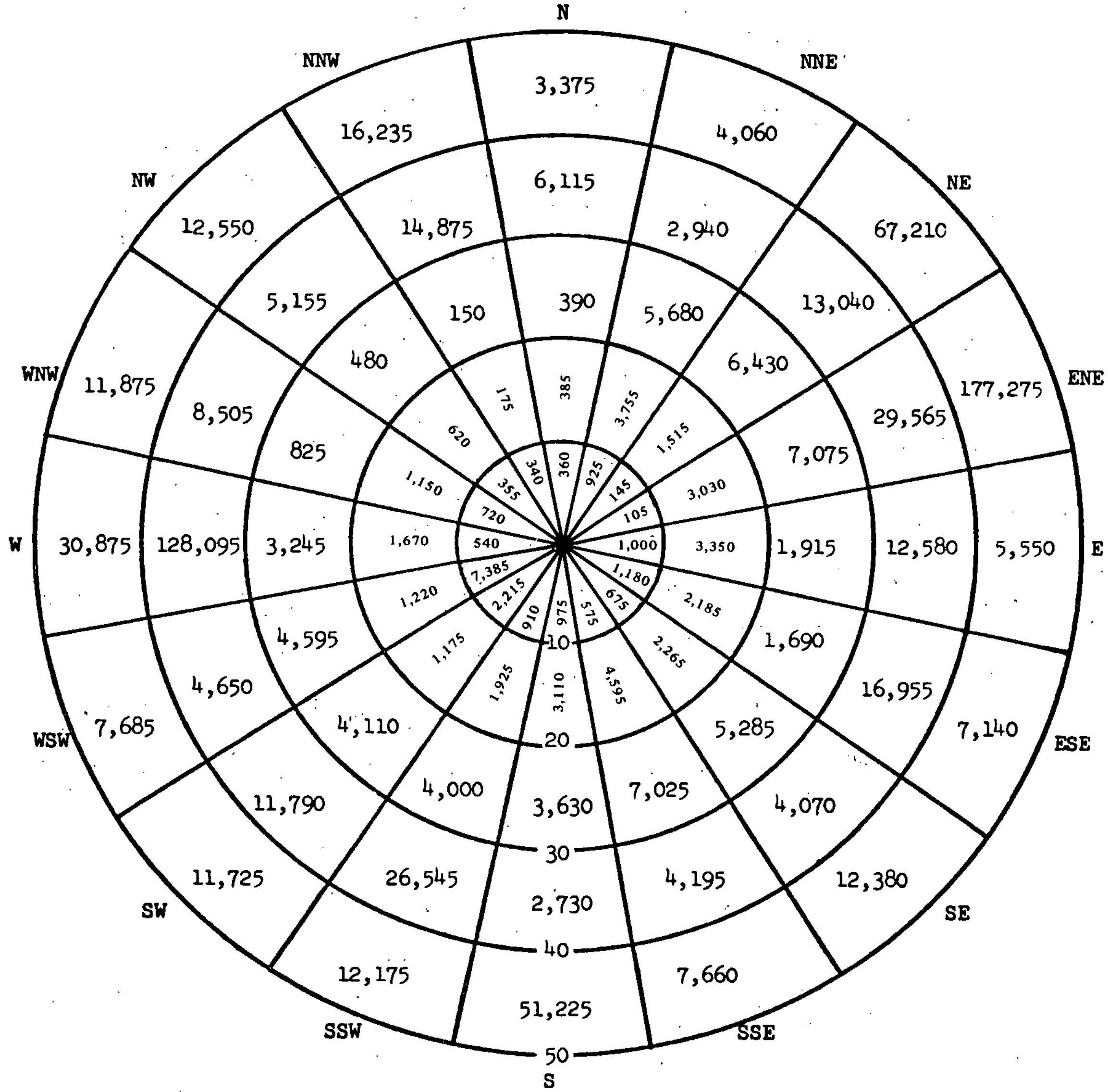

Fig. 2.7. Population Distribution within 50 Miles for 1970. From TVA DES.

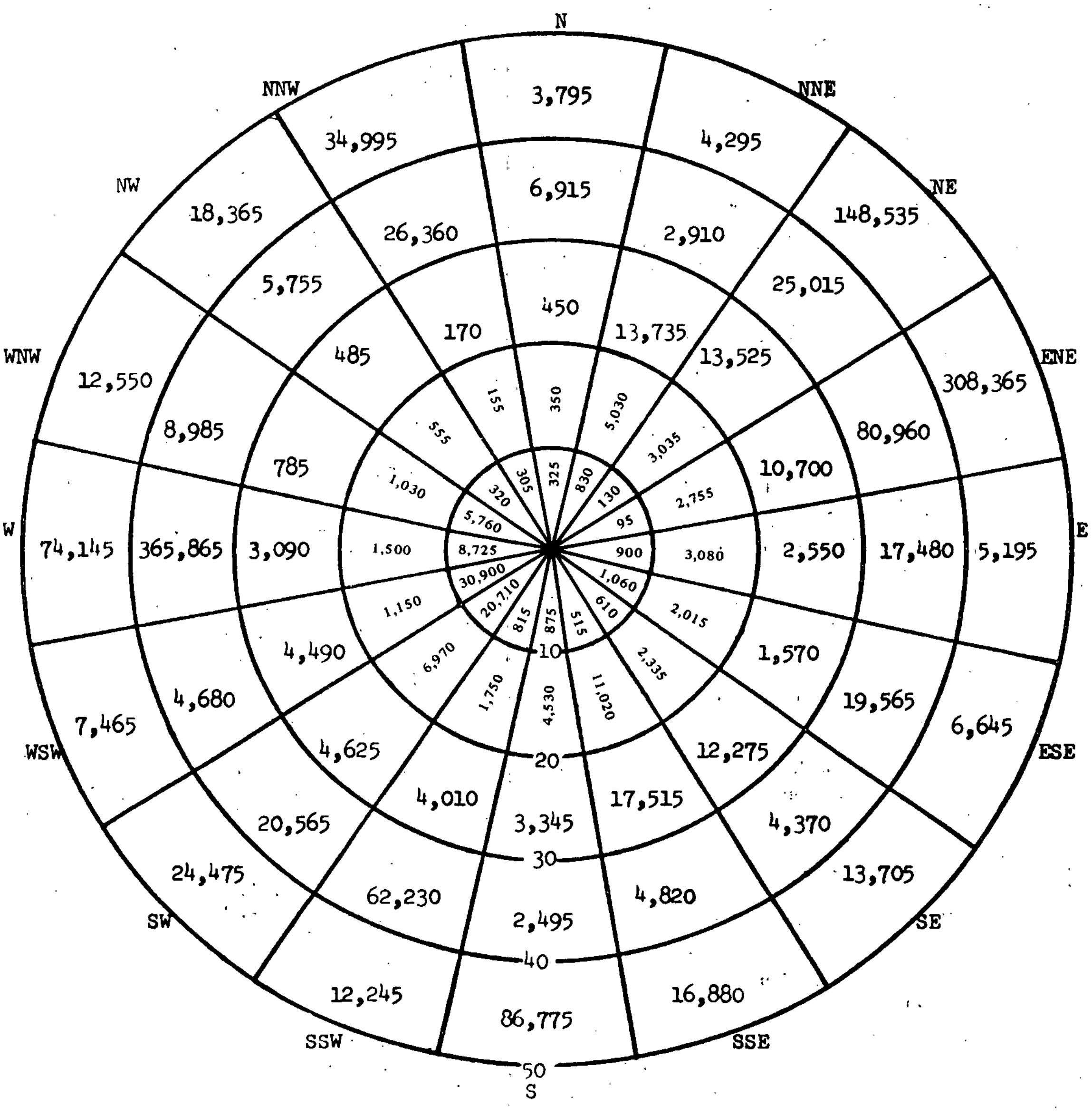

Fig. 2.8. Population Distribution within 50 Miles for 2020. From TVA DES.

2.7.9 Forestry

In 1972, 57 percent of the area around the proposed Bellefonte plant was forested. Average growing stock was 870 cubic feet of merchantable timber per acre with 24 percent softwoods and 76 percent hardwoods. The sawtimber volume was 2010 board feet per acre, 32 percent of which is softwoods. Current wood volumes on the site are below the averages of 950 cubic feet and 2670 board feet for Jackson County, Alabama, and 900 cubic feet and 3230 board feet for the entire Tennessee River Valley.

2.7.10 Government Reservations and Installations

The Tennessee Valley Authority's Nickajack Dam, Guntersville Dam, and Widows Creek Steam Plant and the Department of the Interior's Russell Cave National Monument are the only Federal installations in the general area of the plant. Redstone Arsenal and the Marshall Space Flight Center near Huntsville, Alabama, are located approximately 40 miles west of the site.

2.7.11 Site

Most of the land on the site is in pasture, a small amount in cultivation (corn, soybeans), and some in forests along the reservoir. In the past, cotton was a major crop over much of the site.

Housing structures on the site are unoccupied, and are no longer suitable for occupation. In addition, an old chapel in very poor condition and two unkempt old family cemeteries are on the site. The most recent tombstone inscription reads 1907.

2.8 HISTORICAL AND ARCHEOLOGICAL SIGNIFICANCE OF THE SITE

Adjacent to the plant site is the former Jackson County seat Bellefonte, which is listed in the *Alabama Statewide Plan of Historic Preservation* and is being processed for nomination to the *National Register of Historic Places*. An old tavern, dating back to 1845, is still standing but is in a deteriorated condition, as are some other remaining structures. Part of the old stagecoach road is still in evidence, as is the old courthouse cistern. The staff has requested comments from the Alabama Historical Commission concerning the historical significance of the Bellefonte site. The reply is contained in Appendix A, Page A-39, of this statement.

An archeological investigation of the Bellefonte site was conducted during the summer of 1972 by Mr. Carey B. Oakley, Research Associate in Archeology, Department of Anthropology, University of Alabama. The survey indicated that the Bellefonte site was never extensively utilized by the prehistoric Indian; however, two survey sites, 1 Ja 300 and 1 Ja 302, were identified as ones that should be investigated.

2.9 ECOLOGY

2.9.1 Terrestrial

The site is moderately wooded with steep hills in the portion adjacent to the reservoir proper. Most of the open area was formerly used to grow cotton. The five major vegetation types and their percentage of the site area are: cultivated land, 21%; elm-ash-soft maple, 17%; oak-hickory, 15%; mixed conifers and hardwoods, 15%; and broomsedge-lespedeza, 14%.

There is a good mixture of forest and open vegetation on the site which provides a large variety of niches for animals. The larger mammals on site include: whitetailed deer, gray fox, and cottontail rabbit. Also, partly due to the small intermixed vegetation types, there is a variety of small mammals and birds. The riparian vegetation associated with the overbank areas in the vicinity of the site is well developed and provides excellent habitat for several species of birds (particularly the prothonotary warbler and herons) and mammals that utilize the productivity of the adjacent shallow waters. Details of the site terrestrial ecology can be found in the TVA DES Vol. 1, pp. 1.2-20 to 1.2-26; and in TVA DES Vol. 2, Appendices B2 and B3. The discussion and species lists contained therein are based on an onsite survey (1972), knowledge of past land use practices, and a review of the pertinent literature.

2.9.2 Aquatic

The hydrological characteristics of Guntersville Reservoir are discussed in Section 2.6.2. Little is known about the flow characteristics of the water immediately adjacent to the Bellefonte peninsula.

The waters of Guntersville Reservoir are soft to moderately hard (average pH 7.5; total hardness 40 to 80 ppm as $CaCO_3$, alkalinity 30 to 60 mg/1),[21] and may be expected to have a general biotic productivity greater than soft acidic streams and less than hardwater streams.[22] The productivity of the reservoir is, however, enhanced by the existence of extensive shallow overbank and embayment areas.[23] The water areas immediately adjacent to the Bellefonte peninsula are fairly shallow (generally less than three meters deep). Beyond the overbank area the bottom slopes smoothly and gradually to a depth of 25-30 feet at midchannel. The yearly range of water level fluctuations is generally limited to less than three feet. This reduces the potential disturbance to fish spawning and rearing activities, but drawdowns result in large areas of exposed mud flats in the upper reaches of the Town Creek embayment (north-northwest of the plant site).

The shallow overbank and embayment areas allow for the extensive growth of aquatic vegetation. A series of rooted aquatic macrophytes (from emergent to floating-leaved to submergent) periodically appears at the interface between water and land and out into deeper water. Macrophyte beds and shoreline development provide diverse habitats which support fairly large and diverse macroinvertebrate, zooplankton and periphyton populations. The major benthic organisms include "blood worms" or midge fly larvae (Chironomidae), mayflies (Ephemeroptera) and clams (Pelycepoda). Diatoms (Chrysophyta) and green algae (Chlorophyta) are the dominant phytoplankters, which support a diverse zooplankton assemblage.

The shallows are excellent habitat for reproductive and forage activities of many species of fish. Estimates of fish standing crops have been presented by the applicant.[24] The concentration of ichthyoplankton (5 to 25 mm) in the overbank waters may exceed that of midchannel waters by one to three orders of magnitude.[25] The piscine fauna is dominated by the Centrarchidae (sunfish, bluegills, crappie), Clupeidae (shad) and Sciaenidae (drum). Clupeidae dominate the ichthyoplankton, followed by Cyprinidae (shiners), Sciaenidae, Centrarchidae and Percichthyidae (bass). Catfish, buffalo, carp and drum are important commercial species in the reservoir.

Two invading aquatic species which are colonizing extensive areas of the reservoir are Eurasian waterfilfoil (*Myriophyllum spicatum*) and Asiatic clams (*Corbicula manilensis*).

Details of the site aquatic ecology are based on onsite surveys conducted by the applicant in 1972, other Guntersville and Wheeler Reservoir data, and studies reported in the literature. Information on the aquatic ecology can be found in the TVA DES Vol. 1, pp. 1.2-18 to 1.2-20; and the TVA DES Vol. 2, Appendices B1 and B4; as well as in the responses to various AEC questions.

2.10 Natural Background

The United States Environmental Protection Agency has estimated the annual average background radiation dose to the individual to be 135 mrem per year in Alabama.[26]

The average annual dose from naturally occuring external sources of radiation measured by TVA in the vicinity of the plant site was reported to be 125 mrem.[27]

Table 2.1 presents a tabulation of the natural background dose rate. An estimate of 150 mrem per year is used in this impact statement.

Table 2.1

Annual Natural Radiation Whole-Body Dose

Type of Radiation	Average Annual Dose (mrem) EPA Estimate	Average Annual Dose (mrem) Measured by TVA
Cosmic Radiation	40	125
Natural Terrestrial Radioactivity	70	
Internal Radiation	25	-
	135	125

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27. Op. Cit. Ref. 19, Vol. 2.

3. THE PLANT

3.1 INTRODUCTION

The Bellefonte Nuclear Plant will employ two identical pressurized water reactors which will be supplied by the Babcock & Wilcox Company. Each unit will produce 3600 megawatts thermal (MWt) and a steam turbine-generator will use this heat to provide a net electrical power capacity of 1221 MWe. A design power level of 3760 MWt, 1269 MWe (net), is anticipated at a future date and all the impacts contained herein are evaluated at that power level.

3.2 FACILITY DESCRIPTION

An artist's impression of an aerial view of the station is given in Fig. 3.1.

3.2.1 Nuclear Steam System and Steam-Electric System

Each reactor will be initially loaded with three U-235 concentrations 2.51, 2.92 and 3.45 wt.%) in the fuel. This fuel consists of uranium dioxide pellets enclosed in Zircaloy tubes with welded end plugs and pressurized with helium. The UO_2 fuel weight per reactor is about 230,000 pounds. Heat released from the fuel is transported by the reactor cooling water to the steam generators. The overall thermal efficiency of the plant operating at the design point is about 34%.

3.2.2 Cooling-Water Systems

The plant water systems are divided into engineered and non-engineered safety classes. The essential raw cooling water and the high-pressure fire protection systems for the auxiliary building have the engineered safety features whereas the raw cooling water, cooling-tower makeup water, service distribution and condenser circulating water systems do not have these features. The intake for the cooling-water systems is through the common intake pumping system from the Guntersville Lake, which is a part of the Tennessee River. The main heat rejection from the plant utilizes a closed-cycle cooling scheme.

To meet cooling requirements at Bellefonte Nuclear Plant and at the same time to provide environmental protection for the waters of Guntersville Lake, TVA proposes to install closed-cycle natural-draft hyperbolic cooling towers. This type of condenser cooling-water system would enable the plant to operate with relatively little thermal effect on the lake, since

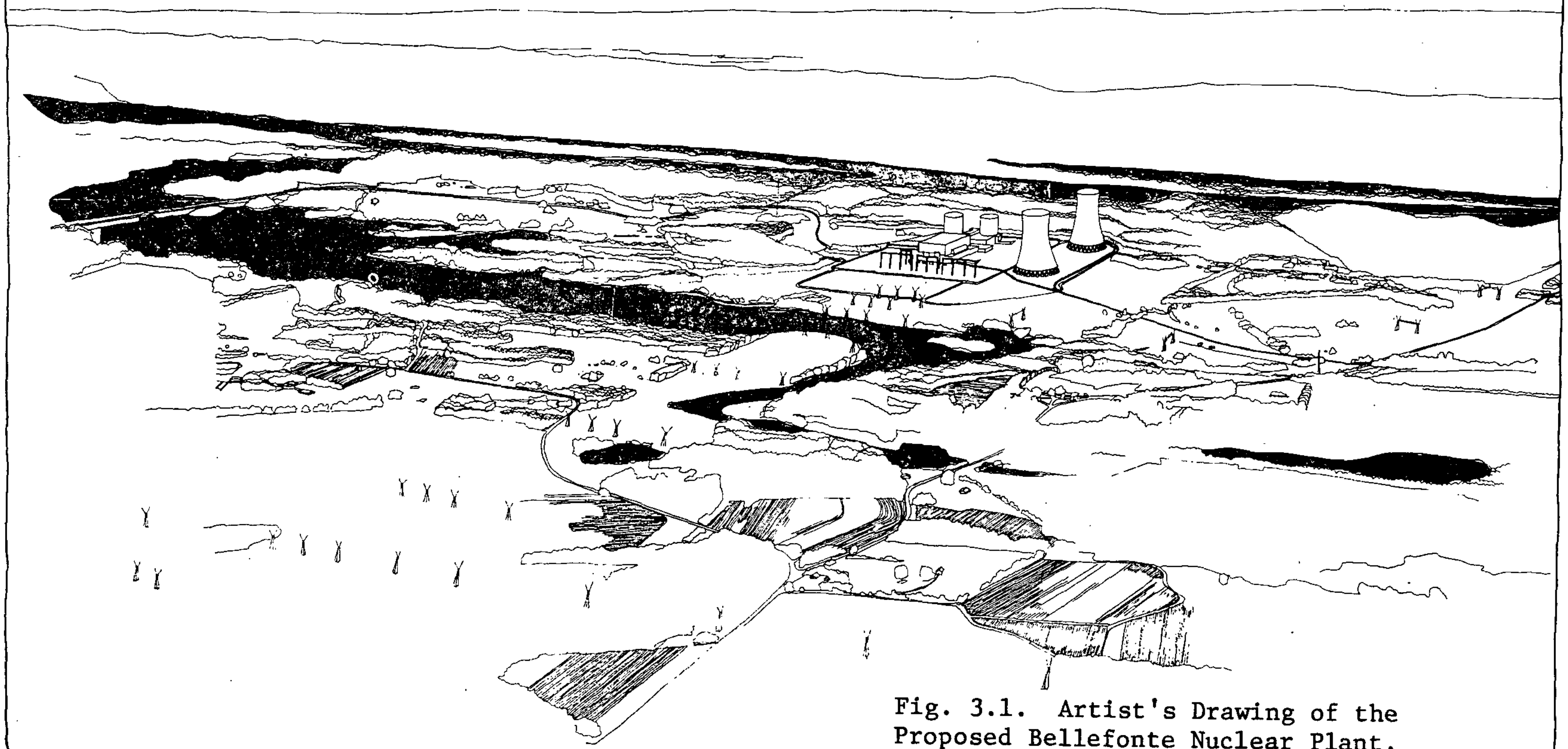


Fig. 3.1. Artist's Drawing of the Proposed Bellefonte Nuclear Plant. View from the Northwest.

the condenser cooling-water system will cycle cool water from the cooling towers through the condensers and discharge the warmed water back to the cooling towers in a closed system rather than discharging it to the river.

The station will utilize two closed-cycle, natural-draft wet cooling towers. The details of the design parameters have not as yet been finalized, but each tower will be approximately 500 feet in diameter at the base and about 500 feet high.

The cooling is accomplished by pumping the hot water into the top of the lower portion of the tower, usually about 50 feet above the ground. The water flows by gravity through a fill material, whose function it is to slow the falling water and to break it into small droplets, thus greatly increasing the surface area of contact of the water with the air. Most of the cooling results from the evaporation of a small portion of the circulating water. Sensible heat transfer also contributes to the cooling process. Drift eliminators trap water droplets so that the fraction of the water lost from the tower (called drift) in excess of that evaporated is extremely small.

A water-use diagram for the plant is shown later in Fig. 3.4. For both units, approximately 872,000 gpm of cooling water would circulate through the condensers. The temperature of the water flowing through the condensers will be raised by approximately 36°F in removing 7.8×10^9 Btu/hr from each unit when operating at normal full load. In the operation of cooling towers a certain portion of the circulating water is continuously lost as a result of evaporation (approximately 46 cfs average), small leaks, drift, and blowdown. Therefore, makeup water must be continuously added to the system. To provide this makeup for both units, an estimated maximum of 66,600 gpm, or 148.5 cfs, will be withdrawn from the Guntersville Lake at TRM 392.25. Normally, about 26,000 gpm, or 57.9 cfs, of this withdrawal will supply water for the essential raw cooling water system. This flow, which may be warmed as much as 13°F in passing through the heat exchangers, will be discharged to the cold water channel of the cooling towers.

Normal water surface of the Guntersville Lake varies between elevations about 595 ft (summer) and 593 ft (winter). The water intake pump structure will be located at the end of an intake channel in which the maximum water velocity of the cross section will be less than 0.2 ft per second, even for a water surface elevation of 593. The intake structure will have four openings slightly over eight feet wide and 15 feet high. The top of the opening will be at elevation 572 and the bottom at elevation 557. The maximum velocity of flow will be less than 0.42 foot per second through each of the openings. The openings will be followed by vertical traveling screens which have 3/8-inch opening mesh. The maximum velocities through clean screens are estimated to be about 0.24 foot per second during summer high-water level and about 0.25 foot per second during winter low-level. All intake water taken from the lake will pass through 1/8-inch-opening strainers after passing through the traveling screens.

Normal blowdown from the natural-draft towers will be discharged into Guntersville Lake at a rate of about 74 cfs. Studies will be made to determine the proper type and the best location for a blowdown diffuser to provide good dilution with the streamflow, consistent with the need to protect the aquatic biota of the lake. The temperature of the blowdown will be the same as the cooling tower effluent, which will vary with the meteorological conditions. A nozzle-type diffuser will be designed to mix the blowdown with nine equal parts of lake water and thus limit the temperature rise after mixing to less than 5°F. For cost-estimating purposes such a design was assumed to consist of an approach pipe approximately four feet in diameter. Mixing would be achieved by means of two 2-foot-diameter nozzles spaced approximately 50 feet apart and oriented to discharge perpendicular to the lake current. The blowdown diffuser will continue to entrain ambient river water even during periods of zero or low flow. The length of time that the blowdown diffuser can operate in these low-flow situations without exceeding a 5°F rise after mixing will depend on the final design of the diffuser.

The diffuser will be designed and located in the stream to minimize the disturbance of the aquatic organisms on the bottom of the lake, and it will be located to take advantage of lake flow to provide mixing to reduce the thermal impact.

While an exact estimate of the mixing zone for the heated discharge can only be determined after the design of the diffuser is finalized, for the 1°F isotherm the surface area is estimated to be 4 to 5 acres.

3.2.3 Radioactive Waste Disposal

3.2.3.1 General

During the operation of Bellefonte Nuclear Plant, radioactive material will be produced by fission and by neutron activation of corrosion products in the reactor coolant system. From the radioactive material produced, small amounts of gaseous and liquid radioactive wastes will enter the waste streams, which will be processed and monitored within the station to minimize the radioactive nuclides that ultimately will be released to the atmosphere and into the Guntersville Reservoir.

The waste handling and treatment systems to be installed at the station are discussed in the Tennessee Valley Authority Preliminary Safety Analysis Report and the TVA DES. In these documents, TVA presents an analysis of its treatment systems and estimates of the annual radioactive effluents. In the following paragraphs, the waste treatment systems are described and an analysis is given based on our model of TVA's radioactive waste systems. The model has been developed from a review of available data from operating nuclear power plants. Adjusted to apply over a 40-year operating life, the model uses somewhat different assumptions than were used by TVA. Coolant activities and flows used in our evaluation are based on experience and data provided from operating reactors. As a result, our calculated effluents are different from those of TVA; however, the resulting differences do not lead to adverse effects in the evaluation. Liquid source terms are calculated by means of a revised version of the ORIGEN code which is described in ORNL 4628, "Oak Ridge Isotope Generation and Depletion Code." Gaseous source terms are calculated by means of the STEFFEG code as described in the report "Analysis of Power Reactor Gaseous Waste Systems," F. T. Binford et al., 12th Air Cleaning Conference. The principal assumptions used in our calculation of source terms are given in Table 3.1.

3.2.3.2 Liquid Wastes

The liquid radioactive waste treatment system consists of process equipment and instrumentation necessary to collect, process, monitor, and dispose of radioactive liquid wastes from the plant. Liquid will be processed on a batch basis to permit optimum control of releases. Prior to release of any treated liquid wastes, samples will be taken and analyzed to determine the type and amount of radioactivity in the batch. Based on the results of the analyses, these wastes will be either released under controlled conditions to the Guntersville Reservoir or retained for further processing. Radiation detectors in the waste discharge line provide a high-radioactivity alarm and trip signal to a flow isolation valve to prevent the discharge of liquids with activity concentrations greater than authorized for release. A simplified diagram of the liquid radioactive system is shown in Fig. 3.2.

The reactor coolant-water purity will be maintained by means of (a) the makeup and purification, and (b) the chemical and boron recovery. Each reactor unit will be equipped with these systems separately. The makeup and purification system will be in continuous use during reactor operation, and it may be used during shutdowns. The chemical addition and boron recovery systems are used during base-load operation for chemical shim adjustment and at each startup and shutdown for boron concentration changes.

TABLE 3.1. Principal Conditions and Assumptions Used in Estimating Radioactive Releases

Power level	3763 MWt
Plant factor	0.80
Fission product source term	0.25%
Total steam flow	1.48×10^7 lb/hr
Weight of liquid in each generator	8.6×10^4 lb
Weight of steam in each generator	6.89×10^3 lb
Steam generator leak rate	20 gpd
Number of steam generators	2
Letdown flow	63 gpm
Gas decay time	60 day
Containment purge	4 times/yr
Containment volume	2.4×10^6 cu ft
Containment leak	40 gpd
Primary coolant degassed	2 times/yr
Volume of primary system	8.93×10^3 cu ft
Auxiliary building leak	20 gpd
Partition coefficient for iodine	
Steam generator internal partition	1
Primary coolant leak to containment	0.1
Primary coolant leak to aux. building	0.001
Condenser air ejector	0.0005
Turbine building leak	5 gpm

Stream	*Flow rate, gpd*	*Decontamination Factors*					
		PCA[a]	*I*	*Cs*	*Mo*	*Y*	*Other*
Shim bleed	24,500	1.0	1×10^5	2×10^4	1×10^6	1×10^5	1×10^4
Tritiated waste	895	0.22	1×10^4	1×10^5	1×10^6	1×10^5	1×10^5
Nontritiated waste	585	0.01	1×10^3	1×10^4	1×10^6	1×10^5	1×10^4
Laboratory drains	400	0.002	1×10^3	1×10^4	1×10^6	1×10^5	1×10^4
Regenerant solutions	1,800	--	1×10^3	1×10^4	1×10^6	1×10^5	1×10^4

Decontamination factor for iodine on charcoal adsorber 10

[a]*Primary Coolant Activity*

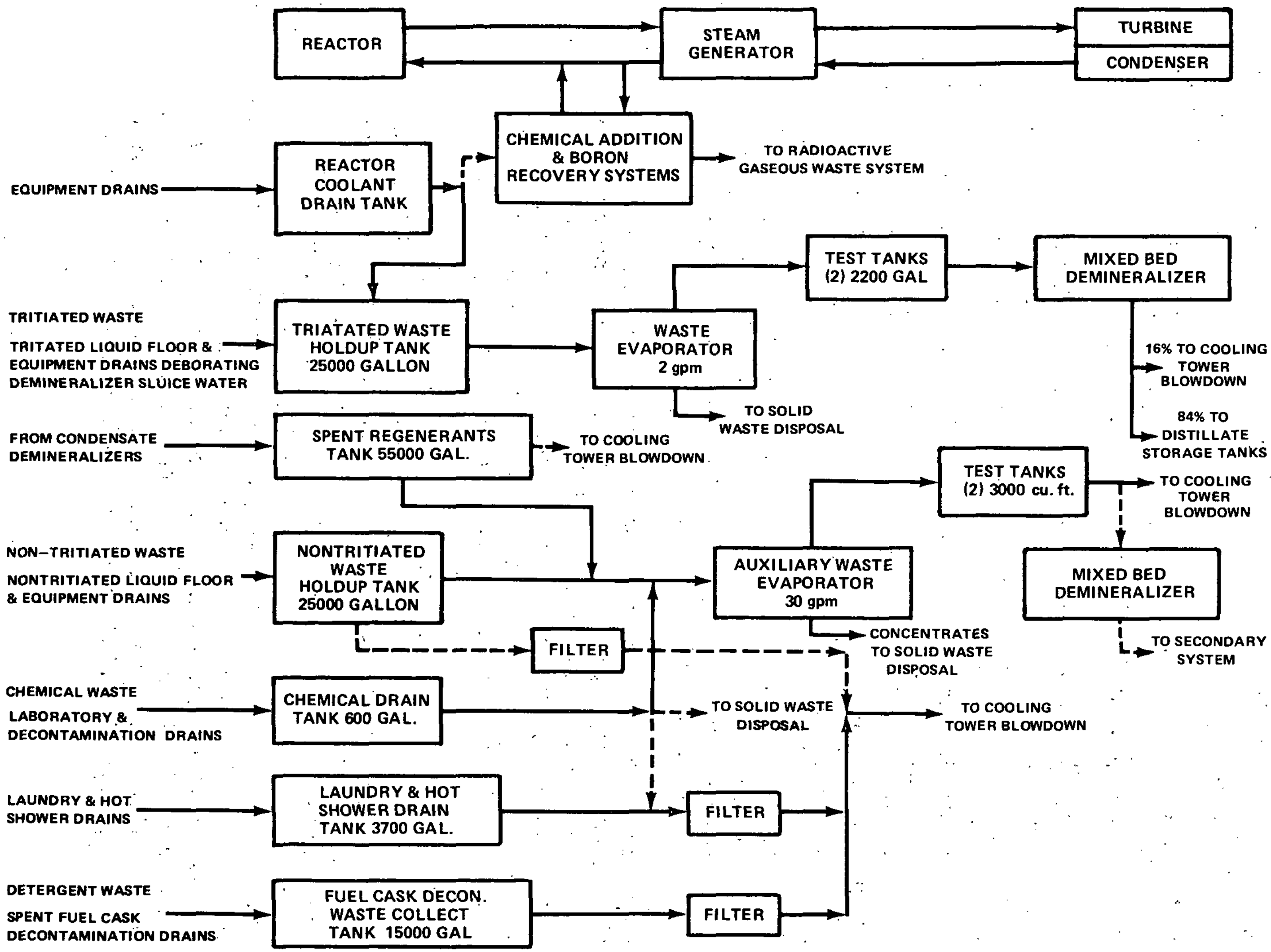


Fig. 3.2. Radioactive Liquid Waste System.

Reactor coolant will be withdrawn from the reactor coolant system at a rate of 63 gpm into the makeup and purification system. The pressure of the stream will be reduced and the water will be cooled, filtered, and passed through purification demineralizers. The liquid will then be stored in the makeup tank. Liquid will be pumped back to the reactor coolant system.

The operation of the makeup and purification system will generate spent demineralizer resins, resin sluice water, and radioactive gas released from the reactor coolant in the makeup tank.

The chemical addition and boron recovery system will be used to make boron concentration changes during base-load operation for chemical shim adjustment. Liquid will be transferred from the makeup and purification system at a point downstream of the demineralizers and will be collected in the reactor coolant bleed tank. The pressure of the coolant will be let down to a pressure slightly above atmospheric in the bleed tank, and much of the dissolved gases will be released from the liquid. These gases will be transferred to the gaseous waste system. Liquid will be pumped from the bleed tank through a demineralizer to a boric acid evaporator. Distillate will be pumped to distillate storage. The evaporator concentrate will be pumped to the boric acid storage tanks for reuse. Waste contributions from this system will consist of spent resins from the demineralizers, resin sluice water, and radioactive offgas.

The liquid radioactive waste treatment system will be divided into four subsystems. These will be the tritiated waste, nontritiated waste, chemical waste, and detergent waste subsystems. Liquid wastes will be segregated by tritium content, and liquids containing a tritium concentration of 10% or more of the reactor-water tritium concentration will be considered as tritiated water.

In the reactor building, equipment drains from the reactor coolant system and related possible tritiated sources will be collected in the reactor coolant drain tank. The liquid collected in this tank will be transferred to the boron recovery system for processing. Liquid collected in the reactor building sump will be handled in the liquid radwaste system by either the tritiated waste subsystem or the nontritiated waste subsystem on the basis of tritium content. The tritiated waste subsystem will process miscellaneous system leakage, demineralizer resins sluice water, deborating demineralizer regenerant solutions, filter backwash and drain liquids, sampling and laboratory drains, and refueling canal drain water. This system will serve both Unit 1 and Unit 2. Waste liquids will be collected in the 25,000-gal tritiated waste holdup tank. From this tank the liquid will flow to a 2-gpm waste evaporator. The concentrate from the waste evaporator will be transferred to the solid waste system for solidification and disposal. The distillate will be collected in one of two 2200-gal test tanks. If the water quality is satisfactory, the liquid in the test tank will be processed through the test tank non-regenerative mixed-bed demineralizer and stored in the distillate storage tanks which are part of the boron recovery system. If the water quality is not satisfactory, the distillate in the test tank will be recycled through the evaporator for further processing until the desired water quality is achieved.

Our evaluation assumed that for each reactor unit, 895 gpd containing approximately 0.22 primary coolant activity (PCA) will be processed through the tritiated waste subsystem and approximately 143 gpd of processed liquid will be released to the environment for primary system tritium concentration control. This will result in an annual release from this subsystem of approximately 0.001 Ci.

Liquid waste containing less than 10% of reactor water tritium concentration will be treated in the nontritiated waste subsystem. The liquid waste processed in this subsystem will include miscellaneous system leakage, decontamination liquid waste, sample drain wastes, filter backwash water, and spent regenerant solution from the condensate demineralizers. All of the above wastes except the spent regenerant solutions will be collected in the 25,000-gal nontritiated waste holdup tank. The spent regenerant solutions will be collected in the 60,000-gal spent regenerant tank. The liquid wastes in these two tanks will be processed through a 30-gpm auxiliary waste evaporator. The concentrates from this evaporator will be transferred to the solid waste disposal system for solidification and disposal. The condensed distillate will be collected in one of two 20,000-gal test tanks. The radioactivity and chemical content will be determined and the distillate will either be discharged to the cooling-tower blowdown streams, processed through a mixed-bed demineralizer for reuse in the secondary system, or transferred back to the nontritiated waste holdup tank for reprocessing. If the waste liquid in the nontritiated waste holdup tank shows a radioactivity concentration of less than 10^{-4} μCi/ml the, liquid may be pumped through a filter and to the cooling-tower blowdown stream for disposal. Our evaluation indicated an activity greater than 10^{-4} μCi/ml and, therefore, we assumed that the normal disposal route will be through the auxiliary waste evaporator. We assumed the distillate will be disposed of via the cooling-tower blowdown stream since the effluent activity will be less than 10^{-4} μCi/ml.

In our evaluation, we assumed for each reactor unit that approximately 585 gpd of liquid waste containing 0.01 PCA and 1800 gpd of condensate demineralizer regenerant solutions containing the nuclides collected on the resins between regenerations will be processed through the nontritiated waste subsystem. It was assumed that all of the processed nontritiated waste and laboratory drains and 10% of the processed regenerant solutions will be released to the cooling-tower blowdown stream. Our evaluation estimates that 0.003 Ci/yr will be released from this subsystem for each reactor unit.

The chemical waste subsystem will handle laboratory drains and decontamination drain wastes from the cleaning of small items. These wastes will be collected in the 600-gal chemical drain tank. The liquid in the tank will be sampled, filtered, and released to the cooling-tower blowdown stream if the radioactive concentration is less than 10^{-4} μCi/ml. If the radioactivity content is greater than this level, the liquid will be processed through the auxiliary waste evaporator in the nontritiated waste subsystem. Our evaluation assumed that approximately 400 gpd will be processed through this system with a radioactivity concentration greater than 10^{-4} μCi/ml. The contribution of the effluent from this system to the liquid source term will be insignificant.

The detergent waste subsystem, laundry and hot shower waste will be collected in a 3700-gal tank. The liquid in this tank will be sampled, analyzed, and released through a filter to the cooling-tower blowdown stream. Spent fuel-cask decontamination waste will be collected in a 15,000-gal tank. The liquid in this tank will be sampled and analyzed before being released to the cooling-tower blowdown stream. Our evaluation assumed the radioactive content of these wastes will be less than 10^{-4} μCi/ml and that the processing rate will be approximately 900 gpd. The annual contribution to the liquid source term will be insignificant.

The total calculated expected radioactive liquid release from each reactor unit, excluding tritium and dissolved gases, is 0.03 Ci/yr. In order to compensate for expected operational occurrences and equipment malfunctions, however, this value has been normalized to 0.1 Ci/yr. Based on previous experience, we estimate that there will also be an annual release of 350 Ci/yr of tritium from each reactor unit. Table 3.2 shows our calculated annual liquid releases.

The applicant estimates that approximately 0.47 Ci/yr of radioactivity and 150 Ci/yr of tritium will be released from each reactor unit. The difference between the applicant's value and ours, is due to differences in assumptions used in the calculations. We assume a decontamination factor (DF) for evaporators to be 10^4 for all nuclides except iodine and 10^3 for iodine. The applicant assumed a DF of 10^3 for nontritiated waste and 10^2 for condensate demineralizer regenerant solutions. These

TABLE 3.2. Calculated Annual Radionuclide Release in Liquid Waste, Per Unit[a]

Corrosion and Activation Products, Ci/yr			
Na-24	2×10^{-5}	Co-60	4×10^{-5}
Cr-51	3×10^{-5}	Mo-99	9×10^{-5}
Mn-56	3.6×10^{-4}	Tc-99m	9×10^{-5}
Fe-55	3×10^{-5}	W-187	6×10^{-5}
Fe-56	2×10^{-5}	Np-239	1×10^{-5}
Co-58	3.0×10^{-4}		
Fission Products, Ci/yr			
Br-82	3×10^{-5}	Te-132	7×10^{-4}
Br-83	80×10^{-5}	I-132	10×10^{-4}
Rb-88	1×10^{-5}	I-133	10×10^{-3}
Sr-89	1×10^{-5}	I-134	1×10^{-5}
Y-91	2×10^{-3}	Cs-134	10×10^{-4}
Y-93	2×10^{-5}	I-135	3×10^{-3}
Mo-99	31×10^{-3}	Cs-136	4×10^{-4}
Tc-99m	29×10^{-3}	Cs-137	7×10^{-4}
Te-127	2×10^{-5}	Ba-137m	7×10^{-4}
Te-129m	5×10^{-5}	Cs-138	1×10^{-5}
Te-129	3×10^{-5}	Ba-139	1×10^{-5}
I-130	5×10^{-5}	Ba-140	1×10^{-5}
Te-131m	5×10^{-5}	All others	1×10^{-4}
I-131	18×10^{-3}		
Total corrosion, activation, and fission products		0.1 Ci/yr	
Tritium		350 Ci/yr	

[a]*Radionuclides in quantities less than* 1×10^{-5} *Ci/yr are not listed in this table.*

differences result in a factor of approximately 10 in evaporator DFs.

Based on our evaluation, the radioactivity in the liquid effluent from Units 1 and 2, exclusive of tritium, will be less than 5 Ci/yr and the whole body and organ doses will be less than 5 mrem/yr. We conclude, therefore, that the liquid radwaste system will reduce radioactive effluents to as low as practicable levels in accordance with 10 CFR Part 50.34(a). The liquid radwaste system, therefore, is acceptable.

TVA has not determined the method to be used for disposal of tritium from the plant. The methods under consideration include trucking to offsite disposal in liquid form, offsite disposal as a solid, disposal as a liquid effluent to Gunersville Reservoir, and disposal to the atmosphere in gaseous form. TVA has been advised that trucking of radioactive liquid wastes is not in conformance with "as low as practicable" guidelines and that the other disposal methods should be considered. Our evaluation assumed that the tritium will be disposed of by release to Guntersville Reservoir through the cooling-tower blowdown.

3.2.3.3 Gaseous Wastes

The gaseous waste treatment and ventilation subsystems consist of equipment and instrumentation necessary to reduce releases of radioactive gases or airborne particulates from reactors, plant equipment, and building vents. The primary source of gaseous radioactive waste will be from the degassing of the primary coolant during letdown of the reactor cooling water into the various process equipment and tanks. This will be principally from the makeup and purification system and vents from the liquid waste processing system. Additional sources of gaseous waste activity will include ventilation air released from the auxiliary building, the turbine building, air ejector, and purging of the reactor containment. Since once-through steam generators (no blowdown) will be used in this plant, there will be no gaseous waste activity expected from this source. The gaseous waste treatment and ventilation systems are shown in Fig. 3.3.

The gaseous waste system will service both reactor units. The gases received by the gaseous waste system will be collected in one of two 3000-cu ft tanks which are designed for 100 psig at 200°F. The gases in the tank will be compressed to 85 psig by means of one of two 30-cfm compressors. Based on a waste gas flow rate of 140 cfd from each reactor unit simultaneously, the waste gas decay tanks will have sufficent capacity to hold up gaseous waste for at least 60 days for radioactive decay. The gas in the decay tanks will be sampled

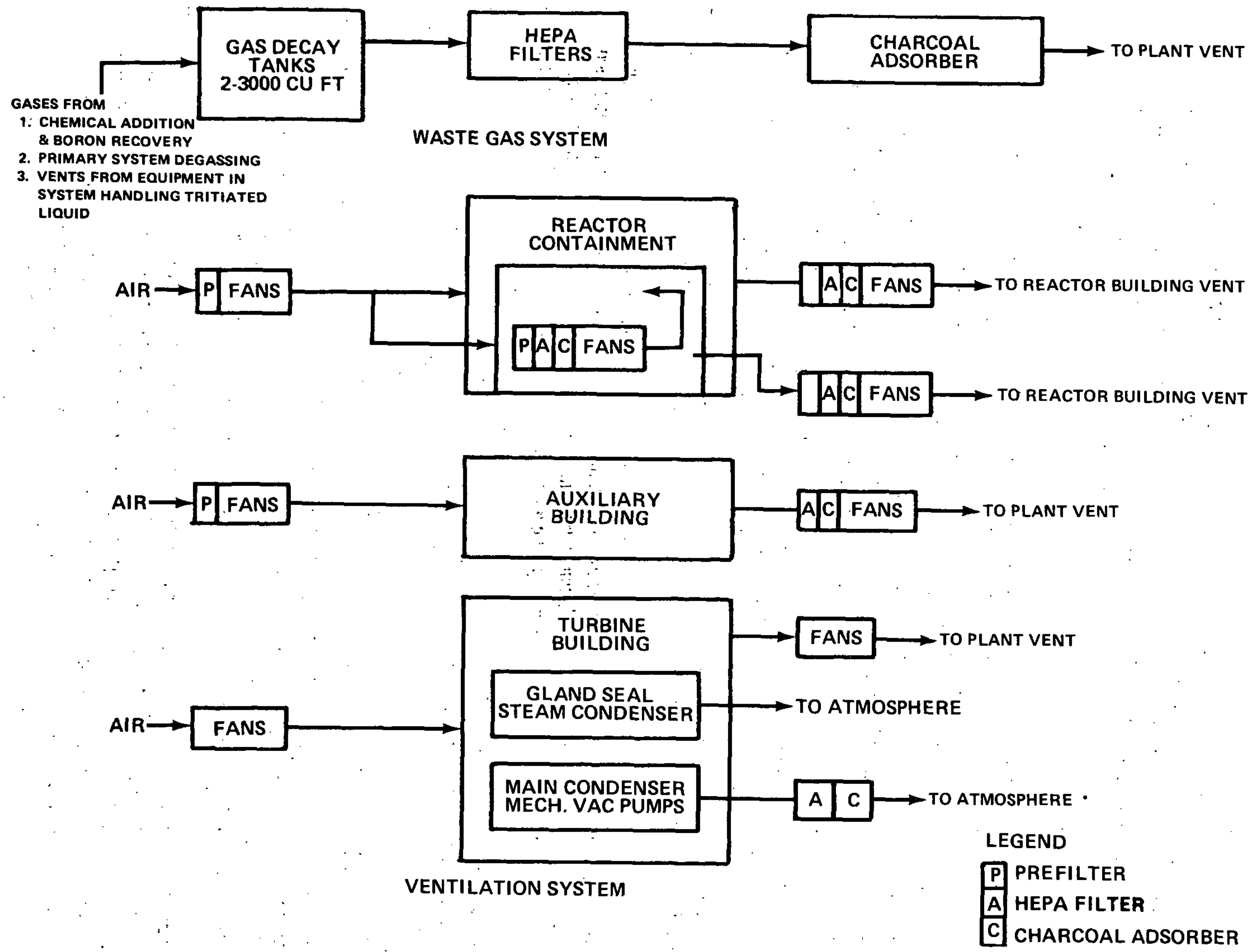


Fig. 3.3. Radioactive Gaseous Waste System.

and analyzed to determine the amount of activity to be released. The gases will then be released at a controlled rate through HEPA filters and charcoal adsorbers to the plant vent.

According to our evaluation, the radioactivity releases from the gaseous waste system will be a negligible quantity of radioiodine and approximately 1320 Ci/yr of noble gases for each reactor unit. TVA calculated 0.0042 Ci/yr of I-131 and 1700 Ci/yr of noble gases for each reactor unit. Our calculated values are in reasonable agreement with TVA's.

Radioactive gases may be released inside the reactor containment building when the primary system is opened to the building atmosphere and from the primary system leaks. Reactor containment will consist of an outer or secondary containment building and an inner or primary containment. The primary containment will be provided with a purge system and an air cleanup system. The secondary containment will be provided with a containment purge system. Normally, ventilation air will be provided to the containment volumes by the primary and secondary purge systems. Air exhausted through these systems will pass through HEPA filters and charcoal adsorbers before being released to the atmosphere through the reactor building vent. The air cleanup system will be used to clean the primary containment atmosphere prior to purging. The capacity of the primary containment air cleanup system is 36,000 scfm. This system will contain prefilters, HEPA filters, and charcoal filters in series, and the system will recirculate the air within the primary containment to accomplish its function. Our evaluation assumed that a containment purge would be made four times per year and that the primary containment air cleanup system will be used prior to each purging. Based on our evaluation, we calculate an I-131 release of 0.0005 Ci/yr and a noble gas release of 84 Ci/yr from the containment purge for each reactor unit. TVA calculated an I-131 release of 0.00036 Ci/yr and a noble gas release of 30 Ci/yr.

The ventilation air from the auxiliary building will be filtered through HEPA filters and charcoal adsorbers before release from the plant vent. Ventilation air within the auxiliary building will be directed from clean areas to potentially more contaminated areas. A radiation monitoring system will be provided to monitor, record, and annunciate high activity in the building exhaust.

We calculate that the I-131 release from this source per reactor unit will be approximately 0.002 Ci/yr and the noble gases release will be 550 Ci/yr. TVA did not report releases from this source separately. Offgas from the gland-seal steam condenser is vented to the environs without additional treatment whereas the offgas from the main condenser mechanical vacuum pumps is to be filtered through HEPA filters and charcoal adsorbers before being released to the atmosphere. Turbine building ventilation air will exhaust from the turbine building roof exhaust housing to the atmosphere without treatment.

We calculate that the I-131 release from vacuum pump system will be approximately 0.001 Ci/yr and a noble gas release of 556 Ci/yr for each reactor unit. We calculate that the I-131 release from the turbine building will be approximately 0.003 Ci/yr and a noble gas release of 66 Ci/yr for each reactor unit. The radioactivity releases from the gland-seal steam condenser will be negligible. TVA has calculated vacuum pump releases of 1.2×10^{-5} Ci/yr for I-131 and 840 Ci/yr for noble gas for each unit, and gland-seal condenser releases of 1.2×10^{-5} Ci/yr for I-131 and 0.8 Ci/yr of noble gases for each reactor unit. TVA did not report turbine building radioactivity releases separately.

Based on our evaluation of the gaseous waste treatment and ventilation systems, we estimate that a total of 2500 Ci/yr of noble gases and 0.007 Ci/yr of I-131 will be released from each reactor unit. TVA estimated 3870 Ci/yr of noble gases and 0.013 Ci/yr of I-131 will be released for each reactor unit. Our calculated releases are in reasonable agreement with those of TVA. Table 3.3 shows our calculated annual gaseous releases.

Based on our evaluation, the annual exposures to the whole body or any organ will be less than 5 mrem for noble gases at or beyond the site boundary and less than 15 mrem for iodine dose to a child's thyroid due to cows' milk from the nearest potential pasture for the combined operation of the two reactor units. We conclude that the gaseous radwaste systems will reduce radioactive effluents to as low as practicable levels in accordance with 10 CFR Part 50.34(a). We conclude, therefore, that the gaseous waste treatment and ventilation systems are acceptable.

3.2.3.4 Solid Wastes

The solid radwaste system will be designed to collect, monitor, process, package, and provide temporary storage for radioactive solid waste prior to offsite shipment and disposal in accordance with applicable regulations.

Miscellaneous dry waste consisting of clothing, rags, paper, and air filters will be compacted into 55-gal drums by a baling machine.

TABLE 3.3. Calculated Annual Release of Radioactive Materials in Gaseous Effluents, Ci/yr/unit

	Gas Stripping		*Building Ventilation*				
Nuclide	*Shutdown*	*Continuous*	*Reactor*	*Auxiliary*	*Turbine*	*Air Ejector*	*Total*
Kr-83m	0*		4.3×10^{-3}	2	2×10^{-3}	2	4
Kr-85m	0		0.05	9	1×10^{-2}	9	18
Kr-85	14	1×10^{3}	1.7	0.8	1×10^{-3}	0.8	1020
Kr-87	0		9×10^{-3}	5	6×10^{-3}	5	10
Kr-88	0		6×10^{-2}	16	2×10^{-2}	16	32
Kr-89	0		3×10^{-5}	0.4	5×10^{-4}	0.4	0.8
Xe-131m	1	67	0.7	2	2×10^{-3}	2	72
Xe-133m	1.7×10^{-6}	1.2×10^{-4}	0.7	9	1×10^{-2}	9	19
Xe-133	3.2	220	80	48	0.6	48	400
Xe-135m	0	0	4×10^{-4}	1	1×10^{-3}	1	2
Xe-135	0	0	0.3	24	3×10^{-2}	24	48
Xe-137	0	0	7×10^{-5}	0.8	1×10^{-3}	0.8	2
Xe-138	0	0	1×10^{-3}	4	5×10^{-3}	4	8
Total	20	1.3×10^{3}	80	120	0.7	120	1640
I-131	0		5×10^{-4}	2×10^{-3}	3×10^{-3}	1.4×10^{-3}	7×10^{-3}
I-133	0		5×10^{-4}	2×10^{-3}	4×10^{-3}	1.8×10^{-3}	9×10^{-3}

*Zero (0) appearing in this table indicates release is less than 10^{-6} Ci/yr.

Spent resins will be placed in 30-gal drums and mixed with a blend of vermiculite and cement for solidification. Evaporator bottoms will be placed in 55-gal drums and mixed with a blend of vermiculite and cement for solidification. If required by the activity level, the filled drums will be enclosed in steel-jacketed lead shields for shipment.

We estimate that for each reactor unit approximately 500 30-gal drums of spent resins, 200 55-gal drums of evaporator bottoms, and 600 55-gal drums of miscellaneous dry waste will be shipped offsite each year. We estimate that each drum of spent resins will contain approximately 10 Ci after 180 days decay; each drum of evaporator bottom will contain approximately 2 Ci after 180 days decay; and the 600 drums of low activity waste will contain less than 5 Ci total.

TVA estimates that approximately 1550 cu ft of spent resins, 960 cu ft of evaporator bottoms and 2450 cu ft of miscellaneous dry wastes will be shipped each year from each reactor unit. TVA also estimates that 775 Ci/yr of radioactivity in spent resin drums, 30 Ci/yr of radioactivity in evaporator bottom drums, and 25 Ci/yr of radioactivity in the miscellaneous dry waste drums for each reactor unit.

Drums will be filled and sealed by remote means. Storage time will be provided depending on the curie content and number of drums generated. Shielding will be provided as required to ensure as low as practicable doses. Based on our evaluation of the quantities of solid wastes that are generated, the provisions for handling the waste, and shipment in accordance with AEC 10 CFR Part 71 and applicable DOT regulations, we conclude that the solid radwaste system is acceptable.

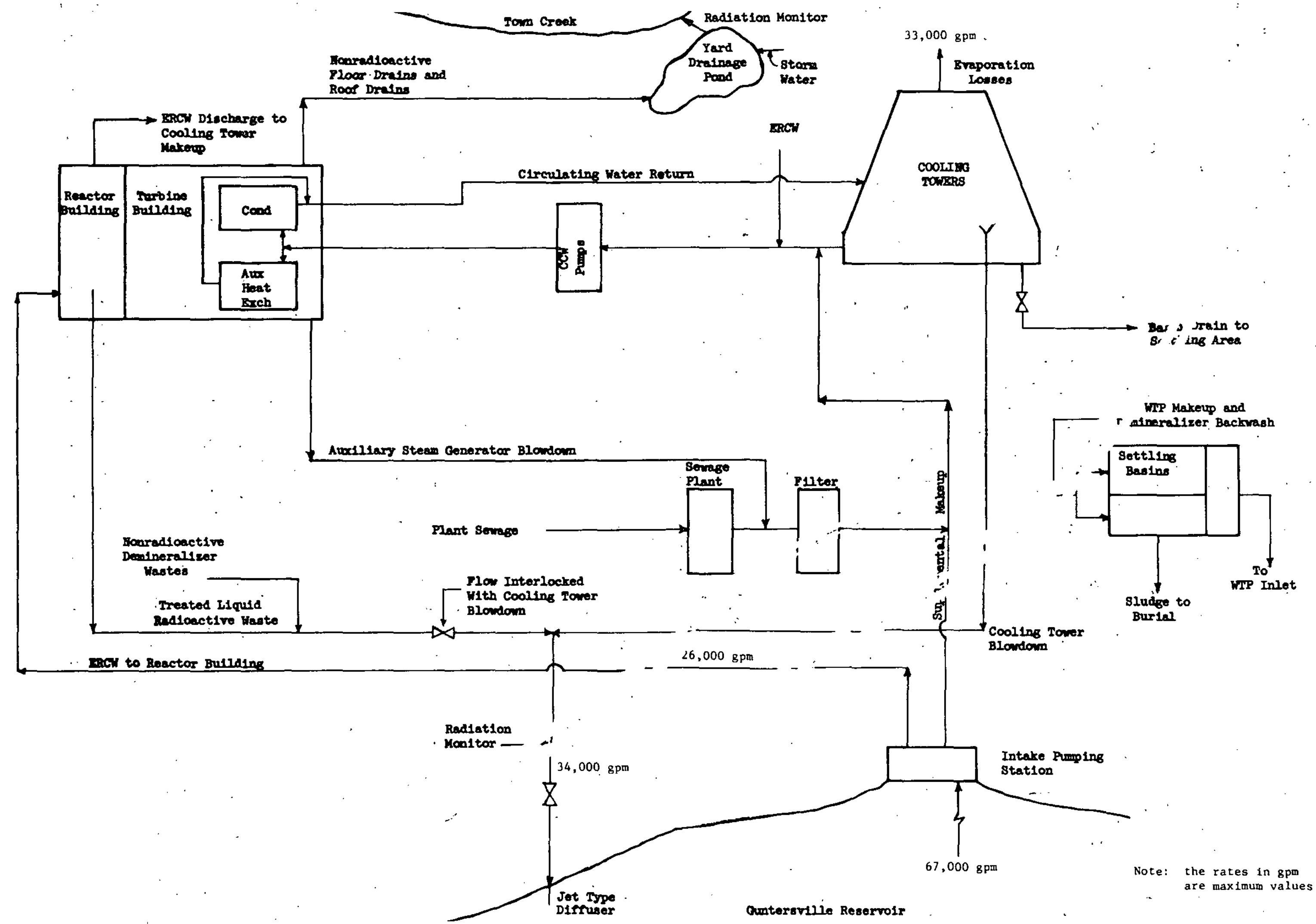
3.2.4 Nonradioactive Waste Disposal

A description of the potential sources and amounts of nonradioactive discharges which have been identified is given in this section. Impacts from these emissions will be discussed in Section 5.

3.2.4.1 Chemical Discharges

The Bellefonte Nuclear Plant liquid flow and discharge system is shown in schematic representation in Fig. 3.4. The sources of chemicals and the maximum expected quantity of resulting chemical end products that could be discharged are summarized in Tables 3.4, 3.5, and 3.6. The TVA states that no sulfuric acid will be needed for the circulating water system to prevent scaling.

An area of approximately 10 acres will be diked to provide a yard drainage pond. Any debris or oil which may be spilled and enter the yard drainage



Fi. .4. Flow Diagram of Plant Discharge System. From TVA DES.

TABLE 3.4. Summary of Added Chemicals and Resulting End Products. From TVA DES.

System	Chemical Treatment Source Chemical	Maximum Annual Use lbs	Waste End Product Chemical	Resulting End Product - lbs Maximum Annual	Mean Daily	Maximum Daily
Steam System Water Filtration Plant[a]	Alum	43,232	$Al(OH)_3$[b]	9,860	27	60
	$Al_2(SO_4)_3 \cdot 18\ H_2O$		SO_4^{--}	18,700	51	110
	Soda Ash	15,596				
	Na_2CO_3		Na^+	6,800	19	42
			Settled Solids[b,c]	21,800	60	151
	Chlorine Cl_2	5,250	OCl^- and Cl^-	5,250	14	30
Steam System Makeup Water Demineralizers[a]	Sulfuric Acid H_2SO_4 (100%)	126,200	SO_4^{--}	123,600	339	1,410
	Sodium Hydroxide NaOH (100%)	103,087	Na^+	59,300	162	1,150
Natural Minerals Removed by Demineralizers[a,c]	Sodium Na^+	2,500	Na^+	2,500	7	28
	Chloride Cl^-	4,810	Cl^-	4,810	13	55
	Sulfate SO_4^{--}	5,760	SO_4^{--}	5,760	16	65
	Total Dissolved Solids	30,900	Total Dissolved Solids	30,900	85	340
Main Steam System Condensate Polishing Demineralizers[d]	Sulfuric Acid H_2SO_4 (100%)	160,000	SO_4^{--}	157,000	430	1,602
	Sodium Hydroxide NaOH (100%)	52,500	Na^+	30,200	83	308
	Ammonia Hydroxide NH_4OH (100%)	33,000	NH_3	17,000	47	173
Main Steam Generator System[d]	Ammonia NH_3[e]	13,000	NH_3[f]	13,000	36	36
	Hydrazine H_2NNH_2[g]	1,900	NH_3[f]	1,900	5	5
Auxiliary Steam Generator System[d]	Ammonia NH_3[e]	175	NH_3	175	0.5	0.5
	Hydrazine H_2NNH_2[g]	26	NH_3	26	0.1	0.1
RCW and ERCW[d]	Acrolein ($CH_2 = CHCHO$)[h]	600	Acrolein	-	-	-
Main Condenser Cooling H_2O[d]	Chlorine (Cl_2)[i]	149,800	OCl^- and Cl^-	149,800	410	410

a. Based on operation at rated capacity 12 weeks per year and less than rated capacity 40 weeks per year.
b. Precipitated material that will make up the water treatment sludge on a dry weight basis.
c. Estimates based on mean water quality data observed at TRM 385.9.
d. Based on 24-hour operation 365 days per year at rated capacity.
e. Ammonia will be added as needed to maintain a pH of approximately 9.4 in the system.
f. Ammonia will be released to the atmosphere through the air vapor outlet.
g. Hydrazine will be added as needed as a "DO" scavenger. Hydrazine assumed to decompose to ammonia.
h. Acrolein will be added to the system for 120 days for one-half hour each day. The acrolein demand of the main condenser water system and cooling tower stripping will prevent acrolein from being discharged to the aquatic environment.
i. Chlorine will be added to maintain a 0.5 mg/l chlorine residual at condenser outlet for one hour each day.

TABLE 3.5. Summary of "Added" Inorganic Chemical Discharges to Guntersville Reservoir Using the Proposed Method of Treatment[a] and Discharge. From TVA DES.

Waste Product Chemical	Maximum Daily Discharge of Product Chemical - lbs	Maximum Daily[b] Contribution to Cooling Tower Blowdown - mg/l	Observed Chemical Concentrations in Reservoir Water at TRM 385.9 mg/l		Blowdown[c] Concentration Factor	Concentration During Period of Added Chemical Discharge				
						Blowdown[d] mg/l		River After[e] Jet Mixing mg/l		Allowable[f] Concentration in Reservoir mg/l
			Average	Maximum		Average	Maximum	Average	Maximum	
Sulfates (SO_4^{--})	3,187	47.9	17.7	23.0	2	83.3	93.9	24.3	30.1	250
					3	101.0	116.9	26.0	32.4	
Sodium (Na^+)	1,528	23.0	7.7	12.4	2	38.4	47.8	10.8	15.9	g
					3	46.1	60.2	11.5	17.2	
Chlorides[h] (Cl^-)	495	7.4	14.8	22.0	2	37.0	51.4	17.0	24.9	250
					3	51.8	73.4	18.5	27.1	
Ammonia[i] (NH_3)	0.6	.009	0.026	0.09	2	.061	.189	.031	0.10	g
					3	.087	.279	.032	0.11	
Total Dissolved Solids	5,402	81.1	95.0	140.0	2	271.1	361.1	112.6	162.1	500
					3	366.1	501.1	122.1	176.1	

a. Assume all maximum daily waste streams are retained in a holding tank and discharged within a 4-hour period each day. The makeup demineralizer spent regenerants and condensate demineralizer spent regenerants will be retained in separate tanks. However, when discharged to blowdown, the tanks could be emptied simultaneously. This will constitute the maximum discharge during a specific 4-hour period.

b. Based on maximum daily contributions in blowdown stream for a 2-unit plant with a 74 ft^3/s continuous blowdown rate.

c. Normal blowdown concentration factor = 2; blowdown concentration factor = 3 following periods when blowdown was discontinued.

d. Based on concentrations occurring only when the cooling tower blowdown is being released.

e. Assumes jet mixing diffuser will be provided to mix 9 volumes reservoir water with one volume of blowdown.

f. Alabama Water Improvement Commission, Water Quality Criteria for Waters of Alabama, July 17, 1972. Note: TVA code requires observance of 150 mg/l for SO_4^{--} instead of the given 250 mg/l

g. No specific standard has been identified, but contribution to dissolved solids is included.

h. Computation is for chlorides.

i. Ammonia and hydrazine added to the auxiliary steam system for pH control and dissolved oxygen control, respectively. Hydrazine assumed to decompose to ammonia.

TABLE 3.6. Summary of Observed Trace Metal Concentrations and Expected Trace Metal Concentrations in the Discharge Stream and at the Edge of the Jet Mixing Zone. From TVA DES.

Parameter (Dissolved)	Number of Times Observed in Nine Samples[a]	Statistics for Observed Values[a] ug/l Minimum	Maximum	Mean	Concentration Factor[b]	Maximum Expected Trace Metal Concentrations Closed-Cycle Cooling Operation[c] ug/l In Blowdown	Edge of Jet Mixing Zone[d]	Effluent Guidelines[e] ug/l	
Zinc	5	6	23	12	2	46	25.3	800	(Zn)
					3	69	27.6		
Boron	9	7	45	24	2	90	49.5		
					3	135	54.0		
Iron	9	4	52	21	2	104	57.2	3,000	(Fe)
					3	156	62.4		
Manganese	3	0.6	1.9	1.4	2	3.8	2.1		
					3	5.7	2.3		
Copper	9	2	9	4	2	18	9.9	500	(Cu)
					3	27	10.8		
Barium	9	11	36	24	2	72	39.6		
					3	108	43.2		
Strontium	9	20	118	54	2	236	129.8		
					3	354	141.6		
Aluminum	6	16	53	28	2	106	58.3		
					3	159	63.6		
Chromium	3	3	13	6	2	26	14.3	500	(Cr)
					3	39	15.6		
Lead	2	11	14	12.5	2	28	15.4		
					3	42	16.8		
Molybdenum	1	12	12	12	2	24	13.2		
					3	36	14.4		
Cadmium[f]	0	-	-	-				<100	(Cd)
Arsenic[f]	0	-	-	-					
Beryllium[f]	0	-	-	-					
Silver[f]	0	-	-	-					
Nickel[f]	0	-	-	-				500	(Ni)

a. From Trace Metals in Waters of the United States: A Five Year Summary of Trace Metals in Rivers and Lakes of the United States, (October 1, 1962 through September 30, 1967), U.S. Department of the Interior, FWPCA, Division of Pollution Surveillance, Cincinnati, Ohio. Weekly samples were composited for 3-month periods twice a year during the period. Data collected at Widows Creek Steam Plant TRM 408.

b. Normal blowdown concentration factor = 2; blowdown concentration factor = 3 when blowdown is resumed following periods when blowdown had been discontinued for up to 5 hours because of low streamflows.

c. Assumes maximum observed concentrations occur.

d. Assumes jet diffuser will be designed to mix nine volumes of river water with one volume of blowdown.

e. Alabama Water Improvement Commission, Tentative Guidelines for Heavy Metal Effluent Limitations, received by letter, October 30, 1972.

f. Not detected in any sample.

system will flow to this pond. A deep-level skimming-type outflow will be provided so that floating debris and oil cannot escape from the pond. This material will be periodically removed from the pond for disposal. Depending on the character of the wastes, disposal will be by such methods as reclamation, burial, landfill, or burning. The pond effluent will go to the Town Creek embayment.

3.2.4.2 Transformers and Electrical Machinery

Some oil leakage may occur from bearings and other parts of certain machinery inside buildings. The oil will be drained to an oil sump that will have adquate capacity to contain all spillage, which will then be recovered for reclamation or disposal.

3.2.4.3 Sanitary Wastes

Extended aeration sewage treatment facilities will be provided during the construction period to treat the domestic wastes from a peak construction force of approximately 2500 persons. Effluent from the plant will be chlorinated before discharge to the river. These treatment facilities will be complemented during construction by portable-type chemical toilets for use in isolated or remote areas of the project site. At the end of construction, these initially installed facilities will be removed.

Secondary treatment facilities with provision for chlorination will be provided for the permanent plant. Effluent will be discharged to the cooling-tower makeup system. As stated by the applicant, the treatment facility will be designed to handle the sewage load for approximately 300 persons, which should be satisfactory for the 170 permanent employees, temporary employees, and special visitors. During periods when a large temporary maintenance force is working at the plant, the permanent waste treatment system will be supplemented by portable-type chemical toilets.

At the visitor's center, TVA estimates about 200 visits per day. The sanitary facilities are separate from those of the permanent plant.

3.2.4.4 Gaseous Emissions

The oil-fired auxiliary steam generators are expected to burn a total of about 4.8×10^6 gallons per year of No. 2 fuel oil, having a maximum sulfur content of 0.5 percent. The boilers are each rated at 100,000 lb/hr steamflow with an input rating of about 145×10^6 Btu/hr. For short times, both units will operate at full capacity, which results in burning 1815 gal/hr of fuel.

The main emissions are: particulates, sulfur oxides, carbon dioxide, carbon monoxide, hydrocarbons, and nitrogen oxides. The emission will be released through a stack which is approximately 125 feet above ground level.

During operation, four diesel generators are on the site; they will only operate during emergency and equipment-testing periods.

3.3 TRANSMISSION LINES

The transmission lines associated with the Bellefonte plant will be constructed in three steps.

Step One will be the construction of a 500-kV line between the Widows Creek fossil-fuel plant and a substation in the Guntersville area. This 40-mile line is being constructed early because of a need for a new interconnection of the TVA system with the Alabama Power Company. This line is to be completed by the summer of 1976. (When Bellefonte generating unit No. 2 comes on-line, approximately in January of 1980, a connection to the plant must be in service.)

Under Step Two, two 500-kV transmission lines will provide system connections for the Bellefonte Nuclear Plant Unit 1. These connections will be provided by opening the existing Widows Creek-Madison 500-kV transmission line and extending the resulting line sections approximately 12 miles to the nuclear plant switchyard. This will establish 500-kV transmission lines to Widows Creek Steam Plant and Madison Substation.

Station service power to the nuclear plant will be provided by opening the existing Widows Creek-Scottsboro 161-kV transmission line in the vicinity of Bellefonte and constructing two lines to the nuclear plant switchyard. Approximately 1.2 miles of new construction will be required for each 161-kV line. The approximate service date for these two lines is June of 1979.

Step Three will be the construction of the 500-kV transmission lines from the plant, across the river on double-circuit transmission line towers, to connection with the lines previously described in Step One. These lines will be about three miles long and will be required for service in March of 1980. Originally it was proposed to extend the Bellefonte-Guntersville 500-kV line an additional 36 miles to the Madison Substation near Huntsville, Alabama. Recent studies, jointly conducted between Southern Services Corporation, Alabama Power Company, and TVA, show that a multipurpose 500-kV interconnection between the Alabama Power Company and the TVA system at Guntersville would provide sufficient power system access for stable operation of the second Bellefonte generating unit. This connection, therefore, eliminates the need for extending the Bellefonte-Guntersville 500-kV line to Madison. For the purposes of this statement, it is assumed that all these planning steps will occur and are assignable to the Bellefonte plant.

The transmission line routes as shown in Fig. 3.5 will require approximately 73 miles of new transmission line construction and necessitate the purchase of 1550 acres of new right-of-way easements. Approximately 50 percent of the required rights-of-way is presently in woodland, 25 percent is used for farming, and the remainder is farmland lying idle.

3.4 SITE ACCESS

There will be two access routes to the site during most of the construction program, one via existing roads west of the plant site and a new permanent access road from a point off U. S. 72 northeast of the site. This new access road will require construction of a causeway across the Town Creek embayment. By the time the construction force reaches 1000 employees, the new access road should be open to traffic. The abnormal construction traffic may necessitate repairs to the existing roads, and the TVA will determine responsibility for repairs on an individual basis with local highway officials at the appropriate time. Road access to the site is discussed in greater detail in the discussion of alternatives in Section 9.2.4.

Most of the heavier items of permanent equipment will arrive by rail or barge shipments. Railroad access to the site will be provided by a new three-mile spur off the Southern Railway main line from a point about one mile west of Hollywood. The selected route follows property lines and will provide rail access to potential industrial lands between the plant site and Scottsboro. A docking facility will be built at the shoreline between the intake channel and the discharge to handle barge traffic.

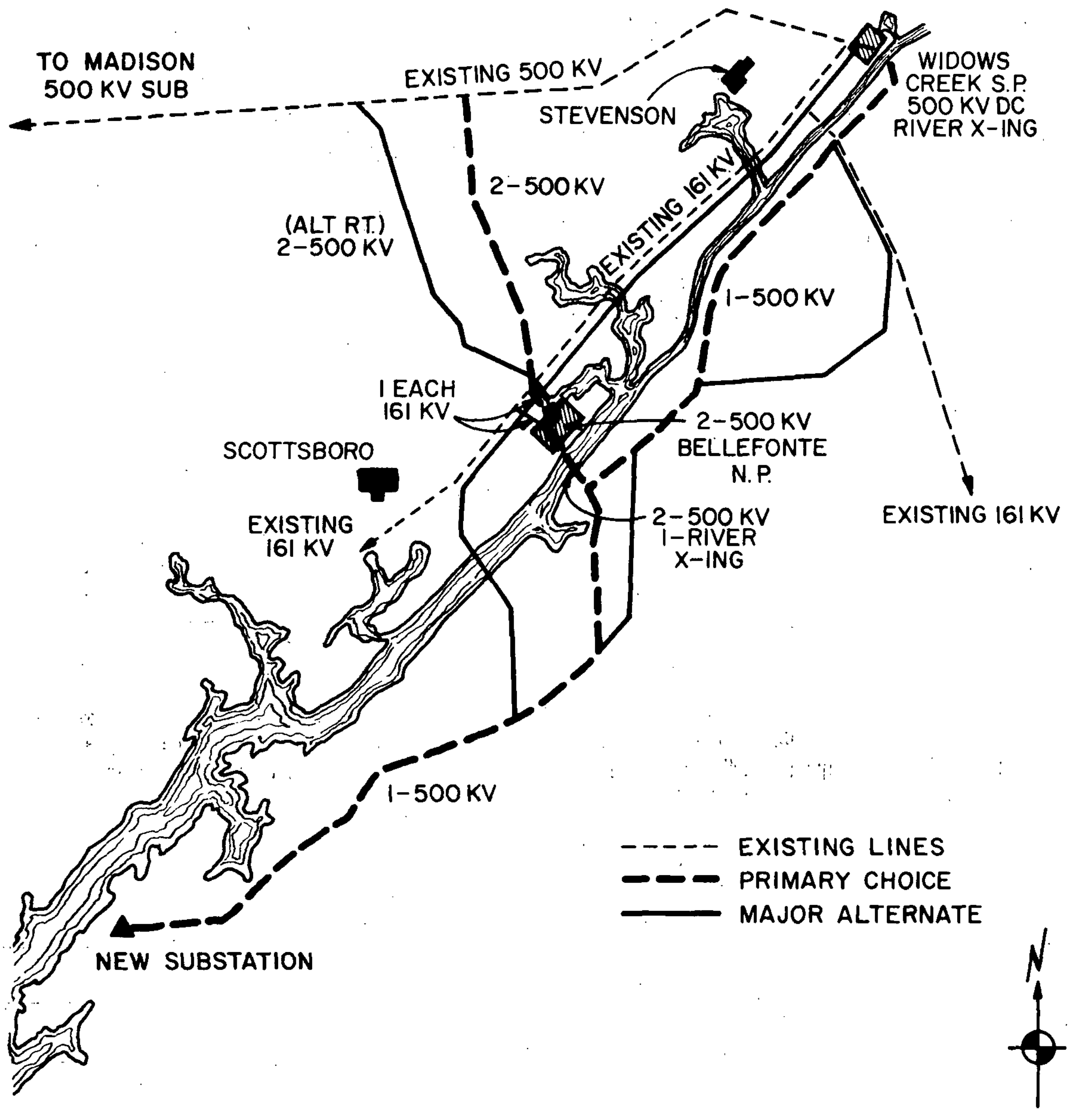


Fig. 3.5. Primary Choice and Major Alternative Routes for Transmission Line Rights-of-Way.

4. ENVIRONMENTAL EFFECTS OF CONSTRUCTION

4.1 TERRESTRIAL EFFECTS

4.1.1 Onsite Construction

Of the 1500 acres of the site, the staff estimates that approximately 400 acres will be disturbed by construction activities. Vegetation will be removed in the construction areas and will be disturbed somewhat in adjacent areas. This will result in a loss of wildlife habitat and the attendant wildlife. Based on preliminary biological surveys, no rare or endangered species of plants and animals are known to inhabit the site. Most of the construction will be on the farmland. The forested highland on the reservoir side of the peninsula, except for the intake, discharge, docking and visitors' center areas, will be left intact. Not only is the forest itself important to many species of wildlife (especially as a refuge area), but the edge along the overbank area of the reservoir is important to species such as the prothonotary warbler and herons. The staff recommends that construction personnel be excluded from the non-construction portions of the overbank area and adjacent forested hills by the use of signs and/or fences.

The grading and excavation estimates for the plant require that a borrow source be used to supply the needed fill material. Approximately 400,000 cubic yards must be obtained. The procedures to be used in the excavation, obtaining of fill, grading, and final surface conditioning will determine much of the impact caused by these activities. The applicant is committed to measures and controls to limit possible adverse effects from construction as given in section 4.4.

Dust control measures to be taken include water sprinkling and chemical treatment. Chemicals to be used for dust control include calcium chloride and water soluble polymers.[1] While the calcium chloride should cause no problems in runoff waters (if used correctly), the staff feels that not enough is known about the use and potential impacts of the use of water soluble polymers. Therefore, the staff recommends that the TVA not use water soluble polymers for dust control. This matter can be reviewed with the AEC in the future if TVA does decide to use them. There will be some unavoidable offsite noise from the movement of trucks and the operation of heavy machinery. The noisiest construction activities, such as pile driving and blasting, will generally be limited to the daytime.

On construction projects of this magnitude, with such concentrated activity of men and machines, extra precautions must be taken to keep construction impacts to acceptably low levels. Erosion during and after construction can be kept to a minimum by several methods.[2,3] The TVA follows some of the practices discussed in these references. In the TVA DES, the TVA states that in conjunction with a master grading plan, berms, diversion dikes, check dams, sediment basins, fiber mats, netting, gravel, mulches, grasses, special drains and other erosion control measures will be used. Turbidity and siltation in the reservoir resulting from erosion of land, and the subsequent effects on aquatic biota will be monitored (see Section 6). Quarterly site inspection visits by TVA ecologists should disclose any severe erosion problems or other unacceptable construction impacts. However, the staff will require the TVA to provide positive plans for coupling results of the construction environmental monitoring with construction practices to ensure that environmental impacts of construction are constrained to acceptable levels.

The TVA DES states that "Minor local ground water disturbances may occur as a result of plant construction, but no permanent ground water level changes are anticipated." (Vol. 1, p. 8.2-7.) Since no ground water will be used at the Bellefonte plant (the site is underlain by Chickamauga Limestone, which in this area is a poorly water-bearing formation [PSAR, Vol. 2, p. 2.4-26 to 2.4-29]), the possible disturbances would be the lowering of ground water levels due to quarrying and dewatering operations. Except to the southwest along the strike of the Chickamauga limestone, the Bellefonte site is hydraulically isolated by Guntersville Lake and Town Creek embayment. There is one private well just offsite in the southwest direction. Any future wells in this direction would necessarily be confined to the Knox Dolomite. The Knox, one of the two principle water-bearing formations in the area, dips to the southeast and at the plant site is 1000 feet below land surface. It is, therefore, extremely unlikely that any ground water disturbances due to construction would extend offsite. Also, once quarrying and dewatering operations cease, the normal local ground water levels on the site would be reestablished. However, should there be any difficulties experienced by residents in the area as a result of construction-induced alteration of the groundwater supply, the TVA should take the necessary actions to alleviate such well-water problems.

4.1.2 Transmission Line Construction[4-6]

General routing of the 73 miles of new transmission lines is fairly firm. Exact location will be determined by field surveys. Residential, commercial, industrial, recreational, historical, cultural and scenic areas, crests of ridges and mountains, buildings and woodlands are avoided where possible. Property lines, land-use zones, and the best places to cross roads and streams are taken into consideration.

In construction of new lines through wooded areas, the TVA proposes to "shear clear" (all vegetation cleared to ground level). Stumps are removed as much as possible (depending on size of stumps and ground conditions) and after construction is complete, the right-of-way is disced, then seeded (usually with Kentucky 31 fescue) and fertilized.

The right-of-way is maintained by mowing every four to five years. In "remote and inaccessible" areas where seeding and mowing are not practicable, the right-of-way is maintained by aerial broadcast applications of herbicides, generally Tandex at the rate of 15.2 pounds (active)/acre. Where erosion control problems could be encountered in areas of rock outcropping, on steep slopes, and in the vicinity of streams, timber is hand-cut. Vegetation is left intact as much as possible near streams and screening is attempted at major road crossings. In moderately rolling terrain and on slopes up to approximately 30 degrees, water breaks and diversion swales are constructed to control erosion. Slash is normally disposed of by open burning. Occasionally, controlled burning (burning in a pit with the aid of blowers) and windrowing of slash are used. Permanent access roads within the right-of-way are generally not built.

From onsite inspections of existing and proposed lines in the Bellefonte area, and from discussions with TVA personnel, the staff feels that the TVA does an adequate job of transmission line routing. The staff foresees no problems with the routing proposed for the Bellefonte lines and concurs with the TVA in rejection of the alternative routings considered.

The manner in which rights-of-way are prepared and used for construction of the lines will greatly influence the kind and extent of future maintenance work as well as the severity of the environmental impacts of construction and maintenance. The staff believes that the TVA has not adquately considered alternative construction and maintenance methods. Their basic approach is not consistent with good construction practices and basic ecological principles, nor is it consistent with what other utilities and governmental agencies have found to be desirable and practicable. A comprehensive treatment of the staff's concerns with the methods the TVA proposes to use for Bellefonte, and some suggested alternatives, is contained in Appendix B.

The staff will require that the TVA submit a plan acceptable to the staff to study the impacts of various alternative methods of construction and maintenance. The Bellefonte line, which must be constructed early (referred to as Step 1 in this document), can be used for this study. Prior to construction of the remaining Bellefonte lines (Steps 2 and 3), the results of this study and an updated version of proposed clearing and maintenance methods (including evaluation of alternatives) will be submitted for staff evaluation. This submittal should include the costs and benefits of alternative methods as TVA sees them at that time. Cost experience factors and the effects on vegetation, wildlife, and soil stability are among the items to be considered.

In addition to Appendix B, transmission lines are also discussed in Sections 5.4.1.2 (operation, particularly maintenance by mowing and herbicides), 6.2.2 (monitoring), and 9.2.4 (alternatives).

4.1.3 Access Railroad Construction

Railroad access to the site will be provided by a new three-mile spur off the Southern Railway main line from a point about one mile west of Hollywood. The selected route follows property lines and will provide rail access to potential industrial lands between the plant site and Scottsboro. In constructing this spur, the TVA will follow the good construction practices discussed in Section 4.1.1. Construction along the selected route will have less potential environmental impact than the alternative route across the Town Creek embayment (which would have the additional impacts of increased turbidity and siltation of Town Creek and the loss of aquatic habitat). (See Section 9.2.7 for discussion of alternate routings.)

4.2 AQUATIC EFFECTS

The chief consequence of onsite and transmission line construction will be the addition to adjacent waters of particulate matter and nutrients which are in excess of the normal load in surface runoff. The applicant estimates erosion of 4600 tons of soil from the site during the six-year construction period. Increases in turbidity and silation will also result from dredging for the intake, discharge, and docking facilities and construction of the causeway. There will be periods during intense construction activities and heavy rains when the erosion of soil and work in the water (dredging, causeway construction, etc.) could lead to extreme turbidity and siltation in the reservoir and in the Town Creek embayment. However, good practice, which includes timing and the use of proper equipment, can substantially reduce the potential for siltation and turbidity.

The minimization of siltation and turbidity is desirable because there are potentially many deleterious effects caused by increased nutrient load, siltation, and turbidity on the aquatic biota.[7-16] These include: nutrient stimulation of algal growth, turbidity- and siltation-caused reduction of primary productivity (by reduction of light penetration, flocculation of planktonic algae, smothering of macrophytes with silt, etc.), modification of the benthic community structure and/or reduction of benthic productivity (by a change of substrate type, settling of suspended soilds, increased oxygen demand from organics in silt, etc.), and numerous effects of fish populations (through fish avoidance of turbid water, difficulty finding food, reduction of available food, cessation of migration, depression of growth, reduction of resistance to other stresses, increased incidence of disease, siltation of spawning grounds and smothering of eggs, etc.).

The position of the staff is that if good practice is followed in construction activities,[14,16-18] construction impacts will be acceptable. In general, TVA proposes construction practices which will limit impact due to siltation and turbidity. However, in the opinion of the staff, a desirable enhancement of good practice would result if the information gathered through the construction monitoring program were used to evaluate construction activities on a periodic basis. To this end, the applicant has provided a summary of procedures for a periodic review to ascertain that construction activities are minimizing adverse biotic impacts. (See Section 6.2.1).

Several acres of the 450-acre Town Creek embayment will be lost to the earthen causeway. The standing crop of adult fish in the embayment will be reduced by several percent. The restriction of flow through two box culverts in the causeway will probably decrease the utility of the embayment for fish spawning and rearing. Retardation of water may increase sedimentation, which could reduce the utility of an area for spawning. Retardation of flow could also increase the suitability of the embayment for growth of aquatic macrophytes. In general, construction of the proposed causeway will probably have undesirable, but acceptable, aquatic impacts.

4.3 SOCIAL AND ECONOMIC EFFECTS

5.3.1 Employment

The construction work force for the Bellefonte plant is expected to grow from an average of 425 in the first year, 1975, to an average of 2200 during the peak construction year, 1978.[19] Table 4.1 gives a projection of employment for the plant.

Surveys[20-22] of the construction impact at three recent TVA steam plants provide a basis for estimating these effects at the Bellefonte plant. The data in these reports suggest that the majority of the workers who changed their place of residence located less than 20 miles from the construction site. It is also evident that a significant fraction of the employees (15 to 37 percent) commuted from 40 to 90 miles to those projects. Conversely, between 63 and 85 percent of the workers resided within 40 miles of the construction sites.

The staff agrees with the TVA estimate that between 25 and 30 percent of the construction work force at the Bellefonte plant will be new residents in the area and that the Scottsboro and Hollywood communities can be expected to absorb approximately 70 percent (420) of the movers[23]. An additional 20 percent of the movers will be distributed as far south as Guntersville, to the west beyond Huntsville and to the north as far as Chattanooga. The remaining 10 percent will be scattered among the small communities on Sand Mountain and the Cumberland Plateau.

TABLE 4.1. Projected Employment, Bellefonte Nuclear Plant

Month-Year[b]	Projected Employment[a]		
	Total	*Construction*	*Permanent*
January 1975	0	0	
January 1976	850	850	
January 1977	1500	1500	
January 1978	2150	2150	
January 1979	2270	2240	30
January 1980	1815	1660	155
January 1981	800	630	170
January 1982	170	0	170

[a]*Source: TVA DES, p. 2.8-10*

[b]*Construction schedule revised by staff to reflect earliest possible starting date.*

4.3.2 Stimulation of Local and Regional Economies

The construction and operation of the Bellefonte Nuclear Plant will also have indirect benefits resulting from the construction and operation of the facility:

4.3.2.1 Stimulation of Local and Regional Economies -- Direct Payroll

In the peak construction year, TVA estimates that peak employment of 2200 workers at an average annual wage of $10,000 will result in a projected annual payroll of $22,000,000. This compares with a total income of residents of Scottsboro of $26.3 million in 1972.[24] The employment of an average of 1300 workers per year during the seven-year construction period will result in a total payroll of $91,000,000. We view these estimates by TVA as being reasonable. Various factors require that the permanent operating personnel be on site during the last half of the construction phase of the project. The buildup of the permanent staff will start soon after the point of peak construction employment and will stabilize at a level of 170 during the last two years of construction. Their average annual payroll of $1,400,000 during this three-year period will be in addition to the construction payroll. The average annual salary of the permanent employees will be $11,250 based on present pay scales. The projected annual payroll for the 170 employees during operation of the plant will be $1,900,000.

4.3.2.2 Local Purchases of Materials and Special Services

The TVA's experience at Browns Ferry indicates that about 0.5 percent of the construction cost of a nuclear plant is spent on purchases and special contracts in what is broadly described as the "local area." Based on the Browns Ferry experience, the average annual expenditure in the local economy due to construction of the Bellefonte plant would be approximately $500,000. With Jackson County wholesale trade representing a total of $16,945,000 in 1967,[25] the increased purchasing requirements represented by the Bellefonte plant would increase annual wholesale trade by approximately three percent. The infusion of additional economic activity is not expected to create situations which might produce significant adverse economic conditions when construction is completed.

4.3.2.3 Capital Formation Effects

The Bellefonte Nuclear Plant will stimulate capital formation in the region. One form of capital formation that could be of significant magnitude is in the housing section. At the height of the construction period approximately 420 workers will have relocated in the general Bellefonte area. Based on modification of estimates supplied by TVA, the Scottsboro-Hollywood area will face an increased demand for approximately 170 houses, mobile homes, and 80 apartments or sleeping rooms. 1970 census data for Scottsboro indicate the inadequacy of the existing housing supply. If Scottsboro were to receive the entire local influx of workers, approximately 135 new homes plus 60 apartment units would have to be built. At an average value of approximately $20,000 per dwelling unit, this could amount to a $3.9 million increase in the value of Scottsboro's housing supply. In addition, capital formation, in the form of new mobile home parks and improvements to existing dwellings, may also be realized.

4.3.2.4 Multiplier Effects on Local Economy

The location of a TVA facility at Bellefonte will have both a direct and indirect impact on the local economy of Jackson County. The direct impact simply accounts for the TVA expenditures made in the region. Direct outlays for labor, and goods and services are estimated at approximately $13 million per year during the construction phase, and $2 million per year during the plant's normal operating life. However, for each dollar spent locally by TVA, there will be additional economic activity and personal income generated within Jackson County as these businessmen and TVA workers spend part of this money locally. A conservative multiplier of two would appear reasonable; therefore the above $13 million and $2 million per year would become $26 million and $4 million for total impact in Jackson County.

4.3.2.5 Transport Systems

Tentative plans call for railroad access to the site via approximately three miles of new roadbed from the Southern Railway main line at a point about one mile west of Hollywood entering the site from the southwest. The right-of-way for the access railroad will require about 65 acres of land presently in forest or agricultural use. The previous trend of the land-use development in the area of the right-of-way was toward low-density rural residential. Construction of the railroad access will enhance the industrial development potential of the properties adjoining the right-of-way. The town of Hollywood has adopted a tentative plan[26] which proposes industrial zoning for the adjoining properties along most of the railroad right-of-way.

4.3.2.6 Property Values

Property values for land in the vicinity of the Bellefonte site have, in the past, been based upon land productivity in agricultural use. Average yield for agricultural land use in Jackson County is about $80 per acre, and land values in the neighborhood of the proposed site range from $1000 to $3000 per acre for road frontage property, and $350 to $800 per acre for pasture land, depending upon local conditions. Current and future relative property values in agricultural use should not be significantly influenced by the construction of the Bellefonte nuclear plant at the proposed site. Furthermore, changes in land productivities and property values along the transmission route are not anticipated as a consequence of building the proposed site.

However, it is expected that substantial appreciation in the value of a few selected parcels will occur where these land sites could be used for commercial and other facilities supplying service to construction labor and, later, operation and maintenance personnel.

4.3.3 Temporary External Costs

External costs associated with the construction of the Bellefonte plant will be extensive. The local, relatively fixed supply of consumer products, housing, private and public services will place an upward pressure on local as well as county goods and services. The movement of workers and their families will place a noticeable strain on housing, schools, hospitals, and various public services including water, sewage, police, fire and other services provided residents in communities. This section will provide analysis into the temporary external cost impacts associated with the construction of the plant.

4.3.3.1 Inflationary Impact on Prices

In most respects, pressure on prices is expected to be moderate. For example, the power plant is estimated to directly cause personal income and wholesale trade in Jackson County to rise by 6.8% and 3%, respectively, during construction. These increases are calculated for the base years of 1969 and 1967. Since the region is experiencing economic growth, and plant construction is set for the latter half of the 1970's, these direct impacts should constitute even smaller proportions at the date they are incurred.

Any inflationary pressure that is realized should be a short-run phenomenon limited to the construction years. The staff foresees the actual operation of the plant having little direct or indirect impact on the region's economy. Aside from the 170 permanent plant employees and related service industries, there will be little interaction with the local economy.

4.3.3.2 Congestion or Stress on Local Public Facilities and Services

Construction workers moving into the area are estimated to comprise about 30 percent of the total construction work force. The Scottsboro-Hollywood area can be expected to absorb approximately 70 percent of the movers.

Approximately 40 percent of those workers moving into the area are expected to buy or rent houses. An additional 40 percent are expected to buy or rent mobile homes and the remaining 20 percent probably will rent apartments or sleeping rooms. Workers who move and bring their families should make up about 70 percent of all workers moving into the area. The remaining 30 percent should be mostly single men or men who will live in the area during the week and return home on weekends. On the average, the staff estimates that workers who bring their families will have about 0.75 school-age child per family.

Using the percentages discussed above, estimates were prepared by the staff for selected employment levels (1000 men and 2000 men) to provide typical figures for the Jackson County area regarding housing demand, school-age children, and total population influx. These estimates are contained in Table 4.2.

The 1970 population of Jackson County was 39,202 and the Scottsboro-Hollywood total was 9625 (Scottsboro 9324 and Hollywood 301).[27] Thus, the staff projects a population influx of 1330 which would represent 3.4 percent of Jackson County's total population and with the 930 people projected to be locating in Scottsboro-Hollywood is a 9.6 percent increase.

If recent population figures provided by the cities of Scottsboro (14,000)[28] and Hollywood (865)[29] are used, a more realistic measure of the population of the combined area is obtained. The influx of 930 people in the area would be a 6.3 percent increase of the present population of 14,865. Although the rising population would have a significant impact, the staff notes that these cities have absorbed in the past many more people during a four-year period than required for plant construction activity to reach a peak.

4.3.3.3 Impact on Streets and Highways

The TVA proposes to use two access roads to the site during most of the construction program, one via an existing road south of the plant site and a new permanent access road from U. S. 72 north of the site. Initially, all traffic will enter the project area via the existing road, which passes through the old town site of Bellefonte. By the time the construction force reaches 1000 employees, driving an estimated 450 cars, the new access road should be open to traffic. After this occurs, employees living north of the plant site will likely use the new road, while those living to the south will continue to use existing road leading to the south entrance. At the peak of activity it is estimated that TVA and contractor employees will drive about 1200 vehicles to and from the plant. The 1970 average daily traffic on U. S. Highway 72 past the plant site was about 3700. Thus, the traffic near peak employment will be significantly increased and some congestion and delay is

TABLE 4.2. Estimated Population Effects of Construction Employees

	Employment Level	
	1000	*2000*
Percent movers	25	30
Number of movers	250	600
Demand for:		
Houses	100	240
Mobile homes	100	240
Apartments and sleeping rooms	50	120
Movers with families	180	420
Movers without families	70	180
School-age children	130	320
Total population influx	570	1330

expected. However, U. S. Highway 72 will be four-lane past the site before the start of construction, which will provide increased carrying capacity and tend to reduce the effects of the increased traffic load on regular users. Most of the heavier items of permanent equipment will arrive by rail or barge shipment, which will reduce the number of motor freight deliveries. Approximately one half of the truck deliveries will enter the site through the south entrance via interchange with a local carrier with terminal facilities in Scottsboro. Concrete aggregates and cement will also arrive by truck. The staff concludes that while demands on the road system will be heavy, the current and planned improvements will be capable of handling the volume.

4.3.3.4 Stress on Municipal Water and Sewage Systems

The Scottsboro municipal water system has a capacity of 6,000,000 gallons per day of potable water and a present total usage of 2,250,000 gallons per day. Of this amount, approximately 1,250,000 gallons are for industrial requirements. The town of Hollywood water system also has a surplus city water system capacity. Thus, the staff foresees an abundance of water for meeting the needs of new residents in the Scottsboro-Hollywood area.

A recent report prepared for the city of Scottsboro analyzes the present sewage system, treatment plants, usage and proposed improvements and additions.[30] Based on the report, the two existing treatments plants have a total designed capacity of 1,550,000 gallons per day and a reported usage of 1,550,000 gallons per day. Approximately 1,100,000 gallons of the daily flow is from five textile mills and the Goodyear Tire and Rubber Company plant where tire yarn is manufactured. The remainder is from residential, commercial and municipal connections to the system.

According to the above report, the capacity and location of the principal treatment plant does not comply with present State and Federal standards. The report also states that the principal plant releases bacterial pollution into Rosemary Creek and Guntersville Reservoir since the effluent is not chlorinated.

The projected population increase of 800 persons in Scottsboro during the peak construction year could add approximately 100,000 gallons to the load on the existing inadequate treatment plant.

The report recommends construction of a new 4,000,000-gallon-per-day treatment plant and various outfall lines estimated to cost $5,100,000. All of these facilities could be eligible for a Federal grant for 60% of their cost. Although it is understood that the project has a low priority for the Federal funding, it has a high priority with the State. Nevertheless, none of the present and future payments in lieu of taxes made by TVA to the State of Alabama will be available for construction of the required improvements.

The Town of Hollywood presently has no sewage system or treatment plant. Their proposed first-stage system and plant is estimated to cost $1,250,000 but it, too, has a low priority. Unless the State releases funds in the near future, the staff concludes that a growing need for sewage treatment may place a major stress on the financial resources of these communities.

4.3.3.5 Stress on Local School Facilities

According to the Economic Atlas (October 1972) prepared by the Top of Alabama Regional Council of Governments (TARCOG), the 1970-1971 enrollment in Jackson County schools was 6959 and in Scottsboro 3183 for a total of 10,142. Approximately 225 additional school-age children are expected in the Scottsboro-Hollywood area at an employment level of 2000. Assuming they all went to Scottsboro schools, this would be a 7.1 percent increase in enrollment and would create a need for eight additional classrooms if surplus capacity is not available. The remaining 95 distributed among other Jackson County schools would be a 1.4 percent increase.

The Economic Atlas indicates that the 1970-1971 per capita expenditure for instruction in Scottsboro schools was $345. Estimates provided by local school officials indicate that current expenditures are $390 per student. Thus, at current levels of cost, 225 additional students would result in an increase of $88,000 for instruction. The primary sources of funds for instruction are from State income and sales taxes. The source of capital funds for permanent classroom space is through bond issues and sale of warrants (liens of future income from local sales taxes). None of the payments in lieu of taxes made by TVA to the State of Alabama will be redistributed to the County of Scottsboro school districts to help defray increased capital and operating costs. However, there is precedent for direct aid to the local school districts by TVA. In another previous instance, where a shortage of classroom space was created by an influx of temporary power plant construction workers, TVA provided portable classrooms to mitigate this aspect of the impact.[31]

4.3.3.6 Stress on Local Hospital Facilities

The Jackson County seat, Scottsboro, is the location of the county hospital, health department and most of the county's health and medical facilities. Two hospitals serve the area and collectively provide 132 beds for a county average of 297 persons per bed.[32] This average compares favorably with the TARCOG average of 310 persons per bed but is considerably below the state average of 126 persons per bed and the national average of 118. A total of 18 physicians have offices in the county, most of which are located in Scottsboro.

In addition to the local facilities, TVA will maintain a field medical office, ambulance and personnel on site during construction for treatment of emergency cases. During operation of the plant, TVA will be responsible for maintaining an onsite organization for emergency first aid, decontamination facilities, and arrangements for tranpsort of injured or contaminated individuals to treatment facilities outside the site boundary.

The influx of an additional 1330 people in the area during construction will be a burden on the existing inadequate medical facilities. It is expected that the county hospital administration's plans for additional capacity and improvements will be accelerated in order to meet present needs and future growth. The proximity of medical facilities in Huntsville, which is only 40 miles west of the site, will also help mitigate dislocations caused by new residents.

4.3.3.7 Stress on Local Housing

We consider that the analysis of the availability of housing in the local area presented in the TVA Draft Environmental Statement is reasonable and conclusive. The data show that as of 1970, the vacant conventional housing for sale and for rent will not nearly meet the additional demand described in Table 4.2. However, it would appear that the additional demand created by the Bellefonte plant and other industrial growth will accelerate construction of conventional units. The data also show a ten-fold increase in the number of mobile homes in Jackson County in the 1960-1970 period. We conclude that the existence of mobile home parks in the local communities provides a system which can expand to satisfy a substantial fraction of the demand.

4.4 MEASURES AND CONTROLS TO LIMIT ADVERSE EFFECTS DURING CONSTRUCTION

4.4.1 Applicant Commitments

The following is a summary of the commitments made by the TVA to limit adverse effects during construction of the proposed station.

1. <u>Tree and brush clearing</u> (Ref. 34, p. 2.7-1 to 2.7-4)

   The construction areas are (or will be) sited wherever possible so as to minimize the necessary clearing of trees and brush. Clearing requirements are coordinated with the TVA Architectural Branch to avoid indiscriminate clearing and to provide screening of the construction area from public roads. As many trees as possible will be left within the construction area where they will not create costly and dangerous obstacles to construction equipment and personnel movements. Merchantable timber will be sold.

2. Landfill (Ref. 34, p. 2.5-17, 2.7-9)

The nonradioactive solid waste will be disposed of in a sanitary landfill located on TVA land and operated by TVA in accordance with EPA guidelines or in a state approved sanitary landfill on non-TVA land and operated by a municipality, county or private contractor. Broken concrete, rock, and residues from burning and scavenged scrap lumber will be used as landfill material on site.

3. Salvagable materials (Ref. 34, p. 2.5-17, 2.7-9)

Scrap metals, other than cans, will be salvaged and sold. Scrap lumber will be salvaged for reuse and made available to scavengers when it can no longer be used by TVA.

4. Burning (Ref. 34, 2.7-9, 3.0-4)

Trees which must be removed that have no commercial value, stumps, and brush will be cut, piled and burned. All burning will be performed in compliance with federal, state, and local air quality regulations when atmospheric conditions permit. There will be no burning of solid waste containing garbage.

5. Excavation - borrow and spoil areas (Ref. 34, 2.7-4 to 2.7-5, 3.0-2; Ref. 35, Comment 50)

Facilities were laid out to minimize the amount of extra fill material that would be necessary. An effort will be made to find suitable fill material in areas without trees, thereby minimizing further clearing. The borrow areas will probably be limited to the depth of the overburden at the site and will probably be quite large. On completion of the borrow operations, they will be graded to fit into the surrounding area and will be seeded and mulched. Unusable spoil material from excavation work will be placed in preselected area as fill, graded to conform to surrounding landscape, covered with topsoil, seeded, and mulched to avoid erosion.

6. Erosion (Ref. 1; Ref. 33, p. 2.7-6 to 2.7-8, 2.9-1, 3.0-1; Ref. 36, Comment 24)

Grading operations will be conducted to provide and maintain a controlled surface drainage system to minimize erosion. Standard techniques will be used to control the effects of wind and rain erosion during construction of the plant. Specifically, the rough and final grading of the plant area and drainage ditches, including those along access roads, will limit gradient slopes to the minimum. Intercept ditches will be provided at the tops of cuts to direct water from the new cut slopes where needed. Settlement basins will be constructed to reduce suspended solids in runoff. Drainage ditches will be protected from erosion by check dams, fiber mats, grouted riprap, or grass seeding, as appropriate. After cut and fill slopes are established, they will be protected by fertilizing, mulching and seeding. Mulch will normally consist of straw secured in place with emulsified asphalt or other approved means. Grass seeds will be a mixture of fescue, vetch, and rye, or as appropriate for the season and location. Relatively level areas of the site disturbed by construction will be (a) covered with crushed stone, (b) sown with grass and mulched, or (c) paved with asphaltic or Portland cement concrete. Some material which has been excavated will be stored in rolled sloped mounds to avoid saturation and erosion to permit its later use as fill. Topsoil will be removed and stored in a manner to minimize loss due to erosion.

Gravel will be used in construction areas to provide cover for parking, storage and work areas. Heavy rock bases will be laid for construction roadways to avoid rutting and erosion from the use of heavy equipment. Side ditches will be cleaned out periodically for proper drainage and side slopes will be protected where deemed feasible by seeding, matting or mulching.

On the proposed access road causeway, the lower sides of the earth-fill affected by water will be riprapped, and the upper slopes will be grassed to prevent erosion.

Inspectors working for the project management organization will control the extent of erodible material uncovered and direct the implementation of erosion control devices as deemed necessary. These inspectors and/or engineers will insure that erosion control practices are reasonably current with the excavation, borrow and grading operations.

7. Dust (Ref. 33; Ref. 34, p. 2.7-11)

Dust from movement of construction vehicles and wind erosion will be controlled by water sprinkling and chemical treatment. Chemicals to be used for dust control include calcium chloride and possible water soluble polymers. All percussion drilling will be performed with drills equipped with water or chemical dust controlling systems. Exceptions to this would be only in the limited use of "jack hammer" drills where dampened surfaces or other approved dust control measures will be used. Sandblasting operations will normally be performed within the paint shop area. Enclosures will be used as required to protect personnel and the environment. Protective clothing and respiratory devices will be used to protect employees performing the work.

8. Blasting (Ref. 33; Ref. 34, p. 2.7-5)

The use of explosives for rock excavation will be carefully planned and controlled by use of suitable blasting delays and presplitting, thereby minimizing overbreak, excessive throw, and dust.

9. Noise (Ref. 33; Ref. 36, Comment 79)

TVA will make every practicable effort to keep noise disturbances to a minimum. Construction activity will be concentrated within the site which is on a peninsula. Pile driving will be restricted to daytime hours. Efforts will be made to schedule blasting over a short time period and, where possible, to daylight hours. Charge sizes will be controlled to reduce noise levels when practicable. Noise generated by the aggregate bins will be controlled by keeping the bins full of aggregate when possible. Efforts will be made to include noise control devices on purchases of new equipment such as rock drills, compressors, and heavy earth movers. All diesel and gasoline powered equipment will be equipped with mufflers.

10. Pesticides and Herbicides (Ref. 33; Ref. 38)

Pesticides and herbicides will be used only under approved conditions and surveillance. The decision has not yet been made to definitely use these chemicals, nor which specific ones would be used. If used, they will be selected from those approved by EPA and the Working Group on Pest Management and applied by trained applicators. Also, the use of these materials will be coordinated with the personnel responsible for the monitoring program in the site area that might be affected.

11. Yard Drainage System (Ref. 34, p. 2.5-14; Ref. 35, Comments 36, 37)

An area of approximately 10 acres will be diked to provide a yard drainage pond. A discharge skimmer structure will skim approximately the top 10.5 feet of the pond. Any debris or oil which may be spilled and enter the yard drainage system will flow to this pond. Periodically this material will be removed. Depending on the character of the wastes, disposal will be by such methods as reclamation, burial, landfill, or burning. Oil will be reclaimed for reuse when practicable. Otherwise, it will be drummed and held on site for late disposal, one possibility being for fuel in one of TVA's fossil-fuel plants.

Since the yard drainage pond will be in an area which may be used for excavating borrow material, a temporary pond will be used during construction until the permanent pond can be used. The effluent from both the temporary and permanent ponds will go to the Town Creek embayment.

12. Sumps (Ref. 34, p. 2.7-8)

Temporary construction sumps will be constructed in the powerhouse area for the diversion and control of runoff inside the excavated area. Water will be pumped to the yard drainage pond where suspended soilds can settle to avoid excessive siltation of the reservoir.

13. Concrete (Ref. 33)

Waste water from aggregate washing, concrete lift operation, from hosing down of concrete trucks, or from the batch plant will have high lime content. Caution will be taken to assure that no permanent or serious temporary damage is caused by change of pH factor. These precautions would normally be sediment basins located between the wash area and stream and would include chemicals to adjust the pH factor if needed. A temporary holding pond will be constructed for batch plant effluent. The effluent from this pond will go to the temporary yard drainage pond.

14. Chemical Cleaning (Ref. 33; Ref. 34, p. 2.5-3, 2.7-10, 3.0-2, 8.2-6; Ref. 35, Comment 53; Ref. 36, Comment 41)

Chemical cleaning operations prior to unit startup will be conducted in such a way as to minimize releases to the reservoir and to ensure that any chemicals released have been neutralized and diluted to meet applicable standards. None of the chemical cleaning or flushing solutions will be discharged directly to a receiving stream. Holding ponds will be used to contain the spent solutions so that the necessary processing can be accomplished to render the final pond effluent acceptable for return to the river or for other use. Depending upon the constituents to be removed from the water, it may be necessary to perform one or more of the following operations: (1) neutralization, (2) sedimentation, (3) chemical precipitation, (4) absorption, and (5) evaporation. Solid waste resulting from the processing will be disposed of via landfill or packaging and burial as may be required. (It has not yet been determined where the effluent from these ponds will go - perhaps to the main circulating water system effluent if that system is ready by the time cleaning operations begin.)

Flushing oils used during the cleaning process for transformer oil systems and turbogenerator lube oil systems will be reconditioned for reuse or will be disposed of at some offsite location.

15. Sanitary Wastes (Ref. 34, p. 2.5-15 to 2.5-16, 2.7-9; Ref. 35, Comment 39)

A temporary package sewage treatment facility will be installed to treat domestic wastes from a peak construction force of approximately 2,500 persons. It will provide extended aeration and chlorination of wastes before discharge to the Town Creek embayment. In addition, portable chemical toilets will be used in isolated or remote areas of the project site. The servicing contractor will remove these chemical toilet wastes from the site under state sanitary health regulations and then haul them to a local sanitary waste treatment plant for disposal.

16. Dredging (Ref. 33; Ref. 34, p. 2.7-6, 3.0-1; Ref. 35; Ref. 36; Ref. 38)

Dredging for the intake, discharge, and docking facilities could utilize a suction dredge but a dipper dredge, dragline, or clamshell may be used instead. Feasibility, costs, and the minimization of turbidity and siltation in the reservoir will be taken into consideration when determining what type of dredge will finally be used. A cofferdam of permanent and temporary sheet pile cells will be driven across the mouth of the existing embayment at the intake location so that most of the excavation for the intake channel will take place behind this cofferdam. Then, from the cofferdam out into the reservoir to the original river channel, the overburden and rock will be removed by dredging. Spoil of unusable material will be disposed of in upland spoil areas which are already cleared. The spoil will be protected to minimize erosion. An adequately designed diked area with seeded slopes and discharge gates will be installed if a suction dredge is used. Sufficient area will be provided to meet water quality turbidity standards of water discharging from the spoil area. Spoil from dragline, dipper, or clamshell dredges will be graded and seeded with grass in a manner similar to excavated areas to minimize erosion. Work at the discharge and docking facilities will be conducted in a manner similar to the intake channel.

The dredging operations will be timed as feasible to coincide with periods of low river flow and will be conducted over as short a period as possible. Present plans call for construction of the cofferdam at the intake beginning about July 1975. Removal of overburden and rock from this cofferdam to the original river channel is scheduled to begin March of 1976 and should be completed in about five months. Pile driving and excavation for the dock should begin after construction starts (approximately August 1974) and should be completed in about five months. Design for the discharge is not far advanced, but work is scheduled for the fall of 1977.

17. Road Repairs (Ref. 34, p. 2.7-12)

If existing roads need repairs due to abnormal use during the construction program, responsibility will be determined on an individual basis with local highway officials and appropriate action will be taken by TVA.

18. Transmission Lines (Ref. 33; Ref. 34, p. 2.2-1 to 2.2-10, 8.2-14 to 8.2-17; Ref. 35, Comments 18, 19, 20; Ref. 36, Comment 56; Ref. 37; Ref. 39)

The following is a list of TVA's commitments regarding the construction of transmission lines. They may be subject to revision for Steps 2 and 3 of transmission line construction pending results of the studies described in Section 6.

a. Lines will be routed to avoid, where possible, residential, commercial and industrial areas, game sanctuaries, recreational areas and other developments; areas of historical, cultural or scenic significance; crests of mountains, ridges, and other high points; long views either perpendicular or parallel to major roadways; homes and barns; relocation of families or businesses; splitting of land-use zones. Locations along property lines and wooded areas are chosen where feasible.

b. Use of both vegetation screening and topographical features is made at major or scenic road crossings to limit visibility of the line to the general public view. If a contractor fails to retain specified screens, he is liable by contract to install suitable replacement plantings if deemed necessary by TVA.

c. In critical areas and stream crossings existing low vegetation will be retained and bridging or culverts will be installed to eliminate damage to stream banks by construction vehicles. Vehicle crossing will be avoided where possible.

d. Access roads will be held to a minimum and an extreme effort will be made to limit them to tower sites only. Where an access road is necessary, visual impact, as well as soil stability, will be a prime consideration.

e. Any grading will be engineered to balance cut and fill, thereby eliminating the need for borrow pits.

f. In areas where rock-outcroppings occur or where steep slopes are encountered, conventional hand felling of timber and brush is utilized in lieu of the shear clearing method. In moderately rolling terrain and on slopes up to approximately 30 degrees, water breaks and diversion swales are constructed to minimize soil erosion and to control the attendant leaching of nutrients and stream siltation. Select hand cutting of vegetation is performed in the vicinity of streams where excessive erosion control problems could be encountered.

g. The usual erosion control measures, such as construction of diversion swales, siltation basins, drainage ditches, terracing, and limitation of slope, will be used on access roads as well as in areas where the ground has been disturbed.

Other erosion controls include: using special construction procedures which limit the use of heavy equipment in areas of high erosion potential, keeping vegetation on the land as long as possible before construction, scheduling construction activities in certain areas to coincide with favorable dry weather conditions, and seeding disturbed areas as soon as possible.

h. Slash will generally be disposed of by open burning, meteorological conditions permitting, in compliance with local, state, and Federal air pollution guidelines. Where open burning is undesirable or not permitted, an air curtain incinerator will be used. Where disposal by burning is not possible, slash will be piled in windrows along the edge of the right-of-way or chipping will be used. Other solid wastes will be returned to staging areas for disposal.

i. Where special selective clearing methods are to be used, such as on the floodplain section and the steep slope up Sand Mountain near Coon Creek on the Bellefonte Widows Creek line, only tall trees and fast growing species will be removed.

j. On the section of the Bellefonte/Widows Creek line (Step 1) which goes through the floodplain land managed by the State of Alabama Department of Conservation and Natural Resources as a waterfowl management area, no construction activity will be performed from November 20 through January 31 (the waterfowl hunting season). TVA will further restrict construction activities to coincide with the summer and early fall dry season to reduce damage which would otherwise be significant to the right-of-way in the winter and early spring.

k. On the seciton through the floodplain land on the Bellefonte/ Widows Creek line, efforts will be made to reestablish some disturbed areas as game habitats by utilizing special seed mixtures as suggested by state and wildlife management personnel rather than Kentucky-31 fescue.

l. Where the shear clearing method is to be used (such as on the section of the Bellefonte/Widows Creek line that runs atop Sand Mountain), the right-of-way will be contoured and seeded with fescue grass when construction is complete.

m. For Step 1, there will be no broadcast use of herbicides. The use of herbicides will be limited to spot application to the stumps resulting from any special clearing methods.

n. Earth removed from the holes excavated for the steel grillage tower foundations will be neatly piled near the hole during placement of the grillage to avoid scattering and generally all soil will be carefully returned to the hole within 6 to 8 hours of the original excavation. Excess dirt will be firmly banked around the footing to allow for settling.

o. Although a specific material staging area and crew assembly point has not been selected, several sites in the Stevenson, Alabama area are being investigated. The final location of the staging site will require: (1) ease of access, (2) no clearing, (3) good drainage, and (4) sufficient screening from the general public view.

p. Portable sanitary toilet facilities will be provided for construction personnel at both the material/crew staging areas and along the transmission line right-of-way at intervals of approximately one mile. As work progresses, these facilities will be relocated periodically as required. A service contract will be obtained for the use of these toilet facilities and the disposal of raw sewage. TVA will require that this disposal of raw sewage be handled in an environmentally acceptable manner.

q. Damage to fences, gates, bridges, and other structures will be paid for or repaired by TVA following construction, and landowners are reimbursed by TVA for the value of crops damaged by construction or later maintenance activity.

19. Feedback from Monitoring Programs to Construction (Ref. 37)

Environmental monitoring feedback to assure minimization to the extent practical of adverse impacts due to construction activities will be accomplished through TVA's administrative control procedures. Initial decisions regarding modification of construction activities will be made by construction personnel who can assess the relative importance of the activities being performed. In the event that the monitoring program identifies a need to alter the manner in which an important activity is being performed, the decision to alter the construction schedule to reduce impacts may be made at a higher administrative level than the construction project manager on recommendation of personnel having the responsibility for environmental monitoring and assessment. (See Section 6.2.1.)

4.4.2 Staff Recommendations

Based on a review of the anticipated construction activities and the expected environmental effects therefrom, the staff concludes that the measures and controls committed to by the applicant, as summarized above, are adequate to ensure that adverse environmental effects will be at the minimum practicable level, subject to the following staff recommendations:

1. If there are any difficulties experienced by residents in the area as a result of construction-induced alteration of the groundwater supply, the TVA shall take the necessary actions to alleviate such well-water problems.

2. Water soluble polymers should not be used for dust control. In the future, if the TVA finds such use to be more desirable than the use of calcium chloride and/or water sprinkling, the use and potential environmental impacts of the specific water soluble polymers to be used shall be reviewed with the AEC staff.

3. When plans become firm regarding the construction and use of holding ponds for controlling the spent solutions from chemical cleaning of plant systems, the adequacy of the ponds and control measures shall be reviewed with the AEC staff.

4. Construction personnel should be encouraged not to enter the non-construction portions of the site, e.g., the overbank area and adjacent forested hills.

5. Any results available from the transmission line studies (see Section 6), and any revisions in the TVA plans for construction and maintenance on the lines covered under Steps 2 and 3, shall be reviewed with the AEC staff prior to initiation of any construction activities on these lines.

6. If a suction dredge is used, the location and adequacy of controls of the upland spoil area, and restoration of such, shall be reviewed with the AEC staff.

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37. Letter from J. E. Gilleland, TVA, to D. R. Muller, AEC, March 27, 1974.

38. Informal discussions between TVA and AEC staffs.

39. Letter from J.P. Darling, TVA, to G. Dittman, AEC, May 6, 1974.

5. ENVIRONMENTAL EFFECTS OF PLANT OPERATION

5.1 IMPACTS ON LAND USE

5.1.1 General

A nuclear power station at the Bellefonte site does not appear to violate any overall land-use plan for this area. The applicant states[1] that the waterfront near Scottsboro has long been designated for industrial use and that the Alabama industrial development agencies have concurred in this designation. The Top of Alabama Regional Council of Governments has proposed a plan[2] for future land use in the area which visualizes the extension of industrial zoning southwestward from the site along the Guntersville Reservoir shoreline and has developed a program[3] for the Hollywood environs which proposes an industrial area along both sides of the access railroad to the station. In view of these proposals, the staff concludes that, insofar as land usage is concerned, the impact of the operation of the Bellefonte plant upon its immediate environs will be acceptable. A certain amount of land will be converted from agricultural production to exclusion area use.

Recreation, picnic, and parking facilities as well as a visitor's center and environmental data station have been proposed for the site. These facilities will also change the relatively undeveloped character of the peninsula, and the resultant influx of visitors can lead to adverse as well as beneficial impacts. Insufficient detail on these uses is available at present to assess the net impact to any degree of accuracy. It is possible, however, with careful planning and implementation of a program of habitat restoration to insure a net beneficial impact.

5.1.2 Public Use

The visitor's center and small picnic area (10-15 tables) will be open to the public. The location of the visitor's center is shown in Fig. 1.1, and the picnic area will be nearby. The TVA estimates that there will be about 60,000 visits per year to the visitor's center and about 4000 visits per year to the picnic area;[4] such visits are expected to last about thirty minutes each. At the center, the public will have an opportunity to view instructive films and an environmental monitoring system. Sanitary facilities for the public will be provided at the visitor's center, but details such as capacity, flow rates, chlorine level, etc. are not yet final.[5] The staff believes that design and operation of these facilities can be carried out to the applicable standards and that associated technical specifications will protect the environment.

No industrial or residential development other than the nuclear facility will take place on the Bellefonte peninsula. In the Town Creek embayment and the reservoir around the peninsula sport fishing and some "commercial" fishing (i.e., trot lining and gill netting) have been observed;[6] it is anticipated that operation of the plant will result in an increase in sport fishing (especially in the discharge area during the cooler months),[7] but that the commercial fishing will probably be unaffected.

Inasmuch as the applicant is committed to the preservation and improvement of the existing wildlife habitats and to the establishment of a colony of nonmigrating giant Canada geese at the Town Creek embayment,[8] it would appear, subject to safety constraints, that viable future recreational activities would include nature walks, bird watching, picture taking, and other nonconsumptive uses of wildlife.

There are no outstanding historic features on the site proper, but there are two old family cemeteries so located that they will be affected by construction activities. They will be relocated with the consent of surviving relatives and with assurance that the cemeteries will be placed in comparable or superior locations and conditions.[9]

Two sites of potential archeological significance have been identified within the station site.[10] One of the sites is remote from the construction area; however, the site (1 JA 300) adjoins the area for the intake from the reservoir. The TVA proposes to salvage excavate this site after possession of the Bellefonte land is obtained. The staff concurs with this plan.

The former county seat of Jackson County, Bellefonte, is situated adjacent to the plant site. This abandoned town is listed in the *Alabama Statewide Plan of Historic Preservation* and is being processed for nomination to the *National Register of Historic Places*. It has been suggested that TVA restore and preserve the Old Bellefonte Inn (built in 1845) and erect appropriate historic markers to identify the site of the town itself and certain of its buildings and other features;[11] however, the matter is still under study by TVA.[12]

The construction and operation of the Bellefonte plant will result in a change in the land use of approximately 1500 acres from agricultural -- mainly grazing -- to industrial use. In addition, right-of-way easements for transmission lines will require about 1550 acres of land of which about 50 percent is woodland, 25 percent is in farming and pasture, and 25 percent is uncultivated open land. Of the 1500-acre site, approximately 400 acres within the exclusion area could be available for public use. The land for access roads and at the base of the towers in the rights-of-way will be withdrawn from use. It thus appears that the overall impact of plant operation on land use will be acceptably small. Some consideration should be given, nevertheless, to the utilization of that portion of the site not required for operation of the station. The applicant intends to make it available for recreation[13] and has proposed a routing of the access road which serves this purpose. In view of the isolated nature of the peninsula, it might be preferable to reroute the access road, and thus preserve the peninsula as a wildlife refuge. This alternative is discussed in Section 9.2.3.

5.1.3 Visual Impact

The plant will be located on a broad plain of the peninsula separated from Guntersville Reservoir by a wooded ridge. An attempt will be made to reduce the visual impact of the large facilities by grouping the structures in a diminishing progression of scale from the containment buildings to the office building. The materials chosen will reflect the changes in scale, from monolithic concrete for the larger masses to concrete, brick, and glass for the smaller buildings. Landscaping will be used to provide a harmonious transition between the natural setting and the plant site. Nevertheless, the facility will present the appearance of an industrial plant dominated by the 500-foot high, hyperbolic cooling towers, which will certainly become a landmark. Because of the topography and the relative isolation of the site, much of the station probably will not be visible from nearby highways. The cooling towers will be exceptions, for very likely they will be visible for some distance, especially when the trees are devoid of leaves. In addition, the vapor plumes from these towers will create an esthetic impact on the surrounding towns, as well as for traffic on nearby U. S. Highway 72.

5.2 IMPACTS ON WATER USE

5.2.1 General

All water for the Bellefonte Nuclear Plant will be drawn from Guntersville Reservoir. Guntersville Reservoir, like other reservoirs of the Tennessee River, provides flood control, navigation, generation of electric power, sport and commercial fishing, recreation, and fresh water supplies. In 1964, Guntersville Reservoir supplied an average in excess of 7.8 million gallons per day potable water to meet the demands of 70,000 people.[14] The people are residents of seven municipalities in Alabama: Albertville, Arab, Bridgeport, Grant, Guntersville, Sand Mountain Water Authority and Scottsboro. In addition, the Guntersville Reservoir serves South Pittsburg, Tennessee. The 7.8 million gallons per day required to meet the potable water demands represents only about 0.03 percent of the total average flow through the reservoir. Except for the Widows Creek Power Plant, which uses 1.6 billion gallons per day, the industrial water use is a small fraction of the potable water demand.

5.2.2 Water Consumption

The maximum consumptive use of water by the Bellefonte Nuclear Plant has been estimated by the applicant to be about 74 cfs (48 million gallons per day) based on a relative humidity of 30 percent and a dry-bulb temperature of 105°F. Since these meteorological conditions are seldom encountered, the estimate represents an upper limit; on an average daily basis including an 80% capacity factor, the estimate is about 30 million gallons per day.[15] This represents about 0.1% of the average river flow.

Given an average annual per capita water consumption of 163 gallons per day in 1980,[16] the evaporation from the Bellefonte plant would be sufficient to support a population of 170,000. Even so, water supplies appear to be adequate to meet all foreseeable requirements in the Guntersville Reservoir area, hence the proposed consumption use for the Bellefonte plant is acceptable.

5.2.3 Water Quality

The portion of Guntersville Lake that includes Bellefonte is classified for use for public water supply (with an exception near the City of Bridgeport), for swimming, and for fish and wildlife. The standards of the State of Alabama Water Improvement Commission apply. These are incorporated in "General Water Quality Criteria and Classifications of the State of Alabama," prepared by the State of Alabama and the Environmental Protection Agency, November 14, 1972. These standards were approved by the EPA in a letter to Mr. James W. Warr, Acting Chief Administrative Officer, Alabama Water Improvement Commission, January 18, 1973. The specific restrictions and conformance requirements are outlined below:

1. *Discharges and the natural water receiving discharges shall be free of floating debris, oil, scum, and other floating materials, and free of substances that will settle to form bottom deposits.* The plant is not expected to discharge such substances, so no violation is anticipated.

2. *The taste, odor, color and turbidity of the water shall not be adversely affected, nor shall fish be tainted as a consequence of discharges.* No such effects are anticipated from plant discharges, so no violation is anticipated.

3. *As a minimum, discharged sewage shall have secondary treatment; in swimming-permitted areas, fecal coliform counts shall not exceed a geometric mean of 200 per 100 ml.* The plant sewage will have secondary treatment and chlorination before discharge into the cooling tower makeup. Fecal coliform counts will be made to assure that the standard will not be violated by discharge of the plant sewage. No violation is anticipated.

4. *The temperature shall not be increased above ambient in excess of 5°F, nor caused to exceed 86°F by a discharge.* As analyzed in Sec. 5.4.2.3, no violation of the 5°F excess is anticipated. However, as shown later in Table 5.10, temperatures in the reservoir are, at times, very close to or actually in excess of 86°F, and any discharge at such times will violate this standard. The applicant proposes not to operate the discharge system if violations of the temperature standards would result.

5. *There shall be no thermal block to the migration of aquatic organisms.* As analyzed in Sec. 5.4.2.3, no violation is anticipated.

6. *There shall be no withdrawal from or discharge of heated waters to the hypolimnion unless it can be shown that such discharge will be beneficial to the water quality.* As analyzed in Sec. 5.4.2.3, it is shown that the reservoir is only slightly stratified, so no violation is anticipated.

7. *The dissolved oxygen content shall not be below 5 mg/l due to discharges.* The small volume of sanitary waste, which will receive secondary treatment and a chlorination, is mixed with a very large amount of cooling tower blowdown. The oxygen content of the cooling tower water will always be significantly greater than 5 mg/l. On this basis, the oxygen content of the discharge water, adjusted for the oxygen demand of the sanitary waste, will not be below 5 mg/l.

8. *No discharge shall cause the natural pH to deviate by more than one unit, and in no case to be less than 6.0 nor greater than 8.5.* The only sizable quantities of acid or alkaline wastes are the makeup and condensate demineralizer wastes; these are neutralized before discharge, so conformance with the standard is expected.

9. *U. S. Public Health standards for drinking water supplies, given in Table 5.1, shall apply to the river.* On the basis of the description of practices in Section 3, in particular Tables 3.5 and 3.6, no violation is expected to occur.

TABLE 5.1. Drinking Water Standards for Guntersville Lake near Bellefonte

Substances	*Limit,[a] mg/l*
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium	0.05
Lead	0.05
Chloride	250.00
Copper	1.0
Manganese	0.05
Nitrate	45.00
Sulfate	250.00
Total dissolved solids	500.00
Zinc	5.0
Cyanide	0.2
Fluoride	∿1.0[b]
Selenium	0.01
Silver	0.05
Alkyl benzene sulfate	0.5
Carbon chloroform extract	0.2
Phenols	0.001

[a] *U. S. Public Health Service Drinking Water Standards, 1962.*

[b] *Actual value depends on annual average air temperature where water is used.*

10. *U. S. Public Health Service drinking water limits on radioactive substances shall apply. Allowed are a maximum of 1000 picocuries (pCi) per liter of gross beta activity in the absence of strontium-90 and alpha emitters; alternatively, the water is acceptable if it contains not more than 3 pCi/l of radium-226 and 10 pCi/l of strontium-90.* Since the quantities of Ra-226 and Sr-90 released per year will each be less than 1×10^{-5} Ci (Table 3.2), the resultant concentrations in the blowdown (at 74 cfs) will average less than 0.004 pCi/l (less than one-tenth that level after diffuser-mixing). The background levels of Ra-226 and Sr-90 are below levels of detectability (1 pCi/l).[17] Accordingly, no violation of the standard is anticipated.

The water quality criteria also contain an antidegradation policy that calls for the maintenance of quality higher than required by the standards for waters whose quality is now above that required by the standards; this policy is not to interfere with necessary economic or social development. The plant adds an average of about 1700 lb/day of chemicals (Table 3.4). For the 36,360 cfs mean stream flow, the dissolved solids content of the river would on this account be increased by 0.009 ppm, a change of 0.007% in the mean dissolved solids level of 127 ppm.[18] The excess solids resulting from the evaporation of an average of about 30 million gpd (see Sec. 5.2.2 above) will yield about 31,760 lb/day of salts returned to the river. This will increase the dissolved solids in the river by about 0.16 ppm, or about 0.13%.

These changes are small compared to normal variations (40-220 ppm);[18] the staff judges that no measurable degradation of the quality of the water in the Tennessee River will result from the operation of the plant, and thus that the intent of the standard is met.

No violations of the Alabama standards resulting from the operation of the Bellefonte Nuclear Plant are expected to occur. Monitoring will be required wherever necessary to assure compliance. The staff believes that the Alabama standards are adequate to protect the use of Guntersville Lake for public water supply and for swimming, and therefore judges that no adverse effect on these uses will result from the operation of the plant.

5.3 RADIOLOGICAL EFFECTS

5.3.1 Radiological Impact on Biota other Than Man

5.3.1.1 Exposure Pathways

The pathways by which biota other than man may receive radiation doses in the vicinity of a nuclear power station are shown in Fig. 5.1. Two

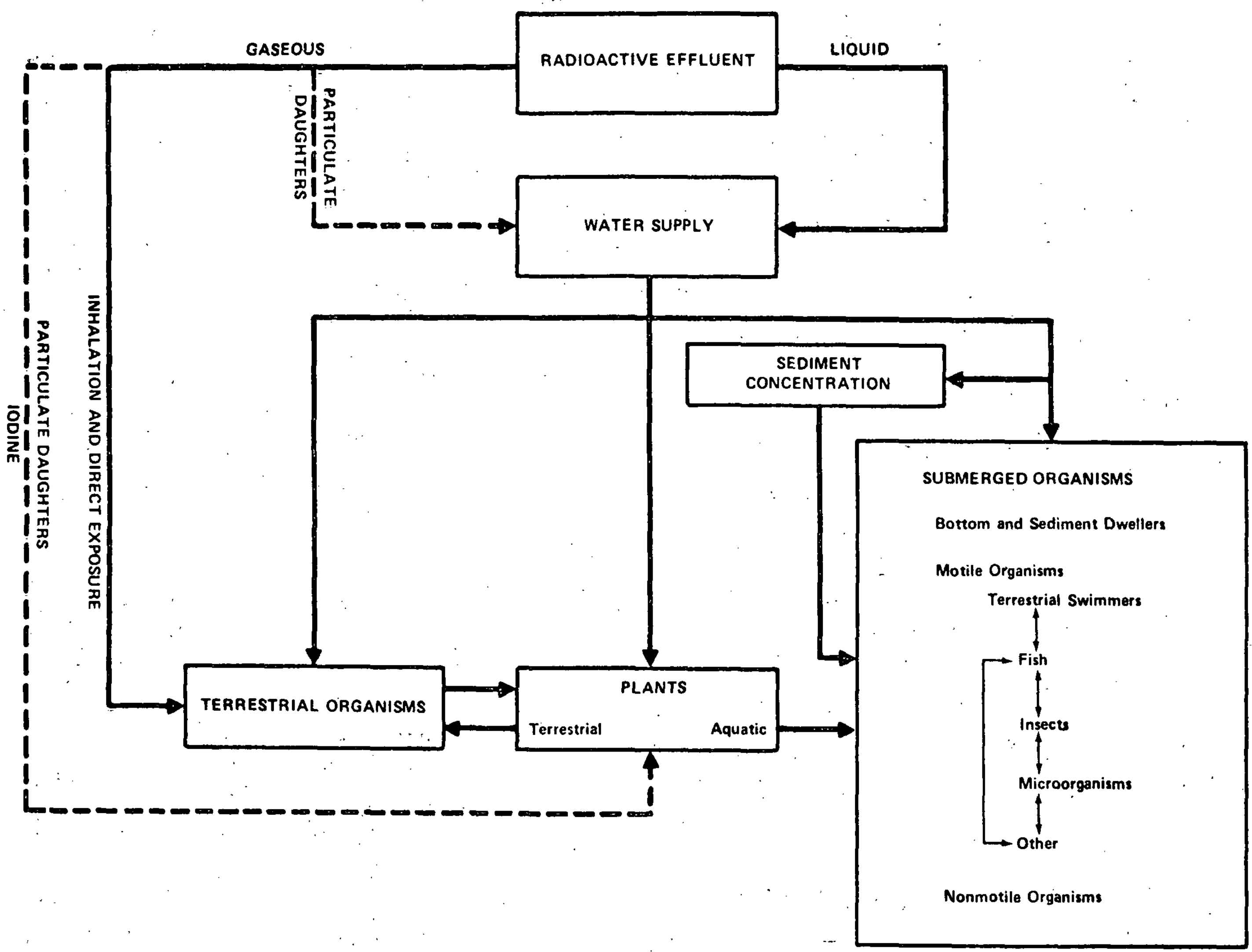


Fig. 5.1. Generalized Exposure Pathways for Organisms Other than Man.

recent comprehensive reports[19,20] have been concerned with radioactivity in the environment and these pathways. They can be read for a more detailed explanation of the subjects that will be discussed below. Depending on the pathway being considered, terrestrial and aquatic organisms will receive either approximately the same radiation doses as man or somewhat greater doses. Although no guidelines have been established for desirable limits for radiation exposure to species other than man, it is generally agreed that the limits established for humans are also adequate for these species.[21]

5.3.1.2 Radioactivity in the Environment

The quantities and species of radionuclides expected to be discharged annually by the Bellefonte Nuclear Plant in liquid and gaseous effluents have been estimated by the staff and are given in Tables 3.2 and 3.3, respectively. The basis for these values is discussed in Section 3.2.3. For the determination of doses to biota other than man, specific calculations are done primarily for the liquid effluents. The liquid effluent quantities, when diluted in the plant discharge, would produce an average gross activity concentration, excluding tritium, of 3.7×10^{-4} picocuries per milliliter in the discharge area. Under the same conditions, the tritium concentration would be 1.3 pCi/ml. Additional discussion concerning liquid dilution is presented in Section 5.3.2.2.

Doses to terrestrial animals, such as rabbits or deer, due to the gaseous effluents are quite similar to those calculated for man (Sect. 5.3.2.3). For this reason, both the gaseous effluent concentrations at locations of interest and the dose calculations for gaseous effluents are discussed in detail in Section 5.3.2.3.

5.3.1.3 Dose Rate Estimates

The annual radiation doses to both aquatic and terrestrial biota including man were estimated on the assumption of constant concentrations of radionuclides at a given point in both the water and air. The radiation dose has both internal and external components. External components originate from immersion in radioactive air and water and from exposure to radioactive sources on surfaces, in distant volumes of air and water, in equipment, etc. Internal exposures are a result of ingesting and breathing radioactivity.

Doses will be delivered to aquatic organisms living in the water containing radionuclides discharged from the plant. This is principally a consequence of physiological mechanisms that concentrate a number of elements that can be present in the aqueous environment. The extent to which elements are concentrated in fish, invertebrates, and aquatic plants upon uptake or ingestion has been estimated. Values of relative biological accumulation factors (ratio of concentration of nuclide in organisms to that in the aqueous environment) of a number of waterborne elements for several organisms are provided in Table 5.2.

Doses to aquatic plants and fish living in the discharge region due to water uptake and ingestion (internal exposure) were calculated to be 2.0 and 0.2 mrads/yr, respectively, for plant operation. The discharge region concentrations were those given above and it was assumed that these organisms spent all of the year in water of maximum concentrations. All calculated doses are based on standard models.[22] The doses are quite conservative since it is highly unlikely that any of the mobile life forms will spend a significant portion of their life span in the maximum activity concentration of the discharge region. Both radioactive decay and additional dilution would reduce the dose at other points in the reservoir.

External doses to terrestrial animals other than man are determined on the basis of gaseous effluent concentrations and direct radiation contributions at the locations where such animals may actually be present. Terrestrial animals in the environs of the station will receive approximately the same external radiation doses as those calculated for man. Table 5.4 given later lists the doses due to the gaseous effluents.

An estimate can be made for the ingestion dose to a terrestrial animal, such as a duck, which is assumed to consume only aquatic vegetation growing in the water in the discharge region. The duck ingestion dose was calculated to be about 2 mrads/yr, which represents an upper limit estimate since equilibrium was assumed to exist between the aquatic vegetation and all radionuclides in water. A nonequilibrium condition for a radionuclide in an actual exposure situation would result in a smaller bioaccumulation and therefore in a smaller dose from internal exposure.

The literature relating to radiation effects on organisms is extensive, but very few studies have been conducted on the effects of continuous low-level exposure to radiation from ingested radionuclides on natural aquatic or terrestrial populations. The most recent and pertinent studies point out that, while the existence of extremely radiosensitive biota is possible and while increased radiosensitivity in organisms may result from environmental interactions, no biota have yet been discovered that show a sensitivity to radiation exposures as low as those anticipated in the area surrounding the plant. In the "BEIR" report,[23] it is stated in summary that evidence to date indicates that no other living organisms are very much more radiosensitive than man. Therefore, no detectable radiological impact is expected in the aquatic biota or terrestrial mammals as a result of the quantity of radionuclides to be released into Guntersville Reservoir and into the air by the plant.

TABLE 5.2. Freshwater Bioaccumulation Factors

Element	Fish,	Invertebrates,	Plants,
	PCi/kg organism per PCi/liter water		
C	4,500	9,100	4,550
Na	100	200	500
P	100,000	20,000	500,000
Sc	2	1,000	10,000
Cr	200	2,000	4,000
Mn	400	90,000	10,000
Fe	100	3,200	1,000
Co	50	200	200
Ni	100	100	50
Zn	2,000	10,000	20,000
Rb	2,000	1,000	1,000
Sr	30	100	500
Y	25	1,000	5,000
Zr	3	7	1,000
Nb	30,000	100	800
Mo	10	10	1,000
Tc	15	5	40
Ru	10	300	2,000
Rh	10	300	200
Ag	2	770	200
Sn	3,000	1,000	100
Sb	1	10	1,500
Te	400	150	100
I	15	5	40
Cs	2,000	100	500
Ba	4	200	500
La	25	1,000	5,000
Ce	1	1,000	4,000
Pr	25	1,000	5,000
Nd	25	1,000	5,000
Pm	25	1,000	5,000
Sm	25	1,000	5,000
Eu	25	1,000	5,000
Gd	25	1,000	5,000
W	1,200	10	1,200
Np	10	400	300
Pu	4	100	350
Am	25	1,000	5,000
Cm	25	1,000	5,000

From Report UCRL-50564 Rev. 1, 1972.

5.3.2 Radiological Impact on Man

5.3.2.1 Exposure Pathways

Routine power generation by the plant will result in the release of small quantities of fission and activation products to the environment. This evaluation will provide the resulting radiation dose estimates which can serve as a basis for determining that releases of radioactive material to surrounding areas are as low as practicable in accordance with 10 CFR 51 and within the limits specified in 10 CFR 20. The AEC staff has estimated the probable nuclide releases from the plant based upon experience with comparable operating reactors and an evaluation of the radwaste system. These releases have been discussed in Section 3.2.3.

Estimates were made of radiation doses to man at and beyond the site boundary via the most significant pathways among those diagrammed in Fig. 5.2. The calculations are based on conservative assumptions regarding the dilutions of effluent gases and radionuclides in the liquid discharge, and the use by man of the plant surroundings. In general, radiation doses calculated by the staff are intended to apply to an average adult. Specific persons will receive higher or lower doses, depending upon their age, living habits, food preferences, or recreational activities.

Based upon experience at comparable operating nuclear power reactors, an estimate has been made of the occupational radiation exposures expected to result from plant operation.

5.3.2.2 Liquid Effluents

Expected nuclide releases in the liquid effluent have been calculated for the plant and are listed in Table 3.2. In the immediate vicinity of the plant discharge, the gross activity concentration, exclusive of tritium, is estimated to be 3.7×10^{-4} pCi/ml. Under the same conditions, the tritium concentration would be 1.3 pCi/ml, as stated in Section 5.3.1.2. During normal reactor operations, a fraction of the noble gases produced will be released in the liquid effluent and subsequently discharged into the Guntersville Reservoir. The staff has analyzed operating reactor radioactive liquid effluents for noble gas content and under conditions of highest annual average noble gas concentrations in the discharge water, no significant doses would be delivered to human beings.

Consumption of water represents a potentially significant exposure pathway to the population. The nearest potable water intake that could be affected by the plant liquid effluents is at Scottsboro, 6.2 miles west-southwest of the site. Individual doses via this pathway are evaluated using standard dose models[21] and an assumed daily consumption of 1.2 liters. The liquid

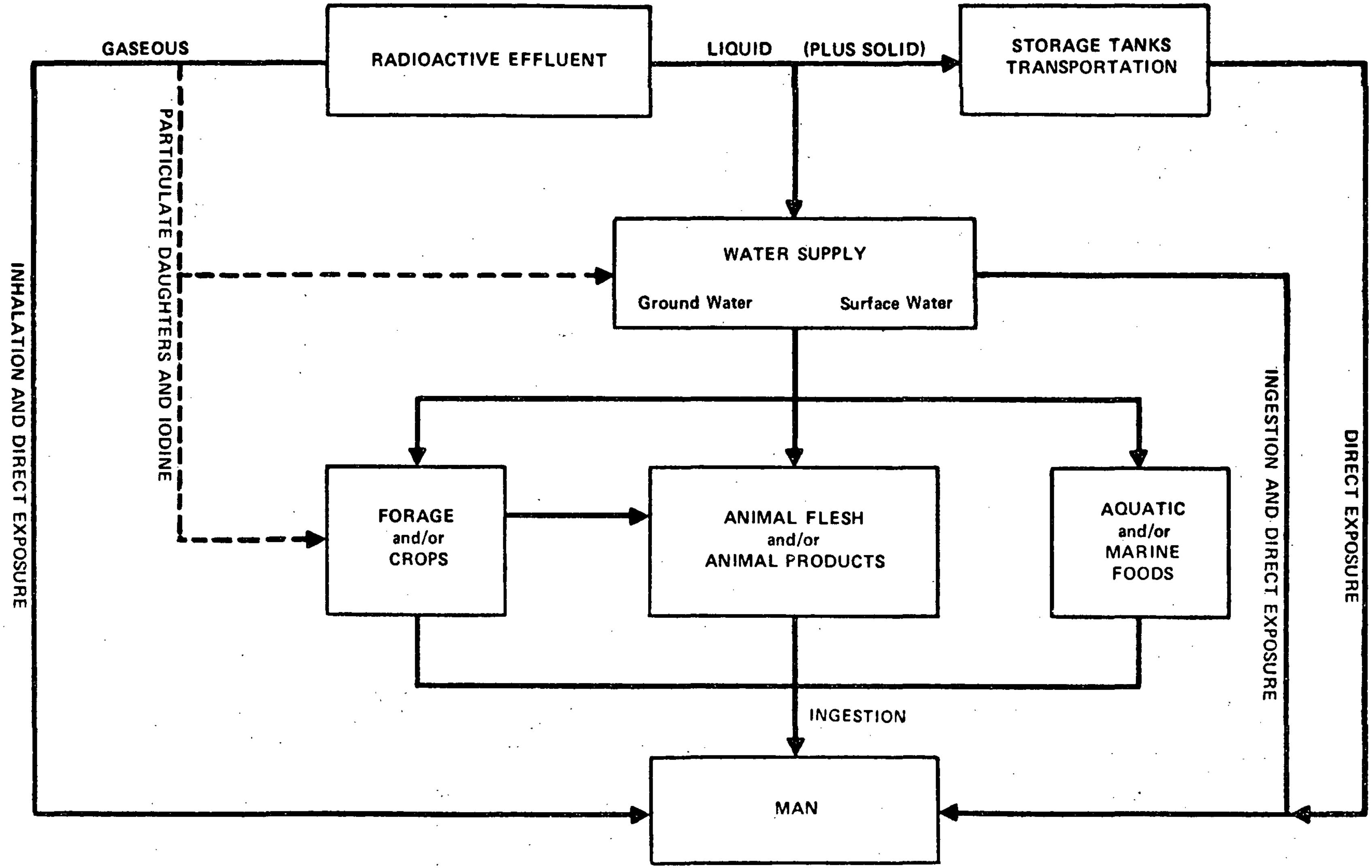


Fig. 5.2. Generalized Exposure Pathways to Man.

effluent is diluted by the 67 cfs blowdown and diluted by a factor of ten at the diffuser discharge. It was assumed that dilution in the lake from the point of discharge to the water intake at Scottsboro consisted of further mixing of the effluent with 50 percent of the flow (27,900 cfs).

Other pathways of relative importance involve recreational use of the lake in the vicinity of the discharge zone. Individual doses from consuming fish caught in the immediate discharge area were evaluated using the biological accumulation factors listed in Table 5.2 and standard models. Swimming, boating, and fishing in the discharge region were also included in the evaluation.

Table 5.3 summarizes the potential individual doses from the liquid effluents.

5.3.2.3 Gaseous Effluents

Radioactive effluents released to the atmosphere from the plant constitute the greatest source of radiation exposure to the public. Staff estimates of the probable gaseous and particulate releases listed in Table 3.3 were used to evaluate potential doses. All dose calculations were performed using annual average site meteorological conditions and assuming that releases occur at a constant rate. Radioactive gases are released near ground level from the plant. Thus, doses result from immersion in the dispersed radioactive gases.[24,25]

The primary food pathway to man involves the ingestion by dairy cows of radioiodine deposited onto grazing areas. Consumption of milk from these cows can result in exposure to the human thyroid. Doses to a child's thyroid which would result from consuming one liter of milk daily from a cow grazing 12 months annually were calculated for the nearest farm using recognized models.[23]

Another food pathway to man of secondary importance involves the consumption of leafy vegetables subject to deposition of the radionuclides released to the atmosphere. The thyroid dose resulting from an annual consumption of 72 kg of leafy vegetables produced at the nearest residence during the three-month growing period was evaluated.

All doses due to gaseous effluents are summarized in Table 5.4.

5.3.2.4 Direct Radiation

5.3.2.4.1 Radiation from the Facility. The plant design includes specific shielding of the reactor, holdup tanks, filters, demineralizers, and other areas where radioactive materials may flow or be

TABLE 5.3. Annual Individual Doses to Man from Liquid Effluents

Pathway	Dose, mrem/yr			
	Total Body	*GI Tract*	*Thyroid*	*Bone*
Coolant Discharge Region				
Fish ingestion	2.0E-02[a]	4.5E-03	3.2E-02	1.2E-02
Swimming (100 hr/yr)	1.8E-05			
Fishing, boating (500 hr/yr)	9.0E-06			
Shoreline (500 hy/yr)	4.5E-04			
Scottsboro				
Water ingestion	2.6E-03	2.6E-03	4.4E-03	1.0E-05
Scottsboro Municipal Park				
Sun bathing	1.8E-05			

[a] *2.0E-02 means 2.3 × 10^{-2}, for example.*

TABLE 5.4. Annual Individual Doses to Man due to Gaseous Effluents

Location	*χ/Q, sec/m³*	*Dose, mrem/yr*		
		Total Body	*Skin*	*Thyroid*
Site boundary[a] (4300 ft SW)	1.0E-05	4.9E-01	2.6	6.7E-02[c]
Nearest farm[b] (11 mi SSW)	1.3E-07	3.3E-03	2.8E-02	1.3E-01[d]
Nearest residence (4300 ft NW)	2.3E-06	1.1E-01	5.9E-01	6.5E-02[e]
Visitors center (1500 ft SE)	7.1E-06	4.1E-01	1.9	5.1E-02[c]
Nearest beach (9 mi SW)	3.8E-07	9.7E-03	8.2E-02	1.8E-03[c]

[a] The gamma and beta air doses at the site boundary are 0.6 mr/yr and 3.5 mrad/yr, respectively.

[b] With a milk animal

[c] I-131 inhalation by adult.

[d] Cow-milk-child iodine pathway.

[e] Leafy vegetable iodine pathway by adult.

stored, primarily for the protection of plant personnel. Direct radiation from these sources is therefore not expected to be significant at the site boundary. Confirming measurements will be made as part of the applicant's environmental monitoring program after plant startup. Low-level radioactivity storage containers outside the plant are estimated to contribute less than 0.07 mrem/yr at the site boundary.

5.3.2.4.2 Transportation of Radioactive Material. The transportation of cold fuel to a reactor, of irradiated fuel from the reactor to a fuel reprocessing plant, and of solid radioactive wastes from the reactor to burial grounds is within the scope of the AEC report entitled *Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants*. The environmental effects of such transportation are summarized in Table 5.5.

5.3.2.4.3 Occupational Radiation Exposure. Based on a review of the applicant's Safety Analysis Report, the staff has determined that individual occupational doses can be maintained within the limits of 10 CFR 20. Radiation dose limits of 10 CFR 20 are based on a thorough consideration of the biological risk of exposure to ionizing radiation. Maintaining radiation doses of plant personnel within these limits ensures that the risk associated with radiation exposure is no greater than those risks normally accepted by workers in other present day industries[26]. Using information compiled by the Commission[27,28] and others[29,30] of past experience from operating nuclear reactor plants, it is estimated that the average collective dose to all onsite personnel at large operating nuclear plants will be approximately 450 man-rem per year per unit. The total dose for this plant will be influenced by several factors for which definitive numerical values are not available. These factors are expected to lead to doses to onsite personnel lower than estimated above. Improvements in systems to maintain offsite population doses as low as practicable may cause an increase to onsite personnel doses, if all other factors remain unchanged. However, the applicant's implementation of Regulatory Guide 8.8 and other guidance provided through the staff radiation protection review process is expected to result in an overall reduction of total doses from those currently experienced. Because of the uncertainty in the factors modifying the above estimate, a value of 900 man-rem will be used for the annual occupational radiation exposure for the 2 unit plant.

5.3.2.5 Summary of Annual Radiation Doses

The combined dose (man-rem) due to gaseous effluents to all individuals living within a 50-mile radius of the plant was calculated using the projected 1980 population data furnished by the applicant.[31] Values for the man-rem dose at various distances from Bellefonte Units 1 and 2 are summarized in Table 5.6.

TABLE 5.5. Environmental Impact of Transportation of Fuel and Waste to and from One Light-Water-Cooled Nuclear Power Reactor[a]

Normal Conditions of Transport			
			Environmental Impact
Heat, weight, and traffic density			Negligible
Exposed Population	*Estimated Number of Persons Exposed*	*Range of Doses to Exposed Individuals*[b] *(per reactor year)*	*Cumulative Dose to Exposed Population (per reactor year)*[c]
Transportation workers	200	0.01 to 300 mrem	4 man-rem
General public			
Onlookers	1,100	0.003 to 1.3 mrem	3 man-rem
Along route	600,000	0.0001 to 0.06 mrem	

[a]*Data supporting this table are given in the Commission's "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants," WASH-1238, December 1972.*

[b]*The Federal Radiation Council has recommended that the radiation doses from all sources of radiation other than natural background and medical exposures should be limited to 5000 millirem per year for individuals as a result of occupational exposure and should be limited to 500 millirem per year for individuals in the general population. The dose to individuals due to average natural background is about 130 millirem per year.*

[c]*Man-rem is an expression for the summation of whole body doses to individuals in a group. Thus, if each member of a population group of 1000 people were to receive a dose of 0.001 rem (1 millirem), or if two people were to receive a dose of 0.5 rem (500 millirem) each, the total man-rem in each case would be 1 man-rem.*

TABLE 5.6. Cumulative Population, Annual Cumulative Dose, and Average Annual Total Body Dose due to Gaseous Effluents in Selected Annuli about Bellefonte Units 1 and 2

Cumulative Radius, miles	*Cumulative Population*	*Annual Cumulative Dose, man-rem*	*Average Annual Dose, millirem*
1	15	0.0	5.8E-02[a]
2	110	0.00	1.9E-02
3	1,770	0.01	6.1E-03
4	2,870	0.02	6.1E-03
5	4,980	0.03	6.1E-03
10	31,570	0.11	3.6E-03
20	65,585	0.14	2.1E-03
30	129,720	0.17	1.3E-03
40	471,530	0.24	5.0E-04
50	960,590	0.31	3.2E-04

[a] *5.8E-02 means* 5.8×10^{-2}*, for example.*

Presently, according to the applicant, about 72,600 people derive their drinking water from the Guntersville Reservoir. The total exposure to this population was evaluated using the drinking water dose presented in Table 5.3. The man-rem contribution from water intakes downstream of the Guntersville Dam is expected to be negligible.

The cumulative dose resulting from the consumption of fish harvested from Guntersville Reservoir was estimated. Current estimated sport and commercial fish caught in the Guntersville Reservoir is 1.7×10^6 kg per year. It was assumed that one half of the catch will be consumed by the population within 50 miles.

The population doses from all sources including cloud immersion, drinking water ingestion, consumption of fish, recreation, and transportation are summarized in Table 5.7.

5.3.2.6 Evaluation of Radiological Impact

The average annual dose from gaseous effluent to persons living within 50 miles of the plant is less than 0.001 millirem per year as shown in Table 5.6. Maximum individual doses due to liquid and gaseous effluent releases are less than 6 millirem per year as seen in Tables 5.3 and 5.4. This is only a few percent of natural background exposure of 150 millirem per year and is below the normal variation in background dose and represents no measurable radiological impact.[32]

Using conservative assumptions, the total man-rem in unrestricted areas from all effluent pathways, received by the estimated 1980 population of 960,590 persons who will live within a fifty mile radius of the Bellefonte plant, would be about 16 man-rem per year. By comparison, an annual total of about 144,100 man-rem is delivered to the same population as a result of the average natural background dose rate of about 150 millirem per year in the vicinity of the plant.

The 900 man-rem estimated as occupational onsite exposure is a small percentage of the annual total of about 144,100 man-rem delivered to the 1980 population living within a 50 mile radius of the plant.

Effluents from plant operation will than be an extremely minor contributor to the radiation dose that persons living in the area normally receive from natural background radiation. The estimated radiation doses to individuals and to the population from normal operation of the plant support the conclusion in Section 3.2.3 that the releases of radioactive materials in liquid and gaseous effluents are as low as practicable.

TABLE 5.7. Summary of Annual Total Body Doses to the Population Within 50 Miles

Category	*Cumulative Dose, man-rem/yr*
Population dose from background	144,100
Restricted Area	
Occupational Radiation Exposure	900
Unrestricted Area	
Gaseous Cloud	0.31
Drinking Water	0.21
Fish Ingestion	1.08
Transportation of Nuclear Fuel and Radioactive Wastes[a]	14.

[a] *Transportation dose includes exposure to people beyond 50-mile radius.*

5.4 NONRADIOLOGICAL EFFECTS

5.4.1 Terrestrial Environment

5.4.1.1 Effects of Cooling Tower Operation

5.4.1.1.1 Principles of Operation. Natural-draft cooling towers, such as those to be used at the Bellefonte plant, rely primarily on the evaporation of water to dissipate waste heat, and they discharge large quantities of water vapor and heat to the atmosphere. As the air rises through the tower, it will carry evaporated water, small water droplets due to recondensation, and a mist of water droplets called "drift," which does not evaporate until after it leaves the tower. As the air passes through the tower, it will usually become supersaturated and the excess moisture will condense, forming a visible cloud-like plume. Because of momentum and buoyancy, the plume rising from a tower will usually continue to rise above the top of the tower. The length of the visible plume and the altitude it reaches will depend primarily upon prevailing meteorological conditions.

Because a tower discharges such large amounts of heat and water vapor from such a small area, the possibility exists that inadvertent weather modification will occur in the locale. Theoretically, the possible environmental impacts of such modifications are the creation of plumes, the initiation of cloud formation, and changes in local rain, drizzle, icing and snowfall patterns. In addition, it is sometimes contended that the fallout of salts from the drift could produce adverse effects.

At Bellefonte, two towers will be built, each about 500 feet in diameter and about 500 feet high. During normal operation each tower will discharge heated air carrying 16,600 gpm water as vapor and 55 gpm water as drift.

5.4.1.1.2 Visible Plume. Observation of existing natural-draft cooling towers indicates that the primary atmospheric effect is the generation of long visible plumes which remain aloft. The plume length will vary from time to time, depending on total load and on variations in wind speed, air temperature, saturation deficit and atmospheric stability. Because air at low temperature has such a low capacity to hold water vapor, the plumes will be most pronounced during winter.

Under certain weather conditions (i.e., low temperature, high humidity, moderate wind speeds, and stable atmosphere) the visible plume may extend several miles. In Kentucky, Colbaugh et al. have measured plumes 16 km long.[33] The staff is aware that longer plumes have been observed but not reported in the literature. Published studies of plume lengths in the inland Pennsylvania area indicate that the plume lengths were generally (87% of the time) less than five tower heights, although in some cases, particularly in winter, they extended to 15 or more.[34] Other than the appearance of an extended plume, the main impact of the elevated plume is the reduction of sunshine reaching the area it covers. The decrease in incoming radiation at ground level is not expected to be significant because of the small area shadowed.

5.4.1.1.3 Ground-Level Fog and Icing. Practically every article on natural-draft cooling towers includes a statement such as "Towers have the potential to cause or to increase the frequency of ground-level fog and icing." On the other hand, available reports of observations near natural-draft towers indicate that the plumes rarely, if ever, reach the ground. For example, Colbaugh et al. report that there have been no cases of visible plumes reaching the ground during two years of operation of the Paradise, Kentucky, Steam Plant.[33] According to Mr. F. A. Schiermeier of the Office of Air Programs (personal communication), no surface fogs or icing have been observed in four years of operation of the Keystone Power Plant (1800 MWe) in Pennsylvania. The Central Electricity Generating Board of Great Britain[35] reported its findings on the environmental effects of cooling towers. No measureable change in surface relative humidity was detected downwind. The visible plume sometimes persisted for a number of miles downwind, altering sunshine in the area. No drizzle was observed from the towers. Cumulus clouds were sometimes formed, but no cases of showers or precipitation being caused by the plume have been observed. The same results have been reported from elsewhere in Europe and in the United States.[35-41] Hosler[42] does report one occasion on which the visible plume from a natural-draft cooling tower did reach the ground; this is the only reported case in the literature. Nevertheless, contrary to actual observations, most theoretical analyses predict frequent tower-induced ground-level fog.[43]

5.4.1.1.4 Plume Modeling. The applicant has developed a statistical model for predicting the length of visible plumes from natural-draft cooling towers and applied it to the Bellefonte plant situation. The length of the visible plume at TVA's Paradise steam plant in Kentucky and the simultaneous weather and plant operating parameters were measured on most mornings between 0600 and 0900 local standard time for a period of 13 months. As mentioned above, none of the visible plumes were observed to reach the ground. The length of the visible plume was then correlated with the saturation deficit in the layer of the atmosphere between 500 and 3000 feet. The observed correlation at Paradise, after an adjustment for plant thermal loading, was used to predict plume lengths at Bellefonte. Since none of the details of the statistical model have been published, the staff is not able to assess the validity of the model or the accuracy of the predictions.

The results of the applicant's calculations are given in Fig. 5.3. The numbers on each of the sixteen directions from the plant show the percentage of days during which the visible plume aloft will be equal to or greater than the indicated distance during the early morning period (0600 to 0900 local time).

The staff concludes that the plume lengths indicated on the above figure are in reasonable agreement with actual observations made at operational cooling towers. The calculations are conservative in that they are based on 100% operation of the plant for the entire year.

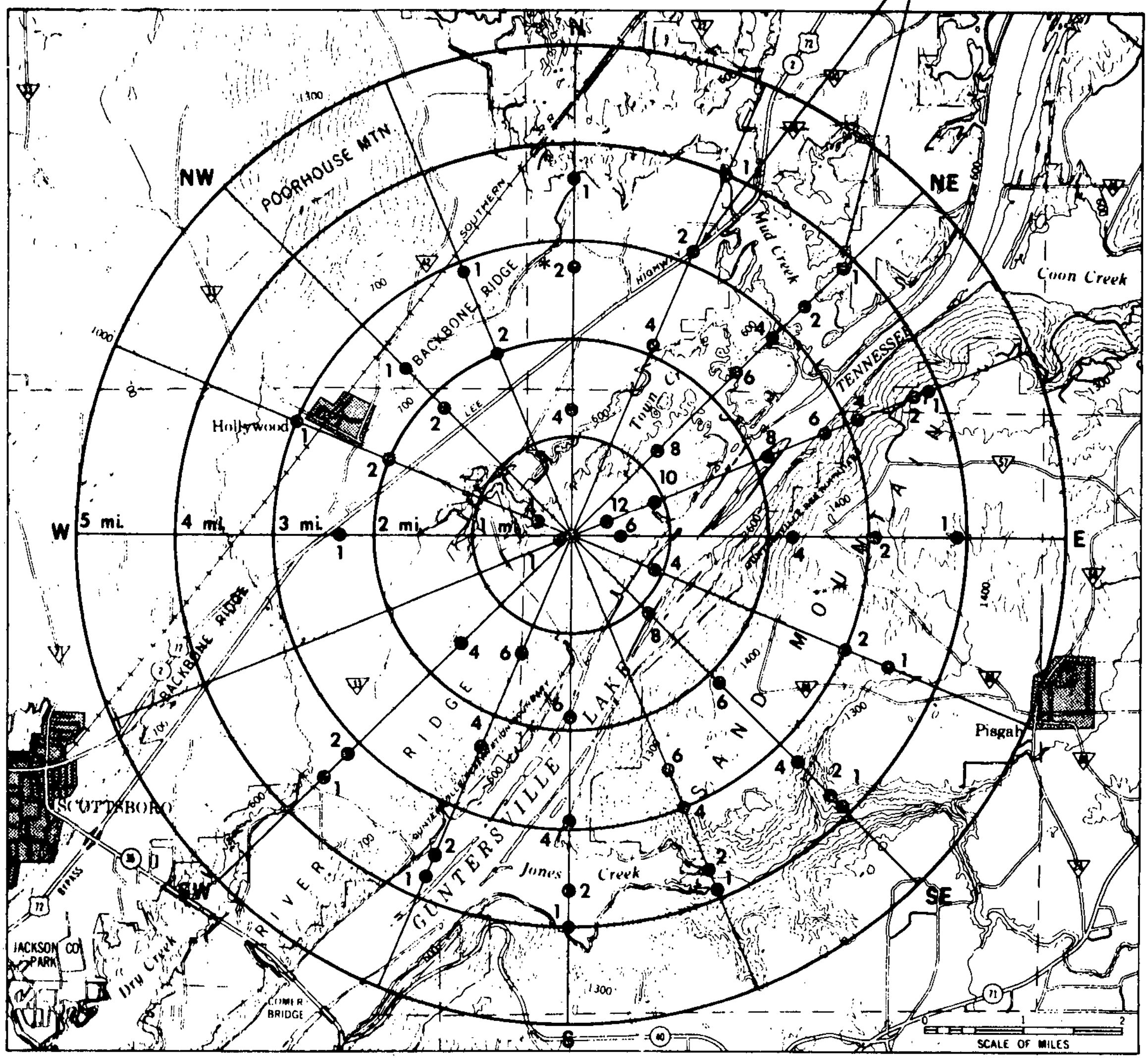
Experience at cooling towers in flat terrain and even in hilly areas indicates that visible plumes rarely if ever descend to ground level and cause localized surface fogging. Nevertheless, the applicant does predict that the plume will frequently cause surface fog on the Sand Mountain Plateau, which is about 1.5 to 2.5 miles southeast and south southeast from the site with an elevation of about 400 ft higher than the tops of the cooling towers. TVA's statistical model predicts up to 22 days per year in some of the sectors, with plumes long enough to reach the plateau as shown in Fig. 5.3; and on at least some of these days, it states, the plume will reach the ground level and cause fogging along the roads (about 80 hours/year).

The staff concludes that these estimates are conservative in that they do not agree with actual experience with cooling towers in hilly areas. Vertical momentum and buoyancy will tend to lift the plumes over the plateau. Further, air flow over hilly terrain tends to follow the terrain, creating further plume rise. Nevertheless, there exists a small probability (1 to 2 days/yr) of ground-level fogs and an even smaller probability of icing in the Sand Mountain Plateau area due to operation of the plant's cooling towers. Increases in atmospheric moisture content are not expected to be measurable at ground level.

5.4.1.1.5 Cloud and Precipitation Formation. Aynsley[44] has observed that cooling tower plumes can, if meteorological conditions are proper, create cumulus clouds. He concludes that this is a "rare occurrence," and that these man-made clouds only precede natural cloud formation. He discussed the possibility that a cooling-tower plume could somehow trigger an existing atmospheric instability and create extra cumulus congestus clouds and precipitation miles downwind of the release point. As the number and size of cooling towers on a given site increase,

* Example: 2 percent of the time (7 days per year)
plumes with lengths ≥ 2.7 miles
occur in the 22½° sector north of site

Percent of
total days in a year



Based on daily early morning record
Aug. 1970 – Aug. 1971

Fig. 5.3. Expected Plume Length and Frequency of Occurrence for 16 Compass Point Sectors (All Temperatures). From TVA.

the probability of significant alteration of cloudiness and precipitation patterns will increase.[38,46] The state of the art in cloud physics is such that meteorologists cannot say with any degree of certainty that there will be any increase in rainfall amounts due to cooling-tower plumes.[38,45] There are at least several reported occurrences of snow showers or ice crystals being generated by cooling towers, but in all cases the amounts were very small.[38]

5.4.1.1.6 Drift. That small fraction of the cooling water that is carried into the plume as "drift" carries with it whatever impurities the cooling water contains. The TVA conservatively estimates that this will be about 0.01% of the circulating water. As the droplets evaporate in the atmosphere, the salts or dissolved solids will concentrate, and, if evaporation is complete, will remain as a dust-like residue. Most of the drift that falls to the ground will do so within 1000 feet of the towers. The remaining drift and residue will be dispersed by the wind and eventually returned to the ground by precipitation scavenging.

5.4.1.1.7 Salt and Moisture Effects. Sufficiently concentrated salts deposited directly on vegetation or root uptake of salt can cause osmotic stress and lead to leaf burn, wilting, etc. However, it is difficult to apply information from the available literature to the assessment of the potential impact of salt drift from the Bellefonte towers. First, in much of the literature, whether pertaining to the effects of road salt[47,48] of airborne ocean salts[49-53], the absolute amounts of salts under consideration are much greater than would be deposited at Bellefonte. For instance, at the seashore, ocean salts are deposited on vegetation at rates on the order of 10^1 g/m^2/hr.[49] Recent measurements made near natural draft cooling towers in England[41,47] indicate maximum rates of salt deposition (calculated from measured rates of "drizzle" or drift from the cooling towers) to be on the order of 10^{-3} g/m^2/hr. (The human senses cannot detect this "drizzle" and the rates measured were less than rainfall rates which produce road wetting.) Secondly, the major anion in the road salt,[47,48] or airborne ocean salts,[49-53] or drift from salt water cooling towers[54,55] would be chloride. Chloride has the potential of being much more harmful to vegetation than the sulphate and carbonate which will be the major anions in the drift at Bellefonte. A third major difficulty in applying the available literature to the situation at Bellefonte is that the specific species of plants which have been studied are generally those which have some tolerance to salt deposition, which is why they grow near the ocean in the first place. A further complication is the fact that even in plant communities extensively exposed to salt, there is a wide range of species' ability to compete and survive.[52] The only conclusion that can be made is that grossimpacts on terrestrial biota is not likely to occur as a result of salt deposition from the Bellefonte cooling towers, but there is a possibility that sensitive species may be adversely effected.

Changes in incoming radiation and moisture regimes could effect biota in the vicinity of the cooling towers. Changes in plant growth, in community structure, and in insect populations and incidences of fungal infections can all be postulated. However, as noted earlier, changes in the abiotic parameters of moisture and radiation are not likely to be distinguished from natural variations. All this is not to say that decreased incident radiation, increased moisture, and deposition of salts will have absolutely no effect on particular species of plants or animals, or on species composition of the various plant, animal, and microbial communities. The impacts may not be adverse and may in fact not be measurable, but over the 40-year lifetime of the station, subtle effects may possibly be detectable. A monitoring program for ecological impacts of cooling tower operation is discussed in Section 6.

5.4.1.1.8 Hazards to Birds. Songbirds and waterfowl migrate past the station. The cooling towers, station buildings and transmission lines are potential obstructions to these migrating birds. Under adverse weather conditions (low and thick cloud cover, fog or precipitation, frontal passage) ceilometer* lights, the navigational lights on tall ($\sim$1000 feet) television towers, and brightly lit buildings apparently attract nocturnal migrating birds (primarily songbirds) which become confused and fly into the ground, buildings, or in particular, television tower guy wires.[57-63] Intervals between major kills (several thousand in one night) can average several years, but small losses can occur intermittently during peak periods of migration, even on clear nights with good visibility.

The cooling towers at Bellefonte will be approximately 500 feet tall and the reactor buildings about 285 feet tall. The cooling towers will be lighted at night as required by FAA regulations, probably the standard red navigational lighting and possibly a high intensity strobe light.

Studies of bird mortalities are being conducted at the Davis-Besse Nuclear Power Station on the soutwest end of Lake Erie.[64,65] This station is under construction and has a 500-ft hyperbolic natural-draft cooling tower and a 225-ft reactor building. Thus far, observations

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* A ceilometer is a device used for measuring the cloud-ceiling height by beaming a collimated light vertically and using triangulation to obtain the distance above ground.

have been conducted during the fall of 1972 and the spring and fall of 1973, and involved almost daily pickup of birds during songbird migrations and some intensive all-night monitoring when particularly adverse weather conditions were forecast. Based on a review of the literature and undocumented experience with bird kills at the Perry Monument (a 352-ft monument on an island a few miles offshore in Lake Eire), it was expected that the Davis-Besse structures would be a hazard to warblers and vireos. So far, a total of 157 dead birds have been found, mostly warblers and kinglets, the observations extend over three migration periods.[66] If the data from one night in the fall of 1973 (which accounted for over half that season's mortalities of 103 birds) is discounted, there is apparently little or no correlation of bird mortalities with either weather conditions or migration potential. As in the referenced bird mortality cases, the Davis-Besse structures apparently are not a hazard to waterfowl, even though the station is immediately adjacent to the Navarre Marsh.

Considering this experience at Davis-Besse, and considering that the structures at Bellefonte are not as tall as the television towers or buildings where major mortalities have occurred nor do they have the guy wires which appear to be particularly lethal, the staff does not expect major bird kills at Bellefonte.

5.4.1.1.9 Noise. About the only noise associated with such towers is that caused by the falling water inside the towers. Such noise has not proven to be objectionable at existing towers.

5.4.1.1.10 Conclusion. Based on the above and experience at power plants with operating natural-draft cooling towers, the staff concludes that the cooling-tower effluents will not create a significant adverse meteorological impact, except for perhaps a small increase in surface fogging on Sand Mountain Plateau. Terrestrial vegetation and animal and microbial communities may be altered by cooling-tower operation because of increased moisture, decreased incoming radiation, or chemicals contained in the drift. However, such effects, if they occur, may not be measurable. The staff concludes that impact of the cooling towers will be small.

5.4.1.2 Transmission Lines

The seeded portions of the TVA rights-of-way are maintained by cutting the grass with a rotary mower about every four years. The staff believes that this maintenance of a grassy pasture by mowing is generally not the most desirable way to maintain a transmission line right-of-way (see Appendix B). More desirable alternatives are available, yet the TVA has not adequately considered them. The TVA plans to initiate a long-range test program to study the practicability of various clearing and maintenance methods. The results of the first portions of these studies should be used to re-evaluate the TVA's construction and consequent maintenance practices prior to construction of the Bellefonte lines classified as Steps Two and Three in Section 3.3. The line classed as Step One has an early service date of the summer of 1976, and tentatively will be one of the lines used for the initial studies.

In "remote and inaccessible" areas, the TVA uses herbicides, generally helicopter spraying of Tandex at the rate of 15.2 pounds/active acre, although Tordon-101 is also used. Remote is defined as "an area that will require a person to leave main thoroughfares or well-traveled secondary roads to approach the area. Also it would indicate that the area is generally not visible to the public except from distant vantage points." Inaccessible refers to "an area which because of local terrain cannot be reached when traveling by wheel or tracked ground vehicles."[67] Areas avoided when spraying include: waterways, wells, croplands, and residential areas. Only trained personnel apply the herbicides. There is only one application (about every four years) and helicopter spraying is done only under ideal weather conditions with wind velocity not exceeding three miles per hour.

From onsite inspections, the staff found that the TVA does a reasonable job of confining the herbicides to the rights-of-way. However, there were some stretches where there was a fair amount of damage to trees and other vegetation alongside the open corridor, where vegetation had been sprayed adjacent to streams (mostly intermittent ones), and where vegetation intentionally left for screening purposes had been inadvertently sprayed. In addition, the TVA apparently allows for spraying within sight (close as well as distant views) of major U. S. and interstate highways. The long swaths of dead vegetation (which are brown for at least a year) are esthetically displeasing. Also, the staff finds the broadcast use of herbicides to be unwarranted, since alternative maintenance methods (such as selective cutting of vegetation and/or selective use of herbicides) are available which afford much less potential danger to ecological systems and man (see Appendix B). For transmission lines classed in Steps Two and Three, TVA will evaluate the construction and maintenance practices and these may include the use of herbicides; however, the staff strongly cautions against the broadcast use of herbicides.

Another part of maintenance is taking care of areas where seed has failed to take and/or where erosion problems develop. The TVA does say that where "extensive" seed failures or "significant" erosion problems are noted, construction personnel make the necessary repairs. However, in the other cases, the TVA requests property owners to correct the situation and then compensates them accordingly. The efficacy of this latter practice is dubious, and the staff proposes that the TVA, within their legal right to so act, take the primary responsibility to make the necessary corrections of erosion problems or vegetation failures.

5.4.2 Aquatic Environment

Possible major environmental impacts on the aquatic ecosystem of Guntersville Reservoir due to the operation of the Bellefonte Units 1 and 2 include fish losses at the cooling water intake screens, almost total loss of unscreened entrained organisms, and effects of thermal and chemical discharges.

5.4.2.1 Fish Impingement

The intake structure will be located at the end of an 800-ft embayment which opens at the shoreline of the reservoir (see Fig. 5.4). A depth of about 30 ft will be maintained by dredging the 25-ft wide intake channel extending from the embayment and the overbank area to the main channel of the Tennessee River. After passing through trash racks, water will enter the intake structure through four forebays (two for each unit). Vertical traveling screens with 3/8-inch square mesh will be located at the rear end of the forebays. Depending on the debris buildup, the vertical traveling screens will be rotated and washed periodically. Average velocity for the maximum flow of 66,600 gpm will be low (<0.2 fps) in the intake channel in the embayment and will increase to about 0.42 fps in front of the intake forebays.

Inasmuch as the water velocity in the intake channel is low, fish will enter the intake channel in the normal course of their activities. The recessed embayment location of the intake is conducive to fish congregation. If these congregated fish swim until they are fatigued, they may eventually impinge upon the traveling screens. Since the overbank area has a high density of young-of-the-year fish,[68] it is expected that impingement will be high for this age group.

Studies sponsored by the TVA are currently in progress at the Brown's Ferry Nuclear Plant on Wheeler Reservoir to relate fish losses by impingement to the fish populations of the reservoir.[69] These studies will shed light on the significance of fish losses by impingement at water intakes on Tennessee River reservoirs. However, due to lack of relevant data at present and uncertainty of the outcome of the TVA study, the staff is of the opinion that, as much as practicable, the intake should be sited and designed to minimize impingement of fishes. The loss of fishes by impingement would most likely be reduced by an alternative location of intake as discussed in reference to entrainment of fish eggs and larvae in the following section.

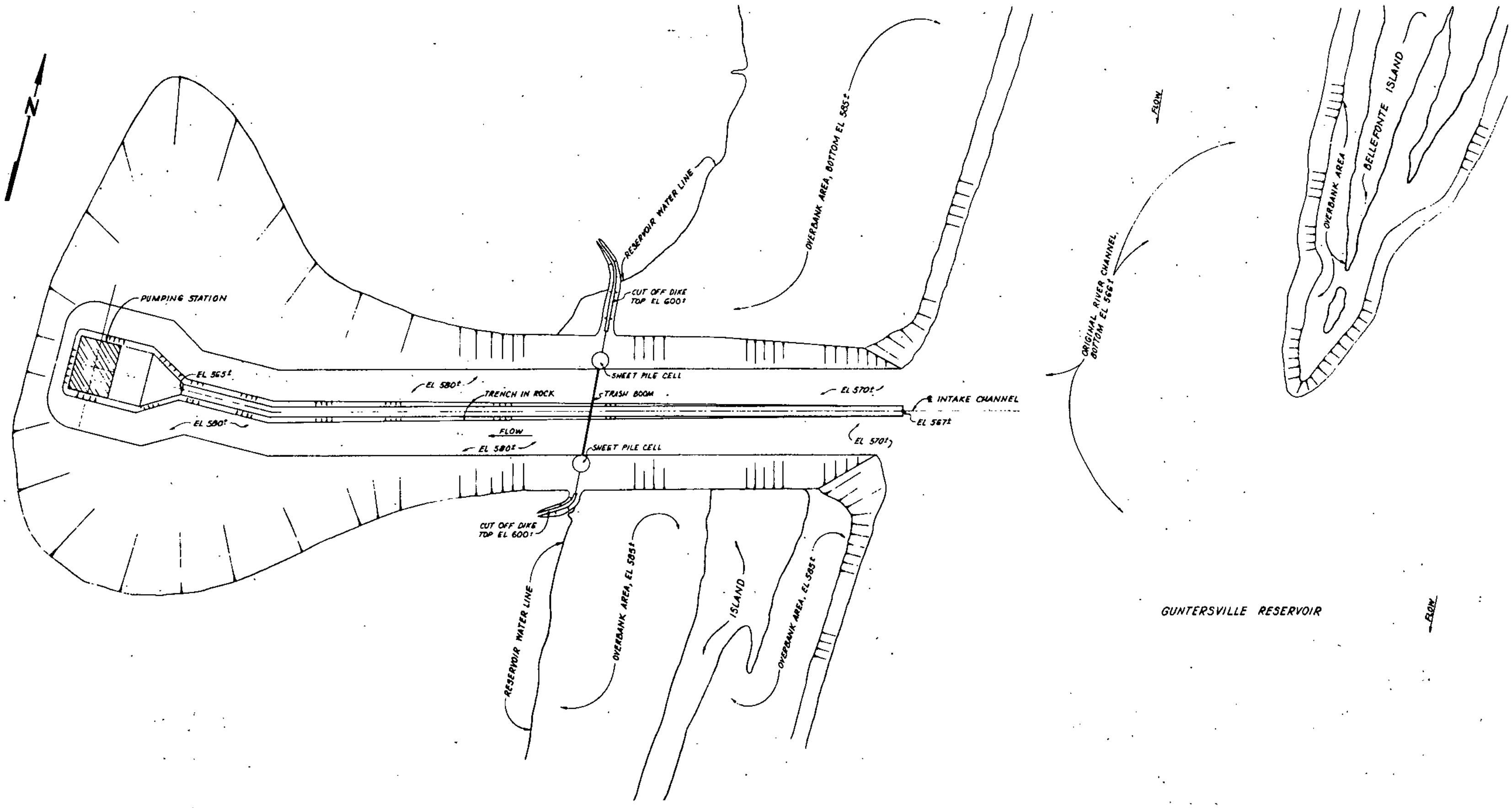

Fig. 5.4. Design of Intake Channel from Reservoir to Pumping Station. From TVA Responses to Second Set of AEC Comments.

5.4.2.2 Entrainment Effects

Because of the closed-cycle mode of cooling it can be assumed that a large proportion of organisms that pass through the 3/8-inch-square mesh of the vertical traveling screens will be destroyed. Such organisms will include phyto- and zooplankton, fish eggs and larvae (ichthyoplankton), and small fish.

The loss of phyto- and zooplankton and fish eggs and larvae can be assumed to be proportional to the intake flow if even distribution of these organisms in the water column is assumed. As a conservative estimate, at times of average summer net downstream flow of 27,100 cfs during summer and maximum withdrawal of 148.5 cfs by the plant, about 0.55% of the downstream flow will be taken by the plant. Under average conditions, this percentage value would be less at other times of the year.

Because of the topographical features of the basin, it seems likely that most of the downstream flow takes place in the old river bed. The mix of waters from the overbank area and the main river channel area and the water recruitment pattern of the intake will determine the relative numbers of organisms to be withdrawn by the plant.

Sampling conducted by the applicant in Guntersville and Wheeler Reservoirs has shown a much higher density of planktonic fish forms in near-shore waters as compared to the deeper areas of the main channel of the river. The shallow overbank and embayment areas serve as excellent nursery and rearing grounds for young of many species of fish. The abundance of free swimming entrainable fish (past the planktonic stage) is expected to be high in the near-shore waters. The larval and post larval entrainable fish forms in Guntersville Reservoir are dominated by gizzard and thread fin shad which are forage species (Table 5.8). Various shiners, the freshwater drum, sunfish, crappie, white bass, and yellow bass are present in lesser numbers. According to the preliminary survey conducted by the applicant, the average density of larval fish in shallow shoreline waters is more than ten times greater than that in the deep (over 5 m depth) mid channel area. Therefore, depending upon the location of the intake openings, the magnitude of loss of planktonic fish forms by entrainment in the intake flow could vary by more than an order of magnitude.

Because of the short generation times, the plankton loss should be made up within a few days for the phytoplankton and in a few weeks for the zooplankton. This temporary reduction in the biomass may not be detectable beyond the immediate vicinity of the discharge because of the dilution and compensatory responses by the population of these organisms. Since larval fish forms do not compensate the loss in a short duration

TABLE 5.8. Relative Abundance of Genera of Larval Fish, Bellefonte Site, June 21, 1972

Genus	*Percent in Catch*
Dorosoma	88.7
Lepomis	1.45
Ictalurus	0.07
Aplodinotus	8.8
Cyprinus	0.1
Notropis	0.8
Unidentified	0.2

From TVA DES.

like phyto- and zooplankton, their loss may result in an unacceptably high and significant loss in adult fish population. Therefore, the staff will require that the loss of fish eggs and larvae due to entrainment be quantified to allow an assessment of this impact for determining acceptability of the proposed intake.

5.4.2.3 Thermal Effects

5.4.2.3.1 Discussion of the Thermal Discharge

a) Characteristics of Guntersville Reservoir. The reservoir flow is controlled by Guntersville Dam, 43 miles downstream from the plant, and Nickajack Dam, about 40 miles upstream. During normal operation of the two dams, the flow at the site reverses daily. The consequences of this reversal of flow will be discussed later with regard to the surface thermal plumes. Figure 5.5 displays the flow at the plant resulting from the discharges at the dams.[70]

In addition to the daily reversal of flow, there are planned periods when there is no flow at one or both of the dams. Table 5.9 lists the duration of zero-flow periods at Nickajack Dam for a three-year period.[71]

The stream flow at the site is estimated to be about 27,900 cfs at a channel velocity of 0.6 fps during the summer months and 44,200 cfs at a channel velocity of 1.1 fps during the winter months.[72]

TVA has been monitoring water temperatures at the dams since 1960. Table 5.10 lists the results of these measurements at Nickajack (1968-1971) and Guntersville Dams (1967-1971).

The reservoir is only slightly stratified since the flow-through time is quite small.[73] There is, however, a strong dirunal stratification in the shallow areas of the reservoir and the nearby creeks.[74] This is shown in Fig. 5.6.

The width of the reservoir at the location of the site is about 3400 feet, with depths ranging up to 30 feet at normal pool elevation (595 feet). The navigation channel is maintained at a minimum of 11 feet in depth.

b) Temperature Standards. The most recent Alabama State water quality regulations were listed in Sec. 5.2.3. These regulations also specify that in the application of temperature criteria, temperatures shall be measured at a depth of five feet in waters 10 feet or greater in depth; and for those waters less than 10 feet in depth, temperature criteria will be applied at mid-depth.[75]

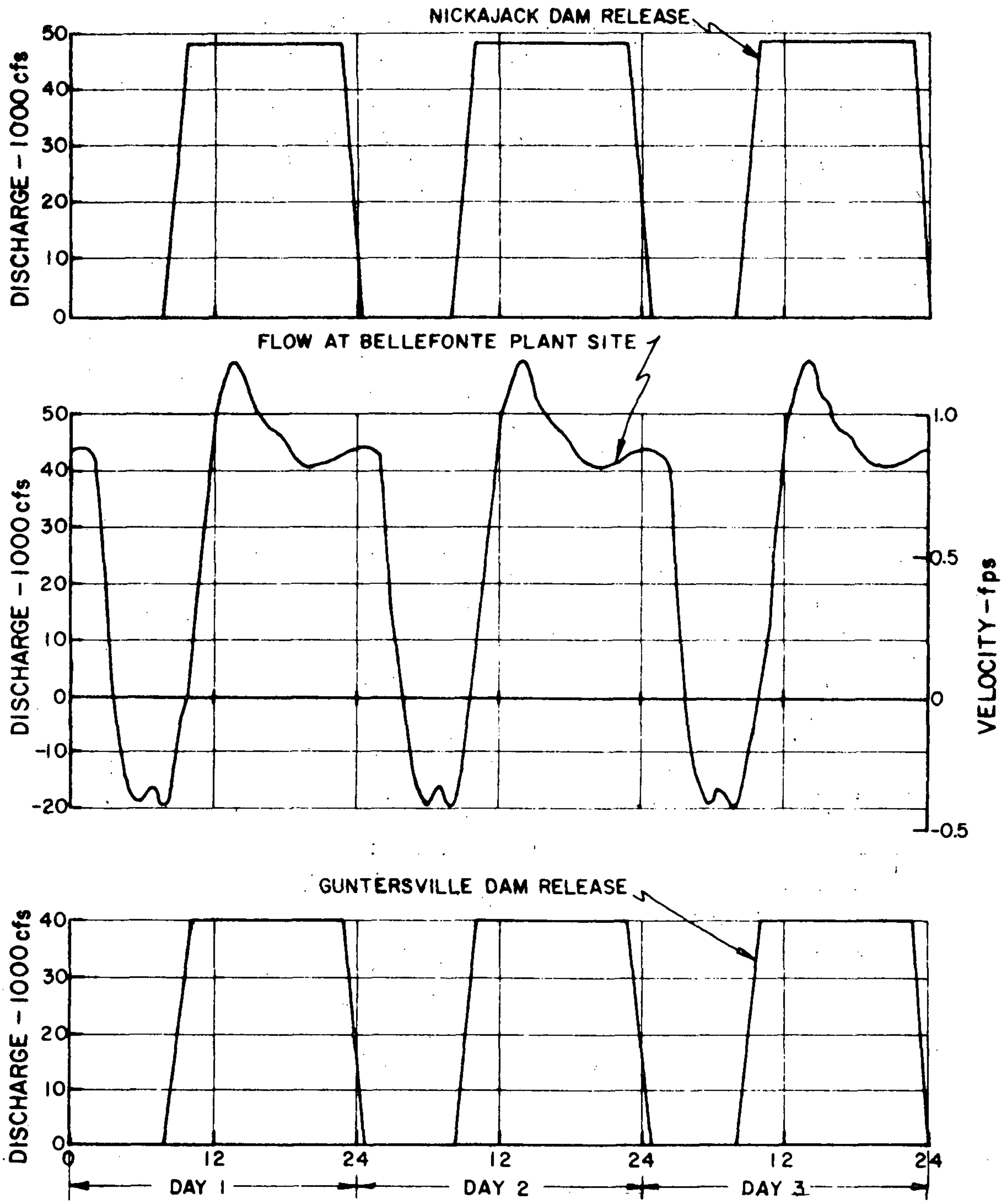

Fig. 5.5. Typical Peaking Operations. From TVA Responses to Second Set of AEC Comments.

TABLE 5.9. Duration of Zero-Flow Periods at Nickajack Dam from May 1968 to October 1971

Duration, hours	*No. of Occurrences from 5/68 to 10/71*
1	32
2	27
3	41
4	62
5	90
6	112
7	89
8	57
9	33
10	21
11	6
12	4
13	0
14	1
15	0
16	1

From TVA DES p. 2.6-8.

TABLE 5.10. Observed Tailrace Water Temperature Data

Week Number	Nickajack Dam 1968-1971 Records: Maximum of the Four Weekly Temp., °F	Nickajack Dam 1968-1971 Records: Average of the Four Weekly Temp., °F	Guntersville Dam 1967-1971 Records: Maximum of the Five Weekly Temp., °F	Guntersville Dam 1967-1971 Records: Average of the Five Weekly Temp., °F
1	50.0	45.2	46.4	44.6
2	44.6	42.2	44.6	42.1
3	44.6	42.8	46.4	43.0
4	44.6	42.5	46.4	44.4
5	48.2	44.6	48.2	45.1
6	44.6	42.8	46.4	44.6
7	43.7	42.1	46.0	44.5
8	44.6	43.3	50.0	46.2
9	50.0	45.5	48.2	45.5
10	48.2	45.5	51.8	47.7
11	50.0	48.2	51.8	48.9
12	50.0	50.0	53.6	51.3
13	53.6	51.4	57.0	53.4
14	57.2	54.7	60.8	59.7
15	59.9	58.1	64.4	62.1
16	64.4	61.3	68.0	64.6
17	64.4	63.5	68.0	65.8
18	66.2	64.4	68.0	66.9
19	68.0	66.7	68.0	67.3
20	69.8	67.6	71.6	69.8
21	73.4	70.7	71.6	69.8
22	77.9	73.9	73.4	71.6
23	75.2	73.6	77.9	73.9
24	77.0	76.1	80.6	77.2
25	78.8	77.7	81.5	79.5
26	80.6	79.0	86.0	83.0
27	82.4	80.4	85.1	83.8
28	82.4	80.6	88.7	83.3
29	82.4	80.8	86.0	84.2
30	82.4	80.6	84.2	81.7
31	82.4	78.4	84.2	82.6
32	82.4	80.2	84.2	82.4
33	80.6	80.2	85.1	81.7
34	81.5	79.9	84.2	81.1
35	80.6	78.8	82.4	80.0
36	80.6	78.8	84.2	79.5
37	80.6	78.4	86.0	79.9
38	80.6	76.1	83.3	77.2
39	78.8	76.1	80.6	72.3
40	78.8	74.8	78.8	72.9
41	75.2	71.6	74.3	72.7
42	71.6	69.4	72.5	69.1
43	69.8	66.8	66.2	64.0
44	69.8	64.4	71.6	64.8
45	60.8	59.4	62.6	59.5
46	59.0	57.4	61.7	57.5
47	57.0	54.0	58.1	54.5
48	52.7	51.6	53.6	52.9
49	51.8	49.1	51.8	50.0
50	51.8	48.7	54.5	50.0
51	51.8	47.8	53.6	49.8
52	51.8	50.2	53.6	48.0

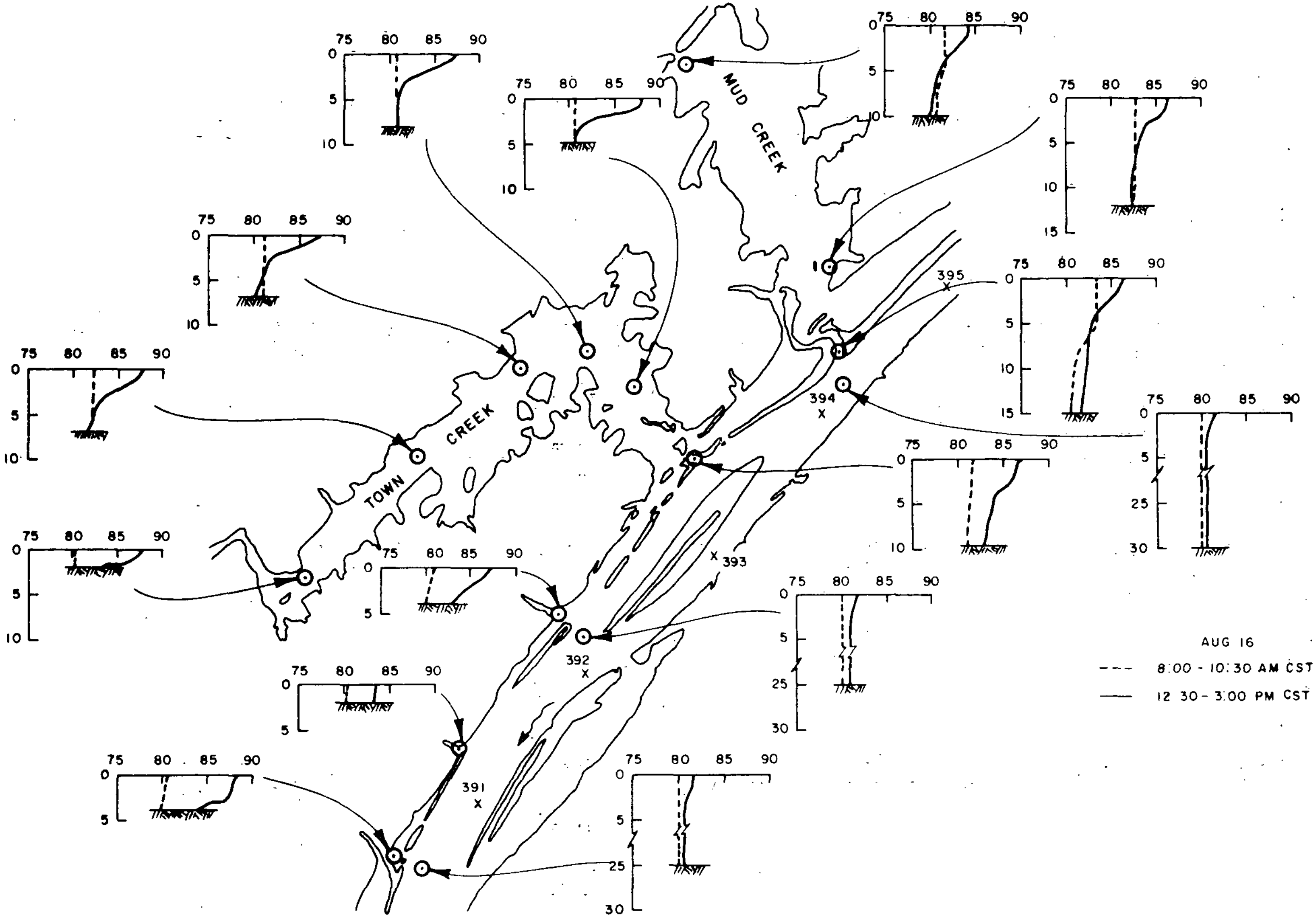

Fig. 5.6. Natural Temperature Regime. From TVA Responses to Second Set of AEC Comments.

c) Blowdown. The blowdown from the cooling towers must be discharged in such a manner that the temperature excess five feet below the surface is at most 5°F. Holdup of the blowdown may be necessary on occasion when the ambient temperature in the summer is near or exceeds the maximum temperature standard (see Table 5.10).

The blowdown temperatures to be expected under normal weather conditions are[76]

Winter	67°F
Spring	74°F
Summer	84°F
Fall	74°F

It is also expected that extreme summer conditions could produce blowdown temperatures of 90°F for a few hours a day. The greatest temperature difference between the blowdown and the ambient river temperature occurs in the winter and is approximately 25°F. The applicant has been very conservative in using a design criterion which will produce sufficient dilution to allow a ΔT of 50°F to meet the temperature standards.

Although the details of the blowdown structure have not as yet been finalized, the most probable design will be a multiport submerged buoyant jet diffuser.[77] There will be more than one discharge nozzle (most likely two) with separations great enough to prevent interaction of the jet mixing regions.

Table 5.11 lists a set of possible parameters for such a pipe located at the bottom of the navigation channel discharging the effluent of one unit. The staff has verified that this most probable design could satisfy the temperature excess standards of the State of Alabama.[78]

Figure 5.7 illustrates the size of the 5°F, 3.5°F, and 2°F isotherm for the configuration and parameters considered. The assumption of a stagnant stream is conservative since the presence of an ambient current increases the dilution.

The fate of the heated discharge after reaching the surface is extremely difficult to predict. The temperature of the buoyant plume is further reduced by turbulent diffusion and surface heat loss to the atmosphere. The size and location of the plume are entirely dependent upon the ambient velocity of the river and the magnitude and direction of the wind. The applicant has made a sample calculation of one possible configuration, as shown in Fig. 5.8. However, under other conditions

TABLE 5.11. Design Parameters for a Submerged Buoyant Jet Diffuser

Discharge depth	30 ft
Nozzle diameter	2 ft
Discharge rate	36 cfs
Discharge velocity	11.5 fps
Initial temperature rise	50°F
Froude number	27.5
Initial discharge angle	0°
Ambient reservoir velocity	0 fps
No stratification	

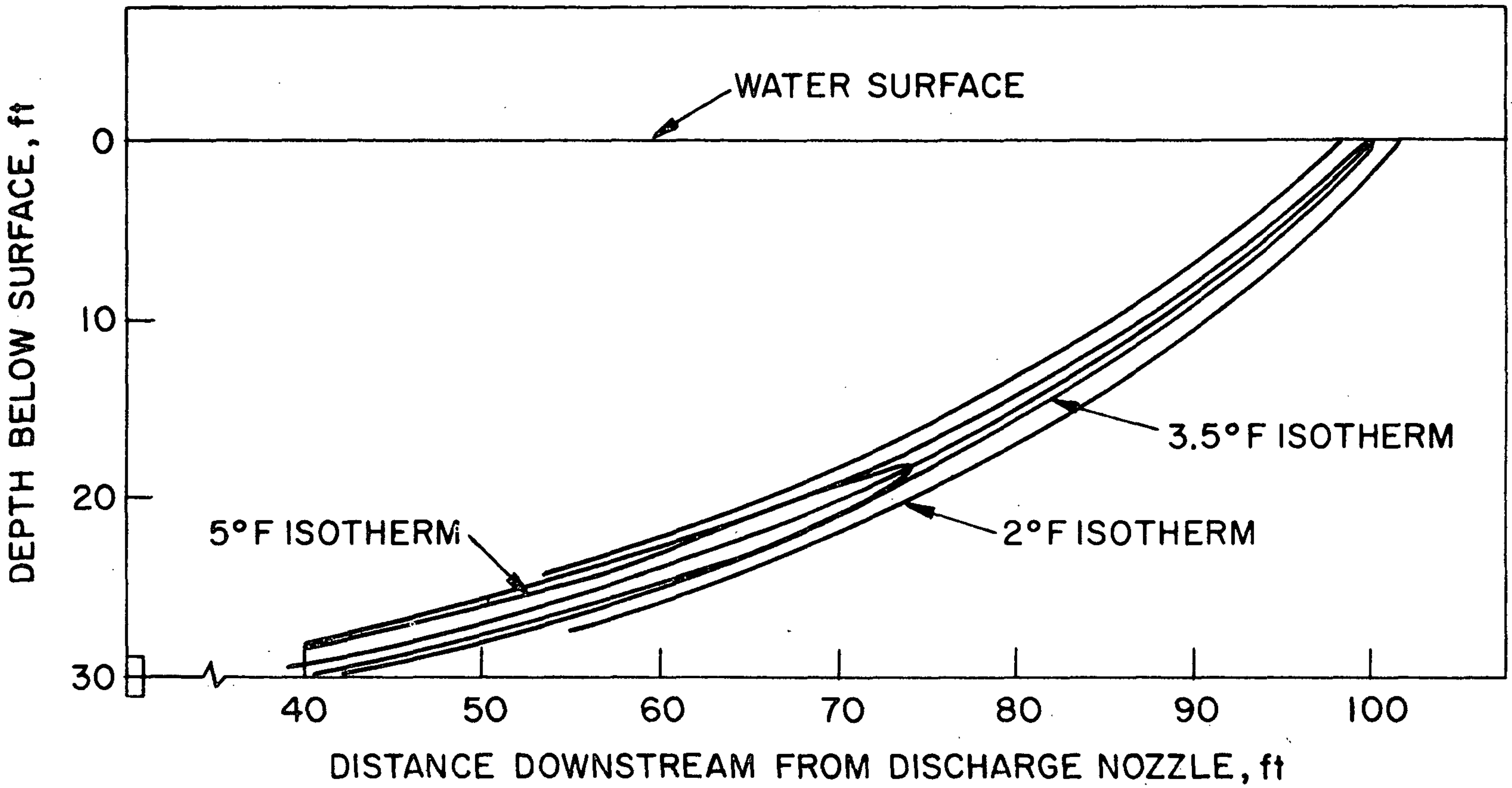

Fig. 5.7. Thermal Plumes from Discharge Parameters of Table 5.11.

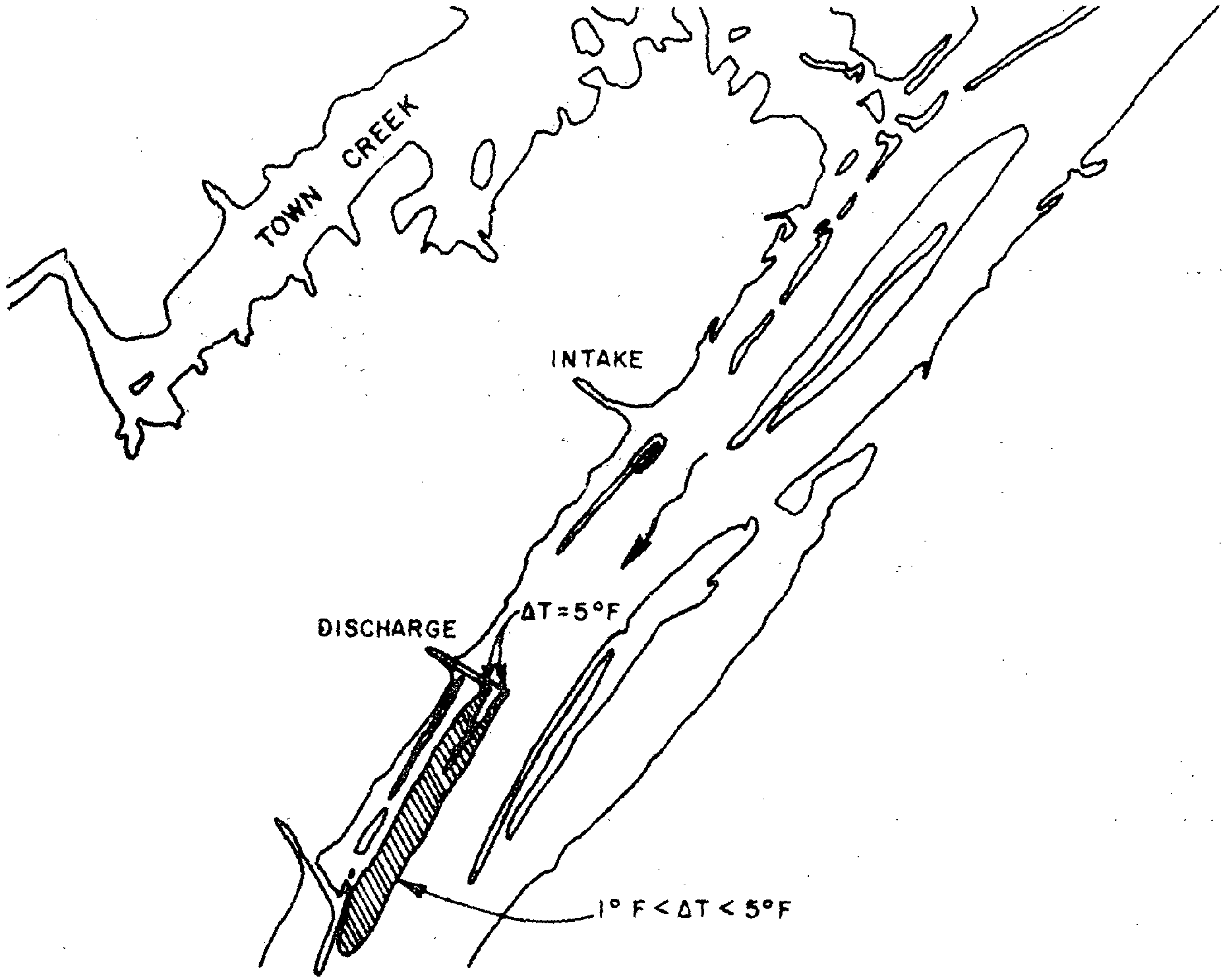

Fig. 5.8. Blowdown Plume. From TVA Responses to Second Set of AEC Comments.

of river flow and wind direction, the plume could be directed toward either shore, and even deflected upstream under conditions of reverse river flow. The applicant does not normally expect the plume to reach the entrance of Town Creek or Mud Creek, although it is a possibility under conditions of extended low flow accompanied by a strong northeasterly wind. This effect, however, would be completely masked by the diurnal surface stratification that occurs in these areas (see Fig. 5.6).

d) Interaction with Widows Creek Plant. The Widows Creek Steam Plant is ∿15 miles upstream of the Bellefonte site. This plant discharges approximately 2400 cfs of water heated 18°F above ambient. If one assumes full mixing before the water reaches the Bellefonte site, the temperature increase will be 1.5°F during the summer and 1.0°F during the winter. This does not include surface heat loss, which of course cools the water. Temperature measurements at Guntersville Dam and Nickjack Dam indicated that the water at the downstream dam is about 1.3°F warmer on the average. A portion of this temperature increase could be due to the Widows Creek plant and a portion is probably due to insolation. The Bellefonte plant by comparison raises the average water temperature flowing past the plant by about 0.1°F. Any combined thermal effect assignable to Bellefonte is expected to be small.

5.4.2.3.2 Plankton. The exposure to increased temperature for plankton (which have not passed through the plant) entrained into the plume will be about one minute and, therefore, should not be detrimental to most of the planktonic species in the reservoir. Because of the relatively small proportion of river flow expected to be affected by the thermal effluent plume, the staff does not expect any measurable changes to occur in the planktonic populations of the reservoir.

5.4.2.3.3 Benthos. Studies on the influence of thermal discharges on the benthic fauna generally indicate that the upper temperature tolerance of these bottom organisms (macroinvertebrates) is reached at temperatures close to 90°F.[79-81] Above this point, normal population structure in terms of species diversity is considerably reduced. If a deep mid-channel location of the diffuser pipe is used, the bottom area will not receive exposure to temperatures high enough to produce adverse effects on benthic organisms.

5.4.2.3.4 Fish. When ambient river temperatures are below the preferred temperature of a given species, it is likely that fish of that species will congregate in optimal temperature regions of the plume. This type of behavior is of common occurrence at the outfalls of power plants.[82] Gammon as a result of his studies on Wabash

River in southern Indiana, ahas categorized the fish species according to their behavioral responses to high temperatures as follows:[83]

A. Most tolerant of high temperatures e.g., carp, long nose gar, gizzard shad, channel cat fish, flathead cat fish, buffalo fish, shortnose gar;

B. Moderately tolerant of high temperatures e.g., river carpsuckers, skipjack herring, white bass, sauger, drum, white crappie;

C. Moderately intolerant of high temperatures e.g., spotted bass, smallmouth bass, moon eye, gold eye;

D. Intolerant of high temperatures e.g., shorthead redhorse, golden redhorse.

Most of these species have been reported from Guntersville Reservoir.[68] However, because of the small size of the effluent thermal plume, no major changes in relative abundance of fish species are expected. Fish which reside in heated water have a higher than normal metabolic rate. In some cases, it has been shown that some species of fish captured in the discharge region have a poorer condition than those from unheated regions.[84,85] Because of the small size of the plume at Bellefonte, the staff does not expect that the loss of condition of some fish, if it occurs, will have a population level impact.

Because of the large thermal reservoir of the circulating water and operating limits that will be established in the technical specifications, the rate of non-emergency shutdown will not be rapid enough to deliver an injurious cold shock to fish congregated in the plume. After both units begin operation, it is unlikely that both would be shut down at the same time. The staff, therefore, does not expect that fish kills due to cold shocks will be a problem.

5.4.2.3.5 Eurasian Water Milfoil. The Eurasian water milfoil has become established in several Tennessee River reservoirs in recent years and is generally regarded as a nuisance organism.[86] Extensive growths have occurred in shallow areas of the reservoir. Drawdowns and herbicide application are used by TVA to control this aquatic macrophyte. In 1971, 240,000 pounds of 2,4-D acid equivalent were applied to 6000 acres in Guntersville Reservoir. A possible effect on milfoil from plant operation is stimulation of growth through thermal enrichment;[87] milfoil also may clog the cooling water intake. During the summer, the surface water within the milfoil beds, which usually are near shore, may reach higher temperatures than are expected in the part of the plume which may occasionally reach the shore. It is not expected that an increase in milfoil growth, which would necessitate increased control measures, will result from plant operation in the summer because of the small amount of warmed water from the plume actually reaching any milfoil beds. Likewise, due to the extent of dilution, no measurable effect is expected in the winter, although the ΔT of the discharge over river temperature is greater in this season. The standing crop of milfoil and other macrophytes should be monitored during operation.

Milfoil has caused problems at other intakes on the river[86] and a similar problem could develop at Bellefonte. It is possible also that nuisance levels of milfoil may become established in Town Creek above the causeway. (On the site visit the staff noted that the embayment was generally free of milfoil.) The staff suggests that herbicides and pesticides (such as 2, 4-D for milfoil control or Abate for mosquito control) used in the Tennessee River and its embayments adjacent to the Bellefonte site be employed only with the consent of the TVA staff responsible for monitoring to avoid adverse impacts to the monitoring programs.

5.4.2.4 Chemical Effects

No deleterious effects on aquatic organisms can be expected from the concentrations of sulfate, sodium, chloride, or total dissolved solids (TDS) projected for the discharge to the reservoir (Table 3.5). Although exposures of several hours to the maximum concentrations of ammonia listed in the table might produce deleterious results on some aquatic organisms,[88] the brief duration (on the order of a minute) of exposure to entrained organisms and the rapid dilution in the river should nullify any ammonia toxicity. A situation similar to that for ammonia exists for zinc, chromium, and copper. Maximum expected levels for these metals (Table 3.6) are typically below those producing deleterious effects in bioassays, although in some situations toxicity might be expected near these values.[88] Dilution and brevity of exposure are such that no detectable effects are expected beyond the immediate vicinity of the discharge.

Details of biocide usage in the plant are not final. However, the technical specifications for operation will require that plant discharge meet standards adequate to protect aquatic organisms. There are no existing applicable standards for chlorine. The EPA's Brungs has recommended that receiving waters not consistently exceed 0.2 mg/l of chlorine (whose percentage of free chlorine is not high) for a maximum of two hours per day in order to protect the (less-sensitive) species of fish found at the Bellefonte site.[89] If the daily time of exposure is greater than two hours, the concentration should not exceed 0.01 mg/l. In addition, the EPA has proposed the tentative guideline that the chlorine concentration in recirculating cooling water systems be limited to an average concentration of 0.2 mg/l during a maximum of one 2-hour period a day and a maximum concentration of 0.5 mg/l for each unit.[90] For Bellefonte, some modification in the plant or in its operation may be required by standards such as these. The staff is convinced that modifications necessary to meet such biocide standards are possible with existing technology. The means available include, but are not limited to, retention ponds, holdup of blowdown, chemical scavengers, and application of biocide to different plant subsystems in such a manner that water with sufficient biocide demand may be mixed with the treated water before discharge.

A further problem is to verify that the standards are actually met. This problem arises (at least for chlorine) because routine analytical devices do not measure accurately below about 0.1 ppm (although the detection limit is theoretically 0.01 ppm), which is in excess of proposed standards. Effectiveness of the system for reducing biocide levels may necessitate indirect assurances of effectiveness.

For example, at one power plant which uses a chemical scavenger for chlorine, an amount stoichiometrically in excess of that required to reduce the chlorine is added to the blowdown in a chamber which insures complete mixing.[91] The staff considers that this procedure gives the best guarantee that applicable standards are met at this plant. The means developed by the applicant for limiting biocide levels to standards can be designed to be effective even though routine verification by direct measurement is not practical.

The plant will use mechanical (Amertap) condenser cleaning and the applicant states that no sulfuric acid will be added to the circulating cooling water to control scale.[92] Calculations by the staff confirm that for average water quality and moderate ambient water and air temperatures there will be little tendency for scale formation. However, under extreme conditions of calcium content, alkalinity, and temperature, scaling conditions may exist. Based on these calculations, the applicant's experience, and the TVA DES, the staff has evaluated aquatic impacts on the basis that sulfuric acid for scale control would be required. For the extreme conditions used in the analysis, however, control would require a large (tons) daily amount of acid addition. In case that acid is required, a reassessment of impacts would be necessary.

5.4.2.5 Summary of Impacts on Aquatic Biota

1. Small fish that enter the intake embayment in the normal course of their activity will be subject to impingement on the vertical traveling screens.

2. No significant adverse population level impact due to entrainment loss of phyto- and zooplankton is expected, largely because of compensatory responses of their populations.

3. Adverse ecological effects associated with dredging activities will occur whenever dredging is done to maintain the necessary depth in the 25 foot wide intake channel extending from the embayment and the overbank area to the main channel of the Tennessee River. These adverse effects can be minimized by proper timing of the dredging activity and good construction practices.

4. Fish eggs and larvae (ichthyoplankton) do not compensate for the loss in a short period. Therefore, their loss may become unacceptable if the intake is located in the shallow area as currently proposed. This loss might be decreased by about one order of magnitude and possibly more by location of intake openings in the main channel of the river or by other modifications of the intake structure. The preliminary data collected by the applicant indicate that larval density is less in the main channel as compared to near shore areas. Since adquate data are not available to fully assess the probable significance of ichthyoplankton mortality due to entrainment, the staff will require implementation of pertinent fishery investigations such that the environmental effects of the proposed intake design may be adequately assessed. An outline of these fishery investigations developed mutually by the staff and the applicant is contained in Section 6.

   The applicant has been requested to propose alternative locations of intake openings to minimize the potential entrainment and/or impingement impacts. These alternatives will meet all applicable safety criteria. The staff will evaluate the significance of the problem when sufficient data are available and may require the applicant to use an alternative intake design and/or location, if necessary. Construction activities which will foreclose options for alternative intake locations can commence after the staff has had an opportunity to review the results of the studies outlined in Section 6. However, the applicant has agreed to assume the risk of any additional costs associated with future modifications which may be necessary as indicated by the outcome of the fishery investigations.

5. Because of the small plume from the blowdown, no significant effects on aquatic biota due to thermal discharges are expected.

6. Chemicals to be discharged from this plant will be controlled by the technical specifications and diluted within a short distance of the effluent discharge and will not have a detrimental effect on the biota.

5.4.3 Effects of Airborne Emissions

The oil-fired auxiliary steam generators will, at peak load, release sulfur oxides to the atmosphere from a 125-ft stack at a rate of almost 143 lb/hr or 18 gm/sec. Using the Turner[93] nomograms for determining ground-level concentrations, a conservative plume rise value (effective stack height 50 meters), a wind of 3 mps, unstable lapse rates (the type that gives maximum ground-level concentrations for this stack height), and no credit for dilution due to building wake turbulence, the maximum SO_2 concentration will be 0.12 ppm. This peak will occur quite close to the plant stack (250 meters downwind) and decrease quite rapidly with distance. The State of Alabama standard is 0.15 ppm for a 24-hour average. Considering conditions used in calculating peak concentrations and that the 24-hour average is always below the peak concentration, the staff believes that the SO_2 releases from the oil-fired auxiliary are acceptable. The staff concurs with TVA's analysis of other releases.

5.5 SOCIAL AND ECONOMIC EFFECTS

5.5.1 Potential Risks to Health and Safety

Environmental radioactivity levels due to releases to offsite areas in the vicinity of the Bellefonte plant will result in radiation doses to man which are less than the variations in the natural background radiation dose. The naturally occurring external and internal sources of radiation near the plant site are about 150 mrem per year. A hypothetical individual who remained continuously at the Bellefonte plant site boundary would receive an annual total body dose of about 0.5 mrem for gasous effluents; or about 0.3 percent of background radiation during the course of normal operation of the plant.

The maximum annual total body dose to an individual at the nearest residence is estimated to be 0.1 mrem with no reduction for shielding by the dwelling or occupancy factor. When the spatial distribution of the population within 50 miles of the Bellefonte plant is considered, the total annual radiation dose due to gaseous effluents to which the local population could be exposed is expected to be about 0.31 man-rem; the total annual radiation dose for all pathways considering drinking water, fish ingestion, and recreation gives 1.6 man-rem. The basis for the radiological doses given here is presented in Section 5.3.

Several monetary estimates have been made of the cost of radiation exposure to population.[94] The most typical range of radiation risk valuation lies between \$10-\$250 per man-rem. Using these values of radiation risk with the cited estimated annual radiation exposure to the population of 1.6 man-rem for the Bellefonte plant, the annual potential social costs for radiation risk in the 50-mile radius would lie between $20 and $400 per year. The staff finds this level of risk extremely small and acceptable. The radiation risk due to transportation of fuel and wastes within and beyond the 50-mile radius is about 14 man-rem per year. This risk is also small and acceptable.

5.5.2 Impairment of Land Use in Areas Adjacent to Site

Little impairment of current land uses near the proposed site resulting from adverse environmental, esthetic, safety impacts, or other considerations are anticipated through construction of the Bellefonte Nuclear Plant. Predicting the impact on future land use is more difficult; however, no significant impairment in future land use is expected due to construction of the plant at the Bellefonte site.

5.5.3 Cost to Local Government

The location of 170 new families in the Scottsboro area for maintenance and operation of the Bellefonte Nuclear Plant will necessitate some expansion in the provision of public goods and services by the Scottsboro municipal government and the city and Jackson County school districts. In 1973 dollars, the Scottsboro city government spends approximately $90 per capita on municipal services such as police, fire protection, parks and recreation, etc; assuming an average family size of 3.5 and no economies or diseconomies of scale in provision of local public services, annual costs to municipal government may be expected to rise by about $53,000 per year as a consequence of new families. As an offset to the increased costs to local government, the new residents will increase the revenues of local government primarily through sales and property taxes.

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6. EFFLUENT AND ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 RADIOLOGICAL PROGRAMS

6.1.1 Pre-operational

The applicant has proposed an offsite radiological monitoring program to provide surveillance and backup support to detailed effluent monitoring as required by Safety Guide 21. The monitoring program is to provide assurance that the contribution of radioactivity to the environment and hence population dose is indeed negligible.

A summary description of the applicant's proposed program is presented in Table 6.1. The description is not intended to be a complete technical specification of the program; monitoring and analytical techniques are developing and are likely to improve before the program is put into effect. More detailed information on the applicant's radiological monitoring program is presented in Section 2.4.6 of the TVA DES. The TVA DES includes discussion of criteria for selection of sampling location and collection frequency as well as sample type and/or measurement. Comparative analyses on environmental samples collected will be performed by the Alabama Department of Public Health Radiological Laboratory and the Eastern Environmental Radiation Laboratory, EPA, Montgomery, Alabama. The applicant proposes to initiate the program at least two years prior to operation of the facility.

The staff recommends that the applicant improve his analysis of milk samples to obtain a sensitivity of 0.5 pCi/l for iodine-131, as discussed in Regulatory Guide 1.42 Revision 1, Appendix D.

6.1.2 Operational

The applicant plans to continue the proposed pre-operational program during the operating period but will modify it as necessary to reflect any changes required as a result of pre-operational experience.

Review of the proposed environmental radiation monitoring program by the staff will continue during the design and pre-operational phases, and adjustments in the program will be considered in establishing technical specifications for the operational phase of the program.

6.2 NONRADIOLOGICAL PROGRAMS

6.2.1 Aquatic

6.2.1.1 Investigations Related to Location of Cooling Water Intake Openings

TABLE 6.1. Environmental Radiological Surveillance Program

	Criteria and Sampling Locations	*Collection Frequency*	*Analysis/Counting*
Atmospheric			
Air			
Particulate	Filter paper at 10 locations	Weekly	Gross beta (gamma scan monthly)
Radioiodine	Charcoal filter at 10 locations	Weekly	I-131
Fallout	Gummed acetate at 10 locations	Monthly	Gross beta
Rainwater	Filter paper at 10 locations	Monthly	Gross beta, Sr-89 Sr-90, H-3
Reservoir			
Water			
Municipal (public supplies)	All public water supply intakes within 10 miles upstream and downstream of the plant	Monthly	Gross beta, gamma scan, H-3
River	Plant discharge and five locations on the Tennessee River	Monthly	Gross beta, gross alpha, gamma scan, Sr-89, Sr-90, H-3
Aquatic biota			
Fish (buffalo, crappie, and catfish)	Three locations	Quarterly	Gross beta, total alpha, gamma scan, Sr-89, Sr-90
Shellfish (asiatic clams)	Three locations	Quarterly	Gross beta, total alpha, gamma scan, (Sr-89, Sr-90 shells only)
Plankton	Three locations	Quarterly	Gross beta, total alpha, gamma scan, Sr-89, Sr-90
Aquatic macrophytes	Three locations	Quarterly	Gross beta, total alpha, gamma scan, Sr-89, Sr-90

TABLE 6.1 (Cont'd)

	Criteria and Sampling Locations	*Collection Frequency*	*Analysis/Counting*
Sediment	Three locations	Quarterly	Gross beta, total alpha, gamma scan, Sr-89, Sr-90
Terrestrial			
Soil	Atmospheric monitoring locations	Quarterly	Gross beta, gamma scan
Vegetation			
Pasturage and and grass	Dairy farms within 10-mile radius of plant and 10 atmospheric monitoring stations	Monthly	Gross beta, gamma scan, Sr-89, Sr-90
Food crops	Within 10-mile radius of plant	Semi-annually	Gross beta, total alpha, gamma scan, Sr-89, Sr-90
Milk	Dairy farms within 10-mile radius of plant	Monthly	Gamma scan, Sr-89, Sr-90
Well water	Farms within five miles of plant	Monthly Quarterly	Gross beta, gamma scan
Direct radiation	TLD's at remote and perimeter monitors	Quarterly	Dose determination

The applicant, in collaboration with the staff, has developed a sampling program to determine the extent of fish larval entrainment at the proposed site. This program will determine the number of larval fish passing the cross section of the lake where the intake openings will be located. Theoretical models will be developed to determine the mix of waters that may be drawn from the lake (i.e. proportions of water with varying densities of larval fish). Predictions will then be made on the percentage of larval fish that may be withdrawn by the plant.

Larval sampling will be conducted in three transects perpendicular to the flow: one at the proposed intake location and one each up - and down stream of the proposed location. At the intake location, five areas will be sampled; these are:

a. On the right bank, one shallow water sample between the islands and the shoreline

b. On the right bank, one shallow water sample between the island and the channel

c. Channel surface - one sample

d. Channel deep (5m) one sample

e. On the left bank, one shallow water sample.

At the other two transect locations area b will not be sampled. Sampling will be conducted once-a-week during the spawning season of key species. It is recommended that the applicant conduct some night sampling to determine if there are any significant diurnal variations in the density of icthyoplankton. It is expected that all entrainable size larval stages will be sampled.

6.2.1.2 Investigations to Determine Construction Effects

As discussed in Sec. 4.1.1, the major impacts on the aquatic habitat and biota will be due to increased turbidity and siltation, as well as alteration or loss of embayment, overbank, and channel regions from construction activities.

The applicant has proposed a monitoring program which is outlined in Appendix L of the TVA FES.[1] The pre-operational monitoring program will begin one year prior to construction. Siltation will be assessed by measuring the depth and area of particulate deposition. Changes in standing crop and species composition of benthic fauna and aquatic macrophytes will be followed before and throughout construction. Macrophyte standing crop will be sampled in alternate months at sampling stations along the main river, in the overbank and embayment (Town Creek) areas near the construction site, and in suitable control areas. Distribution of the macrophytes will also be monitored by aerial photography. Zoobenthos (see Table 6.2) will be sampled monthly from March to October and in January or February. Ten ponar grab samples and replicate samples of sediment will be taken from each of four stations: above the water intake area, between the intake and discharge areas, 200 to 300 yards below the discharge construction area, and within the mouth of Town Creek. Weight and frequency distribution of species will be determined from the grab samples.

Other biotic groups (Table 6.2) will be sampled on the same schedule and at the same locations as for zoobenthos. These are zooplankton phytoplankton, and artificial substrates for benthic fauna and periphyton.

Water quality parameters will be sampled quarterly at three stations on the Tennessee River. These station locations will include one upstream control, one near the intake and discharge sites, and one downstream station. All stations will be in the right descending overbank area. It is possible that a shoreline station (control) will be established on Bellefonte Island should an upstream overbank control be adversely effected by runoff from Mud Creek.

Periodic monitoring for direct construction effects will also be conducted in creeks and sloughs that drain the construction area. These samples will be collected to coincide with surveys for biotic impact assessment, periods of heavy rainfall, and major changes in construction phases. Aerial color photographs will be taken as an aid to further assess the potential impact.

It is important that monitoring be coupled to the regulation of construction activities as a feedback which guarantees that these activities do minimize their erosional and habitat altering potential. The TVA has provided a statement regarding environmental monitoring feedback as it relates to the control of onsite construction activities.[2] Monitoring for the adverse effects due to runoff caused by construction activities as outlined in the TVA DES will be performed by the construction organization on a continuing basis and periodically conducted by other divisions of TVA as the work is being performed. The construction project manager will assign responsibility for the continuous monitoring to the construction engineer and/or safety engineer and their organizations. Adverse effects resulting from construction activities will be corrected immediately upon detection when practical. Those not considered practical to correct or alleviate immediately will be brought to the attention of the project manager for final decision. If action is delayed, reasons will be documented.

TABLE 6.2. Types and Locations of Biological Samples Collected Quarterly to Monitor Nonradiological Preoperational and Operational Conditions in Guntersville Reservoir in Relation to the Bellefonte Nuclear Plant

(January or February and monthly from March through October)

Sample Location	*Depths for Zooplankton, Chlorophyll*[a] *and Phytoplankton (random, replicate samples), m*	*Depths for Productivity,*[b] *m*	*Benthic Fauna-Grabs*[c,e]	*Benthic Fauna - Artificial Substrates*[d]	*Periphyton Substrates*[d]	*Sediment*
Upstream[a]	0, 1, 3, 5	0, 1, 3, 5	10	3	2	2
Plant below outfall[a]	0, 1, 3, 5	0, 1, 3, 5	10	3	2	2
Downstream[a]	0, 1, 3, 5	0, 1, 3, 5	10	3	2	2
Town Creek	0, 1,	0, 1,	10			2

[a]Right overbank and channel.

[b]Location of lower depths depends on depth of the photic zone and water depth.

[c]Number per stratum.

[d]Number per station.

[e]Number subject to adjustment.

Periodic monitoring will be performed as outlined in the nonradiological environmental monitoring program.[1] Any variances, ill effects, potential problems, or suggestions of personnel not a part of the construction organization will be discussed on the site with the appropriate project officials and documented if considered significant. Action to be taken will be decided by the project manager after consultation with appropriate personnel outside the construction organization. The administrative control procedures within TVA can be used should further action than that proposed by the project personnel be thought necessary.

6.2.1.3 Investigations to Determine Operational Effects

The rationale for and outline of an operational aquatic monitoring program presented by the applicant[1] should serve as an adequate basis for the detailed presentation of the program in the Environmental Technical Specifications. The salient features of the operational program are presented in Table 6.3. Considering the lead time (∿6 years) to operation, the expected input from ongoing TVA studies on aquatic impacts, and possible changes in water quality standards and policy, a more detailed discussion of operational monitoring is not warranted at the present time.

6.2.2 Terrestrial

The nonradiological terrestrial monitoring program[1] is designed to evaluate the following hypotheses:

1. Land use changes associated with construction and operation will result in changes or losses of wildlife, wildlife habitat, forested areas, hunting opportunity, and nonconsumptive recreational activities.

2. Transmission line construction, operation, and maintenance will result in changes or losses of wildlife, wildlife habitat, forested areas, hunting opportunity, and nonconsumptive recreational activities.

3. Operation of the facility may result in accumulations of toxic materials in plant and animal tissues or soil.

4. Operation of the facility may alter moisture regimes of natural ecosystems.

Construction monitoring pertaining to onsite impacts will begin in the winter of 1973-1974 and will continue through construction until the plant begins operation. Baseline studies were conducted on the site in August 1972. Studies will concentrate on vegetation and vertebrate parameters for evaluating the direct construction impacts such as

TABLE 6.3. Outline of Proposed Aquatic Monitoring Program

Item	*Rationale*	*Frequency and Location*	*Methods*
Physical parameters (at least the following): pH, conductivity, TDS, TSS, BOD, COD, DO, NO_3, NO_2, org. N, total P, sol. P, NH_4, Cu, Ni, Zn, Cr, total and fecal coliform, sediment	To determine physical aspects of water and chemical quality	Quarterly, at least 3 reservoir locations.	Recommended Methods for Data Acquisition, Federal Interagency Work Group.
Zooplankton, phytoplankton, chlorophyll	To determine biotic aspects of water quality.	Monthly, Mar.-Oct. & Jan. or Feb.; 3 reservoir locations.	As baseline and construction; pre- and post-op'n, up & downstream comparisons.
Artificial substrates for zoobenthos. Periphyton substrates	To determine if plant op'n alters water quality for primary and secondary producers.	Monthly, Mar.-Oct. & Jan. or Feb.; 3 reservoir locations.	As baseline and construction; pre- and post-op'n, up & downstream comparisons.
Zoobenthos	To determine if recovery from const. influences occurs during operations.	Monthly, Mar.-Oct. & Jan. or Feb. 3 reservoir locations.	As baseline and construction; pre- and post-op'n, up & downstream comparisons.
Post-larval and adult fish	To determine changes in distr'n and condition assoc. with heated water.	Yearly (Aug. or Sept.). 2 coves adjacent to discharge.	Rotenone; pre- & post-op'n, up & downstream comparisons.
Post-larval and adult fish	To determine changes in distr'n and condition assoc. with heated water.	Quarterly; 3 reservoir locations.	Gill net; pre- & post-op'n, up & downstream comparisons.
Fish impingement	To determine if fish losses are within acceptable limits.	Cursory inspection at each screen cleaning.	Enumeration of fish as shad and non-shad.
Fish impingement	To determine if fish losses are within acceptable limits.	Intensive periodic inspection.	Identification to species, with size and frequency dist'n.
Entrainment of larvae and eggs	To determine if intake structure minimizes entrainment losses.	Weekly: Mar. 15 to Aug. 1. 3 locations in reservoir cross section; intake flow.	Meter nets.
Macrophytes	To determine if growth is increased and if chemicals of plant origin are concentrated.	Alternate months; stands in discharge and control areas.	As baseline and construction; chemical analysis.

clearing and excavation, noise and vibrations, fuel leaks and spills, etc. In addition to the regular ecological studies, there will be quarterly site inspection visits by the TVA ecologists. Aerial photography will be used to document significant changes in land use on the site and in the vicinity.

Prior to construction of the Bellefonte/Guntersville line (a subsection of the Bellefonte/West Jefferson line), which has been designated as Step 1, vegetation on specific test tracts along the right-of-way will be inventoried. Various alternate clearing, construction and maintenance methods will be evaluated in terms of dollar costs and environmental impacts (primary emphasis will be on vegetation regrowth and invasion rates).[2,3] Concurrent studies will be performed on other transmission line projects in the TVA area to determine specific impacts of various alternative methods on wildlife, understory development, and ecotonal influences.[1,4] Results of all these studies should be used to determine the right-of-way clearing and maintenance methods to be utilized by the TVA for the remainder of the Bellefonte lines (Steps 2 and 3). The TVA and AEC should review the information from the studies and any consequent revisions in TVA's right-of-way clearing and maintenance methods for Steps 2 and 3.

Operational monitoring will involve continued evaluation of land use changes and related impacts, and the evaluation of possible moisture, chemical, and structural impacts associated with the cooling towers. Monitoring of mositure and chemical constituents from the towers will depend on the results of current studies at other TVA plants, although a drift-effect study is discussed in the TVA's monitoring program. A monitoring program will be conducted after the cooling towers are constructed to determine if birds fly into them. The staff concurs with the TVA's monitoring rationale and that the specifics of such programs would be best drawn up later, when results of other monitoring programs are available.

6.3 METEOROLOGICAL PROGRAM

6.3.1 Pre-operational Onsite Meteorological Program

There are several phases of the pre-operational program.

1. A 130-ft tower, 2.2 mi NNW of the plant site, began operation May 12, 1972. Instrumentation on this tower consists of wind speed and direction sensors at 130 ft and 33 ft, although the 33-ft sensor was not installed until September 1973. Temperature is measured at 33 ft and 130 ft and the vertical temperature gradient is computed.

2. A 33-ft tower erected on the proposed site of the reactor structures became operational on October 20, 1972, with only wind speed and direction measured at the top level. This tower will be removed when construction begins.

3. A permanent tower[5] 300 ft high is scheduled to begin operation about 6 months after the start of plant construction. As stated in the PSAR, instrumentation on this tower is to include wind speed and direction measurements at 33 ft and 300 ft, temperature and dew-point temperature at 4 ft, 33 ft, 150 ft, and 300 ft, and solar radiation, total radiation, rainfall, and atmospheric pressure all at 4 ft.

   Data recording at the offsite facility is done on magnetic tape with strip charts forming the secondary system. At the temporary onsite facility, strip charts are used for data recording. Routine calibration of the instruments is performed at least every 6 months. 9 months of data from the onsite facility were submitted in accordance with Regulatory Guide 1.23. These data, covering the months when the poorest atmospheric diffusion conditions should exist, have been used to evaluate atmospheric dispersion characteristics. The staff feels that this data base provides a reasonably conservative initial estimation of the atmospheric dispersion characteristics expected at the site. Once one full year of data is made available to the staff, revised relative concentration values will be calculated and appropriate corrections made. A Gaussian diffusion model, with adjustments for building wake effects, was used to make estimates of relative concentrations at various distances and direction from the site as specified in Sec. 5.

6.3.2 Operational Onsite Meteorological Program

The applicant has stated[6] that the "objective of the onsite program will be to maintain a continuous instrumentation surveillance of the meteorological parameters involved in the atmospheric dispersion of radioactive effluent releases and to have the data available at any time for assessing the relative concentrations and doses resulting from accidental or routine releases," which includes control room monitoring of appropriate meteorological parameters. Staff evaluation of the operational program will be made at an appropriate future date.

References

1. Tennessee Valley Authority, "Final Environmental Impact Statement, Bellefonte Nuclear Plant, Units 1 and 2" Appendix L, Chattanooga, Tenn., May 24, 1974.

2. Letter from J.E. Gilleland, TVA, to Daniel R. Muller, AEC, March 27, 1974.

3. Letter from J.E. Gilleland, TVA, to W.H. Regan, Jr., AEC, February 22, 1974.

4. Letter from J. P. Darling, TVA to G. Dittman, AEC, May 6, 1974.

5. Tennessee Valley Authority, "Preliminary Safety Analysis Report, Bellefonte Nuclear Plant", Docket Nos. 50-438 and 50-439, Chattanooga, Tenn., March 6, 1973, p. 2.3-16.

6. Ibid, p. 2.3-18.

7. ENVIRONMENTAL EFFECTS OF ACCIDENTS

7.1 PLANT ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

A high degree of protection against the occurrence of postulated accidents in the Bellefonte Nuclear Plant is provided through correct design, manufacture, and operation, and the quality assurance program used to establish the necessary high integrity of the reactor system, as will be considered in the Commission's Safety Evaluation. Deviations that may occur are handled by protective systems to place and hold the plant in a safe condition. Notwithstanding this, the conservative postulate is made that serious accidents might occur, even though they may be extremely unlikely, and engineered safety features are installed to mitigate the consequences of those postulated events which are judged credible.

The probability of occurrence of accidents and the spectrum of their consequences to be considered from an environmental effects standpoint have been analyzed using best estimates of probabilities and realistic fission product release and transport assumptions. For site evaluation in the Commission's safety review, extremely conservative assumptions are used for the purpose of comparing calculated doses resulting from a hypothetical release of fission products from the fuel against the 10 CFR Part 100 siting guidelines. Realistically computed doses that would be received by the population and environment from the accidents which are postulated would be significantly less than those presented in the Safety Evaluation.

The Commission issued guidance to applicants on September 1, 1971, requiring the consideration of a spectrum of accidents with assumptions as realistic as the state of knowledge permits. The applicant's response was contained in the *Bellefonte Nuclear Plant Draft Environmental Statement*, dated March 6, 1973.

The applicant's report has been evaluated, using the standard accident assumptions and guidance issued as a proposed amendment to Appendix D of 10 CFR Part 50 by the Commission on December 1, 1971. Nine classes of postulated accidents and occurrences ranging in severity from trivial to very serious were identified by the Commission. In general, accidents in the high potential consequence end of the spectrum have a low occurrence rate and those on the low potential consequence end have a higher occurrence rate. The examples selected by the applicant for these cases are shown in Table 7.1. The examples selected are reasonably homogeneous in terms of probability within each class.

Commission estimates of the dose which might be received by an assumed individual standing at the site boundary in the downwind direction, using the assumptions in the proposed Annex to Appendix D, are presented in

TABLE 7.1. Classification of Postulated Accidents and Occurrences

Class	*AEC Description*	*Applicant's Examples*
1	Trivial incidents	Spills and leaks inside containment.
2	Small releases outside containment	Spills, leaks, and pipe breaks outside containment.
3	Radioactive waste system failure	Equipment failure and malfunction or human error.
4	Fission products to primary system (BWR)	Not applicable.
5	Fission products to primary and secondary systems (PWR)	Fuel cladding defects and steam-generator tube leak, steam-generator tube rupture, off-design transients that induce fuel failure.
6	Refueling accident	Fuel bundle drop and heavy object drop onto fuel in core.
7	Spent fuel handling accident	Fuel assembly drop in fuel storage pool. Heavy object drop onto fuel storage rack and fuel cask drop.
8	Accident initiation events considered in design-basis evaluation in the Safety Analysis Report	Loss of coolant accident, steam line break, and rod ejection accidents.
9	Hypothetical sequence of failures more severe than Class 8	Not considered.

Table 7.2. Estimates of the integrated exposure that might be delivered to the population within 50 miles of the site are also presented in Table 7.2. The man-rem estimate was based on the projected population within 50 miles of the site for the year 2020.

To rigorously establish a realistic annual risk, the calculated doses in Table 7.2 would have to be multiplied by estimated probabilities. The events in Classes 1 and 2 represent occurrences which are anticipated during plant operations; and their consequences, which are very small, are considered within the framework of routine effluents from the plant. Except for a limited amount of fuel failures and some steam generator leakage, the events in Classes 3 through 5 are not anticipated during plant operation; but events of this type could occur sometime during the 40-year plant lifetime. Accidents in Classes 6 and 7 and small accidents in Class 8 are of similar or lower probability than accidents in Classes 3 through 5, but they are still possible. The probability of occurrence of large Class 8 accidents is very small. Therefore, when the consequences indicated in Table 7.2 are weighted by probabilities, the environmental risk is very low. The postulated occurrences in Class 9 involve sequences of successive failures more severe than those required to be considered in the design bases of protection systems and engineered safety features. Their consequences could be severe. However, the probability of their occurrence is judged so small that their environmental risk is extremely low. Defense in depth (multiple physical barriers), quality assurance for design, manufacture and operation, continued surveillance and testing, and conservative design are all applied to provide and maintain a high degree of assurance that potential accidents in this class are, and will remain, sufficiently small in probability that the environmental risk is extremely low.

The AEC is currently performing a study to assess more quantitatively these risks. The initial results of these efforts are expected to be available in 1974. This study is called the Reactor Safety Study and is an effort to develop realistic data on the probabilities and sequences of accidents in water cooled power reactors, in order to improve the quantification of available knowledge related to nuclear reactor accidents probabilities. The Commission has organized a special group of about 50 specialists under the direction of Professor Norman Rasmussen of MIT to conduct the study. The scope of the study has been discussed with EPA and described in correspondence with EPA which has been placed in the AEC Public Document Room (letter, Doub to Dominick, dated June 5, 1973).

As with all new information developed which might have an effect on the health and safety of the public, the results of these studies will be made public and would be assessed on a timely basis within the regulatory process on generic or specific bases as may be warranted.

TABLE 7.2 Summary of Radiological Consequences of Postulated Accidents[1]

Class	*Event*	*Estimated Fraction of 10 CFR Part 20 Limit at Site Boundary*[2]	*Estimated Dose to Population in 50-mile Radius, man-rem*
1.0	Trivial incidents	3/	3/
2.0	Small releases outside containment	3/	3/
3.0	Radwaste system failures		
3.1	Equipment leakage or malfunction	0.035	3.3
3.2	Release of waste gas storage tank contents	0.14	13.0
3.3	Release of liquid waste storage tank contents	0.004	0.36
4.0	Fission products to primary system (BWR)	N. A.	N. A.
5.0	Fission products to primary and secondary systems (PWR)		
5.1	Fuel cladding defects and steam-generator leaks	3/	3/
5.2	Off-design transients that induce fuel failure above those expected and steam-generator leak	<0.001	<0.1
5.3	Steam-generator tube rupture	0.047	4.4

[1]*The doses calculated as consequences of the postulated accidents are based on airborne transport of radioactive materials resulting in both a direct and an inhalation dose. Our evaluation of the accident doses assumes that the applicant's environmental monitoring program and appropriate additional monitoring (which could be initiated subsequent to a liquid release incident detected by in-plant monitoring) would detect the presence of radioactivity in the environment in a timely manner such that remedial action could be taken if necessary to limit exposure from other potential pathways to man.*

[2]*Represents the calculated fraction of a whole body dose of 500 mrem, or the equivalent dose to an organ.*

[3]*These releases are expected to be in accord with proposed Appendix I for routine effluents (i.e., 5 mrem per year to the whole body from either gaseous or liquid effluents).*

TABLE 7.2 (Cont'd)

Class	*Event*	*Estimated Fraction of 10 CFR Part 20 Limit at Site Boundary*[2]	*Estimated Dose to Population in 50-mile Radius, man-rem*
6.0	Refueling accidents		
6.1	Fuel bundle drop	0.007	0.69
6.2	Heavy object drop onto fuel in core	0.13	12.0
7.0	Spent fuel handling accident		
7.1	Fuel assembly drop in fuel rack	0.005	0.44
7.2	Heavy object drop onto fuel rack	0.019	1.7
7.3	Fuel cask drop	N. A.	N. A.
8.0	Accident initiation events considered in design basis evaluation in the SAR		
8.1	Loss-of-coolant accident		
	Small break	0.083	14.0
	Large break	0.066	22.0
8.1(a)	Break in instrument line from primary system that penetrates the containment	N. A.	N. A.
8.2(a)	Rod ejection accident (PWR)	0.007	2.2
8.2(b)	Rod drop accident (BWR)	N. A.	N. A.
8.3(a)	Steamline breaks (PWR's) outside containment)		
	Small break	<0.001	<0.1
	Large break	<0.001	<0.1
8.3(b)	Steamline break (BWR)	N. A.	N. A.

Table 7.2 indicates that the realistically estimated radiological consequences of the postulated accidents would result in exposures of an assumed individual at the site boundary to concentrations of radioactive materials that are within the Maximum Permissible Concentrations (MPC) of 10 CFR Part 20. The table also shows for each postulated accident the estimated integrated exposure of the population within 50 miles of the plant. When considered with the probability of occurrence, the annual potential radiation exposure of the population from all the postulated accidents is a small fraction of the annual exposure from natural background radiation and, in fact, is well within naturally occurring variations in the natural background. It is concluded from the results of the realistic analysis that the environmental risks due to postulated radiological accidents are exceedingly small.

7.2 TRANSPORTATION ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

As discussed in Sect. 5.3.2.4, the Commission's staff has recently completed an analysis of the potential impact on the environment of transporting fuel and solid radioactive wastes for nuclear power plants under existing regulations. The results of this analysis were published in a report entitled "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants," dated December 1972. The report contains an analysis of the probabilities of occurrences of accidents and the expected consequences of such accidents, as well as the potential exposures to transport workers and the general public under normal conditions of transport.

For the Bellefonte Nuclear Plant, the characteristics of the reactor fuel and wastes and the conditions of transport for the fuel and waste fall within the scope of the Environmental Survey of Transportation. The initial fuel supply for each of the Bellefonte units will be supplied by Babcox & Wilcox. At present, the Babcox & Wilcox fabrication facilities are located in Lynchburg, Virginia. The new fuel elements will be shipped approximately 375 miles from the fabrication plant to the site by truck.

Each unit of the Bellefonte Nuclear Plant will replace about 68 of the 205 fuel assemblies each year. It is assumed that spent fuel elements will be shipped from the site by rail to the Allied Gulf Nuclear Services Reprocessing Plant in Barnwell, South Carolina. The shipping distance (about 425 miles) is within the 1000 miles used as a basis for analysis in the survey.

It is assumed that solid radioactive wastes will be shipped by truck to the Nuclear Engineering Company facility in Morehead, Kentucky. This will involve approximately 25 shipments per year for both units. The distance (about 400 miles) is within the 1000 miles used as a basis for analysis in the survey.

In accordance with the proposed amendment (Sect. F) to Appendix D of 10 CFR Part 50, published on February 5, 1973, and the subsequent rule-making hearings, Table 7.3 summarizes the environmental impact of accidents during transportation of fuel and waste to and from the plant. (Normal conditions of transport were summarized in Table 5.5.)

TABLE 7.3 Environmental Impact of Accidents during Transportation of Fuel and Waste to and from the Bellefonte Nuclear Plant

Aspect	*Environmental Risk*
Radiological effects	Small
Common (nonradiological) causes	1 fatal injury in 100 years; 1 nonfatal injury in 10 years; $475 property damage per year

8. IMPLICATIONS OF THE PROJECT

8.1 THE REQUIREMENT FOR POWER

This section of the Environmental Statement contains an evaluation of whether the equivalent power production level of the Bellefonte Nuclear Plant (2340 MWe) is required by TVA at a given time in the future. Included in our evaluation of the characteristics of the TVA system were power requirements considering past and projected load growth, service area, reserve margins, and the reliability of the total power system as well as regional relationships involving regional interconnections and reliability factors.

8.1.1 Description of the TVA System

8.1.1.1 Applicant's System and Service Area

The TVA was established to develop the Tennessee River system and to assist in the development of other resources of the Tennessee Valley and adjoining areas. Part of this development program was the generation, transmission, and sale of electric power. TVA supplies the electric power needs of an area of 80,000 square miles covering practically all of Tennessee (principal exception being Kingsport), and portions of southwestern Kentucky, northeastern Mississippi, northern Alabama and Georgia, and small sections of North Carolina and Virginia. This service area has a total population of about six million people.

TVA is primarily a wholesaler of electric power to three major groups of customers[1]: 1) local municipal and rural electric cooperatives, 2) directly served industries, and 3) directly served Federal agencies. The first group of customers includes 150 municipals and 10 cooperatives. Among these are municipal systems such as Chattanooga, Huntsville, Knoxville, Memphis, Murfreesboro, Nashville, and Scottsboro and among the cooperative systems are the Appalachian, North Alabama, and Sand Mountain Electric Cooperatives. Among the 46 industrial companies served directly are ALCOA, Amoco Chemicals Corp., Armour & Co., B.F. Goodrich Co., Consolidated Aluminum Corp., Diamond Alkali Co., General Analine & Film Corp., Monsanto Chemical Co., Olin Mathieson Chemical Corp., Pennsalt Chemicals Corp., Revere Copper and Brass, Inc., Tennessee Corp., Texas Eastern Transmission Corp., and Union Carbide Corp.[2] The Federal agencies served directly by TVA include The Marshall Space Flight Center of NASA at Huntsville, Alabama, the Arnold Engineering Development Center of the Air Force at Tullahoma, Tennessee, and all of the electrical requirements of the AEC for its plants at Oak Ridge and more than one-half of the electrical power requirements of its Paducah, Kentucky, plants.

The Federal Power Commission has designated the TVA system as Power Supply Area 20 and lists the major geographical electric load centers on the TVA system as Memphis, Nashville, Columbia, Chattanooga, Knoxville -- all in Tennessee -- and Paducah, Kentucky, and Huntsville, Alabama.[3] Figure 8.1 displays the service area of the TVA system along with the major cities, load centers, and transmission interconnections with other systems.

8.1.1.2 Regional Relationships

TVA is a member of the Southeastern Electric Reliability Council (SERC), which was established in January 1970 as one of the nine members of the National Electric Reliability Council (NERC). The purpose of NERC is to encourage improvement in the coordination of bulk electric power systems at both the national and regional levels.

The SERC Region is bordered by other NERC members as follows: 1) on the northeastern perimeter by the Mid-Atlantic Area Coordination Group (MAAC), 2) on the northern border by the East Central Area Reliability Coordination Agreement (ECAR), 3) on the northwestern corner by the Mid-America Interpool Network (MAIN), and 4) on the western border by the Southwest Power Pool (SPP). Figure 8.2 shows the SERC Region subdivided into the four major groups which make up the total region. These sub-regions are the TVA system, the Southern Company System, the Florida Group, and VACAR areas.

It has been estimated that the summer peak load for the entire region will increase from 70.0 GWe in 1973 to 154.5 GWe in 1982 for an annual compound growth rate of about 9.2 percent.[4] This compares with an estimated growth rate for the sum of all of the NERC Regions of only 7.0 percent for the same time period.[5] Based upon historical electrical growth trends in the southeast, the staff agrees with this assessment for power requirements for the early 1980s by the Southeastern Electric Reliability Council.

In order to strengthen electrical reliability and develop more effective bulk power supply systems, SERC anticipates the development of a rather large capability for interregional transfers of bulk power by the 1980's. These interregional transfer capabilities are shown on Figure 8.2 for power exchanges both to and from the SERC Region.[6] The power transfer capabilities do not represent firm power agreements but rather the maximum electrical load transfer capacities of the transmission facilities in a normal state and optimum service conditions of the transmission grid. Also shown in Figure 8.2 are the intraregional power transfer capabilities among the four subregions. The interconnecting systems both within and outside of the SERC Region will strengthen the reliability of electric power supply.

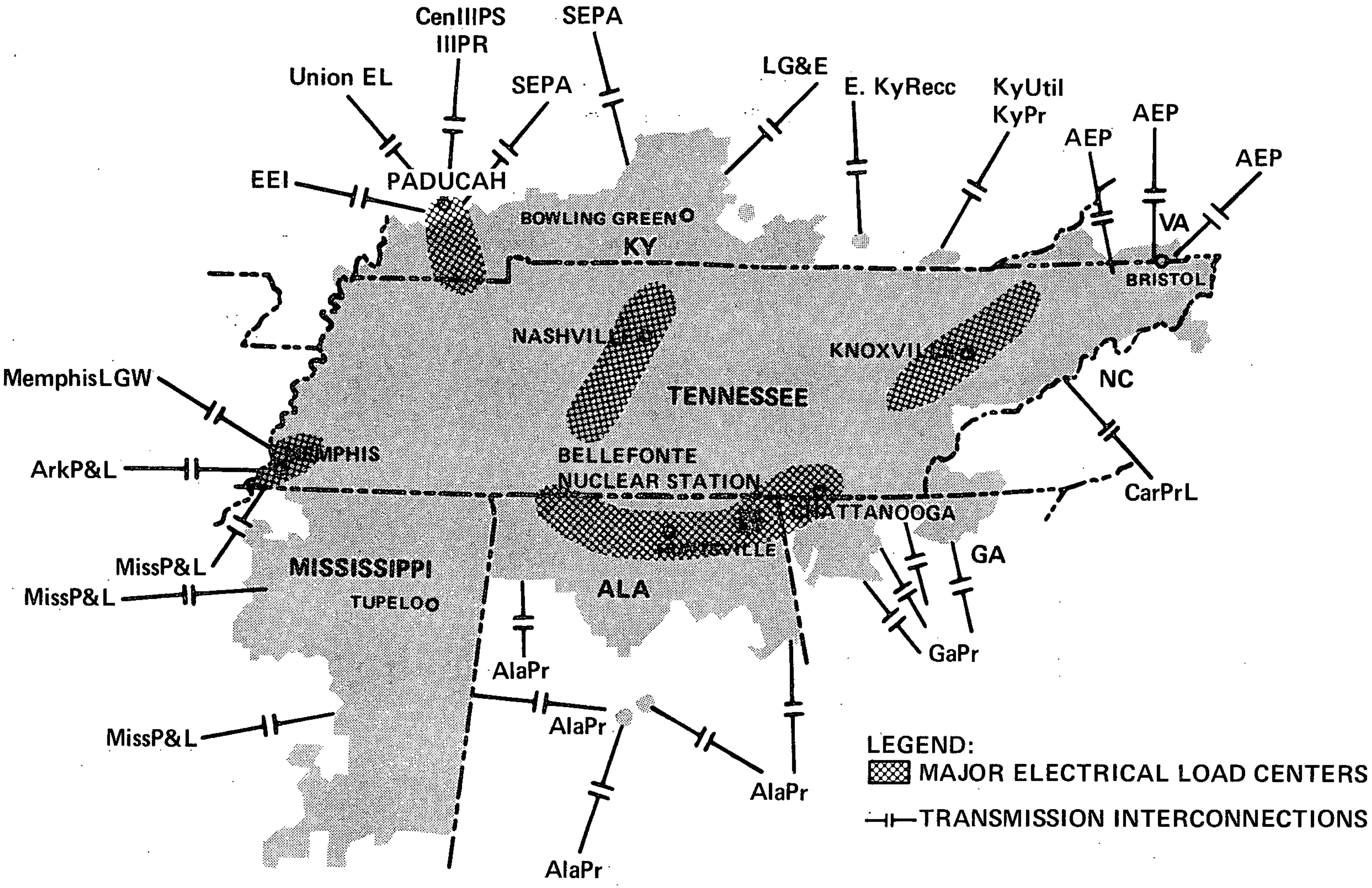

Fig. 8.1. Location of Service Area, Major Cities, Load Centers and Transmission Interconnections of the TVA System.

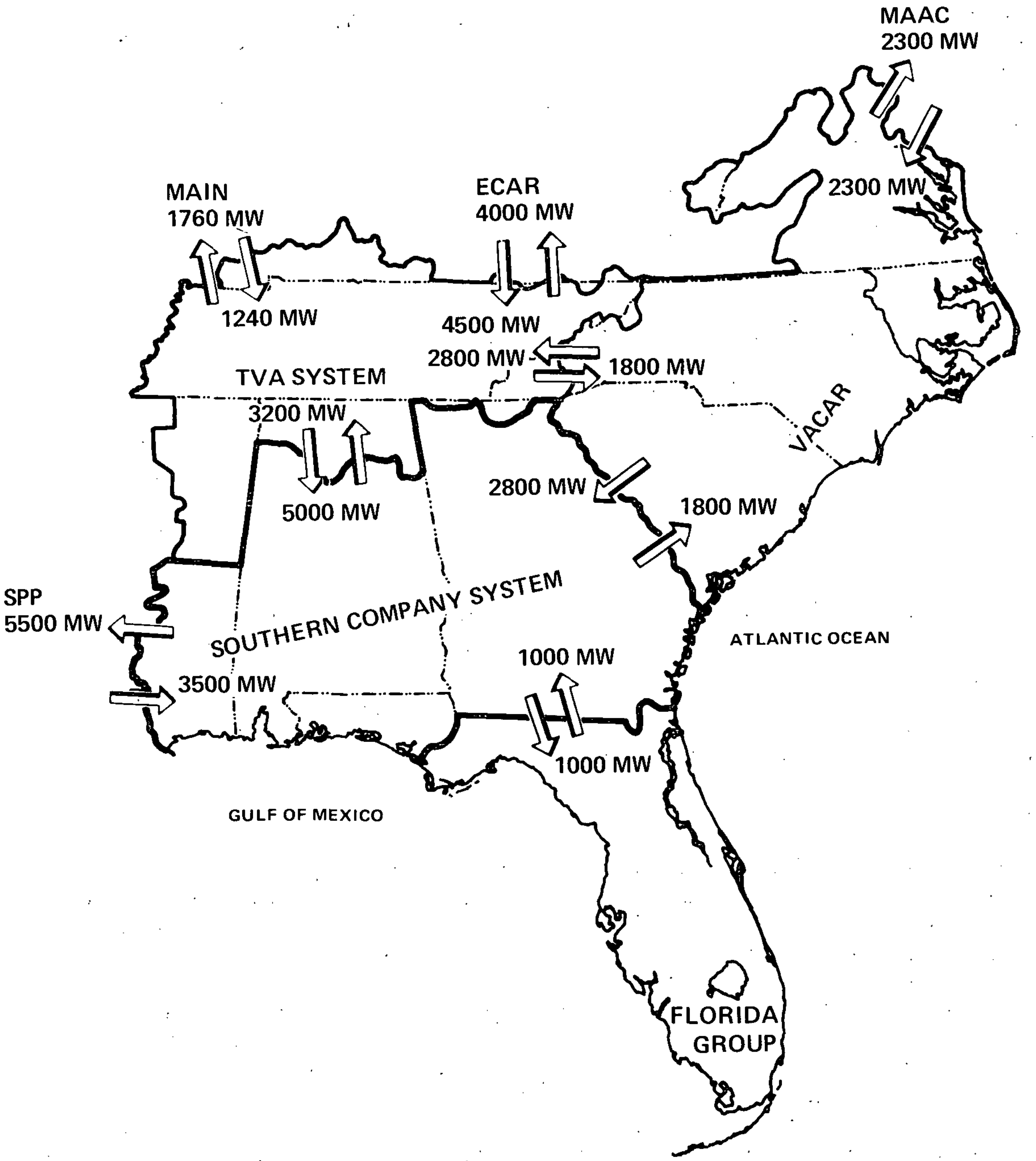

Fig. 8.2. Southeastern Electric Reliability Council Region.

TVA participates in joint operating studies with members of the VACAR group, American Electric Power, and the Southern Company.[7] These studies consider the transmission system interchange and transfer capabilities among the participating companies, and the effects of various single and multiple contingencies on the individual and combined systems of the participating companies under peak load conditions. Thus, the planning of future generating and transmission facilities is more effective for all parties.

TVA delivers electric power over a transmission system of 16,000 circuit miles of high voltage lines and 600 substations.[8] The power system interconnects with 13 neighboring electric utilities at 26 points as shown in Figure 8.1.

Generation planning by TVA is based on the system's peak load requirement which occurs during the winter months. Thus, during the summer months there is generally excess generating capacity. Agreements for the interchange of power among utilities whose peaks occur in the summer months are called "diversity interchange agreements." TVA has interchange agreements with three utility groups. In 1965 TVA reached an agreement with Mississippi Power & Light Company for the exchange of power. In 1972 this interchange amounted to 1800 MWe, but, beginning in 1975, the diversity interchange agreement will be reduced to 1500 MWe. In addition, agreements have been reached with the Southern Company for 300 MWe and the Illinois-Missouri Group for 260 MWe of interchange power. This means that TVA will receive 2060 MWe of power during its winter peaking season in exchange for the same amount of power being supplied to the cooperative groups during the summer months. This interchange power of 2060 MWe is considered by TVA to be firm generating capacity during its peak season and is accounted for in that manner in all generation planning studies.

8.1.2 Past and Projected Load Growth

The TVA peak load in fiscal 1973 occurred on January 12 at 8 a.m. when a demand of 18,888 MWe was met by the system. At the time of this peak load, the applicant had 19,253 MWe of installed generating capacity which included 15,331 MWe of thermal electric power plants and 3922 MWe of hydroelectric capacity.[9] The historical load data are shown in Table 8.1. The applicant's winter peak load increased from 9.6 GWe in 1960 to 16.8 GWe in 1970 for an annual compound growth rate of 5.7 percent. However, from 1970 through 1972, the winter peak load on the system did not increase but decreased slightly from 16.8 GWe in 1970 to 16.7 GWe in 1972. This slack in demand was mainly attributable to variations from normal weather conditions.[10] A less significant factor was the reduced requirements by the gaseous diffusion plants of the AEC

TABLE 8.1. Historical Load Data for the TVA System, 1960-1973
(All figures are rounded to the nearest tenth of a gigawatt, except as noted)[a]

Fiscal Year	Peak Load[b]	Power Supplied to Others	Power Received[c] from Others	Peak Load[b] Served by TVA	Dependable[d] Capacity	Reserve	Margin[e] %	Energy Load (Billions of kWh)	Load Factor %
1960	9.6	0	0	9.6	11.7	2.1	21.3	65.5	77.5
1961	10.3	0	0	10.3	11.7	1.4	13.2	66.7	73.7
1962	10.9	0.3	0	11.2	12.2	1.0	9.0	67.3	70.5
1963	12.1	0	0.3	11.8	12.4	0.5	4.5	71.2	67.0
1964	12.2	0	0.0	12.2	13.8	1.5	12.3	76.4	71.4
1965	12.8	0	0.5	12.3	14.6	2.3	18.8	77.2	68.9
1966	14.3	0.2	0.2	14.3	16.1	1.8	12.8	84.8	67.9
1967	14.6	0.6	0.5	14.7	16.2	1.4	9.8	91.1	71.0
1968	15.3	0.2	1.5	13.9	17.0	3.0	21.9	95.6	71.0
1969	15.0	0.7	2.1	13.6	17.1	3.5	25.8	98.0	74.5
1970	16.8	0.5	2.0	15.3	17.1	1.8	12.2	101.3	68.8
1971	16.7	0.2	1.9	15.1	18.3	3.2	21.3	101.1	68.9
1972	16.7	0.6	2.7	14.5	18.6	4.1	28.2	102.1	70.0
1973	18.9	0	2.4	16.5	19.2	2.7	16.5	115.9[f]	70.0

Historical Growth Rates, 1960-1973
Peak load = 5.3%, Energy load = 4.5%

[a]Sources: TVA Draft Environmental Statement, Bellefonte Nuclear Plant; Power Annual Report, Tennessee Valley Authority, 1972.

[b]Winter peak load.

[c]Includes diversity interchange.

[d]System dependable capacity at time of system peak load.

[e]Percent reserve based on load served by TVA (peak load less net power received).

[f]Staff estimate based on 70 percent load factor.

at Paducah and Oak Ridge. However, the AEC demand is estimated to increase from 1.94 GWe in 1973 to 2.34 GWe in 1974, 2.96 GWe in 1975 and 1976, and 3.16 BWe by 1977.[11] Additional power is needed by the AEC at the gaseous diffusion plants to satisfy the growing requirements for enriched uranium for nuclear power plants in this nation and foreign countries.[12]

Estimates of future electrical loads on the TVA system are prepared by the applicant considering past load trends along with factors which may have an impact on future growth. Electrical forecasts are made by type of service category such as residential, commercial, industrial, and Federal agency loads for several geographical regions within the TVA system. Each of these categories is individually examined with consideration given to factors which influence their demand for electricity. For example, residential demand for electricity is based on factors such as population, number of households, customers per household, saturation of applicances, and annual uses of appliances. The other classes of service categories are similarly analyzed using the appropriate factors to arrive at a total demand for electricity on the TVA system in the future.

Considering the increased AEC demand, TVA is projecting a growth rate of 6.1 percent for its peak load between 1970 and 1975. This estimate is consistent with the FPC projection for TVA of 7.1 percent.[13] From 1976 through 1980, TVA, as shown in Table 8.2, has projected a winter peak demand increase of 5.3 percent per year from 23.7 GWe in 1976 to 29.3 GWe in 1980. The FPC has estimated that the growth rate of the TVA system during this same time period would be 6.5 percent[13] while SERC has estimated a growth rate of about 5.2 percent.[14] With the similarities of projected growth rates shown by TVA, FPC, and SERC, and also the adequacy of TVA's forecasting methodology, the staff concludes that the projections of the winter peak loads for TVA, as shown in Table 8.2, are reasonably accurate.

The energy load (kWh) on the applicant's system has not grown as fast as the peak load. Between 1960 and 1970, the energy load increased at an annual compound growth rate of only 4.4 percent while the peak load increased at 5.7 percent per year. Similarly, the energy load is projected to grow at a rate of only 6.3 percent during the 1970-1975 period and 4.9 percent from 1976 to 1980. As mentioned earlier, the winter peak load is forecast to increase at rates of 6.1 percent and 5.3 percent for these time periods, respectively. The effect of these disparities in growth rates would be a decrease in the system load factor from 70.0 percent in 1972 to 65.6 percent by 1980. While this trend of a decreasing annual load factor indicates a less efficient utilization of generating capacity and a greater need for peaking capacity, the TVA load factor is still considerably higher than the 1972 national average of 62.4 percent.[15]

TABLE 8.2. Projected Load Data for the TVA System, 1974-1982
(All figures are rounded to the nearest tenth of a gigawatt, except as noted)[a]

Fiscal Year	*Peak Load*[b]	*Diversity Interchange*	*Peak Load*[b] *served by TVA*	*Dependable*[c] *Capacity*	*Reserve Margin*[d]	*%*	*Energy Load (Billions of kWh)*	*Load Factor %*
1974	20.8	2.4	18.4	23.0	4.6	24.9	130.8	67.7
1975	22.6	2.1	20.5	25.4	4.9	24.2	137.2	66.9
1976	23.7	2.1	21.6	27.4	5.8	26.7	145.2	67.5
1977	25.2	2.1	23.1	28.5	5.4	23.5	151.7	66.5
1978	26.4	2.1	24.3	28.5	4.2	17.2	158.6	66.1
1979	27.8	2.1	25.7	30.9	5.2	20.1	166.0	65.8
1980	29.3	2.1	27.2	32.0	4.8	17.6	174.2	65.6
1981	31.0	2.1	28.9	34.4	5.5	19.0	181.4	65.0
1982	32.6	2.1	30.6	36.8	6.2	20.3	189.2	64.7

Projected Growth Rates, 1974-1982
Peak load = 5.8%, Energy load = 4.7%

[a]Source: TVA Draft Environmental Statement, Bellefonte Nuclear Plant.

[b]Winter peak load.

[c]System Dependable Capacity at time of system peak load.

[d]Percent reserve based on load served by TVA (peak load less net power received).

Not explicitly included in the TVA estimates of peak load and yearly energy demands are many of the explanatory variables frequently incorporated in econometric analyses. These include the price of electricity, the price of alternative energy sources such as natural gas and oil, population, income, and the price of appliances. At the present time, there is much controversy regarding the price elasticity of electricity which measures the sensitivity of electricity demand to changes in its price. This value has particular relevance to the TVA system because TVA's average price to consumers has increased 62.4 percent between 1967 and March 1973. In a study performed by TVA, it was concluded that price increases have caused little, if any, slow down in residential consumption of electricity.[16] Alternatively, there have been other models developed which suggest that on a national basis, electricity demand is quite responsive to price. One model in this area derived price elasticities of -1.3, -1.5, and -1.7 for residential, commercial, and industrial customers respectively.[17] It should be noted however that these constitute long-run adjustments to price and would take many years to be fully reflected in the projected growth rate of electricity consumption.

Application of econometric analyses to a region that interacts nationally requires a number of empirically developed constants. There is uncertainty among investigators on the value of these constants. The staff has not made an econometric analysis and until the relationships are more uniformly accepted, the estimates of future electrical demands for individual utilities must be based on past methods of analysis, which contain most of the econometric factors in an implicit form.

The flow of energy from the TVA system to its customers is shown in Fig. 8.3 for 1960 and 1972. The significant changes which have occurred to the electrical energy flow pattern of the TVA system during that time period are:

1. A lesser reliance on hydroelectric generating capacity.

2. An increased use of steam electric power generation which compensates for the lack of hydroelectric growth.

3. The emergence of gas turbines for peaking energy in 1972.

4. A significant decrease in demand for electricity by federal agencies.

5. A significant growth in the sales of electricity to municipalities and cooperatives.

6. A greater utilization of diversity interchange agreements.

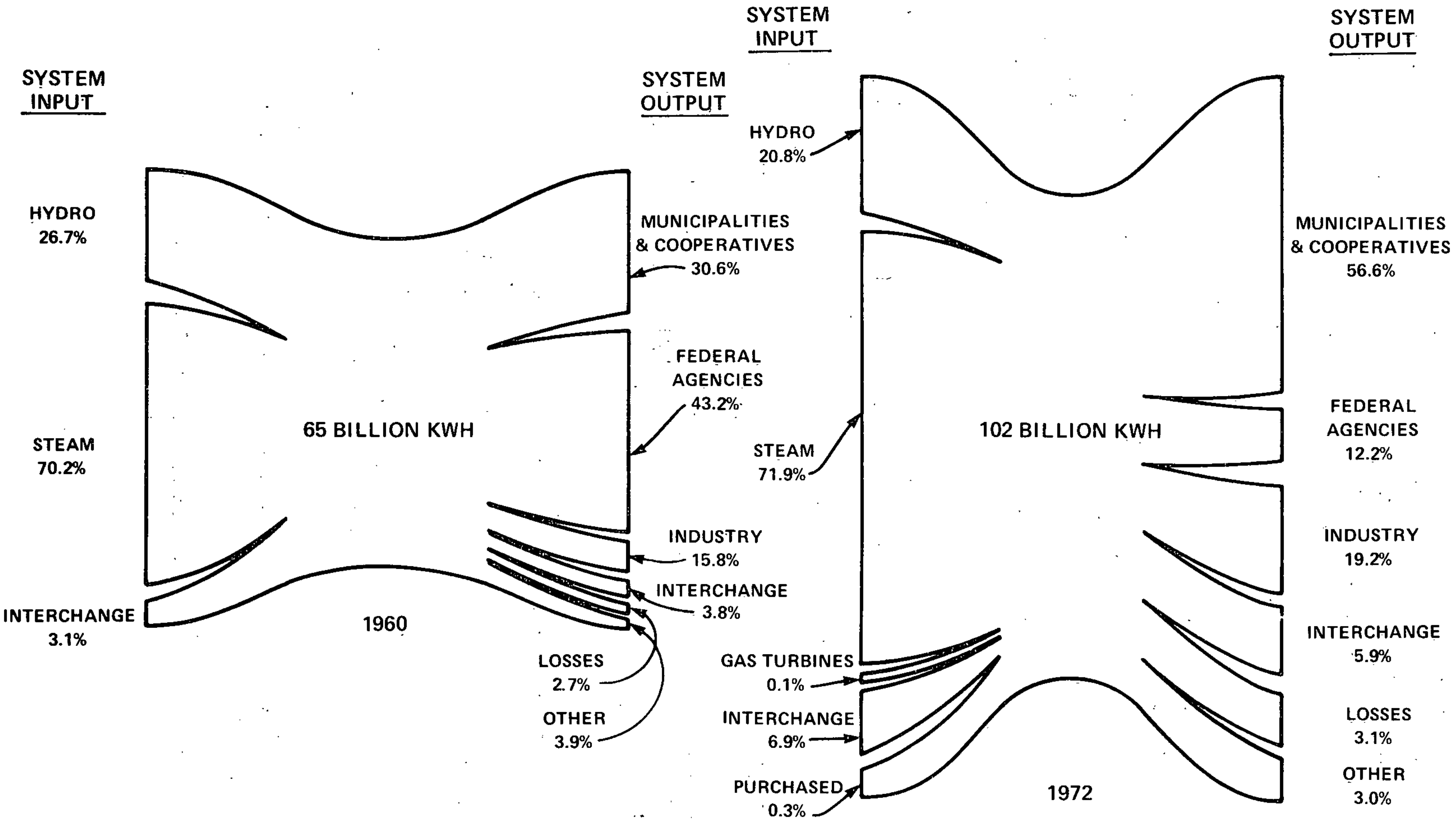

Fig. 8.3. Electric Energy Flow Patterns for 1960 and 1972.

While these flow patterns may change somewhat in the years ahead, the applicant's major demands will continue to be from municipalities and cooperatives, federal agencies, and directly served industry.

8.1.3 Historical and Planned System Capability

At the end of fiscal 1972, the TVA system, which includes leased facilities and Corps of Engineer's dams, had a total installed capacity of about 20.0 GWe. This included 49 hydroelectric plants totaling about 4.4 GWe of generating capacity, 11 coal-fired plants rated at approximately 15.1 GWe, and 28 gas turbine units with a total capacity of nearly 1.1 GWe. Table 8.3 shows the generating units that are under construction or planned by the applicant through 1982. The sum total of the ratings of these units represents about 19 GWe of new generating capacity.

Of the 14 GWe proposed to be installed between now and 1980, about 1.4 GWe is planned to be either pumped storage or conventional hydro. Of the existing hydroelectric capacity, about three-fourths or 3.3 GWe is used for peaking duty.[18] Combining the 1.4 GWe of proposed hydro with the 3.3 GWe of existing hydro and the 1.1 GWe of gas turbine capacity would provide TVA with 5.8 GWe of peaking capacity by 1980. This peaking capacity will represent more than 18 percent of the applicant's installed generating capacity at that time. Most studies concerning the proper mix between baseload and peaking capacity have indicated that 15 to 20 percent of a system's total installed generating capacity should be peaking facilities.[19,20] This would imply that the applicant will have the proper distribution of capacity types by 1980. However, because of the applicant's high system load factor, an even greater portion of their generating facilities should be baseload rather than peaking. Since the applicant will certainly have adequate peaking capacity, the staff concludes that baseload generating units are the appropriate choice during this time frame for the TVA system.

8.1.4 Reserve Margin

The reserve requirements of the applicant are based on a probability method in which a loss of load should not occur more than one time in ten years. In order to provide this degree of reliability, the applicant estimates that a reserve margin of between 20 and 23.5 percent is required. This reserve margin falls within the range of 15 to 25 percent which the FPC considers to be adequate.[21] In determining the minimum reserve margin, the applicant has considered the reliability of individual units on the system, the size of the largest unit relative to the total system load, the mix of generating capacity, preventive maintenance schedules, load characteristics, and interconnections with other power systems.

TABLE 8.3. TVA Unit Additions

Plant	*Unit*	*Type*[a]	*Expected Dependable Capacity - MWe*	*Expected Commercial Operation*
Cumberland	1	F	1,275	March 1973
Cumberland	2	F	1,275	July 1973
Cordell Hull	1	H	33	June 1973
Cordell Hull	2	H	33	August 1973
Cordell Hull	3	H	34	November 1973
Browns Ferry	1	N	1,065	December 1973
Browns Ferry	2	N	1,065	July 1974
Browns Ferry	3	N	1,065	December 1974
Raccoon Mountain	1	PS	325	November 1974
Raccoon Mountain	2	PS	325	February 1975
Raccoon Mountain	3	PS	325	May 1975
Raccoon Mountain	4	PS	325	August 1975
Sequoyah	1	N	1,125	December 1975
Sequoyah	2	N	1,125	August 1976
Watts Bar	1	N	1,170	March 1978
Watts Bar	2	N	1,170	December 1978
Bellefonte	1	N	1,200	September 1979
Bellefonte	2	N	1,200	June 1980
Hartsville	1	N	1,200	- 1981
Hartsville	2	N	1,200	- 1981
Hartsville	3	N	1,200	- 1982
Hartsville	4	N	1,200	- 1982

[a]*Type: F = Fossil, GT = Gas Turbine, H - Conventional Hydro, N = Nuclear, PS = Pumped Storage.*

During the winter of 1978-1979, TVA will have a reserve margin of 20.1 percent as shown on Fig. 8.4 and Table 8.2. The first unit of the proposed nuclear facility is scheduled to come on-line for the winter peak load of 1979-1980. If the unit does start up as scheduled, the applicant's reserve margin will still decrease to 17.6 percent during that winter. During the following year of 1980-1981, the second unit is planned for commercial operation and this will increase the reserve margin to 19.0 percent. Without the proposed generating capacity, the applicant's reserve margin will be only 13.3 percent during the winter of 1979-1980, 10.9 percent during the winter of 1980-81, and 12.7 percent for the 1981-1982 season.

The applicant is in need of additional generating capacity for the years between 1977 and 1982. Even with the installation of the Bellefonte Nuclear Station, the applicant still does not have sufficient generating capacity to meet its desired reserve margin during fiscal years 1980 and 1981. The staff concludes that the additional capacity proposed by the applicant is justified in order to continue to supply reliable electric service.

8.1.5 The Impact of Energy Conservation and Substitution on Need for Power

Recent energy shortages have focused the Nation's attention on the importance of energy conservation as well as measures to increase the supply of alternative energy sources. The need to conserve energy and to promote substitution of other energy sources for oil and gas have been recommended by the Report to the President on the Nation's Energy Future as major efforts in regaining national energy self-sufficiency by 1980.[22]

In assessing the growth in TVA's electrical energy demand over the next five to eight years we recognize that while the aggregate impact of conservation measures will tend to reduce future demand, the substitution by ultimate consumers of electrical energy for oil and gas as fuels will stimulate demand, thus counteracting in whole or in part the savings in electricity brought about by conservation efforts.

While important conservation measures are rather quickly adopted, the consumer substitution of electrical energy for fuels such as oil or gas takes several years to result in a substantial upward impact on the need for power. We expect that the consumer's concern over the future availability of oil or gas as an energy alternative, as well as higher prices for these scarce fuels, will be an important stimulus for substituting electrical energy where this is practicable. This customer substitution

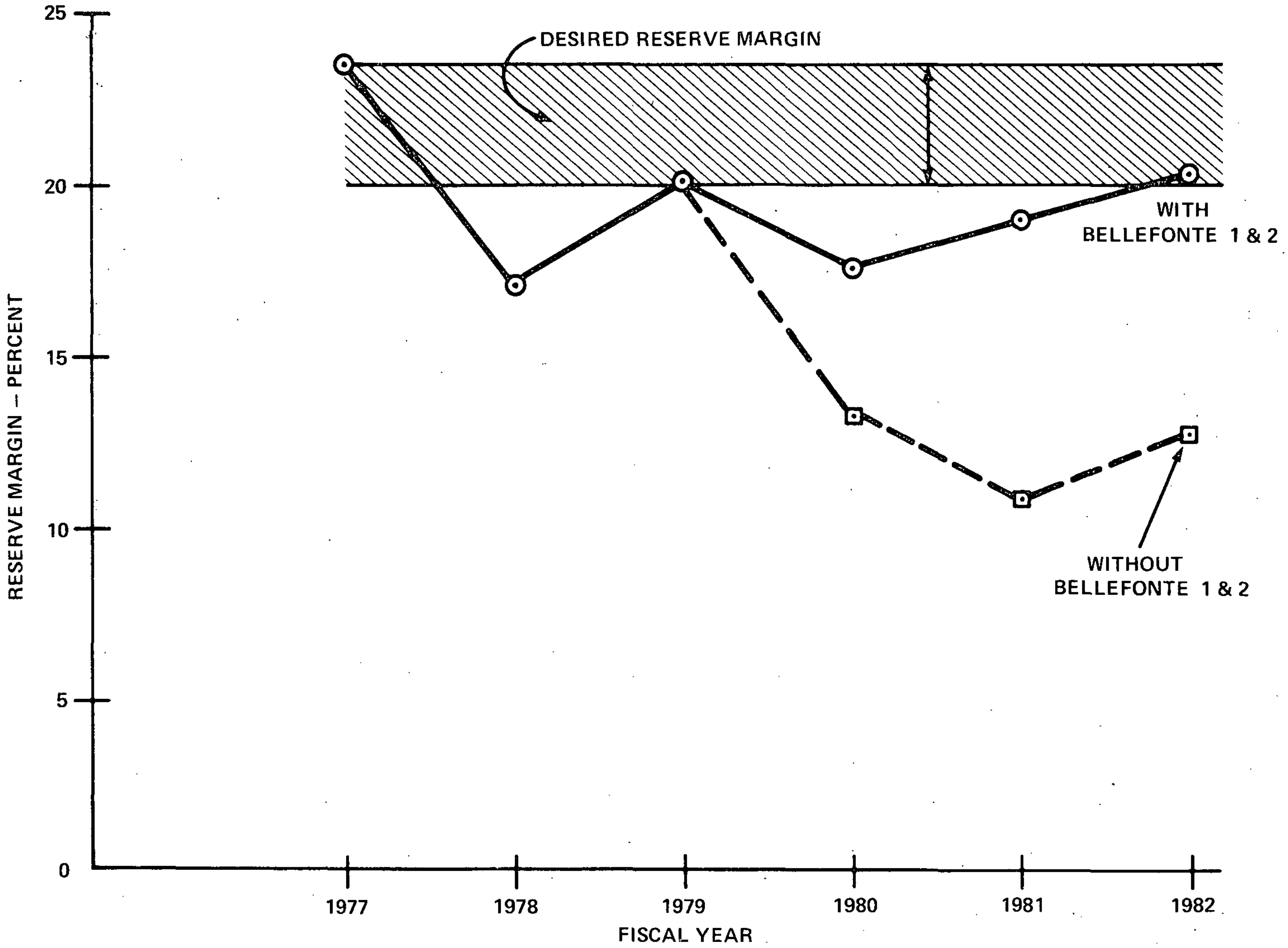

Fig. 8.4. Reserve Margins for the TVA System.

principally involves an increased use of electricity versus oil and gas in space heating and industrial processing plus a relative increase in the use of electricity versus gas in major household appliances. The shift from natural gas to electricity by industrial customers in Tennessee could increase electric consumption in the TVA system by 10 to 15 percent by 1980.[23] Furthermore, new but highly speculative applications such as electrical transport and other new uses may also increase the demand for electricity. Since these factors have not been taken into account in TVA's demand forecast, they too constitute a potential stimulus to future demand that may counteract conservation savings.

Over the past six months it has been estimated that nationally the implementation of energy conservation measures by households, business, and government has already contributed to a lack of growth in the consumption of electricity. For the entire U.S., kwh sales are approximately 2 percent below the previous year and about 10 percent less than projected levels. A portion of this reduced demand must however be attributed to the unusually mild weather experienced this past winter. For the TVA service area the consumption of electricity after adjusting for the milder temperature has been less than the forecasted level by an average of 6.2 percent during the period October 1973 to March 1974. On a monthly basis the variations from the projected sales have been quite volatile. For example, in October, sales actually exceeded the projection by approximately 7.5 percent while in March it was off by about 13.6 percent. Monthly peak load demand has also been below the projected levels for this six month period. After adjusting for milder temperature and peak shaving the average fall off in demand has approximated 8.9 percent.

In the following sections, the staff considers a number of significant conservation measures which are currently in force, or proposed, to reduce the growth in demand for electricity generally and for the TVA system.

8.1.5.1 Advertising and Information Services

In the past, TVA has attempted to accelerate demand for electricity through its advertising program. Generally, the major thrust of advertising was to promote energy demand during off-peak periods, thereby increasing the system load factor. An increase in system load factor has the effect of lowering the average unit cost of electricity generated on a system.

The Applicant terminated promotional advertising in 1971. Accordingly, elimination of promotional advertising is no longer an available measure for the Applicant to dampen demand. On the other hand, on a national basis promotional advertising by manufacturers of electrical applicances and equipment has not been eliminated. These manufacturers spent an estimated $450 million in promotional advertising in 1972.[24] Thus, it is doubtful that the Applicant's reduced advertising will have much, if any, impact on projected demand.

TVA has developed a rather extensive program to promote conservation of electricity. This program was initiated in 1971. Some of the features of this program are company sponsored seminars and meetings, an advertising campaign via newspapers, radio and television; and the issuance of written materials in the form of booklets and brochures. The program has been well received by customers and is appraised to be having a strong influence on the more efficient use of electricity within the Applicant's service area. For example, it is recognized that TVA's involvement in the promotion of conservation measures was directly responsible for pending legislation in the State of Tennessee that sets new improved insulation standards for new homes.

8.1.5.2 Changes in Utility Rate Structure

Historically, utility rate structures were designed to reflect the cost of service of providing electricity to a customer by using the declining block rate system. In the past, the economic logic for declining block rates was never seriously disputed. Today, however, under conditions of increasingly scarce fuel resources, declining block rates may tend to encourage individual customers to use more electricity at the expense of other energy sources. While substitution of electricity for scarce fossil fuels may be beneficial in some cases, wasteful uses of electricity which may result from a declining block rate structure should not be encouraged.

The most commonly mentioned alternatives to declining block rates in order to dampen the demand for electricity are increasing block rates and peak load pricing.

If increasing block rates were implemented, it would be necessary that care was taken to insure that the new rate structure represented a fair and equitible billing method to all customers. Since the declining block rate method represents the cost of service to the consumer, it would be difficult to visualize how an increasing block rate structure could be equitable to all customers. The likely effect of an increasing block structure would be that the larger user of electricity would be subsidizing the smaller user.

Peak load pricing, with some cost modifications, could represent a fair and equitable means of billing the consumer of electricity and it might also reduce demand. However, it is difficult to determine the effect which peak load pricing might have on electrical demand. With sufficient economic incentives, total electrical demand could be reduced or at least its rate of growth reduced. Between 1967 and 1973, TVA increased its rate schedule four times. The effect of these rate increases has been an increase of 62.4 percent in the average cost of electricity to the consumer. In spite of these price increases,-the demand for electricity on the TVA system continued to increase by about 6 percent per year during that period.

8.1.5.3 Load-Shedding and Load Staggering to Reduce Peak Demand

Load shedding is an emergency measure to prevent system collapse when peak demand placed upon the system is greater than the generating capability of the system. This measure is usually not taken until all other measures are exhausted. Reliance on selected load shedding to reduce peak load would necessitate a change in the contractual responsibilities of utilities to their customers. The loss of power, especially during diurnal and seasonal peaks, would be looked upon as an undesirable hardship by most customers. Presently, interruptible service contracts are in effect for 15 industrial customers comprising approximately 1000 MW of TVA's capacity. The demand charge for these customers is approximately 10 to 15 percent less than a conventional service contract depending on the maximum interruptible service the customer has agreed to. Most of these customers would find frequent interruptions in service economically undesirable even at lower rates than those now in effect. Infrequent interruptions of rather limited duration save very little energy but do save somewhat on the need for installed capacity. As long as other less disruptive measures are available, load shedding is not generally a desirable alternative.

Load staggering has also received some attention as a possible conservation measure.[25] Basically this alternative involves shifting the work hours of industrial or commercial firms to avoid diurnal or weekday peaks. However, interference with customer and worker preferences as well as productive efficiencies mades such proposals of questionable desirability, if not feasibility. As in the case of load shedding, such measures tend to be more capital saving than energy saving thus doing little to solve energy shortages.

8.1.5.4 Factors Effecting the Efficient Utilization of Electrical Energy

During the past two years, much of industry, the Federal Government and many State and local governments have made the promotion of energy conservation a priority program. The Depart of Commerce has developed a departmentwide effort to: (1) encourage business firms to conserve energy in the operation of their own processes and building; (2) encourage the manufacture and marketing of more energy-efficient products; and (3) encourage businessmen to disseminate information on energy conservation. The National Bureau of Standards has been given a leading role in promoting the development and implementation of energy saving standards. Programs include: voluntary labeling of household appliances; research, development and education relative to energy conservation in building; efficient use of energy in industrial processes; and improved energy efficiency in environmental control processes. While considerable efficiencies in electricity usage have already been gained, and while further efficiencies will be realized, any present estimates of the magnitude of electricity savings to be realized overtime must be treated as tentative and subject to continual reassessment.

The need for generating capacity is based on annual peak load demand and not on the volume of consumption over the year. Any conservation measures which reduce consumption but not peak demand will have little or no impact on the need for capacity. The applicant's most recent forecasts for total sales and annual peak load demand indicate that total sales are expected to grow at an annual rate of 4.7% while peak demand is expected to grow at 5.8% per year. The growth in peak demand will continue to be strongly influenced by installation of air-conditioning in an increasing percentage of residences and commercial and industrial buildings. Service area projections by the applicant indicate that between 1973 and 1982 the saturation of room air-conditioners will increase from 44% to 56% while the saturation of central air-conditioning will increase from 15% to 22%.

Considerable efficiency can be achieved in space conditioning by improved insulation and the use of building materials with better insulation properties as well as by using equipment which transfers or stores excess heat or cold. For example, the seven story Federal Office Building to be built in Manchester, N. H. illustrates the potential for energy conservation in future commercial buildings using existing technology. For this particular building, energy savings are anticipated to be a minimum of 20 to 25 percent over a conventionally designed building in the same location.[26] Heat savings alone are expected to be 44 percent because of better insulated walls, less window area, use of efficient heating and heat storage equipment, and the use of solar collectors on the roof.

In 1971, FHA established new insulation standards which were to reduce average residential heating losses by one-third. Studies have shown that it is possible to gain even greater reductions in heat loss through improved insulation at costs which are economical over a period of years.[27] Improved insulation conserves not only in winter but also reduces the air conditioning burden in the summer.

Lighting, which has accounted for about 24 percent of all electricity sold nationally, is another area where savings are being realized. Many experts believe recommended lighting levels in typical commercial buildings have been excessive.[28] It has been calculated that adequate illumination in commercial buildings can be achieved at 50 percent of current levels through various design and operational changes.[29] Another study indicated that if all households in 1970 had changed to fluorescent from incandescent lighting, the residential use of electricity for lighting would have been reduced approximately 75 percent and total electrical sales would be reduced approximately 2.5 percent.[30] However, since the majority of residential lighting occurs in off peak hours, the reduction on peak demand would be less than one percent.

The potential for greater energy efficiency in household appliances is well recognized. The National Bureau of Standards is working with an Industrial Task Force, from the Association of Home Appliance Manufacturers, in a voluntary labeling program which would provide consumers with energy consumption and efficiency values for each applicance and educate them as to how to use this information. Room air conditioners are the first to be labeled. The next two categories of house appliances which are to be labeled are refrigerators and refrigerator/freezers and hot water heaters.

The importance of energy efficiency labeling of appliances is that it will allow the consumer to select the most energy efficient appliance. A recent study titled, "The Room Air Conditioner as an Energy Consumer," has estimated that an improvement in average efficiency from six to 10 Btu/Watt-hr. could hypothetically save electric utilities almost 58,000 MW in 1980.[31] Air conditioners which are more energy efficient require a combination of increased heat exchanger size and higher efficiency compressors resulting in higher initial cost. The consumer must be convinced that it is profitable for him in the long run to purchase the more expensive machine. Today, however, there is a high degree of uncertainty in predicting to what extent consumers will actually purchase these more expensive appliances. In addition, selection of central air conditioning by developers and many home owners has historically been based on minimizing front end costs consistent with meeting local building codes.

Considerable opportunity for electricity conservation exists in industry in addition to lighting and air conditioning efficiency already mentioned. Electric motors should be turned off when not in use and motors should be carefully sized according to the work they are to perform. Small savings can be realized by deenergizing transformers whenever possible. Fuel requirements for vacuum furnaces can be reduced by 75 percent if local direct combustion low quality heat is employed rather than high quality electrical resistance heating.[32]

It is possible that some of the above examples of potential energy saving will be realized in the future but in other instances there will be a substantial shortfall in achieving theoretical potentials due to economic, political and technological performance considerations. As historical experience accumulates, a better forecast of the extent to which savings for these kinds of conservation measures will be implemented. In addition the staff is aware that the National Institute of Occupational Safety and Health has recommended heat stress standard to the Occupational Safety and Health Administration which, if adopted, would require a significant number of employers to air condition their plants.[33] This possible requirement, coupled with the above makes any significant reduction in the future peak demand for electricity due to this conservation of energy measure speculative at this time.

8.1.5.5 Consumer Substitution of Electricity for Scarce Fuels

Substitution of electricity for scarce energy sources will likely accelerate in the Applicant's service area because of the uncertainty of oil and gas supplies and the outlook for high prices relative to the price of electricity produced from hydroelectric, coal-fired or nuclear plants. Nationally, electric space heating is projected to grow from 7.6 percent of all homes in 1970 to 16 percent in 1980 and to 27 percent in 1990.[30] In the Applicant's service area about 40 percent of living units were electrically heated in 1972 and a projected 50 percent will be electrically heated by 1982. Other increases are forecasted in the growth of electric water heaters and ranges which also suggests a shift away from gas and oil by household units. The advent of other new uses of electricity cannot be discounted but are not quantified in projecting need for power.

8.1.6 Summary

From the foregoing discussions on the need for power, the staff concludes that:

1. The applicant's prediction that the peak load on the TVA system will double between 1972 and 1982, from 16.7 GWe to 32.6 GWe is valid.

2. Additional capacity needed to meet this increased demand will be approximately 19.0 GWe.

3. During the interval between 1978 and 1981, baseload generating capacity, rather than peaking capacity, will be required.

4. The reserve margin of the TVA system with the proposed Bellefonte units will be about 17.6 percent and 19.0 percent during fiscal years 1980 and 1981, respectively.

5. Even with the Bellefonte Nuclear Station, the applicant's reserve margin will be below its desired reserve margin of 20 to 21 percent in 1980 and 1981.

6. Without the proposed additional generating capacity in 1980 and 1981, the applicant's reserve margins will fall to 13.3 percent and 10.9 percent, respectively.

7. The need by the applicant for additional generating capacity for the 1980-1981 period is justified.

8. Although each of the conservation of energy measures evaluated by the staff has a potential for reducing the future demand for electricity, there is no reliable way at this time to quantify the reduction in power demand resulting from conservation of electricity methods which could be implemented by either federal, state or local regulating bodies or voluntary action of the public. Our ability to predict is speculative due to the uncertain nature of the effectiveness of the measures that may be taken, by substitutional effects, and by possible regulations that may require increased electrical demand.

8.2 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

8.2.1 Abiotic Effects

8.2.1.1 Land

Construction of the Bellefonte Nuclear Plant will result in the 30-40-year diversion of approximately 1500 acres of rural land to an industrial use. Of this acreage, however, only about 150 acres will be required for the plant's operational activities. The remaining land, after construction has ceased, may be allowed to revert to a natural state; some land might be used for recreational facilities at the tip of the peninsula. A temporary increase in erosion of the land opened by the construction activities will occur. Some chemical and/or salt deposition and possibly heavy metal contamination within about 1000 feet of the cooling towers may occur. An additional land diversion and its attendent lost productivity will result from the construction of transmission towers, access roads, and the railroad siding.

8.2.1.2 Water

A maximum consumptive water loss to the Tennessee River flow of about 74 cfs due to evaporation and drift from the natural-draft cooling towers is postulated at full power operation.

About 1700 pounds of chemicals per day will be released to the Tennessee River in the blowdown from the cooling towers. Trace quantities of radioactive substances will also be discharged to the Tennessee River via the blowdown.

8.2.1.3 Air

Small amounts of air contamination will occur. This air contamination will include: dust and other particulate matter generated during construction; high level plumes from the natural-draft cooling towers; SO_2, particulates, and NO_x from the operation of the starting boilers and emergency diesel electric generators; and traces of radioactive substances. Large amounts of heat will be liberated to the atmosphere by the operation of the cooling towers.

8.2.1.4 Noise

A detectable increase of the noise levels of the area will occur, particularly during construction. No environmentally unacceptable noise levels are postulated, however, by the staff.

8.2.1.5 Esthetics

A pronounced esthetic change will be occasioned by the construction of the plant's cooling towers, principally the massive natural-draft towers and their plumes, and the approximate 73 miles of transmission lines. Many persons will consider the change to be adverse.

8.2.2 Biotic Effects

Adverse effects that can occur to the terrestrial environment due to plant construction and operation are as follows:

a. Terrestrial vegetation, animal, and microbial communities may be altered by cooling tower operation; if alterations occur, they may not be measureable.

b. Increased soil erosion during construction.

c. Clearing of vegetation as transmission line rights-of-way may not be beneficial to wildlife.

Unavoidable adverse effects on aquatic life of the Tennessee River can arise from:

a. Entrainment of eggs and larvae of fish in the plant's cooling water.

b. Impingement of fish on the traveling screens.

The radiation dose to people within 50 miles of the plant due to its routine operation is estimated to be about 2 man-rem per year and the dose to people within and beyond 50 miles of the plant due to transportation of fuel and wastes is about 14 man-rem per year.

8.3 RELATION BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

8.3.1 Summary

In fulfilling its responsibility under the National Environmental Policy Act, the staff has analyzed the proposed project to evaluate both qualitatively and quantitatively the environmental effects of the proposed project and its alternatives. The purpose of this section is to set forth the relationship between the proposed 30-40-year use of man's environment associated with the construction and operation of the plant and the actions that could be taken to maintain and enhance the long-term productivity of the plant's environs.

8.3.2 Enhancement of Productivity

Plant operation will result primarily in the production of electrical power needed to meet the demands of the region's society. Availability of this power will have a sustaining beneficial effect on the societal activities, improve the local economy and allow for continued industrial growth and inprovement in the material and social life of the service area. These improvements are considered by the staff to be a national benefit.

8.3.3 Uses Adverse to Productivity

8.3.3.1 Land Usage

The land involved in this proposal has been used primarily as agricultural and wood land. No short-term (30-40-year) productive use of the land (aside from that derived from plant operation) is planned, other than possible recreational and conservational uses.

The adversity or benefit derived from the railroad spur will depend in part on the development of the area. This spur will take about 65 acres from rural uses.

Construction of the transmission lines will remove small areas at the base of the towers from productive use; trees will be removed from wooded areas. Some small loss of agricultural and woodlot productivity will result.

8.3.3.2 Water Useage

The consumptive use of water by the plant is less than 0.2% of the average river flow; this will not interfere with waterway traffic, commercial or recreational uses of the river, or with possible future water withdrawals downstream. The exception to this statement is the location and water recruitment pattern of the cooling water intake; this problem is under study.

8.3.3.3 Decommissioning

No specific plan for the decommissioning of the Bellefonte plant has been developed. Near the end of a reactor's useful life, the licensee will initiate such action by preparing a proposed decommissioning plan which is submitted to the AEC for review. The licensee will be required to comply with Commission regulations then in effect and decommissioning of the facility may not commence without authorization from the AEC.

To date, experience with decommissioning of civilian nuclear power reactors is limited to six facilities which have been shut down or dismantled: Hallam Nuclear Power Facility, Carolina Virginia Tube Reactor (CVTR), Boiling Nuclear Superheater (BONUS) Power Station, Pathfinder Reactor, Piqua Reactor, and the Elk River Reactor.

There are several alternatives which can be and have been used in the decommissioning of reactors: (1) Remove the fuel (possibly followed by decontamination procedures); seal and cap the pipes; and establish an exclusion area around the facility. The Piqua decommissioning operation was typical of this approach. (2) In addition to the steps outlined in (1), remove the superstructure and encase in concrete all radioactive portions which remain above ground. The Hallam decommissioning operation was of this type. (3) Remove the fuel, all superstructure, the reactor vessel and all contaminated equipment and facilities, and finally fill in cavities with clean rubble topped with earth to grade level. This last procedure is being applied in decommissioning the Elk River Reactor. Alternative decommissioning procedures (1) and (2) would require long-term surveillance of the reactor site. After a final check to assure that all reactor-produced radioactivity has been removed, alternative (3) would not require any subsequent surveillance. Possible effects of erosion or flooding will be included in these considerations.

Estimated costs of decommissioning at the lowest level are about $1 million plus an annual maintenance charge in the order of $100,000.[34] Estimates vary from case to case, a large variation arising from differing assumptions as to level of restoration. For example, complete restoration, including regrading, has been estimated to cost $70 million.[35] At present land values, it is not likely that consideration of an economic balance alone would justify a high level of restoration. (For the purposes of the statement, the estimated cost of decommissioning is 25 million dollars.)

Planning required of the applicant at this stage will assure, however, that variety of choice for restoration is maintained until the end of useful plant life.

The degree of dismantlement would be determined by an economic and environmental study involving the value of the land and scrap values versus the complete demolition and removal of the complex. In any event, the operation will be controlled by rulse and regulation to protect the health and safety of the public that are in effect at the time.

8.4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

8.4.1 Introduction

Irreversible commitments generally concern changes set in motion by the proposed action which at some later time could not be altered so as to restore the present order of environmental resources. Irretrievable commitments are generally the use or consumption of resources that are neither renewable nor recoverable for subsequent utilization.

Commitments inherent in environmental impacts are identified in this section, while the main discussions of the impacts are in Sections 4 and 5.

8.4.2 Commitments Considered

The types of resources of concern in this case can be identified as: (1) material resources -- materials of construction, renewable resource material consumed in operation, and depletable resources consumed -- and (2) nonmaterial resources, including a range of beneficial uses of the environment.

Resources which, generally, may be irreversibly committed by the operation are: (1) biological species destroyed and soil lost in the vicinity, (2) construction materials that cannot be recovered and recycled with present technology, (3) materials that are rendered radioactive but cannot be decontaminated, (4) materials consumed or reduced to unrecoverable forms of waste, including uranium-235 and -238 consumed, (5) the atmosphere and water bodies used for disposal of heat and certain waste effluents, to the extent that other beneficial uses are curtailed, and (6) land areas rendered unfit for other uses.

8.4.3 Biotic Resources

The proposed intake may result in reductions of fish populations.

8.4.4 Material Resources

8.4.4.1 Materials of Construction

Materials of construction are almost entirely of the depletable category of resources. Concrete and steel constitute the bulk of these materials, but there are numerous other mineral resources incorporated in the physical plant. No commitments have been made on whether these materials will be recycled when their present use terminates.

Some materials are of such value that economics clearly promotes recycling. Plant operation will contaminate only a portion of the plant to such a degree that radioactive decontamination would be needed in order to reclaim and recycle the constituents. Some parts of the plant will become radioactive by neutron activation. Radiation shielding around each reactor and other components inside the dry-well portion of each containment structure constitute the major materials in this category, for which it is not feasible to separate the activation products from the base materials. Components that come in contact with reactor coolant or with radioactive wastes will sustain varying degrees of surface contamination, some of which would be removed if recycling is desired. The quantities of materials that could not be decontaminated for unlimited recycling probably represent very small fractions of the resources available in kind and in broad use in industry.

Construction materials are generally expected to remain in use for the full life of the plant, in contrast to fuel and other replaceable components discussed later. There will be a long period of time before terminal disposition must be decided. At that time, quantities of materials in the categories of precious metals, strategic and critical materials, or resources having small natural reserves must be considered individually, and plans to recover and recycle as much of these valuable depletable resources as is practicable will depend upon need.

8.4.4.2 Replaceable Components and Consumable Materials

Uranium is the principal natural resource material irretrievably consumed in plant operation. Other materials consumed, for practical purposes, are fuel cladding materials, reactor control elements, other replaceable reactor core components, chemicals used in processes such as water treatment and ion exchanger regeneration, ion exchange resins, and minor quantities of materials used in maintenance and operation. Except for the uranium isotopes 235 and 238, the consumed resource materials have widespread usage; therefore, their use in the proposed operation must be reasonable with respect to needs in other industries. The major use of the natural isotopes of uranium is for production of useful energy.

The two reactors in the plant will be fueled with uranium enriched in the isotope 235.

After use in the plant, the fuel elements will still contain uranium-235 slightly above the natural fraction. This slightly enriched uranium, upon separation from plutonium and other radioactive materials (separation takes place in a chemical reprocessing plant), is available for recycling through the gaseous diffusion plant. Scrap material containing valuable quantities of uranium is also recycled through appropriate steps in the fuel production process. Fissionable plutonium recovered in the chemical reprocessing of spent fuel is valuable for fuel in power reactors.

The applicant has forecasted the natural uranium requirements for both units at 400 tons of U_3O_8 per year. Over the life of the plant, assuming a 30-year life, the total requirement would amount to 12,000 tons. Of this, approximately 27 tons each of U^{235} and U^{238} would be consumed. In addition to the uranium requirements, approximately 4.8 million gallons of fuel oil will be used in the auxiliary boilers and diesel generators for testing purposes.

8.4.5 Land Resources

Generally, land commitment is not irretrievable or irreversible except for the reactor building site itself. The degree of commitment here is a function of the level of decommissioning (see Section 10.4.1). High-level or complete restoration could reestablish the land to approximately its present state; however, complete restoration is unlikely because land values will probably not be high enough to warrant such action.

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9. BENEFIT-COST ANALYSIS OF ALTERNATIVES

Section 8 established that the applicant will require additional generating capability of about 2300 MWe in the 1979-to-1980 period to meet future demands and to insure a reliable power supply to the applicant's customers. This section will examine the potential sources of energy to create this electricity, possible sites to locate the generating station, and alternative plant designs of the power station considering both environmental and economic costs.

9.1 ALTERNATIVE ENERGY SOURCES AND SITES

9.1.1 Energy Sources

There exist many alternative energy sources for the generation of electric power by TVA. Some of these are the fossil fuels (coal, oil, and natural gas), nuclear fuel, and geothermal energy. Another alternative is the purchase of power from another power company.

9.1.1.1 Power Purchases

For the TVA system to purchase 2340 MWe from neighboring utilities, it would be necessary that the purchased power be a firm commitment for at least five years beginning in the 1979-1980 period. For less than a five-year period, the change in planning would only represent a delay in scheduling and construction of the Bellefonte plant.

An examination of neighboring utility systems indicates that excess generating capacity of the magnitude required for TVA's needs will not be available in the 1979-1980 period or immediately thereafter. As pointed out in Section 8.1.2 of this statement, the electric systems surrounding the TVA service area are some of the fastest growing in the United States in terms of electrical demand. To meet this growing requirement, these electric utilities are continuing to install additional generating capacity to meet their own needs. For example, to the south of the TVA system is the Southern Company. In 1979 and 1980, the Southern Company will install approximately 6300 MWe of new generating capacity.[1] With these additions, the reserve margin of the Southern Company will be about 18 percent in 1979 and 1980, which is below their desired reserve of 20 percent. If this system were to supply TVA with 2340 MWe of firm capacity, the Southern Company's reserve margin would be only 9-10 percent in 1979 and 1980. The same situation exists to the east of the TVA system with the VACAR group. During the years of 1979 and 1980, this group of utilities plans to install about 10,000 MWe of new generating capacity which will provide their systems with a reserve margin of between 16 and 17 percent.[2] If the utilities in the VACAR group were to provide TVA with 2340 MWe of firm capacity, their reserve margins would drop to about 11 percent. The Kentucky-Indiana Pool (KIP) is the major group of utilities to the north of the TVA system which could potentially sell firm power to TVA. However, this power pool will be adding about 2200 MWe of generating facilities in 1979 and 1980 which will afford their group a reserve margin of between 15 and 16 percent.[3] If KIP were to sell 2340 MWe of capacity to TVA, they would have no reserve capacity. Finally, to the west of the TVA service area is the Middle South Utilities Company (MSU). During 1979 and 1980, they will have 3000 MWe of new generating capacity coming on-line.[4] With these additions to generation, MSU will have a reserve margin of 16 percent during that period. However, if MSU were to supply TVA with 2340 MWe of power, they, like KIP, would not have enough capacity to meet their future loads. Therefore, from the foregoing discussion the staff concludes that TVA will not be able to purchase 2340 MWe of power from any one or combination of the surrounding systems in order to satisfy their future needs but, rather, will have to supply it from their own resources.

9.1.1.2 Hydroelectric Power Generation

TVA presently has 4372 MWe of hydroelectric capacity which in 1972 generated 21,293 million kwh of electricity.[5] These production facilities represent more than 8 percent of all the hydroelectric capacity and energy generated in the United States in 1972.[6] Because of this extensive hydroelectric development by TVA, the potential for further expansion in the Tennessee and Cumberland River Basins is limited. The Federal Power Commission has reported that the undeveloped hydroelectric power at many sites in the Tennessee and Cumberland River Basins have a potential of only 1536 MWe with a capability of generating only 2765 million kWh.[6] While this estimate indicates a sizeable amount of generating capacity (1536 MWe), the electrical energy production capability of the undeveloped sites is relatively small. This represents a capacity factor for the undeveloped hydroelectric capacity of about 20 percent. With this alternative, additional capacity (∿800 MWe) would be required and older fossil units would have to be run at higher capacity factors. Also, 17 hydro units must be constructed and operated versus two units at Bellefonte. This alternative does not appear to be environmentally nor economically attractive. The staff concludes that the use of undeveloped hydroelectric sites in conjunction with construction of other units is not an acceptable alternative.

Pumped storage is another hydro-type alternative. TVA's Raccoon Mountain plant on the Tennessee River is a pumped storage facility of 1350 MWe with the first unit going into commercial operation in May 1975. Pumped storage units would tend to increase the annual average capacity factor for the mid-range units of TVA, and, to a smaller extent, the baseload units over that existing prior to installation. TVA has a reasonably high overall capacity factor for its units; with the nuclear units in 1979-1980 already at high capacity factors and constituting about only ∿25% of the dependable capacity, the most likely power increase would be from the older coal-fired units, which have high operating costs. The comparative economics and environmental impacts were not investigated by the staff, but general considerations of the TVA situation in 1979 and the fact that 3 kWh must be generated in older coal-fired units to obtain 2 kWh from the pumped-storage unit militate against the attractiveness of such an alternative.

9.1.1.3 Geothermal

Electric power is being generated by geothermal steam at The Geysers on the Pacific Gas and Electric Company system. Currently, The Geysers plant has a capacity of about 290 MWe with additional generating facilities being installed to bring the total capacity up to 1300 MWe by the end of 1980. Geothermal power is being studied for other favorable sites.[7] However, TVA states that the potential for geothermal power is very low and no sites have been identified to date in the TVA service area.[8] The staff does not consider geothermal energy as a viable energy source on the TVA system.

9.1.1.4 Natural Gas

Natural gas in the quantities which would be required for a 2340-MWe electric power station is not considered to be a feasible energy source for electric power generation on the TVA system. Recent shortages of natural gas[9] have caused the Federal Power Commission to issue Order No. 467,[10] which sets forth initial priorities based on end-use of gas to be followed by pipeline companies. The Order states that those users of natural gas with the lowest priority are:

> "Interruptible requirements of more than 10,000 Mcf per day, where alternate fuel capabilities can meet such requirements."

The natural gas requirements for a 2340-MWe power plant have been estimated by the applicant to be about 500,000 Mcf per day.[11] Since the generation of electricity can be attained with alternate fuels such as coal or nuclear, and TVA has stated that natural gas could not be obtained on a non-interruptible basis, the use of natural gas as a boiler fuel in electric power generation has the lowest priority of all the end uses.

Even more to the point is a recent ruling by the FPC which denied the Alabama-Tennessee Natural Gas Company the authority to deliver interruptible gas to a TVA electric power plant because "the gas would be used in an inferior manner."[12] Because of the present shortages, curtailments, and end use priorities of natural gas, the staff does not consider this fuel as a viable alternative energy source.

9.1.1.5 Oil

Presently, the dominant sources of energy for the generation of electricity on the TVA system are hydro power and coal. However, the use of oil as a source of energy for the generation of electricity from a 2340-MWe power plant was considered by the applicant. Assuming that an oil-fired steam plant would have a heat rate of about 9000 Btu/kWh, and that the average heat content of oil is approximately 150,000 Btu per gallon, the fuel requirements for an oil-fired plant producing the same quantity of electrical energy as the proposed Bellefonte Nuclear Station would be about 23.4 million barrels per year or 64.2 thousand barrels per day. TVA contacted several major oil companies in an effort to obtain a long-term contract for this quantity of oil (Ref. 11, p. 4.1-3). However, as pointed out in the applicant's Draft Environmental Statement, they met with little success. The present problems with foreign oil supply dictate the use of other fuels to the extent practical. The staff concurs with this finding based on the information supplied by other applicants in the vicinity of TVA concerning the availability of fuel oil for electric power production.[13,14] Even if low-sulfur fuel oil were available, this alternative with the present trend in prices would be much more expensive, perhaps by one-half billion dollars on a present worth basis, than a nuclear plant.

9.1.1.6 Coal

Coal is the most abundant of our domestic fossil fuel resources. Estimates place our coal reserves at 3200 billion tons with 390 billion tons of this recoverable under current technological and economic conditions. This compares with a total annual consumption rate of only about 0.6 billion tons.[15]

TVA has used coal as a source of energy for years. In 1972 TVA had more than three quarters of its generating capacity fired by coal. In addition, TVA is in the process of starting up two 1300-MWe coal-fired units at the Cumberland Station. Coal for electric power generation in 1972 for the TVA system was provided from the areas shown in Table 9.1.[16] Thus, it can be seen that TVA is a major consumer of coal and, in fact,

TABLE 9.1. Source of Coal for TVA in 1972

Source	*Tons*	*Percent of Total*
Western Kentucky	18,584,000	55
Tennessee	4,449,000	13
Eastern Kentucky	4,257,000	14
Illinois	4,225,000	12
Alabama	1,555,000	5
Virginia	370,000	1
Oklahoma	76,000	-
Indiana	6,000	-
Total	34,022,000	100

burns more than 10 percent of all the coal that is used in the U. S. for electric power generation. Because of the abundance of domestic coal reserves and the operation of coal-fired plants by TVA, the staff believes that coal is a viable alternative energy source. This alternative is compared with a nuclear power plant for the TVA system in Section 9.1.2 of this statement.

9.1.1.7 Other Energy Sources

There is a continuing effort on the part of both government and industry to find new sources of energy to provide power which would have minimal impacts on the natural environment. These long-range power developments include both new energy sources, such as solar, fusion, and tidal energies, and new energy conversion methods, such as breeder reactors, magnetohydrodynamics, electrogasdynamics, fuel cells, and binary cycles. All of these advanced methods of power generation offer certain potential benefits when compared with conventional methods of power production; however, a review of the current literature on the subject[17-19] leads the staff to believe that none of these forms of generation will be sufficiently developed to enable commercial power production in the time period required by TVA.

9.1.2 Comparison of Viable Energy Alternatives

The staff concluded in Section 9.1.1 of this statement that the only viable alternative energy source for baseload electric power generation by the applicant, other than nuclear fuel, was the utilization of coal. This section of the Environmental Statement will assess the relative merits of both a coal-fired plant and a nuclear-fueled power plant. In the analysis, it was assumed that each plant consisted of two 1170 MWe units for commercial operation in September 1979 and June 1980.

9.1.2.1 Economics

In the staff analysis, two types of coal-fired plants were examined -- one which would burn low-sulfur coal and a second which would burn high-sulfur coal with stack-gas cleaning systems to remove most of the sulfur content of the gaseous effluent. The results given in Table 9.2 show that a nuclear plant has a definite economic advantage over both types of coal-fired plants. Using the capacity factors forecasted by the applicant (80 percent during the first 15 years of operation, 55 percent during the next 10 years, and 43 percent during the last five years), the economic advantage of nuclear relative to coal-fired plants amounts to about $360 million on a present worth basis. Considering that the capacity factors are somewhat uncertain, the staff has additionally estimated

TABLE 9.2. Economics of Alternative Energy Sources[a] (2340 MWe Capacity, Two Units, Operation 1979 and 1980)

	Coal								*Nuclear*			
	Low Sulfur				High Sulfur							
Investment cost, $/kW	260 (277)				306 (331)				378 (293)			
Fuel cost, ¢/10^6 Btu	60 (70)				42 (50)				18 (20)			
Net plant heat rate, Btu/kWh	8947				8947				9943			
Capacity factor, percent	60	70	80	TVA[b]	60	70	80	TVA[b]	60	70	80	TVA[b]
Investment cost, mills/kWh[c]	4.4	3.8	3.3	3.6	5.2	4.4	3.9	4.2	6.4	5.5	4.8	5.2
Operation and Maintenance Cost, mills/kWh[d]	0.5	0.5	0.5	0.5	1.5	1.5	1.5	1.5	0.4	0.4	0.4	0.4
Fuel cost, mills/kWh	5.4	5.4	5.4	5.4	3.8	3.8	3.8	3.8	1.8	1.8	1.8	1.8
Total	10.3	9.7	9.2	9.5	10.5	9.7	9.2	9.5	8.6	7.7	7.0	7.4
Differential cost, mills/kWh	1.7	2.0	2.2	2.1	1.9	2.0	2.2	2.1	Base	Base	Base	Base
Total generating cost Annualized present worth,[e] millions of dollars	127	139	151	143	129	139	151	143	106	110	115	111
Total generating cost Present worth,[e] millions of dollars	1430	1565	1700	1610	1452	1565	1700	1610	1193	1238	1295	1250
Differential present worth, millions of dollars	237	327	405	360	259	327	405	360	Base	Base	Base	Base

[a]*Numbers in parenthesis indicate TVA estimate.*

[b]*Capacity factor used in these calculations is based upon TVA estimate of average capacity factors of 80 percent during first 15 years of operation, 55 percent during next 10 years, and 43 percent during the last 5 years of operation.*

[c]*Based on capital recovery factor for 8 percent over 30 years.*

[d]*Operation and maintenance cost for a coal-fired plant using high-sulfur coal includes 1 mill per kilowatt-hour for sulfur removal equipment.*

[e]*Discount rate of 8 percent for 30 years.*

that the economic advantage of nuclear over coal-fired units ranges from $237 million if a lifetime plant capacity factor of 60 percent is assumed to $405 million if an 80-percent capacity factor is used in the economic analysis. The staff's estimates of capital costs are based on the use of a computer code presently in use in the industry.[20]

The staff's estimate of plant capital costs and fuel costs do not agree with those presented by the applicant (applicant's estimated costs are shown in parentheses in Table 9.2). However, the conclusions reached by the staff and the applicant are the same. That is, nuclear power is a more economic energy source than coal at this general location and during this time frame.

The major economic disadvantage of coal is its rapidly rising costs. As shown in Fig. 9.1, the average cost of coal on the TVA system is estimated to be 37 cents per million Btu by 1974. This cost represents only the average cost of coal which is affected by previous low-cost coal contracts. New contracts for TVA are generally in the range of 42 to 43 cents per million Btu.[21-22] Low sulfur coal has been estimated by the staff to cost about 60 cents per million Btu. This estimate is based on the present cost of low-sulfur coal from Montana and Colorado to other electric systems which are about equidistant from the western coal fields as TVA.[23,24] The applicant has estimated that coal costs "would almost double" if environmental standards were to necessitate the use of western coals.[25] This would indicate that the applicant believes the low sulfur western coal to cost about 70 to 80 cents per million Btu based on 1973 and 1974 projected coal costs for the TVA system.

The cost of both nuclear fuel and coal were assumed to remain constant through the thirty-year plant life. The staff realizes that fuel costs will increase in the years ahead. However, projected fuel cost estimates show fossil fuels increasing at greater rates than nuclear fuel.[26,27] This would tend to make the present-worth generating cost differential between nuclear and coal to be even more favorable for a nuclear power plant.

If high-sulfur coal were to be used, the applicant would be required to install sulfur removal equipment. At the present time, there is uncertainty as to the reliability and commercial costs for sulfur removal equipment. The staff used a cost for this equipment of $46 per kilowatt in additional capital expenditures and an increased operation and maintenance cost of about 1 mill per kilowatt-hour. These projected costs are consistent with estimates for sulfur removal for the Summit power plant.[28,29]

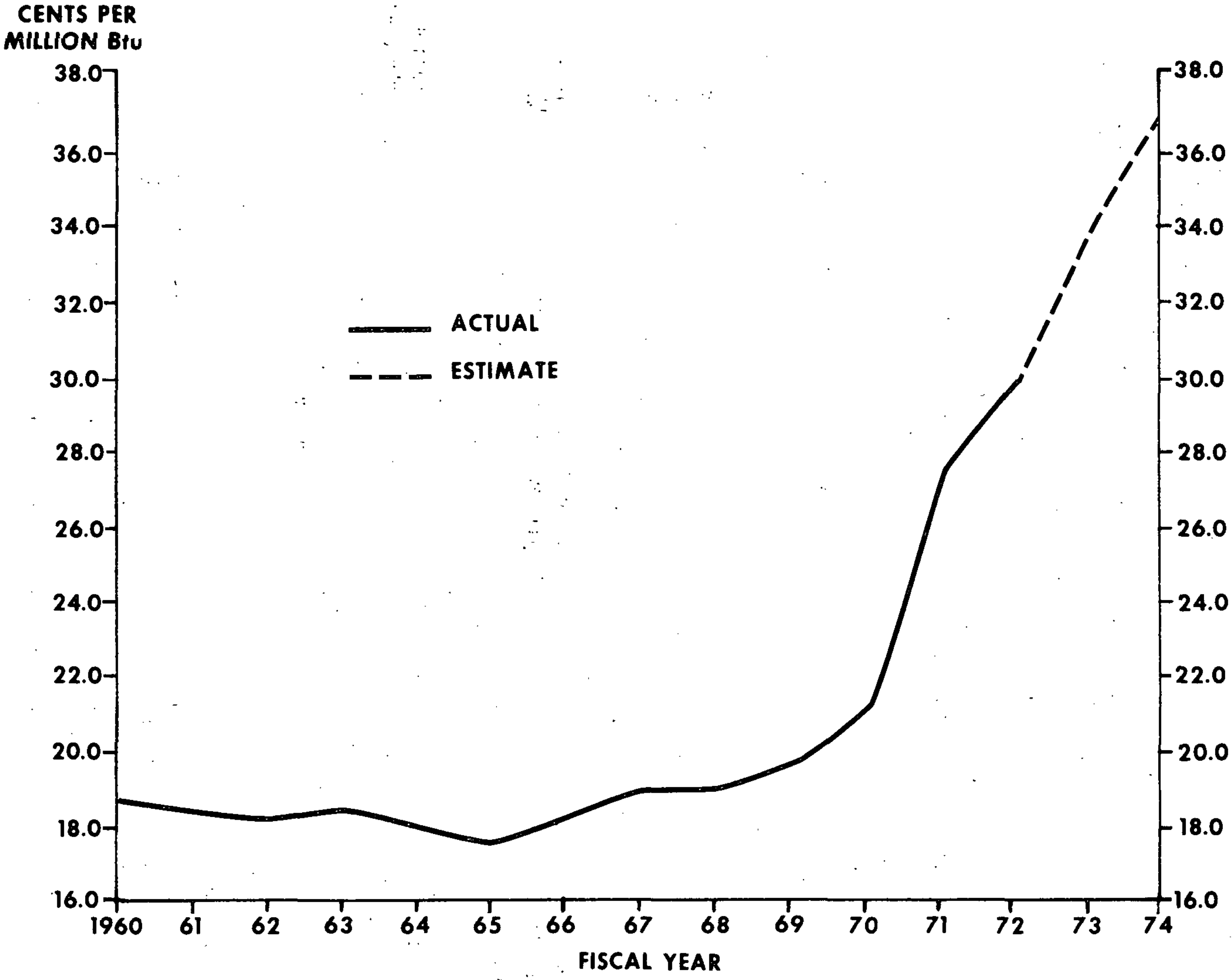

Fig. 9.1. Average Coal Cost for the TVA System.

9.1.2.2 Environmental Impact

Table 9.3 summarizes the major environmental impacts of a coal-fired plant and a nuclear plant which would have an electrical capacity of 2340 MWe. From an environmental standpoint, the most significant advantage which a coal-fired plant has relative to a light-water reactor nuclear plant, which is the type being proposed by the applicant, is its thermal efficiency. As shown in Table 9.2, the net plant heat rate of a coal-fired plant is 8947 Btu/kWh (38% thermal efficiency) as opposed to a net plant heat rate of 9943 Btu/kWh (34% thermal efficiency) for a nuclear power plant. When one considers the differences in thermal efficiency and that about 10 percent of the heat input to a coal-fired plant is rejected through the stack, then the amount of thermal discharge to the cooling water is approximately 40 percent greater from a nuclear plant than from a similarly sized coal-fired plant.

The radioactive effluents from a nuclear plant would be greater than those from a coal-fired plant. However, the controls imposed on a nuclear plant would result in the effluent being equivalent to only a small fraction of the natural background radiation.

A disadvantage of a coal-fired plant is the amount of pollutants which would be released to the air. The staff has estimated, based on EPA standards,[30] that a coal-fired plant would emit 5600 tons of particulates per year, 68,000 tons of sulfur dioxide per year, and 39,000 tons of nitrogen oxides per year.

Coal consumption and storage also present environmental impacts. A 90-day supply of coal at the plant site would require approximately 70 acres of land.* The amount of coal consumed each year by a coal-fired plant would be about 4,700,000 tons.** Assuming delivery by unit trains of 120 cars, with each car having a capacity of 100 tons, a train load of fuel would be required every 22 hours for a 2340-MWe coal-fired power plant.

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*Staff assumed coal with a density of 80 lb/cu ft and 10-foot high coal pile.

**Staff assumed a lifetime plant capacity factor of 61.4 percent and coal with a heat content of 12,000 Btu/lb.

TABLE 9.3. Environmental Impacts of Alternative Energy Sources

Impact	*Coal*	*Nuclear*[a]
Land Use		
Plant proper, acres	∿200	256
Fuel storage, acres	70	Insignificant
Total plant, acres	∿600	1,500
Releases to Air		
Particulates, tons per year	5,600	64
Sulfur dioxide, tons per year	68,000	63
Nitrogen oxides, tons per year	39,000	252
Radioactivity, man-rem per year	0[b]	14.3[c]
Fogging, days per year	1 or 2	1 or 2[d]
Icing, days per year	none	none[d]
Releases to Water		
Heat, Btu per hour	2.5×10^8	3.5×10^8
Radioactivity, man-rem per year	none	6.4[c]
Chemicals, tons per year	700	1,000
Consumptive Use of Water		
Evaporation (maximum), cfs	53	74
Drift, cfs	0.25	0.25
Total	53.25	74.25
Fuel		
Consumed, tons per year	4,700,000	400[e]
Transported, tons per year	4,700,000	100[f]
Wastes, tons per year	470,000	120
Esthetics	Would require tall stacks, coal yard, frequently used railroad. Would create a visible smoke plume. Large cooling tower.	Large cooling tower.

[a]*TVA estimate.*

[b]*Radionuclides of naturally occurring radium, thorium, and uranium are emitted with the fly ash.*

[c]*AEC estimate. The radioactive releases to air include 14 man-rem per year from the transportation of fuel and radioactive waste.*

[d]*AEC estimate.*

[e]*Natural uranium,* U_3O_8.

[f]*Slightly enriched uranium dioxide pellets.*

At the present time, the quantification of human health impacts from the alternative generating units is uncertain. Each alternative meets applicable standards.

If it is assumed that the environmental impacts of a coal-fired plant and a nuclear plant are equivalent, the lower power generating costs of a nuclear plant compared with a coal-fired plant favors the selection of a nuclear plant. The staff believes that with the cooling towers and low releases of radioactivity, a nuclear plant will not degrade the environment more than the fossil alternative and that a nuclear-fueled power plant is more economical. Therefore the nuclear alternative energy source is favored.

9.1.3 Alternative Sites

The methodology employed by TVA in selecting the Bellefonte site was basically a four-step process. In the first step, the applicant identified many different potential sites which were believed to merit a preliminary examination. Included among these potential sites was the Bellefonte location. The second step in the site selection process was to perform a preliminary study on each site to determine if a further, more detailed study was warranted. The preliminary study of each site included a cursory examination of cooling water availability, transmission facility proximity, demography, site accessability, land use and ownership assessment, topography, navigability and flooding potentialities of the waterway, and site proximity to unique areas such as recreation or wildlife regions. After completing these preliminary studies of potential sites, the third step was to examine in greater detail those sites which were found to have favorable characteristics with regard to the preliminary studies in step two. These more detailed studies included the physical characteristics of the various sites such as foundation conditions, meteorological and hydrological characteristics, and archaeological conditions. The fourth and final step was to determine which of those sites examined in step three was the most favorable site for a steam-electric power plant from an environmental and economic viewpoint. The staff believes that this was a reasonable and logical approach in determining a power plant site.

A preliminary site study was warranted for 30 potential plant sites. All of these 30 sites were located in the Tennessee River Valley since TVA believed that stream temperature standards would allow once-through cooling as a heat dissipation method. The Tennessee River had adequate flow to permit once-through cooling while other waterbodies were either too small or located in areas with questionable seismic characteristics.

The staff does not agree with the applicant in limiting site studies only to those regions which have large waterbodies capable of once-through cooling. In further support of the staff's position, it should be noted that the proposed Bellefonte plant will employ natural draft cooling towers as discussed in Section 3 rather than once-through cooling. On the other hand, the Tennessee River extends about 650 miles from the Ohio River in Kentucky through the western portion of Tennessee and upper part of Alabama and then onto Knoxville, and the staff finds that a reasonable number of realistic siting options can be identified which present a spectrum of environmental and economic effects. The Tennessee River also affords reasonable transmission ties to the major electrical load centers on the TVA system such as Knoxville, Chattanooga, Huntsville, and Paducah. These major electrical load centers, as shown in Figure 8.1, closely follow the Tennessee River Valley. From an environmental standpoint, the larger flow rates of the Tennessee River would dilute and disperse the blowdown from a power plant more effectively than smaller streams. Similarly, makeup water for the plant would be a smaller percenttage of the total stream flow on a larger river than on a small stream.

The preliminary studies of the 30 sites indicated that eight of these sites merited further and more detailed investigation. The 22 sites which were eliminated were found to have less desirable characteristics than those chosen for more detailed study. The eight sites identified for further examination are listed in Table 9.4. These sites extend from the Knoxville area through northern Alabama to the western portion of the TVA service area. The linear distance between the eastern and western-most sites along the Tennessee River is about 400 miles. The eight sites are located on five different reservoirs of the Tennessee River—these reservoirs being the Kentucky, Pickwick, Guntersville, Chickamauga, and Watts Bar.

Site A on the Kentucky Reservoir and Site B on the Pickwick Reservoir are located in the western portion of the TVA system where the seismic conditions were being examined but not clearly defined at the time the site studies were being conducted. Because of the unknown seismic conditions, further consideration was not given to these plant sites at the time. In order to describe more fully the seismic design requirements for future nuclear power plants in the western portion of the TVA system, a report entitled Relationship of Earthquakes and Geology in the West Tennessee and Adjacent Areas was submitted by TVA to the U. S. Atomic Energy Commission in June of 1972. Since that time, the staff has reviewed this report[31] and has found, pending a detailed site investigation, that locations northward along the Tennessee River

TABLE 9.4. Alternative Sites

Site	*Reservoir*	*Location, Tennessee River Mile*
A	Kentucky	174
B	Pickwick	215
C	Guntersville	369
D	Guntersville	386.5
Bellefonte	Guntersville	392
F	Guntersville	398.5
G	Chickamauga	499
H	Watts Bar	559

to TRM 170 would be acceptable for a nuclear power plant from a seismology standpoint. Both Site A and Site B (TRM 174 and 215) would be included in this area. However, the staff believes that the decision of the applicant to eliminate these two sites from consideration at that time was a reasonable determination. In any event, the environmental impacts at Sites A and B would not be substantially different than those at the other six sites.

Some of the more important features of the six remaining sites are summarized in Table 9.5. All of these sites are considered to be potentially suitable for a thermal electric power plant. Sites D, F, and H were found by the applicant to be slightly less desirable at this time due to a variety of reasons -- Site D conflicted with potential urbanization of Scottsboro, Site F was too near a wildlife sanctuary, and Site H would require a large amount of excavation and ultimate disposal. The staff finds that locating a power plant at Site D would encroach on present residential developments taking place in this area and in the vicinity of Alabama Highway 35. In addition, a study is in progress which is expected to recommend that much of the area defined as Site D be zoned for agricultural and low density residential development.[32] The staff also found that Site F would be surrounded by a wildlife management area which is principally made up of forest lands at the present time.[33] In addition, seismic investigations at Site F indicate that suitable foundation rock is at a depth of more than 100 feet. Because the site is more than 4000 feet from Guntersville Reservoir, water conduits of much greater length than those proposed for Bellefonte would be required. The development of Site H would require the disposal of 1.2 million cubic yards of excess excavation material[34] which could present an environmental problem. The staff believes that other than the effects mentioned above, the environmental impacts of sites D, F, and H would not be substantially different than those at sites C, G, and Bellefonte.

The final three sites -- C, Bellefonte, and G -- were evaluated in greater detail in order to determine the final site location. The staff finds that the hydrology, seismology, and meteorology of all three sites are very similar and, therefore, are not critical decision items in site selection. Since all three sites lie within the Southern Appalachian Seismotectonic Province, it can reasonably be assumed, pending more detailed site investigations, that all three sites would have similar seismic conditions. Likewise, the meteorological conditions of the sites would have marked resemblances since all are within the same climatic regimes. While the hydrology of the three sites vary somewhat (average annual flow at sites C and Bellefonte equals approximately 41,000 cfs while at Site G, average annual flow equals 33,000 cfs), the staff does not consider this to be a significant difference.

TABLE 9.5. Site Alternatives

Site	C	D	Bellefonte	F	G	H
Location						
Tennessee river mile	369	386.5	392	398.5	499	559
Reservoir	Guntersville	Guntersville	Guntersville	Guntersville	Chickamauga	Watts Bar
Nearest town	Grant, Ala.	Scottsboro, Ala.	Hollywood, Ala.	Stevenson, Ala.	Dayton, Tenn.	Rockwood, Tenn.
Population	382	9,324	865	2,390	4,361	5,259
Distance, miles	6	4	3.5	6	6	5
Nearest city	Huntsville, Ala.	Huntsville, Ala.	Huntsville, Ala.	Chattanooga, Tenn.	Chattanooga, Tenn.	Oak Ridge, Tenn.
Population	137,802	137,802	137,802	119,082	119,082	28,319
Distance, miles	30	36	39	37	30	25
Distance to nearest highway	16	1	2.5	1	0	6
Distance to nearest railroad	16.5	2.5	3.5	2	19	8
Distance to nearest transmission lines						
500 kV	28	13	10	6	3.5	6
161 kV	4	2	2	1	6	7
Total site requirements, acres	700	900	1,500	1,300	1,100	1,000
Owned by TVA	325	200	240		200	50
Comments	Recreation, housing nearby. Major industry 2.5 miles from site.	Site conflicts with potential urbanization of Scottsboro.	Site adjacent to farm land.	Depth of foundation rock in excess of 100 ft. Water conduits of 4000 ft. required.	No major developments near site.	Excessive excavation disposal.

As shown in Table 9.6, all three of the sites are in relatively sparsely populated areas. The population density of the Bellefonte site is about 80 persons per square mile within a 40 mile-radius and approximately 105 persons per square mile within a 50-mile radius.

The land requirements, as shown in Table 9.6, differ by a factor of two with Site C requiring 700 acres, Site G 1,100 acres, and Bellefonte requiring about 1,500 acres. The land requirements for a particular site are significantly influenced by site topography and land ownership.[35] The Bellefonte site requires more land area than Sites C and G because the plant would be located on a peninsula. By owning the entire peninsula, the applicant can control ingress and egress to the periphery of the peninsula which it would not otherwise maintain.

Development of any one of the three sites would be compatible with projected land uses in that area. Since Site G is adjacent to a wildlife refuge, some additional care would be required during construction to minimize impacts on the refuge. However, operation would not entail any special impacts on the refuge. The staff found that there was no conflict with land use plans at either Site C or Bellefonte. Furthermore, the staff found that the vicinity in which the Bellefonte site is located has been planned for industrial development.[36] Therefore, the use of this land for a nuclear power plant would be consistent with future land use plans of the Hollywood, Alabama area.

Impacts on esthetics and recreation for the Bellefonte site are discussed in Sections 2.7.5 and 5.1.3 of this Statement. The staff believes that the effects of the power plant on esthetics and recreation would be similar at Sites C and G. There is no reason to believe that there would be any significant damages to the aquatic environment at any one of the three sites with properly designed and located intake and discharge structures as discussed in Section 5.4.2. Since the staff finds that the physical and environmental features of each of the three sites are similar, the final site selection was based on economic considerations.

There were four economic factors which were considered by TVA in determining the final site selection. These were (1) access facilities, (2) transmission connections, (3) site development, and (4) land. Table 9.6 provides quantified data on each of these items for the three sites. Table 9.7 summarizes the cost of developing each of the three sites. The staff finds that most of these estimates are reasonably accurate and are consistent with a previous TVA document.[37] The cost of land and transmission system connections shown in Table 9.7 are considered by the staff to be comparable with estimates submitted by other applicants for

TABLE 9.6. Comparison of Site Alternatives[a]

Site	*C*	*Bellefonte*	*G*
Population			
within 5 miles	3,378	2,755	3,691
10 miles	13,112	18,405	16,768
20 miles	88,359	50,530	100,220
30 miles	223,524	106,860	287,274
40 miles	459,347	398,665	467,050
50 miles	653,925	837,658	683,226
Access facilities			
Highway	Construct 1000 ft road Reconstruct 3.8 miles of road Improve 12 miles of road	Construct 4000 ft road Reconstruct 1.5 miles of road	Maintain 8 miles of road
Railroad			
Miles of construction	16.5	3.5	19
Bridges	2	0	6
Transmission lines			
Construction required, miles			
500 kV	72	70.5	165
161 kV	0	2.4	12
Number of river crossings	4	3	6
Right-of-way area, acres	1,750[b]	1,550	4,300[b]
Site development			
Grading, millions cu. yd.			
Excavation	1.2	0.8	0.3
Fill	1.0	0.4	0.5

[a]*Source: TVA Draft Environmental Statement, Bellefonte Nuclear Plant.*

[b]*Staff assumes a 200-ft right-of-way.*

TABLE 9.7. Summary of Site-Related Costs[a,b]
(Thousands of 1972 Dollars)

Item	*C*	*Bellefonte*	*G*
Access facilities[c]			
Highway	1,600	250	100
Rail	5,000	850	5,200
Site development	3,500	1,000	Base
Transmission system connections	14,660	11,990	25,575
Land	432	1,109	570
Total site-related cost	25,192	15,199	31,445
Difference	9,993	Base	16,246

[a]*Source: TVA Draft Environmental Statement, Bellefonte Nuclear Plant.*

[b]*Cooling facilities costs were judged to be comparable for same heat dissipation.*

[c]*Barge facilities costs were judged to be about the same at each site.*

those cost categories. The cost of access facilities and site development for the Bellefonte site are consistent relative to costs for the alternative sites.

Bellefonte shows a cost advantage of approximately $10 million over Site C and more than $16 million over Site G. The major advantage of the Bellefonte site when compared with Site C is the lower cost of access facilities including both highway and rail. When compared to Site G, Bellefonte is preferable due to the almost $9 million difference in transmission costs.

The staff believes that all three sites would be suitable for a steam-electric power plant and from the standpoint of environmental impacts are equivalent. The Bellefonte site has economic advantages relative to Sites C and G. Considering all environmental and economic factors, none of the alternate sites present a more desirable alternate to the proposed Bellefonte site.

9.2 ALTERNATIVE PLANT DESIGNS

This section of the environmental statement will analyze possible modifications to the applicant's proposed plant design that might significantly change the balance between economic and environmental costs.

9.2.1 Cooling Systems

The applicant has estimated (Ref. 11, p. 2.6-3) that the amount of heat which must be rejected at the Bellefonte Nuclear Station will be 15.6×10^9 Btu/hr when the plant is operating at full load. In designing an acceptable method of dissipating this quantity of waste heat, the applicable water quality standards of the State of Alabama must be considered (see Sec. 5.2.3).

At the present time, there are six methods of dissipating waste heat from steam-electric power plants. These include (1) once-through cooling, (2) cooling lakes, (3) natural draft evaporative cooling towers, (4) mechanical draft evaporative cooling towers, (5) spray canals, and (6) dry cooling towers.

9.2.1.1 Once-Through Cooling

Once-through cooling is the process whereby water is drawn from a water body, circulated through the steam condenser where its temperature is raised about 20°F, and discharged directly into the same water body.

If it is assumed that the steam condenser is designed for a 20°F rise in temperature, the water requirements for the Bellefonte Nuclear Plant would be about 3500 cfs. The average summer streamflow at the Bellefonte site is approximately 27,000 cfs (Ref.11, p. 1.2-9). This would have the effect of raising the river temperature about 2.6°F if complete mixing is assumed. Based upon data supplied by the applicant (Ref.11, p.1.2-58), the staff concludes that this heat input would cause the stream temperature to be greater than 86°F during some portions of the summer months, especially during low flow. Thus either the State of Alabama's water quality standards would be violated or plant output would be severely curtailed. This curtailment would result in an economic penalty to the system.

The applicant concluded that once-through cooling was not feasible for the Bellefonte plant because this system would fail to meet the water quality standards of the State of Alabama (Ref.11, p. 2.6-16). The staff concurs with the applicant's assertion that water quality standards would not be met and further notes that the alternative of reducing electrical output would create a significant economic penalty. For these reasons, as well as the biological impact on the reservoir, once-through cooling is rejected.

9.2.1.2 Dry Cooling Towers

Dry cooling is the method of cooling in which heat is dissipated directly to the atmosphere by conduction and convection rather than by evaporation as in other cooling methods. Because there are no evaporative or drift losses in this type of system, many of the problems of conventional cooling systems are eliminated. For example, there are no problems with blowdown disposal, water availability, chemical treatment, fogging or icing when dry cooling towers are utilized. Although the elimination of such problems would be beneficial, the dry towers have associated technical obstacles such as high turbine backpressure, noise from very large fans in mechanical-draft towers, and possible freezing in cooling coils during periods of light load and startup. There has been no experience with large dry towers in the U. S. The largest dry cooling installation in the world is a natural-draft tower for a power plant with a rating of about 220 MWe.[38]

The incremental cost difference between dry and wet cooling towers in the southeastern section of the U. S. is on the order of 1 mill/kWh.[39] For the Bellefonte Nuclear Plant, this would be equivalent to about $15 million per year or about $170 million on a present worth basis.

Considering the production cost penalty and technical obstacles with respect to the previously mentioned advantages, the staff believes that dry cooling towers are not justified for the Bellefonte Nuclear Plant at this time.

9.2.1.3 Natural-Draft Cooling Towers

The applicant has proposed the use of two closed-cycle natural-draft cooling towers approximately 500 feet in diameter and 500 feet high for the Bellefonte Nuclear Plant. Each of these towers would circulate 466,000 gpm of water and have a cooling range of 36°F. Thus, each will dissipate about 7.8×10^9 Btu/hr when the nuclear plant is operating at full load. The total makeup water requirement for both cooling towers, as shown in Table 9.8, will amount to about 148 cfs. This water requirement includes evaporative losses of 74 cfs (maximum), 74 cfs of blowdown, and 0.25 cfs of drift losses. The blowdown will meet Alabama standards for temperature and dissolved solids.

Ground level fogging and icing are generally not a problem with large natural-draft cooling towers. However, at the Bellefonte station, TVA has conservatively estimated that plumes of sufficient length to reach the Sand Mountain Plateau, which is approximately 400 feet higher than the tops of the cooling towers, will occur about six percent of the time or 22 days per year. Potential increased icing incidents could occur about two percent of the time or seven days per year. The applicant has estimated that Alabama Highway 40, which averaged 2200 vehicles per day in 1970, could be affected about one percent of the time by fogging and 0.5 percent of the time by increased icing. The staff believes that the icing frequency will be practically zero and the fogging frequency may be one or two days per year.

The applicant has estimated the initial investment cost for the two closed-cycle natural-draft cooling towers to be $58 million, which includes conduits, condensers, and site preparation.

Open-cycle natural-draft cooling towers 480 feet in diameter and 400 feet high were considered as an alternative to the proposed closed-cycle cooling towers. The environmental and economic differences between these two types of cooling tower systems are summarized in Tables 9.8 and 9.9. The significant differences between the cooling towers, in addition to their physical size, are the increased losses of larval and small fish (1.8 billion vs. 0.1 billion) and the increased capital expenditure of $17.1 million for the open-cycle cooling tower as given in the TVA DES. This increased investment cost is due to the

TABLE 9.8. Economic Impacts of Alternative Cooling Systems[a]

	Cooling Towers				Spray Canals		Cooling Lake
	Natural Draft		Mechanical Draft				
	Closed	*Open*	*Closed*	*Open*	*Closed*	*Open*[b]	*Closed*
Engineering considerations							
Heat rate, Btu/kWh	9,534.4	9,501.3	9,534.9	9,483.2	9,553.6	9,477.0	9,510.0
Capability losses, MWe	Base	-8.54[c]	0.12	-13.14[c]	4.94	-14.88[c]	-6.2[c]
Economic considerations							
Present worth costs							
Capital cost, $/million	Base	17.14	-1.51	17.39	5.54	16.25	8.94
$/kW	Base	7.32	-0.65	7.43	2.37	6.94	3.82
Operation and maintenance costs, $/million							
Replacement power	Base	-2.36	0.05	-3.68	1.39	-4.16	-1.75
Fuel	Base	-1.12	0.02	-1.72	0.64	-1.94	-0.82
Pumping power	Base	-2.62	3.69[d]	-1.77[d]	2.47	-2.77	-2.64
Maintenance	Base	-0.19	3.70	3.16	0.99	0.99	-0.69
Total O & M	Base	-6.29	7.46	-4.01	5.49	-7.88	-5.90
Total present worth-cost $/million	Base	+10.85	+5.95	+13.38	+11.03	+8.37	+3.04

[a] *TVA estimates.*

[b] *Spray canal with intake from Town Creek.*

[c] *Negative sign indicates an increase in capacity relative to the base case.*

[d] *Cost includes fan power for mechanical-draft cooling towers.*

TABLE 9.9. Environmental Impacts of Alternative Cooling Systems[a]

Impact	Cooling Towers: Natural Draft Closed	Cooling Towers: Natural Draft Open	Cooling Towers: Mechanical Draft Closed	Cooling Towers: Mechanical Draft Open	Spray Canals: Closed	Spray Canals: Open	Cooling Lake: Closed
Additional land requirement, acres	9	57	20	55	66	76	5650
Water requirements							
Drift, cfs	0.5	0.5	2.5	2.5	0.2	0.2	0
Evaporation, cfs	74	74	74	74	73	73	70
Blowdown, cfs	74		71		73		70
Total makeup, cfs	148	74	147	76	146	73	140
Additional fogging, days/year	22	22	61	61	47	47	83
Additional icing, days/year	7	7	70	70	70	70	43
Peak blowdown temperature, °F	90	94	89	95	97	98	95
Losses of larval and small fish, billions/year	0.1	1.8	0.1	2.0	0.1	2.3	0.1

[a]*TVA estimates*

Note: *The visual impacts have not been included.*

additional channels, gates, and diffusers of the open-cycle system. The overall present-worth cost difference including capital cost and operation and maintenance expenses is $10.85 million in favor of the closed-cycle system or about 0.1 mills/kWh.

9.2.1.4 Mechanical-Draft Cooling Towers

Mechanical-draft cooling towers were considered as an alternative method of heat dissipation to closed-cycle natural-draft cooling towers at the Bellefonte Nuclear plant. These two types of cooling towers operate on the same basic thermodynamic principles, that is, cooling takes place by evaporation and sensible heat transfer. At the Bellefonte site, however, the mechanical-draft cooling towers would be at a disadvantage when compared to natural-draft cooling towers in two areas: (1) economics and (2) atmospheric impacts.

The economic comparison of mechanical-draft cooling towers, both open- and closed-cycle, with natural-draft cooling towers is shown in Table 9.8. The capital cost of the mechanical-draft towers are equivalent to the capital cost of natural-draft cooling towers, but the operation and maintenance costs are considerably higher for the mechanical-draft towers.

The primary disadvantage of mechanical-draft cooling towers when compared to natural-draft towers is the increased potential for ground-level fogging and icing. This phenomenon is caused by the relatively low discharge point for the water vapor from the mechanical-draft towers. In general, mechanical-draft towers are about 60 feet in height. For comparative purposes, the proposed Bellefonte natural-draft towers will be 500 feet high. Mechanical-draft towers discharge the vapor plume at a lower elevation than natural-draft towers. The applicant has estimated that because of this about three times the amount of fogging incidents and ten times the number of icing incidents occur when mechanical-draft towers are used.

The staff agrees with the applicant's conclusions that mechanical-draft towers would cause an increase in fogging and icing which could be serious for the particular topography and the road and city locations in the Guntersville Reservoir area. Because of the atmospheric and economic impacts, the staff believes that mechanical-draft cooling towers would be inferior to natural-draft towers at the Bellefonte site.

9.2.1.5 Cooling Lake

The construction of a cooling lake for waste heat dissipation at the Bellefonte Nuclear Plant is a technically feasible cooling alternative. The cooling lake would require a surface area of between 2500 acres and

5000 acres based upon the general rule of one to two acres of surface area per megawatt of electrical capacity.[40] The applicant has estimated (Ref.11, p. 2.6-24) that by impounding the Dry Creek basin and flooding it to an elevation of 630 feet, a lake would be created with a surface area of 5650 acres. This would be sufficient to dissipate the thermal discharges of the Bellefonte Nuclear Station. In constructing such a lake, approximately eight miles of dikes would have to be built and 6100 acres of sparsely populated land would have to be cleared. Approximately 140 occupied structures would have to be removed.

Table 9.8 summarizes the major environmental impacts attendant to the construction of a cooling lake for the Bellefonte Nuclear Plant. The total water requirements for a 5650 acre cooling lake would be about 140 cfs -- evaporative losses amounting to 70 cfs and blowdown equaling 70 cfs. There are no anticipated drift losses with the cooling lake. Thus, the cooling lake alternative would consume about the same amount of water as the natural-draft cooling system.

The impact of a cooling lake on the aquatic biota due to impingement and entrainment in the Tennessee River would be no greater than for other closed-cycle alternative cooling systems. However, the aquatic life of the impounded streams and the terrestrial life of the flooded area would be affected. Because of the number of lakes for recreation in the region, the incremental benefit of the cooling lake would not be large. Esthetically, the lake would probably be more attractive than other man-made cooling systems.

In addition to the large amount of land area required, another disadvantage of a cooling lake is the fogging and icing due to its heated waters. These would create hazardous conditions for a few days per year on both U. S. Highway 72 and the Southern Railroad which would cross the lake. Increased fogging has been observed at other cooling lakes such as the one at the Mt. Storm coal-fired plant of Virginia Electric and Power Company. Road icing has been observed at Commonwealth Edison Co.'s Dresden power plant.

The relative economics, shown in Table 9.9, of a cooling lake as opposed to a closed-cycle natural-draft cooling tower indicates that a cooling lake would cost about $3 million more on a present worth basis. This would be equivalent to increasing the busbar cost of electricity by 0.03 mills/kWh.

9.2.1.6 Spray Canals

Spray canals were considered for waste heat dissipation at the Bellefonte Nuclear Plant. In order to dissipate the 15.6 x 10^9 Btu/hr which would be rejected by the Bellefonte Nuclear Plant to the cooling water, a spray canal system approximately 2.5 miles long and 200 feet wide would be required.

The primary disadvantages of spray canals are similar to those of mechanical-draft cooling towers when compared with natural-draft towers. These disadvantages are the economic and atmospheric impacts. As shown in Tables 9.8 and 9.9, both the capital and operation and maintenance costs are greater for a closed-cycle spray canal than a natural-draft cooling tower. Also, about twice as much fogging and seven times as much icing would occur with spray canals when compared to natural-draft towers. The staff believes natural-draft cooling towers are more favorable from an economic viewpoint than spray canals and will have fewer atmospheric impacts.

The staff concludes that closed-cycle natural-draft cooling towers would provide the most effective method of waste heat dissipation of all the alternatives from an economic and environmental standpoint.

9.2.2 Cooling-Water Intake

The staff has discussed its concern regarding entrainment of ichthyoplankton in Section 5.4.2.2. At the staff's request, the applicant has considered a number of cooling-water intake designs.[41] The safety criteria for essential cooling-water flow under emergency conditions must, of course, be met, in order to have a viable comparison of environmental, capital, and operating costs for alternatives. Considerations pertinent to water intake locations at the Bellefonte site follow.

For protection of the biota, water should be taken from a region that has a low density of entrained organisms, principally ichthyoplankton, and a low potential for fish congregation and fatigue-producing conditions. Systems that have shoreline and shore-inlet intake locations do not meet this criterion as well as ones with deep-water (old river bed) intakes.

The environmental costs are estimated by TVA on the basis of the dollar value of the ichthyoplankton loss, which value is based on the cost of replacement with hatchery stock.[42] From data on densities from the collection on ichthyoplankton on one day in 1972, the applicant estimates the dollar value (1970) of the ichthyoplankton loss at an offshore intake at $12,000 annually and at a near-shore intake at $200,000. Data from the 1972 Wheeler Reservoir studies based on ten sampling days indicate a six-fold greater concentration than does the one-day Guntersville Reservoir sampling.[43]

A major uncertainty in any decision on intakes is the level of ichthyoplankton and small fish destruction that will be compensated for or will be negligible in terms of reduction in adult fish population. At the present time, the impact on adult fish populations is unknown.

The applicant and the staff have agreed upon a sampling program as outlined in Section 6.2.1.1. This program will provide a basis for estimating the entrainment of ichthyoplankton flowing past the plant. If the fraction of ichthyoplankton entrained is less than 5%, no change in the intake design and location will be necessary. If the fraction is greater than 25%, the applicant will be required to implement an alternate intake scheme to reduce entrainment. If the fraction of entrained ichthyoplankton is between 5-25%, the data will be assessed by the staff and may lead to either additional collection or implementation of an alternate intake scheme to reduce entrainment.

9.2.3 Access Roads

The applicant has proposed that another access road to the site be built. The new access to the site would be from U. S. Highway 72 across Town Creek via a causeway to the tip of the peninsula and down the peninsula to the plant. This distance is slightly less than three miles. The existing access road (County Road 33) also connects with U.S. Highway 72 about two miles closer to Scottsboro than the proposed entrance to U. S. 72 of the new access road. County Road 33 is contiguous with the site boundary (south entrance to site) a short distance and loops toward Scottsboro; a reconnection with U. S. Highway 72 and a connection with Alabama Highway 35 can be made in this direction.

Plans for other types of access to the site include a railroad spur from the Southern Railway and a dock facility on the Tennessee River. Most of the heavy pieces of permanent equipment would be transported to the site by rail or barge.

There are two alternatives under consideration for vehicle access to the site: (1) the construction of a new access road with a causeway across Town Creek and (2) the upgrading and use of the existing access road. The applicant proposes alternative one; the staff recommends alternative two.

The applicant's position in summary form is: the causeway route allows access to the tip of the peninsula where a recreational development may occur; the size, ~500 acres, and topography of the tip is not readily matched from land presently in TVA ownership on the reservoir; the needed recreational development has benefits greater than costs; the impact on Town Creek embayment is small; the 2.7-mile road only removes ∿10 acres of land from productive use; there is some impact on wildlife by habitat removal and disturbance; the route minimizes possible damage or destruction to historical structures in the Bellefonte town site; and it reduces traffic congestion during construction.

The staff's position expressed in the DES has been reviewed in light of additional TVA information on the plans for the recreational area and on a reduced dollar cost differential (from $400,000 to $160,000) for the construction of the causeway compared with use of the existing access road. Some of the considerations involved in the staff selection of the alternative will be briefly discussed.

According to TVA, the use of the tip for a future recreational area requires an access road that does not pass the plant in order to comply with nuclear safety requirements. In the unlikely case of a large accident under unfavorable upvalley wind conditions, an evacuation procedure plan is required that does not result in an excess radiation dose to occupants on the tip, which is within the plant exclusion area. The AEC has not analyzed for acceptability the intended recreational use from a nuclear safety standpoint, but will do so at the time of final safety evaluation. The extent of recreational activities may be influenced by this analysis.

The staff notes that another peninsula of land between Town Creek and Mud Creek is under public ownership by TVA. The extent and topography of this land is quite similar to the tip of the Bellefonte peninsula. Since this land would also be outside the exclusion boundary, controlled activities are not required. Recreational use of this land could take place prior to 1985, which is the assumed date for the recreational use of the tip of the Bellefonte peninsula. Another consideration is that protection of plant facilities is enhanced by the lack of open public activities on the tip of the Bellefonte peninsula.

The construction impacts for the causeway involve the removal of a small amount of Town Creek embayment from aquatic productivity and an increased turbidity and siltation in Town Creek. As given in Section 4.2, construction of the proposed causeway will have undesirable, but acceptable aquatic impacts. Terrestrial impacts include the removal of a few acres of land from productivity and the need for increased fill material; this is an added burden to a project that requires a permanent borrow source for earth fill. The upgrading of the existing access road also has adverse impacts. The detail requirements for upgrading the access road are not known; however, it is believed that they are less than those for a new road because the road exists and any added bridging is over a narrow stream of water.

Also, the construction of the recreational facilities and recreational use of the Bellefonte peninsula will have impacts on the wildlife and vegetation. The applicant maintains that the adverse impacts on wildlife would principally be those associated with habitat losses due to factors such as recreation facilities and access roads; in fact, careful development would hopefully avoid disturbance of important habitat, and properly managed wildlife development could even enhance wildlife benefits more than leaving the peninsula to natural changes. While this may be true in theory, it is difficult to see how the projected intensive use of the peninsula will allow for such avoidance of disturbance and enhancement of wildlife benefits.

One of the items involved in the comparison of alternative access roads is the impact of road use on the site of the old Bellefonte Town which is not part of the power plant site. At the start of construction only the existing access road will be in use, and its use will continue through most of the construction period. The condition of the buildings is classed as deteriorated which is one step above "ruins" in the U. S. Department of Interior's National Register of Historic Places - Nomination Form. The Alabama Historical Commission suggests that markers be erected and that one building (the Old Bellefonte Inn, circa 1845) be restored; the building need not be restored at its present location. TVA is negotiating with the University of Alabama to explore the historic significance of the area. In any event, the staff expects little change in the building condition whether the causeway is built or not. Thus, impacting the site of the old Bellefonte Town is not an issue; but rather the construction of the power plant is an opportunity to recreate a cultural image of the namesake for the project.

A major issue in the selection of alternatives involves the development and use of a resource, namely, the tip of the peninsula. At the present time about 25% of the tip is a wildlife management area under the supervision of the State of Alabama. Of the remaining ∿375 acres (exact boundaries of recreational area have not been specified) about 50% is wooded; the other half is open land. The staff believes that with the construction of the plant the tip has an isolation and habitat conducive to a natural wildlife area. With the existence of the public land between Town Creek and Mud Creek, a recreational area could be established there instead. (If the future need justified another area, the tip and a causeway could always be developed later.) With expected increasing future development along the reservoir, the general need for diversity of land use favors the use of the tip as a wildlife preserve without any recreational development.

Other points could also be discussed, but perhaps the increased dollar cost for the causeway alternative is one of the most significant points. Originally, TVA estimated that the incremental cost for the causeway would be $400,000. As TVA developed more information, the cost differential has been reduced to $160,000. The differential does not include the cost for land and utility relocation; in addition the maintenance of the county road is not included for the causeway alternative. Inclusion of these costs would increase the differential. There are also impacts on owners and developers of land depending on the access route. It would appear that the least impact would be through the use of the existing road. Another point that TVA makes is the distance for workers to travel. During construction, workers from the north would drive shorter distances whereas after construction the operating personnel residing in the Scottsboro and Hollywood areas would drive longer distances. During the construction period, there is an average of eight times as many employees as there is for operating the plant. Considering the other variables of time and distance and future developments in the area, the staff finds that this is not a significant argument one way or the other.

In summary, the staff favors the upgrading and use of the existing access road because such a choice appears to provide the best balance of the environmental and cost factors.

9.2.4 Transmission Lines

Alternative transmission line routing, construction practices and maintenance methods are discussed in detail in Sections 4.1.2 and 5.4.1.2 and Appendix B. The staff concurs with the applicant that the designated routes are to be preferred over the alternative routes suggested.

The transmission line construction sequence may be divided into three steps (see Sec. 3.3). TVA will study alternative clearing and maintenance methods as part of the Bellefonte-Widows Creek 500-kV line No. 2 and the Bellefonte-Guntersville area line. This Step One in the construction sequence is to be completed by the middle of 1976. Studies will also be carried out on other transmission facilities and routes in TVA's territory.

As described in Section 5.4.1 and Appendix B, the staff believes that TVA has not adequately considered alternative construction and maintenance methods for transmission lines. The staff therefore recommends that TVA submit for staff re-evaluation the methods for Steps Two and Three. The submitted information will have the then-current results of TVA's forementioned studies. This submittal shall contain the costs and the benefits of alternative construction and maintenance methods as TVA sees them at that time. Cost experience factors and the effects on vegetation, wildlife, and soil stability are among the items to be considered.

9.2.5 Thermal Discharge Facilities

The discharge facilities for the blowdown from the plant are still under study by the applicant. There are two broad categories of discharge structures -- surface and submerged. A surface discharge can be expected to produce fairly large areas of water with a temperature excess. The warm effluent usually spreads out in a rather thin layer above the ambient water.

Although a surface discharge can be designed for a considerable degree of mixing of the warm effluent with the cooler ambient, this is more easily accomplished by means of a submerged discharge. There are a variety of configurations possible, such as single round ports, multiple round ports, and slotted ports. Other variables which affect the degree of dilution are: (1) discharge angle relative to ambient current, (2) discharge velocity, (3) depth of discharge, and (4) interactions with the river bottom.

The TVA is performing the requisite hydraulic modeling studies in an effort to finalize the outfall location and configuration.

The TVA shall submit for approval their selection of location and design configuration of the thermal discharge facilities.

9.2.6 Radwaste Systems

The TVA is considering several alternative methods for disposing of the tritiated water removed from the primary coolant system. These alternatives include: (1) the discharge of excess tritiated water to the atmosphere as water vapor; (2) the discharge of such water liquid to Guntersville Reservoir; (3) off-site disposal in solid form; and (4) off-site disposal in liquid form. The TVA has not yet chosen a method; however, it has been advised that the trucking of liquid radioactive wastes is not acceptable under the "as low as practicable" guidelines.

When TVA chooses a method from among the other alternatives, it shall be submitted for evaluation.

9.2.7 Access Railroad[44,45]

The TVA considered two alternative routes for the construction of a railroad spur to the plant site. The first alternative (Alternative No. 1) and that being proposed by TVA as the most desirable, is a 3-mile spur which takes off from the main line of the Southern Railroad at a point about one mile southwest of Hollywood. This route follows an eastward course to the plant site (see Figure 9.2) and crosses U.S. 72 near the Scottsboro bypass intersection. The second alternative railroad access route (Alternative No. 2) would cut off the Southern Railroad main line about 1 1/2 miles northeast of Hollywood and would follow a south-southeast direction to the plant site. This alternative would intersect U.S. 72 at a point about 6,000 feet northeast of the Bellefonte Street - U.S. 72 intersection and would also cross Town Creek.

Either access route would provide the necessary functions required for power plant construction and operation. Thus, the beneficial aspects of either railroad spur relative to power plant operation would be equal. Both routes would also enhance the potential for industrialization along the rail spur. Alternative No. 1 passes through land which has been designated by TARCOG for industrial purposes. However, the staff has observed that land near the Scottsboro bypass intersection on U.S. 72 is currently being developed largely for residential and commercial use. On the other hand, Alternative No. 2 passes through land which has been designated by TARCOG for low and medium density residential development and for recreational purposes. The staff did not observe significant residential development currently taking place along this route although the route would pass by recreational land near Town Creek.

The primary disadvantages of Alternative No. 1 are that this route (1) would be slightly longer than Alternative No. 2 and would thus require 5 acres of additional land; (2) would require approximately 200,000 cubic yards more earth borrow that Alternative No. 2;[45] and (3) would create some adverse impacts primarily from dust and noise inherent in construction and filling across a small inlet of the Town Creek embayment.

The primary disadvantage of Alternative No. 2 include: (1) the splitting of several large tracts of land; (2) the at-grade crossing of one more county road than Alternative No. 1; (3) the possibility that two or three residences might have to be relocated; (4) the temporary impact on the Town Creek embayment from siltation and turbidity during construction; and (5) the greater amount of excavation required, possibly through rock, which could increase the cost of this alternative.

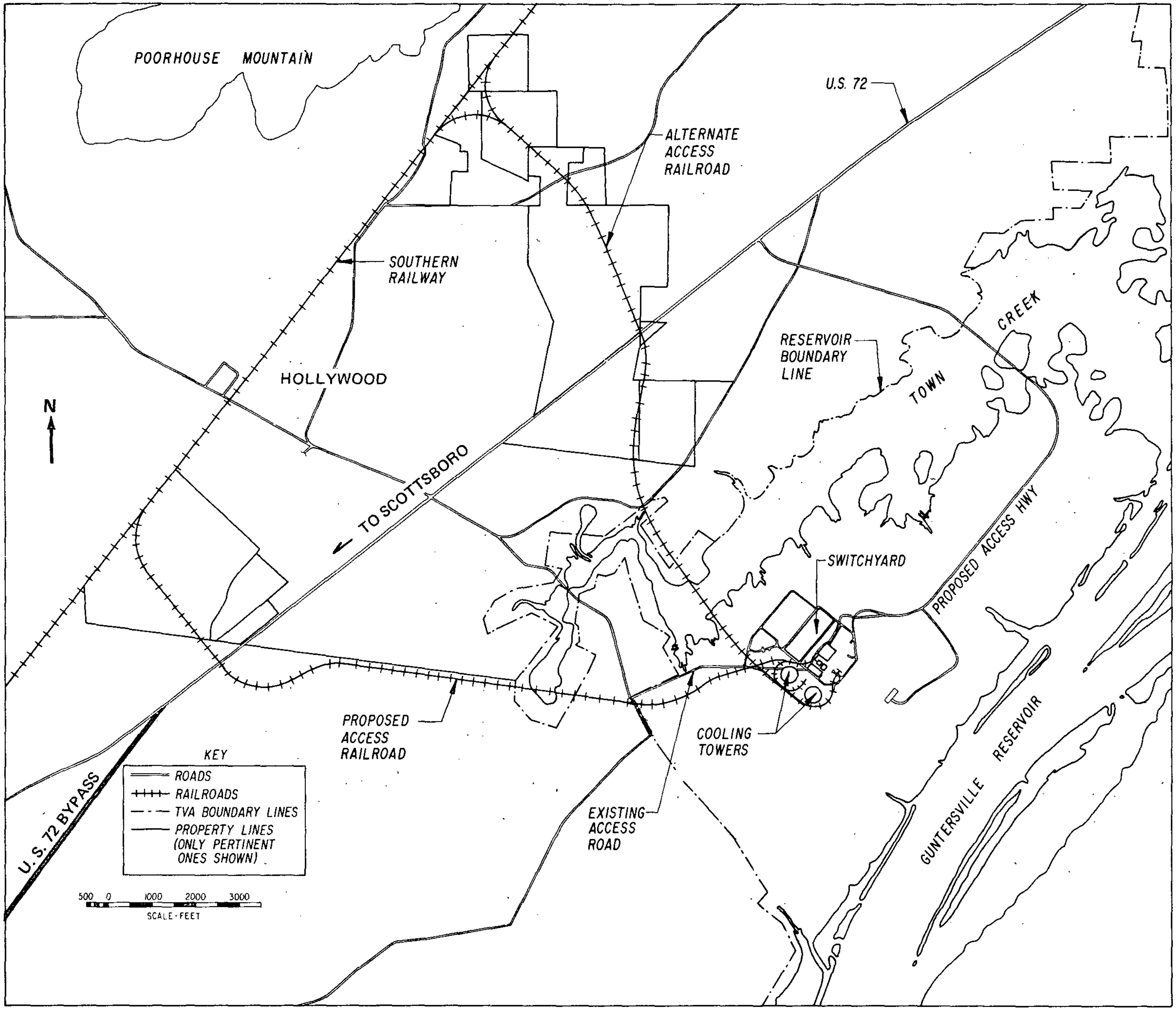

FIG. 9. 2. PROPOSED AND ALTERNATE ACCESS RAILROAD ROUTINGS.

Alternative No. 2 would follow one of the proposed transmission right-of-way corridors for some distance thereby minimizing the number and size of access routes required for rail, roadway, and electric transmission. The proposals made by TVA concerning access right-of-ways to the site from the north would require the purchase of three right-of-way corridors in addition to the existing county access road--one each for rail, highway, and transmission. If the staff's preference to locate the highway access, via the existing roadway is implemented only two new right-of-ways would be required. Furthermore, if Alternative No. 2 were adopted for the rail line, possible only one new right-of-way would be required to be purchased.

In summary, the route for Alternative No. 1 is consistent with TARCOG planning studies but seems to be inconsistent with current developments near U.S. 72. The route for Alternative No. 2 does not seem to be incompatible with present developments but is not consistent with TARCOG studies. However, on the whole, the staff finds that neither alternative rail spur access route offers a significant advantage over the other.

9.3 ALTERNATIVES TO NORMAL TRANSPORTATION PROCEDURES

Alternatives such as special routing of shipments, providing escorts in separate vehicles, adding shielding to the containers, and constructing fuel recovery and fabrication facilities on the site rather than shipping fuel to and from the plant have been examined by the staff for the general case. The impact on the environment of transportation under normal or postulated accident conditions is not considered to be sufficient to justify the additional effort, cost, and/or environmental impact required to implement any of the alternatives.

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10. BENEFITS, COSTS AND RESOURCE EFFECTS OF PROPOSED PLANT CONSTRUCTION AND OPERATION

The economic and social effects of construction and operation of the Bellefonte Nuclear Plant have been evaluated both quantitatively and qualitatively with respect to near-term and long-term costs and benefits.

10.1 INTRODUCTION

The benefits, costs, and resource effects from the construction and operation of this station depend on the position of the viewer. For example, the benefits may outweigh the costs to the people receiving the power, but the local people might be inflicted with higher costs than benefits; the converse of this situation may also occur. A brief discussion of primary and secondary benefits, internal and external costs, local effects, and resource commitment will be made.

The primary benefits are the kilowatts and kilowatt-hours from the plant. Secondary benefits arise indirectly from the project, e.g., research and development applicable to other activities. These benefits are paid for by the project. In some cases, such as cooling lake use for recreation and the visitor centers, an added expense is incurred based on incorporating features in the project that have public appeal.

Internal costs are those included in the dollar price of power and energy; external costs are those paid for by the society at large and not included in the dollar price of power and energy. External costs are usually difficult to quantify.

Local benefits and costs depend on the boundary drawn by the assessor. Taxes from the plant, for example, may represent a real benefit to a community; however, they represent a transfer payment within our society. Employment is another local effect; for a community with a high unemployment rate, the plant can be a real benefit.

The commitment and use of resources are part of the infrastructure of our society. Man continues to use resources available to enhance his individual good. The desired specific commitment, or expenditure, through time of these resources should be for the collective good of all individuals. To the extent that resource prices are real, i.e. not distorted by incentives, special taxes, or improper price regulation, the balancing of the near-term commitment of resources against non-development or non-use in the near term is carried out in the normal business operations of our society.

10.2 PRIMARY AND SECONDARY BENEFITS FROM THE PLANT

10.2.1 Energy Production

The primary benefits from completion and operation of the Bellefonte Nuclear Plant result from (1) the annual generation of electricity which when levelized will yield about 15 billion kilowatt-hours, and (2) the increased reliability within the TVA system because of the addition of two 1170-MWe units or a total plant capacity of 2340 MWe.

For the purpose of estimating the present value of the revenue received from the sale of this energy, it has been assumed that the Bellefonte plant will operate as shown in the following table during its 30-year life:

Years	Capacity Factor	Annual Net Generation (million kWh)	Total Transmission and Distribution Losses (million kWh)	Annual Energy Available For Sale (million kWh)
1-15	80%	16,399	1,123	15,276
16-25	55%	11,274	772	10,502
26-30	40%	8,199	562	7,637

10.2.2 Market Value of Electricity

In 1972, TVA estimated the average price of electricity to all their customers to be 1.05 cents per kilowatt hour.[1] The cost of a unit of electric energy to the individual user varies widely depending on the consumer class and quantity consumed. Based on the present rate structures of TVA and the distributors of power, 1974 average prices to the ultimate consumer are as follows:

Residential	1.519 ¢/kWh
Commercial	1.421 ¢/kWh
Industrial	0.933 ¢/kWh
Government	0.788 ¢/kWh
Other	1.276 ¢/kWh

On the TVA system, like most systems throughout the country, electric rates historically declined until the mid-1960s. Based on the recent past and general trends, the rates are expected to increase.

If one assumes a 2 percent real rise per annum in the price of electricity, the average price would be 1.59¢ per kilowatt hour in 1990 and 1.94¢ per kilowatt hour by the year 2000. The rise in price is largely a system-related rise in revenue requirements rather than a rise related to the cost of power from the Bellefonte plant, although some operating costs are expected to increase.

10.2.3 Primary Benefit by User Category

The applicant estimates, on the basis of fiscal year 1973 data plus extrapolation of estimated incremental demand increases, that the anticipated growth in generation and consumption in total and by consuming sector will be as shown in Table 10.1. As the projected figures indicate, total sales are estimated to rise by 56% between 1973-1980.

Between 1973 and 1980, residential consumption is anticipated to rise by 51 percent while its share of total consumption is anticipated to decline from 30.6 percent in 1973 to 29.6 percent in 1980. Based on a projected residential rate of 1.70 cents per kilowatt-hour and a stable distribution by consumption user categories, with an 8% discount factor, the present worth value of residential revenues associated with the Bellefonte plant would be $810 million.

During the 1973-1980 period, generation sales to the industrial sector is anticipated to increase by 49 percent. Anticipated industrial demand relative to the total electricity demand at TVA will decline from 35.8 percent in 1973 to 34.1 percent in 1980. Based on the 1980 projected kilowatt-hour price of $1.05 per kilowatt-hour, the total present worth revenue from sales represented by the industrial sector, would be $611 million over the life of the Bellefonte plant.

In 1973 the commercial sector accounted for 12.9 percent of kilowatt-hour sales. Between 1973 and 1980, the consumption of electricity is anticipated to grow by 74 percent with the average load growth increasing to 14.0 percent of total energy sales. Based on the 1980 projected price of $1.60 per kilowatt-hour, the total present worth revenues from sales will amount to $378 million for the 30-year plant life.

In a similar manner, the Government sector is anticipated to increase its share of the total from 17.7 percent in 1973 to 18.8 percent in 1980. Growing demand for enriched uranium processed in the Government-owned gaseous diffusion plants will contribute to the 65 percent rise in Government energy requirements during the 1973-1980 period. Based on the projected 1980 revenue rate of 0.89¢ per kilowatt-hour, present worth revenues from plant sales to the Government sector, over the life

TABLE 10.1. Current and Projected TVA Sales in Billions of kWh by Consuming Sector

	1973 Load	*% of Total*	*1980 Load*	*% of Total*
Residential	30.6	29.6	46.3	28.7
Commercial	12.9	12.5	22.5	14.0
Industrial	37.1	35.8	55.3	34.1
Government	18.3	17.7	30.3	18.8
Other sales	4.6	4.4	7.1	4.4
Total sales	103.5	(100)	161.5	(100)

From TVA DES p. 8.1-1.

of the plant, will amount to 284 million. The "other sales" sector is anticipated to remain steady at 4.7 percent of the energy sales. The projected price of 1.44¢/kWh will yield $109 million in sales from the Bellefonte plant. We consider these estimates to adequately reflect consumer usage.

Based on an 8% discount rate, a 2 percent per year "real" price rise,* and a 30-year plant life, our estimate of the market value of electricity revenues brought to present value in 1980 in total and by consuming sector is shown in Table 10.2. Consuming sector shares are assumed to remain stable from the startup of the plant in 1980 through the 30-year projected life of the Bellefonte plant. The energy production over the 30-year life of the plant totals 400 billion kilowatt-hours with energy consumption totaling 372 billion kilowatt-hours from the various consuming sectors when allowances are made for transmission and distribution losses.

The market price of electricity represents only a partial measure of its true worth. An additional value can be assigned to electricity by measuring the difference between the market price and what one would be willing to pay rather than do without various uses of electricity. This difference constitutes "consumer surplus."[2] Since 1967, the applicant's average price of electricity has increased about 62 percent. Coupled with these rate increases has been a steady growth in TVA's peak demand and energy load. Consequently, since total and per capita demand continued to expand in the midst of substantial rate increases, it is concluded that electric power is in all probability associated with a sizeable consumer surplus.

There are no plans for providing other products or services from the Bellefonte site. Thus, revenues from generation will represent the total revenues of the facility.

10.2.4 Secondary Economic Benefits

10.2.4.1 Research

The applicant's proposed environmental monitoring programs will provide useful data on atmospheric, terrestrial and aquatic conditions at and near the site. Data from this instrumentation will be available to interested individuals in research activities.

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*The combination of an 8 percent discount rate with a 2 percent "real" rise in constant dollar prices means an effective discount rate of 5.88 percent. The 8 percent discount rate is based on the current cost of money to TVA.

TABLE 10.2. Estimated Present Worth Revenues by Consuming Sector and in Total

Consuming Sector	*Revenues, millions*
Residential	$810
Commercial	378
Industrial	611
Government	284
Other	109
Total	$2,192

The staff believes that additional research benefits will occur through the assessment of the historical and archeological significance of the proposed site and extensive ecological surveys of the Bellefonte area.

10.2.4.2 Education

A visitor's center is planned to be constructed on a hill overlooking the site. The center will be open to the public during most of the construction phase and during operation of the plant. Although no specific plans and details have been made available concerning the scope and operation of the center, typical facilities at other centers include a building housing displays which describe how a nuclear power plant operates, generous landscaping, parking spaces and other conveniences. The location of the plant in relation to nearby recreational developments will provide a unique point of interest for both educational and recreational purposes. The educational benefits of the Bellefonte plant are estimated by the applicant to be 60,000 visits per year after the center is completed. The staff believes that TVA's estimated annual value for these visits of $45,000 is reasonable.

10.2.4.3 Recreation

The recreational benefits of the Bellefonte Nuclear Plant will be derived from the visits which will be made to the plant each year. The applicant has estimated that there will be 4,000 visits each year. Assuming that each visit is worth $0.75, the annual benefit from the power plant for recreational purposes would be $3000 per year.

10.3 LOCAL ECONOMIC AND SOCIAL BENEFITS

While the primary benefit of the facility is the power used by the consumers, other benefits are derived from the employment during the construction and operation of the facility. Payments are made to the states by TVA "in lieu of taxes" and the local and regional economies are stimulated as a result of this facility.

10.3.1 Payments in Lieu of Taxes

TVA makes payments in lieu of taxes[3] on its power properties and operations even though it is not subject to taxation in the usual sense by State or local governments. Section 13 of the TVA Act requires TVA to pay annually to the States in its service area five percent of its gross revenues from sale of power in the preceding fiscal year, excluding revenue from power sold to Federal agencies. One-half of the annual payment is divided among the States in the same proportion that the investment in TVA's power property in each State relates to the total investment in TVA's power property; the remaining half is divided in the same proportion that TVA's power revenues in each State relate to TVA's total power revenues.

The Act also specifies that TVA pay directly to counties amounts equivalent to the former county and district taxes paid on properties which were taxed as power facilities at the time TVA acquired them, reservoir lands allocable to power, and underground coal reserves acquired for power use. These payments are minor and are deducted from the amount otherwise payable to the State in which the counties are located. The amount of these payments to Alabama counties in TVA's service area made in the fiscal year ending June 30, 1972 was $39,377 of which Jackson County received $4953.[4]

Five of the States to which TVA makes payments redistribute to local units of government all or a portion of these funds in accordance with State laws. Three, Alabama, Illinois, and Virginia, of the eight States in which TVA power is sold make no redistribution to county and municipal governments. The amount of the payment by TVA to the State of Alabama in the fiscal year 1973, was $6,271,018. The projected payment by TVA to the State of Alabama for 1974 is $7.2 million.

The TVA payments to the State of Alabama are included,[5] along with other sources of revenue, in the General Fund. The General Fund is distributed to support the State police department, health department, judicial court systems, district attorney's offices, board of corrections, and all other departments, boards and commissions which are not supported by "earmarked" funds such as hunting and fishing licenses and gasoline taxes. None of the TVA payments in lieu of taxes made to the State of Alabama reach any of the State, county or local school districts. The operating budgets of the school systems are provided for by other sources of revenue, the most important of which are State income and sales taxes.[6]

TVA sells power directly to 160 municipal and rural electric distribution systems, which pay State and local taxes or make payments in lieu of taxes.

Based on the projected average annual value of energy to be generated at the Bellefonte plant minus the amount sold to the

Federal Government, the annual TVA payment in lieu of taxes which will be distributed to the eight states in its service area is approximately $6,800,000.[7] The portion of this amount which the staff estimates will be received by the State of Alabama is approximately $4 million.

We have concluded that the only direct tax impact which the governmental units of Jackson County, Scottsboro, Hollywood, and their school districts will experience as a result of the location of the plant will be caused by the removal of 1500 acres of land from the tax rolls and the attendant loss of property taxes paid by the previous private owners. There is a possibility that new demands placed on school districts will be offset by payments from the Federal Aid to Impacted Schools Program.

10.3.2 Other Taxes

The major indirect tax impacts which will be experienced by the governmental units of Jackson County, Scottsboro, Hollywood, and their school districts are the additional property and sales taxes paid by new resident temporary construction workers and permanent plant employees. The staff in general, believes that the costs of increased services required for new residents are not adequately covered by their additional property and sales taxes when they are not supplemented by additional revenue from new industry.

During the peak construction year with an average of 2200 workers employed, the staff estimates that the communities within 20 miles of the site could realize the benefits of approximately 700 additional jobs. Consequently, unemployment, which stood at slightly more than 6 percent in Jackson County in April 1972,[8] should be reduced as a result of plant construction. Given a median wage of $8200 per year,[9] the staff also expects that because the project will pay relatively high wages ($10,000), some persons now working in other industries can be expected to shift to construction work.

A major impact on wages is likely to occur in both construction and non-construction activities. Non-construction employers will increase wage rates in order to retain existing employees or to obtain replacements for those shifting to construction work. Non-union construction workers now working at rates lower than union scale will be drawn to the power plant project because it will offer better wages. Employers in such instances will have to compete with the power plant for replacement workers. Consequently, wage rates for most construction activities within the region probably will increase. However most of the 170 permanent highly skilled jobs will be filled by personnel who will most likely be new residents in the area.

10.4 COSTS

10.4.1 Internal Costs

The primary internal costs of the Bellefonte Nuclear Plant are the capital cost of the facilities, including both plant and transmission, the fuel costs, the operation and maintenance costs, and the plant decommissioning costs.

The total capital cost of the Bellefonte Nuclear Plant has been estimated by the staff to be $901 million. Table 10.3 summarizes the major cost categories of the proposed TVA plant.

The power production cost, including both fuel and operation and maintenance costs, have been estimated by the applicant to be 2.2 mills/kWh. As mentioned in Section 9, these real costs are not expected to increase significantly over the life of the plant. Based on a decreasing capacity factor as discussed earlier in this section and an 8 percent discount rate, the present worth production cost is calculated to be $350 million.

No specific plan has been developed for the decommissioning of the Bellefonte Nuclear Plant. The applicant has stated that plant decommissioning will not introduce any technical problems that differ significantly from those encountered during normal refueling and maintenance operations with the reactor. The applicant has not submitted an estimate of decommissioning costs. However, based on estimates of other nuclear reactors,[10-12] the staff has estimated the cost of decommissioning the Bellefonte Nuclear Plant, which would include the removal of both cores from the two reactors, decontamination of the remaining components and building isolation, to be about $25 million on a current cost basis.

10.4.2 External Costs

External costs associated with construction and operation of the Bellefonte Nuclear Plant are far ranging. These external costs include inflationary pressures on prices during the construction years, increased congestion or stress on local public facilities and services, increased usage of streets and highways, greater water utilization and sewage treatment, increased enrollment in local schools, greater burdens on existing medical facilities, and increased demand for local housing. All of these external costs and others have been examined by the staff and are presented in greater detail in Sections 4.4.3 and 5.5.

TABLE 10.3. Capital Cost of the Bellefonte Nuclear Plant (Millions of Dollars)

Land and land rights	1.3
Structures and improvements	73.1
Reactor plant	135.8
Turbogenerator plant	150.5
Accessory electrical equipment	39.8
Miscellaneous power plant equipment	6.5
Spare parts and contingency	27.8
Subtotal -- steam production plant	434.8
Transmission plant	17.5
Construction facilities equipment and service	24.2
Engineering and construction management	61.5
Other	18.5
Interest	149.5
Escalation	195.4
Total	901.4

References

1. Tennessee Valley Authority, "Draft Environmental Statement, Bellefonte Nuclear Plant," Vol. 1, Dockets Nos. 50-438 and 50-439, Chattanooga, Tenn., p. 8.1-2, March 6, 1973.

2. Samuelson, P. A., "Economics: An Introductory Analysis," (New York: McGraw-Hill Book Co., Inc.), 1961, p. 446.

3. "TVA Power: Payments in Lieu of Taxes," Information Office, TVA, pp. 1-3, 1972.

4. Ibid., p. 8.

5. "State of Alabama Executive Budget -- State General Fund and Trust Funds for the Fiscal Years Ending September 30, 1974 and September 30, 1975," Finance Dept., State of Alabama, pp. 7-33.

6. "State of Alabama Executive Budget — Educational Funds for the Fiscal Years Ending September 30, 1974 and September 30, 1975," Finance Dept. State of Alabama, p. 5.

7. Letter from J. P. Darling, TVA, to G. L. Dittman, AEC, April 12, 1974.

8. "TARCOG Economic Atlas," p. EC-3.

9. "Alabama Communities in Perspective," Alabama Development Office, Office of the Governor, State of Alabama, Montgomery, p. 62, May 1973.

10. "Final Environmental Statement, Prairie Island Nuclear Generating Plant," USAEC, Docket Nos. 50-282 and 50-306, p. VIII-2, May 1973.

11. "Final Environmental Statement, North Anna Power Station," USAEC, Docket Nos. 50-338, 9, and 50-404, 5, p. 8-8, April 1973.

12. "Georgia Power Company, Vogtle Nuclear Plant, Construction Permit Stage," Docket No. 50-242, 5, 6, 7, p. 9.1-4, Aug. 1, 1972.

11. BENEFIT-COST SUMMARY

11.1 BENEFITS

11.1.1 Power and Energy

The primary benefit from the construction and operation of the Bellefonte Nuclear Plant will be the average annual generation of about 14 billion kilowatt-hours of electrical energy and the increased reliability of electrical service within the TVA system due to the addition of 2340 MWe of generating capacity. The value of this power has been estimated by the staff to be about $2.2 billion on a present worth basis when evaluated over the 30-year life of the plant. This value, of course, accrues not only from the generating capacity, but also from the transmission, distribution, and management components of the total electrical system. Based on the applicant's projections, about 66 percent of the electrical energy on the TVA system in 1982 will be supplied to municipalities and rural electric cooperatives, about 16 percent will be consumed by Federal agencies, and the remaining 18 percent will be required by directly served industries.

11.1.2 Payments in Lieu of Taxes

Based on the projected average annual value of electricity to be generated at the Bellefonte Nuclear Plant, the applicant has estimated that payments in lieu of taxes to the eight states in its service area will be approximately $6.8 million per year. Electricity sold to Federal agencies was not included in this approximation. The staff has estimated that about $4 million of these payments will be distributed to the General Fund of the State of Alabama.

Indirect tax benefits will accrue to local governmental bodies by the increased sales and property taxes paid by new residents of the area.

11.1.3 Local Employment

The Bellefonte Nuclear Plant will provide 170 permanent jobs when construction is complete on the first unit in October 1979. The applicant estimates that the mean annual salary of these employees based on present pay scales will be about $11,250. During the construction of the plant, approximately 6.4 million man-hours will be expended in order to complete the facility. This will provide 2300 jobs for workers during the peak construction period.

At current salary levels, the permanent jobs created by the power plant would inject about $2 million per year into the local economy. During plant construction, the construction workers could be expected to introduce about $90 million into the local area.

11.1.4 Recreation

Recreational visits to the Bellefonte plant are estimated to be 4000 visits per year. Assuming that each visit is valued at $0.75, the annual value of recreation on the site would be $3000 per year.

11.1.5 Education

The applicant has estimated that the educational benefits of the Bellefonte Nuclear Plant would be derived from approximately 60,000 visits per year after the plant is operational. Assuming the value of each visit to be $0.75, the annual value of the educational visits would be $45,000.

11.2 COSTS

11.2.1 Generating Costs

The staff has estimated that the total generating cost on a present worth basis with a discount rate of 8% will be about $1.3 billion over the 30-year life of the plant. This generating cost is comprised of the initial investment cost and operating costs including fuel and maintenance expenses. The estimate of decommissioning costs is $25 million. Neglecting inflation and any increases in real costs, the staff calculates that the present worth of this future expenditure is not significant compared with the generating costs.

11.2.2 Land Use

About 1500 acres of land will be included in the exclusion area boundary plus part of Town Creek embayment. Development of the nuclear facility will preempt about 250 acres of land which until now has been used primarily for grazing and agricultural purposes. The applicant will also acquire right-of-way easements for transmission line corridors which will require about 1550 acres.

11.2.3 Water Use

The Bellefonte Nuclear Plant will require approximately 148 cfs of water from Guntersville Reservoir when the plant is operating at full load. On the average, about one-third of this amount will be lost through evaporation and drift. The water returned to the reservoir will have only a small local temperature effect and will have a dissolved solid concentration of no greater than two times the reservoir concentration. The applicant has stated, and the staff concurs, that all cooling tower blowdown will be stopped when there is insufficient flow of river water available to provide dilution of the blowdown.

11.2.4 Air

Fogging from the natural-draft cooling towers is expected to increase by one to two days per year. Icing is not expected to occur. Water transportation would not be affected with the use of natural-draft cooling towers. The effect on ambient air quality of chemical discharges from the auxiliary steam boilers and the diesel generators is expected to be minor and will not produce any perceptible impact.

11.2.5 Ecological Impacts

11.2.5.1 Terrestrial

Land will be removed from natural production where buildings, parking lots, roads, etc. are built. There will be some eorsion of the soil onsite and on the transmission line rights-of-way. The clearing of vegetation on transmission line rights-of-way may not be beneficial to wildlife.

Terrestrial vegetation, animal and microbial communities may be altered by cooling-tower operation because of increased moisture, decreased solar radiation, or chemicals contained in drift. However, such effects, if they occur, may not be measureable (neither the abiotic nor the biotic effects), except perhaps over the lifetime of the station.

11.2.5.2 Aquatic

Transmission line, road and site construction activities will lead to increased nutrient and suspended solid (turbidity) loads in adjacent waterways. Such effects and their attendent impacts on aquatic biota are expected to be temporary. Siltation may lead to long-term effects on biota, but careful planning and the use of the proper methods and equipment should minimize these impacts.

Several acres of shallow waters (in Town Creek and overbank areas) will be removed from benthic and fish production. Because of the location of the proposed intake structure, the loss of larval fish is expected to be higher than it would be if the intake were at mid-channel. Impingement of small fish is also expected due to the dead-end design of the intake structure, even though flow velocities are quite low. The location of the discharge diffuser in deep mid-channel should minimize possible thermal impacts, none of which is expected to be detectable at the population level. Likewise, compliance with the NPDES permit is expected to hold deleterious chemical discharges to levels at which impacts could not be detected at the population level.

The naturally occurring external and internal sources of radiation near the plant site result in a dose of about 150 mrem per year to an individual. A hypothetical individual who remained at the Bellefonte plant site continuously would receive an annual total body dose of about 0.5 mrem from gaseous effluents or about 0.3 percent of the natural background radiation. The total man-rem received by the 1980 estimated population of 961,000 persons who will live within a 50-mile radius of the Bellefonte plant would be about two man-rem per year from all pathways; the potential dose within and beyond the 50-mile radius from transportation of the fuel and wastes from the plant amounts to about 14 man-rem per year. The staff concludes that operation of the Bellefonte plant will be an extremely minor contributor to the radiation dose to the public compared with the dose it would normally receive from natural background radiation. The estimated cost of this impact is between \$160 and \$4000 per year.

11.3 COSTS AND BENEFITS

A summary of the costs and benefits of the proposed facility is given in Table 11.1.

11.4 BALANCING COSTS AND BENEFITS

11.4.1 For the County in which the Plant is Located (Jackson Co.)

The county will absorb the direct and many of the spinoff costs associated with plant construction and operation. Increased county expenditures for roads, police, schools, and many other services will undoubtedly be required. To defray some of these expenditures, Federal impact aid could become available to school systems. In any event, TVA has indicated that school facility planning, mobile classrooms, or payments in lieu of classrooms will be made available if justified on the basis of need. In addition to increased demands on public services, some noise and other deleterious impacts such as on scenic values will certainly occur and especially during the construction phase. However, little long-term degradation of the environment is anticipated.

TABLE 11.1. Costs and Benefits of the Proposed Facility

Benefits:	
Levelized electrical energy sold	14 billion kWh per year
Generating capacity	2,340,000 kilowatts
Employment:	
Permanent	170 jobs
Construction during peak	2,300 jobs
Recreation[a] and Education	64,000 visits per year
In lieu of tax payments	$6,800,000 per year
Costs:	
Present worth generating cost	$1.3 billion
Land use:	
Plant proper	250 acres
Exclusion area	1250 acres
Transmission right-of-way	1550 acres
Water consumed (maximum)	74 cfs
Water intake (maximum)	148 cfs
Fogging	1 or 2 days per year
Icing	small potential
Radiological:	
Cumulative population dose (50-mile radius)	2 man-rem per year (less than .001 percent of dose due to natural background)
Transportation of fuel and wastes (within and beyond the 50-mile radius)	14 man-rem per year
Biological	Some destruction of aquatic life in Guntersville Reservoir.

[a]Includes visitor's center only

In the construction and operation of most large power plants, some number of individuals or families may be relocated or displaced. This action can be viewed as beneficial for some parties while it presents hardships to others. In certain cases, this relocation has increased the quality of life of the impacted party. On the other hand, persons with strong ties in the immediate vicinity of the plant may have their life styles and heritages changed or disrupted. In either case, the impact of relocation must be judged as a cost or benefit on an individual basis.

On the positive side, the county will benefit from the increased employment and the higher income level derived from the proposed plant. As plant-related economic activity increases and as new income flows into the economy, the county will receive higher tax revenues from its share of the income, property, and sales taxes. In addition, the county will benefit from recreational improvements and research projects by added inflow of money and by more knowledge of local history.

During the seven years required to build the plant, an average construction force of 1300 workers will be employed at the site and will earn a total of approximately $91 million. Furthermore, 170 permanent jobs will be created for the operation and maintenance of the plant, and the employees will probably reside in the county. Large labor demands will clearly increase near-term employment with a significant increase in the attendant wage level because of TVA's relatively high pay rates. In terms of the desire of the county leaders to expand the industrial base and employment of the county, the construction and operation of the Bellefonte plant is totally consistent.

Most of the tax benefits will necessarily come as a result of the multiplier effects associated with the facility since TVA's payments in lieu of taxes will go directly to the State's general fund rather than being redistributed to the counties as done by some states. Consequently, county revenues will be derived from the generated income, property, and general sales tax and other forms of ex-plant taxes.

It is the staff's opinion that, on balance, the county will benefit from the construction of the plant.

11.4.2 For Towns and Cities Receiving Substantial Impacts (Scottsboro and Hollywood)

Much like the county in which they are located, Scottsboro and Hollywood will experience the brunt of the social and economic costs associated with the construction and operation of the Bellefonte plant. These towns will incur costs primarily due to the increased pressures on public facilities and services.

In both Scottsboro and Hollywood, the largest service costs will be associated with sewage facilities and schools. Additional demands will be placed on general municipal services as well. Presently, Hollywood does not have a centralized sewage treatment facility and Scottsboro does not have available capacity to meet the growth caused by construction of the Bellefonte plant. One means of financing a portion of the cost of the required treatment plants is through Federal aid; however, such aid has been impounded by the present administration. Without Federal or State funds, the municipalities will have to rely on septic tanks to meet this expanding waste load. Nevertheless, on October 5, 1973, the Alabama State Water Improvement Commission authorized funding of the engineering design work on the Scottsboro waste treatment plant which infers it has a high priority within the State.[1]

These cities similarly face the prospect of an inadequate number of teachers and classrooms for school children of TVA workers. If Federal impact aid is not available, TVA has indicated that school planning assistance and mobile classrooms may be supplied, or payments can be made to the community in lieu of mobile classrooms if needed. TVA precedent for such action was noted at the Watts Bar and Cumberland plants.[2] While a near-term peak demand will be caused by the need for classes for construction worker children, the more permanent or long-term impact on the schools will be from the school children of TVA's 170 permanent employees. Based on current local expenditures per school child, the staff estimates that the added operating costs will amount to $68,000 a year to the school budget during plant operation.

The Scottsboro city government spends approximately $90 per capita on municipal services such as police, fire protection, and recreation. Assuming an average family size of 3.5 for each permanent employee associated with the Bellefonte plant, the annual long-term cost to the city for these services may be expected to rise by approximately $53,000 per year. The cost of such services at the peak of construction is estimated to be $83,700.

Based on past TVA experience, it is anticipated that construction and operation of the Bellefonte plant will promote economic activity in the local area. Direct local outlays for labor, goods and services are estimated to be approximately $13 million per year during the construction phase, and $2 million per year during plant operation. To a large extent, these expenditures will stay within the Scottsboro-Hollywood area and will further stimulate economic activity and local income within these municipalities. As local income and output rises, the cities will benefit from higher tax revenues via its share of general sales tax, excise tax, and larger property tax revenues. In the staff's opinion, the plant will, on balance, result in greater benefits than costs to these communities. A short-term net cost may exist during the peak of construction activity, but a long-term net benefit will exist throughout the 30-year operation of the plant.

11.4.3 For the State in which the Plant is Proposed (Alabama)

The State of Alabama will benefit from the location of the Bellefonte Nuclear Plant through the availability of electric generation for consumption by residents of northern Alabama. As a result of plant operation, the State will receive payments from TVA in lieu of taxes along with other states in the TVA system. The staff estimates that Alabama's share of the payment total will amount to $4 million. Similar to the county and towns near the plant site, the state will further its employment goals by the addition of an average of 1300 jobs per year during the construction phase. The number of jobs added to the state will be greater than that of the county in which the plant is located since it is estimated by TVA that approximately 70 percent of the construction workers will be commuting for a distance of more than 20 miles. All these developments will contribute to increased state income, employment, retail and wholesale trade, and taxes. The existence of relatively low-cost power will also increase the potential for additional jobs throughout the northern part of Alabama.

On the cost side, some 10 billion gallons of water per year will be evaporated as a result of the cooling requirements of the plant. However, this evaporation rate represents about 0.1 percent of the annual flow of the Tennessee River past the plant at this site. It should also be noted that the use of the 1500-acre site for power plant purposes forecloses the use of the site for other industrial purposes.

On balance, the staff concludes that the benefits in terms of construction and permanent employment, power to support jobs, increased taxes, payments in lieu of taxes, and added recreational lands clearly offset the impact upon water resources and land use. We conclude that the plant would be a net benefit to the State.

11.4.4 For the Multistate TVA Grid

Residents of the multistate TVA system will obtain the primary benefits from the Bellefonte facility in terms of available power for consumption. Increased availability and maintenance or enhancement of power system reliability are prerequisities for further increases in employment, improvements in living standards via higher income levels and economic activity within the region. It is a benefit to the entire system to have: (1) a relatively low-cost plant, and (2) additional reserves on the system to increase the system reserve margin to an acceptable level.

11.4.5 For the Nation as a Whole

The nation as a whole shares many of the benefits that accrue to the State of Alabama and consumers of electric power. The construction and operation of the plant will result in a larger gross regional and national product through new jobs created by construction and operation of the plant. Much of the work, however (such as uranium mining, milling, and fabrication, turbine generator and nuclear steam supply steam construction), will take place outside the region. It is likely that numerous other components will be manufactured and fabricated outside the TVA system. Consequently, there will be substantial multiplier effects of economic and employment activity resulting from the decision to construct and operate the Bellefonte plant. The selection of a relative low-cost plant, such as the Bellefonte Nuclear Plant, will mean greater cost-effectiveness by supplying the needed electrical generation with less outlay of resources.

In addition, the plant will result in increased system reliability which, given some inter-ties provides national benefits by reducing the potential costs -- direct and indirect -- associated with outages. Land costs will be associated with the foreclosing of 1500 acres of land from other uses; however, the benefits to the nation exceed the costs envisioned by the construction and operation of the facility.

11.4.6 Mankind's Needs: Present Vs. Future Generations

To the extent that resources will not be reuseable, future generations will be denied their use. Nevertheless, the creation of plutonium in the reactor will partially offset the depletion of uranium that occurs in supplying society's energy needs. Such plutonium creation will especially become an asset in the future if the breeder reactor becomes a commercial reality. Plutonium from light water reactors will be used to initially fuel such breeders.

Because the plant utilizes uranium instead of fossil fuels, our fossil resource base is extended. Uranium consumptive use is virtually limited to electric power, while fossil fuels have many alternative uses -- in power plants; in mobile sources such as trucks, autos, trains and airplanes; in stationary source consumption such as in industrial hydrocarbon products and process heating as well as heating and cooling of residential, commercial, and industrial facilities. The use of nuclear energy instead of fossil fuels provides the basis for obtaining relative low-cost energy for the present generation while permitting the use of our fossil fuel resources for a variety of applications in the future.

Although decommissioning the plant may make several acres unavailable for other uses, the location of a future power plant at the same site would result in a reduced impact on future generations. The amount of land that would be made unavailable for future use would depnd on the level of decommissioning. High levels or complete restoration, including regrading, could reestablish the land to approximately its present state; however, complete restoration is unlikely because land values will probably not be high enough to warrant such action.

In the staff's opinion, the sizeable benefits accruing to society in terms of: (1) available power and increased reliability, (2) employment, and (3) maintenance or enhancement of living standards will far outweigh the minor loss of benefits to future generations.

References

1. Based on a telephone conversation with Mayor John Reid, Oct. 5, 1973.

2. Agreement between RHEA County Board of Education and TVA for Educational Facilities Assistance, Aug. 15, 1972.

12. DISCUSSION OF COMMENTS RECEIVED ON THE DRAFT ENVIRONMENTAL STATEMENT

Pursuant to paragraphs A.6 and D.1 of Appendix D to 10 CFR 50, the Draft Environmental Statement (DES) of February 1974 was transmitted, with a request for comment, to:

Advisory Council on Historic Preservation
Department of Agriculture
Department of the Army, Corps of Engineers
Department of Commerce
Department of Health, Education and Welfare
Department of Housing and Urban Development
Department of the Interior
Department of Transportation
Environmental Protection Agency
Federal Power Commission
Alabama Department of Conservation and Natural Resources
Alabama Development Office
Alabama State Board of Education
Alabama Historical Commission
Alabama State Department of Public Health
Top of Alabama Regional Council of Governments
Alabama Water Improvement Commission
Georgia Office of Planning and Budget
Tennessee Office of Urban and Federal Affairs
Tennessee Department of Public Health
Mayor of the City of Hollywood, Alabama
Mayor of the City of Scottsboro, Alabama
Board of Education, City of Scottsboro

In addition, the AEC requested comments on the Draft Environmental Statement from interested persons by a notice published in the Federal Register on February 1, 1974 (39 FR 4127).

Comments in response to the requests referred to above were received from:

Advisory Council on Historic Preservation (ACHP)
Department of Agriculture (USDA)
Department of the Army, Corps of Engineers (DOA)
Department of Commerce (DOC)
Department of Health, Education and Welfare (HEW)
Department of Housing and Urban Development (HUD)
Department of the Interior (DOI)

Department of Transportation (DOT)
Environmental Protection Agency (EPA)
Federal Power Commission (FPC)
Alabama Historical Commission (AHC)
Alabama State Department of Public Health (ADPH)
Georgia Office of Planning and Budget (GOPB)
Tennessee Department of Public Health (TDPH)
Mayor of the City of Hollywood, Alabama (T/H)
Alabama Conservancy: Huntsville, Birmingham Sections (AC/H, AC/B)
Geothermal Energy Institute: March 20, 1974, March 30, 1974 (GEI, GEI,1)
Southern Confederation of Concerned Citizens (SC/CC)
Tennessee Valley Authority (TVA)
William E. Garner (WEG)

Appendix A reproduces the comments received. The staff's consideration of these comments and the disposition of the issues involved are reflected in part by revised text in other sections of this Statement and in part by the following discussion.

12.1 GENERAL CONSIDERATIONS

12.1.1 Cumulative Effects (AC/H, A-12; DOI, A-8)

These comments suggest that the cumulative radiological, thermal and chemical environmental effects of all nuclear plants on the Tennessee River be considered in the Bellefonte statement.

Response: The Bellefonte plant is located at ∿ TRM 391. The Watt's Bar plant is ∿ 135 river miles upstream; the Sequoyah plant is ∿ 90 river miles upstream; the Browns Ferry plant is about 100 river miles downstream. Over these large distances the thermal coupling with the Bellefonte plant will be very samll. It is doubtful that thermal measurements of the water could be made at Bellefonte or at Browns Ferry that would indicate whether the upstream plants were operating at the time that the water passed the upstream plants. Thermal effects (expected to be slight in the case of the Bellefonte plant) may occur in the vicinity of the plants. For the distances involved, biological models showing downstream thermal effects from these few plants are not available to estimate possible downstream propagation of the induced effects from the plants on a collective basis.

As shown in the text, the change in chemical concentration of the assembled solids caused by the Bellefonte plant is small (∿0.1%). In the case of stable, soluable chemicals their concentration changes due to upstream plants do persist downstream; the chemicals end up in the Gulf of Mexico.

From the standpoint of water quality as influenced by chemicals, the Bellefonte plant meets the State standards. The staff believes that the Alabama standards do protect the use of Guntersville Lake for public water supply and swimming.

The staff has chosen not to evaluate the regional radiological impact of multiple plant operation in environmental statements prepared for a specific proposed licensing action. Radiation effects on humans are assumed to be linear with dose, so the impact for a region can be estimated by examining the individual environmental statements or similar documents for plants in the area. Appendix J of Vo. 2 of the TVA DES presents a discussion of the cumulative radiological impact on the Tennessee River from the operation of TVA nuclear plants.

12.1.2 Flooding Safeguards (AC/H, A-15)

This comment requests a discussion of plant safeguards in the event of collapse of an upstream dam.

Response: Plant safety aspects are considered separately as part of the Preliminary Safety Analysis Report prepared by TVA and the staff's evaluation contained in the Safety Evaluation Report. The AEC's criteria for design against flooding of the plant site is given in Appendix A of 10 CFR 50 (Criterion 2).

12.1.3 Theft and Sabotage (AC/H, A-13)

The comment requests a discussion of theft and sabotage as related to the Bellefonte reactors and the associated fuel.

Response: Plant safety aspects are considered separately as part of the Preliminary Safety Analysis Report prepared by TVA and the staff's evaluation contained in the Safety Evaluation Report.

12.1.4 Ozone Production (EPA, A-34)

The comment recommends that an assessment of ozone production of energized high voltage lines be provided in the Statement.

Response: Ozone is recognized as a major component of the photochemical air pollution-oxidant complex. Because of the possibility of adverse environmental effects caused by ozone generated by corona discharge in the vicinity of energized EHV transmission lines, this question has been reviewed by the staff. The National Primary Air Quality Standard for oxidants, as issued by the Environmental Protection Agency, is 80 parts per billion (ppb) by volume maximum arithmetic mean for a one-hour concentration, not to be exceeded more than once per year (Appendix D of 42 CFR 410).

Ozone is produced naturally in the atmosphere by a variety of reactions. Dissociation of oxygen by ultraviolet radiation in the stratosphere and lightning discharges are probably the major natural sources of ozone. Ground-level ozone concentrations in remote areas distant from urban pollution sources ususally range from 10 to 50 ppb. Unusually high ozone concentrations (60-100 ppb) in remote areas may be due to mixing from the stratosphere by violent meteorological conditions or to photochemical reactions involving volatile compounds emanating from natural vegetation such as pine trees.

Ozone and small amounts of nitrogen oxides are also produced by corona discharge from energized high voltage transmission lines. Corona discharges can increase as a result of abrasions, foreign particles, or sharp points on electrical conductors; or as a result of incorrect design characteristics that product excessively high potential gradients.

In both laboratory and field studies of EHV transmission lines operating up to, or in excess of, 700 kV and under a variety of meteorological conditions, it was concluded that the amount of ozone produced by the lines could not be distinguished from variations in ambient concentrations of total oxidents in the vicinity of the lines.[1,2,3]

Based on conductor size, configuration, and height for the Bellefonte 500 kV transmission line and the data in the references cited above, the staff believes the applicant should be able to operate the 500 kV transmission system within the limits of acceptable impact with regards to ground-level concentrations of ozone.

12.1.5 Assurance of Historic Preservation (AC/H, A-13; ACHP, A-38)

The comments suggest that additional discussion is needed to provide assurance that the Bellefonte project will not have an adverse effect on historical, architectural and archeological resources.

Response: The historic Bellefonte town site is on lands not under the control or jurisdiction of the Federal Government.

Comments on the AEC DES provided by the Alabama Historical Commission (Appendix A, page A-39) indicate concurrence with the staff's assessment that there will be no significant adverse effects on the historic and architectural landmarks in the vicinity of the Bellefonte site.

12.2 THE SITE

12.2.1 Geology and Seismology (DOI, A-9)

This comment suggests that the statement contain a more comprehensive summary of the geologic and seismologic environment.

Response: Geological and seismological considerations in licensing actions are principally matters concerning safety. These are summarized in the applicant's Preliminary Safety Analysis Report, and will be fully evaluated in the course of the staff's safety evaluation. It is not the policy of the AEC to repeat these discussions in the Environmental Statement in greater detail than is presently presented.

12.2.2 Conversion of Agricultural Lands to Industrial Use (AC/H, A-12; SC/CC, A-18; WEG, A-21)

The comments suggest that the conversion of agricultural lands to industrial use be evaluated and shown to be desirable.

Response: An evaluation of the desirability of converting forestry and agricultural lands into industrial developments is outside the jurisdiction of the AEC's area of responsibility. This type of investigation would be more appropriate for a regional or state governmental body. The staff has visited with members of TARCOG and also with the town leaders of Scottsboro and Hollywood. From these meetings, the staff found that the use of the Bellefonte site for industrial purposes is not inconsistent with the long-range goals and objectives being set for that area.

The staff has estimated the average value of lost farm products to be $80 per acre. If it is assumed that all 1,500 acres of the plant site were taken out of productive use relative to agricultural output, this would represent a loss of $120,000 per year or $1.35 million on a present-worth basis. To the extent that a portion of the plant site could continue to provide agricultural output, the value of farm products derived from this acreage should be subtracted from the estimated loss indicated above.

While the loss in agricultural output could be significant, a portion of the site will be used for electric power production which would have a value considerably greater than the lost farm output. The market value of electricity is discussed in Section 10.2.2 of this Statement.

12.2.3 Decommissioning Costs (ADPH, A-30)

The comment suggests that $70 million rather than $25 million be used as the decommissioning cost for the Bellefonte plant.

Response: As pointed out on page 10-9 of the AEC DES, the staff assumed that decommissioning would cost approximately $25 million in calculating the total generating cost for the Bellefonte plant. Since the plant site is not likely to be returned to its original state after plant-life because of economic tradeoffs between land values at that time and the development of the site for further industrial use, the staff chose not to use the $70 million estimate.

12.2.4 Recoverable Minerals on the Bellefonte Site (WEG, A-20)

The comment suggests that recoverable limestone and oil and gas production on the Bellefonte site be further discussed and the construction permit conditioned to allow property owners retention of oil and gas rights.

Response: According to the 1970 Edition of "Mineral Facts and Problems" by the U.S. Department of the Interior, the 1968 calculated value per ton of calcium in crushed limestone was $3.74. The price for any specific region would vary depending on the size of the shipment, the grade of the limestone, and the distance to the market. Assuming that prices have escalated at about 5 percent per year since 1968, the current average price of limestone would be about $5 per ton. However, it should be pointed out that limestone reserves are abundant in the U.S. and no supply problem is foreseen. These conditions would tend to minimize the escalation of prices for this product.

The staff was made aware of oil and gas sutudies being conducted in the vicinity of the site by members of TARCOG and Mr. W. E. Garner. However, it was our understanding that the oil and gas reserves being investigated were speculative in nature. Thus, the staff chose not to include a discussion of these studies in the Environmental Statement.

Finally, the judicial determination of property rights in the Bellefonte proceeding is not before the AEC as part of these proceedings.

12.2.5 Relocation of Old Cemeteries (AC/H, H-13)

The comment requests additional information concerning the location of and attempts to locate the nearest living relative of those interred in the cemeteries that will be relocated.

Response: The following information has been supplied by the applicant.[4]

> "The persons known to be buried in Shipp Cemetery are Alberta Shipp, Tom Shipp, David Stern, and Nancy Ann Stern. It is felt that all of the heirs at law and next of kin of these people have been located.
>
> The next of kin of the Sternes descend from three children: Annie Finnell, Mary J. Shipp, and a son who moved away from the area many years ago and is now dead and all of the local owners believe that there are no descendants of this son now living.

The descendants of Mary Jane Shipp are the same persons who own the fee simple title to Shipp Cemetery and are also the next of kin of the Shipp children, Tom Shipp, age 7, and Alberta Shipp, age 18.

A Contract for Purchase and Sale of the Land has been obtained from all of the Shipp heirs and TVA is in the process of closing this acquisition. The deed contains the provision that the grantors specifically convery any and all easement and burial rights the have in Shipp's Cemetery.

Unlike Shipp Cemetery, the title to which was owned in fee simple by the Shipp heirs as set out above, only outstanding burial rights to be acquired in Finnell Cemetery together with the permission to disinter and reinter the bodies buried therein. Most of the Finnell heirs would be unknowns, with the possible exceptions of the Annie Finnell descendants who have been identified. The interest of persons who are the next of kin of the persons buried in the cemetery together with right to disinter and reinter the bodies will probably be acquired from a court of competent jurisdiction. At the present, the identity of those persons buried in Finnell Cemetery is unknown and cannot be investigated until ownership of the property is obtained.

In the event that additional graves are discovered in Shipp Cemetery, it may be necessary to condemn rights of unknown owners in that cemetery."

12.2.6 Land Use Projections (AC/H, A-13; WEG, A-21)

The comments request that it be made clear whether the TARCOG study, "Sketch Development Plan-Year 2000," was prepared prior to or as a result of the applicants Bellefonte Nuclear Plant proposal.

Response: TVA awarded a contract for the nuclear steam supply system for the Bellefonte Nuclear Plant in August 1970 and made a request to purchase the Bellefonte site in March 1971. The Town of Hollywood became aware of the proposed nuclear plant in 1970. Municipal officials were of the opinion that without proper planning and regulatory controls, the impact of the proposed nuclear facility on Hollywood could prove to be detrimental. In 1972, the Town of Hollywood, with the aid of a Federal planning grant, contracted the services of TARCOG to prepare a Sketch Development Plan, Zoning Ordinance and Subdivision Regulations. The Sketch Development Plan was completed by TARCOG in March 1973 while the latter two reports were completed in May 1973. The sketch plan, zoning ordinance, and subdivision regulations proposed by TARCOG in these reports were adopted by the Town Council and the Planning Commission for the Town of Hollywood in May 1973.

12.3 RADIOACTIVE RELEASES

12.3.1 Gaseous Effluents to Meet Appendix I Guidelines (DOI, A-9)

The comment suggests that the final statement clearly indicate that the gaseous effluents from this plant meet proposed Appendix I guidelines.

Response: The gaseous effluents from the Bellefonte plant will meet the guidelines of Regulatory Guide 1.42 and other acceptance criteria which provide the interim licensing guidelines pending the issuance of the proposed Appendix I to 10 CFR Part 50.

12.3.2 Release of Noble Gases (DOC, A-6)

The comment is concerned with the appropriate average annual dispersion factor to be utilized in computing total body and skin annual doses.

Response: The release rate of radioactive gaseous waste to the atmosphere will be governed by the limits specified in the Technical Specifications which will be written for plant operation. We assume the release of gas will occur over a period of days, and therefore, use the annual average dispersion factor. On this basis then, the calculated total body and skin annual doses are correctly computed.

12.3.3 Disposal of Tritiated Liquid Wastes (AC/H, A-12; AC/B, A-30; EPA, A-32)

The comments suggest that a cost-benefit analysis of the various alternatives of disposing of tritiated liquid be included in the final statement and question the desirability of disposing of it in Guntersville Resevoir.

Response: The applicant will not be permitted to truck liquid waste to a disposal site as part of normal operation. There are several acceptable methods for tritium control under consideration by the applicant. During the OL stage review, the staff will review the selected method which should be compatible with existing regulations and "as low as practicable" guidelines.

The concentration of tritium that will be released from the Bellefonte reactors into the Tennessee River will be small in comparison to the amounts present in nature. Dilution of the effluent stream by the river will result in insignificant increase in concentrations in the river water. The concentration of radioactivity involved will be a small fraction of the permissible concentrations listed in Table II, Appendix B of 10 CFR Par 20; therefore, it is not practical to remove small amounts of radioactive material from the effluent water.

12.3.4 As Low as Practicable (AC/H, A-13)

The comment asks the meaning of as low as practicable.

Response: The term means as low as practicable taking into account the state of technology and the economics of improvements in relation to benefits to the public health and safety and in relation to the utilization of atomic energy in the public interest.

12.3.5 Amount of Radioactivity in the Liquid Effluent From Units 1 and 2 (TDPH, A-16)

The comment suggests that since the staff's estimate of the effluent release is less than 1 Ci/yr, it should be stated that way and not as less than 5 Ci/yr.

Response: The intent was to show that the calculated liquid radioactive effluent was less than the design objective of 5 Ci/yr in accordance with the "Concluding Statement of Position of the Regulatory Staff", Docket No. RM-50-2.

12.3.6 Solid Wastes (DOI, A-9)

The comment requests a discussion of the kinds of radionuclides, their physical states, concentrations and total volume of solid wastes during the expected life of the reactors.

Response: Wet solid wastes will consist mainly of spent demineralizer resins, filter sludges and evaporator bottoms. We consider that all wet solid waste will be stored onsite for approximately 180 days prior to shipment which allows short-lived radionuclides time for decay. Dry solid wastes will consist of ventilation air filters, contaminated clothing, paper and miscellaneous items such as tools and laboratory glassware. Since these wastes normally contain less radioactivity than wet solid wastes we assume that these wastes are shipped as soon as they are packaged and not held for decay.

Based on our evaluation of similar type reactors and data from operating reactors, we estimate that approximately 5400 Ci/yr of wet solid wastes will be shipped from the site in drums or shipping casks. We estimate that less than 5 Ci/yr of dry and compacted solid wastes will be shipped from the station. Greater than 90% of the radioactivity associated with the wastes will be long lived fission and corrosion products, principally Cs-134, Cs-137, Co-58, Co-60, and Fe-55.

12.3.7 Difference Between AEC and TVA Estimates of Shipped Solid Waste (TDHP, A-17)

The comment requests an explanation of the difference between the AEC and TVA estimates of the solid waste to be shipped from the reactor site each year.

Response: Our evaluation assumed that the liquid waste would be processed in the liquid waste treatment system with no trucking of liquid, and considered the parameters given in WASH-1258. TVA's estimate took into consideration trucking of some liquid waste for tritium concentration control which would reduce the volume of solid waste produced.

12.3.8 Offsite Disposal of Solid Waste (DOI, A-9; GOPB, A-35; GEI,1, A-35)

The comments suggest that the enviromental statement consider an evaluation of the solid radioactive waste disposal site, including licensing provisions, criteria, and responsibilities. Specific concerns include hydrogeologic suitability, surveillance and monitoring, and remedial/regulatory actions that might be required.

Response: The concerns expressed in this comment are appropriately addressed in the AEC document "Environmental Survey of the Uranium Fuel Cycle." As noted in that document, the environmental effects of the entire uranium fuel cycle with regard to an individual reactor are small. Further, the potential for any significant effect from the disposal of solid radioactive wastes from a reactor is extremely limited due to (1) the small quantity of radioactivity contained in the wastes, and (2) the care taken in establishing and monitoring commercial land burial facilities. Commercial land burial facilities must be located on land which is owned by a state or the Federal government, and after radioactive wastes are buried at a site the land must not be used for any other purpose. Authorization to operate a commercial land burial facility is based on an analysis of nature and location of potentially affected facilities and of the site topographic, geographic, meteorological, and hydrological characteristics; which must demonstrate that buried radioactive waste will not migrate from the site. Environmental monitoring includes sampling of air, water and vegetation to determine migration, if any, of radioactive material from the actual location of burial. To date, there have been no reports of migration of radioactivity from commercial burial sites. In the event that migration were to occur, plans for arresting any detected migration have been developed. On the basis of the general environmental considerations of burial sites now developed, the wide range of wastes that can be buried, and the observation that an applicant is not restricted to a specific burial site, the staff believes that a detailed discussion of solid radioactive waste disposal sites is inappropriate to an environmental statement for any one nuclear power plant facility.

12.3.9 Ultimate Fate of Radioactive Wastes (AC/H, A-15; GEI,1, A-35)

The comment requests a discussion of the ultimate fate of the radioactive wastes generated by the plant.

Response: The question of the ultimate disposal of high-level radioactive waste is one of the most important issues currently facing the AEC. At the present time storage facilities do exist which are adequate and safe for handling the radioactive waste that is being and will be generated by nuclear power plants in the foreseeable future.

To accommodate the anticipated need for disposal of high-level waste that will accumulate as a result of the growing nuclear power industry, the AEC will develop, during the latter part of the century, the necessary capacity in engineered surface storage facilities. These additional facilities will be ready by the 1980's to receive the first shipments of radioactive wastes from commercial nuclear power plants. Thereafter, the surface storage facilities will be capable of handling all the radioactive waste from commercial nuclear power plants.

As an alternative method, the AEC plans to develop a pilot repository in an appropriate underground geologic formation. If the experience gained in the pilot underground repository is favorable, we would then permanently dispose of the radioactive waste in geologically stable, underground respositories.

While a final solution to the problem posed by the long-term storage of radioactive waste has not yet been chosen, a number of approaches capable of handling this problem are presently technologically feasible.

12.4 RADIOLOGICAL EFFECTS

12.4.1 Exposure Pathways (AC/H, A-13)

The comment suggests that more opinions should be presented in the discussion of limits for radiation exposure to species other than man.

Response: The use of the phrase "generally agreed" is a summary statement of the discussion in the review article referenced (i.e., S. J. Auerback, "Ecological Consideration in Siting Nuclear Power Plants. The Long Term Biota Effects Problems", Nuclear Safety 12:25, 1971).

12.4.2 Dose Rate Estimates (AC/H, A-13)

The comment suggests that immobile forms of life be included in the discussion on dose rate to biota other than man.

Response: The doses to both aquatic plants and fish were calculated assuming the total life span was spent in water with a radioactivity concentration equivalent to what will exist in the plant discharge region. The statement with regard to mobility characterizes the conservatism involved in the calculation. Because of radioactive decay, the dose at any other point in the resevoir would be less than at the discharge region.

12.4.3 Radiological Monitoring for Samll Game (DOI, A-10)

The comment suggests that the radiological monitoring program be expanded to include small game within the site area.

Response: Small game will receive radiation exposure from immersion in noble gases and consumption of vegetation. The external radiation exposure received by these animals will be indicated by the TLD measurements. A conservative estimate of the dose which will be received by terrestrial animals is made in Section 5.3.1.3 of this statement. This calculation, assuming that a duck ingests vegetation growing only in the region of the plant discharge into Guntersville Reservoir, results in a dose of only 2 mrads/yr. In addition to the TLD measurements, both water and vegetation will be sampled from the plant environs during plant operation. Therefore, it is not necessary to sample small game as part of the environmental radiological monitoring program.

12.4.4 Radiological Monitoring of Rain Water (ADPH, A-30)

The comment requests clarification of the procedure to be used for filtering the rain water collected in the radiological monitoring program.

Response: The following information has been supplied by the applicant.[4]

"Rainwater samples will be collected in a container and the samples will be counted directly, with no filter systems involved."

12.5 CHEMICAL DISCHARGES

12.5.1 Sulfuric Acid (AC/B, A-30)

The comment suggests that the discharge of sulfuric acid to Guntersville Reservoir not be treated casually.

Response: The treatment of the possible discharge of tons of sulfate (from sulfuric acid) was not intended to be casual. Using mechanical cleaning of condenser tubes, the applicant anticipates no use of acid for descaling. The stated staff position is that the use of such acid would not be permitted without an additional environmental assessment.

12.5.2 Fuel Oil Storage and Concrete Batch Plant Facilities (EPA, A-34)

The comment requests discussion of the impact of these facilities and the strategies to be employed to prevent air pollution and particulate emissions.

Response: The following information has been supplied by the applicant.[4]

Fuel Oil Storage

Fuel oil will be stored in two 100,000-gallon tanks located in the yard and in sixteen 18,700-gallon tanks located in the diesel generator building. The tanks in the yard will be diked to contain the oil in the event of rupture. The tanks in the diesel generator building will be embedded in concrete in the building substructure. The building will be a seismic category 1 structure and the tanks will be vented to the atmosphere through nominal six inch diameter flameproof vents. Provisions will be made for collecting any spillage that may occur at locations where tanks are filled from rail cars and tank trucks.

Under normal conditions, there will be no effect on the quality of air due to oil storage. Also, it should be noted that the fuel oil storage tanks will contain No. 2 fuel oil, which is exempt from standards of performance for new stationary sources (see 40 CFR Subpart K, 60.111(b)).

Concrete Plant

The concrete mixing "batch" plant will comply with particulate emission requirements of the Alabama Air Pollution Control Rules and Regulations by the installation of adequate hoods, fans, and ducts to transport dust from cement and fly ash silos and batchers to a dust collector. With these controls, there should be no significant amount of dust emitted to the ambient air.

12.6 CONSTRUCTION EFFECTS

12.6.1 Yard Drainage Pond (DOI, A-8)

The comment suggests additional discussion of the yard drainage pond is needed including construction details and associated environmental impacts.

Response: The "yard drainage pond" is approximately 10 acres in area and the preliminary volume of liquid is estimated to be about 49 acre feet. In general the excavation for the pond will be down to bedrock, which is in the neighborhood of the 590 to 595 ft MSL elevation. Near the outlet weir, the excavation will be into bedrock (∿585 ft MSL). The construction impacts will be much the same as for other facilities where excavation is required during construction. An overflow-spillway is provided to maintain dikewall integrity during flooding conditions.

12.6.2 Wellwater (AC/H, A-12)

The comment requests the defining of the specific actions TVA will be required to take to alleviate wellwater problems during construction.

Response: Specific well-water problems are not evident; therefore, defining remedial action is not productive. TVA will be required by the AEC to take adequate remedial action should the need exist. (See the applicant's PSAR, Vol. 2 Section 2 for information on ground water and well information.)

12.6.3 Herbicides (AC/H, A-13; WEG, A-20)

The comment suggests a discussion on the environmental effects of herbicides be included in the statement.

Response: Specifics as to the environmental effects of the herbicides to be used are given in TVA Responses to AEC's Comments on Bellefonte Draft Environmental Statement, dated July 12, 1973, Comment 19, as well as in Appendix B of this Statement.

12.6.4 Open Burning (AC/H, A-12)

This comment contends that open burning is illegal under Alabama air pollution laws.

Response: The staff finds that the EPA Region IV is not currently considering Federal regulation of open burning in Alabama. According to the Alabama Air Pollution Laws (Environment Reporter, State Air Laws, Alabama, p. 301:0512-0513), burning regulations are essentially a local government matter within the state and open burning is allowed by permit. From a phone conversation with EPA Region IV, there are apparently no recent moves on the part of EPA to change the Alabama laws on this matter, or make open burning illegal.

12.6.5 Maintenance Dredging (AC/H, A-13)

The comment suggests further discussion of the effects on fish populations due to siltation and spoil banks produced by maintenance dredging of the intake channel is needed.

Response: Although it was stated that the proposed intake channel would be maintained by dredging, the staff has subsequently been informed by the applicant that up to the present time maintenance dredging has not been required on the intake canals for any of its Tennessee River plants and, therefore, does not expect to have to do any at Bellefonte. Should the rare occasion arise where maintenance dredging is required at Bellefonte, it would be subject to the same controls to limit adverse effects as discussed for construction dredging in Section 4.4.

12.6.6 Noise Levels (EPA, A-34)

The comment requests that additional information on noise level projections and abatement schemes be included in the statement.

Response: The following material is from TVA Responses to Second Set of AEC Comments on Bellefonte Draft Environmental Statement, dated October 5, 1973, page 79-1.

"The major sources of noise at the construction site will be diesel powered equipment (dozers, trucks, compressors, etc.), rock drills, the mixing plant, pile drivers, and blasting operations. Perceived noise levels will obviously vary with the number of equipment items operating simultaneously, location on the construction site, meteorological and topographical conditions, and time of day. Noise levels at the 3- to 2-mile distance may vary from 62 to 78 dB(A) during daylight hours and up to 53 dB(A) at nighttime. In unusual meteorological conditions blasting noise may reach 90 dB(A). According to HUD criteria, 62 to 74 dB(A) would be normally acceptable to the community if these levels were not exceeded for more than 6-40 percent of the time. Noise levels up to 53 dB(A) are normally acceptable up to 99 percent of the time. Criteria for blasting noise are not available.

TVA will make every practical effort to keep noise disturbances to a minimum. For example, pile driving will be restricted to the daytime hours. Blasting will be scheduled, where possible, to daylight hours and charge sizes will be controlled to reduce noise levels when practicable. Noise generated at the aggregate bins will be controlled by keeping the bins full of aggregate when possible. Efforts will be made to include noise control devices on purchases of new equipment such as rock drills, compressors, and heavy earth movers. All diesel and gasoline powered equipment will be equipped with mufflers."

12.7 COOLING TOWERS

12.7.1 Salt Deposition (DOI, A-9)

The comment requests details concerning the amounts of salt considered in studies referenced in the AEC DES and questions the staff's estimate of the distance within which salt and mineral deposition will occur.

Response: TVA estimates its drift losses at 0.01% (not 0.015%) of the circulating water. The staff considers this value to be conservative compared to recent measurements of operating cooling towers.[5,6]

Although several models for predicting the deposition of water and salts from cooling tower drift exist, none has been shown to be valid because of the almost complete lack of quantitative data of drift deposition. For example, a recent EPA report states "Unfortunately, the state-of-the-art is inadequate to precisely quantify the fallout characteristics of cooling tower drift.[7] In general, these papers indicate that the majority of drift particles will fall out within 2,000 feet of a cooling tower under normal conditions. The report concludes that "no adverse environmental effects have been experienced" at cooling towers using ocean (salt) water as makeup in England and in the United States.

The primary reason for the lack of quantified data on drift deposition is its very low rate. TVA attempted to measure drift deposition rates at its Paradise plant. While mist was felt on the face of the observers out to distances of 1,000 ft., the rates were too low to be measurable with rainfall collectors. In England, where there are more than 300 operational natural draft towers (some of these have operated for several decades), similar results have been observed. Spurr, in a summary report on the atmospheric effects of these cooling towers on the environment in England, states.... "Detailed measurements of rain-out drift have been made round a number of large power stations having up to 8 cooling towers, each serving the plant to a rating of 250 MW(E). From a tower fitted with an approved modern design and construction of pack, water distribution nozzles and droplet eliminatiors, rain-out does not exceed a peak of 0.01 mm/hour, such short term peaks occurring at a distance of about 300 m. The human senses cannot detect this precipitation so that not surprisingly there is no record of public complaint."[8]

Experience in Europe is similar. Bøgh, reporting on a series of studies at cooling towers in Germany and Furitzer Land, states .... "As to artificial precipitation, drift experience with natural draft cooling towers without drift eliminators had shown them to be very detrimental to the environment, giving rise to local precipitation and serious icing in winter. After the installation of drift eliminators no further precipitation could be either measured or observed."[9]

It would appear that, except under very humid conditions, drift from cooling towers equiped with state-of-the-art drift eliminators, rarely reaches the ground before evaporating. The salt particles that remain will be very small and remain airborne until washout by natural rainfall returns them to the ground.

Thus, based on experience at hundreds of natural draft cooling towers, the staff concludes that water drift from the Bellefonte towers will rarely reach the ground, and that when it does, most of it will be fall within 1,000 feet of the towers.

12.7.2 Alternate Operating Modes (EPA, A-33)

The comments recommend the exploration of alternate cooling tower operating procedures for the blowdown discharge such as temporary retention and allowing higher concentrations than the 2 or 3 proposed by the applicant.

Response: The volume of water in the circulating water system has not been provided. A ten-foot depth in each 500-foot diameter cooling tower basin would provide a volume in each of nearly two million cubic feet.* At an evaporation rate of 37 cfs for each tower for periods of high evaporative (TVA DES, p. 2.6-7), operation with no blowdown for as long as about 15 hours would be possible without using more than half of the water in the basin. Thus, the applicant's proposal to operate several hours at a time would not seem to require the existence of an auxiliary stored water supply.

With respect to the possibility of operating with the cooling water more concentrated than proposed by the applicant, further concentration might increase problems due to scale formation, corrosion, and excessive sludge deposition. It might also require the addition of sulfuric acid for the control of scaling. The total quantity of chemicals discharged, in excess of those in the discharged volume of reservoir water, would be roughly independent of the blowdown rate employed (and therefore of the concentration factor). Thus, advantages related to the quantity of heat discharged need to be balanced against operational disadvantages and the possiblility of the addition of excess sulfate to the reservoir.

12.7.3 Paradise, Kentucky Steam Plant (AC/H, A-13)

The comment requests further discussion of the atmospheric conditions at the Paradise plant which make it comparable to the Bellefonte site.

Response: Experience with cooling towers at the Paradise, Kentucky Steam Plant was used to estimate plume effects at the Bellefonte plant because Paradise is the closest site of an operating natural draft cooling tower. While conditions in the zone of primary importance (500 to 1,500 feet above grade) are not identical, they are sufficiently similar to qualitatively predict plume behavior at the site.

12.7.4 Salt and Moisture Effects (AC/H, A-13)

The comment requests clarification as to the staff's predicting an ecosystem simplification.

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*The cooling tower circuit at the Davis-Besse 2633 MW(th) plant will contain 11.2 x 10^6 gal or 1.5 x 10^6 cu. ft, prorating to 2.0 x 10^6 gal for 3600 MW(th). See FES, Davis-Besse Construction, AEC Docket 50-346, p. B2, March 1973.

Response: As stated in Section 5.4.1.1.7 of this Statement, there may be some changes in species composition of the various plant, animal and microbial communities. However, this is not meant to imply that there will necessarily be an ecosystem simplification.

12.7.5 Design Parameters (EPA, A-34)

The comment requests that additional design parameters be included in the statement.

Response: The applicant has supplied the following information.[4]

The following parameters were used to design the cooling towers.

Range	- 34°F.
Approach	- 24°F.
Design wet bulb	- 55°F.
Design dry bulb	- 60°F.

The cooling towers have been designed for the annual average meteorological conditions in the area of the plant.

12.8 AQUATIC EFFECTS

12.8.1 Discharge Diffusion Nozzles (AC/H, A-13)

The comment requests that the distance between the discharge nozzles to prevent interaction of the jets be discussed.

Response: The full width of the plume when it reaches the surface is calculated to be 40 feet. The width is defined to be equal to four standard deviations of the local temperature distribution across the plume trajectory where this distribution is assumed to be Gaussian. Thus, at the surface, where the centerline temperature increase is 3.5°F, the ΔT at the edge of the plume is only .06°F. If the two discharge ports are 40 feet apart, the two plumes will not appreciably interact.

12.8.2 Discharge Plume Dissipation (AC/H, A-13)

The comment suggests that the fate of the heated plume be calculated by more sophisticated techniques and discussed further.

Response: The data input to the model for predicting the extent of the thermal plume was extremely conservative. The temperature difference between the blowdown and the river water was assumed to be 50°F, almost twice the maximum expected. The river was assumed to be stagnant, which only occurs instantaneously during the flow reversal, as shown in Figure 5.5 of the AEC DES. Inclusion of a flowing ambient would further dilute the heated effluent. Since the maximum temperature rise at the surface was only 3.5°F under these conservative assumptions, and an increase of only about 1.5°F would be expected using more realistic values, the staff feels that an extensive calculation is unnecessary.

12.8.3 Water Quality During Construction (AC/H, A-13)

The comment is concerned with construction activities violating the water quality criteria pertaining to siltation and turbidity.

Response: Section 5 applies to plant operation. For construction considerations, please note the amplification of the text in Section 4.4 which addresses the measures and controls to be utilized during construction to limit adverse effects, including siltation and turbidity.

12.8.4 Return of Impinged Nekton to Guntersville Reservoir (EPA, A-33)

The comment recommends that impinged nekton be returned to Guntersville Reservoir.

Response: Due to the lack of adequate technology for the separation of fish from debris, the staff feels this recommendation is infeasible at the present time.

12.8.5 Cooling Water Intake (EPA, A-33)

The comment suggests that the cooling water intake design be evaluated against the best technology available proposed by EPA.

Response: The staff has recommended a condition to the issuance of a construction permit for the Bellefonte plant which requires the applicant to "...provide the results of a fishery investigation that would characterize the region and allow an assessment of the significance of ichthyoplankton mortality due to entrainment." If results of the study indicate that an adverse impact due to entrainment will occur, the applicant will be required to adopt an alternative intake design and/or location.

12.8.6 Antidegradation Policy on Water Quality (AC/H, A-13)

The comment requests the basis for the staff's judgement that the intent of this standard is met.

Response: The staff has made a value judgement based on the discussion in Section 5.2.3 of this statement.

12.8.7 Sanitary Wastes (AC/B, A-30; WEG, A-21)

The comment suggests that additional discussion is needed relating to the sanitary waste effluent from the construction force at the Bellefonte plant.

Response: Extended aeration (secondary treatment) and chlorination will be used during construction, discharging to Guntersville Reservoir. The permanent plant will have secondary sewage treatment, with provision for chlorination; discharge will be into the cooling tower makeup system. In both cases, treatment systems will be subject to TVA sanitation standards and Alabama Water Quality Criteria. The latter require 85% BOD removal and analysis of the receiving stream to assure that the fecal coliform count is not in excess of 200/100 ml (geometric mean). For the latter, see Section 5.2.3, item 4 of this statement.

12.9 SOCIAL AND ECONOMIC EFFECTS

12.9.1 Impact on Local Housing Market (AC/H, A-13)

The comment suggests that housing built during the construction of the plant will subsequently become empty after construction is completed and will result in an adverse economic impact.

Response: The demand for housing will be accelerated during construction of the Bellefonte plant as discussed in the statement in Section 4.3.2.3. Due to the continued growth of the Scottsboro-Hollywood area, any new construction of housing units could have a positive effect on the supply of adquate housing after the peak of construction without creating an oversupply. The current tight housing situation in the Scottsboro-Hollywood area could be alleviated if additional housing was made available due to the construction of the power plant. However, after construction of the Bellefonte plant is completed, new housing would be required for the 170 individuals, and their families, who will be permanently employed at the plant. Some of these families will no doubt move into homes which will be vacated by construction workers. Furthermore, any mobile homes which are located in the Bellefonte area during plant construction could be transported to another site upon completion of the plant. On the whole, the staff does not foresee any significant adverse impact resulting from completion of the project on the housing market.

12.9.2 TVA Customers (AC/H, A-12; SC/CC, A-18)

The comment requests clarification of the consumers of electricity considered in the statement.

<u>Response</u>: The statement considers the future electrical demands of both existing and new customers of TVA. The projected per capita consumption of electricity and the forecasted number of new customers on the TVA system are presented in detail in the "TVA Responses to Second Set of AEC Comments on Bellefonte Draft Environmental Statement," October 5, 1973, Response No. 61.

12.9.3 <u>Plant Airborne Emissions (AC/H, A-13)</u>

The comment requests a discussion of air degradation in the vicinity of the plant.

<u>Response</u>: No combustion process takes place during the operation of a nuclear power plant, thus there will be no air-borne pollutants emitted during plant operation. There will be small emissions from the operation of auxiliary steam boilers and diesel generators and estimates of these emissions are shown in Table 9.3, and discussed in Section 3.2.4.4 of the AEC DES.

12.9.4 <u>Sewage Treatment Plants for Hollywood and Scottsboro (AC/H,-A-13; DOI, A-9)</u>

The comment requests a solution to the potential problem of inadequate sewage treatment capacity for the towns of Hollywood and Scottsboro as a result of construction and operation of the Bellefonte plant and further discussion of the sewage flow and treatment capacity numbers presented in the statement.

<u>Response</u>: The Commission's responsibilities under NEPA are to assess the environmental impact of the proposed nuclear power plant which the staff has done. The Commission has no authority by which it can require sewage treatment plants to be constructed in the towns of Scottsboro and Hollywood.

The staff reviewed a report prepared by Harry Hendon and Associates, Inc., which is titled "Improvements to the Scottsboro, Alabama Sanitary Sewer System," March 1972. On page 3 of this report, it states that Scottsboro has two sewage treatment plants. Sewage Treatment Plant No. 1 is located in the southeastern section of the city on Jefferson Drive and has a capacity of 1.5 MGD. Sewage Treatment Plant No. 2 is located in the newly annexed section of Scottsboro on Roseberry Creek and has a capacity of 0.05 MGD. Thus, the total capacity of the two sewage treatment plants in Scottsboro total 1.55 MGD.

On page 16 of the same report, it is stated that the sewage flow at the existing treatment plant is approximately 1.5 MGD. Since the statement refers to only one sewage treatment plant, that being Sewage Treatment Plant No. 1, the staff assumed the second treatment plant would also be operating at approximately peak capacities. Even if the second plant were not operating at all, which is very unlikely, the sewage flow at treatment plants in Scottsboro would be 1.5 MGD while the capacity of the plants would be only 1.55 MGD.

12.9.5 Air Degradation Due to Automobile Traffic (AC/H, A-12)

The comment requests a discussion of air degradation as a result of traffic attracted to the plant.

Response: Degradation of air quality as a result of automobile emissions is a function of the number of miles driven. The table below provides a staff estimate of the amount of pollutants that will be emitted by automobiles in the vicinity of the Bellefonte site due to the construction of the power plant. However, several points must be recognized relative to these emission estimates.

The estimates represent the absolute quantity of pollutants discharged to the atmosphere. To the extent that these vehicles would be driven elsewhere if Bellefonte where not contructed, the incremental impact on the atmosphere by auto emission would be less that shown in the table.

At the peak of construction activity, about 1,200 vehicles will enter the construction area. The amount of NO_x discharged by these vehicles is estimated to be about 32 lbs. per day. For comparative purposes, the amount of NO_x discharged from a coal-fired electric plant, as shown in Table 9.3 of the AEC DES, is estimated to be about 215, 000 lbs. per day. Thus, the relative impact of auto emission due to plant construction is rather small.

Emissions, lbs per day*	450 autos	1200 autos
Hydrocarbons	13	36
Carbon monoxide	155	413
Nitrogen oxides	12	32

*Based on 1973 EPA automobile exhaust standards. Staff assumed the round trip distance from U.S. 72 to the plant site to be 4 miles.

Air pollution cased by the traffic attracted to the visitor's center of the plant or by the operating staff will be based upon about 100 to 150 cars per day entering and leaving the area. In 1971 the average daily traffic load on US-72 (which is about two miles away) was 3700. With the 4-lane highway in 1980 the daily traffic load will be considerably higher. Including the starts and stops of cars, the staff believes that auto source pollution in the vicinity will not be largely perturbed by auto traffic involved in the plant operations and in visits to the plant.

12.9.6 Dispersion Calculations (AC/H, A-13)

The comment suggests that the Turner nomograms are too crude to be used to predict dispersion and more sophisticated techniques be employed.

Response: The Turner nomograms, while admittedly not perfect, are the result of a very large number of dispersion experiments and have been shown to yield reasonably accurate forecasts of ground level concentrations. The calculations in Section 5.4.3 did take into consideration atmospheric stability; the stability class yielding a maximum (therefore conservative) value of SO_2 concentration was used.

12.10 PLANT ACCIDENTS

12.10.1 Alternate Water Supplies (AC/H, A-12)

The comment requests a discussion of alternate water supplies for the communities considered in the AEC DES in the event of a massive reactor accident.

Response: Plant safety aspects are considered separately as part of the Preliminary Safety Analysis Report (PSAR) prepared by TVA and the staff's evaluation contained in the Safety Evaluation Report (SER).

The design of the Bellefonte Plant is such as to minimize the probability of accidents which could cause the release of radioactivity. In addition, significant potential sources of radioactivity are located within structures designed to withstand the effects of natural phenomena as required by General Design Criterion 2 Appendix A to 10 CFR 50. Details of many of the specific accidents considered are presented in Chapter 15 of the PSAR and will be discussed in the SER.

12.10.2 Reactor Safety Study Results (AC/H, A-13; DOI, A-10; EPA, A-32; WEG, A-21)

These comments relate to the availability of the results of the Reactor Safety Study currently being prepared by the AEC to assess the risks associated with Class 9 accidents and its inclusion into this statement.

Response: As stated in Section 7.1 of the AEC DES, the results of the Reactor Safety Study will be made public. Current expectations are that the results will be available during, rather than early, 1974. However, the developed information will not be presented on a case-by-case basis and will not appear in individual statements.

12.11 ALTERNATIVES

12.11.1 Hydrogen Conversion (AC/H, A-13)

The comment suggests further discussion is needed on the conversion of hydrogen into electricity for commercial use.

Response: The staff does not consider the production, transportation, and conversion of hydrogen to electricity to be an economically attractive alternative to electric power transmission and distribution by conventional means. This alternative would require that a conversion plant be constructed in which the electricity generated at the Bellefonte plant be used to produce hydrogen. The hydrogen would then have to be transported by some method to the customer. It would then be necessary to convert the hydrogen back into electricity with some conversion mechanism such as a fuel cell. While this process is technically feasible, the staff does not consider it to be economically feasible relative to conventional electrical transmission and distribution systems.

12.11.2 Geothermal Energy (GEI, A-7)

The comment suggests that there is no factual basis supporting the staff's position on geothermal energy as a viable alternative and no mention was made of the geothermal-geopressured potential of the Gulf Coast.

Response: Geothermal energy is currently being developed as a power source in Europe and to a limited extent in the western part of this country. The only extensive development in operation in the U.S. at present is in the dry-steam field at The Geysers, California, with present installed capacity of 300 MW with a planned expansion to 633 MW (Goldsmith, 1971) by 1975.

Geothermal fields are known to exist in the eastern United States. In particular there are the geothermal reservoirs associated with hot springs and the geo-pressured zone of the Northern Gulf Coast belt extending up to 75 or 100 miles inland. In comparison with the granitic stock field at The Geysers, which has been under development since the middle 1950's, the capacity of these potential reservoirs and their exploitability remain relatively unknown.

As discussed by Fenner and Klarman (1971) "Generation of electric power from the earth's heat...is still in the experimental stage...Numerous questions about the suitability of geothermal power for large-scale production remain largely unanswered...It is important at this early stage of the development of geothermal power production that extensive research into the problem areas of geothermal power be conducted before full-scale investment in production system occurs...The high cost of development of geothermal resources may easily be beyond the reach of present electric utility companies." Additionally, the Geothermal

Resources Research Conference sponsored by the National Science Foundation in September 1972 made a recommendation for a 10-year, $684.7 million research program at the Federal level to probe the engineering and productions unknowns and to understand utilize this resource (NSF, 1972).

The staff review of the potential for the use of geothermal power leads to the following conclusions:

(1) The best geothermal site for use at this time as a power source for the area would have the characteristics of the only site known to be exploitable in this country as a power source; i.e., the characteristics of the dry field, granitic-stock type with a capacity comparable to that of The Geysers.

(2) Such an exploitable site has not been identified as present in or near the TVA service area.

(3) Such an exploitable site, if present, would not be readily susceptible to development to produce the power planned for Bellefonte in the same time period.

(4) Exploitation of other geothermal reservoirs associated with hot springs and the geopressured zone of the Gulf Coast belt would be considerably slower than for a dry steam field with which there has been experience in this country.

(5) In view of the above points there are no known potential geothermal sites within the service area of TVA and for this reason geothermal energy as an alternative source of power was not further considered by the staff.

12.11.3 <u>Fuel Costs (GEI,1, A-35)</u>

This comment questions the use of the 1970 National Power Survey report as an accurate source of projected fuel cost information and the fuel cost assumptions used by the staff.

<u>Response</u>: The 1970 National Power Survey was not used by the staff to obtain a precise estimate of future fossil and nuclear fuel costs but rather as a trend indicator recognizing that post-1970 data suggests the Surveys' projections of rising fuel costs are undoubtably a conservative estimate of changing fuel prices. Recent experiences have proven that the 1970 National Power Surveys' projection that fossil fuel prices would increase at a greater rate than nuclear fuel prices is basically sound. However, the staff has made no attempt to utilize the absolute cost values presented in the 1970 Survey for either fossil or nuclear fuels in any of the analyses.

The staff made the assumption thatthe production power cost, including both fuel and operation and maintenance costs, would not increase significantly over the life of the plant. The staff is cognizant, as pointed out on page 9-6 of the AEC DES, that fuel costs will increase over the 30-year plant life. However, in evaluating alternative energy sources such as a coal-fired plant, the staff chose not to escalate either nuclear or coal prices. If escalation of fuel prices were included in the analysis, the nuclear option would be even more favorable from an economic point of view.

A second point to be made in this regard is that even if it is assumed that the price of nuclear fuel will increase by 50 percent over the life of the plant, the present worth generating cost would increase by only about 5 percent.

Finally, some studies indicate that nuclear fuel costs will remain constant in the future because of improvements in tehcnology and cost reductions as a result of increases in scale of manufacturing. For example, "The Nuclear Industry - 1973", WASH 1174, makes this type of prediction.

12.11.4 Spent Fuel Reprocessing (GEI,1, A-35)

The comment questions the applicants having taken steps to assure itself of an adequate reprocessing capacity.

Response: At present there are three fuel reprocessing plants in operation or being constructed in the United States. One plant, owned by Nuclear Fuel Services and located at West Valley, New York, was built in 1966. This plant is currently shut down for modifications and expansion to a capacity of 750 MTU/yr. The Barnwell Nuclear Fuel Plant is presently under construction at Barnwell, South Carolina and will have a capacity of 1,500 MTU/yr when completed in 1975. A third reprocessing plant is owned by General Electric Company and is located near Morris, Illinois. This plant, which has a capacity of 300 MTU/yr, is scheduled to commence operation during 1974. The three plants have a combined design capacity to meet the projected needs for fuel reprocessing services until late in the 1970's. The staff is of the opinion that as demand for spent fuel reprocessing expands in the future, private industry will develop additional processing facilities to meet the demand.

12.11.5 Nuclear Fuel Reserves (GEI,1, A-35; WEG, A-21)

The comments request information on the availability of uranium supplies.

Response: A study on nuclear fuel requirements and reserves has been made by the Division of Production and Materials Management of the U.S. Atomic Energy Commission. This report, titled "Nuclear Fuel Supply", presents information on forecasted supply and demand for uranium through the year 2000.

12.11.6 Reserve Margin (AC/H, A-14; SC/CC, A-18; WEG, A-21)

The comments suggest that the reserve margin desired by TVA is unrealistic and too large.

Response: The desired reserve margin to TVA is 20 percent which would provide a reliability index of one day's outage in ten years. One day's outage in ten years is an industry standard which is recommended by most of the Electric Reliability Councils.

The staff has estimated that TVA's reserve margin in 1980, 1981, and 1982 will be 17.6, 19.0, and 20.3 percent, respectively. Reserve margins of this magnitude are within the recommended range of reserve margins which the Federal Power Commission has considered to be adequate. The reserve margins of TVA are also consistent with recommendations made by various reliability councils and other electric utility systems. The staff does not find that the reserve margin of TVA is unrealistic.

12.11.7 Near-Term Commitment Versus Non-Development of Resources (AC/H, A-14)

The comment questions the staff's discussion as a justification of the Bellefonte plant.

Response: The statement by the staff on the balancing of the near-term commitment of resources against the non-developemnt of resources is not meant to be a justification for the Bellefonte plant. The statement was meant to imply that if the price of resources is real, that is, if the current price reflects the true value of a particular resource, then a business decision based on economics would most likely determine the economic feasibility of near-term commitment as opposed to the non-development of resources.

12.11.8 Alternate Sites (SC/CC, A-18)

The comment requests further discussion on the TVA owned lands that were used by the applicant to generate potential plant sites.

Response: While the staff does not know if all the land owned by TVA was considered as a potential site for a nuclear power plant, it is the understanding of the staff that in performing their preliminary site studies, TVA gave consideration to land ownership. This was indicated in the TVA DES on page 4.2-2. If TVA owned all or part of the site being investigated, a favorable evaluation was given for that particular aspect of the overall siting study. However, as pointed out on page 4.2-2 of the TVA DES and page 9-11 of the AEC DES, site ownership represented only one of many considerations used in performing preliminary siting studies.

12.11.9 Access Road (DOI, A-10)

The comment suggests that the staff reexamine its position on the access road causeway across Town Creek because public recreation should be encouraged at this site.

Response: The staff has reexamined its position on the access causeway road which is discussed in Section 9.2.3 of this statement. The construction permit is no longer conditioned by prohibiting the causeway construction, however, the staff is still of the opinion that the selected alternate should be upgrading and use of the existing access road.

12.12 BENEFIT COST CONSIDERATIONS

12.12.1 Recreational Monetary Value (AC/H, A-14)

The comment requests further discussion of the monetary value of a visit to the Bellefonte plant.

Response: The U.S. Department of Interior has recommended that the monetary unit value of the beneficial effects of a recreation-day for general recreational activities is in the range of \$0.75 to \$2.25. The staff used the lower estimate in evaluating the benefits that would be derived from visits to the Bellefonte site for both recreational and educational purposes.

12.12.2 Significant Costs (AC/H, A-14)

The comment suggests that the staff is inconsistent in that a \$5 million cost difference was considered significant when comparing alternate sites but \$25 million was insignificant when discussing decommissioning costs.

Response: The cost difference between Site C and the Bellefonte site is now \$10 million due to a reduction in transmission costs for the Bellefonte site. The \$10 million is a present-worth cost estimate. The \$25 million cost estimate for decommissioning is not a present-worth estimate but an estimate of the costs when the plant is decommissioned at the end of its useful life. On a present-worth basis, this expenditure is equivalent to about \$2.5 million.

12.12.3 Plutonium Recovery (AC/H, A-15)

The comment requests additional discussion on the recovery of plutonium from fission wastes as the staff considers plutonium production from LWR's an asset.

Response: The staff mentioned the production of plutonium in light water reactors only in the context that the Bellefonte plant will deplete some of our natural resources (U-235) on the one hand while increasing our energy resource supply (plutonium) on the other. The plutonium recovered in the spent fuel can be used as a fissile material in other light water reactors or in breeder reactors when they become available. The staff has not presented a discussion in the AEC DES on the recovery of plutonium from spent fuel; however, this subject is described in detail in WASH-1248 -- "Environmental Survey of the Uranium Fuel Cycle" and WASH-1303 -- "Effects of Plutonium Utilization on the Performance of Light Water Reactors."

Fuel reprocessing, which is included as a cost component in the overall fuel cost, recovers all but about 1 to 1.5 percent of the plutonium in the spent fuel. The isotopes of plutonium which are recovered in reprocessing are Pu-239, Pu-240, and Pu-241. The Pu-239 and Pu-241 isotopes are fissile while Pu-240 is a fertile material. The fissile isotopes account for about 80 to 85 percent of the recovered plutonium with the remainder being the fertile isotope Pu-240. Thus, more than 80 percent of the plutonium recovered in reprocessing can be used as a fissionable fuel in other reactors.

12.12.4 Quality of Life (AC/H, A-15)

The comment suggests that the evaluation of the Bellefonte Nuclear Plant project be based on the concept of an enhanced quality of life.

Response: The staff has not attempted to evaluate the full effects which the construction and operation of the Bellefonte plant will have on the quality of life. The staff has, however, identified the major benefits which will result from plant construction and operation such as the various uses of electricity and the more restricted local benefits including employment, recreation, education and payments in lieu of taxes. Generally, these benefits do enhance the quality of life for all or some of the persons residing the TVA service area and the nation as a whole.

12.12.5 Electrical Production and Reliability (AC/H, A-14)

The comment questions the benefit of electrical production if growth is the result which will tend to negate the added reliability of the system due to reserve capacity.

Response: The staff stated that the primary benefits to be derived from the Bellefonte plant were the production of electricity and the increase in system reliability. The staff estimated the average annual generation of electricity to be about 14 billion kwh. The nuclear plant will make a significant contribution to the reliability and adequacy of electric power supply in the TVA service area during the plant's 30 year life. In FY 1981, the Bellefonte plant will represent about 6.8 percent of the total installed capacity on the TVA system. As the peak demand and installed capacity grow, the Bellefonte plant will represent less and less of the total installed capacity on a percentage basis. However, it will continue to enhance system reliability throughout its operating life.

12.12.6 Work Force (AC/H, A-14)

The comment requests clarification of the make up of the construction work force in terms of union membership and discussion of subsequent impacts on families accustomed to an enhanced standard of living upon completion of construction.

Response: It is the staff's understanding that the various tradesmen and laborers required for the construction of the Bellefonte plant will be mostly unionized personnel. This is based on the "General Agreement between TVA and the Tennessee Valley Trades Labor Council" which indicates that memberships in unions is advantageous to employees and that qualified union members are selected and retained for employment in preference to qualified non-union applicants or employees.

The construction of the Bellefonte plant will provide employment to many individuals as indicated in Section 4.3.1 of the AEC DES. After the completion of this project, those individuals employed at Bellefonte would most likely go on to other employment in the construction industry. The experience gained at Bellefonte would be valuable to many of these persons in obtaining employment in fields other than power plant construction.

12.12.7 Benefits to the Nation (SC/CC, A-18)

The comment requests discussion on the benefits that would accrue to the nation from the use of federal funds for acquisition of land or construction and operation of a nuclear facility at Bellefonte.

Response: The staff is not aware of any federal funds being used for the acquisition of the plant site or for construction and operation of the nuclear facility at Bellefonte.

12.13 LOCATION OF PRINCIPAL CHANGES IN THIS STATEMENT IN RESPONSE TO COMMENTS

Topic Commented Upon	Agency	Section Where Topic is Addressed
The Proposed Project	AC/H, A-12	1.1
Executive Orders	DOC, A-6 ACHP, A-38	1.2
Ground Water	DOI, A-9 AC/H, A-12	2.6.1
Farming	WEG, A-21	2.7.3
Natural Background	WEG, A-21	2.10
Gaseous Effluents	TDPH, A-16	3.2.3.3
Onsite Construction	DOI, A-8	4.1.1
Construction Aquatic Effects	AC/H, A-12	4.2

Measures and Controls to Limit Adverse Effects During Construction	AC/H, A-13 EPA, A-34 DOI, A-10	4.4
Water Quality	AC/H, A-12 ADPH, A-30	5.2.3 & 2.6.2
Interaction of Widows Creek Steam Plant and Bellefonte	EPA, A-33 WEG, A-21	5.4.2.3.1
Biocides	DOI, A-10	5.4.2.4
Load Growth	AC/H, A-13	8.1.2
Energy Conservation	SC/CC, A-18 WEG, A-21 AC/H, A-13	8.1.5
Access Roads	WEG, A-21 AC/H, A-14	9.2.3

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1. H. N. Scherer, Jr. et al., "Gaseous Effluents due to EHV Transmission Line Corona," IEEE Transactions on Power Apparatus and Systems, Vol. Pas-92(3):1043-1049, 1973.

2. M. Frydman et al., "Oxidant Measurements in the Vicinity of Energized 765-kV Lines," IEEE Transactions on Power Apparatus and Systems, Vol. PAS-92(3):1141-1148, 1973.

3. W. J. Fern and R. I. Brabets, "Field Investigation of Ozone Adjacent to High Voltage Transmission Line," presented at IEEE PES Winter Meeting, New York, Jan. 27-Feb. 1, 1974.

4. Letter from J. E. Gilleland, TVA, to W. H. Regan, Jr., AEC, dated May 10, 1974.

5. F. Shofner et al., "Measurement and Interpretation of Drift Particle Data," in Cooling Tower Environment, AEC Symposium Series (1974).

6. J. D. Holmberg, "Drift Management in the Chalk Point Cooling Tower," in Cooling Tower Environment, AEC Symposium Series (1974).

7. "Reviewing Environmental Impact Statements--Power Plant Cooling Systems, Engineering Aspects," EPA Report EPA-660/2-73-016, National Environmental Research Center, Corvallis, Oregon, October 1973.

8. G. Spurr, "The Magnitude of the Problem of Thermal Discharges from Nuclear Power Plants," Central Electricity Generating Board, Report PL.SP/EG/3/72, September 1972.

9. P. Bøgh et al., "A New Method of Assessing the Environmental Influence of Cooling Towers as First Applied to the Kaiseraugst and Leibstadt Nuclear Plants," International Nuclear Industries Fair (Nuclex 72), October 1972.

APPENDIX A

COMMENTS ON

DRAFT ENVIRONMENTAL STATEMENT

CONTENTS

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
AREA OFFICE
DANIEL BUILDING, 15 SOUTH ~~20TH STREET~~, BIRMINGHAM, ~~ALABAMA 35233~~

REGION IV
REGIONAL OFFICE
ATLANTA, GEORGIA

AREA OFFICES:
Atlanta, Georgia
Birmingham, Alabama
Columbia, South Carolina
Greensboro, North Carolina
Jackson, Mississippi
Jacksonville, Florida
Knoxville, Tennessee
Louisville, Kentucky

February 13, 1974

RECEIVED FEB 20 1974

IN REPLY REFER TO:
4.2PP

50-438
50-439

Mr. Daniel R. Muller
Assistant Director for
Environmental Projects
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

RE: Bellefonte Nuclear Plant
Jackson County, Alabama

Dear Mr. Muller:

SUBJECT: Request for HUD Comments on Draft Environmental Impact Statement

We are pleased to acknowledge receipt of the above referenced request for HUD comments under the requirements of the National Environmental Policy Act of 1969 (PL 91-190).

We have reviewed the information submitted along with your referral and, to the extent of our available staff resources, have investigated the environmental impact, adverse effects, alternatives, short-term uses of the local environment and long-term productivity and irreversible and irretrievable commitment of resources which the project involves. From the information available to us, we find no basis for formal comment because of special HUD interest or expertise. However, we would call your attention to the areas indicated on the attached "HUD Comments on Draft Environmental Impact Statement" which we feel would assist your agency in the evaluation and execution of this project.

Should further clarification of our review be deemed necessary, please contact Mr. Peter W. Field, Director, Operations Division, #15 South 20th Street, (Daniel Building - Sixth Floor), Birmingham, Alabama 35233 at (205) 325-3697.

Sincerely,

Raymond M. Sherry

Raymond M. Sherry
Assistant Director of Operations
Planning and Relocation

DHUD COMMENTS ON DRAFT
ENVIRONMENTAL IMPACT STATEMENT

Project Identification: Bellefonte Nuclear Plant

Project Location: Jackson County Alabama

The following includes the general caveats and remarks which we feel should be brought to the attention of any State, local or Federal agency which has requested DHUD review of and comment on a draft Environmental Statement under the Environmental Policy Act of 1969 and the CEQ Guidelines. We have checked those comments which seem to be particularly applicable to the draft statement identified above; however the letter of transmittal will amplify these general comments if appropriate.

COMMENTS

☐ Inasmuch as HUD has no direct program involvement in Historic sites or structures effected by the subject project, we defer to the Advisory Council on Historic Preservation with respect to Historic Preservation matters.

☐ HUD has direct program involvement in the Historic Preservation aspects of the proposed project and appropriate comment is included in the transmittal letter.

☐ The subject project effects an urban park or recreational area and appropriate comment is included in the transmittal letter.

☐ The subject project effects only rural parks and recreational areas and HUD therefore defers to the Forest Service of the Department of Agriculture, the Bureau of Outdoor Recreation, Bureau of Land Management, National Park Service and the Bureau of Sports Fisheries and Wildlife with respect to comments on the Parks, Forests and Recreational effects thereof.

☐ This project will probably involve a statutorily required HUD review under Section 4(f) of the Transportation Act of 1966. Therefore, we defer comment on the parks and recreational aspects of the project pending request by D.O.T. for such a review.

[ ] This review covers the HUD responsibilities under Section 4(f) of the Transportation Act of 1966.

[ ] The Draft Environmental Statement fails to reflect clearance or consultation with the appropriate local planning agency which is: ____.

[ ] The Draft Environmental Statement fails to reflect consultation or clearance with the appropriate areawide planning agency which is: ____.

[ ] The Draft Environmental Statement fails to reflect consultation or clearance with the appropriate State Clearinghouse as required by Circular A-95, Office of Management and Budget. The A-95 Clearinghouse of jurisdiction is: ____.

[ ] The project apparently requires the displacement of businesses or residences. The Draft Environmental Statement does not reveal full consideration of the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646). If relocation assistance is desired, please contact Mr. Bob Lunsford, Director, Operations Div., Daniel Bldg., 15 So. 20th Street, Birmingham, Ala. at 205-325-3697. In the local community the person or office most familiar with relocation resources is: ____.

[ ] The draft statement does not discuss apparently feasible alternatives which may have a more beneficial effect on the urban environment. See letter of transmittal for possibly overlooked alternatives.

[X] In general, HUD defers to other agencies with respect to establishing and enforcing air and water quality standards, thermal pollution standards, radiation and general safety standards. We have no formal jurisdiction over such matters and no comments contained herein should be construed as assuming such responsibility or jurisdiction.

[ ] Since this project raises issues involving radiation safety, we recommend consultation with: Dr. Joseph Lieberman, Radiation Office, E.P.A., 5600 Fishers Lane, Parklawn Building, Rockville, Maryland 20852.

[ ] We recommend that you write or call the Office of Management and Budget for a copy of "Directory of State, Metropolitan and Regional Clearinghouses under B.O.B. Circular A-95," and consult with such clearinghouses as appropriate.

2/12/74 — DATE

Donald R. [signature] — PREPARED BY (FIELD REPRESENTATIVE)

2-13-74 — DATE

[signature] — CONCURRED IN (PROGRAM MANAGER)

UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

P. O. Box 311, Auburn, Alabama 36830

March 6, 1974

RECEIVED MAR 12 1974

Mr. Daniel R. Muller
Asst. Director for Environmental Projects
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muller:

We have reviewed the draft environmental statement related to the proposed Bellefonte Nuclear Plant. Our comments are as follows:

1. Land uses on the 1,500-acre plant site are well documented; however, it appears that a more detailed land use description could be provided for the 2,900 acres associated with transmission lines.

2. We suggest that the type of vegetative treatments for transmission lines be planned on individual site basis to best provide the needs for erosion control, wildlife, and esthetics.

Soil Conservation Service personnel headquarted in Scottsboro, Guntersville, and Huntsville can provide technical assistance on this type of planning.

We appreciate the opportunity to review and comment on this proposed project.

Sincerely,

W B Lingle

W. B. Lingle
State Conservationist

cc:
K. E. Grant, SCS, Washington, DC
T. C. Byerly, Ofc of the Sec, USDA, Washington, DC

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

OFFICE OF THE SECRETARY

WASHINGTON, D.C. 20201

MAR 18 1974

RECEIVED MAR 21 1974

Mr. Daniel R. Muller
Assistant Director for Environmental
Projects
Directorate of Licensing
Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muller:

Thank you for your letter of February 1 requesting comments on the draft Environmental Impact Statement for the Bellefonte Nuclear Plant, Docket Numbers 50-438 and 50-439. Based on the review by appropriate program agencies and regional offices, we have the following comments to offer:

It has been determined that the proposed plant can be constructed and operated without an undue impact on the environment or the health of man from releases of radioactive materials.

However, the temporary impact on local facilities during the construction period, when as many as 2200 workers will be employed at the plant site, will be significant in that it will over-tax already inadequate sewage treatment and medical care facilities. While plans have been developed to improve the existing sewage treatment facilities, these have low priority for State budget support at the present time.

It is also estimated that the impact on local schools will require an additional $38,000 annual expenditure for instruction plus the provision of eight additional classrooms. Will the Tennessee Valley Authority provide temporary room facilities to affected schools as it has in past situations of this sort?

Thank you for the opportunity to comment on this statement.

Sincerely,

Charles Custard

Charles Custard
Director
Office of Environmental Affairs

2895

Town of Hollywood

HOLLYWOOD, ALABAMA 35752

RECEIVED MAR 21 1974

March 18, 1974

Mr. Daniel R. Muller, Assistant Director
for Environmental Projects
Directorate of Licensing
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Sir:

After reviewing your Draft Environmental Statement on the Tennessee Valley Authority's proposed Bellefonte Nuclear Plant, Docket Nos. 50-438 and 50-439, we find no reasonable basis for disagreement with the conclusions you have reached.

We certainly hope that it will be possible for this project to go forward as expeditiously as possible.

Sincerely,

E E Dutton

E. E. Dutton, Mayor

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
U.S. COAST GUARD (G-WS/73)
400 SEVENTH STREET SW.
WASHINGTON, D.C. 20590
PHONE: 426-2262

RECEIVED MAR 20 1974

19 MAR 1974

50-438
50-439

Mr. Daniel R. Muller
Assistant Director for Environmental
Projects
Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muller:

This is in response to your letter of 1 February 1974 addressed to Mr. Benjamin O. Davis concerning the draft environmental impact statement for Bellefonte Nuclear Plants 1 and 2, Jackson County, Alabama.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. The Coast Guard commented as follows:

"The draft statement indicates the cooling intake and outflow structures have not been designed. When these structures are designed, they must not have an adverse affect on navigation."

The Department of Transportation has no further comments to offer nor do we have any objection to this project.

The opportunity to review this project is appreciated.

Sincerely,

R. I. [illegible]
Captain, [illegible]
Deputy [illegible]
[illegible]
By direction [illegible]

2358

OFFICE OF THE ASSISTANT SECRETARY OF COMMERCE
Washington, D.C. 20230

March 19, 1974

50-438/439

RECEIVED MAR 22 1974 U.S. ATOMIC ENERGY COMMISSION

Mr. Daniel R. Muller
Assistant Director for Environmental
Projects
Directorate of Licensing
Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muller:

The draft environmental impact statement for the Bellefonte Nuclear Plant, Tennessee Valley Authority, Docket Numbers 50-438 and 50-439, which accompanied your letter of February 1, 1974, has been reviewed by the Department of Commerce and the following comments are offered for your consideration.

It does not appear that the noble gases eventually released to the atmosphere from the gaseous waste system is on a continuous basis as is implied by table 3.3 and by the use of an average annual relative concentration factor. According to the description of the waste system on page 3-11 the gases will be pumped into one of two 3000 ft^3 tanks where they will be held for at least 60 days for radioactive decay. Then they will be released to the atmosphere "at a controlled rate" according to the staff. We assume that the controlled rate will be over a relatively short time compared to a year, since only 2 tanks are available, one for filling while the other is held for radioactive decay. Consequently, since the waste gas system processes over half the noble gases released to the atmosphere, we think the total body and skin annual doses are incorrectly computed as listed in table 5.4.

Executive Order 11507 was superseded on December 17, 1973, by Executive Order 11752. The footnote referring to this Executive Order should be corrected as well as the statement on page 1-2.

2414

- 2 -

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving a copy of the final statement.

Sincerely,

Sidney R Galler

Sidney R. Galler
Deputy Assistant Secretary
for Environmental Affairs

GEOTHERMAL ENERGY INSTITUTE
680 BEACH STREET, SUITE 426
SAN FRANCISCO, CALIFORNIA 94109
(415) 474-0404

RECEIVED
MAR 28 1974

March 20, 1974

Atomic Energy Commission
Washington, D.C. 20545

RE: AEC Dkt. Nos. 50-438, 50-439
Bellefonte Nuclear Plant
Jackson County, Alabama

Gentlemen:

May we comment on the alternative energy sources section of the February 1974 draft environmental statement prepared by your staff with respect of two proposed 1221 MW nuclear power plants scheduled for 1979-1980 operation.

In our opinion the summary statement that "The staff does not consider geothermal energy as a viable energy source on the TVA system" (page 9-3) is not an adequate independent assessment of geothermal alternatives required by NEPA and the Commission's own rules.

This opinion is unsupported by factual data or analysis and is buttressed merely by reference to the applicant's self-serving statement that "The potential for geothermal power is very low and no sites have been identified to date in the TVA system."

No reference is made to the significant geothermal - geopressured potential of the Gulf Coast which is quite significant as Hon. John Nassikas, Chairman of the Federal Power Commission, recently pointed out in testimony to the Congress.

In our opinion there is no factual basis supporting the staff's opinion, and it is one which cannot be intelligently reviewed.

We also believe that the staff's comments on "other energy sources" on page 9-4 are also inadequate. We do not believe that the mere "review of current literature" (i.e., three references: the 1970 National Power Survey, a 1972 Interior pamphlet, and a 1973 paper by S. Baron) is an adequate basis on which to judge new energy conversion methods.

Very truly yours,

Donald F. X. Finn

Donald F.X. Finn
Managing Director

DF/jm
cc: Hon. John J. Sparkman, Senator, State of Alabama
Hon. James B. Allen, Senator, State of Alabama
Hon. Robert E. Jones, Representative, Jackson County

2637

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

RECEIVED
MAR 27 1974

In reply refer to:
(ER-74/164)

MAR 22 1974

50-438
50-439

Dear Mr. Muller:

Thank you for your letter of February 1, 1974, transmitting copies of the Atomic Energy Commission's draft environmental statement dated February, 1974 on environmental considerations for Bellefonte Nuclear Plant, Units 1 and 2, Jackson County, Alabama.

The draft statement does not adequately address our previous suggestions concerning this project which were sent to you on December 10, 1973, and to Mr. F. E. Gartrell, Tennessee Valley Authority, on June 19, 1973.

Our comments are presented according to the format of the statement or according to subject.

GENERAL

The proposed Bellefonte Nuclear Plant will be the fourth such plant to be planned, constructed and operated by TVA on the Tennessee River. Two plants, Sequoyah (TRM 484.5) and Watts Bar (TRM 526) are located above the Bellefonte site while Brown's Ferry (TRM 294) is located downstream from the Bellefonte site. We recommend the final statement be expanded to consider the cumulative environmental effects of radiological, thermal and chemical releases from all of these proposed plants.

The draft statement appears to reflect comprehensive planning and discussion of monitoring programs to assess environmental impacts as they occur for this plant. However, there appears to be inadequate discussion or evidence of planning for design and construction to achieve minimal environmental impacts related to all types of earthwork. For example, the first and only specific mention of grading requirements appears to be near the end of the draft statement on page 9-17 where it is estimated that requirements include 800,000 cubic yards of excavation and 400,000 cubic yards of fill. This suggests that disposal of at least 400,000 cubic yards of excavated material would be required, but no discussion of this activity or any of its possible environmental impacts is presented.

THE PROPOSED PROJECT

The preliminary layout of the Bellefonte Plant shown on figure 1.1 indicates that a "yard drainage pond" would be constructed along the edge of Town Creek embayment and immediately northwest of the plant. The proposed pond is also illustrated in an artist's drawing of the proposed plant in figure 3.1 and appears to be a diked enclosure covering about 13 acres. However, the design of construction of the pond, and its perimeter dike and outlet; and the depth or amount of any excavation required to construct this facility, or of any related environmental impacts should be discussed in the final statement. The discussion of this pond on pages 3-16 is inadequate.

We suggest that additional maps be incorporated into the final statement which would clearly show both the present shoreline configuration at the site and the proposed shoreline changes for the cooling water intake system and blowdown discharged back into the Tennessee River. The structures to be built along the shoreline should be carefully identified on these maps.

GEOLOGY AND SEISMOLOGY

The brief sections on geology and seismology on pages 2-1 and 2-4 are inadequate for an independent assessment of the geologic environment relevant to the design, construction, and operation of Units 1 and 2. The physical properties of the geologic materials on which the plant would be founded are not described, nor have seismic-design parameters and the methods of their derivation been discussed. The only mention of the prescence or character of unconsolidated surficial deposits at the site is a brief reference to "residual soil overlying rock paralleling the topographic surface" in paragraph 2.6.1. The draft statement provides no indication of either the areal or the vertical distribution of any type of geologic material underlying the proposed nuclear plant. The final statement should explain these aspects of the project; and, in addition, should provide assurances that geology and seismology of the Bellefonte site have been taken into account in an appropriate manner, as prescribed in AEC's "Seismic and Geologic Siting Criteria for Nuclear Power Plants" (10 CFR 100 Appendix A, Federal Register, Vol. 36, no. 228, Nov. 25, 1971).

Under previous arrangements, the Geological Survey of this Department has reviewed the geologic conditions related to construction of the Bellefonte Nuclear Plant, as presented in the Preliminary Safety Analysis and Amendment 1. That review was transmitted to the AEC Directorate of Licensing on November 15, 1973. Nevertheless, we believe that the draft statement should provide a more comprehensive summary of the geologic and seismologic environment for the benefit of other independent reviewers.

GROUND WATER

This section contains just two lines; it does not provide data locating wells nor provide suitable identification of the ground-water regimes. The possible effect of de-watering operations is given only cursory treatment in paragraph 4.1.1. In a limestone area where ground-water is extensively used, fuller treatment of potential problems in this area is justified. The applicant's draft statement contains a limited but insufficient amount of data on ground water. A piezometric contour map of the local ground-water regime would be desirable.

GASEOUS WASTES

We suggest that the final statement should clearly indicate whether or not the effluents from this plant will meet proposed Appendix-I guidelines.

SOLID WASTES

The solid radioactive wastes that result from operation of each of the two units have been estimated to include annually approximately 500 30-gallon drums of spent resins, 200 55-gallon drums of evaporator bottoms, and 600 55-gallon drums of miscellaneous dry waste. The total activity is estimated to be approximately 5,400 curies on page 3-14. It has been assumed that the wastes would be shipped to an offsite burial ground at Morehead, Kentucky. Practically no additional information is provided on the ultimate disposition of the wastes or any related environmental effects. It is suggested that the statement specify the kinds of radionuclides, their physical states, their concentrations, and the estimated total volume of wastes during the expected life of the reactors. It would also be advisable to discuss Federal and State licensing provisions, criteria, and responsibilities for the burial site in connection with: (1) its hydro-geologic suitability to isolate solid wastes of the Bellefonte Nuclear Plant from the biosphere; (2) surveillance and monitoring of the disposal site; and (3) any remedial or regulatory actions that might be necessary during the period in which the wastes will be hazardous.

STRESSON MUNICIPAL WATER AND SEWAGE SYSTEMS

We suggest that the final statement should evaluate all effects that could be caused by the untreated sewage effluent from the proposed population increase, as this is a secondary effect caused by this project.

EFFECTS OF COOLING TOWER OPERATION

It is estimated on page 5-23 that the amount of water carried into the plume "will be about 0.015 of the circulating water." In regard to previous studies of the effect of salt deposition on plants and soil, it is stated on page 5-24 that "the absolute amounts of salt under consideration in the above mentioned studies are much greater than would be deposited at Bellefonte." However, the amounts considered in these studies have not been given, and no specific estimate of the amount that would be deposited in the vicinity of the Bellefonte Plant is furnished.

It is indicated on page 8-14 that "some chemical and/or salt deposition and possibly heavy metal contamination within about 1,000 feet of the cooling towers may occur." Considering the 500-foot height and 500-foot base diameter of the cooling towers, it seems highly unlikely that the distribution of deposited salt would be limited to 1,000 feet from the cooling towers.

TRANSMISSION LINES

We suggest the use of herbicides should be restricted and support the staff recommendations.

AQUATIC ENVIRONMENT

Little information has been provided on dredging of the intake channel or related impacts. For example, although the channel would be dredged to a depth of about 30 feet, a width of 25 feet, and a length of perhaps 1,500 feet, no mention is made of the volume of dredging or blasting, the method of dredging or excavation, the type of material, or the disposal of the spoils. The fact that considerable excavation would be performed below the water line is evident on figure 5.4. An underwater trench excavated in rock is also evident on that map but this excavation and its impact are not discussed in the text. The only discussion of related impacts appears to be a brief reference to "increased turbidity and siltation, as well as alteration or loss of embayment, overbank, and channel regions from construction activities" on page 6-4. In the discussion of unavoidable environmental effects on pages 8-14 and 8-15, no mention has been made of the dredged intake channel, including alteration of the lakeshore and bottom, or the impact of spoil disposal. We recommend that the final statement consider the omissions noted above.

Further, the potential problems of siltation of the intake channel should also be discussed, including the stability of its side slopes, the form in which the slopes would be graded and protected from erosion, and any other related impacts.

If fish entrapment proves to be a problem at this plant, it may be feasible for the intakes to be extended into the main reservoir.

RADIOLOGICAL MONITORING

The program described in section 6 should be expanded to include small game within the project area.

PLANT ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

Discussion of accident probabilities is purely qualitative, and discussion of the most serious, Class 9, accidents is limited largely to the statement that they are "sufficiently small in probability that the environmental risk is extremely low." We cannot agree that environmental risk can be considered low simply because probability is low, but we believe that both the probability and the severity of the accident must be considered in estimating environmental risk. Although neither of these two factors have been quantitatively estimated as yet, it is noted that "AEC is currently performing a study to assess these risks more quantitatively" and that initial results of the study are expected to be available in early 1974 (p. 7-5). We also note that similar parameters associated with the environmental effects of Class 9 accidents are not evaluated. Despite the very low probability, we believe that this information should be included in the final statement.

BIOCIDES

We suggest that the recommended EPA discharge standards for chlorine be applied to the Bellefonte plant.

UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

The final statement should assess the effects of discharging 1700 pounds of chemicals per day on the Tennessee River.

RECREATION

The statement contains an inconsistency regarding a proposed causeway across Town Creek embayment northeast of the plant. It is stated on page 4-4 that several areas of the embayment will be lost to the earthen causeway. However, it had been stated earlier on page iv that issuance of a construction permit would stipulate that "the causeway across Town Creek embayment shall not be constructed." We suggest that access to the 400 to 500 acres of land at the end of the peninsula on which the Bellefonte Plant will be sited for recreation purposes is of particular interest. We suggest that the applicant and the staff might consider the alternative of an elevated roadway to the recreational site. Such a roadway might be less costly to construct and would cause less environmental damage than a causeway. However, we urge that public recreation should be fully encouraged at this site.

The staff decision to withhold a construction permit unless the causeway is abandoned should be reexamined. Such reexamination should be postponed until the "...safety review of the detailed recreational plan" is conducted as indicated on page 9-28. In that regard, it would be appropriate for the Department of the Interior to participate in the review of the recreation plan. If requested to do so, the Bureau of Outdoor Recreation through its Regional Office in Atlanta, Georgia, would be pleased to assist the TVA in developing its land use and/or recreation plan for the Bellefonte site.

We hope these comments will be helpful to you in the preparation of the final statement.

Sincerely yours,

Royston C. Hughes

Assistant Secretary of the Interior

Mr. Daniel R. Muller
Assistant Director for Environmental
Projects
Directorate of Licensing
Atomic Energy Commission
Washington, D. C. 20545

Incorporated 1969

The Alabama Conservancy

ROWLAND E. BURNS, PRESIDENT
1920 ROSALIE RIDGE
HUNTSVILLE, ALABAMA 35811

Mr. Gerald L. Dittman
Directorate of Licensing
U.S. Atomic Energy Commission
Washington, D.C., 20545

Dear Mr. Dittman:

I am enclosing comments on the draft environmental statement related to the proposed Bellefonte Nuclear Plant. I wish to request that my comments be made a permanent part of the material on this project and that all of my questions be answered and my comments discussed.

Sincerely,

Rowland E. Burns

(Dr.) Rowland E. Burns

Comments, Page 1, Rowland E. Burns

Page 1-1, Para. 3: It should be stated whether or not this refers to present customers or customers that will be attracted as a result of plant construction.

Same, para. 4: The current DES refers to only two units of the proposed nuclear plant construction along the Tennessee River. It is apparent that all plants are, to some extent, additive. Thus, individual EIS do not reflect the overall impact of each plant. What is required under full disclosure apects of NEPA is a single impact statement assessing the impact of all planned nuclear plants.

Same, para. 5: The proposed facility will certainly aid the industrialization referred to. The conversion of crop lands to industrial lands must be evaluated and shown to be desirable.

Same, para. 6. The word 'will' in the first sentence assumes a favorable outcome of the plant from the point of view of TVA. The AEC, as juror, should not make such a flagrant assumption.

Page 1-2, para. 4: The question of whether or not TVA is exempt from state regulation is currently under litigation. The statement made is invalid under such circumstances.

Same, last para. Since the meeting referred to discussed, at least indirectly, the expenditure of public funds it should have been announced so that interested citizens might attend. The reason that it was not announced should be stated at this point.

Page 2-8, para. 2.6.1. The discussion of ground water is totally inadequate. The sub-surface flows to the depth of the worst credible accident involving the reactor should be detailed.

Page 2-9, para. 1. The radioisotopes which have been detected should be specifically named.

Smae, para. 3: Do the communities which are referenced have alternative water supplies in case of a massive accident at the nuclear plant? This point should be discussed.

Same, para. 6; The total value of the commercial fishing and recreational fishing should be evaluated. This loss of income must be considered as a possibility in case isotope leakage/ accident at the reactor site becomes a reality.

Page 2-10, para. 2.7.4 As stated, attracted traffic will be drawn into the vicinity of the reactor complex. This traffic will produce air pollution. As you are well aware, recent court decisions (NRDC vs. EPA) had held that existing air cannot be degraded. How will this be taken into account with respect to attracted traffic?

Same, para. 2.7.5. Loss of income to recreation must be accounted for in cases similar to those discussed above for fishing.

Page 3-4, para. 3.2.3 The entire concept of dumping radioactive wastes into Guntersville must be justified. It is stated that only small amounts of such wastes will be dumped, but why should any be dumped? The plant obviously will have large quantities of wastes hauled from the site. Why should these small amount of wastes not also be carried away rather than dumped into the drinking water of the citizens of the area?

Page 4-1, last para. The actions that TVA will be required to take to alleviate well-water problems should be detailed.

5 pages total

Comments, page 2, Rowland E. Burns

Page 4-2, para. 1. The possibility of total elimination of transmission lines via the conversion of the elctricity to gaseous hydrogen for later usage has not been considered. This would have the advantage of totally eliminating transmission lines and much of the subsequent environmental difficulties.

Same, para. 3. A specific section on the environmental effects of the listed herbicides should be given. Furthermore, open burning is illegal under Alabama air pollution laws. I recommend that you deal with this point.

Page 4-4, para. 1. The concept of equating 'acceptable' with 'lowest practicable' is not only an affront to the concept of a DES but, worse, an affront to logic as well.

Page 4-6, paras. 4.3.2.2 and 4.3.2.3, comparison. The final sentence of the prior paragraph states that significant adverse economic impacts are not expected to result when construction is complete. Yet the following paragraph states numerous new housing units will have to be constructed in the vicinity. It is apparent that these contradict each other. If local business men must invest in housing that will become empty this certainly is an adverse economic impact. A similar comment can be made about the required expansion of the school system which is hinted at on page 4-8.

Page 4-10, para. 4.3.3.3. The air degradation in the vicinity of the plant is not discussed. This must be accounted for.

Page 4-11, para. 1. It is an incredible coincidence that the sewage treatment capacity exactly matches the load. So coincidental that a misprint is suspected.

Same, para. 4&5. The problem is outlined but no solution is suggested. What do you intend to do about the waste situation? Simply pollute Guntersville? If so, state that you specifically intend to allow raw sewage to be dumped into the lake in order to facilitate plant construction.

Page 4-11, last line. 'Unacceptable' implies a value judgement and should be quantified.

Page 5-1, para. 1. It should be made clear whether or not the TARCOG plan was worked out before TVA proposed the Bellefonte site. It is well known that TARCOG and TVA work hand-in-glove, so citing one of the pair to support the other is not a justification for either.

Page 5-2, para. 2. The surviving relatives of the people buried in the cemetaries may not be locatable. Please comment on how many relatives have been found, and how you expect to establish whether or not you have located the nearest living relative.

Same, para. 4. No assurances of historic preservation are given. This is critical.

Page 5-3, paragraph at top of page. This contains a typographical error (typo).

Same. It should be stated whether or not the esthetic impact is considered to be positive or negative.

Page 5-4, paragraph which is labeled by the number '2'. Is it claimed that this will be true (i.e., no violation) during construction?

Page 5-5, second para. from the bottom. How do you know that the intent of the standard is met? Is this a value judgement?

Page 5-7, para. 5.3.1.1. The phrase 'generally agreed' is too vague to be acceptable. A spectrum of opinions should be presented.

Comments, page 3, Rowland E. Burns

Page 5-9, para. 1. Only mobile forms of life are considered. Immobile ones should be discussed. Furthermore, the comment on radioactive decay is out of context since the half-lives are very long in general.

Page 5-17, last sentence on the page. What does 'as low as practicable' mean?

Page 5-22, para. 5.4.1.1.3. If the Paradise, ky., plant is to be used for purposes of comparison, then it should be established that the atmospheric conditions at that site are very similar to those at the Scottsboro site.

Page 5-24, para. beginning at the top of the page. An ecosystem simplification is apparently being predicted. Is this what is truly expected?

Page 5-26, para. 5.4.2.1. The dredging will result in siltation and spoil banks. The effects of this on the fish population should be discussed.

Page 5-28, para. 1. A discussion of measures to be taken if severe fish depopulation occurs should be given at this point.

Page 5-35, para. 3. The separation distance between the nozzles that is required to prevent interaction of the jets is not given. This distance could be wider than the river channel, so the distance should be given.

Same, para. 6. The fate of the heated discharge can be predicted by numerical integration of the standard equations of fluid mechanics, though the job is admittedly extensive. Even so, due to the importance of the result, this should be done.

Page 5-39, para. 5.4.2.3.2 and 5.4.2.3.5. Typos.

Page 5-41, last para. Typo.

Page 5-42, para. above #4. This point must be resolved before even a DES is issued.

Page 5-43, para. 5.4.3. The Turner nomograms are far too crude to deal with this matter. A full diffusion simulation including stability class, inversion ceiling, etc., must be made.

Page 5-44, top para. 'Acceptable' implies a value judgement.

Page 7-5, para. 3. Will the developed information become a part of the EIS?

Same, para. 4. '10 CFR Part 20'should be given in the DES for comparison purposes for readers which do not have it available.

Page 7-6, section 7.2. Theft and sabotage are not discussed. They should be. (Jack Anderson has many interesting comments on this point.)

Page 8-3, para. 3. Have the new cutbacks in the usage of electric current due to the energy crisis been figured into the growth rate estimates?

Page 8-5, para. 8.1.2. The AEC has often been accused of being both the salesman and promoter of nuclear power. But in this case the AEC is also to be the customer for the final product. The conflict of interest is thus at three levels. The AEC can build their empire via approval of this plant. It is truly said that where interest prevails, honor fails. The feedback loops are apparent.

Page 8-7, para. 3. The 'elasticities' referred to should be quntified.

Comments, page 4, Rowland E. Burns

Page 8-16, para. 8.3.3.2. Typo.

Same, para. 8.3.3.3. Please explain why nuclear reactors wear out.

Page 8-17. Numerous typos.

Page 9-1, last para. TVA is stated to desire a reserve of 20%. Is this desire justifiable? Also, typo.

Page 9-2, last para. The statement that the environmental impacts and comparative economics were not investigated by the staff is totally inadequate.

Table 9.2 Typo.

Page 9-10. The statment that a coal fired plant would produce a large smoke plume is unfair. This would be illegal under Alabama law.

Page 9-19. A glaring error occurs here in comparison with para. 11.2.1. In the former case you argue that $5 million is significant, yet in the latter case you argue that $25 million are essentially insignificant. This inconsistency is absurd.

Page 9-21, para. 4. Typo

Page 9-25, para. 2. A value judgement is made.

Page 9-27, para. 2. The interaction of this material with the non-degradation rulings should be discussed.

Page 9-28, para. 2. The staement 'It has been stated' is a total breach of scientific tradition without a reference. It is unworthy of an organization such as the Atomic Energy Commission.

Same, para. 3. There is an implicit assumption of the growth ethic. If you wish to assume this, establish that it is worthwhile.

Same, para. 4. The sentence which begins 'Perhaps an acceleration....' should be removed. If it is a perhaps, it is also a 'so what?'.

Page 9-29, para. 9.2.6. How can a DES possibly be issued with a question of this sort unresolved? TVA must choose their method before any evaluation can be made.

Page 10-1 para. 4. The concept of internal and external costs should be more detailed.

Same,para. 6. The concepts of near term commitment vs. non-development discussion is probably true, but is this intended to be a justification for the current work?

Same, last para. I must be noted that the two 'advantages' which are listed as benefits from the plant may well be contradictory. If the annual production of electricity results in growth, the the added reliability of the system due to reserve will be lost.

Page 10-6, paras. 10.2.4.2 and 10.2.4.3. In these paragraphs are listed 'values' of visits. Please explain how these values were derived, who recieves the value, and who pays the value.

Page 10-8, para. 5. The discussion of shifting work forces is interesting. Two points should be made, however. First of all, it is not clear if only union workers will be employed on the project and this should be made clear. Secondly, some discussion is in order about what will happen to families who have been accustomed to an enhanced standard of living when the plant is completed.

Page 11-8, para. 11.4.7. Typo

Same. The statement that a larger gross regional and national product will result, if true, begs the question. Most modern economists no longer grant that GNP is a valid measure of the health of the nation. For example, direct conversion of scarce raw material to garbage would increase the GNP. The more accepted figure of merit is the net economic worth or a project. The entire project should be based on the concept of an enhanced quality of life.

General comment on the cost to benefit ration calculations. This section of the DES is very qualitative and, ultimately resolves down to a simple opinion. A rigorous quantification of this section of the report must be made.

Page 11-8, para. 11.4.8. You list the plutonium from light water reactors as an asset since this is to be the fuel for the breeder reactor. If you wish to so list it, a discussion about the recovery of plutonium from the fission wastes should be made. The estimates that I have seen indicate that much of the plutonium remains in the wastes. Furthermore, a discussion of whether or not all of the produced plutonium isotopes can be so used is in order.

General comments about the overall DES.

1. One of the prime objections to fission plants is that the money that is being spent on such facilities is being withdrawn from research on fusion reactions. It should be justified that it is of more benefit to the country, in the long term, to spend money on fission plants than it would be to spend the money on fusion research.

2. The most severe environmental impact of the entire plant is not listed, namely the growth that the availability of this power will bring to the region. I have personally researched the results that can be expected in a city as the population grows. I request the right to present this data to the AEC and/or TVA in a presentation form and thus have these results included in the overall EIS. Since not all of the results of growth would be seen as desirable by a reasonable person, the negative aspects of growth must be addressed.

3. The Trojan nuclear plant near Portland, Oregon is protected by a high wall as a safeguard in case dams upstream from this this plant collapse. No discussion of such a high wall is included in the DES. Justification for this omission should be given.

4. The DES is overly qualitative. Many of the values in this report could be quantified to specific numbers instead of simply stated. The report should be rewritten from this point of view. In every case tolerence limits on the numerical values should be given.

5. No discussion of the ultimate fate of the wastes generated by the reactor is given. It is easily seen that the fission product wastes are the result of this reactor operating at this site, yet they are simply dismissed via trucking 'away'. This is obviously a part of the environmental impact of the plant...the environmental impact is not limited to the Bellefonte land, per se. A safe method of disposal of the wastes must be outlined.

STATE OF TENNESSEE
OFFICE OF URBAN AND FEDERAL AFFAIRS
SUITE 1312
ANDREW JACKSON STATE OFFICE BUILDING
NASHVILLE 37219

GARY S. BASSE
DIRECTOR

615-741-2714

RECEIVED MAR 29 1974 U.S. ATOMIC ENERGY COMMISSION

March 25, 1974

Mr. Daniel R. Muller, Assistant Director
for Environmental Projects
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

50-438
50-439

Re: Environmental Impact Statement by the U. S. Atomic Energy Commission Related to Proposed TVA Bellefonte Nuclear Plant

Dear Mr. Muller:

In conformance with guideline procedures stipulated in OMB Circular A-95 and in accordance with the Governor's Executive Order 6, designating the Office Of Urban and Federal Affairs as the State Clearinghouse for Federal grant programs, we have reviewed your draft environmental statement on the above mentioned proposed project (Jackson County, Alabama, 43 miles upstream of Guntersville Dam in Guntersville Reservoir).

Our evaluation of submitted materials identified no conflicts with existing or planned State activities. However, we are attaching comments received from the Tennessee Department of Public Health concerning several inaccuracies and discrepancies referred to in the statement as they relate to local environmental effects. We encourage you to consider these comments prior to finalization of the statement to insure accuracy and consistency.

If our office, as the State Clearinghouse, can be of further assistance, please do not hesitate to contact us.

Sincerely,

Suzanne M. Bentley

Suzanne M. Bentley
Grant Review Coordinator

SMB/prp

FROM	DATE
~~BB~~	3/18
~~RHW~~	3/18
DHB	3/18

DEPARTMENT OF PUBLIC HEALTH
CORRESPONDENCE

FROM	TO	DATE
IRH	EHS	3/18

DATE: March 18, 1974

TO: David Booth

FROM: Bill Graham

SUBJECT:

As requested in your memo dated February 11, 1974, the following will detail our comments on the Draft Environmental Statement as prepared by AEC on Bellefonte Nuclear Plant.

1. Page 3-11

We question the statement found in paragraph 1, "Based upon our evaluation, the radioactivity in the liquid effluent from units 1 and 2 exclusive of tritium will be less than 5 curies/year..." Table 3.2 on page 2 shows that the calculated annual radionuclide release in liquid waste, per unit, exclusive of tritium to be 0.1 Ci/yr. Also this figure of 0.1 Ci/yr was normalized from 0.03 Ci/yr on page 3-9. Thus, the total effluent from both units as derived from Table 3.2 equal 0.2 Ci/yr. Our question is this. Why overstate the problem by saying that the effluent release will be less than 5 Ci/yr when it will actually be less than 1 Ci/yr?

2. Page 3-15 Table 3.3

It was impossible for us to determine from table 3.3 the calculated annual release of radioactive materials in gaseous effluents as many of the totals shown appear to be grossly incorrect. The most apparent inaccuracies are noted in the following:

Item	Total Shown	Correct Total
Total for Kr-85	1.8×10^3	1017
Total for Xe-133	1.3×10^3	400
Total for auxiliary	600	122
Total for air ejector	600	122

In addition, as the footnote denotes that (0) indicates release is less than 10^{-20} Ci/yr, all releases therefore noted in the table, even though minute, become significant and should be included in the totals.

DEPARTMENT OF PUBLIC HEALTH

CORRESPONDENCE

FROM	TO	DATE

DATE:

TO:

FROM:

SUBJECT:

3. Page 3-14

There is considerable difference in AEC and TVA estimates of solid waste to be shipped from the reactor site each year.

	Spent resins	Evaporator bottoms	Misc. dry waste
TVA estimate	3100 ft^3	1920 ft^3	4900 ft^3
AEC estimate	4000 ft^3	2941 ft^3	8820 ft^3

Also large differences are noted between AEC and TVA estimates of curies of material leaving the plant as solid waste each year.

	Spent resins	Evaporator bottoms	Misc. dry waste
TVA estimate	1550 Ci/yr	60 Ci/yr	50 Ci/yr
AEC estimate*	10,000 Ci/yr	800 Ci/yr	5 Ci/yr

* After 180 days decay

No explanation is given for the wide variations in estimates. As can be noted some of the variations are extremely large.

FROM	DATE

4. Page 5-7

Under Section 5.3.1.2 reference is made to Section 3.5 "The basis for these values is discussed in Section 3.5". There appears to be no section 3.5 in this document.

TO	

BG

B.G.

db

EXPERIMENTAL
TENNESSEE DEPARTMENT PUBLIC

March 25, 1974 #1
Dixon Springs, Tennessee 37057

Deputy Director for Reactor Projects
Directorate of Licensing
U. S. Atomic Energy Commission
Washington, D. C. 20545

50-438
50-439

Dear Sir:

We have been asked to comment on the Draft Environmental Statement related to the proposed Bellefonte Nuclear Plant recommended by the Tennessee Valley Authority. After examination of the statement we have concluded that the need for the nuclear electric generating facility has been overestimated by the utility, in these particulars.

No entry has been made to indicate that the utility has reassessed the growth of electricity consumption in the region since the augmentation of a national policy of energy conservation in November 1973. No entry has been made to indicate that TVA has reassessed the need for the Bellefonte agricultural acreage to remain in farm production during the next immediate years to avert a pending food crisis in the nation and elsewhere. No entry has been made to indicate that the utility has made an effort to revise its rate structure so as to encourage a decrease in electricity consumption by large industrial users thereby decreasing the need for additional electric generation. No entry has been made indicating that the utility has made an effort to revise its rate structure as to reduce need for heavy use of electricity at peak load times by charging a higher rate for electricity use at those times of day or of the week. No entry has been made indicating that the utility has made an effort to reduce rather than increase its reserve margin by a program of intensive inspection and maintenance of its existing electric generating facilities.

No entry has been made to indicate that the utility has reassessed its position in the nuclear electric generating field based on the recurring failures of its nuclear facility at Browns Ferry, recently causing a shutdown of the facility in a series of many such failures within the past few months of that facility, the doubling of construction and other costs at its on-going Watts Bar and Sequoyah facilities, and a growing national unease concerning the waste, transportation, operation, and construction of nuclear electric facilities. No entry has been made to indicate the utility has acknowledged that uranium supplies available to it, according to an Atomic Energy Commission study of 1974, at currently economically attractive prices, will cease to exist during the life of the projected facility. It is questionable that the TVA system will obtain benefits from the Bellefonte facility in terms of available power for consumption. The TVA system operates primarily and basically, all euphemisms to the contrary, in the state of Tennessee and fringe areas of serveral neighboring states. There is no indication that the utility has made any effort to justify its electric generation potential with a projection of population figures for the future. Assuming that each of seven regions of the nation acquires an even share of the projected 14 million (U. S. Census, 1974), the South could expect an increase of 2 million individuals over eight to eleven states. The utility has made no entry to indicate what portion of that increased population it plans to serve nor the necessity for the addition of thirteen nuclear electric generating facilities to serve it nor specifically what part the Bellefonte proposed facility would serve of that narrow population increase. At present the utility is the world's largest supplier of electricity in an area consuming less that 7% of the nation's electricity.

No entry has been made to indicate what benefits could accrue to the nation from the use of federal funds for acquisition of land, or construction and operation of a nuclear facility at Bellefonte for limited use in a small fraction of the nation's geographic area. No entry has been made to indicate that the utility has investigated the use of its 2,000,000 acres for a nuclear facility in place of the privately owned and not readily available Bellefonte site.

Respectfully yours,

Faith Young

Southern Confederation of Concerned Citizens

DEPARTMENT OF THE ARMY
NASHVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 1070
NASHVILLE, TENNESSEE 37202

IN REPLY REFER TO
ORNED-P

25 March 1974

RECEIVED
MAR 27 1974
U.S. ATOMIC ENERGY COMMISSION
Regulatory
Mail Section

Mr. Daniel R. Muller, Assistant Director
for Environmental Projects
Directorate of Licensing
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muller:

Reference is made to your letter of 1 February 1974, forwarding the Draft Environmental Impact Statement, Bellefonte Nuclear Plant, Tennessee Valley Authority, Docket Nos. 50-438 and 50-439.

We have reviewed the statement and have no comments to offer; the opportunity is appreciated.

Sincerely yours,

E. C. Moore

E. C. MOORE
Chief, Engineering Division

2530

AN EQUAL OPPORTUNITY EMPLOYER

March 27, 1974

RECEIVED
APR 4 1974
ATOMIC ENERGY COM

Mr. Gerald L. Dittman
Environmental Project Manager
Directorate of Licensing
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Dittman:

Attached will be found my comments on your Draft Environmental Statement for the Bellefonte Nuclear Plant.

Time will not permit a complete analysis of this statement. Hopefully, other members of the public will comment, and who knows, even a state or federal agency might get up guts enough to disagree with Big Sister at the Atomic Energy Commission or Big Brother at the Tennessee Valley Authority.

It is to be hoped that the Atomic Energy Commission will make factual response to the comments rather than the bull conclusory type statements that are not based on fact that dominate the A E C statement.

Very truly yours,

Bill Garner
Bill Garner
Route 4, Box 354
Scottsboro, Alabama 35768

Re: In The Matter of Tennessee Valley Authority (Bellefonte Nuclear Plant Units 1 and 2) Docket Nos. 50-438 and 50-439

Comments of Bill Garner of Route 4, Box 354, Scottsboro, Alabama 35768.

Re: Atomic Energy Commission Draft Environmental Statement (Numbered references are to pages, sections, figures, tables, etc.:

SUMMARY AND CONCLUSIONS:

3.g. The statement that "Land use for the 1500-acre site is primarily agriculture and forestry" is a misstatement of fact.

h. The d.e.s. says, "It is not anticipated that the adverse social impacts will be large. The applicant states that it will take mitigating action and aid local political bodies should a need arise." The social impacts will be large. There is no assurance that the Applicant will take mitigating action and aid local political bodies should a need arise.

j. It is common knowledge that the herbicides used by the T V A are similar to the herbicides that caused large scale birth defects in Viet Nam. The Department of Defense should be compelled to release its secret reports on this matter.

FOREWORD:

The staff did not make an independent assessment nor did it prepare a detailed statement.

All references below are to section numbers of the d.e.s.:

1.1. The statement that the site is six miles east-northeast of Scottsboro, Alabama is a misstatement of fact. The sorry record of Babcox-Wilcox in furnishing reactor vessels is not discussed.

1.2. Here and throughout the d.e.s. the A E C refers to the T V A environmental report as a draft environmental statement. This is a misstatement of fact. The T V A is not exempt from state and local reviews and approvals of their action. It should be pointed out that the T V A has refused to comply with Executive Order 11507.

2.3. Recoverable limestone on the site is not adequately discussed. Oil, gas and mineral production on the site is not adequately discussed. Since the development of the site for nuclear power does not preclude recovery of oil and gas, the license should be conditioned on the T V A permitting the property owners to retain the oil and gas rights.

2.5.3. The T V A's refusal to comply with air standards at Widow's Creek should be discussed. The mixing of sulphur dioxide from the Widow's Creek plant with fog from the Bellefonte plant should be discussed.

2.7.3. Farm product values should be updated.

2.7.4. A good faith study of the choice of railroad routes should be made.

3.2.4.3. At least secondary sewage treatment facilities should be required initially.

3.2.4.4. The gaseous emissions cannot be justified.

3.3. The need for a new interconnection of the T V A system with the Alabama Power Company is purely conclusory.

3.4. A good faith study of highway and railroad alternatives has not been made by the T V A and the A E C.

4.1.3. A good faith study has not been made of access railroad construction.

4.3.1. A good faith study of the social and economic effects of employment has not been made.

4.3.2.6. An honest good faith study of the unavailability of insurance and its effect on property values has not been made.

4.3.3.2. A good faith study has not been made of the congestion or stress on local public facilities and services.

4.3. Insufficient facts are given to justify any of the conclusions on the social and economic effects of the plant. There is a total lack of quantification in these areas.

5.1. Impacts are not quantified. Sufficient facts are not given.

5.4.2.3.2. The assumptions as to plankton damage are not based on any facts and are completely conclusory.

5.5.1. The damage from so-called normal background radiation is not considered at all. Assuming the A E C figures are correct, do the T V A and the A E C plan to compensate the people in the area on a basis of the A E C monetary estimates of radiation damage?

7. As everyone knows, the safety of nuclear plants exists only in the speeches of Richard Nixon and the rantings of Dixy Lee Ray. The effects of Class 9 accidents should have been included in the environmental statement.

8.1. Insufficient facts are given as a basis for project load growth. The statement is made in 8.1.2. "With the ever greater use of electricity, the positive effect on demand caused by the increase in consumers in the TVA region could offset the negative consumption effect caused by price increases." This statement is completely conclusory and no facts are given on which it is based.

8.1.4. The large reserve margins are unrealistic and not based on fact.

8.2.1.4. No facts are given as to noise pollution levels.

8.2. No facts or conclusions are given as to the damage that will be done as to wildlife due to displacement or construction activity, and wildlife that will be killed by increased traffic in the area. More facts are needed as to the effect of T V A use of groundwater on other groundwater users. The Alabama Geological Survey has done a study of dangers of groundwater contamination on a similar limestone aquafer. The staff has not even considered this study.

8.1. The results of energy conservation measures advocated by the Nixon Administration have not been considered.

8.4.4.2. No information is given on how long the present supply of uranium will last.

9.1.1.7. Insufficient facts are given. The fact that the A E C is throwing up road blocks to the development of other energy sources has not been considered.

9.1.3. The information as to alternative sites is factually inadequate. The staff conclusion that the Bellefonte site should be selected is conclusory and based on insufficient facts.

10.3. All of the conclusions in this section are based on insufficient facts.

11. The benefits and costs are based on insufficient facts and are not sufficiently quantified as described by the National Environmental Policy Act and accepted accounting principles.

GENERAL COMMENT:

No breakdown of the amount of electricity sold and produced in each of the seven states is given. Alabama and Kentucky are the major donor states to the T V A power system. Consequently, this plant should be located in either Tennessee, Mississippi, Georgia or Virginia. (North Carolina is also a donor state.) Furthermore, there is no way that a staff can reach an unbiased decision as to the need for this plant because of the incestuous relationship between the A E C and T V A. Nuclear plants were on their way out until the T V A went big on nuclear plants. Furthermore, the A E C is either the T V A's largest or second largest customer and this plant will directly benefit the A E C. Also, consideration was not given in the "Need for Power" section to the fact that a process for using less electricity to extract aluminum from its ore has been developed. Further, consideration was not given to the fact that the centrifuge process replacing the gaseous diffusion process will make the requirements of the A E C for electricity far less.

The A E C d.e.s. relies almost totally on "facts", "studies," etc. furnished it by the T V A. Subsequent to the preparation of the A E C d.e.s. , a United States District Court held that in the Duck River project that T V A and its

Chairman Aubrey J. Wagner, "did not reach their decision to proceed with the construction of this project after a full, good faith consideration of the environmental factors." In view of this, the A E C will be derelict in its duty if it does not do a new Draft Environmental Statement that is based totally on its own investigations. See attached clippings from The Chattanooga Times and The Nashville Tennessean. The assumption that the T V A tells the truth about anything simply cannot be indulged in.

THE TENNESSEAN

NASHVILLE, TENN., SATURDAY, MARCH 9, 1974

Court Orders Work On 2 Dams Halted

By KEEL HUNT

A federal judge, saying the Tennessee Valley Authority suppressed significant information on the Columbia and Normandy dams, has ordered a halt to all work on the Upper Duck River project.

U.S. Dist. Judge Charles G. Neese said construction on "the Duck River project" must cease by midnight March 30 and remain halted until TVA files an acceptable environmental impact statement as required by federal law.

IN A 26-page opinion, Neese concluded that TVA and its chairman, Aubrey J. Wagner, "did not reach their decision to proceed with the construction of this project after a full, good faith consideration of the environmental factors."

The case may be appealed to the U.S. Sixth Circuit Court of Appeals. A TVA spokesman declined to discuss this possibility yesterday but did say:

"It will take some study before TVA decides what step it will take at this point. Of course, construction on the project will stop at midnight, March 30."

NEESE, JUDGE of the eastern federal district of Tennessee, heard five days of testimony in January in a lawsuit brought by the Duck River Preservation Association (DRPA).

The dams and reservoirs in the project would affect portions of Bedford, Coffee, Marshall and Maury counties in Middle Tennessee. Work began on the $35 million Normandy Dam in June 1972, and on the $53.5 million Columbia facility last August.

The pouring of concrete for the Normandy structure is almost complete, but only preliminary site preparation has been completed at Columbia.

THE CASE centered around TVA's final environmental impact statement for the Duck River project and whether TVA gave a fair picture of the true costs — as well as the benefits — of the two dams and the reservoirs that would collect behind them.

The statement is required by the National Environmental Policy Act to help federal decision-makers learn the impact of a proposed project.

TVA lawyers had contended that the environmental impact statement was a balanced assessment of the project, but attorneys for DRPA argued that important costs — such as the loss of sales from flooded farmland and relocation payments to displaced families — were not reflected in the document.

TVA's OWN experts in agricultural economics had concluded before the statement was published that "unavoidable losses" from farm sales alone would total $1.3 million and that losses to farm-dependent businesses would amount to some $3.3 million.

THE TVA document, according to Neese, also was not sufficient in discussing the true impact of the project on recreation and wildlife and on the cost of relocating displaced residents.

THE TENNESSEAN
Tuesday January 29, 1974 Page 13

Two Groups Charge TVA 'Influence' by Aiding Backers of Dams

By KEEL HUNT

Officials of two environmental groups charged the Tennessee Valley Authority yesterday with "influencing" a 1971 public hearing by providing information in advance to supporters of the proposed Duck River dams.

Members of the Tennessee Citizens for Wilderness Planning (TCWP) and the Tennessee Scenic Rivers Association (TSRA) strongly criticized the federal agency's role in assisting development groups which favored the Columbia and Normandy dams.

"IT IS SHOCKING to find that an agency supported by public funds was working behind the scenes to 'stack the deck' by influencing the expression of public opinion at a supposedly open hearing," said Bill Russell, former TCWP president.

An internal TVA memorandum — written two months before the August 1971 public hearing — indicated that the TVA Office of Tributary Area Development was working to assist opponents of environmentalists.

The June 11, 1971, memo was filed recently as an exhibit in a federal court lawsuit challenging the adequacy of TVA's environmental impact statement for the dams. The document was not brought out in open court, but it read in part:

"THE OFFICE of Tributary Area Development will discuss appropriate techniques and information to be supplied to organizations in the Upper Duck River area for use in combatting efforts of so-called wilderness preservation groups opposed to the Duck River Project."

A TVA spokesman said Thursday the pro-dam information was provided to development groups before the public hearing and added that "in any kind of a controversial project, we are, of course, going to explain why TVA thinks it makes sense to do something."

Juanita Guinn, TSRA president, said yesterday in Nashville the TVA apparently was prejudiced since it assisted opponents of preservation groups before holding the hearing to obtain citizens comments.

"FOR ANY AGENCY to decide — prejudicially, in my opinion — what is best for any area, and yet try to make it seem like people are getting all the information, really disturbs me," she said.

"The decision-makers should have all the facts," she added. "They've got to have the good and the bad, and whenever either the good or the bad is deleted, then you have no basis for reaching conclusions."

Russell, who lives and works in Oak Ridge, said the TVA memorandum, which indicated the agency's opposition to environmental groups such as his, was "proof of TVA's lack of open-mindedness."

"THE CITIZEN groups who want to preserve the last sizeable river in Tennessee as a free-flowing stream are regarded by TVA as enemies who would be singled out for 'combatting' through 'appropriate techniques,'" Russell said.

The federal court trial on TVA's Duck River environmental statement ended Jan. 18, in Winchester but U.S. Dist. Court Judge Charles Neese has not ruled in case. The plaintiff was the Duck River Preservation Association.

Letters to the Editor

The Chattanooga Times

FRIDAY, MARCH 29, 1974.

TVA Scored

TVA's Duck River Project was recently ordered halted by U.S. District Court Judge Charles Neese, after it was demonstrated that this project has been clothed . . . in falsehood and deception all along, and that it is an unbelievable rip-off of the American taxpayers and the people of Tennessee. . .

The suppression of information about the $4.6 million annual loss in agricultural benefits, information provided them by their own agricultural experts, smacks of the same type of mentality which has brought us Watergate. Contrary to what many people have been led to believe, the project will generate no hydroelectric power whatsoever. The projected benefits of the project are calculated with population figures which TVA's own experts subsequently revised downward drastically, but the benefits were never recalculated using the more realistic population figures. The data on industrial effluents were copied (incorrectly) from a state report prepared in 1964 and now completely out of date. Recreational benefits were systematically falsified. Relocation costs of the project were not included as a part of the total cost, and the discount rate assumed is so ridiculously low that no one could conceivably borrow money at that rate.

In testimony given under oath and not refuted by TVA, it was demonstrated in Federal District Court that financially this project is a big, fat loser; that it is another one of these ill-planned pork-barrel projects which waste our resources, ruin our economy with inflation, and saddle us with debts. . . This deliberate and blatant attempt to mislead the people of Tennessee about the Duck River Project is inexcusable; (Aubrey) Wagner and (Lynn) Seeber have no choice but to resign if they wish to restore public confidence in TVA. With projects like this, how can we expect our rates to go any direction but up?

—David J. Wilson
Nashville

TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE
37401

March 27, 1974

50-438

50-439

Mr. Daniel R. Muller
Assistant Director for
Environmental Projects
Directorate of Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Muller:

The TVA staff has reviewed the AEC draft environmental statement transmitted by William H. Regan's letter of February 5, 1974, to James E. Watson. The enclosed comments are offered for AEC's consideration.

These comments have been restricted to four topical areas: construction of the access road across Town Creek via causeway, fisheries investigations, transmission line construction and maintenance methods, and control of onsite construction activities. These comments are included as enclosures 1-4. Additional comments of a minor nature have been identified and will be discussed with the AEC staff on an informal basis.

Very truly yours,

J. E. Gilleland

J. E. Gilleland
Assistant to the Manager of Power

Enclosures

RECEIVED
MAR 30 1974

2700

ENCLOSURE 1

Construction of Access Road Across Town Creek via Causeway

TVA considered two locations for road access to the Bellefonte Nuclear Plant site in the early planning stages. One location utilized the existing county road that passes through old town Bellefonte near the plant site. The other required construction of a new road that would cross Town Creek (via a causeway) to the end of the peninsula.

The existing county road would need to be upgraded to provide permanent access to the site. Also, it passed through the old Bellefonte townsite which was listed in the Alabama Statewide Plan of Historic Preservation and was being processed for nomination to the National Register of Historical Places. The volume of heavy traffic (e.g., delivery trucks and construction equipment) that would use this route if it were the only access to the site would probably cause more rapid deterioration of the already deteriorated structures of possible historic significance in the townsite. The road across Town Creek embayment, after construction, would allow the heavy traffic to avoid the Bellefonte townsite. This access would also allow development of approximately 500 acres of land on the tip of the peninsula for public use, as well as reduce traffic congestion during construction.

Prior to AEC's issuance of their draft environmental statement for the Bellefonte project, recreational use of the peninsula was unspecified; therefore, few benefits on the recreational use of the peninsula were available for consideration. The AEC staff states that the aquatic impacts associated with construction of the causeway would be undesirable but acceptable and concludes that, on balance, the causeway should not be constructed. The AEC staff also indicates that the peninsula should be preserved as a wildlife region.

Recently, the additional information given below has been developed in relation to the causeway and the alternate route, recreation development on the peninsula, and its compatibility with wildlife uses of the peninsula.

The natural flow pattern in Town Creek consists primarily of runoff flowing into Guntersville from a small drainage area of 0.43 square mile. The average runoff flow is estimated to be 5 cfs. The construction of the causeway will not alter the magnitude of the net flow in the creek. In the immediate vicinity of the causeway there will be a local increase in water velocity as the flow passes through the box culverts. For an average runoff the velocity in the culverts is estimated to be only 0.033 ft/sec. Changes in the transport and deposition of sediment may also result, but only in the immediate vicinity of the causeway. Sedimentation in the creek upstream from the causeway will not be generally increased.

The Bellefonte tract is important to recreation development on Guntersville Lake for several reasons:

1. Although much of the upper portion of the reservoir is in TVA ownership it is generally in narrow strips which limit development. The south side of the reservoir borders the Sand Mountain escarpment, is extremely steep, and lacks road access. The north side of the reservoir extends into the gently sloping to flat valley area, and the lands acquired by TVA are subject to flooding. Most of this land is licensed to the State of Alabama as wildlife management areas. Addition of the Bellefonte tract to the public land base and development of the tip of the peninsula for public recreation would be a significant increase in upper Guntersville Lake recreation opportunities.

2. Recreational development on Guntersville has been traditionally concentrated at the end of the lake nearest the dam and the city of Guntersville. Future growth of other population centers, such as the cities of Scottsboro, Hollywood, and Stevenson, will necessitate a better dispersion of shoreline recreational developments and lake activities. Bellefonte peninsula is within 10 miles of each of these cities, as well as on the same side of the lake.

3. The gentle topography and large size of the tract make it suitable for a number of types of recreational developments.

A preliminary recreation plan has been developed and includes development of a campground-park complex offering a complete range of camping facilities and passive recreation opportunities emphasizing the ecological and natural resources of the area. A system of foot trails and nature study opportunities as suggested by the AEC on page 5-2 of their draft environmental statement, as well as a boat access area and bank fishing opportunities, are planned to enhance recreational opportunities.

Day use facilities, including swimming, picnicking, playfields, etc., are also planned as a part of the complex. The feasibility of incorporating hunting into the total recreational package will be explored with the Alabama Department of Natural Resources.

It is estimated that the present worth of the recreation provided by this area over the life of the plant based on $1.25 per visit is $2,800,000.

Further investigation shows that, if the recreation development on the peninsula were done in a manner to specifically avoid disturbance of important habitat to the maximum extent practical, properly managed wildlife development on the peninsula could actually enhance wildlife benefits when compared to the alternative of allowing no access and leaving the peninsula to natural changes. The adverse impacts on wildlife would principally be those associated with habitat losses due to factors such as recreation facilities and access roads. Careful planning, however, could result in realization of benefits to both recreation and wildlife.

The development of the recreation facilities will be carried out so that adverse impacts on the environs of the peninsula will be minimized. The riparian woodlands along the tip of the peninsula, the steeper slopes, and known heron roosting areas will be left largely in their natural state. Facilities will be located for the most part in the midportion of the peninsula on land that is, at present, primarily open.

Protection of the areas indicated above and the planting of various tree and shrub species in the open areas to be developed along with natural succession is expected to improve the peninsula habitat.

The route across the Town Creek embayment requires the construction of an access road 2.7 miles long which will remove about 10 acres of land from productive use. This route is estimated to cost approximately $160,000 more than the direct route discussed above. TVA's Bellefonte draft environmental statement stated this cost difference to be $400,000. However, more detailed studies made since the statement was issued show that the total cost of the access via the Town Creek causeway is expected to be about $1,070,000, while the total cost of upgrading the road through old town Bellefonte is expected to be about $910,000. As stated above the environmental impacts associated with building the causeway across the Town Creek embayment--the turbidity and siltation during construction, the more limited water transfer, and loss of some aquatic habitat in Town Creek embayment--are minimal. The advantages of this route are that it minimizes possible damage or destruction to the historical structures in the Bellefonte townsite and the public convenience and recreation potential of the peninsula is enhanced.

In summary, the principal costs associated with recreational development of the peninsula include an incremental total cost of $160,000 for access construction, approximately $500,000 for development of the recreation area, and the impact on wildlife of some habitat removal and disturbance. Benefits derived from the recreational development include $2,800,000 (1985 dollars) in recreation benefit over the life of the plant, reduced traffic through old town Bellefonte, and increased utilization of existing wildlife resources.

After considering the alternatives, TVA selected the indicated route across Town Creek as representing the best balance between cost, environmental impact, and the other considerations discussed.

ENCLOSURE 2

Intake and Related Fisheries Investigations

The AEC staff states in their draft environmental statement that the intake structures should be located in deep water because fish impingement "would most likely be reduced" (page 5-28). They state that "it is imperative that loss of fish eggs and larvae be minimized . . . by location of the intake opening in an area of low larval density" (page 5-30). These points are reiterated by the staff at various places in the statement.

The staff also states (page 5-42) that they will require that TVA develop and submit a plan for a 2-year fishery investigation to assess the impacts of the proposed intake design and that "Construction activities related to the intake structure shall not commence until the staff has had an opportunity to review the results of the studies as outlined above."

In response to previous AEC requests, TVA has studied and submitted to the AEC staff six viable alternative intake designs, three of which utilize deepwater intake openings. TVA agrees that a deepwater intake would reduce the number of larval fish entrained; however, it is the judgment of TVA fishery biologists that the number entrained utilizing the proposed intake will not result in significant impact. They also judge the number of healthy fish that will be impinged on the traveling screen to be inconsequential due to the very low velocity in the intake channel of the proposed design.

In reference to the fishery investigation outlined on page 5-42, TVA questions the necessity for such detailed studies to determine that impacts due to the proposed intake are insignificant. Beginning in early April 1974 weekly samples will be taken to describe the distribution, relative abundance, and seasonal timing of ichthyoplankton in the vicinity of the plant. These studies will be used as a basis for verifying TVA's judgment that entrainment of ichthyoplankton will not result in significant impacts to the fishery of Guntersville Reservoir.

Studies of distribution and abundance of "fish" (it is presumed that AEC's usage of this term refers to post-larval fish) were conducted and appear in TVA's draft environmental statement. Fecundity and spawning habits information on important species is available in the published literature. Consequently, no studies of this type are considered necessary. Spawning sites and nursery grounds will be identified if in the vicinity of the plant or in an area of projected plant impact, but no reservoir-wide survey is planned. While determination of survival rates and age class strengths is a worthy objective, TVA doubts that meaningful quantification of these is possible in a 2-year period.

TVA feels that it would be sufficient to make water velocity surveys at the site to determine the distribution of flow in the river cross section at the intake and to use this information to estimate the source (i.e., shoreline, midchannel, etc.) of the intake flow. The water velocity surveys would be a one-time data collection and not a part of a continuing monitoring program. It should also be noted that there is no way of measuring the actual intake effects in the field prior to operation and that only estimates of the intake flow source can be made. However, TVA believes that the estimates described above would be adequate to determine the recruitment pattern of nearshore and offshore waters into the intake openings.

Vulnerability to entrainment is limited to the larval stage (i.e., from hatching to approximately 2 months). Data obtained at Browns Ferry Nuclear Plant in October 1973 and January-March 1974 indicate that vulnerability of healthy fish to impingement was limited primarily (90 to 95 percent) to fish less than 150 mm total length, that more than 90 percent of impinged fish are clupeids, and that from two to four age groups (depending on species) are impinged. The fact that the proposed intake design for Bellefonte will have intake screen velocities about an order of magnitude less than those at Browns Ferry should result in much smaller impingement.

While the studies suggested on page 5-42 are appropriate in considering population dynamics and impact assessment in general, TVA does not believe that all of the studies are necessary to determine that the impact of the proposed intake will be minimal nor that delays in construction are justified in view of the responsible judgments regarding potential impacts presented in TVA's draft environmental statement.

Based on the cost-benefit analysis of the intake alternatives that was supplied to AEC previously, TVA concludes that the originally proposed intake design is the best choice.

ENCLOSURE 3

Transmission Line Construction and Maintenance

TVA does not agree with the AEC staff statement that TVA's ". . . basic approach is not consistent with good construction practices and basic ecological principles." However, TVA is willing to conduct an evaluation study to assess alternative methods of construction and maintenance of transmission lines.

The line sections to be used in this evaluation study are an 11-mile section along the Tennessee River and a 4.6-mile section located atop Sand Mountain. A description of these line segments and clearing methods to be used is given below.

Approximately 11 miles of the proposed Bellefonte-Widows Creek No. 2 500-kV line parallels the Tennessee River at a distance of 2,000 to 3,000 feet from the river. The land traversed by this section of line is relatively flat and varies in elevation from 600 to 650 feet. Approximately 10.5 miles of this line section is managed by the State of Alabama Department of Conservation and Natural Resources as a waterfowl management area. Farming and pasturing (both active and inactive) constitute about 50 percent of the present land usage along the right of way. The remaining right of way area consists of various trees and brush cover which are scattered at random locations along the 11-mile route.

Special clearing methods will be used for this 11-mile section in which only select tall trees and fast-growing species will be removed. The use of herbicides in TVA's clearing operation for the initial transmission line constructed under step one (as designated by AEC in their draft statement) will be limited to spot application of herbicides to the stump resulting from the special clearing methods used on a portion of this line. No broadcast use of herbicides is planned for the clearing operations associated with this transmission line connection to Bellefonte. For the transmission lines to be constructed under steps two and three, the use of herbicides will be contingent upon the results of the right of way clearing studies performed on the transmission line constructed under step one.

The 4.6-mile section of line atop Sand Mountain generally parallels the river, traversing alternately open farmland, pasture, and wooded farm lots. The shear clearing method will be utilized where wooded areas cross the proposed route. The potential for soil erosion through this relatively level and semiagricultural area is very slight. The longest continuous wooded area along this line section is approximately 4,800 feet. Following construction, the right of way in this section will be seeded with fescue grass.

In critical areas near the Tennessee River and other waters, minimum clearing will be done and screening will be left. Screens will be left at major or scenic roads.

During construction, access roads will be held to a minimum and an extreme effort will be made to limit them to tower sites only. Where an access road is necessary, visual impact, as well as soil stability, will be a prime consideration and the access will be designed to minimize both.

On the final cleanup where seeding is required, efforts will be made to reestablish some areas as game habitats by utilizing seed mixtures as suggested by state and wildlife management personnel rather than Kentucky 31 fescue. In those seeded areas not marked for game habitat, fescue will be used.

During subsequent maintenance periods, plant reinvasion and the vegetative regrowth rate will be recorded to determine the effectiveness of these two right of way clearing methods as it relates to maintenance and environmental impacts.

Prior to construction of the transmission line connections discussed under step one (as designated in AEC's draft environmental statement), an inventory of vegetation on specific test tracts along the right of way will be evaluated.

The specific tracts to be used in this evaluation program will be determined at a later date. During subsequent maintenance periods, plant reinvasion and regrowth rates will be recorded to determine the effectiveness of various right of way clearing methods, including shear clearing treatment as it relates to line maintenance and environmental impacts. Concurrent studies will be performed also on other transmission line projects in the TVA area to determine specific impacts to wildlife, understory development, and ecotonal influences.

Cost and relative benefits for shear clearing and select clearing methods of right of way clearing will be obtained from proposed test sections. Results from these test areas, in addition to other proposed TVA research projects on right of way clearing methods, will form the basis for assessment of clearing practices to be used for the transmission lines to be constructed under steps two and three of this project.

ENCLOSURE 4

Control of Onsite Construction Activities

Environmental monitoring feedback to assure minimization to the extent practical of adverse impacts due to construction activities is accomplished through TVA's administrative control procedures. As discussed below, initial decisions regarding modification of construction activities are made by construction personnel who can assess the relative importance of the activities being performed. In the event that the monitoring program identifies a need to alter the manner in which an important activity is being performed, the decision to alter the construction schedule to reduce impacts may be made at a higher administrative level than the construction project manager on recommendation of personnel having the responsibility for environmental monitoring and assessment.

Monitoring for the adverse effects due to runoff caused by construction activities as outlined in TVA's environmental statement will be performed by the construction organization on a continuing basis and periodically conducted by other divisions of TVA as the work is being performed. The construction project manager will assign responsibility for the continuous monitoring to the construction engineer and/or safety engineer and their organizations. Adverse effects resulting from construction activities will be corrected immediately upon detection when practical. Those not considered practical to correct or alleviate immediately will be brought to the attention of the project manager for final decision. If action is delayed, reasons will be documented.

Periodic monitoring will be performed as outlined in the revised nonradiological environmental monitoring program for the Bellefonte Nuclear Plant. Any variances, ill effects, potential problems, or suggestions of personnel not a part of the construction organization will be discussed on the site with the appropriate project officials and documented if considered significant. Action to be taken will be decided by the project manager after consultation with appropriate personnel outside the construction organization. The administrative control procedures within TVA can be used should further action than that proposed by the project personnel be thought necessary.

TVA does not anticipate encountering problems with construction personnel having access to nonconstruction areas of the site and sees no need to exclude construction personnel from these areas. Consequently, TVA does not intend to erect signs and/or fences for this purpose.

State of Alabama
Department of Public Health
State Office Building
Montgomery, Alabama 36104

IRA L. MYERS, M. D.
STATE HEALTH OFFICER

March 28, 1974

Directorate of Licensing
United States Atomic Energy Commission
Washington, D. C.

Re: Docket Nos. 50-438, 439

Gentlemen:

We have reviewed the Draft Environmental Statement prepared by the Direcorate Licensing, and we have the following comments:

1. On Page 5-5, your response to Criteria 10 of the Alabama Water Improvement Commission is vague. We would suggest that your response indicate that the calculated sum of radium 226 and strontium 90 includes the naturally occurring radioactivity. Further, in your comment you indicate the information comes from Table 3.2, yet Table 3.2 does not specifically name either radium 226 or strontium 90.

2. On Page 6-2, Table 6.1 on rainwater, you indicate that the criteria for sampling locations are filter paper at 10 locations. We are unsure of what procedures are to be followed. Will the rainwater be collected in a container and then passed through a filter and the filter counted, or will the rainwater collect on a filter in the field, and the filter be counted later?

3. In your discussion of decommissioning on Page 8-17, you indicate three possible levels of decommissioning with corresponding estimated costs of $1 million to $70 million. We suggest that since the proposed decommissioning provided for as 1 and 2 require commitments requiring an additional Environmental Impact Statement, but proposal number 3 would return the land to a nearly undisturbed state, then at this time, the $70 million cost estimate for proposal number 3 should be used.

Thank you for the opportunity to comment on the Environmental Draft Statement.

Sincerely,

Aubrey V. Godwin

Aubrey V. Godwin, Director
Division of Radiological Health

AVG/dm

APR 2 1974

2778

The Alabama Conservancy

CONSERVATION CENTER

1816-E 28TH AVENUE, SOUTH (HOMEWOOD) • BIRMINGHAM, ALABAMA 35209 • (205) 871-0389

RECEIVED
APR 3 1974
U.S. ATOMIC ENERGY COMMISSION
Regulatory
Mail Section

Draft Environmental Statement
Bellefonte Nuclear Plant
Tennessee Valley Authority
Dockets Nos. 50438

50-438
50-439

Comments and Questions:

<u>32.3.2 Page 3-11.</u>

Firm plans for disposal of tritium from the plant are most important. The level of tritium in the nation's waters has been steadily increasing under Atomic Energy Commission's licensing activity. With the numerous nuclear facilities sited and proposed on the Tennessee River, serious problems of radioactive waste in the river's water should be contemplated and avoided. Disposal of the tritium as a liquid effluent to Guntersville Reservoir is certainly of questionable desirability.

<u>3.2.4.3 Page 3-16</u>

Sanitary Waste. Insufficient data is provided for consideration of waste from approximately 2500 persons for a period of six years.

Since waste will be discharged to Guntersville Reservoir, classified for "swimming and body contact sports," it must at least meet secondary waste treatment standards. (85% BOD removal, fecal coliform maximum averages of 200/100 ml, etc.). If, as indicated, a lagoon system is to be used, will the holding time be of at least 90 days? Will the lagoon be properly sited and constructed to prevent groundwater contamination? Will the necessary continuous maintenance be provided and the discharge effluent monitored? What will be the ultimate disposal or use of this lagoon following the six year construction period?

<u>5.4.2.4 Page 5-41</u>

Chemical effects. Daily discharge of unexpected tons of sulfuric acid must <u>not</u> be treated casually.

Louise G. Smith

Mrs. Louise G. Smith
Clean Water Chairman

March 29, 1974

WS:ej

2845

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

Mr. L. Manning Muntzing
Director of Regulation
U.S. Atomic Energy Commission
Washington, D. C. 20545

50-438
50-439

Dear Mr. Muntzing:

The Environmental Protection Agency has reviewed the draft environmental statement issued in conjunction with the application of the Tennessee Valley Authority for a construction permit for the proposed Bellefonte Nuclear Plant Units 1 and 2. Our detailed comments are enclosed.

Our review indicates that operation of the Bellefonte Nuclear Plant, as proposed, will comply with Alabama water quality standards and the thermal requirements of the Federal Water Pollution Control Act (FWPCA) Amendments of 1972. However, the choice of intake structure location may not reflect the best available technology as presented in Section 316(b) of the FWPCA. Accordingly, we believe the AEC staff should encourage the applicant to explore methods of locating the intake structure such that impacts are further reduced.

The radioactive waste treatment equipment planned for Bellefonte Nuclear Plant Units 1 and 2, in combination with TVA commitments to maintain and operate the equipment properly, should result in population and individual doses which can be considered "as low as practicable."

In light of our review and in accordance with EPA procedures, we have classified this project as LO (Lack of Objections) and have rated the draft environmental statement Category 1 (Adequate). If you or your staff have any questions concerning our classification or comments, we will be happy to discuss them with you.

Sincerely yours.

Sheldon Meyers

Sheldon Meyers, Director
Office of Federal Activities A-104

Enclosure

ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D. C. 20460

MARCH 1974

ENVIRONMENTAL IMPACT STATEMENT COMMENTS

Bellefonte Nuclear Plant, Units 1 and 2

TABLE OF CONTENTS

INTRODUCTION AND CONCLUSIONS

The Environmental Protection Agency has reviewed the draft environmental impact statement issued by the U.S. Atomic Energy Commission (February 1, 1974) in conjunction with the application of the Tennessee Valley Authority for permits to construct the Bellefonte Nuclear Plant, Units 1 and 2. Our major conclusions are as follows:

1. It is anticipated that the operation of the Bellefonte Nuclear Plant, as proposed, will comply with Alabama water quality standards and the thermal requirements of The Federal Water Pollution Control Act Amendments of 1972 (FWPCA). However, we recommend that the applicant further explore methods (e.g., alternative intake structure locations) for reducing the potential impact upon the aquatic environment, and evaluate the potential impact of an increase in concentration factor in the cooling water system, prior to blowdown. In addition, the applicant is urged to make available details of the blowdown discharge scheme, as they are developed, to EPA and other interested parties.

2. Our review indicates that the radioactive waste treatment equipment planned for Bellefonte, in combination with TVA commitments to maintain and operate the equipment properly, should result in population and individual doses which can be considered "as low as practicable."

RADIOLOGICAL ASPECTS

Radioactive Waste Management

Based on our review of the draft environmental statement, we find that the radioactive waste management practices and treatment equipment planned for Bellefonte will be consistent with state-of-the-art technology. Thus, the radioactive effluents will be consistent with the "as low as practicable" philosophy of 10 CFR Part 50.34.a.

However, in the draft statement, the AEC has indicated that TVA's plan to truck tritiated liquid waste to the nearest approved low level burial site, is not in conformance with the "as low as practicable" guidance, and other disposal methods should be considered. EPA agrees with this determination, since commercial facilities have not been licensed to dispose of low level liquid wastes. The final statement should include a discussion of the possible disposal alternatives for these liquids, including a cost-benefit analysis and description of the environmental impact of each alternative. The optimum alternative should be selected based on a balance between cost and environmental consequences.

Transportation

In our earlier reviews of the environmental impact of transportation of radioactive material, we agreed with the AEC that many aspects of this problem could best be treated on a generic basis. The generic approach has reached the point where on February 5, 1973, the AEC published for comment in the Federal Register a rulemaking proposal concerning the "Environmental Effects of Transportation of Fuel and Wastes from Nuclear Power Reactors." We commented on the proposed rulemaking by a letter to the AEC, dated March 22, 1973, and by an appearance at the public hearing on April 2, 1973.

Until such time as a generic rule is established, we will continue to assess the adequacy of the quantitative estimates of environmental radiation impact resulting from transportation of radioactive materials provided in environmental statements. The estimates provided for this station are deemed adequate based on currently available information.

Reactor Accidents

We have examined the AEC analysis of accidents and their potential risks which AEC has developed in the course of the engineering evaluation of reactor safety in the design of nuclear plants. Since these accident questions are common to all nuclear power plants of a given type, we concur with the AEC's approach to evaluate the environmental risk for each accident class on a generic basis. The AEC has in the past and still continues to devote extensive efforts to assure safety through plant design and accident analyses in the licensing process on a case-by-case basis. However, we favor the additional step now being undertaken by the AEC of a thorough analysis on a more quantitative basis of the risk of potential accidents in all ranges. We continue to encourage this effort and urge the AEC to press forward to its timely completion and publication. We believe this will result in a better understanding of the possible risks to the environment.

We are pleased to note in the draft statement the discussion of the Reactor Safety Study and the commitment for timely public presentation of its results. If AEC's efforts indicate that unwarranted risks are being taken at the Bellefonte Nuclear Plant, we are confident that the AEC will assure appropriate corrective action. Similarly, if our efforts related to the accident area uncover any environmentally unacceptable conditions related to the safety of the plant, we will make our views known.

NON-RADIOLOGICAL ASPECTS

Thermal and Biological Effects

The proposed Bellefonte Nuclear Plant will have two pressurized water reactors with an electrical output of 2,664 megawatts. Condenser cooling will be accomplished by evaporative, natural-draft cooling towers within a closed-cycle system. Make-up water for the cooling system will be drawn from the Tennessee River at the rate of 4.20 cubic meters/second (148.5 cfs) and at an intake velocity of from .076 meters/second (.25fps) in winter to .073 meters/second (.24fps) in summer. Cooling-tower blowdown will be discharged downstream from the intake at the rate of 2.09 cubic meters/second (74 cfs).

Alabama water quality standards, applicable to the Tennessee River at the Bellefonte site, limit maximum stream temperature to 30°C (86°F) with an allowable maximum rise over ambient stream temperature of 2.8°C (5°F). TVA has stated that they will operate the Bellefonte plant in compliance with these standards. This will be accomplished by holdup of the blowdown to the extent required to restrict heated discharges to time periods when the wet-bulb temperature is most favorable. However, AEC indicates (p. 5-4) "... temperatures in the reservoir are, at times, close to or actually in excess of 30°C (86°F), and any blowdown at this time would violate this standard."

The applicant proposes not to operate the discharge system if violations of the temperature standards would result. However, no contingency plans are offered in the draft for these anticipated periods of no-discharge. In this regard, we recommend that the applicant explore methods for temporary retention (e.g. holdup pond) which would preclude the need for blowdown discharge under adverse conditions.

Temperatures at Guntersville Dam are noted in the draft statement to have reached a maximum of 31.5°C (88.7°F) (page 5-10); however, no indication is given as to whether this is due, at least in part, to operation of Widows Creek Steam Plant (the second largest fossil fired station in the TVA system) upstream on Guntersville Reservoir. Interaction between these facilities should be evaluated in the final statement.

TVA proposes to operate the cooling towers at two cycles of concentration. This will result in a two-fold increase in the dissolved solids present in the system, except during those periods when hold-up is required because of low flow releases from peaking power operation at Nickajack Dam. Under these conditions, increases in dissolved solids to approximately three times those in the river are anticipated. We recommend that the applicant study the feasibility of operating the cooling towers at higher concentration factors than the two to three, as presently proposed. For instance, use of a concentration factor of ten would reduce make-up requirements by approximately 50 percent and would reduce intake velocities and expected impingement, as well as reducing entrainment damage by about 50 percent. Additionally, blowdown volume would be reduced by almost 90 percent, as would be the heat discharged from the plant. Discharge concentrations of natural and added pollutants would be increased at higher concentration factors; use of a concentration factor of ten and a ten-to-one dilution as presently proposed, would result in an approximate doubling of the presently expected pollutant concentrations in the river. However, the reduced volume could be discharged through a multiport diffuser system to obtain similar dilution to that presently proposed. Therefore, it is recommended that cooling tower blowdown procedures, reduced flow or closed-cycle cooling for the essential raw cooling water system, diffuser alternatives, and the associated costs be re-evaluated in the final statement.

Section 316(b) of the Federal Water Pollution Control Act Amendments of 1972 requires that "... the location, design, construction, and capacity of cooling water intake structures reflect the best technology available for minimizing adverse environmental impact." In order to implement these requirements, draft regulations and a development document ("Development Document for Proposed Best Technology Available for Minimizing Adverse Environmental Impact of Cooling Water Intake Structures" December 1973) have recently been published by EPA. It is recommended that the proposed intake design be re-evaluated against the technology presently in the development document. Return of impinged nekton to Guntersville Reservoir at a point unaffected by the plant intake should be provided. However, debris collected by the trash boom and intake screens should be disposed of by sanitary landfill, or other acceptable method, and should not be returned to the reservoir.

ADDITIONAL COMMENTS

In certain instances the draft statement does not provide sufficient information to substantiate the conclusions presented. We recognize that much of this information is not of major importance in evaluating the environmental impact of the Bellefonte Nuclear Plant. The cumulative importance, however, could be significant. It would, therefore, be helpful in determining the impact of the plant if the following topics were addressed in the final statement.

1. Figure 3.3 should show treatment of gaseous release from the air ejector as a component of the gaseous waste treatment system, as mentioned on page 3-11.

2. The draft statement does not discuss the impact of fuel oil storage facilities. Strategies that will be employed to prevent air pollution should be provided.

3. The impact of the concrete batch plant that will be used in the construction phase of the plant is not discussed adequately in the draft statement. Particulate emissions from this source should be quantified and control measures that will be employed addressed.

4. An assessment of ozone production by energized high voltage transmission lines should be provided in the final statement.

5. Noise impact during the construction phase is both temporary and difficult to analyze; however, it should receive more attention than the depth of analysis implied by the brief statements on page 8-15 to the effect that ". . .no environmentally unacceptable noise levels are postulated. . ." It would be helpful if the final statement includes noise level projections and a description and analysis of noise abatement schemes.

6. Waste treatment facilities should be provided to achieve the requirements proposed by EPA (Limitations Guidelines for Existing Sources in Standards of Performance and Pretreatment Standards for New Sources for the Steam Electric Power Generating Point Source Category) to provide "best practical control technology currently available," for both preoperational and operating wastes. Although these requirements, as proposed, do not include conditions for radioactive waste discharges, facilities have been proposed for other nuclear plants (e.g. Shearon Harris), which provide significantly greater removal for organics and other oxygen-demanding pollutants. Use of such facilities for the chemical and detergent waste subsystems should be evaluated.

7. Specific measures to be instituted to limit adverse effects during construction (Section 4.4) should be included in the final statement. Discussion of construction impacts in the reservoir (intake and discharge structures) should also be provided.

8. We concur with comments on the need for additional evaluation of alternatives for transmission line construction and maintenance (especially the broadcast application of herbicides) and the need for a study to determine the impacts of transmission line construction.

9. Design parameters other than dry bulb temperature and relative humidity for the cooling towers (such as wet bulb, approach, etc.) should be provided in the final statement as well as the expected frequency of occurrence for all design parameters.

50-438

Office of Planning and Budget

Executive Department

James T. McIntyre, Jr.
Director

STATE CLEARINGHOUSE MEMORANDUM

TO: Mr. Daniel R. Muller, Assistant Director for Environmental Projects
Directorate of Licensing
United States Atomic Energy Commission
Washington, D.C. 20545

FROM: Charles H. Badger, Administrator
Georgia State Clearinghouse
Office of Planning & Budget

RECEIVED APR 5 1974 U.S. ATOMIC ENERGY COMMISSION Regulatory Mail Section

DATE: March 29, 1974

SUBJECT: RESULTS OF STATE-LEVEL REVIEW

Applicant: Atomic Energy Commission

Project: Draft Environmental Statement, Bellefonte Nuclear Plant

State Clearinghouse Control Number: 74-02-06-02

The State-level review os the above-referenced proposal has been completed. This proposal has been found to be consistent with State goals, policies, objectives, plans, programs and fiscal resources.

Additional Comments:

Several questions arose during State agency review concerning safety features of the project. It is felt that those questions may be adequately addressed in the later Final Safety Analysis Report and we would request review and comment privileges to that document. The following questions should be addressed:

(a) Where will radioactive waste be disposed? How long will these wastes have to be monitored?
(b) What would be the environmental effects to leakage from the disposal site?
(c) How would undetected faulty hardware or operator oversight effect risk calculations?

CC: Anne Bramlette, DNR
Larry Gess, OPB

270 Washington St., S. W. Atlanta, Georgia 30334

3120

GEOTHERMAL ENERGY INSTITUTE
680 BEACH STREET, SUITE 426
SAN FRANCISCO, CALIFORNIA 94109
(415) 474-0404

RECEIVED APR 2 1974 U.S. ATOMIC ENERGY COMMISSION Regulatory Mail Section

March 30, 1974 50-438/439

Atomic Energy Commission
Washington, D. C.

RE: Proposed Bellefonte Nuclear Power Plant
Units 1 & 2
Jackson County, Alabama

Gentlepersons:

We submit the following comments in response to the issuance by your staff of the draft environmental impact statement related to these proposed nuclear reactor-steam generator power plants (2 units producing 3600 MW thermal heat and 1221 MW of electricity each).

We are of the opinion that the section on economics (9.1.2.1) and costs (10.4) are not adequate enough to be reviewed.

We question whether the capacity factors of the applicant (e.g., 80% for the first 15 years) can be relied upon; and whether the staff has taken the rapidly rising costs of uranium fuels sufficiently into account; and whether it is proper to rely upon the 1970 National Power Survey report as an accurate source of information with respect to projected fuel costs; and whether the costs of reprocessing fuel or disposing of it have been adequately examined.

The nuclear industry is facing a "reprocessing crunch" and the applicant has not taken steps to assure itself of adequate reprocessing capacity - nor does it appear that it has secured a reliable source of nuclear fuel at a price certain.

No economic analysis is made of geothermal alternatives.

We believe it to be a mistake to assume, as the staff does, that the fuel and operation costs will not increase significantly over the life of the plant in view of general economic conditions and industry expectations generally.

Finally we are of the opinion that the analysis of radioactive waste disposals is inadequate. The subject should be treated directly and succintly without reference to other documents and the facts as to the ultimate disposal of the wastes should be clearly set forth.

Sincerely yours,

Donald F. X. Finn

2831

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

APR 3 1974

Mr. Daniel R. Muller
Assistant Director
For Environmental Projects
Directorate of Licensing
Office of Regulation
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Muller:

This is in response to your letter dated February 1, 1974, requesting comments on the AEC Draft Environmental Statement related to the proposed issuance of construction permits to the Tennessee Valley Authority (TVA) (Applicant) for the construction of the Bellefonte Nuclear Plant Units 1 and 2 (Docket Nos. 50-438 and 50-439). The 1,221 megawatts each proposed Units 1 and 2 are scheduled for commercial service in September 1979 and June 1980, respectively. The proposed site is a 1,500-acre tract of land on a peninsula at Tennessee River Mile (TRM) 392 on the west shore of Guntersville Lake about six miles east-northeast of Scottsboro, Alabama.

These comments by the Federal Power Commission's Bureau of Power staff are made in compliance with the National Environmental Policy Act of 1969 and the August 1, 1973, Guidelines of the Council on Environmental Quality, and are directed to the need for the capacity represented by the Bellefonte Nuclear Plant, and to related bulk power supply matters.

In preparing these comments, the Bureau of Power staff has considered the AEC Draft Environmental Statement; the TVA Draft Environmental Statement and TVA's responses to AEC comments thereto; related reports made in accordance with the Commission's Statement of Reliability and Adequacy of Electric Service (Docket No. R-362); and the staff's analysis of these documents, together with related information from other FPC reports. The staff generally bases its evaluation of the need for a specific bulk power facility upon long-term considerations as well as upon the load-supply situation for the peak load period immediately following the availability of the new facility. It should be noted that the useful life of each of the Bellefonte generating units is expected to be 30 years or more. During that period, each unit will make a significant contribution to the reliability and adequacy of electric power supply in the Applicant's service area.

The Applicant is the largest member system of the Southeastern Electric Reliability Council (SERC). SERC coordinates the planning of the members' bulk power facilities. The Applicant's system and other utility systems of the Council, serve the area which includes Tennessee, North Carolina, Georgia, South Carolina, Florida, Alabama, and portions of Mississippi, Virginia and Kentucky. The Applicant's system is strongly interconnected with adjoining utility systems of the SERC region and adjacent regions. These interconnections provide for intra and inter-regional power exchanges, including operating contingency support of the interconnected systems, thereby improving the reliability of bulk power supply.

The Applicant's system is winter peaking. The Applicant minimizes investment in generating plant dedicated to peaking applications by entering into coordinated power interchanges with summer peaking systems within and adjoining the SERC area.

The Bureau of Power staff notes that the projected annual rate of load growth by the Applicant is 6.4 percent for the 1973-81 period, which is not inconsistent with the Applicant's history or that of other utilities of the region. The Applicant, and other regional utilities have experienced higher growth rates over several years in the immediate past. Planned new generation for 1973-81 would provide an annual growth rate of generating capacity of 7.5 percent, which would result in an increase in the reserve margin from 16.5 percent of the 1973 annual peak load to 19.0 percent of the 1980-1981 annual winter peak. This assumes that all new planned generation will be in commercial service when scheduled; however, experience during the 1970-1973 period indicates that many large new units have suffered delays in coming into commercial service.

The Applicant states that a reserve margin of 20 percent to 23.5 percent of annual peak load is generally required to meet a reliability criterion that the probability of loss of load should not occur more than one time in ten years. The Applicant's projected reserve margins for the 1973-1981 period generally fall short of its criterion, but do fall within the 15 to 25 percent range generally reported to the Federal Power Commission by electric utility industry entities.

The capacity of the Bellefonte units is included in the projected capacity of 156,000 megawatts for the SERC region in the summer of 1980. With these units available, the projected reserve margin for the SERC region is expected to be 18.1 percent.

Without them, the reserve would be decreased to 16.3 percent of peak load. These projections are based on the assumption that all of the capacity additions planned for the SERC region will be accomplished on schedule.

The Bureau of Power staff concludes that additional capacity equivalent to that represented by the proposed Bellefonte Units 1 and 2 is necessary to provide for the projected load growth of the affected systems and to provide the level of reserve capacity the Applicant's criterion requires to meet normally encountered contingencies.

Very truly yours,

T. A. Phillips

T. A. Phillips
Chief, Bureau of Power

Advisory Council
On Historic Preservation
1522 K Street N.W. Suite 430
Washington D.C. 20005

Docket No. 50-438/439

April 23, 1974

RECEIVED
APR 25 1974
U.S. ATOMIC ENERGY COMMISSION
Regulatory Mail Section

Mr. Daniel R. Muller
Assistant Director for Environmental
Projects
Directorate of Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Muller:

This is in response to your request of February 1, 1974, for comments on the environmental statement for the Bellefonte Nuclear Plant, Jackson County, Alabama. Pursuant to its responsibilities under Section 102(2)(C) of the National Environmental Policy Act of 1969, the Advisory Council on Historic Preservation has determined that while you have discussed the historical, architectural, and archeological aspects related to the undertaking, the Advisory Council needs additional information to adequately evaluate the effects on these cultural resources. Please furnish additional data indicating:

Compliance with Executive Order 11593 of May 13, 1971.

1. In the case of land under the control or jurisdiction of the Federal Government, a statement should be made as to whether or not the proposed undertaking will result in the transfer, sale, demolition, or substantial alteration of potential National Register properties. If such is the case, the nature of the effect should be clearly indicated.

2. In the case of lands not under the control or jurisdiction of the Federal Government, a statement should be made as to whether or not the proposed undertaking will contribute to the preservation and enhancement of non-federally owned districts, sites, buildings, structures, and objects of historical, archeological, architectural, or cultural significance.

To insure a comprehensive review of historical, cultural, archeological, and architectural resources, the Advisory Council suggests that the environmental statement contain evidence of contact with the appropriate State Historic Preservation Officer and that a copy of his comments concerning the effects of the undertaking upon these resources be included in the environmental statement. The State Historic Preservation Officer for Alabama is Mr. Milo B. Howard, Jr., Chairman, Alabama Historical Commission, State Department of Archives and Historic, 305 S. Lawrence Street, Montgomery, Alabama 36104.

The Council is an independent unit of the Executive Branch of the Federal Government charged by the Act of October 15, 1966 to advise the President and Congress in the field of Historic Preservation.

3657

Should you have any questions or require any additional assistance, please contact Ernest Holz, at 202-254-3974, of the Advisory Council staff.

Sincerely yours,

Myra F. Harrison

Ann Webster Smith for AWS
Director, Office of Compliance

STATE OF ALABAMA
ALABAMA HISTORICAL COMMISSION
725 MONROE STREET
MONTGOMERY, ALABAMA 36104

W. WARNER FLOYD
EXECUTIVE DIRECTOR

TELEPHONE NUMBER
269-6839

May 6, 1974

RECEIVED
MAY 1 0 1974
U.S. ATOMIC ENERGY COMMISSION
Regulatory
Mail Section

Mr. Jerry Dittman, Project Manager
Directorate of Licensing
U. S. Atomic Energy Commission
Wall Lane
Washington, D. C. 20545

RE: Proposed Bellefonte Nuclear Site
(Tennessee Valley Authority)
Jackson County, Alabama

Dear Mr. Dittman:

Following extensive investigation and analysis of the proposed T.V.A. Bellefonte nuclear plant in Jackson County near Scottsboro, Alabama, I have been instructed by the Honorable Milo B. Howard, Jr., State Historic Preservation Officer for Alabama, to comment for the Alabama Historical Commissoion, the official State agency charged to inventory, register, restore and preserve the historic, architectural and archaeological landmarks of Alabama. Our agency offers these comments: (1) Mr. Howard and other policy-makers of our historic preservation agency and our staff have discussed the nuclear site and its possible impact on the physical evidences of the past of the Bellefonte vicinity on numerous occasions; (2) the executive director and other members of the Commission staff have visited and examined the historic Bellefonte town site and conducted a thorough investigation of the historic documents relating to the same; (3) the staff administrator met with representatives of the Argonne National Laboratories acting as consultants for the Atomic Energy Commission in my Montgomery office in October, 1973 and held an extensive discussion with Mr. George Montet, Ms. Sandy Palmer and Mr. Kenneth Hub regarding the proposed facilities and its impact upon the general and historic environment; (4) our staff has reviewed the drafted Environmental Impact Statement dated February, 1974, issued by the U. S. Atomic Energy Commission and are in general concurrence with the same.

Further, our agency observes that: (1) Argonne Laboratories and the Atomic Energy Commission conducted a thorough investigation and formulated an accurate interpretation of the historical, architectural and archaeological data submitted by the Alabama Historical Commission and other agencies interested in preserving visible objects of antiquity which will reflect past achievements; (2) an adequate archaeological investigation sponsored by T.V.A. has been conducted, is underway, or is scheduled to probe and protect the surviving evidences of Bellefonte village, and (3) neither the construction activity of the nuclear plant, nor the considerable

upgrading of the current access road near the Bellefonte town site will impair the historic and architectural landmarks of Bellefonte and this area of Jackson County.

The Alabama Historical Commission reiterates its recommendation that the Tennessee Valley Authority restore the historic 1845 Tavern and Inn either on site or nearer the proposed facility and rehabilitate this historic landmark, adapting it as a visitor information center and thus depicting the intriging contrast between the nuclear plant facility which will project into the 21st century with the rustic, historic buildings of the middle 1800's.

Our agency deeply appreciates this opportunity to comment on this proposed nuclear power facility.

Sincerely,

W. Warner Floyd

W. Warner Floyd

WWF/af

APPENDIX B

TRANSMISSION LINE CONSTRUCTION AND MAINTENANCE

APPENDIX B. TRANSMISSION LINE CONSTRUCTION AND MAINTENANCE

Planning of transmission lines involves consideration of the engineering problems of construction, future maintenance, and environmental impact. The TVA's rationale for shear clearing in forested areas is: to facilitate movement of construction and maintenance equipment without extensive development of access roads, for benefits to wildlife, for ease of maintenance, and for lower costs. The staff feels that the TVA's basic approach to construction and maintenance is not consistent with the minimization of undesirable environmental impact and enhancement of desirable ones. The methods it proposes to practice are neither recommended in the USDI-USDA "Environmental Criteria for Electric Transmission Systems"[1] nor are they consistent with good conservation practices and basic ecological principles. Alternatives to the TVA's present construction and maintenance practices, and reasons for considering such alternatives, are discussed below.

Alternatives which would greatly reduce erosion potential are not always given enough consideration. While it is true that it takes considerable effort and money to carefully plan and construct a system of access roads for the Bellefonte transmission lines, this is not adequately weighed against the environmental costs in terms of erosion of land and siltation of waterways (see Sec. 4). After vegetation is shear-cleared, bulldozing to remove stumps and other soil disturbance due to movement of heavy construction equipment (especially during critical periods such as in the spring) can lay land bare for over a year. A well-planned and constructed system of access roads could greatly reduce the erosion potential[2,3] by confining vehicle movement to the road and tower sites. Also, more care is usually put into erosion control when effort can be concentrated on the access road.

Since the TVA has not studied plant reinvasion rates on transmission line rights-of-way[4] under various clearing and maintenance methods, its contention that the shear clearing method is best in terms of future maintenance lacks substance. For instance, in other forested areas in the eastern U. S.,[5-8] it has often been found that selective clearing of vegetation, leaving low-growing species of trees and shrubs intact, perhaps followed by selective treatment with herbicides to prevent sprouting, leads to the establishment of an almost permanent community of low-growing vegetation. This can be maintained by relatively infrequent selective cutting and/or selective herbicide application.

The TVA's contention that a shear-cleared, grassed right-of-way is very beneficial to wildlife is also questioned. First, no wildlife studies have been made on a TVA shear-cleared right-of-way seeded with Kentucky 31 fescue. Second, Kentucky 31 fescue, although good for erosion control, is generally not too palatable[9,10] to browsers such as deer. Of course, some animals will eat it and birds will utilize the seeds, but to keep it in a condition suitable for wildlife food, it should be mowed every year or it becomes too rank and fibrous. The TVA mows about every four years. Landowners are encouraged to plant species which are much better for wildlife, but less than one percent of TVA's rights-of-way are seeded in this way.[4] Also, wildlife need cover, nesting habitat, and other food sources. Therefore, the forest edge where an open area meets a wooded area has generally been found to support high populations of birds, small mammals, deer, etc.[11-15] Cottontail rabbits, for example, favor "edge" situations and will not thrive unless they can find a good food supply of fresh grasses, herbs, legumes, etc. in close proximity to a place of refuge.[14] Woodchucks, various mice and many birds also benefit from the clearing of forests. Deer, a popular game animal, benefit from an interspersion of vegetation types. Land is often managed for deer by cutting trees in some areas to make more browse available, and by planting trees, shrubs, or other herbaceous plants in other areas to provide food or cover.[15] But the edge of the forest on a TVA grassed right-of-way is only that: the forest sharply ends at the grassed area with little development of a true forest edge community (the zone of "low trees, shrubs and forbs, 10 to 60 feet wide"[12]). There will be little development of the low tree-shrub habitat. Yet, the shrubs, which are particularly important for wildlife, are included in that catch-all category of "brush" which the seeded grass is supposed to inhibit. In North Carolina, where the grassing method has been used, it was recognized that a permanent zone of shrubs is desirable and at least shrub lespedeza was planted along the edges of the right-of-way.[16]

The staff is also concerned about the TVA broadcast use of herbicides. The TVA program for chemical control of "brush" on the rights-of-way is approved annually by the Federal Working Group on Pesticide Management, and from a staff review of the literature, it appears that Tandex may be less dangerous than 2,4,5-T (which the TVA previously used extensively). Its oral, dietary, and dermal toxicities are low, and it does not appear to accumulate in the tissues of the animals tested. It is effective against ash trees, which the TVA has had difficulty controlling. Nevertheless, the staff questions the necessity for the broadcast use of herbicides to control the undesirable vegetation on the rights-of-way.

For the proper use of herbicides, it is important to determine the path of herbicides in the ecosystem, their mode of action, their movement and degradation in the soil, and the potential danger to man and wildlife from their usage. There has been a great amount of research effort to answer such questions regarding 2,4,5-T, and, consequently, some serious objections have been raised against its use. Tandex, on the other hand, has been on the market for only a few years and has not been put under the intensive scrutiny which 2,4,5-T has received. It is known to be a soil sterilent and exhibits moderately long persistence in soil under most conditions. The active ingredient is thought to inhibit the Hill Reaction (photosynthesis). Little is known about degradation products. Since the risks associated with the use of Tandex are not clearly defined, a prudent approach would be to use as little as possible. Selective application would scatter much less herbicide about the countryside than broadcast application.

Alternatives to shear clearing would require much effort in the area of education of and control over the men in the field. For example, personnel must be able to recognize a dogwood from a maple tree. There must be adequate supervision in the field to see that precautions are taken to utilize existing vegetation for screening purposes and to ensure that stream crossings (including the intermittent streams) result in as little vegetation alteration as possible. Access roads should be routed so as not to defeat the purpose of leaving such vegation intact, and, further, maintenance crews should be prevented from inadvertently destroying it years later. Equipment operators should learn that the best way to go from the top to the bottom of a hill is not always straight down. The staff's experience with other utilities indicates that this education of and control over the field personnel can be accomplished.

Although an alternative such as selective clearing of vegetation followed by selective maintenance as recommended in the USDI-USDA "Environmental Criteria for Electric Transmission Systems,"[1] is standard practice with other utilities,[17] and is highly desirable from an ecological and esthetic point of view, it should not be applied across the board to the situation at Bellefonte. Site-specific decisions must be made in the field as to the best way to construct and maintain a given section of right-of-way. What is best on a flat hilltop is not always best on the slopes. What is best in an oak forest area is not always best in a pine forest area.

Ecological studies need to be undertaken to provide input to careful cost-benefit analyses where environmental costs and benefits are considered in addition to the traditional dollar costs of material and labor.

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7.

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Box 3