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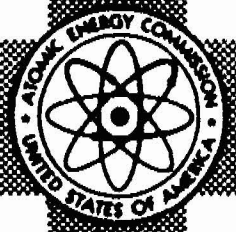
DOCKET-50439--77

SUPPLEMENT NO. 1 TO THE SAFETY EVALUATION OF THE

BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2

DOCKET NOS. 50 - 438 AND 50 - 439



U. S. ATOMIC ENERGY COMMISSION
DIRECTORATE OF LICENSING
WASHINGTON, D. C.

ISSUE DATE: AUG. 30, 1974

SUPPLEMENT NO. 1

TO THE

SAFETY EVALUATION REPORT

BY THE

DIRECTORATE OF LICENSING

U.S. ATOMIC ENERGY COMMISSION

IN THE MATTER OF

TENNESSEE VALLEY AUTHORITY

BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2

DOCKET NOS. 50-438 AND 50-439

AUG 3 0 1974

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1.0 INTRODUCTION

The Atomic Energy Commission's (Commission) Safety Evaluation Report in the matter of the application by the Tennessee Valley Authority to construct and operate the proposed Bellefonte Nuclear Plant Units 1 and 2 (Bellefonte 1 and 2 or facility) was issued on May 24, 1974. In this Safety Evaluation Report the Regulatory staff indicated (1) certain matters would be resolved prior to issuance of construction permits, and (2) additional information would be required to permit the staff to confirm that certain commitments made by the applicant meet our requirements.

The purpose of this report is to supplement the Safety Evaluation Report by providing the staff's evaluation of additional information submitted by the applicant since the issuance of the Safety Evaluation Report, and to address the comments made by the U.S. Geological Survey, the U.S. Army Corps of Engineers and the Advisory Committee on Reactor Safeguards (ACRS) in their reports of July 9, 1974, June 26, 1974 and July 16, 1974, respectively. In addition, this report provides corrections and explanations applicable to information provided in the Safety Evaluation Report. Each of the following sections in this report is numbered the same as the section of the Safety Evaluation Report that is being updated.

2.0 SITE CHARACTERISTICS

2.3 Meteorology

We stated in the Safety Evaluation Report that we would evaluate the relative concentration values used in the offsite dose evaluation (Section 15 of the Safety Evaluation Report) with respect to the accuracy of the delta-T measurement used for determination of atmospheric stability and with respect to one full year of onsite data.

In Amendment No. 12 to the PSAR and in a letter dated August 15, 1974, the applicant supplied indications of the delta-T measurement accuracy and its influence on the relative concentration values. The applicant also supplied additional data representing one full year of collection. We have evaluated the full year of onsite data from November 1972 to October 1973. The relative concentration values derived from these data were about 30% lower than those reported in the Safety Evaluation Report for the 0-2 hour period at the exclusion distance and for the 0-8 hour period at the LPZ distance. This reduction in the relative concentration values confirms the conservative estimates for the radiological accident consequences (Table 15-1 of the Safety Evaluation Report) which are well below 10 CFR 100 limits.

The applicant also furnished additional information in Amendment No. 12 to the PSAR concerning the permanent meteorological facility. This facility will be used to collect data for use during our FSAR review and during operation of the Bellefonte Nuclear Plant. We have reviewed

the proposed location and instrumentation for the permanent meteorological facility. We conclude that the general location and instrumentation as proposed are acceptable.

Although our evaluation of the delta-T measurement technique used by the applicant indicates that it may not literally conform to Regulatory Guide 1.23, we believe the relative concentration values used in the accident analysis are conservative and adequate for the Construction Permit review stage. This conclusion is based on the fact that the Bellefonte facility design incorporates several features such as the Secondary Containment Air Purification and Cleanup System to lower the doses and we have concluded that these features will accommodate any reasonable increases in the relative concentration values that would result from using the more sophisticated permanent meteorological facility equipment.

2.5 Geology and Seismology

We stated in the Safety Evaluation Report that the conclusions of our advisors, the U.S. Army Corps of Engineers and the U.S. Geological Survey, would be presented in a supplemental report. These conclusions are presented in Appendix B and Appendix C.

The conclusions of our advisors support the conclusions presented in the Safety Evaluation Report. In addition, a recently identified fault in the facility water intake channel area is discussed in the U.S. Geological Survey report. During investigations for the intake channel, a minor recemented thrust fault was encountered near the edge

of Guntersville Reservoir. The sense of movement and orientation of the fault is consistent with late Paleozoic tectonics. Both the staff and our consultant, the U.S. Geological Survey, examined the core borings from these investigations and have concluded that there is no basis to assume that an earthquake will occur on this fault and that the fault is not capable as defined by 10 CFR Part 100.

We conclude, based on the evaluation of our consultants evaluation and on our own evaluation, that the geology, seismology and foundation engineering aspects of the site are acceptable.

3.0 DESIGN CRITERIA FOR STRUCTURES, COMPONENTS, EQUIPMENT AND SYSTEMS

3.8 Seismic Design

We stated in the Safety Evaluation Report that the lumped-soil spring approach can be used to account for the soil-structure interaction effects of the borated water storage tank (BWST) provided the applicant supplied additional supporting information on this approach.

Amendment No. 12 to the PSAR provided additional information to support the use of the lumped-soil spring approach. This information included a comparative description of the computer program, the soil depth, the soil properties, the fundamental frequency and other characteristics used in the analysis of both the BWST and a diesel-generator building whose adoption of the lumped-soil spring method had previously been justified.

We have reviewed this additional information and have concluded that the use of the lumped-soil spring approach will provide an acceptable basis for the seismic design of the BWST based on the similarity of the BWST soil-structure interaction to that of a structure where this approach had previously been analyzed and justified by the applicant.

5.0 REACTOR COOLANT SYSTEM AND CONNECTED SYSTEMS

5.4 Component and System Design

We stated in the Safety Evaluation Report that the applicant had indicated that instrumentation would be added to the decay heat removal system to detect check valve leakage and to prevent overpressurization of this system. We further stated that this commitment was acceptable and would require that it be documented prior to issuance of a construction permit.

Amendment No. 12 to the PSAR documented this commitment. We find this matter resolved.

5.5 Loose Parts Monitor

We stated in the Safety Evaluation Report that the applicant had indicated that a loose parts monitoring system would be installed on the Bellefonte reactors and that we would require this commitment be documented.

Amendment No. 12 to the PSAR documented this commitment. We find this matter resolved.

6.0 ENGINEERED SAFETY FEATURES

6.3 Emergency Core Cooling Systems

We stated in the Safety Evaluation Report that we would require the applicant to document its commitment to have motor operated valves, with control and indication in the control room, to allow flow from the Low Pressure Injection (LPI) system to be diverted to the suction of the High Pressure Injection (HPI) system. Amendment No. 12 to the PSAR documented this commitment. We find this matter resolved.

6.4 Control Room Habitability

We stated in the Safety Evaluation Report that the applicant would document the changes to the facility design relating to minimizing a potential chlorine hazard. Amendment No. 12 to the PSAR documented these changes. We have reviewed these changes and conclude that the facility design provides adequate protection for the reactor operators in the unlikely event of a chlorine release in the vicinity of the site.

7.0 INSTRUMENTATION AND CONTROLS

7.3 Engineered Safety Features Actuation System

We stated in the Safety Evaluation Report that the changeover from injection to recirculation mode and the cross-over mode (using LPI pumps as boosters for the HPI pumps) of operation following a loss-of-coolant accident require a series of manual actions. We further stated that we required the applicant to justify that the time required for these actions was available and the actions were of such simplicity that exceptions to Section 4.17 of IEEE Std 279-1971 could be justified.

Amendment No. 12 to the PSAR supplied additional information to justify the proposed design. We conclude that the proposed design is acceptable based on the applicant's information showing sufficient time would be available to perform the necessary actions and these actions are of a simple nature.

7.5 Safety Related Display Instrumentation

We stated in the Safety Evaluation Report that the PSAR listing of instrument channels for post-accident surveillance did not include provision for continuous control room recording of all parameters considered essential by the staff and in addition that some wiring would pass through non-Class I equipment. We stated that we would require the applicant to commit to necessary additions and modifications in this area prior to issuance of a construction permit.

Amendment No. 12 of the PSAR reflects these additions and modifications. We have reviewed this material and conclude that the safety related display instrumentation is now adequate.

17.0 QUALITY ASSURANCE

17.1 Tennessee Valley Authority

We stated in the Safety Evaluation Report that the applicant had recently proposed organizational changes under the Division of Construction and we would require the changes be documented in the PSAR prior to issuance of a construction permit.

The applicant documented these changes in Amendment No. 12 to the PSAR. Figures 17.1A-2 and 17.1A-4 of the PSAR depict these organizational changes. We find this matter resolved.

18.0 REVIEW BY THE ADVISORY COMMITTEE ON REACTOR SAFEGUARDS (ACRS)

The ACRS completed its review of the application for a construction permit for the Bellefonte Nuclear Plant at its 171st meeting, July 11, 1974. A copy of the Committee's report dated July 16, 1974 is attached as Appendix D. We have considered the comments and recommendations made by the ACRS. The actions we have taken or plan to take in response to these comment and recommendations are described in the following paragraphs.

18.1 Emergency Core Cooling System

The Committee recommended that the applicant continue studies directed at further improvement in the capability and reliability of the emergency core cooling system (ECCS). The Committee also noted that complete analyses of the 17 x 17 fuel rod array are not yet available.

At the present time, the Regulatory staff is reviewing the Babcock & Wilcox evaluation model that will be used for the analysis of the Bellefonte 1 and 2 ECCS. A revised loss-of-coolant accident analysis performed in accordance with the ECCS Acceptance Criteria* will be submitted by the applicant as part of the final safety evaluation of the plant. The staff will evaluate results of this analysis against the various requirements of the above mentioned criteria in order to determine acceptability of the Bellefonte 1 and 2 ECCS design.

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*Acceptance Criteria for Emergency Core Cooling Systems for Light Water-Cooled Nuclear Power Reactors published in the Federal Register (39 FR 1001) January 4, 1974.

18.2 Reactor Protection System

The Committee noted the fact that a new reactor protection system (RPS-II) was proposed for the Bellefonte facility and that a series of qualification tests have been proposed by the applicant for this system. The Committee also noted that this matter should be resolved in a manner satisfactory to the Regulatory staff.

In Section 7.2 of the Safety Evaluation Report we described this system, RPS-II, and stated that except for certain reservations regarding the implementation of the approved design criteria this design is acceptable. We plan to review in detail the areas where we have reservations as well as the qualification test results prior to issuance of the operating license. At that time if these areas have not been resolved to our satisfaction we will require the applicant to make modifications to the reactor protection system to achieve the same degree of safety that exists in the previously reviewed and accepted system, RPS-I.

18.3 Guard Pipes for Process Lines

The Committee recommended that the Regulatory staff review the design of the guard pipes for process lines traversing the annulus formed by the inner primary containment and the outer secondary containment. The staff has reviewed the Bellefonte facility to determine which of these process lines should be guarded and the design criteria for the guard pipes.

In order to prevent overpressurization of the annulus in the unlikely event of a process line failure the applicant proposes to place guard pipes around certain of the process lines. These include the main steam lines, the main feedwater lines and the steam generator startup line. We have reviewed the applicant's criteria for selecting these lines and conclude that these are the only lines that require the additional protection of guard pipes.

Further, we have reviewed the criteria proposed by the applicant for the design of the guard pipes for these lines. These criteria include Seismic Category I and Subsection NE of Section III of the ASME code for Class MC components. Adequate conservatism in the proposed design is demonstrated by the fact that, consistent with the specified criteria, the yield strength of the guard pipe material will not be exceeded even in the unlikely event of pressurization to the process pipe design pressure with safe shutdown seismic loads.

18.4 Containment Rock Anchors

The containment structures for the Bellefonte facility will be anchored to the underlying limestone by rock anchors. The Committee recommended that the tests of this rock anchor system, including investigation of any corrosion control actions be resolved in a manner satisfactory to the Regulatory staff.

In this regard the applicant has committed to perform additional rock anchor lift-off tests at the existing rock anchor test facility prior to installation of any containment rock anchors. In addition, the applicant indicated that the grout mixture will be chemically

analyzed to assure that the contents of the mixture is within appropriate limits to prevent corrosion of the rock anchor tendons.

18.5 Geology

The Committee noted that a minor fault has been identified in the vicinity of the cooling water intake structure. Both staff and U.S. Geological Survey geologists have examined the core borings in this area and have concluded that the fault is incapable (see also Section 2.5 and Appendix B of this report).

18.6 Instrumentation to Monitor the Course of An Accident

The Committee recommended that the applicant address more attention to instrumentation for determination of the course of potentially serious accidents, particularly with regard to upper range limits to fully encompass the spectrum of possible accidents. In Section 7.5 of the Safety Evaluation Report and in this report, the staff has addressed the number of recorded parameters and the environmental qualification of instrumentation for this purpose. In Amendment No. 12 to the PSAR the applicant committed to meet the staff requirements in this area. In addition, the applicant has indicated that the instrumentation to be provided will be sufficient to follow the course of any accident analyzed in Chapter 15 of the PSAR.

Presently the staff is developing a regulatory guide on this subject. A draft of this regulatory guide has been reviewed by the ACRS and their comments will be considered in the revised version. When this

regulatory guide is finalized we will evaluate the impact on this facility and if additional measures are required beyond those already afforded then we will require appropriate changes.

18.7 Reactor Coolant Pump Overspeed

The Committee noted that the Regulatory staff has been investigating the potential for reactor coolant pump overspeed in the unlikely event of a particular pipe break and that additional protective measures may be warranted for the Bellefonte reactors.

The Regulatory staff has instituted a generic study in this area to assess whether, in fact, this matter is a problem. Some of these efforts involve actual test data from scale model pumps under simulated accident conditions. This work is proceeding on schedule and when the tests and analytical studies are completed, the staff will evaluate the impact on the Bellefonte facility. If additional measures are required beyond those already afforded, we will require appropriate changes. We expect to keep the ACRS informed as results from these investigations become available.

18.8 Generic Problems

The Committee expressed its continuing concern regarding generic problems related to large water reactors, recommending that such problems be dealt with appropriately by the applicant and the Regulatory staff. These generic problems, discussed in a report by the ACRS dated February 13, 1974, are being worked on by the various reactor vendors and other industrial organizations and will be the subject of continuing attention by the Regulatory staff. If additional

measures are required beyond those already afforded, we will require appropriate changes.

20.0 FINANCIAL QUALIFICATIONS

We concluded in the Safety Evaluation Report issued on May 24, 1974 that the Tennessee Valley Authority is financially qualified to design and construct Bellefonte Nuclear Plant Units 1 and 2. However, we found the estimated construction costs of the nuclear production plant to be on the low side and requested the applicant to submit more recent estimates. On August 12, 1974 we received such estimates, which are presented below and compared with the initial estimates shown in the Safety Evaluation Report (NP = total nuclear production plant costs; TDG = transmission, distribution, and general plant costs; and NFC = nuclear fuel inventory cost for first core).

ESTIMATED CONSTRUCTION COSTS
(Millions)

	Revised		Initial	
	Unit 1	Unit 2	Unit 1	Unit 2
NP	$490.0	$480.0	$350.0	$345.0
TDG	18.3	18.2	18.3	18.2
NFC	38.6	34.7	38.6	34.7
Total:	$546.9	$532.9	$406.9	$397.9

Using a net capacity of 1,200,000 KWe for each unit, the nuclear power production plant costs increased from $291 and $288 per KWe for Units 1 and 2 according to the initial cost estimates of $408 and $400 based on the revised cost estimates. This represents increases of 40.2% and 38.9% for Units 1 and 2 over the initial estimates based on determinations made in 1971.

Based on the CONCEPT Phase III-B program (documented in ORNL-4809, April 1973) for estimating nuclear production plant costs, projected costs of Units 1 and 2 at year of commercial operation (1979 and 1980) are $461.7 million and $421.8 million, respectively, and are compared below with the applicant's estimated costs in millions of dollars.

	Unit 1	Unit 2	Total
CONCEPT estimates	$461.7	$421.8	$883.5
Applicant's estimates	490.0	480.0	970.0
Percent over Concept	6.1%	13.8%	9.8%

Using the capital cost parametic curves developed by Oak Ridge National Laboratory for a PWR reactor with a net capacity of 1,200 MWe and commercial operation beginning in 1980, the indicated range costs is a maximum of $545 and a minimum of $430 per KWe. The midpoint computed at $488 is within 0.41% of the applicant's estimated cost for Unit 1 and 1.7% of the estimated cost for Unit 2.

Based on the analysis presented above, we conclude that the applicant's estimated costs of constructing the nuclear production plant for the Bellefonte Nuclear Plant Units 1 and 2 are reasonable. We have requested that the applicant supply more recent financial information relative to the revised estimated facility cost to confirm our previous conclusion (Section 20 of the Safety Evaluation Report) that the applicant is financially qualified. This matter will be resolved prior to issuance of a construction permit.

21.0 CONCLUSIONS

Except as noted, all outstanding matters have been resolved in a manner satisfactory to the Regulatory staff. The staff's conclusions as stated in the Safety Evaluation Report, Section 21.0, remain unchanged.

APPENDIX A

CHRONOLOGY OF SAFETY REVIEW

May 22, 1974	Amendment #11 docketed.
May 25, 1974	St · Safety Evaluation Report issued.
June 17-18, 1974	ACRS subcommittee meeting with staff and applicant
June 26, 1974	U.S. Army Corps of Engineers issued report on stability of intake channel slopes.
July 9, 1974	U.S. Geological Survey issued report on geology and seismology of the Bellefonte site
July 11, 1974	ACRS meeting with staff and applicant
July 16, 1974	ACRS issued report on the Bellefonte facility
August 1, 1974	Letter to the applicant requesting revised financial information
August 9, 1974	Additional financial information submitted by the applicant
August 15, 1974	Additional me· ·ological information submitted by the applicant
August 19, 1974	Amendment #12 docketed
August 27, 1974	Additional information concerning guard pipe design criteria submitted by the applicant

Regulatory Docket File

APPENDIX B

50-438-439

United States Department of the Interior

GEOLOGICAL SURVEY
WASHINGTON, D.C. 20242

JUL 9 1974

Mr. L. Manning Muntzing
Director of Regulation
U.S. Atomic Energy Commission
Washington, D.C. 20545

Dear Mr. Muntzing:

Transmitted herewith, in response to a request by your staff, are reviews of geologic and seismologic data relevant to the Tennessee Valley Authority, Bellefonte Nuclear Plant, Jackson County, Alabama (AEC Docket Nos. 50-438 and 50-439). Inasmuch as the geologic and seismologic conditions are somewhat different for each site, a separate report is enclosed for each.

The reviews for the site were prepared by Mr. F. A. McKeown and Mr. W. V. Mickey of the Geological Survey.

We have no objection to your making the reviews part of the public record.

Sincerely yours,

V. E. Shamburger

Acting Director

Enclosure

Tennessee Valley Authority
Bellefonte Nuclear Plant
Jackson County, Alabama
AEC Docket Nos. 50-438 and -439

Introduction

The geology described in the Preliminary Safety Analysis Report (PSAR), the amendments through number 11, and the preliminary information received at the site on June 17, 1974, have been reviewed. Sections of the PSAR concerning hydrology, rock mechanics and soils engineering were not reviewed. A satisfactory, detailed geologic map of the site area has not been received. Exclusive of the inadequate site map, the applicant has responded satisfactorily to all other geologic questions and comments posed by the U.S. Geological Survey. The site was visited on September 19, 1973, and again on June 17, 1974, in company with AEC and TVA officials.

In the preliminary Review and Interim Review reports transmitted to W. P. Gammill from E. H. Baltz on November 15, 1973, and January 21, 1974, respectively, the U. S. Geological Survey noted in particular the lack of an adequate and accurate map. This is especially important to an evaluation of the Bellefonte site, because the site is in an area of major structural deformation. That an accurate map based on careful field observations and throughtfully interpreted is essential, has become very obvious, because of the recent discovery of a small reverse fault in the intake area. This discovery was cause for the site visit of June 17, 1974.

Geology

The Bellefonte Nuclear Plant site is in Browns Valley in Alabama which is coextensive with Sequatchie Valley in Tennessee. The valley is in the erosionally breached Sequatchie anticline that extends for over 150 miles, from near Blount Springs, Alabama, to Crab Orchard, Tennessee. In the vicinity of the site the valley is about 5 miles wide, and the elevation of the valley floor is about 600 feet. Sequatchie anticline is a western outlier of the Valley and Ridge Province, but the anticline is generally considered to be in the Cumberland Plateau section of the Appalachian Plateau Province.

The plant will be founded on limestone of the middle part of the Chickamauga Formation whose total thickness in the vicinity of the site is about 1400 feet. Carbonate rocks of the Knox Group underlies the Chickamauga and crops out about 1 mile northwest of the site. Shale, siltstone, and limestone of the Red Mountain Formation crop out in a ridge between the site and Guntersville lake about 1/2 mile southeast of the site.

The site is on the southeast flank of the Sequatchie anticline where the rocks generally dip 15° - 20° to the southeast; the dip becomes less towards the southeast. The northwest flank of the anticline is truncated by the Sequatchie thrust fault about 2 1/2 miles northwest of the site. This fault is a major geologic structure and extends northeast-southwest for about 150 miles from central Alabama to northern Tennessee. The fault dips to the southeast, probably flattening at depth. Its location below the plant site is not known

but according to the applicant (p. 2.5-5 amend. 1) is probably several thousand feet. The only other fault reported by the applicant in the vicinity of the site is about 4,000 feet east of the site. This fault was discovered as the result of careful lithologic logging of exploratory drill holes in the intake area. In the preliminary information received during the site visit of June 17, 1974, the applicant reports that the fault is a reverse fault, has about 8.5 feet of displacement on it, dips 34° SE, and strikes N 33° E. The applicant also states that the fault represents adjustment of less competant limestones and siltstones in the Red Mountain Formation associated with folding of the Appalachian system near the end of the Paleozoic era.

Both the Sequatchie thrust and the small reverse fault are reported by the applicant to have been immobile since the end of the Paleozoic era.

It is not surprising that a small fault was discovered during recent exploratory drilling. Other faults are likely to be discovered during excavation of the site. The available data do not appear to be adequate to determine the location of faults prior to excavation or to infer with reasonable assurance the existence of faults. It is not likely however, that any large faults are in the vicinity of the site. No major discontinuities in rock type appear evident from the logs of drill holes at the proposed location of the reactor facilities. We recommend that all excavations for foundations or other purposes at the site be mapped in detail and documented.

The age of the faults as given by the applicant seems reasonable. This judgment however, is based only upon search of the literature and discussion with colleagues. The generally accepted geologic history of the area and surface geologic characteristics of the faults suggest that the known faults are not capable as defined in AEC criteria (10 CFR, Part 100). Recent geologic deposits suitable for absolute dating of the last movements of the faults do not appear to exist in the vicinity of the site.

The available data lead us to conclude that there is no basis to assume that an earthquake will occur on any particular known fault.

Seismology

The seismologic aspects of the Preliminary Safety Analysis Report (PSAR) and Amendments through 11 for the Bellefonte Nuclear Plant (BNP) have been reviewed by the U.S. Geological Survey seismologists.

The geological review has contained the first reports of a reverse fault 1210 metres (4000 ft.) east of the site with 2.6 metres (8.5 ft.) of displacement, dipping 34° SE and striking North 33° E. It further reports that the fault represents "adjustment of less competent limestones and siltstones in the Red Mountain formation associated with faulting of the Appalachian system near the end of the Paleozoic era." Both the 240 kilometre (150 miles) long Sequatchie thrust fault and the recently discovered reverse fault are reported to have been immobile since the end of the Paleozoic era. This age was based only upon judgment, literature search, and discussions with colleagues since "material and recent geological deposits suitable for dating the faults do not appear to exist in the vicinity of the site."

The BNP site is located near the boundary of Zones 1 and 2 of the Seismic Risk Map of the United States (Algermissen 1969) and is in the southern Appalachian Tectonic Province, bounded on the east by the western extent of the Piedmont Province; on the west by the Cumberland Plateau; on the south by the Gulf Coastal Plain Province; and on the north by the Valley and Ridge Province. Accelerations for the site, as selected by the applicant, were based upon the MM VIII Giles County, Virginia earthquake of May 31, 1897. The applicant uses the Gutenberg-Richter relationship

for acceleration and intensity which is based mainly upon California observations. This empirical equation yields 0.15g. The applicant selected 0.18g as the Safe Shutdown Earthquake (SSE) and acknowledges that the empirical relationship is questionable when applied to the eastern United States.

A member of the Advisory Committee on Reactor Safeguards has issued a formal statement concerning the need for an additional margin of safety (seismic) for all future nuclear plant sites east of the Rockies.

The tabulations on Figure 2.5-14-2 show earthquakes having a Richter scale magnitude equal to or greater than 4.3 within the geodetic coordinate lines of 30 to 37 degrees north and 78 to 92 degrees west. This includes the southeastern states of Alabama, Georgia, Mississippi, South Carolina and Tennessee with portions of Kentucky, Virginia, North Carolina, Arkansas, Louisiana, and Florida. The data start with the New Madrid shocks of 1811. It is very interesting and relevant to note that from 1811 to 1931 (120 years) there was an average of one earthquake of intensity MM VII or greater every 5.5 years. From 1931 to 1974 (July 1974, the present) there has been only one intensity VII. The change from one every 5.5 years to the present span of 43 years for only one emphasizes the need for the additional margin of safety.

Although it is generally accepted that earthquakes in the eastern U.S. cannot be identified with geological structure it is difficult to be confident that the MM V shock of June 16, 1927 near Scottsboro, Alabama did not occur on the Sequatchie thrust zone or the new found reverse

fault 1210 metres east of the site. If the 1917 shock had occurred near the site the overall gound motion would probably be below the proposed SSE accelerations; however, there would have been higher accelerations. The September 4, 1972 earthquake of magnitude only 4.5 near Bear Valley, California was recorded on a nearby accelerograph with one "spike" of 0.7g.

Studies of earthquake magnitude and displacement along resultant faults would infer a magnitude 7.5 earthquake for the new found reverse fault. Conversely the 240 km long Sequatchie fault would result in a displacement of about 6 metres if the rupture occurred as one episodic event.

The geological review concludes that "the available data lead us to conclude that there is no basis to assume that an earthquake will occur on any particular known fault."

With this assumption and assurance that the major concerns can be accepted, we conclude that the proposed acceleration value of 0.18g for the Safe Shutdown Earthquake is adequate. It is our intention that the acceleration value be used as the zero period and acceleration in the development of the appropriate design response spectra as described in the AEC Regulatory Guide 1.60, Revision 1, December 1973.

Regulatory Docket File

APPENDIX C

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
P. O. BOX 631
VICKSBURG, MISSISSIPPI 39180

IN REPLY REFER TO: WESST

50-438

50-439

26 June 1974

Mr. William P. Gammill
Chief, Site Analysis Branch
Directorate of Licensing Regulation
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Gammill:

As requested informally by your office and as agreed during a meeting in our offices on 6 February 1974, we have reviewed additional rock and soils investigations and analyses data in the Intake Channel Area of the Bellefonte Nuclear Power Plant that we received directly from TVA.

We conclude that the additional data indicate intake channel slopes should be stable for normal operating and seismic design conditions, although we do not agree with all aspects of the analyses and selected design criteria. The use of R instead of S-R combined-strength envelopes and a safety factor of 1.0 for the SSE with normal pool are not considered conservative; nevertheless, considering the R analyses and check computations we have made, together with seismic factors selected, we regard these slopes to be stable. We understand the slopes will be protected by filters and riprap, which is considered necessary for them to be stable.

If you have any questions concerning our review, please contact Dr. R. J. Lutton or Mr. S. J. Johnson at area code 601, telephone No. 636-3111, extension 3393 or 2743.

Sincerely yours,

JAMES P. SALE
Engineer
Chief, Soils and Pavements Laboratory

APPENDIX D

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
UNITED STATES ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

July 16, 1974

'74 JUL 17 AM 10:50
OFFICE OF THE SECRETARY
RECEIVED

Honorable Dixy Lee Ray
Chairman
U. S. Atomic Energy Commission
Washington, D. C. 20545

Subject: REPORT ON THE BELLEFONTE NUCLEAR PLANT, UNITS 1 AND 2

Dear Dr. Ray:

At its 171st meeting, July 11-13, 1974, the Advisory Committee on Reactor Safeguards completed its review of the application of the Tennessee Valley Authority for a permit to construct the Bellefonte Nuclear Plant, Units 1 and 2. This application had been considered previously during a Subcommittee meeting in Scottsboro, Alabama on June 18, 1974, subsequent to a tour of the site. In addition, the ACRS Subcommittee on Babcock and Wilcox Water Reactors discussed topics pertinent to the nuclear steam supply system for this plant at a meeting in Washington, D. C. on July 5, 1974. In the course of its review, the Committee had the benefit of discussions with representatives and consultants of the Tennessee Valley Authority, the Babcock and Wilcox Company, and the AEC Regulatory Staff. The Committee also had the benefit of the documents listed.

The site for the Bellefonte Nuclear Plant is a 1,500 acre tract located in Jackson County, Alabama, approximately 38 miles east of Huntsville, Alabama, the nearest population center (reported 1970 population of 146,000). The minimum exclusion area radius will be about 0.6 miles. The radius of the low population zone has been selected to be two miles.

The Bellefonte Nuclear Plant consists of two units, each using a B&W two-loop pressurized water nuclear steam supply system having a design power level of 3600 MW(t). The reactor core will use 205 B&W Mark C (17x17) fuel assemblies. The Committee recommended in its report of January 7, 1972, on Interim Acceptance Criteria for ECCS, that significantly improved ECCS capability should be provided for reactors for which construction permit applications were filed after January 7, 1972. This position was repeated in its report of September 10, 1973 on Acceptance Criteria for ECCS. The Mark C fuel assemblies are responsive to this recommendation. The new fuel assemblies will be operated at lower linear heat generation rates and are expected to yield greater thermal margins for fuel design

limits and improved safety margins in the analyses of the loss of coolant accidents. An extensive program has been initiated for determining the mechanical and thermal-hydraulic characteristics of the new fuel assemblies. A program of control rod tests also is proposed, including testing of trip times and control rod wear. Should modifications become necessary as a result of the control rod tests, retesting of the entire control rod drive would be undertaken. While many of the details of the proposed design are available, complete analyses of the performance of the Mark C fuel are not yet available, and the AEC Regulatory Staff has not completed its review. The Committee reserves judgment concerning the final design until the required performance information is presented and has been adequately reviewed. The Committee recommends that the applicant continue studies directed at further improvement in the capability and reliability of the ECCS. The Committee wishes to be kept informed.

The applicant proposes to utilize a new reactor protection system designated as RPS-II. The system, a hybrid using both analog and digital techniques, represents an evolution from the analog system, RPS-I, currently in use in the Oconee reactors. RPS-II incorporates a single-chip central processor unit as a microcomputer for the more complex trip functions. The applicant has proposed a series of environmental, reliability, and in situ tests for qualification of this system prior to its use in Bellefonte Units 1 and 2. This matter should be resolved in a manner satisfactory to the Regulatory Staff.

The Bellefonte design uses a dual containment system. The inner primary containment is a 135 ft. diameter x 269 ft. high steel lined prestressed concrete structure. The outer, secondary containment is a reinforced concrete structure. The annulus between the two structures will be maintained at a negative pressure continuously. The Committee recommends that the Regulatory Staff review the design of the guard pipes for process lines traversing the annulus.

The vertical tendons of the primary containment structure will connect to the underlying limestone through rock anchors, each consisting of an assembly of 170 1/4-in.-diameter button-headed wires grouted into 48 ft. deep holes bored in the limestone base. The applicant has indicated that he will make thorough tests of the rock anchor system, including investigation of any corrosion control actions that may be appropriate. This matter should be resolved in a manner satisfactory to the Regulatory Staff.

The limestone has been shown from test borings to be sound and of very high quality in the area designated for the reactor site. A minor fault has been exposed in the vicinity of the water intake structure. Investigations by the U. S. Geological Survey and the applicant indicate the fault to be incapable.

The Committee believes the applicant should address more attention to instrumentation for the determination of the course of potentially serious accidents, particularly with regard to upper range limits to fully encompass the spectrum of possible accidents. The instrumentation system should respond on a time scale which would permit necessary emergency action. The applicant should assure himself that appropriate calibration methods and calculated bases for interpreting instrument responses are available.

The Regulatory Staff has been investigating on a generic basis the problems associated with a potential reactor coolant pump overspeed in the unlikely event of a particular type of rupture at certain locations in a main coolant pipe. Some additional protective measures may be warranted for Bellefonte in this regard. The Committee recommends that resolution of this matter be expedited. The Committee wishes to be kept informed.

Generic problems relating to large water reactors have been identified by the Regulatory Staff and the ACRS and discussed in the Committee's report dated February 13, 1974. These problems should be dealt with appropriately by the Regulatory Staff and the applicant.

The Advisory Committee on Reactor Safeguards believes that the items mentioned above can be resolved during construction and that, if due consideration is given to the foregoing, the Bellefonte Nuclear Plant, Units 1 and 2, can be constructed with reasonable assurance that it can be operated without undue risk to the health and safety of the public.

Sincerely yours,

W. R. Stratton

W. R. Stratton
Chairman

References Attached

References

1. Tennessee Valley Authority (TVA) letter, June 19, 1973, to Directorate of Licensing with Application for Construction Permit for Bellefonte Nuclear Plant, Units 1 and 2, and Preliminary Safety Analysis Report (PSAR), Vols. 1 through 6 (Vols. 7, 8, and 9, submitted with Amendments 4 and 9)

2. Amendments 1 through 11 to the Application

3. Directorate of Licensing letter, May 24, 1974, transmitting Safety Evaluation Report

4. Department of the Army, Corps of Engineers letter, June 26, 1974

5. Neva Dawkins letter, July 2, 1974

6. Department of the Interior, U. S. Geological Survey letter, July 9, 1974

APPENDIX E

ERRATA TO THE SAFETY EVALUATION REPORT BELLEFONTE NUCLEAR PLANT UNITS 1 AND 2

Page	Line	
1-13	11	"inlet" in place of "incore"
1-13	18	"single rods" in place of "bundles"
1-14	11	"Inlet" in place of "Incore"
2-2	2	"2000" in place of "1970"
2-11	20	"onsite" in place of "offsite"
2-17	8	"570.3" in place of "568.5"
2-17	11	"568.5" in place of "570.3"
2-17	15	"570.3" in place of "568.5"
2-23	6	"These" in place of "There"
2-24	14	delete "(six)"
2-26	10	"Southeast Georgia embayment" in place of "Northeast Georgia (Raritan) embayment"
2-27	2	"from" in place of "to"
2-29	9-10	"an approximately 75 foot wide berm" in place of "a 75 foot wide berm"
5-12	21	"obtained" in place of "developed"
5-18	8	delete "redundant"
5-19	19	add "not" after "there is"
8-6	7	"and" in place of "an/"
11-9	22-23	delete "steam generator blowdown tank discharge and composite sample"
15-1	5	"coolant" in place of "coola"
15-12	12	"unacceptable con-" in place of "unacceptableon-"