OCT 8 1975

Docket Nos. 50-438
and 50-439

Tennessee Valley Authority
ATTN: James E. Watson
Manager of Power
818 Power Building
Chattanooga, Tennessee 37401

Gentlemen:

On June 17, 1975, we advised you that pursuant to Sec. V.A. of Appendix I of 10 CFR Part 50 which was issued on May 5, 1975, it would be necessary for you to submit for review and approval the means you propose to employ for keeping levels of radioactive materials in effluents from the Bellefonte Nuclear Plant, Units 1 & 2, to unrestricted areas as low as practicable in accordance with the Appendix I guidelines.

On September 4, 1975, an immediately effective amendment of Appendix I was adopted. The amendment provides persons who have filed applications for construction permits for light-water-cooled nuclear power reactors which were docketed on or after January 2, 1971, and prior to June 4, 1976, the option of dispensing with the cost-benefit analysis required by Paragraph II.D. of Appendix I, if the proposed or installed radwaste systems and equipment satisfy the Guides on Design Objectives for Light-Water-Cooled Nuclear Power Reactors proposed by the regulatory staff in the rulemaking proceeding on Appendix I (Docket-RM-50-2). You may comply with the September 4 amendment rather than submit a cost-benefit analysis required by Paragraph II.D. of Appendix I.

If you select this option, the information identified in Enclosure I should be provided in your "Environmental Report - Operating License Stage" to allow a determination of compliance with the design objectives of Paragraphs II.A., II.B. and II.C. of Appendix I.

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DATE ➤						

Alternatively, should you choose to comply with the design objectives and cost-benefit analysis requirements of Section II of Appendix I, Section III requires the use of calculational procedures that are based on models and data that assure that the actual exposure of an individual through appropriate pathways is unlikely to be substantially underestimated. To achieve this objective, Appendix I encourages the staff and applicants to develop and use realistic models to characterize the sources of radioactive material, transport pathways, and resultant doses. Such realistic staff models have been developed, and Enclosure 2 reflects the information we believe you should provide in order to use these models in the cost-benefit analysis of the radwaste system of your facilities. We recognize that because of difficulty in obtaining data it may not be practical in all cases to perform the most realistic dose calculation that is technically achievable. Therefore, if you choose to carry out the cost-benefit analysis and to provide site specific data in less detail than requested in Enclosure 2, it will be necessary to use a less complex calculational procedure, comparable in conservatism to that used in the past, to demonstrate compliance with the Appendix I guidelines. Thus, the depth and scope of the information you wish to provide will dictate the calculational procedures to be used to demonstrate compliance with the Appendix I design objectives, but the information provided should, at a minimum, be sufficient to support the analyses used in your assessments. In any event, the calculational procedures utilized to demonstrate compliance with Appendix I and the data to be used in those models must be such that the actual exposure of an individual is unlikely to be substantially underestimated.

If you select this option, the information identified in Enclosure 2 should be provided by March 31, 1976, or included in your "Environmental Report - Operating License Stage", whichever occurs first.

If the information requested in Enclosures 1 or 2 has been provided by you in material which you already have submitted or if the information has been provided for another docket file, references as to where the requested information can be found will be sufficient. In the event the information you provide changes the description of systems or designs previously described in your Preliminary Safety Analysis Report (PSAR), the Final Safety Analysis Report (FSAR) should be appropriately corrected.

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The reporting requirements and the application requirements contained in Appendix I of 10 CFR Part 50 have been approved by the U. S. General Accounting Office under clearance number B-180225 (920071). This clearance expires June 30, 1978.

Sincerely,

Original signed by
Daniel R. Muller

Daniel R. Muller, Assistant Director
for Environmental Projects
Division of Reactor Licensing

Enclosures:
1) Additional information needed to comply with 9/4/75 Amendment to Appendix I
2) Additional information needed to comply with Section II.D. of Appendix I issued 5/5/75

cc: (See attached list)

DISTRIBUTION
Dockets(ENVIRON)
NRC PDR
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Appropriate AD-LWR
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Appropriate Project Manager - LWR
Lab Team Leader
Lab Environ. Projects Director
Safety Licensing Assistant
H. Denton, SS
D. Crutchfield, SS
R. Tedesco, CS/TR
J. Kastner, RAB/TR
J. Collins, ETSB/TR

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SURNAME ➤	RBoyle:ws	WRegan	DRMuller			
DATE ➤	10/2/75	10/7/75	10/7/75			

Bellefonte

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ENCLOSURE 1

ADDITIONAL INFORMATION NEEDED FROM APPLICANTS FOLLOWING OPTION PROVIDED IN THE SEPTEMBER 4, 1975, AMENDMENT TO SECTION II.D. OF APPENDIX I

1. For each building housing systems containing radioactive materials:

   a. Provide a description of the provisions incorporated to reduce radioactive releases (iodine and particulates) from ventilation exhaust systems.

   b. Provide the location, height of release, inside dimensions of release point exit, effluent temperature and exit velocity.

   c. For the containment building indicate the expected purge and venting frequencies and duration, and the continuous purge rate (if used).

2. For a pressurized water reactor having recirculating U-tube steam generators and employing all volatile treatment (AVT) to main secondary coolant chemistry, provide the following information:

   a. Expected blowdown rate (lb/hr) and method of processing blowdown.

   b. Number and type of condensate demineralizers (if applicable) and flow rate of condensate through polishing demineralizers (lb/hr).

   c. Expected frequency of resin regeneration or replacement, volumes and radioactivity of regenerant and rinse solutions, sluice water, or backwash water per batch of resin regenerated or replaced.

   d. Method of collection, processing and disposal of liquid wastes, including decontamination factors assumed for process operations.

   e. P&ID's and process flow diagrams for the steam generator blowdown system and condensate polishing system.

3. Provide a map showing the detailed topographical features (as modified by the plant) on a large scale within a 10-mile radius of the plant and a plot of the maximum topographic elevation versus distance from the center of the plant in each of the sixteen 22-1/2 degree cardinal compass point sectors (centered on true north), radiating from the center of the plant, to a distance of 10 miles.

4. Provide representative annual and, if available, monthly summaries of wind speed and direction by atmospheric stability class, in joint frequency form from onsite data. If available, describe airflow trajectory regimes of importance in transporting effluents to a distance of 5 miles from the plant, including airflow reversals.

5. Tabulate, for each compass point sector radiating from the center of the plant, the location of the nearest existing milk producing animals (cows and goats) within 5 miles of the site.

NOTE: If you choose to provide site specific data in less detail than requested above, it will be necessary to use a less complex calculational procedure comparable in conservatism to that used in the past, to demonstrate compliance with the Appendix I guidelines. Thus, the depth and scope of the information you wish to provide will dictate the calculational procedures to be used to demonstrate compliance with the Appendix I design objectives, but the information provided should, as a minimum, be sufficient to support the analyses used in your assessments. In any event, the calculational procedures utilized to demonstrate compliance with Appendix I and the data to be used in those models must be such that the actual exposure of an individual is unlikely to be substantially underestimated.

ADDITIONAL INFORMATION NEEDED TO COMPLY
WITH SECTION II.D OF APPENDIX I ISSUED MAY 5, 1975

General: Predictive models are necessary in estimating the concentrations of radionuclide effluents in pathways to man and their resultant doses. For the purpose of implementing the requirements of Appendix I, models are classified into two categories: those that estimate physical effects using simplifying, conservative assumptions, and those that are state-of-the-art attempts at realistically modeling physical effects. Prediction of the transport of radioactive effluents may require the use of one or both categories of models, each applicable under different situations and for different regions of the environment. A discussion of the rationale for model choice, the range of applicability of the models utilized, the methods used in model calibration and verification, and the input data selected for prediction should be provided as indicated below. The following request for information is generic in nature and may not be uniformly applicable to all sites and models utilized. The information provided should be sufficient to support the analysis to be used in your Appendix I assessments. Where the requested information has been previously provided in either the ER or SAR, provide a specific cross reference thereto. The projected plant operating life should be assumed to be 30 years.

A. Hydrology

1. Provide quantitative water-use diagrams for the plant showing maximum and monthly average flow rates to and from the various plant water systems (heat dissipation system, sanitary system, radwaste and chemical waste systems, process water system, etc.) in support of liquid radionuclide release rate and concentration estimates.

2. Provide the maximum and monthly average consumptive use of water by the plant. Include consideration of maximum and minimum power operation and temporary shut down.

3. Provide estimated monthly average release rates (flow volume and concentration) for liquid radionuclide effluents.

4. Provide a detailed description of the liquid discharge structure. Identify any institutional restrictions (State or local) on releases.

5. Identify the location, nature, and amounts of present and projected (over plant life) surface water uses (e.g., water supply, irrigation, reservoirs, fisheries, recreation) within 50 miles of the plant where detectable amounts of radioactivity from plant liquid effluents may be expected to affect such use. (See question 6 also.) The bases for estimating present and projected water use

must be provided and the users located on maps of legible scale. Provide a tabulation of the following specific information for water users.

a. Map identification key;

b. Radial and water route distance from the plant to the intake and discharge;

c. Withdrawal and return rates in cfs or gpm for present and projected monthly use;

d. Type of water use (e.g., municipal, industrial, irrigation);

e. Source and projection dates of water use estimates.

6. The ambient flow field of the water body affected by plant liquid radionuclide effluents must be described out to a radius of 50 miles. Expected seasonal and other temporal variations of important parameters (e.g., flows, currents, tides) should be described. At all points that could be affected by detectable amounts of radioactivity from plant liquid effluents where water is used, or where there are important changes in flow parameters, the following information should be provided for both present and projected conditions.

   a. For rivers, provide monthly average flows, velocities, and water levels. In the case of large lake and coastal sites, provide estimates of the persistence and frequency distribution of current magnitude and direction;

   b. Bathymetry and shoreline geometry;

   c. Bases and sources for data and estimates.

7. Describe the ambient flow conditions at, and downstream of the plant, for both present and projected upstream use. The area of consideration is not limited to 50 miles, but must reflect all important upstream processes that may affect the ambient flow. Provide information similar to that requested in 5 and 6 above for the points of significant effect.

8. Provide estimates of radionuclide concentrations and travel times at use locations identified in 5, above annually and for the time periods used to identify water use, flow fields and release rates. Describe the transport model(s) used, input data and parameters, sources of data and parameters, techniques and results of both laboratory and field calibration and verification studies, and the results of sensitivity analyses.

9. Discuss the importance of sorption of radionuclides by both suspended and bottom sediments on or as pathways to man. Consider the potential for ingestion, direct contact, and transfer to the aquatic food chain. Provide estimates of concentrations of radionuclides for these pathways. Describe the models used to estimate sediment uptake, buildup, and transport of radionuclides on and by sediments. Provide the bases for the models, parameters, and input. Describe the results of model verification and sensitivity analyses. Provide estimates of the effects on radionuclide concentrations at the users identified in 5, above.

10. Discuss the potential for the release of liquid radionuclide effluents to the ground water regime as a significant pathway to man. If significant, identify the locations and withdrawal rates of users, and interfaces with surface waters. Provide estimates of radionuclide concentrations and travel times at the locations identified. Describe the transport models used, input data and parameters, source and bases for the data and parameters, techniques and results of both laboratory and field calibration and verification studies, and the results of sensitivity analysis.

B. Meteorology

An assessment of atmospheric transport and diffusion conditions to a distance of 50 miles from the plant is necessary to perform the meteorological evaluation needed to implement the provisions of Appendix I. Such a meso-scale evaluation requires the definition of airflow trajectories and diffusion characteristics over a large area, and thus requires meteorological data representative of regional conditions. The meteorological data collected onsite usually do not adequately represent regional conditions. Therefore, additional meteorological data, such as from National Weather Service stations, will ne necessary to define the airflow trajectories and diffusion characteristics within the region. To assure that dose estimates will not be "substantially underestimated", through deficiencies in the meteorological data and/or inadequacies in the transport and diffusion models, conservative adjustments to the calculated concentrations based on regional meteorological conditions should be made.

Some of the requested information concerning site and/or regional meteorological conditions may have been previously provided to NRC in conjunction with other licensing actions. The information previously provided should then be reviewed to determine that it represents the best available information, and that it will provide an adequate basis to allow the staff to perform an independent meteorological evaluation. If the information meets these criteria, then specific references to this information should be provided.

1. Provide the following information from the onsite meteorological program:

   a. Monthly and annual wind speed and direction data, in joint frequency form, at all heights of measurement representative of wind characteristics for points of effluent release to, and transport within, the atmosphere.

   b. Monthly and annual joint frequencies of wind direction and speed by atmospheric stability class at heights and intervals relevant to atmospheric transport of effluents.

   c. Total precipitation by month, number of hours with precipitation, rainfall rate distributions and monthly precipitation wind roses.

   Note: The information, based on onsite meteorological measurements, should include at least one annual cycle of data collection from the onsite program. The information should be fully documented and substantiated as to the validity of its representation of expected long term conditions at and near the site.

2. Provide the following information, concerning regional meteorological conditions characterizing atmospheric transport processes within 50 miles of the plant, for as many relevant stations as practicable or necessary to define these transport processes within the region:

   a. Wind speed and direction data at all heights(s) at which wind characteristic data are applicable or have been measured;

   b. Atmospheric stability data as defined by vertical temperature gradient or other well-documented parameters that have been substantiated by diffusion test data;

   c. Monthly mixing height data; and

   d. Total precipitation by month, number of hours with precipitation, rainfall rate distributions and monthly precipitation wind roses.

   e. Describe airflow trajectory regimes of importance in transporting effluents to a distance of 50 miles from the plant, including airflow reversals.

   Note: The regional meteorological information provided should be based on at least a one-year period of record and should be concurrent for each station with the period of onsite data collection. Both onsite and regional meteorological data should be presented for each hour, and if possible also be available on magnetic tapes to expedite the staff review. Sources of

meteorological information, in addition to the onsite program could include available National Weather Service (NWS) stations and other well-maintained and well-exposed (e.g. other nuclear plants, university, private meteorological programs) meteorological facilities.

3. Provide the following topographical information:

   a. A map showing the detailed topographic features (as modified by the plant) on a large scale within a 5-mile radius of the plant, and a smaller scale map showing topography within a 50-mile radius of the plant.

   b. A plot of the maximum topographic elevation versus distance from the center of the plant in each of the sixteen 22-1/2 degree cardinal compass point sectors (centered on true north, etc.), radiating from the center of the plant, to a distance of 50 miles.

4. Provide the following information concerning meteorological data:

   a. The identity of the sources of meteorological data used in the atmospheric transport models to assess the dispersion of gaseous effluents from the plant to a distance of 50 miles, and a description of the locations and elevations of all observations and the frequency and duration of the measurements made at each station.

   b. A description of the onsite pre-operational and operational meteorological programs including the instruments, performance specifications, calibration and maintenance procedures, data output and recording systems and locations, and data analysis procedures.

   c. A detailed description of any models(s) to derive estimates of basic meteorological parameters, such as atmospheric stability, and information concerning the validity and accuracy of the model(s).

5. Provide the following information concerning concentration evaluations:

   a. Estimates of relative concentrations (X/Q) and or deposition (D/Q) at points of potential maximum concentration outside the site boundary, at points estimated maximum individual exposure, and at points within a radial grid of sixteen 22-1/2 degree sectors (centered on true north, etc.) and extending to a distance of 50 miles from the plant. A set of data points should be located within each sector at increments of .25 mile to a distance of 1 mile, at increments of .5 mile from a distance of 1 to 5 miles, at increments of 2.5 miles from a distance of 5 to 10 miles, and at increments of 5 miles thereafter to a distance of 50 miles.

b. Estimates of X/Q for noble gas effluents and, if applicable, X/Q depleted by deposition and D/Q for iodine effluents at each of these grid points, as well as averages of these X/Q and/or D/Q values between all adjacent grid points along the radials.

c. A detailed description of the model(s) and the model assumption(s) used to determine the air concentrations and/or deposition, and information concerning the validity and accuracy of the model(s) and assumptions, and the identity of the meteorological data used.

C. Radiological Dose Assessment

1. If there is a priori knowledge that the current 50 mile population age distribution may be significantly different from the U.S. population distribution, then furnish the current age distribution of the 50 mile population (e.g., 0-12, 12-18, >18).

2. Provide in tabular form, the distances from the centerline of the first operational reactor for each of the sixteen sectors described in Section 2.1.3 of R.G. 4.2, Rev. 1, to the nearest vegetable garden (greater than 500 ft^2) out to a distance of 5 miles.

3. Tabulate, for each compass point sector radiating from the center of the plant, the location of the nearest existing milk producing animals (cows and goats) within 5 miles of the site.

4. Provide data on annual meat (kg/yr), milk (liters/yr) and truck farming production (kg/yr) and distribution within a 50 mile radius from the reactor. Provide the data by sectors in the same manner indicated in Sections 2.1.3.1 and 2.1.3.2 of R.G. 4.2, Rev. 1.

5. Furnish information on type, quantity and yield (kg/m^2) of crops grown.

6. Provide information on grazing season (give dates), feeding regimes for cattle (such as grazing practices, green chop feeding, corn & grass sileage feeding and hay feeding) pasture grass density (kg/m^2) and yield statistics (kg/m^2) for harvested forage crops for beef and dairy cattle feeding.

7. Determine and indicate in tabular format the present and projected commercial fish and shellfish catch (in lbs/yr) from contiguous waters within 50 miles of the plant discharge. Report the catch by total landings and by principal species, indicating the relative amounts used as human food. Indicate the location of principal fishing areas and ports of landing associated with these contiguous waters and relate these locations to harvest by species.

Indicate the relative amounts consumed locally. Determine and tabulate the present and projected recreational fish and shellfish harvest from these waters in the same format, also indicating principal fishing areas and their yield by species. As above, indicate the relative amounts consumed locally. Include any harvest and use of seaweed, other aquatic life, or any vegetation used as human food from these waters. Identify and describe any fish farms or similar aquatic activity within the 50-mile area utilizing water that may reasonably be affected by the power plant discharge. Indicate the species and production from each of these facilities and indicate the relative amounts consumed locally.

8. Identify any additional exposure pathways specific to the region around the site which could contribute 10% or more to either individual or population doses.

9. Annual Population Doses - Calculate, using the information provided in response to questions 1-8 above and any other necessary supporting data, the annual total-body man-rem and the annual man thyroid-rem to the population expected to reside in the 50 mile region at the midpoint of plant operation as well as the annual total body man-rem and the annual man thyroid-rem received by the U.S. population at the same time from all liquid and gaseous exposure pathways. Provide as an appendix to your response a description of the models and assumptions used in these calculations.

D. Effluent Treatment Systems

The following information should be consistent with the contents of the Safety Analysis Report (SAR) and Environmental Report (ER) for the proposed reactor. However, based on more recent operating data the staff has modified the calculational models previously used in the evaluation of radwaste treatment and effluent control systems. These modifications to models may result in an increase in the expected releases of radioactive materials in effluents particularly with respect to gaseous releases. In addition, the gaseous source terms now contain values for carbon-14, tritium, argon-41 and particulates not previously considered in our evaluation. Appropriate sections of the SAR and ER containing more detailed discussions of the required information should be referenced following each response. Each response, however, should be independent of the ER and SAR. This information constitutes the basic data required in performing a cost-benefit analysis for radwaste systems. All responses should be on a per-reactor basis.

1. Provide detailed cost estimate sheets, similar to attachments A and B, listing all parameters (and their bases) used in determining capital, operating, and maintenance costs associated with all augments considered in the cost-benefit analysis. All costs should be stated in terms of 1975 dollars.

2. Provide the cost of borrowed money used in the cost analysis and the method of arriving at this cost.

3. Describe the methods and parameters used in the cost-benefit analysis and provide bases for all parameters. Include the following information:

   a. Decontamination factors assigned to each augment and fraction of "on-line" time assumed, i.e., hours per year used.

   b. Parameters and method used to determine the Indirect Cost Factor and the Capital Recovery Factor.

4. Ventilation and Exhaust Systems

   For each building housing systems that contain radioactive materials, the BWR turbine gland seal exhaust and mechanical vacuum pump, the steam generator blowdown system vent exhaust (PWR), and the main condenser air removal system (PWR), provide the following:

   a. Ventilation system flow rates and provisions incorporated to reduce radioactivity releases through the ventilation or exhaust systems.

   b. Decontamination factors assumed and the bases (include charcoal absorbers, HEPA filters, mechanical devices).

   c. Release rates for radioiodine, noble gases, and radioactive particulates (Ci/yr), and the bases.

   d. Release points to the environment including location, height of release, inside dimension of release point exit, effluent temperature, and exit velocity.

   e. For the containment building, provide the building free volume (ft^3) and a thorough description of the internal recirculation system (if provided) including the recirculation rate, charcoal bed depth, operating time assumed, and mixing efficiency. Indicate the expected purge and venting frequencies and duration, and continuous purge rate (if used).

   f. If HEPA filters are used downstream of pressurized storage tanks provide the decontamination factor used in your evaluation.

5. Pressurized Water Reactor Blowdown System

For a pressurized water reactor having recirculating U-tube steam generators and employing all volatile treatment (AVT) to main secondary coolant chemistry, provide the following information:

a. Expected blowdown rate (lb/hr) and method of processing blowdown.

b. Number and type of condensate demineralizers (if applicable) and flow rate of condensate through polishing demineralizers (lb/hr).

c. Expected frequency of resin regeneration or replacement, volumes and radioactivity of regenerant and rinse solutions, sluice water, or backwash water per batch of resin regenerated or replaced.

d. Method of collection, processing and disposal of liquid wastes, including decontamination factors assumed for process operations.

e. P&ID's and process flow diagrams for the steam generator blowdown system and condensate polishing system.

ATTACHMENT A

TOTAL DIRECT COST ESTIMATE SHEET

Description of Augment _____

DIRECT COST (1975 $000)

ITEM	LABOR	EQUIPMENT/MATERIALS	TOTAL	BASIS FOR COST ESTIMATE
1. Process Equipment				
2. Building Assignment				
3. Associated Piping Systems				
4. Instrumentation & Controls				
5. Electrical Service				
6. Spare Parts				
SUBTOTAL				
7. Contingency				
8. TOTAL DIRECT COSTS				

ATTACHMENT B

ANNUAL OPERATING AND MAINTENANCE COST ESTIMATE SHEET

Description of Augment _____

COST (1975 $000)

ITEM	LABOR	OTHER	TOTAL	BASIS FOR COST ESTIMATE
1. Operating Labor, Supervisory and Overhead				
2. Maintenance Material and Labor				
3. Consumables, Chemicals and Supplies				
4. Utilities & Services Waste Disposal Water Steam Electricity Building Services Other				
5. TOTAL O & M ANNUAL COST				