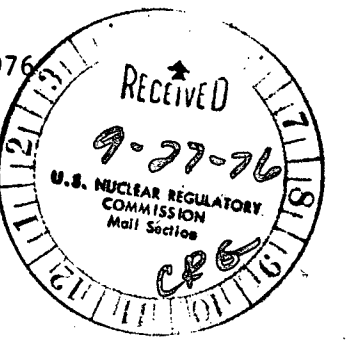
[redacted]30 Power Building
TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401

[redacted]Regulatory File Cy

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

September 20, 1976



Director of Nuclear Reactor Regulation
Attention: Mr. Voss A. Moore, Assistant Director
Environmental Projects
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Moore:

In the Matter of the Application of) Docket Nos. 50-390
Tennessee Valley Authority) 50-391

As promised in our May 17, 1976, letter, enclosed for your review are the remaining responses to the material requested related to the compliance of our Watts Bar Nuclear Plant with Appendix I of 10 CFR Part 50. The responses are to questions II.A.1-5 and II.B.2.e from Daniel R. Muller's letter to James E. Watson dated October 6, 1975.

Very truly yours,

J E Gilleland

J. E. Gilleland
Assistant Manager of Power

Enclosure

Question:

A.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.

Response:

Attached is a water-use diagram and a table giving the flow rates for the various indicated points on the drawing.

TABLE 1

FLOWS ASSOCIATED WITH PLANT WATER USE DIAGRAM*

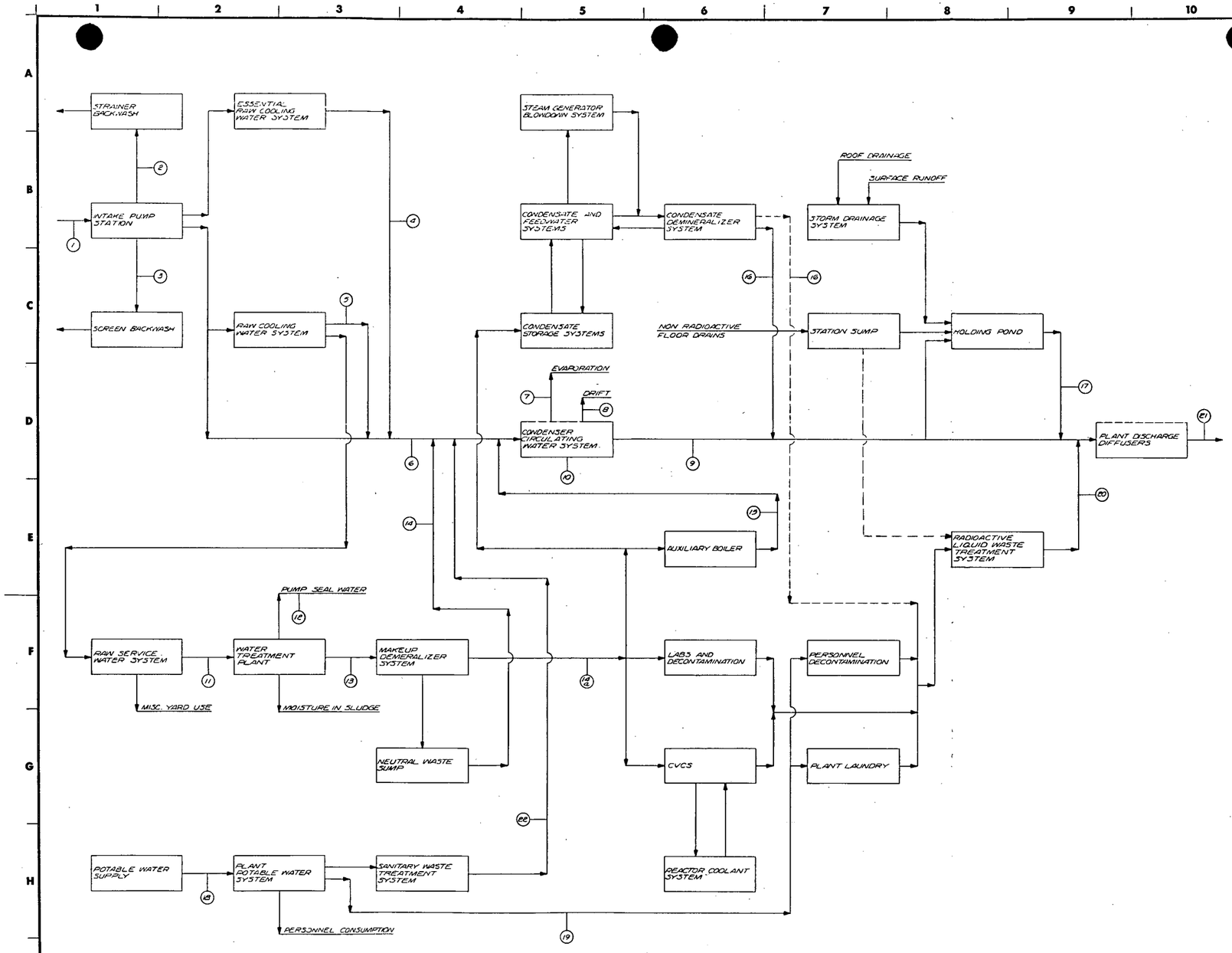
Node Point See Plant Water Use Diagram	A Flow - Normal Full Load Operation of Two Units	B Flow - Full Load Operation of One Unit with Other Unit Shutdown	C Flow - Both Units Shutdown
1. Intake	67,000 gpm (max) 61,000 gpm (avg)	52,000 gpm (max) 39,500 gpm (avg)	16,000 gpm (avg)
2. Strainer Backwash	900 gpm (10 minutes daily)	Same as A	Same as A
3. Screen Backwash	480 gpm (intermittant)	Same as A	Same as A
4. Essential Raw Cooling Water	31,000 gpm (max) 30,000 gpm (avg)	32,000 gpm (max) 23,500 gpm (avg)	15,000 gpm (avg)
5. Raw Cooling Eater System	36,000 gpm (max) 31,000 gpm (avg)	20,000 gpm (max) 16,000 gpm (avg)	0
6. Cooling Tower Makeup Water	67,000 gpm (max) 61,000 gpm (avg)	52,000 gpm (max) 39,500 gpm (avg)	0 0
7. Cooling Tower Evaporation Rate	28,800 gpm (max) 22,590 gpm (avg) 19,860 gpm (min)	14,400 gpm (max) 11,295 gpm (avg) 9,930 gpm (min)	0 0
8. Cooling Tower Drift Rate	90 gpm (avg)	45 gpm (avg)	0
9. Cooling Tower Blowdown Flow	47,050 gpm (max) 38,320 gpm (avg)	42,025 gpm (max) 28,160 gpm (avg)	0 0
10. Condenser Circulating Water System (flow through towers)	820,000 gpm	410,000 gpm	0
11. Raw Service Water System	1,000 gpm (max)	1,400 gpm (max)	1,400 gpm (max)
12. Pump Seal Water	32 gpm (avg)	16 gpm (avg)	0

TABLE 1 (Continued)

FLOWS ASSOCIATED WITH PLANT WATER USE DIAGRAM

Node Point See Plant Water Use Diagram	A Flow - Normal Full Load Operation of Two Units	B Flow - Full Load Operation of One Unit with Other Unit Shutdown	C Flow - Both Units Shutdown
13. Treated Water Supply to Makeup Demineralizer	480 gpm (max) 400 gpm (avg)	Same as A	Same as A
14. Demineralizer Spent Regenerants	25 gpm (avg)	Same as A	Same as A
14a. Demineralized Water Supply	320 gpm (max)	Same as A	Same as A
15. Auxiliary Boiler Blowdown	0	0	3 gpm (max)
16. Condensate Demineralizer Spent Regenerants	30 gpm (avg)	Same as A	Same as A
17. Holding Pond Discharge	38,320 gpm (avg)	28,160 gpm (avg)	0
18. Potable Water Supply	16,000 gpd (max)	Same as A	Same as A
19. Potable Water Supply to Hot Showers and Laundry	4,000 gpd (max) 1,500 gpd (avg)	Same as A	Same as A
20. Radioactive Liquid Treatment System Discharge	5.7 gpm (avg)	Same as A	Same as A
21. Plant Discharge	76,640 gpm (max) 38,320 gpm (avg)	56,320 gpm (max) 28,160 gpm (avg)	16,400 gpm (avg)
22. Sanitary Waste Discharge	12,000 gpd (max) 6,000 gpd (avg)	Same as A	Same as A

* All average flow rates are yearly averages.



NOTES
1 ——▶ DENOTES ROUTING IF RADIOACTIVITY IS SIGNIFICANT.

REV NO.	ECN NO.	DATE	DSGR	DRWN	CHKD	SUPV	CHGR	INSP	SUBM	RECM	APPR

DSGR
DRWN
CHKD
SUPV
INSP
ENGINEER

WATER USE DIAGRAM

TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED

INSPECTED AND APPROVED FOR ISSUE

KNOXVILLE

Question:

A.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.

Response:

Attached is a table giving the monthly average and maximum consumptive use of water by the plant.

MAXIMUM AND MONTHLY AVERAGE CONSUMPTIVE USE

OF WATER BY WATTS BAR NUCLEAR PLANT[1]

BOTH UNITS AT 100% RATED POWER[2]

	Maximum[3] (gpm)	Average (gpm)
January	23,070	20,098
February	23,370	20,262
March	24,570	21,328
April	26,670	23,050
May	27,630	23,870
June	28,770	24,936
July	28,890	25,018
August	28,770	24,936
September	28,050	24,280
October	26,250	22,772
November	24,570	21,246
December	23,550	20,426

[1]The above rates may vary depending on meteorological conditions and the amount of moisture in solid wastes.

[2]The valves for one unit at 100% power and one unit shutdown will be approximately one half those shown above.

[3]The maximum could occur if one CCW pump is lost.

Question:

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

Response:

The discharge from the liquid radioactive waste treatment system empties directly into the plant discharge. The liquid radwaste treatment system discharges at a yearly average flow rate of 5.7 gal/min. The radionuclide inventories are listed on the attached table.

The plant discharge flow rates listed in the response to A.1 are 76,640 gal/min maximum and 38,320 gal/min average. The minimum flow at which liquid radioactive waste will be discharged is 28,000 gal/min as stated in Section 11.2 of the Watts Bar FSAR.

For further information on the Watts Bar liquid radioactive waste processing system, see Section 11.2 in the Watts Bar FSAR. The yearly releases are given in Table 11.2-8.

TABLE A.3

Liquid Radioactive Treatment System Discharge Inventories

Flow Rate (Yearly Average) _ _ _ _ _ 5.7 gal/min

Isotope	Concentration uci/gm
CR 51	4.7E-10
MN 54	2.2E-07
FE 59	5.4E-10
CO 58	8.9E-07
CO 60	2.0E-06
BR 83	7.0E-09
BR 84	6.5E-09
BR 85	1.3E-11
RB 86	5.8E-11
RB 88	4.1E-09
SR 89	2.2E-10
SR 90	6.2E-12
Y 90	9.4E-12
SR 91	2.0E-10
Y 91M	2.0E-10
Y 91	1.3E-09
Y 93	4.1E-11
ZR 95	3.1E-07
NB 95	4.4E-07
MO 99	2.0E-07
TC 99M	2.0E-07
RU 103	3.1E-08
RH 103M	2.9E-11
RU 106	5.3E-07
RH 106	6.2E-12
TE 125M	1.6E-11
TE 127M	1.7E-10
TE 127	3.5E-10
TE 129M	9.0E-10
TE 129	9.2E-10
I 130	7.4E-09
I 131	3.6E-11
I 131M	1.1E-09
I 131	1.7E-06
TE 132	1.3E-08
I 132	2.4E-07
I 133	1.5E-06
I 134	3.0E-08
I 135	5.2E-07
CS 134	2.9E-06
CS 136	8.7E-09
CS 137	5.3E-06

Isotope	Concentration uci/gm
BA 137M	1.3E-08
BA 140	1.3E-10
LA 140	1.1E-10
CE 141	4.8E-11
CE 143	1.7E-11
PR 143	3.0E-11
CE 144	1.1E-06
PR 144	2.4E-11
NP 239	6.1E-10
H 3	9.8E-03

PLANT DISCHARGE FLOW RATE

MAXIMUM - 76,640 gal/min

AVERAGE - 38,320 gal/min*

LOWER LIMIT FOR RADWASTE DISCHARGE 28,000 gal/min

*YEARLY AVERAGE

Question:

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

Response:

The discharge structure at Watts Bar is a multiport diffuser system. The system will consist of two parallel conduits extending into the river. Attached are two drawings showing the diffuser layout.

TVA, as a Federal agency, is not subject to administrative procedures requiring state and/or local permits. However, TVA must comply with all substantive state or local regulations which become a part of the NPDES permit to be received from EPA. Federal regulations are the basis for effluent limitations in our NPDES permit, and any more stringent limits required by state or local authorities are included by EPA in the body of the permit.

For your information is a copy of the State of Tennessee Water Quality Criteria. The specific effluent limitations required to achieve these criteria will appear in the EPA permit when it is issued.

APPENDIX B

GENERAL WATER QUALITY CRITERIA FOR THE DEFINITION AND CONTROL OF POLLUTION IN THE WATERS OF TENNESSEE

Adopted on October 26, 1971

Amended on December 14, 1971 and October 30, 1973

Tennessee Water Quality Control Board

The Water Quality Control Act of 1971, Chapter 164 Public Acts of 1971 as Amended by Chapter 386, makes it the duty of the Water Quality Control Board to study and investigate all problems concerned with the pollution of the waters of the State and with its prevention, abatement, and control and to establish such standards of quality for any waters of the State in relation to their reasonable and necessary use as the Board shall deem to be in the public interest and establish general policies relating to existing or proposed future pollution as the Board shall deem necessary to accomplish the purpose of the Control Act. The following general considerations and criteria are officially adopted by the Board as a guide in determining the permissible conditions of waters with respect to pollution and the preventive and corrective measures required to control pollution in various waters or in different sections of the same waters.

GENERAL CONSIDERATIONS

1. Waters have many uses which in the public interest are reasonable and necessary. Such uses include: sources of water supply for domestic and industrial purposes; propagation and maintenance of fish and other desirable aquatic life; recreational boating and fishing; the final disposal of municipal sewage and industrial waste following adequate treatment; stock watering and irrigation; navigation; generation of power; and the enjoyment of scenic and esthetic qualities of the waters.

2. The rigid application of uniform water quality is not desirable or reasonable because of the varying uses of such waters. The assimilative capacity of a stream for sewage and waste varies depending upon various factors including the following: volume of flow, depth of channel, the presence of falls or rapids, rate of flow, temperature, natural characteristics, and the nature of the stream. Also the relative importance assigned to each use will differ for different waters and sections of waters throughout the stream.

3. To permit reasonable and necessary uses of the waters of the State, existing pollution should be corrected as rapidly as practical and future pollution controlled by treatment plants or other measures. There is an economical balance between the cost of sewage and waste treatment and the benefits received. Within permissible limits, the dilution factor and the assimilative capacity of surface water should be utilized. Waste recovery, control of rates and dispersion of waste into the streams, and control of rates and characteristics of flow of waters in the stream where adequate, will be considered to be a means of correction.

4. Sewage, industrial wastes, or other wastes, as defined in the Water Quality Control Act of 1971, Chapter 164 Public Acts of 1971, as amended by Chapter 386, shall not be discharged into or adjacent to streams or other surface waters in such quantity and of such character or under such conditions of discharge in relation to the receiving waters as will result in visual or olfactory nuisances, undue interference to other reasonable and necessary uses of the water, or appreciable damage to the natural processes of self-purification. In relation to the various qualities and the specific uses of the receiving waters, no sewage, industrial wastes, or other wastes discharged shall be responsible for conditions that fail to meet the criteria of water quality outlined below. Bypassing or accidental spills will not be tolerated.

   The criteria of water quality outlined below are considered as guides in applying the water quality objectives in order to insure reasonable and necessary uses of the waters of the State, in order to protect the public health and maintain the water suitable for other reasonable and necessary uses; to provide for future development; to allow proper sharing of available water resources; and to meet the needs of particular situations, additional criteria will be set.

CRITERIA OF WATER CONDITIONS

1. Domestic Raw Water Supply

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Hardness or Mineral Compounds - There shall be no substances added to the wate s that will increase the hardness or mineral content of the waters to such an extent to appreciably impair the usefulness of the water as a source of domestic water supply.

(d) Total Dissolved Solids - The total dissolved solids shall at no time exceed 500 mg/l.

(e) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character as may impair the usefulness of the water as a source of domestic water supply.

(f) Turbidity or Color - There shall be no turbidity or color added in amounts or characteristics that cannot be reduced to acceptable concentrations by conventional water treatment processes.

(g) Temperature - The maximum water temperature change shall not exceed 3C° relative to an upstream control point. The temperature of the water shall not exceed 30.5°C and the maximum rate of change shall not exceed 2C° per hour. The temperature of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

(h) Microbiological Coliform - The concentration of the fecal coliform group shall not exceed 1,000 per 100 ml. as the logarithmic mean based on a minimum of 10 samples collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. In addition, the concentration of the fecal coliform group in any individual sample shall not exceed 5,000 per 100 ml.

(i) Taste or Odor - There shall be no substances added which will result in taste or odor that prevent the production of potable water by conventional water treatment processes.

(j) Toxic Substances - There shall be no toxic substances added to the waters that will produce toxic conditions that materially affect man or animals or impair the safety of a conventionally treated water supply.

(k) Other Pollutants - Other pollutants shall not be added to the water in quantities that may be detrimental to public health or impair the usefulness of the water as a source of domestic water supply.

2. Industrial Water Supply

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours

(c) Hardness or Mineral Compounds - There shall be no substances added to the waters that will increase the hardness or mineral content of the waters to such an extent as to appreciably impair the usefulness of the water as a source of industrial water supply.

(d) Total Dissolved Solids - The total dissolved solids shall at no time exceed 500 mg/l.

(e) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character as may impair the usefulness of the water as a source of industrial water supply.

(f) Turbidity or Color - There shalll be no turbidity or color added in amounts or characteristics that cannot be reduced to acceptable concentrations by conventional water treatment processes.

(g) Temperature - The maximum water temperature change shall not exceed 3C° relative to an upstream control point. The temperature of the water shall not exceed 30.5°C and the maximum rate of change shall not exceed 2C° per hour. The temperature of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

(h) Taste or Odor - There shall be no substances added that will result in taste or odor that would prevent the use of the water for industrial processing.

(i) Toxic Substances - There shall be no substances added to the waters that may produce toxic conditions that will adversely affect the water for industrial processing.

(j) Other Pollutants - Other pollutants shall not be added to the waters in quantities that may adversely affect the water for industrial processing.

3. Fish and Aquatic Life

(a) Dissolved Oxygen - The dissolved oxygen shall be a minimum of 5.0 mg/l except in limited sections of streams where, (i) present technology cannot restore the water quality to the desired minimum of 5.0 mg/l dissolved oxygen, (ii) the cost of meeting the standards is economically prohibitive when compared with the expected benefits to be obtained, or (iii) the natural qualities of the water are less than the desired minimum of 5.0 mg/l dissolved oxygen. Such exceptions shall be determined on an individual basis but in no instance shall the dissolved oxygen concentration be less than 3.0 mg/l. The dissolved oxygen concentration shall be measured at mid-depth in waters having a total depth of ten (10) feet or less and at a depth of five (5) feet in waters having a total depth of greater than ten (10) feet. The dissolved oxygen concentration of recognized trout streams shall not be less than 6.0 mg/l.

(b) pH - The pH value shall lie within the range of 6.5 to 8.5 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character that may be detrimental to fish and aquatic life.

(d) Turbidity or Color - There shall be no turbidity or color added in such amounts or of such character that will materially affect fish and aquatic life.

(e) Temperature - The maximum water temperature change shall not exceed 3C° relative to an upstream control point. The temperature of the water shall not exceed 30.5°C and the maximum rate of change shall not exceed 2C° per hour. The temperature of recognized trout waters shall not exceed 20°C. There shall be no abnormal temperature changes that may affect aquatic life unless caused by natural conditions. The temperature of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

(f) Taste and Odor - There shall be no substances added that will impart unpalatable flavor to fish or result in noticeable offensive odors in the vicinity of the water or otherwise interfere with fish or aquatic life.

(g) Toxic Substances - There shall be no substances added to the waters that will produce toxic conditions that affect fish or aquatic life.

(h) Other Pollutants - Other pollutants shall not be added to the waters that will be detrimental to fish or aquatic life.

(i) Microbiological Coliform - The concentration of the fecal coliform group shall not exceed 1,000 per 100 ml. as the logarithmic mean based on a minimum of 10 samples collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. In addition, the concentration of the fecal coliform group in any individual sample shall not exceed 5,000 per 100 ml.

4. Recreation

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character that may be detrimental to recreation.

(d) Turbidity or Color - There shall be no turbidity or color added in such amounts or character that will result in an objectionable appearance to the water.

(e) Temperature - The maximum water temperature change shall not exceed 3C° relative to an upstream control point. The temperature of the water shall not exceed 30.5°C and the maximum rate of change shall not exceed 2C° per hour. The temperature of impoundments where stratification occurs will be measured at a depth of 5 feet, or mid-depth whichever is less, and the temperature in flowing streams shall be measured at mid-depth.

(f) Microbiological Coliform - The concentration of the fecal coliform group shall not exceed 200 per 100 ml. as the logarithmic mean based on a minimum of 10 samples collected from a given sampling site over a period of not more than 30 consecutive days with individual samples being collected at intervals of not less than 12 hours. In addition, the concentration of the fecal coliform group in any individual sample shall not exceed 1,000 per 100 ml. Water areas in the vicinity of domestic wastewater treatment plant outfalls are not considered suitable for body contact recreational purposes.

(g) Taste or Odor - There shall be no substances added that will result in objectionable taste or odor.

(h) Toxic Substances - There shall be no substances added to the water that will produce toxic conditions that affect man or animal.

(i) Other Pollutants - Other pollutants shall not be added to the water in quantities which may have a detrimental effect on recreation.

5. Irrigation

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Hardness or Mineral Compounds - There shall be no substances added to the water that will increase the mineral content to such an extent as to impair its use for irrigation.

(d) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character as may impair the usefulness of the water for irrigation purposes.

(e) Temperature - The temperature of the water shall not be raised or lowered to such an extent as to interfere with its use for irrigation purposes.

(f) Toxic Substances - There shall be no substances added to water that will produce toxic conditions that will affect the water for irrigation.

(g) Other Pollutants - Other pollutants shall not be added to the water in quantities which may be detrimental to the waters used for irrigation.

6. Livestock Watering and Wildlife

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) pH - The pH value shall lie within the range of 6.0 to 9.0 and shall not fluctuate more than 1.0 unit in this range over a period of 24 hours.

(c) Hardness or Mineral Compounds - There shall be no substances added to water that will increase the mineral content to such an extent as to impair its use for livestock watering and wildlife.

(d) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks or such size or character as to interfere with livestock watering and wildlife.

(e) Temperature - The temperature of the water shall not be raised or lowered to such an extent as to interfere with its use for livestock watering and wildlife.

(f) Toxic Substances - There shall be no substances added to water that will produce toxic conditions that will affect the water for livestock watering and wildlife.

(g) Other Pollutants - Other pollutants shall not be added to the water in quantities which may be detrimental to the water for livestock watering and wildlife.

7. Navigation

(a) Dissolved Oxygen - There shall always be sufficient dissolved oxygen present to prevent odors of decomposition and other offensive conditions.

(b) Hardness or Mineral Compounds - There shall be no substances added to the water that will increase the mineral content to such as extent as to impair its use for navigation.

(c) Solids, Floating Materials and Deposits - There shall be no distinctly visible solids, scum, foam, oily sleek, or the formation of slimes, bottom deposits or sludge banks of such size or character as to interfere with navigation.

(d) Temperature - The temperature of the water shall not be raised or lowered to such an extent as to interfere with its use for navigation purposes.

(e) Toxic Substances - There shall be no substances added to water that will produce toxic conditions that will affect the water for navigation.

(f) Other Pollutants - Other pollutants shall not be added to the water in quantities which may be detrimental to the waters used for navigation.

These criteria should not be construed as permitting the degradation of higher quality water when such can be prevented by reasonable pollution control measures. The above conditions are recognized as applying to waters affected by the discharge of sewage and/or industrial waste or other waste and not resulting from natural causes.

DEFINITIONS

1. Conventional Water Treatment - Conventional water treatment as referred to in the criteria denotes coagulation, sedimentation, filtration and chlorination.

2. Mixing Zone - Mixing zone refers to that section of flowing stream or impounded waters necessary for effluents to become dispersed. The mixing zone necessary in each particular case shall be defined by the Tennessee Water Quality Control Board.

INTERPRETATION OF CRITERIA

1. Interpretations of the above criteria shall conform to any rules and regulations or policies adopted by the Water Quality Control Board.

2. Insofar as practicable, the effect of treated sewage or waste discharges on the receiving waters shall be considered after they are mixed with the waters and beyond a reasonable zone of immediate effect upon the qualities of the waters. The extent to which this is practicable depends upon local conditions and the proximity and nature of other uses of the waters.

3. The technical and economical feasibility of waste treatment, recovery, or adjustment of the method of discharge to provide correction shall be considered in determining the time to be allowed for the development of practicable methods and for the specified correction.

4. The criteria set forth shall be applied on the basis of the following stream flows: unregulated streams - stream flows equal to or exceeding the 3-day minimum, 20-year recurrence interval; regulated streams - instantaneous minimum flow.

5. In general, deviations from normal water conditions may be undesirable, but the rate and extent of the deviations should be considered in interpreting the above criteria.

6. The criteria and standards provide that all discharges of sewage, industrial waste, and other wastes will receive the best practicable treatment (secondary or the equivalent) or control according to the policy and procedure of the Tennessee Water Quality Control Board. A degree of treatment greater than secondary when necessary to protect the water uses will be required for selected sewage and waste discharges.

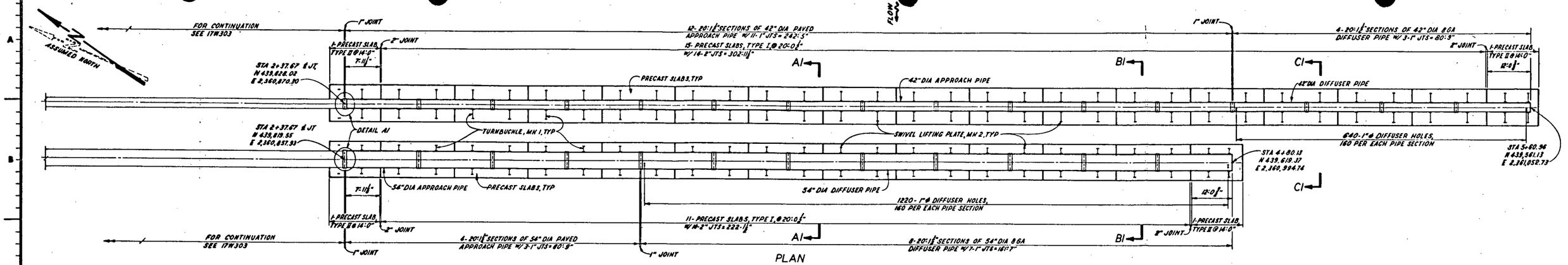
TENNESSEE ANTIDEGRADATION STATEMENT

1. The Standards and Plan adopted are designed to provide for the protection of existing water quality and/or the upgrading or "enhancement" of water quality in all waters within Tennessee. It is recognized that some waters may have existing quality better than established standards.

2. The Criteria and Standards shall not be construed as permitting the degradation of these higher quality waters when such can be prevented by reasonable pollution control measures. In this regard, existing high quality water will be maintained unless and until it is affirmatively demonstrated to the Tennessee Water Quality Control Board that a change is justifiable as a result of necessary social and economic development.

3. All discharges of sewage, industrial waste, or other waste shall receive the best practicable treatment (secondary of the equivalent) or control according to the policy and procedure of the Tennessee Water Quality Control Board. A degree of treatment greater than secondary when necessary to protect the water uses will be required for selected sewage and waste discharges.

4. In implementing the provisions of the above as they relate to interstate streams, the Tennessee Water Quality Control Board will cooperate with the appropriate Federal Agency in order to assist in carrying out responsibilities under the Federal Water Pollution Control Act, as amended.



NOTE:
FOR LIST OF NOTES, KEY PLAN AND REFERENCE DRAWINGS, SEE 31W326-2.

PRELIMINARY

DATE

DES NO	ECN NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	INSP	SUB	RECM	APPR

DSGN
DRWN A.B. RUSSELL
CHKD
SUPV
INSP
ENGINEER

THIS DRAWING HAS BEEN ADDED DUE TO ECN 1149

CONDENSER WATER SUPPLY
COOLING TOWER SYSTEM UNITS 1 & 2

CONCRETE BLOWDOWN DIFFUSER PIPE OUTLINE & REINFORCEMENT

WATTS BAR NUCLEAR PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

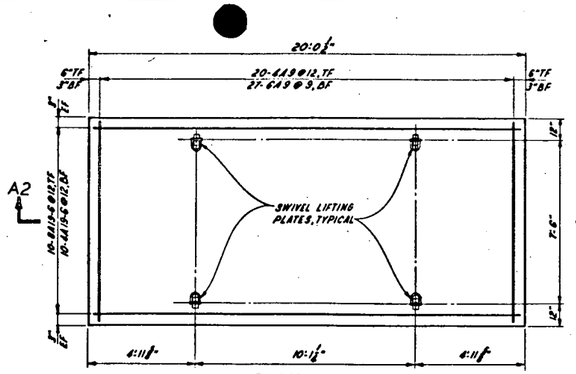
SUBMITTED	RECOMMENDED	APPROVED

INSPECTED AND APPROVED FOR ISSUE

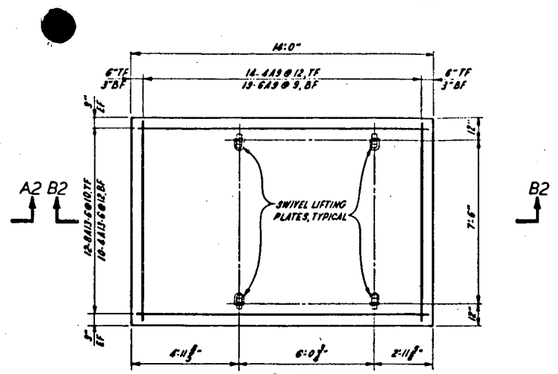
KNOXVILLE | 85 C 31W326-1 R0

RECORD DRAWING AS CONSTRUCTED

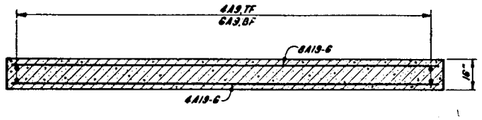
REQD-R
DWG SIZE
F H
PRINT H



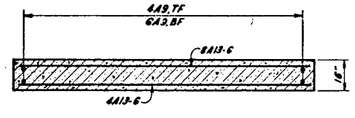
PLAN
TYPE I
26 REQD



PLAN
TYPE II
4 REQD

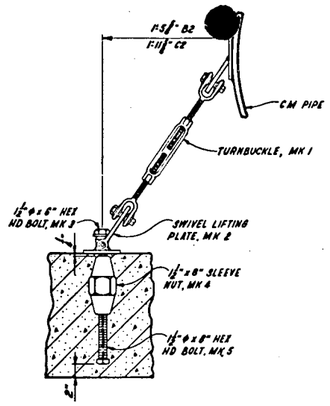


SECTION A2-A2

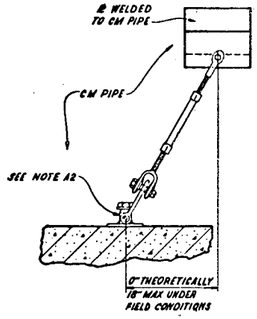


B2-B2

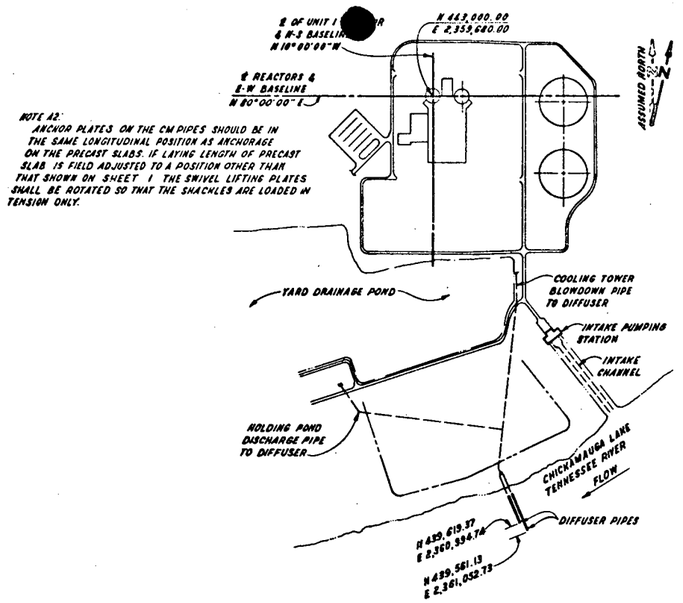
DETAIL A2
PRECAST SLABS
EG SHEET 1



DET B2 & C2
F3 SHEET 1
1 1/2"=1'-0"



DET D2
D9 SHEET 1
1 1/2"=1'-0"



KEY PLAN
1"=500'

PRELIMINARY

REV NO.	ECN NO.	DATE	DSGN	DRWN	CHKD	SUPV	ENGR	IRSP	SUBM	RECM	APPR

DSGN N.C. BUSSELL DATE
DRWN
CHKD
SUPV
IRSP
ENGINEER

THIS DRAWING HAS BEEN ADDED DUE TO ECN 1149

CONDENSER WATER SUPPLY
COOLING TOWER SYSTEM UNITS 1 & 2

SCALE 1"=10' EXCEPT AS NOTED

COMPANION DRAWING:
31W326-1

REFERENCE DRAWINGS:
31BM326-1 BILL OF MATERIAL
31BS326-1 ANCHOR BOLT DETAILS

CONCRETE BLOWDOWN DIFFUSER PIPE OUTLINE & REINFORCEMENT

WATTS BAR NUCLEAR PLANT
TENNESSEE VALLEY AUTHORITY
DIVISION OF ENGINEERING DESIGN

SUBMITTED	RECOMMENDED	APPROVED

INSPECTED AND APPROVED FOR ISSUE
DESIGN PROJECT MANAGER

KNOXVILLE | 85 | C | 31W326-2 | R0

REQD FOR SIZE F H

Question:

A.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 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., muncipal, industrial, irrigation);

e. Source and projection dates of water use estimates.

Response:

A discussion of water-use may be found in Section 2.4 of the Watts Bar Nuclear Plant Final Safety Analysis Report.

Question:

B.2.e. Describe air flow trajectory regimes of importance in transporting effluents to a distance of 50 miles from the plant, including air flow reversals.

Response:

A general discussion of air flow patterns in the area within a 50-mile radius of the Watts Bar Nuclear Plant is attached.

AIRFLOW PATTERNS IN AREA WITHIN 50 MILES OF WATTS BAR NUCLEAR PLANT SITE

Atmospheric circulation over eastern Tennessee on an annual basis is predominantly southerly to southwesterly. Secondary wind directions are westerly, northerly, and northeasterly. Northeasterly wind patterns tend to dominate slightly in late summer and early fall. The influence of the western extension of the Azores-Bermuda subtropical high pressure ridge and the frequent deceleration and occasional stagnation of extra-tropical high pressure systems (cold air masses) provide a climatic pressure gradient favorable for southerly to southwesterly air circulation. The location and orientation of the mean pressure ridge, with a weak secondary high pressure center located north or northeast of the area, in late summer and early fall enhances northeasterly flow during that part of the year. In late fall, winter, and early spring, migratory low and high pressure systems increase the relative frequencies of airflow from the west and the north, and occasionally the northeast.[1,2]

The circulation patterns in the lower atmosphere over eastern Tennessee are strongly influenced by the topography. Three major features dominate--(1) the Cumberland Plateau, (2) the Great Valley of East Tennessee, and (3) the Great Smoky Mountains and associated ranges.[3] These features are aligned approximately northeast-southwest, but the latter two features tend to be curved such that near and east of Chattanooga the orientation is more nearly north-northeast to south-southwest. The Cumberland Plateau in most of the area has an average elevation of about 2,000 feet MSL, but rises to over 3,000 feet MSL north of Oak Ridge. The mountain ranges east of the Great Valley have numerous elevations from 3,000 to 4,000 feet MSL, with the Great Smoky Mountains generally rising to 4,000 to 6,000 feet MSL. The Great Valley lies between these

two main prominences and is somewhat irregularly corrugated with smaller ridges, generally aligned northeast-southwest, most of which rise only 200 to 400 feet above the valley floor. The elevation of the valley floor is generally less than 1,000 feet MSL between Chattanooga and Knoxville.

The Watts Bar Nuclear Plant site is located along the Tennessee River in the western portion of the Great Valley, which is about 30 miles wide at that point. A low, rounded ridge lies one to two miles east of the Watts Bar site, and the eastern edge of the Cumberland Plateau (Walden Ridge) is about eight miles west-northwest at its nearest point to the site. The Chattanooga Airport (Lovell Field) is about 45 miles southwest; the Knoxville Airport (McGee-Tyson Field) is just less than 50 miles east-northeast; and the Oak Ridge National Weather Service (NWS) station is about 40 miles northeast of the site. TVA meteorological towers other than at Watts Bar are located near the Kingston Steam Plant (about 25 miles northeast), at the proposed Clinch River Breeder Reactor Plant (CRBRP) site (about 30 miles northeast), near the Bull Run Steam Plant (about 45 miles northeast), and at the Sequoyah Nuclear Plant site (about 30 miles southwest). All of these wind data sources lie within the Great Valley.

In general, the low-level wind patterns over eastern Tennessee show that the most frequent wind directions are in the northeast and southwest quadrants. These wind patterns reveal the effects of the topographic channeling, which is most pronounced in the Great Valley. There is some spatial variation as well as seasonal variation in these patterns. At the Chattanooga NWS station, the two most frequent directions have usually been south and north.[4,5] However, the Chickamauga Creek Valley, in which the station is located, is oriented south-north. For the Knoxville NWS station, the west-southwest, west, northeast, north, and southwest wind directions have been relatively more frequent than

other directions.[6,7] The lack of significant topographical obstructions for 40 miles to the west and to the north of this station appears to be a factor in the higher frequencies of westerly and northerly winds, which are part of the secondary regional airflow patterns previously described. The attached Sequoyah and Watts Bar joint frequency distributions of wind direction and wind speed at 300 feet above the ground surface are examples of the general upvalley-downvalley channeling of wind direction.

A significant diurnal shift in wind direction is another major feature of the airflow pattern in the Great Valley. At Oak Ridge, the prevailing winds are usually upvalley (southwest to west) or downvalley (northeast to east).[8] For light winds associated with weak pressure gradients, daytime flow is usually from the southwest and nighttime flow from the northeast. Knoxville experiences a prevailing wind direction from the southwest in the daytime and from the northeast in the nighttime.[7] Also, data from the TVA towers in the area within 50 miles of the Watts Bar site show such a diurnal wind shift pattern, which is associated with periods having relatively weak pressure gradients and surface-based nocturnal temperature inversions. During periods with such conditions, including cases of atmospheric stagnation, wind direction "reversal", or shifts of approximately 180 degrees, can be expected diurnally. Usually this involves northeast-southwest or adjacent wind direction pairings. Such diurnal wind shift occurrences are relatively more frequent in the summer and fall. When a sufficient atmospheric pressure gradient or nearly neutral temperature lapse rate conditions exist, the wind direction will generally be upvalley or downvalley, or occasionally cross-valley, without a diurnal shift. Airborne effluent from the Watts Bar Nuclear Plant may tend to accumulate in the valley air to somewhat higher concentrations during periods with the diurnal shifts

of wind direction than would be expected when the air flows in accordance with synoptic patterns, without the diurnal change of direction. Cross-valley air flow should normally be accompanied by neutral or unstable temperature lapse rate conditions in the near-surface layer of air and is usually more frequent in the winter half of the year than in the summer half.

Within five miles of the Watts Bar site, the onsite meteorological data best represent the local airflow patterns, which are little different from the patterns over the larger area. Joint frequency distributions of wind direction and wind speed have been provided previously in response to the Nuclear Regulatory Commission enclosure 2 item B.1.a.

REFERENCES

1. U. S. Atomic Energy Commission. A Meteorological Survey of the Oak Ridge Area, Weather Bureau, Publication ORO-99, Oak Ridge, Tennessee, November 1953, page 377. (Figure 2.3-1 in the Watts Bar Nuclear Plant FSAR).

2. U. S. Department of Commerce. Climatic Atlas of the United States, ESSA, Environmental Data Service (EDS), June 1968.

3. Dickson, Robert R. Climates of the States - Tennessee, Climatography of the United States No. 60-40, U. S. Department of Commerce, Weather Bureau, February 1960.

4. U. S. Department of Commerce. Wind Distribution by Pasquill Stability Classes (5) - STAR Program, 1967 - 1971, Chattanooga, Tennessee, NOAA, EDS, NCC, Asheville, North Carolina, July 23, 1973.

5. U. S. Department of Commerce. Local Climatological Data, Annual Summary with Comparative Data, 1975, Chattanooga, Tennessee, NOAA, EDS, NCC, Asheville, North Carolina.

6. U. S. Department of Commerce. Wind Distribution by Pasquill Stability Classes (5) - STAR Program, 1966 - 1970, Knoxville, Tennessee, NOAA, EDS, NCC, Asheville, North Carolina, October 15, 1971.

7. U. S. Department of Commerce. Local Climatological Data, Annual Summary with Comparative Data, 1975, Knoxville, Tennessee, NOAA, EDS, NCC, Asheville, North Carolina.

8. U. S. Department of Commerce. Local Climatological Data, Annual Summary with Comparative Data, 1975, Oak Ridge, Tennessee, NOAA, EDS, NCC, Asheville, North Carolina.

PERCENT OCCURRENCE OF WIND SPEED FOR ALL WIND DIRECTIONS

SEQUOYAH NUCLEAR PLANT METEOROLOGICAL FACILITY*

JUL 1, 73 - JUN 30, 75

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	≥24.5	TOTAL
N	0.12	0.76	1.12	1.43	3.45	2.17	0.38	0.02	9.45
NNE	0.07	0.98	2.43	3.44	6.87	3.34	0.40	0.0	17.53
NE	0.12	0.90	1.21	1.26	1.76	0.54	0.03	0.01	5.83
ENE	0.07	0.69	0.65	0.37	0.32	0.07	0.03	0.0	2.20
E	0.06	0.40	0.47	0.20	0.22	0.09	0.02	0.0	1.46
ESE	0.04	0.40	0.29	0.08	0.14	0.06	0.01	0.0	1.02
SE	0.04	0.27	0.52	0.12	0.07	0.04	0.0	0.01	1.07
SSE	0.02	0.47	0.58	0.32	0.58	0.27	0.06	0.06	2.36
S	0.06	0.91	1.16	1.16	2.91	2.12	0.95	0.11	9.38
SSW	0.10	1.18	2.25	2.46	7.15	4.96	1.39	0.26	19.75
SW	0.09	1.01	2.56	2.31	4.54	2.33	0.72	0.21	13.77
WSW	0.07	0.66	1.02	0.60	0.62	0.52	0.10	0.09	3.68
W	0.06	0.31	0.32	0.21	0.52	0.42	0.22	0.09	2.15
WNW	0.06	0.30	0.24	0.21	0.49	0.48	0.17	0.11	2.06
NW	0.07	0.30	0.28	0.32	1.05	1.12	0.18	0.06	3.38
NNW	0.05	0.39	0.42	0.47	1.66	1.52	0.34	0.0	4.85
SUBTOTAL	1.10	9.93	15.52	14.96	32.35	20.05	5.00	1.03	99.94

CALM = 0.01

16070 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF 17520 TOTAL HOURS = 91.72 PERCENT

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED .74 MILES SW OF SEQUOYAH NUCLEAR PLANT
WIND INSTRUMENTS 300 FEET ABOVE GROUND

TABLE 2.3-14

PERCENT OCCURRENCE OF WIND SPEED
FOR ALL WIND DIRECTIONS

WATTS BAR NUCLEAR PLANT METEOROLOGICAL FACILITY*

JUL 1, 73 - JUN 30, 75

WIND DIRECTION	WIND SPEED (MPH) 0.6-1.4	1.5-3.4	3.5-5.4	5.5-7.4	7.5-12.4	12.5-18.4	18.5-24.4	≥24.5	TOTAL
N	0.18	0.61	0.86	0.84	1.64	1.15	0.06	0.0	5.34
NNE	0.18	1.40	2.17	1.88	3.31	1.46	0.23	0.01	10.64
NE	0.19	1.86	3.14	2.55	4.16	1.18	0.11	0.0	13.19
ENE	0.12	1.26	1.53	1.29	1.46	0.19	0.03	0.01	5.89
E	0.07	1.07	1.15	0.74	0.88	0.13	0.0	0.01	4.05
ESE	0.04	0.58	0.61	0.33	0.26	0.04	0.0	0.0	1.86
SE	0.12	0.54	0.43	0.12	0.16	0.04	0.01	0.0	1.42
SSE	0.08	0.79	0.47	0.14	0.29	0.08	0.01	0.01	1.87
S	0.08	0.85	0.73	0.53	0.55	0.33	0.21	0.06	3.34
SSW	0.08	1.37	2.30	1.69	2.82	1.77	0.67	0.15	10.85
SW	0.09	1.49	3.14	3.14	5.94	3.14	1.15	0.21	18.30
WSW	0.10	1.05	1.56	1.48	2.75	1.44	0.40	0.11	8.89
W	0.06	0.75	0.72	0.58	0.95	0.61	0.18	0.13	3.98
WNW	0.08	0.53	0.38	0.29	0.92	0.69	0.16	0.03	3.08
NW	0.08	0.51	0.35	0.34	1.21	0.81	0.21	0.01	3.52
NNW	0.11	0.65	0.40	0.45	1.21	0.79	0.12	0.01	3.74
SUBTOTAL	1.66	15.31	19.94	16.39	28.51	13.85	3.55	0.75	99.96

CALM = 0.04

15662 VALID WIND DIRECTION - WIND SPEED READINGS OUT OF 17520 TOTAL HOURS = 89.39 PERCENT

ALL COLUMNS AND CALM TOTAL 100 PERCENT OF NET VALID READINGS

*METEOROLOGICAL FACILITY LOCATED 0.5 MILE SSW OF WATTS BAR NUCLEAR PLANT
WIND INSTRUMENTS AT 300 FEET ABOVE GROUND