VIRGIN ISLANDS
WATER
AND POWER
AUTHORITY

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January 8, 1991

Mr. Steven C. Riva, Chief
Air and Environmental Applications Section
U.S. Environmental Protection Agency
26 Federal Plaza
New York, NY 10278

RE: Protocol for Meteorological Tower on St. Croix

Dear Mr. Riva:

In your letter of May 8, 1990 you suggested that the Virgin Islands Water & Power Authority (VIWAPA) install a meteorological monitoring tower at our Richmond power plant to collect on-site data for use in the computer dispersion that we used in our PSD permit application. Enclosed please find the protocol which describes in detail the monitoring program that you urged us to undertake.

It is our intent to erect a 100 meter (329 feet) tower at the northern boundary of the plant and operate it for a one year period. Since we are going to a great expense in collecting this data, we would like some assurances from EPA that the data we collect will be acceptable for use in the latest approved dispersion models. We intend to use the Complex Terrain Dispersion Model PLUS (CTDMPLUS) model for our next analysis to show what the impacts are on the island.

VIWAPA has met with the necessary local government and permitting Agencies and is in the process of attempting to obtain approval of the 329 foot tower. As you know, our plant is close to the landing area that the sea plane utilizes. Nevertheless, the construction of the tower has been approved by the FAA (see attachment) and will meet all

FAA requirements as indicated in the "Acknowledgement of Notice of Proposed Construction or Alteration". Your office would be advised if we are denied any other permits presently being sought to erect the tower or if we have to use a smaller tower for this data collection effort.

We would be glad to meet with you or your staff and go over any of the details of this effort. If you have any questions please call Michael Lukey at Pacific Environmental Services (PES), our environmental consultants, at (703) 471-8383.

It is important that you give us written approval as soon as possible of the monitoring program, so that we have some assurance that there will not be any changes in your acceptance of the model that we selected or the data that we would use to run that model.

We appreciate the help your staff and Mr. Conrad Simon has given WAPA in the past concerning our efforts to maintain compliance with the DPNR and EPA environmental regulations. Thank you for your cooperation.

Sincerely,

Donald C. Francois
Chief Operating Officer

DCF/dt

pc: Alberto Bruno-Vega
Ken Thomas
Greg Rhymer
Michael Lukey

PROTOCOL FOR COLLECTING METEOROLOGICAL DATA AT VIWAPA'S RICHMOND POWER PLANT ON ST. CROIX

submitted by

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August 30, 1990

PROTOCOL FOR COLLECTING METEOROLOGICAL DATA AT VIWAPA'S RICHMOND POWER PLANT ON ST. CROIX

Background

The Virgin Islands Water and Power Authority (VIWAPA) currently operates an 88 megawatt power generating station at its Richmond site on the north shore of St. Croix. VIWAPA had requested permission to operate the plant at virtually full capacity in a prevention of significant deterioration (PSD) air permit application that was submitted to the U. S. Environmental Protection Agency (EPA) on April 11, 1989.

A list of the power generation equipment is shown in Table 1 and the plant layout is shown in Figure 1.

The EPA reviewed VIWAPA's application in the summer of 1989 and requested additional modelling using the San Juan meteorological data set. The additional information was submitted in September 1989.

On May 9, 1990 EPA advised VIWAPA by letter that the entire modelling would have to be redone using on-site meteorological data and strongly recommended that VIWAPA install an on-site meteorological tower and commence data collection.

The purpose of this document is to describe the methodology that VIWAPA will use in collecting data for redoing the modeling study as part of its PSD air permit application.

We request that EPA concur in writing with the approach that VIWAPA intends to use.

Discussion of Modelling Options

The type of meteorological data collected will depend on the dispersion model that will be used in the PSD application. VIWAPA proposes to use the CTDMPLUS dispersion model when completing the PSD application. We understand that this model represents the state-of-the-art as far as dispersion modelling is concerned in a roughterrain situation.

A general description of the meteorological data requirements for the currently available dispersion models follows:

TABLE 1

VIWAPA EMISSION SOURCES

Source	Capacity (MW)	MMBTU/ Hour	Fuel/Type	Installation Date
Unit #10	7.5	260	No. 6/Steam Boiler	1967
Unit #11	18	470	No. 6/Steam Boiler	1970
Unit #12	4.5	50	No. 2/Diesel Unit	1968
Unit #14	15	290	No. 2/Jet Turbine	1972
Unit #16	23	390	No. 2/Gas Turbine	1981
Unit #17	88	275	No. 2/Gas Turbine	1988

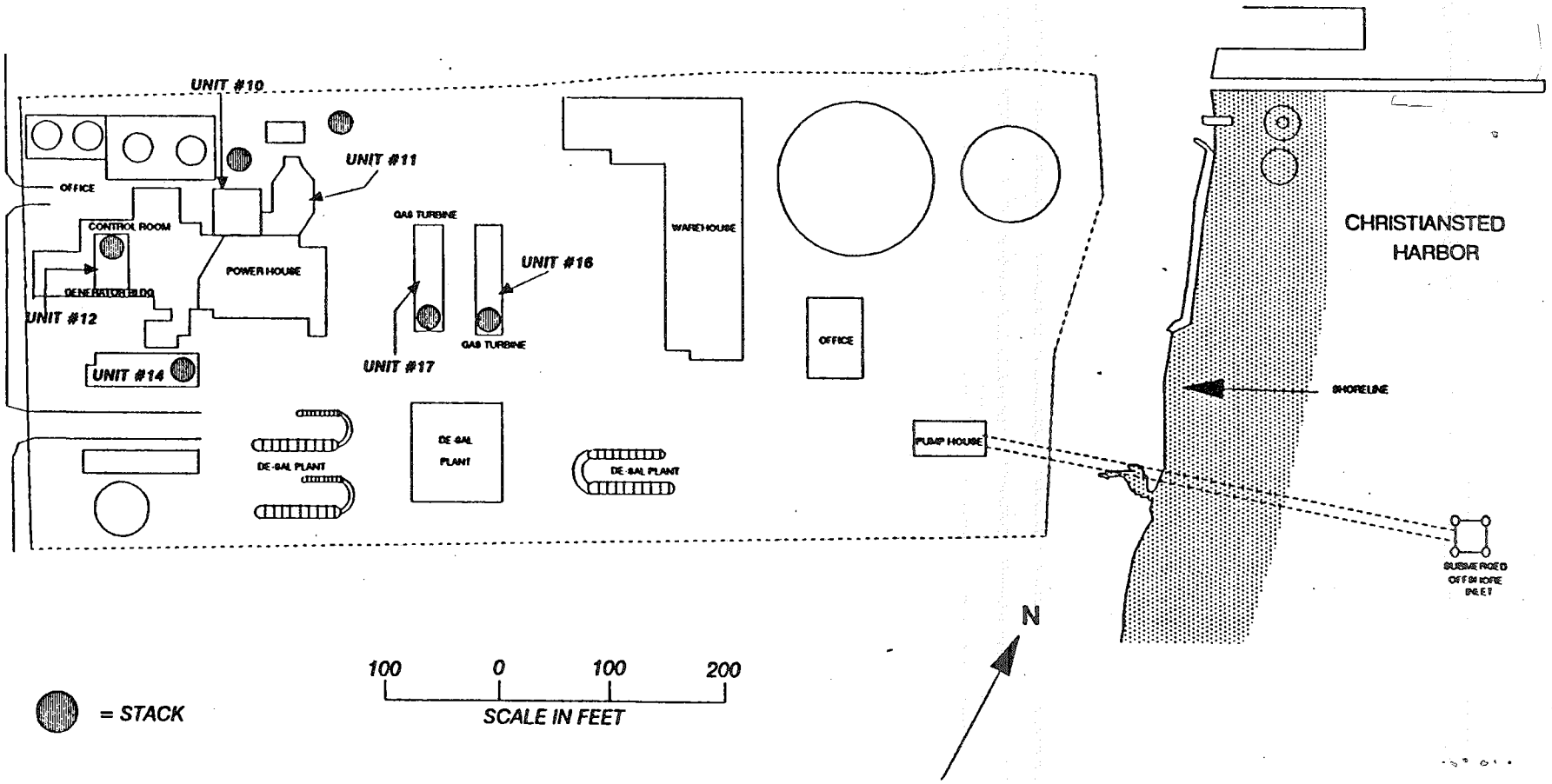

FIGURE 1 CHRISTIANSTED GENERATING STATION SITE PLAN

Model	Parameters	Comments
VALLEY	(none)	Very conservative
COMPLEX I	WD, WS, Stability	Wind measured at stack top
RTDM	WD, WS, Stability	Wind measured at stack top, (model may be changed)
CTDMPLUS	WD, WS, Solar radiation, Sigma-theta, Sigma-w, temperature, and delta-T	Needed at three levels up to 100m
CTSCREEN	(none)	Conservative screening model based on CTDMPLUS

Site Characteristics

Figure 2 is a topographical map of the area showing the location of the plant and the surrounding area. The primary wind direction is from the eastern quadrant. According to data collected from the San Juan Airport, the wind direction is from the north-east through southeast quadrant about 75% of the time.

The relevant stack and emission data are shown in Table 2. The tallest stack is connected to Unit #11 and has a height of 130 feet. The other sources have lower stacks but much higher velocities since the sources are gas turbines. Unit #16 has a 33 foot stack and a 150 feet per second exit velocity.

The plant is located at about 20 feet above msl. The terrain rises to the west of the plant to a maximum of 580 feet 2 km southwest of the plant. SCREEN model runs indicate that the plume will impact the terrain:

	Unit #11 steam boiler	Unit #16 gas turbine
Stack height (m)	39.62	10.00
Final stable plume height (m)	113.10	151.70
Distance to final rise (m)	151.30	151.30

Proposed Meteorological Monitoring Station

VIWAPA proposes to place one meteorological tower on their property and locate it near the pump house on the north side of the property. That area is free from the influence of buildings and other natural obstructions. At that point the tower would be

TABLE 2

EMISSIONS AND STACK PARAMETERS FOR MODELING
PROPOSED PERMITTING SCENARIO

Unit	Emissions (TPY) SO_2	NO_x	TSP	Stack Height (ft)	Stack Temp (°F)	Stack Diameter (ft)	Stack Velocity (ft/s)
Unit 10	600	420	61	115	385	4.6	47
Unit 11	1,079	757	110	130	410	8.2	36
Unit 12	5	74	5	30	940	2.0	90
Unit 14	52	126	9	30	1,094	1.03	127
Unit 16	348	395	62	33	970	8.5	150
Unit 17	243	155	43	33	970	8.5	137
Buccaneer Hotel	25	370	26	30	650	2.0	90

located between 300 and 400 feet from the stacks.

A brief summary of the monitoring station follows:

Height of tower	100 meters
Number of levels	3 (10m, 40m and 100m)
Parameters	WD, WS, sigma-theta, sigma-w, temp., delta-T
Ground level parameter	solar radiation using a net radiometer
Data sampling rate	once per second
Data logger	PC/PS computer
Back-up system	strip charts

VIWAPA proposes to use the rawinsonde data from the San Juan Airport to determine the mixing level at the Richmond site.

Detailed Description of Monitoring Station

The proposed tower will be a 100-meter guyed structure with instrumented platforms at the 10-meter, 40-meter, and 100-meter levels. The tower will be constructed with an open-lattice design to minimize the aerodynamic effect of the tower on the measured wind data. The instrumentation will consist of sensors or transducers which convert the mechanical or thermal energy of the medium being measured into an electrical signal, signal conditioners which transform these tranducer outputs into a suitable form for recording and processing, and recording and processing devices, which will consist of a microprocessing based system for primary recording, and analog strip charts for back-up recording. A detailed description of the proposed instrumentation for each of the meteorological variables is provided below.

Wind

Wind instruments will be mounted on horizontal booms extending at least two tower diameters from the nearest point on the tower. The booms will be mounted on the east side of the tower in order to face into the prevailing easterly winds and further minimize the potential effect of the tower on measurements. The instrumentation at each measurement level will consist of a cup anemometer to measure average wind speed, a wind vane to measure average wind direction and the standard deviation of the lateral direction fluctuations (sigma-theta), and a vertical propeller anemometer to measure the standard deviation of the vertical wind speed fluctuations (sigma-w). The intruments will be separated laterally on the boom to minimize their effect on the measurements. Instruments will be selected which meet the accuracy and response characteristics recommended in Table 5-2 of "On-site Meteorological Program Guidance for

Regulatory Modeling Applications" (EPA-450/4-87-013). These sensor specifications are summarized in Table 3.

Temperature and Temperature Difference

Temperature sensors will be mounted in aspirated radiation shields on booms at each of the three primary measurement levels. An additional temperature measurement will be made at a height of 2 meters. The 2-meter temperature will be used in the calculation of buoyancy flux used in the plume rise equations of the models. Vertical temperature differences (delta-T) will also be measured across the 100-10 meter range for determination of the critical dividing streamline (Hcrit), and across the 100-40 meter range for use in plume rise equations for stable conditions. A 10-2 meter delta-T will be measured for possible use in a radiation/delta-T based stability category method. The temperature sensors will be of the linear thermistor type for accuracy, stability and cost-effectiveness. The sensor specifications for the temperature and delta-T variables are included in Table 3.

Radiation

Radiation data, both incoming solar radiation and net (incoming - outgoing) radiation, will be measured with a net radiometer. In order to accurately measure net radiation, the radiometer will be mounted about 1 meter above the ground surface, and away from obstructions that could cast shadows on the unit or from which appreciable radiation might be reflected. The radiometer should preferably be located above a surface with grassy or other naturally occurring vegetation. The net radiation may be used in a radiation/delta-T based stability category method, and also may be used as an input to the preprocessor for CTDMPLUS for the calculation of Monin-Obukov length, a measure of stability. Sensor specifications for the radiation measurements are include in Table 3.

Other Variables

The secondary variables of dew point and precipitation may also be considered for inclusion in the monitoring system. While not directly used by the existing EPA dispersion models, they serve a useful purpose as part of the data review and validation process. Otherwise anomalous behavior of other variables may be easily explained by the occurrence of rainfall or fog at the monitoring site. The dew point would be measured with a lithium chloride dew cell mounted at the 10-meter level of the tower, and precipitation would be measured with a tipping bucket rain gage mounted at ground level.