Final MTI Data Report: Comanche Peak Steam Electric Station (U)

Westinghouse Savannah River Company
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Aiken, SC 29808

August 2002

Prepared for the U. S. Department of Energy under contract no. DE-AC09-96SR18500

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INTRODUCTION

During the periods from May 2000 to September 2001 and March 5 to April 10, 2002, cooling-lake surface water temperature data was collected at the Comanche Peak Nuclear Power Station near Granbury, Texas (Figure 1). This effort was led by the Savannah River Technology Center (SRTC) with the assistance of plant personnel. Permission for setting up these monitoring sites was granted by TXU Energy, which owns the plant site and surrounding property including Squaw Creek reservoir where the measurements were taken. This work was done in support SRTC's ground truth mission for the US Department of Energy's Multispectral Thermal Imager (MTI) satellite (Garrett, et al, 1999). Data described in this report are available from the authors (contact information provided at the end of report).

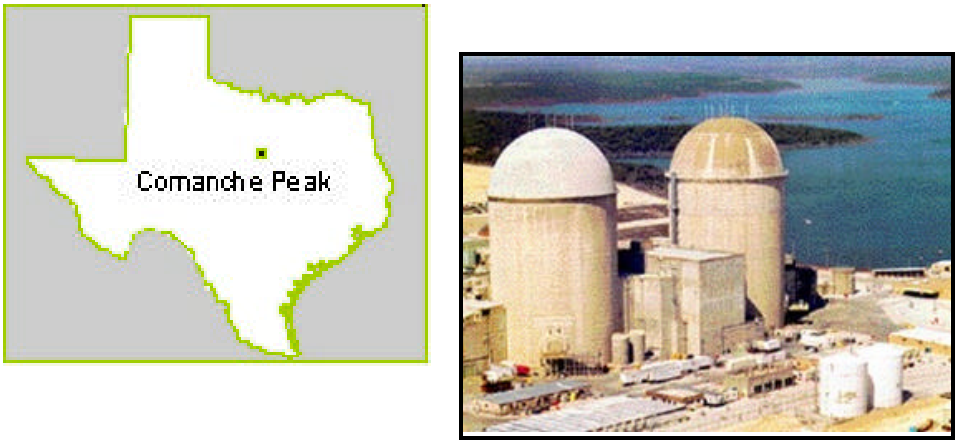

Figure 1. The Comanche Peak Nuclear Power Station near Granbury, Texas.

SURFACE WATER TEMPERATURE MEASUREMENTS

Three monitoring sites, in the warm-water discharge flow (shown as "OBL"), at the plant water intake (shown as "Intake"), and in a so-called safe shutdown impoundment (shown as "SSI") were used and are shown in Figure 2. These locations were intended to capture temperature extremes of the lake at any given time. Unfortunately, the amount of data collected was less than expected due to frequent loss of sensors (vandalism and excessive corrosion) or flotation problems, which failed to keep the sensors properly submerged.

In light of the lack of data a month-long field campaign was conducted during the period from March 5 to April 10, 2002 to collect more extensive sur-

Data described in this report are available from the authors.

face water temperature data. With able support from plant personnel, ten monitoring sites were installed (Figure 2) to capture the overall temperature distribution of the lake. These sites are shown as: "SSI", "IO", "OBL", "Bubbler Buoy", "Alternate Lake Discharge", "A", "B", "C", and "D". This period also coincided with an unusual orbit of MTI whereby the same location could be consecutively imaged for about two weeks. One hundred percent data recovery was attained for the period.

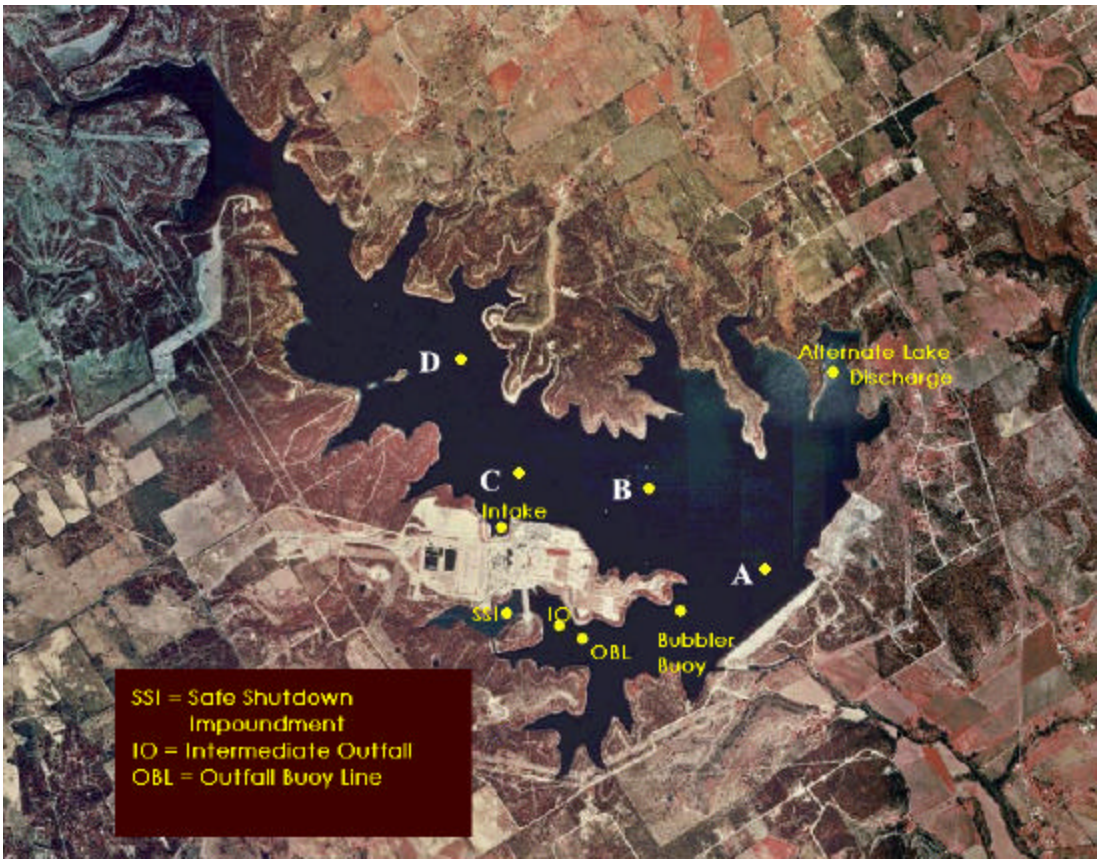

Figure 2. Surface water temperature monitoring site locations.

Figure 3. The Hugrun SeamonÒ MiniÒ suspended from a float before deployment.

Figure 4. The StowAwayÒ TidbiTÒ (front view, left, and rear view, right).

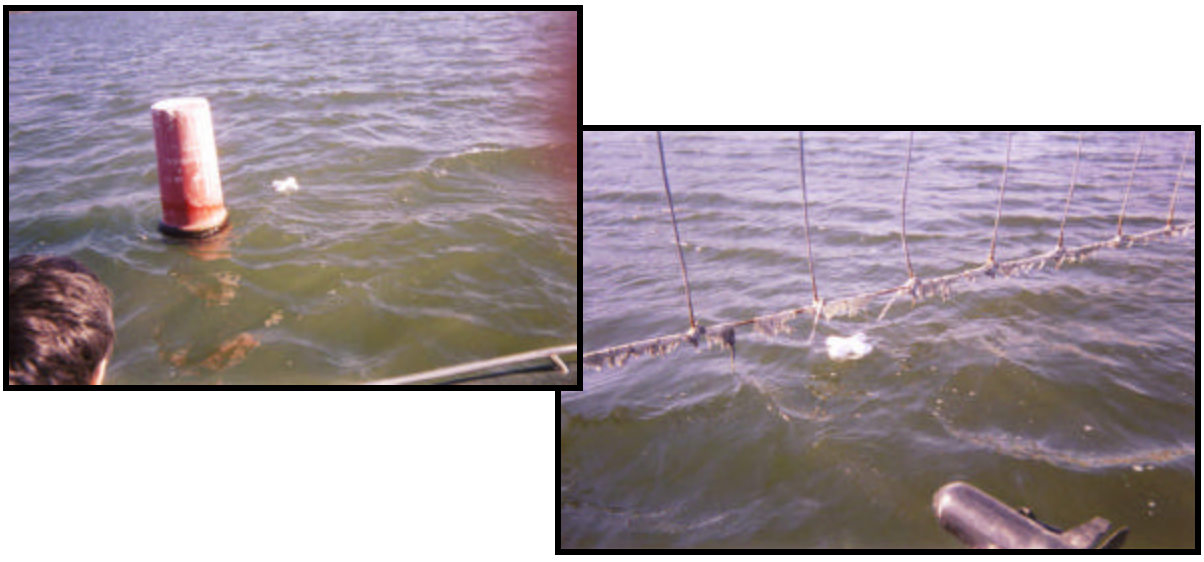

Figure 5. Initial water temperature sensor deployment at the outfall buoy line (OBL), left, and at the plant water intake fence, right.

Figure 5. Images of deployment locations for March-April 2002 (Alternate Lake Discharge not shown).

Table I. Coordinates for Monitoring Sites

Site	Coordinates (WGS-84)
Safe Shutdown Impoundment (SSI)	N32.29378, W97.7865
Intermediate Outfall Buoy (IO)	N32.2930, W97.7806
Outfall Buoy Line (OBL)	N32.2920, W97.7783
Bubbler Buoy	N32.2941, W97.7687
Alternate Lake Discharge	N32.3144, W97.7531
Intake	N32.3016, W97.7866
A	N32.2976, W97.7601
B	N32.3047, W97.7717
C	N32.3062, W97.7848
D	N32.3157, W97.7905

Additionally, Comanche Peak personnel supplied plant operating and meteorological data for the entire period of study. These data were merged with the water temperature data and are stored in a spreadsheet (see "Data Description", page 6).

TIME STAMPS

Data were collected with time stamps corresponding to local Eastern (Standard or Daylight) Time for the May 2000 – September 2001 period. Greenwich Mean Time (GMT) was used for the March 5 – April 10, 2002 period. Time stamps associated with the surface water temperatures were used as the time stamp for all data. Given this requirement, the meteorological and plant operating data that most closely corresponded with the time stamp of the surface water temperature data were merged as though they had an identical time stamp. In the majority of cases, the actual difference between the various data types was less than 10-15 minutes making relevant comparisons appropriate. All Hugrun Seamon® Mini® data were collected at hourly intervals, all StowAway® TidbiT® were collected at 30 minute intervals except for the March 5 – April 10, 2002 data which were collected at 15 minute intervals.

Plant operating data were sub-sampled to correspond to the water temperature data, and the meteorological data are reported as hourly averages.

DATA DESCRIPTION

The following table summarizes the headings in the file called QA_CP.xls (available from the authors), which contains surface water temperature data, meteorological data, and plant operating data.

Table II. Description of Data Nomenclature

SURFACE WATER TEMPERATURES

Name	Description (All temperatures °C)
Intake	Surface water temperature near the plant water intake
Discharge	Surface water near the warm-water discharge outfall
Impoundment	Surface water temperature in the plant safe shutdown impoundment

PLANT OPERATING DATA READINGS

Name	Description
T2400A	Cooling water inlet A-1 temperature (°C)
T2401A	Cooling water inlet A-2 temperature (°C)
T2402A	Cooling water outlet A-3 temperature (°C)
T2403A	Cooling water outlet A-4 temperature (°C)
T2404A	Cooling water outlet B-3 temperature (°C)
T2404A	Cooling water outlet B-4 temperature (°C)
Q2851A	Power variability (MW)
Q0340A	Electric power output (MW)
U3477	Reactor thermal output (MW)
(Waste power)	Calculated from U3477 – Q0340A (MW)
(Estimated flow from power)	Calculated flow (m3/s)
(Estimated inlet temperature)	Calculated inlet temperature (°C)
(Estimated outlet temperature)	Calculated outlet temperature (°C)
(Estimated flow from outlets)	Calculated from inlet and outlet data (m3/s)

SURFACE WATER TEMPERATURES

Name	Description (All temperatures °C)
A	Surface water temperature at location A near the dam
Alternate Lake Discharge	Surface water temperature in bay where water is transported from Lake Granbury
B	Surface water temperature at location B offshore from a plant maintenance building
Bubbler Buoy	Surface water temperature at buoy demarcating a deep water bubbler system
C	Surface water temperature at location C offshore from the plant water intake
D	Surface water temperature at location D offshore from the state park
Impoundment	Surface water temperature in the plant safe shutdown impoundment
Intake Fence	Surface water temperature near the plant water intake
Intermediate Outfall	Surface water temperature nearest the warm-water discharge outfall
Outfall Buoy Line	Surface water temperature in the warm-water discharge fall

QUALITY ASSURANCE

Data quality assurance was performed on all surface water temperature measurements. Time series plots of data were reviewed for obvious outliers or other problematic data. Problematic data were deleted and appear as blanks within the data files.

EXAMPLE DATA PLOTS

The following figures show examples of data plotted from the quality assured spreadsheet (QA_CPxls).

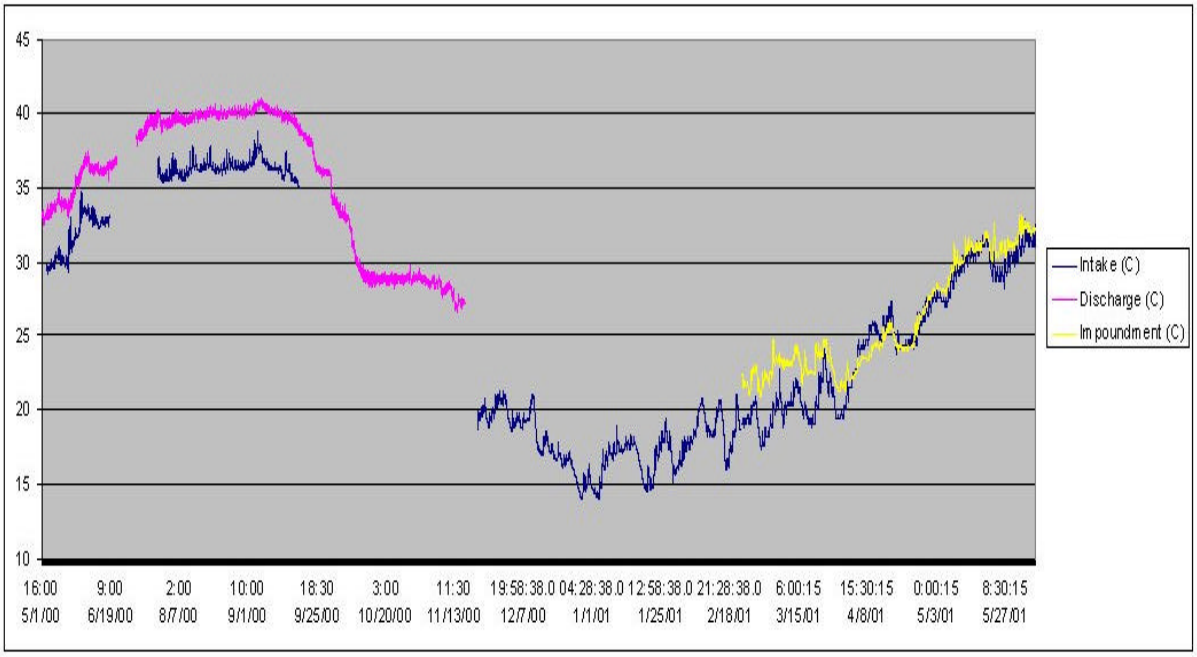

Figure 7. Time series plot of water temperature data collected during the May 2000-May 2001 period. Note the lengthy periods of missing data for all locations. The Impoundment (SSI) location was not installed until early 2001.

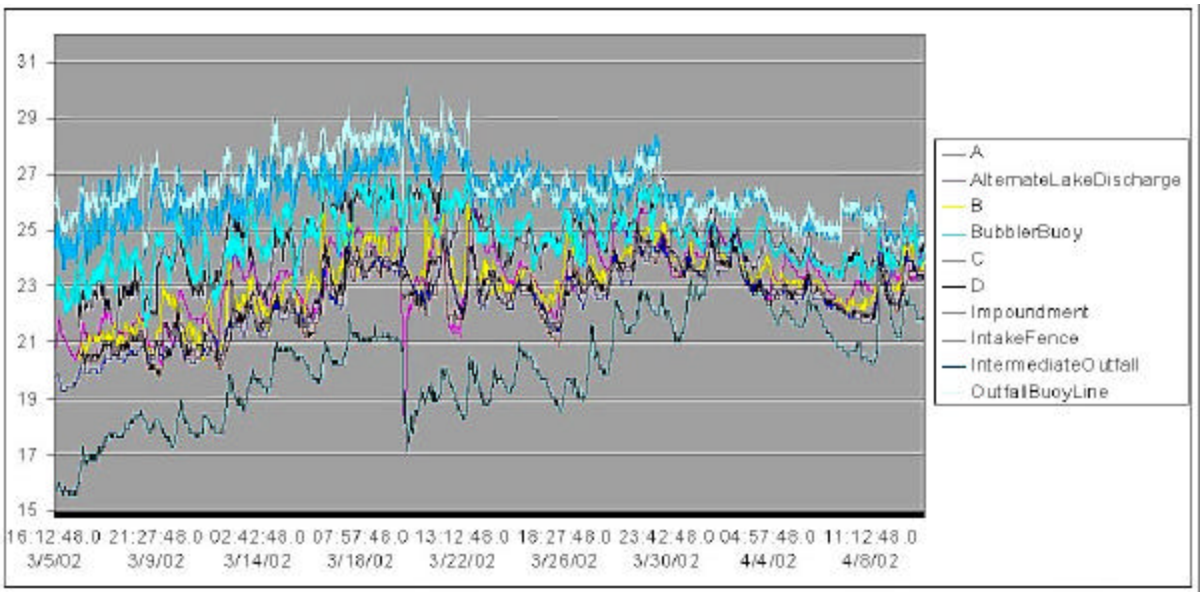

Figure 8. Water temperature measurements during the March-April 2002 period.

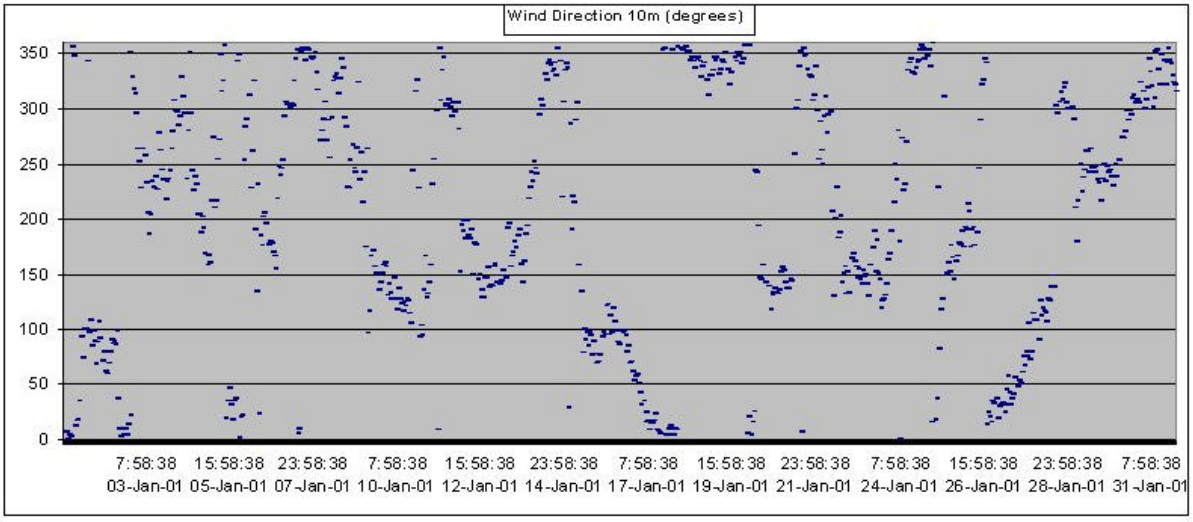

Figure 9. Example of wind direction data collected at 10 m on the Comanche Peak tower in January 2001.

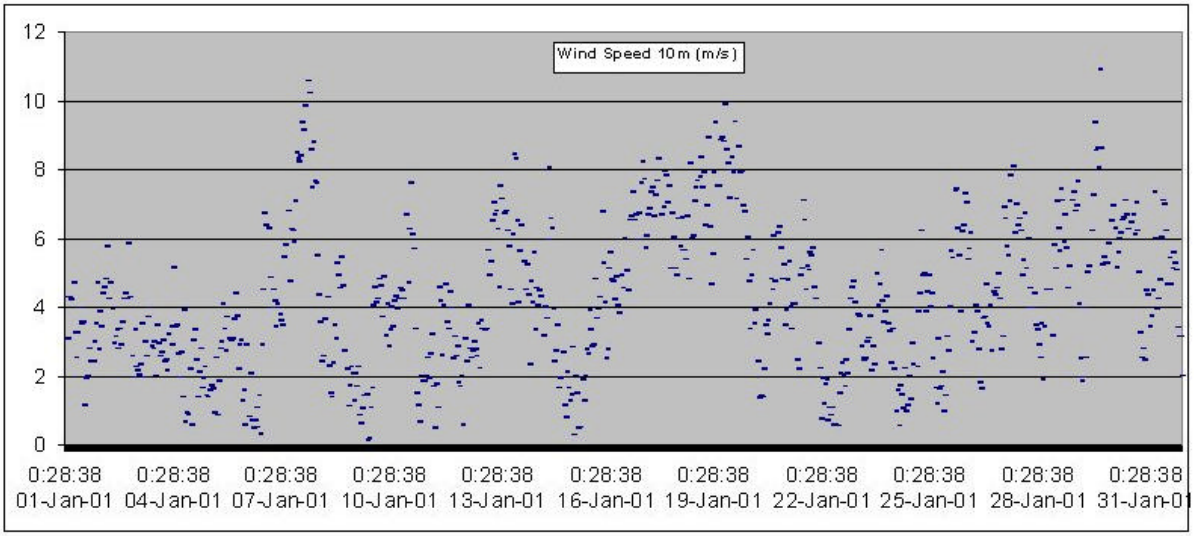

Figure 10. Example of wind speed data collected at 10 m on the Comanche Peak tower in January 2001.

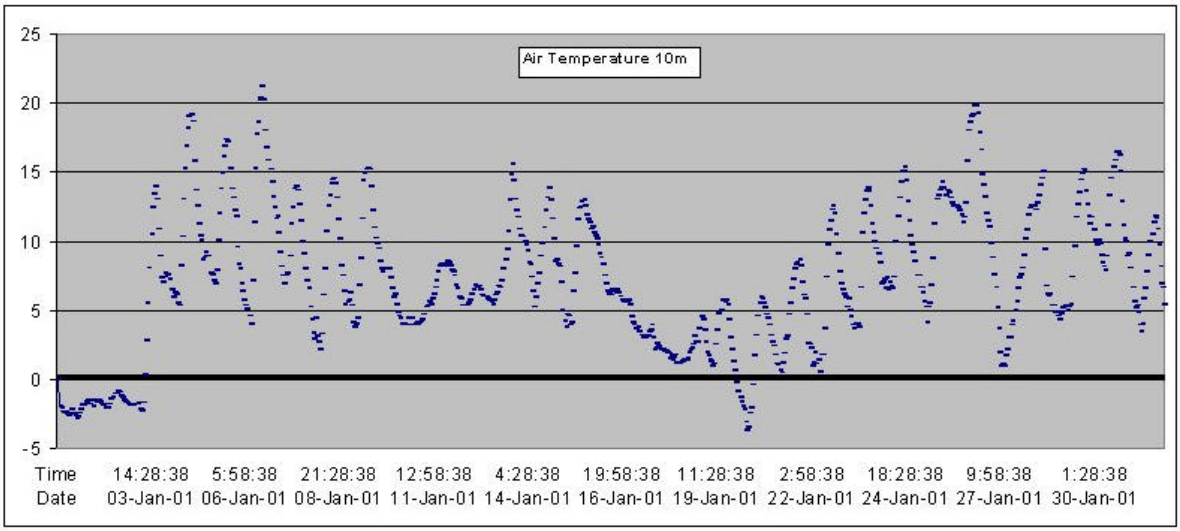

Figure 11. Example of air temperature data collected at 10 meters on the Comanche Peak tower in January 2001.

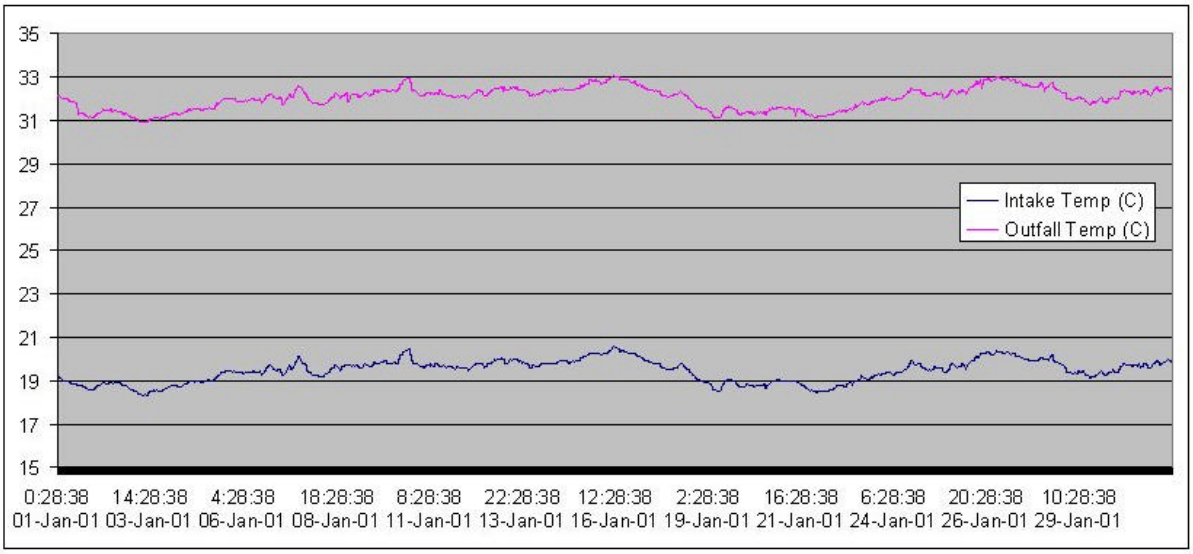

Figure 12. Example of plant water intake and outfall temperatures for January 2001.

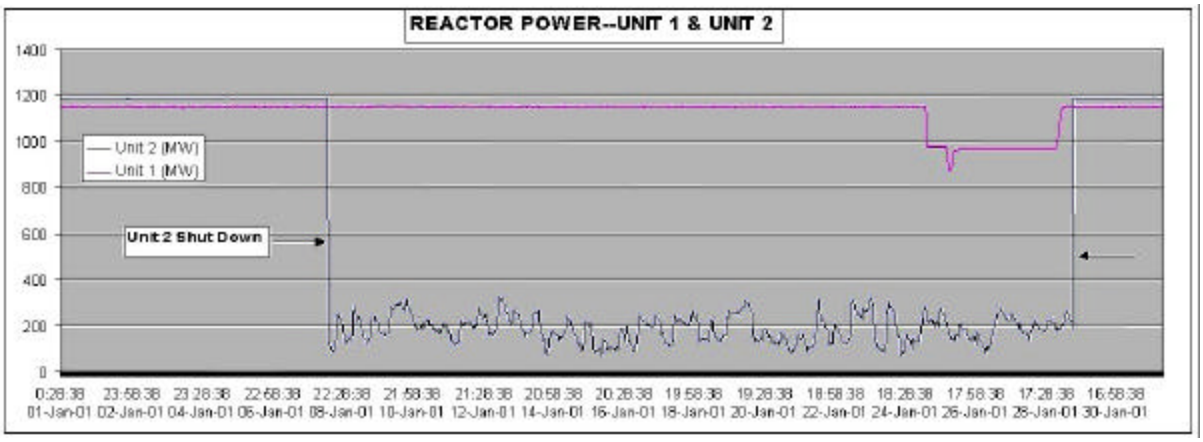

Figure 13. Example of plant power data for January 2001. Note the period where Unit 2 was shut down

ACKNOWLEDGEMENTS

Special thanks to Gordon Dalby, Bruce Turner, and Don Doan of TXU Energy for providing dedicated support to data collection efforts and for supplying plant operating and meteorological data. Thanks also to Kuo-Fu Chen of SRTC for assisting with data quality assurance.

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Garrett, A. J., R. J. Kurzeja, B. L. O'Steen, M. J. Parker, M. M. Pendergast, and E. Villa-Aleman, 1999: Ground-Truth Measurements Plan for the Multispectal Thermal Imager (MTI) Satellite. WSRC-TR-99-00455. Westinghouse Savannah River Company, Aiken, SC.