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Description of a Computer Data Base from The Full Scale Plume Study Tracy Power Plant, Nevada

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Description of a Computer Data Base from The Full Scale Plume Study Tracy Power Plant, Nevada

by

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ABSTRACT

As part of the U.S. Environmental Protection Agency's effort to develop and demonstrate a reliable model of atmospheric dispersion for pollutant emissions in irregular mountainous terrain under stable atmospheric conditions, the Complex Terrain Model Development Program was initiated in 1980. Four field tracer studies were designed and directed by the model developers to test model estimates of plume impaction with observed tracer concentrations. The first study was conducted in October November 1980 at Cinder Cone Butte, a roughly axisymmetrical, isolated 100-m high hill near Boise, Idaho, and the second study was performed along a 1.5-km section of Hogback Ridge, a 90-m high ridge near Farmington, New Mexico in October 1982.

Studies number 3 and 4 were located at the Tracy Power Plant near Reno, Nevada and were designed as realistic, full scale plume studies, with a tracer gas released through the smokestack of an active power plant, in a region of irregular and complicated terrain. Tracer study number three in November 1983 was conceived as a modest feasibility study for the more comprehensive fourth study, but enough useful meteorological and tracer data were assembled into a data base to support additional model development and evaluation. The fourth study, designated the Full Scale Plume Study, was conducted in August 1984, and it is the major source for the data base described in this report.

The Tracy Power Plant is located about 27 km east of Reno, Nevada in the Truckee River Valley with mountains surrounding the power plant on all sides. Peaks as high as 460 m above the smokestack base afforded opportunities for plume impaction in many directions, particilarly with anticipated westerly flow associated with stable atmospheric conditions. The power plant was maintained in a warm stand-by condition as SF6 tracer gas and oil-fog were injected into the base of a 91.4-m smokestack. Also, CF3Br tacer gas was released from one of three levels on a 150-m tower located about 1.2 km east of the power plant and up wind of the main targeted terrain. Meteorological data were recorded on the 150-m tower included wind components from triaxial propeller anemometers at six levels, cup and vane anemometers at three levels, sonic anemometers at three levels, and temperature and temperature differences at six levels. Four 10-m towers and two electronic weather stations were located on terrain surrounding the power plant to record wind and temperature; two vertical doppler acoustic sounding systems were operated near the stack and in the river valley. Tethersonde soundings were flown near the 150-m tower to compliment data from the tower and nearby doppler sounding system. Two radar-tracking balloon systems recorded wind profiles up to 4 km during periods of tracer release. A LIDAR system was employed to sample quasi-perpendicular transects through the oil-fog plume emitted with SF6 tracer gas from the top of the stack, and a program of plume photography recorded visual plume-to-terrain interactions.

Tracer samples were collected in Tedlar bags at 110 sites in the surrounding terrain. Concentrations were determined by gas chromatographic analysis.

The Full Scale Plume Study comprised 14 experiments from August 6 to 27, 1984 for a total of 128 hours of data collection, mainly during late evening or early morning hours. Study hours encompassed a variety of conditions ranging from very stable with light winds to morning inversion breakup and fumigation. Prolonged periods of anticipated stable conditions with westerly flow occurred with frequent plume impaction on sampler instrumented terrain east of the stack. A tracer concentration data base of over 11,000 hourly samples was accumulated for both tracer gases, and, in conjunction with the meteorological data base, it is available to model developers to refine existing models or to test new models.

Data acquired at the Tracy Power Plant during tracer study number 3, the preliminary full scale plume study from November 7 to 19, 1983, are also included in the Full Scale Plume Study's data base. Ten experiments were performed for a total of 90 sampling hours employing a network of 53 samplers, however only one tracer gas, SF6, was used for smokestack injection. Meteorological data from the 150-m tower, 10-m towers, electronic weather stations, doppler acoustic sounders and tethersondes were also recorded. Data recording on the 150-m tower was continued from the end of study number 3, November 1984, until the start of the Full Scale Plume Study, August 1984, and these data are included in the total data base.

All meteorological and tracer gas concentration data have been edited and recorded on magnetic tape and are now available upon request at the EPA National Computer Center, Research Triangle Park, North Carolina, either as copies or by interactive computer access.

CONTENTS

FIGURES

TABLES

LIST OF SYMBOLS

ft	Feet
g	Acceleration due to gravity
ix,iy,iz	Turbulence intensities alongwind, crosswind and vertical from tri-axial props
km	Kilometers
m	Meters
Q	Tracer gas emission rate
(R,O,Z)	Polar coordinates with origin at Tracy Stack
η	Standard deviation
σ_u	Standard deviation of alongwind velocity fluctuations about mean wind
σ_v	Standard deviation of crosswind velocity fluctuations about mean wind
σ_w	Standard deviation of vertical velocity fluctuations
t	Time
T	Temperature
u	Wind speed
(x,y,z)	Cartesian coordinates with origin at Tracy Stack
Z	Height above datum, base of Tracy Stack, 1300m

LIST OF ABBREVIATIONS

A.I.R.	Atmospheric Instrumentation Research, Inc.
ARLFRD	Air Resources Laboratory Field Research Division
ASRL	Atmospheric Sciences Research Laboratory
C	Celsius
CF_3Br	Freon 13B1
CCB	Cinder Cone Butte
CTDM	Complex Terrain Dispersion Model
CTMD	Complex Terrain Model Development
ECL	Executive Control Language
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ERT	Environmental Research & Technology, Inc.
FMF	Fluid Modeling Facility
FSPS	Full Scale Plume Study
ft	feet
GC	Gas chromatograph
HBR	Hogback Ridge
Hz	hertz
LMF	linear mass flow meter
m	meter
MDA	Meteorological Data System
m/s	meter per second
m.r.	mixing ratio
mb	millibar
msl	mean sea level
mw	megawatts
us/m3	micro-seconds per cubic meter
NOAA	National Oceanic and Atmospheric Administration
ns/m3	nano-seconds per cubic meter
PDT	Pacific daylight time
PST	Pacific standard time
ppt	parts per trillion by volume
r.h.	relative humidity
RTD	Resistance Thermometric Device
RTI	Research Triangle Institute
sec	second
SF_6	Sulfur hexafluoride
SHIS	Small Hill Impaction Study
UTM	Universal Transverse Mercator Grid System
WPL	Wave Propagation Laboratory

ACKNOWLEDGEMENTS

This report is partly composed of excerpts from publications and documents produced by Environmental Research and Technology, Inc, (ERT) the prime contractor for the Complex Terrain Model Development project, who compiled the Full Scale Plume Study data base on magnetic tape. As referenced in the text, the Fourth Milestone Report - 1984 by Strimaitis et al. (1984) was an important source, as was the Fifth Milestone Report - 1985 by DiCristofaro et al. (1985). All credit for creation of the magnetic tape files in the computer data base must go to the scientists amd investigators at ERT.

Special thanks go to Mrs. Hazel Hevenor who devoted so much time and effort to the production of this report.

SECTION 1

INTRODUCTION

1.1 EPA PROGRAM

The extensive development of energy resources, especially in the mountainous terrain of the western United States, has generated concern about the resulting impact on air quality (as well as on water and land quality). Even in relatively simple situations, it has been difficult to produce reliable calculations of atmospheric transport and diffusion. In complex terrain, the mathematical modeling problem is compounded because the physical processes are more complicated and meteorological measurements are less representative than in level terrain settings. Responding to this fundamental problem, the U. S. Environmental Protection Agency (EPA) has embarked upon the Complex Terrain Model Development Program (CTMD), a major effort to develop and demonstrate reliable models of atmospheric dispersion for emissions in mountainous terrain.

An early step in the development of this program was the convening of a workshop on problems in modeling atmospheric dispersion over complex terrain. In concert with recommendations in the workshop report (Hovind et al., 1979) EPA's CTMD Program required a coordinated effort in mathematical model development, field experimentation, and scaled physical modeling. The Program's basic objective has focused on the problem of stable plume impaction/interaction with elevated terrain. This phenomenon was singled out because of the likelihood of relatively high concentrations and because models now in use

have been challenged extensively on this point. The approach has been to study stable plume interactions first in relatively simple terrain settings and subsequently in more complex situations.

EPA's prime contractor for carrying out the CTMD Program is Environmental Research and Technology, Inc. (ERT). Significant contributions are also provided by EPA's Fluid Modeling Facility (FMF), by the National Oceanic Atmospheric Administrations's Air Resources Laboratory Field Research Division (ARLFRD) and Wave Propagation Laboratory (WPL). ARLFRD conducted flow visualization and tracer experiments and operated the real-time data acquisition and analysis system. WPL contributed through their sophisticated measurement capabilities with optical and acoustic anemometers and Lidar instruments.

Four field tracer studies were designed and directed by the model developers to test model estimates of plume impaction on elevated terrain with observed tracer concentrations. Usually two tracer gases and a visible oil-fog were emitted simultaneously to impinge on a targeted terrain feature instrumented with a network of gas samplers. A meteorological monitoring system based on a 150-m tower recorded profiles of wind, temperature and turbulence concurrently with tracer releases. The first study, Small Hill Impaction No.1 (SHIS #1), was conducted in October-November 1980 at Cinder Cone Butte (CCB), a roughly axisymmetrical, isolated 100-m high hill near Boise, Idaho. The SHIS #1 tracer source data (emission rates, locations and heights of SF6, CF3Br and oil-fog releases), tracer concentrations and meteorological data from the 150-m tower, five 10-m towers, a tethersonde and free balloons were subsequently delivered to EPA to form an accessible computer data base. The data base is described in a report (Truppi and Holzworth,

1983) that explains the system used to collect the data, the operation procedures used to run the system, and the resulting magnetic tape files that are accessible by the public either as copies or by interactive computer operation. A complete description of SHIS #1 at Cinder Cone Butte is contained in the First Program Milestone Report (Lavery et al., 1982) and the Second Milestone Report (Strimaitis et al., 1983), while a third report, (Greene and Heisler, 1982) described the very thorough quality assurance procedures maintained during the study.

The second tracer study, SHIS #2, was conducted along an approximately 1.5-km section of the 90-m high Hogback Ridge (HBR) near Farmington, New Mexico to extend the modeling data base to include a study of flow and dispersion around a two-dimensional ridge. Meteorological data from a 150-m tower, three 10-m towers, two tethersondes, three crosswind optical anemometers and tracer concentrations of SF6 and CF3Br were assembled into accessible computer data base, described in an associated report (Truppi, 1985). The Third Milestone Report (Lavery et al., 1983) describes the study at HBR, and the quality assurance procedures are reported in another, (Greene, 1985).

Tracer studies 3 and 4 were conducted at the Tracy Power Plant near Reno, Nevada, where a tracer gas was emitted from the smokestack of a working power plant to perform a full scale plume study in a region of irregular and complicated terrain. Study number 3 in November 1983 was conceived as a modest feasibility study for the more comprehensive fourth study, but enough useable data were collected and preserved in a data base to support additional model development and evaluation. The fourth study, designated the

the Full Scale Plume Study, was performed in August 1984, and it contributes the major portion of the data base recorded at the Tracy Power Plant.

The Tracy Power Plant is located about 27 km east of Reno, Nevada in the Truckee River Valley with mountains surrounding the power plant on all sides. Some peaks as high as 460 m above the smokestack base afforded opportunities for plume impaction in many directions, particularly with anticipated westerly wind flow associated with stable atmospheric conditions. The power plant was maintained in a warm stand-by status with the exhaust fan operating as SF6 tracer gas and an oil-fog were injected into the base of a 91.4-m (300-ft) smokestack. CF3Br tracer gas was released from one of three levels on a 150-m meteorological tower located 1.2 km downwind of the power plant and upwind of the main targeted terrain. Meteorological data recorded on the 150-m tower included wind components from tri-axial propeller anemometers at six levels, cup and vane anemometers at three levels, sonic anemometers at three levels and temperature and temperature differences at six levels. Four 10-m towers and two electronic weather stations were located on terrain surrounding the power plant, and two vertical doppler acoustic sounding systems operated near the stack and in the river valley. Tethersonde ascents were flown near the 150-m tower to compliment data from the tower and a nearby doppler acoustic sounder. Two radar-tracking balloon systems obtained wind profiles up to 4 km during periods of tracer release. A lidar system was employed to sample quasi-perpendicular transects through the oil-fog plume emitted with the SF6 tracer from the top of the stack.

The Full Scale Plume Study comprised 14 experiments from August 6 to 27,

1984 for a total of 128 hours of data collection, mainly during the late evening or early morning hours. Study hours encompassed a variety of conditions ranging from very stable with light winds to morning inversion breakup and fumigation. Prolonged periods of anticipated stable conditions with westerly flow occurred with frequent plume impaction on sampler instrumented terrain east of the stack. Tracer samples were collected in Tedlar bags at 110 sites, and concentrations were determined by gas chromatographic analysis. A tracer concentration data base of over 11,000 hourly samples was accumulated for both tracer gases, and, in conjunction with the meterological data base, it is available to model developers to refine existing models or to test new models.

Data acquired at the Tracy Power Plant during tracer study number 3, the preliminary full scale plume study from November 7 to 19, 1983, are also included in the Full Scale Plume Study's data base. Ten experiments were performed collecting tracer samples with sequential syringe samplers at 53 sites, however, only one tracer gas, SF6, was released from the smokestack. Meteorological data from the 150-m tower, 10-m towers, two electronic weather stations, a doppler acoustic sounder and two tethersondes were also recorded. Data recording on the 150-m tower was continued from the end of study number 3, November 1983, until the start of the Full Scale Plume Study , August 1984. These data are included on the magnetic tape files in the total base from the Full Scale Plume Study (FSPS).

A complete description of the FSPS at the Tracy Power Plant is contained in the Fifth Milestone Report (DiCristofaro et al., 1986), and the preliminary FSPS is covered in the Fourth Milestone Report (Strimaitis et al.,

1984).

1.2 OBJECTIVE

The purpose of this report is to describe the data collected at the Tracy Power Plant, Nevada. The purpose of the FSPS was to extend the modeling data base to include a realistic situation where tracer gas is emitted from the smokestack of a operating power plant surrounded by mountainous terrain.

This report describes the setting of FSPS, the experimental approach, and the following data archived on magnetic tape in three sets of data files:

1. Preliminary FSPS - November 7 to 19, 1983;
   - ° Tower meteorological data - 5-minute averages; 150-m tower east of the stack (wind, temperature, turbulence scales at four levels - 5 m, 10 m, 100 m, 150m); two 10-m towers (wind and temperature);
   - ° Tracer gas concentrations, SF6 - 1-hour averages (conc Chi - PPT)
   - ° Two optical crosswind anemometers, wind speed - 10-min averages;
   - ° Two tethersondes, instantaneous data, two profiles per hour up to 600 m (winds, height, temperature, r.h., m.r., pressure);
   - ° Two T-sondes (minisondes), instantaneous data, one profile per hour up to 3,000 m (winds, heights temperature);
   - ° Two electronic weather stations, 1-hour averages (winds, temperature);
   - ° Doppler acoustic sounder, 10-minute averages (winds, heights).
2. Continuous data recording at Tracy Power Plant - October 14, 1983 to July 10, 1984;
   - ° Tower meteorological data - 1-hour averages;

150-m tower east of the stack (wind, temperature, turbulence scales at four levels - 5 m, 10 m, 100 m, 150 m)

3. FSPS at Tracy Power Plant - August 6 to 27, 1984:

   ° Tower meteorological data 150-m tower east of stack - 5-minute, 1-hour averages (wind, temperature, turbulence scales at six levels - 10 m, 50 m, 75 m, 100 m, 125 m, 150 m; solar and net radiation at one level - 1 m);

   10-m towers (4) - 5-minute, 1-hour averages (wind, temperature);

   ° Tracer gas concentrations, SF6, CF3Br - 1-hour averages (concentrations Chi/Q - nsec/m3);

   ° Tethersonde, instantaneous data, one profile hour up to 600 m (winds, height, temperature, r.h., m.r., pressure);

   ° Sonic anemometer data, 5-minute, 1-hour averages (wind, temperature, turbulence scales at three levels, 10 m, 100 m, 150 m on 150-m tower);

   ° Two electronic weather stations, 1-hour averages (winds, temperature);

   ° Two doppler acoustic sounders, 10-minute averages, (winds, heights);

   ° Two radar balloon systems (RABAL), instantaneous data, one profile per hour up to 3,000m (winds, heights).

Although extensive lidar measurements were made of the oil-fog plume, these data are contained on a separate computer data base and not included with the meteorological and tracer data. Copies of the lidar data tapes and supporting documents may be obtained by a request to the author for the FSPS lidar data base. Extensive photography of the oil-fog plumes was also performed, and copies may be obtained from the CTDM project officer.

SECTION 2

FIELD STUDY AT THE TRACY POWER PLANT, NEVADA

2.1 GEOGRAPHIC AND METEOROLOGICAL SETTINGS

The Tracy Power Plant was selected as the site of of the Full Scale Plume Study (FSPS) in the CTMD project after an extensive study of power plants in the western United States located in settings that could qualify as complex terrain. The Tracy station is operated by Sierra Pacific Power Company, and the operators were very cooperative in the design of the FSPS. Unit 3 at Tracy, a 120-MW unit, is maintained in a warm standby status when it is not generating power, and it is serviced by a 91.4-m (300-ft) smokestack. Most importantly, complex terrain surrounds the plant, the elevations of the mountains affording opportunities for plume impaction in many directions. The principal drawbacks to Tracy were that it is currently gas-fired so that the plume cannot be traced visually or by lidar and that its 120-megawatt capacity and common standby status did not make it representative of large new sources undergoing regulatory review.

The first of these drawbacks was overcome with augmentation of particulate emissions by injection of an oil-fog "smoke" into the base of the stack. Secondly, the size of Unit #3 at Tracy was not regarded as disqualifying for the purposes of CTMD since new power-generation units in the West were tending to fall into the 250-MW range rather than the larger stations common in

the previous decade, and most sources undergoing regulatory review were better represented by Tracy than another larger power plant at full load. Moreover, the scale of Tracy stack emission required less tracer to keep sample concentrations within an analytical range yielding good chromatographic precision.

Figure 1 shows the location of the Tracy Power Plant in the Truckee River Valley about 27 km (17 mi) east of Reno, Nevada. The Sierra Nevada Mountains lie to the west and the gradient of the terrain is from west to east. Large-scale downslope winds drain off the Sierra at night, flow through the canyon, and reinforce the drainage down the valley. At about 4.5 km east of the plant, the river swings sharply north through a narrow gorge between two large hills, Beacon Hill, 1594 m MSL to the west and Target Mountain, 1757 m MSL to the east. These two terrain features were the principal target areas to be instrumented with tracer samplers in anticipation of westerly winds associated with stable nightime conditions. The elevation of the base of the Tracy stack is 1300 m MSL.

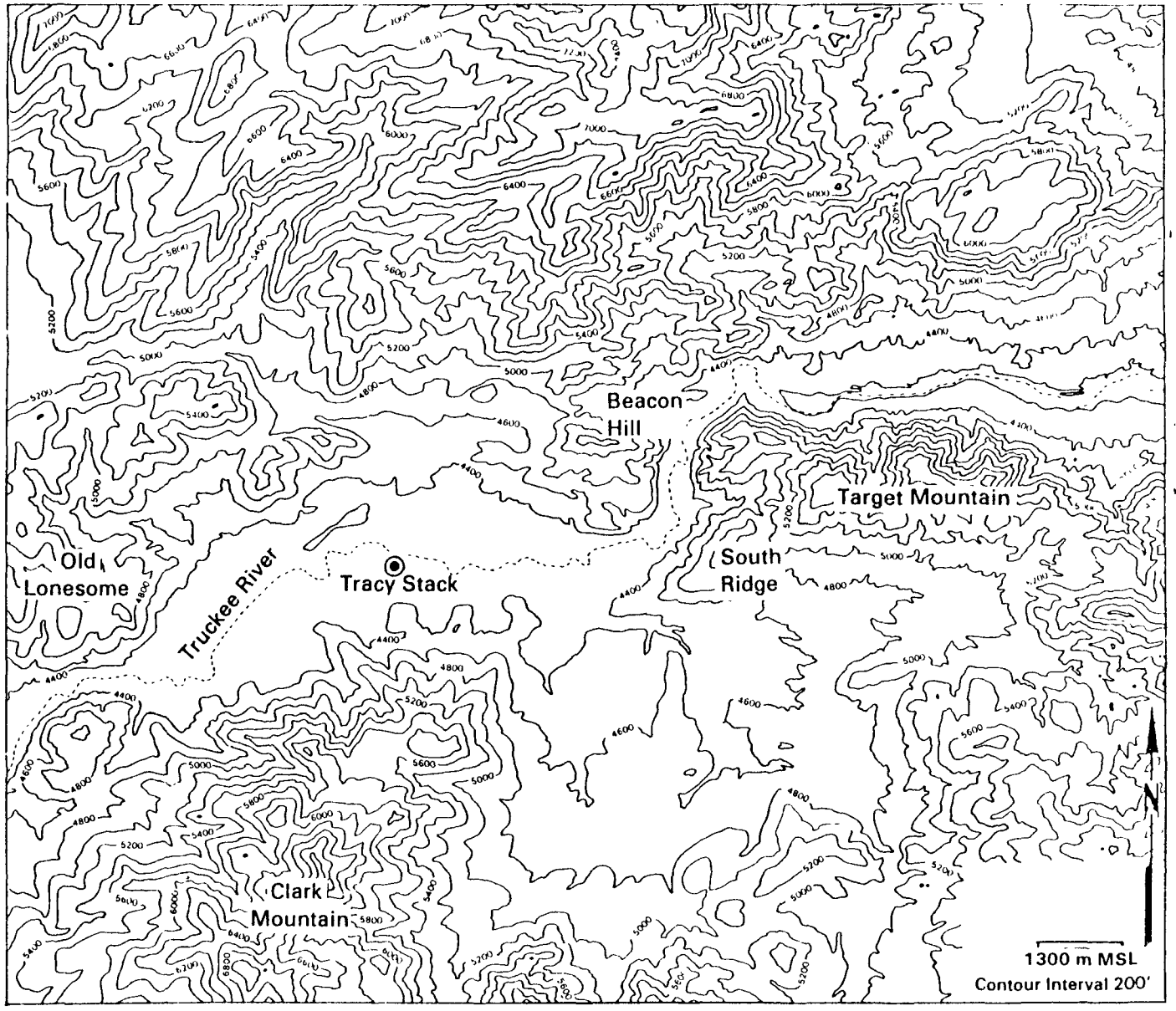

Figure 1. Tracy Power Plant site (From DiCristofaro et al., 1985)

No historical meteorological record is available from anywhere in the Truckee River Valley, however, a previous field study (Kapsha, 1976) which included aircraft, mobile van measurements of SO2 as well as pilot balloon data, suggested that plume transport from the Tracy stack would produce significant ground-level concentrations at Beacon Hill and Target Mountain. In July 1983, as part of their initial feasibility study, ARLFRD released oil-fog from the Tracy stack, and the smoke plume was seen to impact on both Beacon Hill and Target Mountain.

2.2 Experimental Design

A preliminary field study was performed at Tracy in November 1983 with the objective of assessing the feasibility of the Tracy site for the FSPS and to gather information for the experimental design. The scope of this study was expanded substantially by the co-operation of the Electric Power Research Institute (EPRI), with the result that the preliminary field study yielded a data base useful for model development and evaluation in its own right. Thus, the preliminary study in November 1983 is considered as the CTMD tracer study #3, and the August 1984 study is study #4, the FSPS.

Experimental design for both Tracy studies was based on a 150-m meteorological tower erected near the stack to establish profiles of temperature and wind. This was the same tower employed in the first two CTMD field studies at Cinder Cone Butte and Hogback Ridge. A network of tracer samplers was established on terrain targeted for plume impaction, and additional meteorological instruments were deployed around the region of tracer release to compliment meteorological data from the 150-m tower. Sites for plume

photography and arc lamps to illuminate the oil-fog plume were arranged in the surrounding terrain.

During selected nightime hours when stable conditions were prevalent, SF6 tracer and oil-fog particulates were injected into the base of the Tracy stack as the plant was operating in a warm standby condition. In study number 4, FSPS, CF3Br tracer was also released from one of three levels on the 150-m tower. A sampler network of 53 sequential syringe samplers was used in study number 3, but in FSPS, the network was increased to 110 samplers and the samplers were changed to those that sequentially filled 2-liter Tedlar bags. Concentrations were determined by gas chromatography.

SECTION 3

PRELIMINARY FULL SCALE PLUME STUDY

3.1 PERIODS OF DATA COLLECTION

Table 1 shows the dates and times of the experiments for the preliminary FSPS. Collection of meteorological data from the 150-m tower, 10-m towers and electronic weather station was continuous from November 6, 1983, the day preceding the start of tracer release, through November 21, 1983.

3.1.1 DATA TAPE FILES

Data are stored at the National Computer Center, Environmental Research Center, Research Triangle Park, North Carolina on Sperry UNIVAC 1100/83 systems magnetic tape, nine track, odd parity, ASCII-quarter word mode, density 6250 BPI, tape number 007654. Record length is 132 characters, and the block size is 1320 words or 40 records per block. Upon request, copies can be furnished and translated into formats acceptable to any computer using 9-track tape drives.

3.1.2 Data Tape File Index

All data recorded at the preliminary FSPS are contained on the first 14 files on tape number 007654 at the National Computer Center, Research Triangle Park, North Carolina. This tape holds the data base for both the preliminary and the final FSPS at Tracy Power Plant, Nevada. Table 2 presents an index of the first 14 files.

TABLE 1. PERIODS OF EXPERIMENTAL HOURS
PRELIMINARY FSPS

Experiment No.	Date* Nov. 1983	Times Tracer Release PST
1	7	7/0000 - 0600
2	8	8/0000 - 0300
3	9	9/0200 - 0700
4	10	10/0000 - 0500
5	12	12/0000 - 0900
6	14	14/0000 - 0900
7	15	15/0000 - 0900
8	15 - 16	15/2100 - 16/0600
9	17 - 18	17/2200 - 18/0700
10	19	19/0000 - 0900

*Week 1 - November 7-13, 1983

Week 2 - November 14-20, 1983

TABLE 2. PRELIMINARY FULL SCALE PLUME STUDY
TAPE FILE INDEX

File No.	Data
1	150-m Tower meteorological data; 5-min avg.
2	Sampler locations.
3	SF6 tracer concentrations (ppt), week 1; 1-hour avg.
4	SF6 tracer concentrations (ppt), week 2; 1-hour avg.
5	Minisonde meteorological data, central site; week 1.
6	Minisonde meteorological data, remote site; week 1.
7	Minisonde meteorological data, central site; week 2.
8	Minisonde meteorological data, remote site; week 2.
9	10-m Towers 1 & 2 meteorological data; 5-min avg.
10	Optical crosswind anemometer data; 5-min avg.
11	Electronic Weather Stations, East & West, meteorological data; 1-hour avg.
12	Doppler acoustic sounder data; 10-min avg.
13	Tethersonde meteorological data, NOAA/WPL site.
14	Tethersonde meteorological data, NOAA/AFRLD site.

3.2 TOWER METEOROLOGICAL DATA

Three meteorological towers were deployed during the preliminary FSPS at the Tracy Power Plant. Figure 2 shows the locations around the Tracy stack. A 150-m "profile" tower was located about 1.2 km east of the stack, between the stack and the targeted terrain. The purpose of the 150-m tower was to

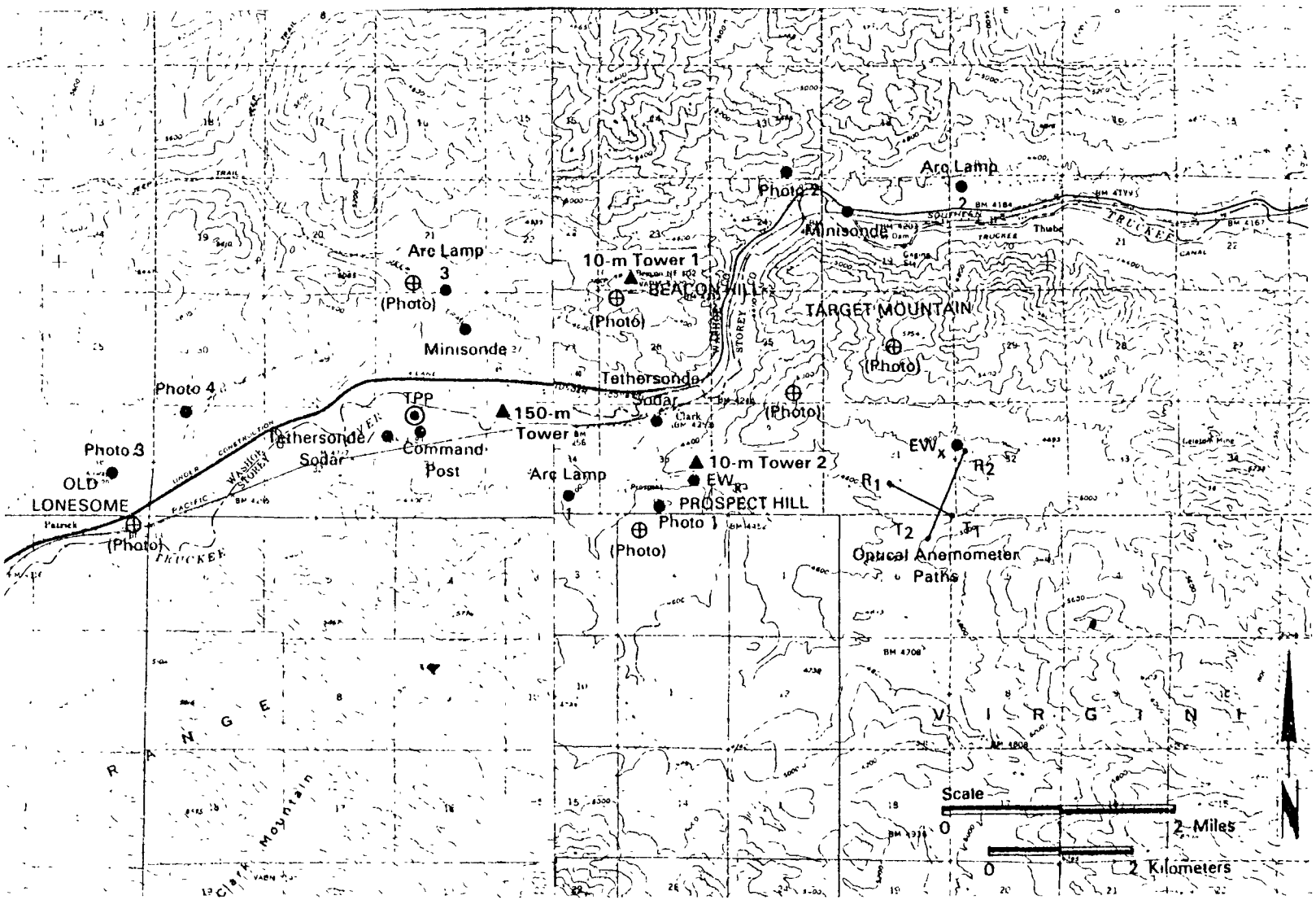

Figure 2, Preliminary FSPS experiment layout (From Strimaitis et al., 1984)

characterize the flow between the tracer plume from the stack and the network of samplers with regard to temperature stratification, wind speed and direction, and horizontal and vertical turbulence. To accomplish this, the 150-m tower was instrumented at four levels, 5, 10, 100, and 150 m. Triaxial propeller wind sets and temperature sensors were installed at all levels to obtain a profile of wind, turbulence and temperature. Data are available as 5-minute and 1-hour averages.

A 10-m tower, tower 1, was installed on the crest of a major terrain feature and tracer target, Beacon Hill, at an altitude of 1598 m. One cup-and-vane anemometer and temperature sensor were used to record wind speed, direction and temperature. Another 10-m tower, tower 2, was located near the foot of another terrain target, Target Mountain, at an altitude of 1401 m. Instrumentation was the same as tower 1, with the data available as 5-minute averages.

In addition to the towers, wind and temperature data were recorded by two electronic weather stations installed in an eastwest line in a canyon at the base of Target Mountain. Cup-and-vane and temperature sensors were placed on 1.5-m masts. Data are available as 1-hour averages.

Table 3 identifies the codes used for each type of data measurement and the formulae used to derive additional values, and table 4 shows the arrangement of instrumentation on each tower and mast.

TABLE 3. DEFINITION OF MEASURES

Code	Measurement	Units
U, V, W	Vector averaged wind components - props	m/s
UX, UV	Vector averaged wind components - cup	m/s
WS, WD	Vector averaged wind speed and direction - props	m/s, deg
SP, DR	Vector averaged wind speed and direction - C&V	m/s, deg
SD	Sigma theta - props	deg
SW	Sigma-W - props	deg
T	RTD temperature	C
DT	RTD delta T; (T - T(5 m))	C

TABLE 4. TOWER INSTRUMENTATION AND MEASURES

SITE	INSTRUMENTS *	DIRECT MEASURES **	DERIVED MEASURES ***
150-m Tower (Tower base = 1296 m MSL)			
Level 1 (5 m)	Triaxial props	U,V,W	WS,WD,SD,SW
	RTD	T	
Level 2 (10 m)	Triaxial props	U,V,W	WS,WD,SD,SW
	RTD	DT	
Level 3 (100 m)	Triaxial props	U,V,W	WS,WD,SD,SW
	RTD	DT	
Level 4 (150 m)	Triaxial props	U,V,W	WS,WD.SD,SW
	RTD	DT	
Tower 1 (Tower base = 1598 m MSL)			
Level 1 (10 m)	Cup-and vane	UX,UV	SPD,DIR
	RTD	T	
Tower 2 (Tower base = 1401 m MSL)			
Level 1 (10 m)	Cup-and-vane	UX,UV	SPD,DIR
	RTD	T	
Electronic Weather Station - East (Mast base = 1448 m MSL)			
Level 1 (1.5 m)	Cup-and-vane	UX,UV	SP,DR
	RTD	T	
Electronic Weather Station - West (Mast base = 1324 m MSL)			
Level 1 (1.5 m)	Cup-and-vane	UX,UV	SP,DR
	RTD	T	

* All temperature sensors were mounted in aspirated radiation shields; an RTD is a Resistance Thermometric Device.

TABLE 4. TOWER INSTRUMENTATION AND MEASURES (Continued)

** Direct measures are those calculated by the MDS microprocessors from outputs of the instrument translators. These measures are sampled at a frequency of 4 scans per second to form a "raw" data base from which 5-minute and 1hour data bases are developed. Direct measures include U,V,W wind components from the triaxial props, UX,UV wind components from the cup-and-vane anemometer, and temperature and temperature difference from the RTD temperature probe.

*** Derived measures are those calculated by the MDS computer from formulae using one or more "raw" instrument outputs.

Formulae for Computing Derived Meteorological Measures

1. Wind Speed and Direction;

   WS,WD - props; SPD,DIR - cup-and-vane

   u, v, ="raw" wind components from props;

   ux, uv = "raw" wind compontents from Cup-and-vane

   $WS = SQRT(u^2 + v^2)$; $SP = SORT(ux^2 + uv^2)$

   $WD = \tan^{-1}(u/v)$; $DR = \tan^{-1}(ux/uv)$

2. Turbulence scale; Sigma-w

$$SW = SQRT\left[\frac{1}{N}\left(\Sigma w^2 - \frac{1}{N}(\Sigma w)^2\right)\right]$$

3. Sigma theta;

$$s = SQRT\,(u^2 + v^2)$$

$$SD = SQRT\left[\frac{1}{N}\,\Sigma\,\arctan^2\left(\frac{v\,\Sigma\,(u/s) - u\,\Sigma\,(v/s)}{u\,\Sigma\,(u/s) + v\,\Sigma\,(v/s)}\right)\right]$$

3.2.1 Data Acquisition System

NOAA ARLFRD provided a real-time Meteorological Data System (MDS) to acquire, process, display and store data from the 150-m tower and towers 1 & 2. Operating continuously during each experiment, the MDS sampled the tower meteorological sensors at a frequency of 4 scans per second, calculated some derived measures from sensor values and stored all values on magnetic to form a "raw" data base from which a modeler could recreate any experiment. In addition, 5-minute and 1-hour averages were computed to form the final and usable data base. Sensors on the 150-m tower were linked by cable to the MDS, and data from towers 1 & 2 were telemetered by radio from the remote sites to the MDS. Wind and temperature data from the electronic weather station were not acquired by the MDS, but were recorded on chart rolls and later coded onto magnetic tape.

The Research Triangle Institute, Research Triangle Park, North Carolina, EPRI's external audits contractor, provided independent checks of the precision and accuracy of the field measurements and data handling results. On-site performance audits were performed on the 150-m tower measurement systems of wind speed and direction, turbulence and temperature, and on the 10-m tower's measurements of wind speed and direction and temperature.

3.2.2 150-m Tower Tape File Records

File number 1 on the data base tape contains meterological data from the 150-m tower as 5-minute averages. Observations began on November 6, 1983, Julian day 310, and ran continuously until November 21,1983. The first five records have alphabetic ASCII characters of identification and column

headings for the data fields in the records that follow. All data records have data fields arranged as shown in table 5.

Table 6 is a printout of the first block, 40 records, from the first file on the tape that is FSPS data base. It illustrates how the alphabetic heading records identify columns of data fields in the data records that follow. Each data record has 5-minute averages, ending at time indicated, of the observed or derived meteorological measures on the 150-m tower as indicated by the heading records.

TABLE 5. 150-m TOWER DATA RECORDS FORMAT

Position	Contents	Format
1 to 3	Julian day (310 - 325)	I3
4 to 5	Hour (00 - 23); PST	I2
6 to 7	Minute (00 - 55)	I2
8 to 23	Wind direction (WD), 4-levels; deg	4F4.0
24 to 43	Wind speed (WS), 4-levels; m/s	4F5.1
44 to 63	Sigma theta (SD), 4-levels; deg	4F5.1
64 to 68	Temperature (T), 5-m; C	F5.1
69 to 83	Delta-T (DT), 3-levels; C	3F5.2
84 to 103	Vertical wind component (W), 4-levels; m/s	4F5.2
104 to 123	Sigma-W (SW), 4-levels; m/s	4F5.2

TABLE 6. FILE NUMBER 1: 150-M TOWER 5-MINUTE AVERAGES SAMPLE PRINTOUT

PRELIMINARY FULL SCALE PLUME STUDY - TRACY, NEVADA
NOVEMBER 7-19, 1983
150-METER TOWER METEOROLOGICAL DATA

JDY TME # HRMN	WIND DIR(DEG) 5M	10M	100M	150M	WIND SPD(M/S) 5M	10M	100M	150M	SIGMA-THETA(DEG) 5M	10M	100M	150M	T(C) 5M	DELTA T(C) 10M	100M	150M	W(M/S) 5M	10M	100M	150M	SIGMA-W(M/S) 5M	10M	100M	150M
3101700222.214.207.210.	3.9	4.7	9.5	9.1	17.0	16.2	9.1	9.8	16.8	-.11	-.75	-1.32	-.16	.03	.07	.36	.12	.19	.82	.81
3101705216.214.216.219.	3.1	4.0	8.1	7.8	16.2	15.0	9.9	11.7	16.7	-.12	-.76	-1.32	-.15	-.11	.29	.68	.18	.26	.66	.48
3101710222.218.218.219.	4.0	5.1	9.5	9.5	19.2	14.5	6.7	7.8	16.7	-.10	-.76	-1.33	-.16	-.11	.22	.30	.19	.26	.90	.74
3101715229.223.216.215.	3.8	4.7	8.7	9.1	15.1	10.5	7.4	7.8	16.7	-.11	-.72	-1.24	-.24	-.11	.29	.68	.18	.27	.74	.58
3101720222.216.216.217.	4.4	5.5	10.1	10.6	15.5	13.0	9.1	8.2	16.7	-.11	-.78	-1.30	-.24	-.11	.22	.62	.19	.26	.82	.80
3101725216.212.216.221.	5.1	6.5	10.6	11.0	16.2	14.6	7.1	7.8	16.6	-.12	-.83	-1.35	-.32	-.27	.06	.46	.28	.34	.76	.74
3101730230.223.218.221.	4.4	5.5	10.3	10.6	11.9	11.3	4.2	5.4	16.5	-.12	-.84	-1.36	-.25	-.12	-.14	.30	.18	.28	.75	.80
3101735230.223.221.221.	3.5	4.7	9.8	9.8	14.4	15.0	5.8	9.4	16.4	-.08	-.72	-1.25	-.16	.04	.44	.68	.18	.18	.82	.64
3101740238.236.226.226.	5.1	6.0	11.4	10.4	9.6	8.1	3.8	4.6	16.4	-.10	-.78	-1.29	-.24	-.11	.14	.47	.18	.26	.67	.59
3101745234.229.230.230.	4.2	5.2	9.1	8.9	10.7	9.7	7.1	6.6	16.2	-.12	-.79	-1.33	-.24	-.18	-.22	.37	.18	.33	.74	.64
3101750253.249.237.236.	3.1	3.9	8.3	8.5	17.7	17.4	8.3	7.5	16.0	-.09	-.62	-1.12	-.08	.11	.21	.46	.11	.18	.60	.49
3101755238.236.226.230.	6.1	7.5	11.4	11.0	10.0	8.5	6.7	8.5	16.3	-.11	-.76	-1.32	-.24	-.18	.07	.47	.18	.18	.75	.59
3101800251.245.240.240.	3.7	4.3	9.1	8.7	15.5	13.7	9.6	9.0	15.9	-.10	-.71	-1.22	-.16	.04	.52	.94	.11	.27	.60	.42
3101805260.260.249.244.	2.9	3.7	8.5	8.7	11.1	10.1	8.3	10.6	15.7	-.08	-.55	-1.02	-.16	.04	.44	.94	.11	.18	.50	.32
3101810249.242.232.234.	4.4	5.2	10.6	10.2	10.7	8.5	5.5	7.0	15.9	-.08	-.66	-1.18	-.16	.04	.60	.62	.18	.26	.75	.42
3101815238.234.226.230.	4.8	5.7	10.1	10.4	10.3	10.5	7.9	6.6	15.9	-.09	-.76	-1.28	-.24	-.18	.60	.79	.18	.27	.82	.33
3101820241.236.230.230.	5.3	6.5	12.0	12.2	9.6	8.9	5.4	5.9	15.9	-.10	-.72	-1.24	-.24	-.18	.29	.53	.18	.34	.74	.59
3101825245.241.235.234.	5.5	6.7	13.1	12.8	8.9	10.5	5.5	4.6	15.8	-.10	-.69	-1.17	-.24	-.18	-.07	.52	.27	.26	.44	.42
3101830258.251.235.238.	3.9	4.9	10.7	10.9	10.0	11.3	7.1	7.4	15.6	-.07	-.62	-1.14	-.16	.04	.29	.62	.12	.18	.60	.42
3101835266.262.253.251.	4.8	5.5	9.8	9.7	15.5	16.9	11.6	8.2	15.5	-.12	-.71	-1.18	-.16	-.11	.13	.61	.11	.27	.44	.42
3101840279.276.265.263.	3.9	4.9	8.7	8.7	4.9	4.6	4.2	4.3	15.0	-.04	-.51	-.94	-.09	.10	.06	.46	.04	.19	.36	.34
3101845283.280.268.265.	5.0	6.0	9.8	10.1	5.7	6.2	5.8	4.6	15.1	-.04	-.54	-1.00	-.08	.11	.22	.62	.11	.18	.43	.42
3101850278.276.263.263.	4.4	5.5	8.9	8.9	14.8	13.8	5.0	3.8	15.1	-.06	-.57	-1.00	-.08	.10	.28	.68	.03	.19	.44	.42
3101855275.272.277.276.	3.1	3.7	7.5	7.2	15.2	13.8	8.7	9.8	14.8	-.05	-.46	-.96	-.09	.03	.36	.68	.12	.19	.36	.34
3101900275.276.281.276.	3.0	3.9	6.9	6.6	17.8	14.2	4.7	5.1	14.6	-.09	-.50	-.93	-.09	.03	.36	.52	.12	.18	.36	.49
3101905306.301.286.280.	4.6	5.6	6.9	6.4	4.4	3.7	3.1	5.0	14.5	-.04	-.29	-.63	-.08	.19	.07	.31	.03	.11	.28	.33
3101910307.301.290.280.	4.3	5.3	6.9	6.0	8.6	7.0	8.7	7.8	14.4	-.05	-.46	-.74	-.09	.10	.06	.21	.04	.12	.36	.33
3101915303.299.281.274.	4.0	4.9	6.5	6.0	11.1	10.1	7.4	10.1	14.3	.00	-.37	-.76	-.09	.11	.22	.46	.04	.11	.35	.33
3101920291.290.281.272.	3.9	4.7	6.0	5.2	8.6	6.2	11.5	12.3	14.2	-.06	-.23	-.61	-.09	.10	.06	.21	.04	.19	.44	.42
3101925308.301.283.272.	3.3	4.1	4.2	4.3	8.1	4.9	8.7	11.7	14.4	-.01	-.38	-.75	-.08	.10	-.07	.04	.03	.11	.44	.49
3101930314.310.291.280.	3.7	4.7	4.8	3.7	8.6	8.5	12.9	16.9	14.3	-.05	-.48	-.82	-.08	.11	.22	.04	.03	.11	.43	.42
3101935318.312.300.298.	4.0	4.9	5.6	4.5	4.9	4.6	4.2	8.2	14.0	-.07	-.33	-.74	-.09	.10	.13	.21	.04	.12	.29	.34
3101940306.301.296.288.	3.3	4.3	5.6	4.7	7.4	7.0	2.6	6.2	14.0	-.04	-.55	-.96	-.09	.10	.14	.37	.04	.12	.19	.17
3101945290.288.290.286.	3.5	4.1	6.7	5.8	9.3	6.5	2.6	3.5	13.9	-.06	-.45	-.78	-.08	.10	.28	.52	.03	.11	.20	.18
3101950298.297.296.290.	3.6	4.4	6.9	6.2	8.1	7.8	5.8	4.6	13.9	-.03	-.50	-.87	-.08	.11	.14	.37	.03	.11	.20	.27

3.3 Tracer Gas Data

ARLFRD provided an oil-fog generator and a SF6 tracer gas release system to inject oil-fog and SF6 directly into the 91.4-m stack flue at the Tracy power plant. The SF6 tracer gas was stored in two compressed gas cylinders at ground level, and piping carried the gas through a linear mass flow meter (LFM) system to the point of discharge into the stack. The LFM measured and displayed the rate of gaseous tracer discharge via real-time digital display, the total amount of gas discharged via a digital counter, and the analog output voltage directly proportional to the flow rate.

A nominal SF6 release rate (Q) of 1.26 g/s was used during the preliminary FSPS study. The SF6 and oil-fog releases commenced approximately 30 minutes prior to the start of sampling to ensure that the SF6 tracer had time to reach the sampling grid when the samplers were turned on. During the course of the study, the power plant was in a warm standby status with the stack continually vented by an exhaust fan located at the bottom of the stack. Only occasionally was the plant used to generated electricity, at about 20 MW.

3.3.1 Tracer Sampling and Analysis

A sampling network of 63 sites (figure 3) was established by Rockwell International, an EPRI contractor. Of these sites 43 locations were deployed to sample concentration during expected westerly wind flow, but easterly winds were encountered so frequently that additional sites around the plant became necessary.

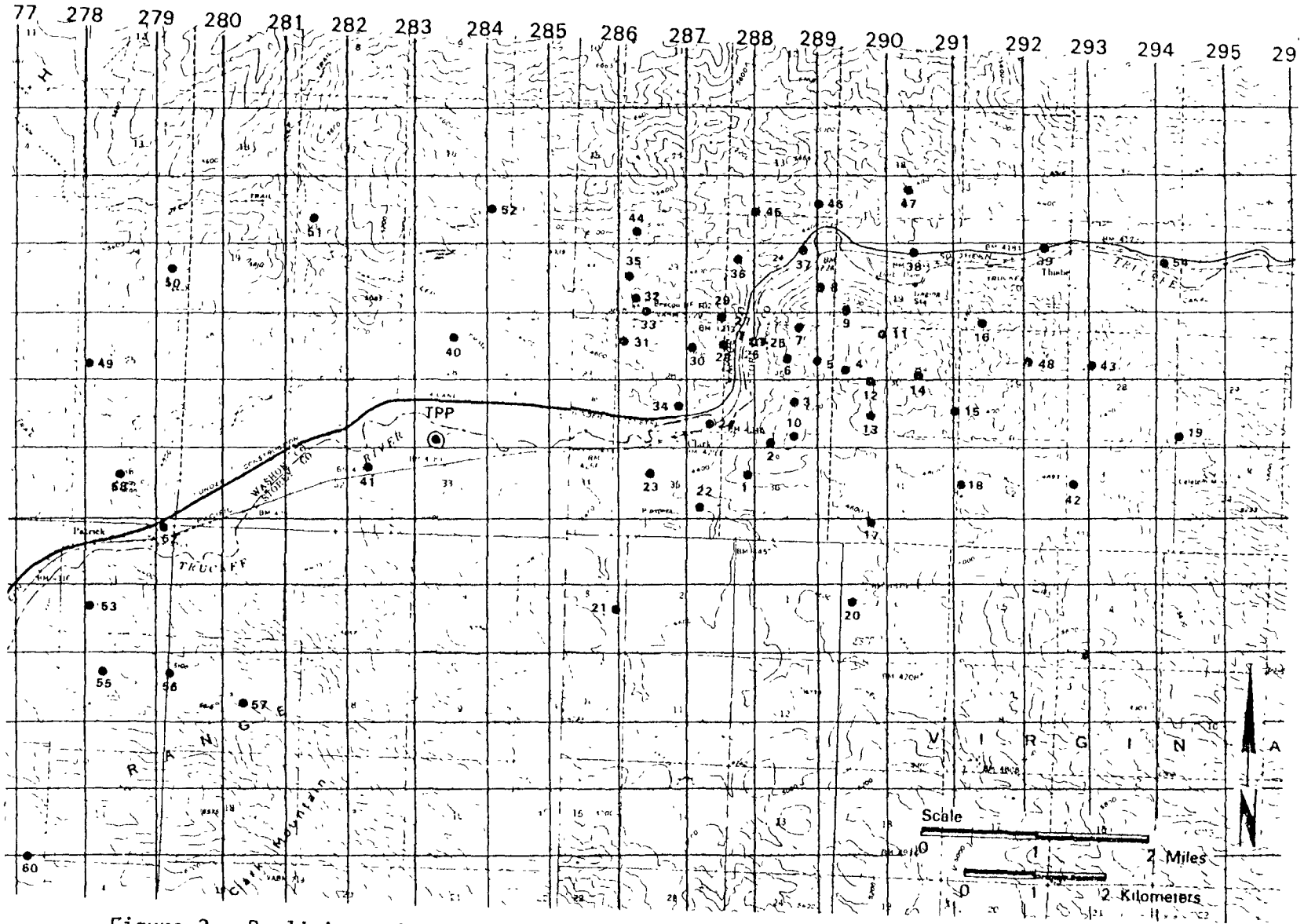

Figure 3. Preliminary FSPS sampler locations (From Strimaitis et al., 1984)

The samplers used were sequential syringe types manufactured by D&S Instruments. Nine 30 cm3 syringes were housed at each site where one syringe functioned at 1-hour intervals during a typical 9-hour experiment. A typical experiment ran from midnight to 0900 PST. In addition to the syringe samplers ARLFRD provided five sequential bag samplers that filled 2-liter Tedlar bags. These were collocated at five syringe sites for the purposes of quality assurance purposes. SF6 concentrations from the collocated samplers were included in the data base with the syringe concentrations.

A printout of file number 2, table 7, contains a listing of UTM coordinates and elevations for all sampler sites. Since each of the 63 possible sites might also be used for a collocated bag sampler, 126 sites are identified. Coordinates of the Tracy stack (SRCE) and tethersonde central (TSDC) and remote (TSDR) sites are included in the first three data records. Sampler sites are identified by an "A" or "C" in the first position and three integers that follow. The "A" indicates a syringe sampler, and the "C" indicates a collocated 2-liter Tedlar bag sampler. Five header records identify the file and present headings to the columns of data records that follow.

3.3.2 Tracer Gas Data Tape Files

SF_6 (PPT) concentrations detected by the sampler network are stored in files number 3 and 4 on tape number 007654 following meteorological data from the 150-m tower. File 3 has data from the first week of operation, November 7 - 13, 1983, and file 4 has data from the second week November 14 - 20, 1983. Table 8, a sample printout of file 3, illustrates how the data are

TABLE 7. FILE NUMBER 2: SF6 SAMPLER LOCATIONS SAMPLE PRINTOUT

PRELIMINARY FULL SCALE PLUME STUDY - TRACY, NEVADA
NOVEMBER 7-13, 1983; NOVEMBER 14-20, 1983
SF6 SAMPLER LOCATIONS (126), STACK (SRCE) & T-SONDE (TSDC,TSDR) LOCATIONS
X AND Y UTM COORDINATES (KM) AND ELEVATION Z (M) MSL

SITE	X	Y	Z	SUM
SRCE	4382.080	283.308	1300.	5965.388
TSDC	4383.652	283.654	1353.	6020.306
TSDR	4384.896	289.680	1286.	5960.576
A001	4381.669	287.892	1457.	6126.561
C001	4381.669	287.892	1457.	6126.561
A002	4382.082	288.285	1469.	6139.367
C002	4382.082	288.285	1469.	6139.367
A003	4382.646	288.647	1465.	6136.293
C003	4382.646	288.647	1465.	6136.293
A004	4383.164	289.429	1457.	6129.593
C004	4383.164	289.429	1457.	6129.593
A005	4383.271	289.026	1464.	6136.297
C005	4383.271	289.026	1464.	6136.297
A006	4383.308	288.471	1458.	6129.779
C006	4383.308	288.471	1458.	6129.779
A007	4383.778	288.656	1429.	6101.434
C007	4383.778	288.656	1429.	6101.434
A008	4384.348	289.039	1469.	6142.387
C008	4384.348	289.039	1469.	6142.387
A009	4384.013	289.395	1607.	6280.408
C009	4384.013	289.395	1607.	6280.408
A010	4382.167	288.598	1540.	6210.765
C010	4382.167	288.598	1540.	6210.765
A011	4383.633	289.947	1565.	6238.580
C011	4383.633	289.947	1565.	6238.580
A012	4382.973	289.784	1562.	6234.757
C012	4382.973	289.784	1562.	6234.757
A013	4382.458	289.759	1580.	6252.217
C013	4382.458	289.759	1580.	6252.217
A014	4383.036	290.459	1751.	6424.495
C014	4383.036	290.459	1751.	6424.495
A015	4382.557	291.022	1658.	6331.579
C015	4382.557	291.022	1658.	6331.579
A016	4383.813	291.425	1574.	6249.238
C016	4383.813	291.425	1574.	6249.238

TABLE 8. FILES NUMBER 3 AND 4: TRACER GAS CONCENTRATION DATA SAMPLE PRINTOUT

PRELIMINARY FULL SCALE PLUME STUDY - TRACY, NV
TAPE CONTAINS EPRI-PMV TRACY SITE DATA FOR THE WEEK OF 11/07/83.

DATA INCLUDED: SF6		BEGIN		END		AVG.	DATA PTS
SITE ID	CONC(PPT)	MODYHR	HRMM	MODYHR	HRMM	SEC	NO.
SF6		110700	0000	110700	0100	3600	047
A001	6						
A002	2						
A003	7						
A004	1						
A005	3						
A006	0						
A007	0						
A008	0						
A009	0						
A010	0						
C010	0						
A011	3						
A012	3						
A013	3						
A014	0						
A015	0						
A016	0						
A017	0						
A018	0						
A019	0						
A020	0						
A021	0						
A022	4						
C022	2						
A023	7						
A024	10						
A025	0						
A026	0						
A027	2						
C027	0						
A028	0						
A029	0						
A030	3						
A031	4						
A032	0						

presented. The first five records are header records that identify the file and present column headings. The first data record with "SF6" in the first three positions identifies the hour ending the sampling in positions 49 to 52. Each time a new hour of sampling data is presented, a new data record with a date - time identification appears. Data records with SF6 concentrations identify the site in positions 1 to 4 and the concentrations follow in positions 11 to 16.

3.4 MINISONDE DATA

Data are stored in files number 5, 6, 7, and 8 on tape number 007654 following the tracer gas tape files. Two minisonde sites operated by Rockwell International recorded data at 1-hour intervals during periods of tracer release; one near the Tracy stack, termed the central site, and a remote site in the Truckee River Valley east of the targeted terrain. Double theodolite tracking was used up to 2.5-3 km above the ground. Files 5 and 6 store minisonde data from the first week, November 7 - 13, 1983, of the preliminary FSPS for the central site and remote site respectively, and files 7 and 8 contain the second week's data, recorded November 14 - 20, 1983.

3.4.1 Minisonde Tape File Records

Header records occupy the first 5 records, followed by two data records with date and time identification. Each following data record is a level of minisonde data. Termination of a minisonde ascent is indicated by the introduction of two new time and date records. Data records have data fields arranged as shown in table 9.

TABLE 9. MINISONDE DATA RECORDS FORMAT

Position	Contents	FORMAT
9 to 10	Level number	I2
16 to 20	Height of level; m	F5.0
26 to 30	Wind speed; m/s	F5.0
36 to 40	Wind direction; deg	F5.0
46 to 50	Temperature; K	F5.0

Table 10, a sample printout of file 5, shows how the data are presented. The same tape formats are used for files 6, 7, and 8. Missing data are denoted by Δ value of -955.

3.5 10-M TOWER METEOROLOGICAL DATA

Data are stored in file 9 on tape number 007654. Instrumentation for the 10-m towers has been previously explained in table 4. Data are presented as 5-minute averages of temperature, wind speed and direction for both stations 1 and 2.

3.5.1 10-M Tower Tape File Records

Seven alphabetic header records precede the data records to identify the date and time and to place column headings. Data records follow with 5-minute averages of meteorological data from both towers. Table 11 shows the arrangement of data fields in file 9.

TABLE 10. FILE NUMBER 5: MINISONDE DATA SAMPLE PRINTOUT

PRELIMINARY FULL SCALE PLUME STUDY - TRACY, NEVADA
NOVEMBER 7 -13, 1983; (WEEK 1)
MINISONDE DATA - TSDC (CENTRAL SITE)

		HT (M)	WIND SPD (M/S)	WIND DIR (DEG)	TEMP (K)
DATE(MODYYR)-		110783.	110783.	110783.	110783.
TIME(HRMM)-		30.	30.	30.	30.
LEVEL -	1	0.	-995.	-995.	286.
	2	70.	3.	316.	286.
	3	160.	4.	321.	286.
	4	183.	1.	305.	285.
	5	246.	5.	315.	284.
	6	349.	4.	291.	-995.
	7	415.	3.	255.	-995.
	8	458.	2.	260.	-995.
	9	509.	-995.	-995.	-995.
	10	577.	-995.	-995.	-995.
	11	645.	-995.	-995.	-995.
	12	713.	-995.	-995.	-995.
	13	781.	-995.	-995.	-995.
	14	848.	-995.	-995.	-995.
	15	916.	-995.	-995.	-995.
	16	984.	-995.	-995.	-995.
	17	1052.	-995.	-995.	-995.
	18	1120.	-995.	-995.	-995.
	19	1188.	-995.	-995.	-995.
	20	1256.	-995.	-995.	-995.
	21	1324.	-995.	-995.	-995.
	22	1391.	-995.	-995.	-995.
	23	1459.	-995.	-995.	-995.
	24	1527.	-995.	-995.	-995.
	25	1595.	-995.	-995.	-995.
	26	1663.	-995.	-995.	-995.
	27	1731.	-995.	-995.	-995.
	28	1799.	-995.	-995.	-995.
	29	1866.	-995.	-995.	-995.
	30	1934.	-995.	-995.	-995.
		110783.	110783.	110783.	110783.
		130.	130.	130.	130.
	1	0.	-995.	-995.	285.

TABLE 11. 10-M TOWER DATA RECORDS FORMAT

Position	Contents	Format
1 to 7	Hour Minute.sec; PST	F7.2
11 to 17	Temperature, tower 1; C	F7.2
21 to 27	Wind speed, tower 1; mi/hr	F7.2
31 to 37	Wind direction, tower 1; deg	F7.2
41 to 47	Temperature, tower 2; C	F7.2
51 to 57	Wind speed, tower 2; mi/hr	F7.2
61 to 67	Wind direction, tower 2; deg	F7.2

Table 12. is a sample printout of file 9. Data were recorded continuously beginning on November 6, 1983 and ending on November 21, 1983. Missing values are denoted by '9999' in the data field.

3.6 OPTICAL CROSSWIND ANEMOMETER DATA

WPL provided a two-path crosswind anemometer system that was located at the east end of Target Mountain Draw, and the observations are presented in file 10. Data consists of direct measures of wind speeds crosswind to the paths, and the derived values of east-west (U), north-south (V) components, wind speed and wind direction averaged at 5-minute intervals. Heights of optical transmitter and receiver at the end of each path were 1 m above the ground.

TABLE 12. FILE NUMBER 9: 10-M TOWER DATA SAMPLE PRINTOUT

PRELIMINARY FULL SCALE PLUME STUDY - TRACY,NEVADA
NOVEMBER 6 - 19, 1983
10-METER TOWER METEOROLOGICAL DATA STATIONS 1 & 2
EXP. #1; NOV. 6 - 7, 1983

	STATION 1			STATION 2		
	TEMP	SPD	DIR	TEMP	SPD	DIR
HRMM	T1-DEG C	MI/HR	WD=DG	T2-DEG C	MI/HR	WD=DG
2200.00	9999.00	9999.00	9999.00	9999.00	10.00	283.00
2205.00	9999.00	9999.00	9999.00	9999.00	11.00	275.00
2210.00	9999.00	9999.00	9999.00	9999.00	11.00	218.00
2215.00	9999.00	9999.00	9999.00	9999.00	12.00	270.00
2220.00	9999.00	9999.00	9999.00	9999.00	10.00	255.00
2225.00	9999.00	9999.00	9999.00	9999.00	12.00	208.00
2230.00	9999.00	9999.00	9999.00	9999.00	12.00	290.00
2235.00	9999.00	9999.00	9999.00	9999.00	12.00	278.00
2240.00	9999.00	9999.00	9999.00	9999.00	13.00	285.00
2245.00	9999.00	9999.00	9999.00	9999.00	11.00	300.00
2250.00	9999.00	9999.00	9999.00	9999.00	11.00	290.00
2255.00	9999.00	9999.00	9999.00	9999.00	11.00	288.00
2300.00	9999.00	9999.00	9999.00	9999.00	12.00	268.00
2305.00	9999.00	9999.00	9999.00	9999.00	12.00	238.00
2310.00	9999.00	9999.00	9999.00	9999.00	7.00	245.00
2315.00	9999.00	9999.00	9999.00	9999.00	8.00	270.00
2320.00	9999.00	9999.00	9999.00	9999.00	8.00	270.00
2325.00	9999.00	9999.00	9999.00	9999.00	9.00	283.00
2330.00	9999.00	9.00	9999.00	9999.00	9.00	290.00
2335.00	9999.00	9.00	9999.00	9999.00	10.00	288.00
2340.00	9999.00	15.00	9999.00	9999.00	13.00	278.00
2345.00	9999.00	10.00	9999.00	9999.00	10.00	268.00
2350.00	9999.00	25.00	9999.00	9999.00	14.00	270.00
2355.00	9999.00	15.00	9999.00	9999.00	13.00	200.00
2400.00	9999.00	30.00	9999.00	9999.00	19.00	265.00
2405.00	9999.00	26.00	9999.00	9999.00	12.00	236.00
2410.00	9999.00	26.00	9999.00	9999.00	15.00	280.00
2415.00	9999.00	21.00	9999.00	9999.00	17.00	293.00
2420.00	9999.00	16.00	9999.00	9999.00	14.00	280.00
2425.00	9999.00	23.00	9999.00	9999.00	15.00	278.00
2430.00	9999.00	22.00	9999.00	9999.00	12.00	303.00
2435.00	9999.00	10.00	9999.00	9999.00	13.00	205.00
2440.00	9999.00	19.00	9999.00	9999.00	12.00	208.00

3.6.1 Optical Crosswind Anemometer Tape File Records

Six alphabetic header records precede the data records to identify the date and time an to place column headings. Data records follow and summarize 5-minute averages of wind data from both paths. Table 13 shows the arrangement of data fields in file 10.

TABLE 13. OPTICAL CROSSWIND ANEMOMETER DATA RECORDS FORMAT

Position	Contents	Format
1 to 2	Hour; PST	I2
3 to 4	Minute	I2
7 to 13	Crosswind wind speed - path 1; m/s	F7.2
17 to 23	Crosswind wind speed - path 2; m/s	F7.2
29 to 35	East-west wind component (U); m/s	F7.2
38 to 44	North-south wind component (V); m/s	F7.2
47 to 53	Wind speed; m/s	F7.2
58 to 64	Wind direction; deg	F7.2

Table 13a illustrates the arrangement of header and data records in file 10.

TABLE 13a FILE NUMBER 10: OPTICAL CROSSWIND ANEMOMETER DATA SAMPLE PRINTOUT

PRELIMINARY FULL SCALE PLUME STUDY - TRACY, NEVADA
OPTICAL ANEMOMETER DATA - TEST DATE: 11/5-6/83
AZIMUTH PATH 1 = 117.4 AZIMUTH PATH 2 = 202.8

TIME	CROSSWIND SPEEDS PATH 1	PATH 2	U	V	SPEED	DIRECTION
HRMM	(M/S)	(M/S)	(M/S)	(M/S)	(M/S)	(DEG)
1910	1.20	.80	-1.18	-.74	1.39	57.87
1915	1.20	1.00	-1.36	-.65	1.50	64.47
1920	1.00	1.30	-1.55	-.32	1.58	78.15
1925	1.10	1.40	-1.67	-.37	1.72	77.51
1930	1.40	1.50	-1.88	-.60	1.97	72.24
1935	1.50	1.40	-1.83	-.74	1.97	67.96
1940	1.20	1.80	-2.07	-.28	2.09	82.33
1945	.60	1.80	-1.84	.28	1.86	98.55
1950	.60	1.80	-1.84	.28	1.86	98.55
1955	.80	1.70	-1.83	.04	1.83	91.41
2000	.70	1.60	-1.70	.09	1.70	93.08
2005	.30	1.60	-1.54	.16	1.61	106.66
2010	.30	1.80	-1.72	.55	1.81	107.84
2015	.70	1.70	-1.79	.14	1.79	94.40
2020	.80	1.70	-1.83	.04	1.83	91.41
2025	.50	1.80	-1.80	.37	1.84	101.59
2030	.20	2.00	-1.86	.74	2.00	111.66
2035	-.10	1.70	-1.48	.88	1.72	120.74
2040	.50	1.10	-1.17	.05	1.18	92.22
2045	1.30	.60	-1.04	-.93	1.39	48.34
2050	1.70	1.10	-1.64	-1.06	1.96	57.03
2055	1.50	1.60	-2.01	-.65	2.11	72.10
2100	1.00	1.80	-1.99	-.09	1.99	87.30
2105	.70	1.90	-1.96	.23	1.98	96.67
2110	.40	1.90	-1.85	.51	1.92	105.35
2115	.40	1.50	-1.49	.32	1.53	102.20
2120	1.30	1.10	-1.49	-.69	1.64	64.94
2125	1.20	1.20	-1.54	-.56	1.63	70.10
2130	.20	1.40	-1.32	.46	1.40	109.20
2135	-.10	.80	-.67	.16	.82	124.43
2140	.20	.30	-.34	-.05	.35	82.33
2145	1.10	.20	-.61	-.92	1.11	33.22
2150	1.50	.80	-1.30	-1.02	1.65	51.85
2155	.60	1.60	-1.66	.18	1.67	96.32

3.7 ELECTRONIC WEATHER STATION DATA

Data recorded at two electronic weather stations located at the east and west ends of Target Mountain Draw are in file 11 of the data base tape. Values were recorded as 1-hour averages of wind speeds and directions on 1.5-m masts at both stations and temperature values at at east station.

3.7.1 Electronic Weather Station Tape File Records

Nine header records precede the data records, followed by twenty four hourly data records. Table 14 illustrates the arrangement of data fields in file 11.

TABLE 14. ELECTRONIC WEATHER STATION RECORDS FORMAT

Position	Contents	Format
9 to 10	Month	I2
11 to 12	Day	I2
13 to 14	Year	I2
17 to 18	Hour ending; PST	I2
20 to 21	Second	I2
26 to 29	Wind direction, east station; deg	F4.0
35 to 38	Wind speed, east station; m/s	F4.1
44 to 47	Temperature, east station; C	F4.1
58 to 61	Wind direction, west station; deg	F4.0
67 to 70	Wind speed, west station; m/s	F4.1

Table 15 is a sample printout of file 11.

TABLE 15. FILE NUMBER 11: ELECTRONIC WEATHER STATION DATA SAMPLE PRINTOUT

EPA COMPLEX TERRAIN PRELIMINARY EXPERIMENT
TRACY STATION, NEVADA
NOVEMBER 4TH THROUGH 21ST, 1983
EWS DATA

MODYYR	HOUR ENDG. (PST)	EAST WIND DIRECTION (DEGREES)	EAST WIND SPEED (MPS)	TEMP. (DEG C)	WEST WIND DIRECTION (DEGREES)	WEST WIND SPEED (MPS)
110483	1:00	999.	99.9	99.9	999.	99.9
110483	2:00	999.	99.9	99.9	999.	99.9
110483	3:00	999.	99.9	99.9	999.	99.9
110483	4:00	999.	99.9	99.9	999.	99.9
110483	5:00	999.	99.9	99.9	999.	99.9
110483	6:00	999.	99.9	99.9	999.	99.9
110483	7:00	999.	99.9	99.9	999.	99.9
110483	8:00	999.	99.9	99.9	999.	99.9
110483	9:00	999.	99.9	99.9	999.	99.9
110483	10:00	999.	99.9	99.9	999.	99.9
110483	11:00	999.	99.9	99.9	999.	99.9
110483	12:00	999.	99.9	99.9	999.	99.9
110483	13:00	999.	99.9	99.9	255.	1.3
110483	14:00	999.	99.9	99.9	261.	2.7
110483	15:00	999.	99.9	99.9	249.	2.7
110483	16:00	270.	1.8	15.6	243.	2.7
110483	17:00	270.	1.8	14.4	255.	2.2
110483	18:00	288.	2.2	12.8	288.	.9
110483	19:00	171.	1.3	11.1	261.	.4
110483	20:00	54.	.9	10.0	90.	.9
110483	21:00	36.	.9	8.3	70.	.9
110483	22:00	15.	.4	7.2	81.	.9
110483	23:00	324.	.4	6.7	90.	.9
110483	24:00	333.	.4	6.7	90.	.9

EPA COMPLEX TERRAIN PRELIMINARY EXPERIMENT
TRACY STATION, NEVADA
NOVEMBER 4TH THROUGH 21ST, 1983
EWS DATA

HOUR ENDG.	EAST WIND DIRECTION	EAST WIND SPEED	TEMP.	WEST WIND DIRECTION	WEST WIND SPEED

3.8 DOPPLER ACOUSTIC SOUNDER DATA

A doppler acoustic sounding system was installed by WPL near the Tracy stack to test the feasibility of obtaining realtime information on the vertical structure of winds. Data from the system were averaged at 10-minute intervals and placed on tape file 12. Soundings began on November 9 and continued until November 18, 1983. Measures of wind speed and direction were made at 25 m height intervals from 50 m to 400 m.

3.8.1 Doppler Acoustic Sounder Tape File Records

Seven header records precede the data records when the file begins. The first three identify the file and the next four head the data column and identify dates, times, measures and heights. Each data record has measures at one level for six consecutive 10-minute values of wind speed and direction. Arrangement of data fields in file 12 is shown in table 16.

TABLE 16. DOPPLER ACOUSTIC SOUNDER RECORDS FORMAT

Position	Contents	Format
3 to 5	Height of measure; m	I3
17 to 21	Wind speed; m/s	F5.1
26 to 28	Wind direction; deg	I3
36 to 40	Wind speed; m/s	F5.1
45 to 47	Wind direction; deg	I3
55 to 59	Wind speed; m/s	F5.1
64 to 66	Wind direction; deg	I3
74 to 78	Wind speed; m/s	F5.1
83 to 85	Wind direction; deg	I3
93 to 97	Wind speed; m/s	F5.1
102 to 104	Wind direction; deg	I3
112 to 116	Wind speed; m/s	F5.1
121 to 123	Wind direction; deg	I3

Table 17 is a sample printout of file 12 of the data base tape.

TABLE 17. FILE NUMBER 12: DOPPLER ACOUSTIC SOUNDER DATA SAMPLE PRINTOUT

PRELIMINARY FULL SCALE PLUME STUDY - TRACY, NEVADA
NOVEMBER 9-18, 1983
DOPPLER ACOUSTIC SOUNDING DATA

	11/ 9 2220		11/ 9 2230		11/ 9 2240		11/ 9 2250		11/ 9 2300		11/ 9 2310	
HEIGHT	WS	DIR	WS	DIR	WS	DIR	WS	DIR	WS	DIR	WS	DIR
400	-9.9	999	-9.9	999	-9.9	999	-9.9	999	8.1	136	-9.9	999
375	-9.9	999	-9.9	999	-9.9	999	-9.9	999	7.0	166	-9.9	999
350	-9.9	999	-9.9	999	-9.9	999	-9.9	999	6.1	163	-9.9	999
325	-9.9	999	-9.9	999	-9.9	999	7.6	180	5.4	167	-9.9	999
300	5.5	201	-9.9	999	-9.9	999	6.3	186	6.4	157	-9.9	999
275	5.4	209	-9.9	999	-9.9	999	6.5	170	5.8	168	7.3	160
250	5.0	222	-9.9	999	3.6	251	5.6	170	6.0	170	6.8	157
225	4.2	203	4.4	225	1.7	250	5.6	176	6.6	166	6.0	170
200	6.0	201	3.7	215	-9.9	999	6.0	185	6.6	165	5.2	168
175	5.8	201	4.8	219	1.0	190	5.7	188	6.5	174	3.9	183
150	2.8	187	3.8	203	1.6	175	3.8	195	5.6	167	4.4	172
125	3.4	204	4.5	206	1.2	256	4.2	192	5.6	190	4.9	174
100	3.4	164	4.5	223	0.3	222	5.0	181	5.1	177	4.6	172
75	2.8	173	2.8	205	0.2	140	4.4	188	4.7	185	4.9	179
50	2.1	156	2.3	224	0.3	248	4.2	186	4.0	197	4.1	187

	11/ 9 2320		11/ 9 2330		11/ 9 2340		11/ 9 2350		0/ 0 0000		0/ 0 0000	
HEIGHT	WS	DIR	WS	DIR	WS	DIR	WS	DIR	WS	DIR	WS	DIR
400	-9.9	999	-9.9	999	-9.9	999	-9.9	999	0.0	0	0.0	0
375	-9.9	999	-9.9	999	-9.9	999	-9.9	999	0.0	0	0.0	0
350	-9.9	999	-9.9	999	-9.9	999	-9.9	999	0.0	0	0.0	0
325	-9.9	999	-9.9	999	-9.9	999	-9.9	999	0.0	0	0.0	0
300	-9.9	999	-9.9	999	4.4	148	-9.9	999	0.0	0	0.0	0
275	-9.9	999	6.2	89	3.6	124	2.5	274	0.0	0	0.0	0
250	-9.9	999	5.8	82	3.8	93	2.4	268	0.0	0	0.0	0
225	6.5	153	-9.9	999	3.4	87	0.7	240	0.0	0	0.0	0
200	7.5	167	-9.9	999	3.5	78	0.5	153	0.0	0	0.0	0
175	6.2	155	4.9	100	3.3	56	0.3	68	0.0	0	0.0	0
150	6.0	156	3.6	103	4.0	42	1.0	32	0.0	0	0.0	0
125	6.5	141	3.8	87	4.5	35	1.8	33	0.0	0	0.0	0
100	6.0	131	3.3	72	4.7	28	2.3	36	0.0	0	0.0	0
75	5.8	140	2.7	77	4.4	19	2.8	39	0.0	0	0.0	0

3.9 TETHERSONDE DATA

Tethersonde data were observed at two locations during the preliminary FSPS. WPL operated a tethersonde east of the Tracy stack upwind of the targeted terrain at the bend to the north of the Truckee River. Data from this site are contained in file 13 of the data base tape. ARLFRD operated a tethersonde system slightly upwind of the Tracy stack, and data are held in file 14. Both systems observed profiles up to 600 m during periods of tracer release. Ascents were flown during the first half-hour of each experiment hour and descents during the second half-hour.

3.9.1 Tethersonde Tape File Records

Each tethersonde recorded data in slightly different formats. Five alphabetic header records precede each experiment's set of ascents to identify the date and times of observations, but data records differ beween the two sites. Table 18 illustrates the data record formats for the WPL site, and table 19 shows the arrangement or records used by the ARLFRD system.

TABLE 18. WPL TETHERSONDE DATA RECORDS FORMAT

Position	Contents	FORMAT
1 to 2	Month	I2
3 to 4	Day	I2
5 to 6	Year	I2
9 to 10	Hour; PST	I2
11 to 12	Minute	I2
13 to 14	Second	I2
17 to 22	Barometric pressure; mb	F6.2
24 to 30	Height of level; m	F6.1
32 to 36	Temperature; C	F5.1
39 to 43	Relative humidity; %	F5.1
46 to 50	Mixing ratio;	F5.1
55 to 59	Wind direction; deg	F5.1
61 to 65	Wind speed; m/s	F5.1
68 to 72	Potential temperature; K	F5.1

TABLE 19. ARLFRD TETHERSONDE DATA RECORDS FORMAT

Position	Contents	Format
1 to 5	Day	F5.0
6 to 10	Run number	F5.0
12 to 13	Hour; PST	I2
14 to 15	Minute	I2
16 to 18	Seconds	F3.0
21 to 26	Height of level; m	F6.2
29 to 34	Temperature; C	F6.2
38 to 42	Wind speed; m/s	F5.2
45 to 50	Wind direction; deg	F6.2
53 to 58	Barometric pressure; mb	F6.2

Tables 20 and 21 are sample printouts of files 13 and 14.

TABLE 20, FILE NUMBER 13: WPL TETHERSONDE DATA SAMPLE PRINTOUT

PRELIMINARY FULL SCALE PLUME STUDY - TRACY, NEVADA
NOVEMBER 8-19, 1983
TETHERSONDE DATA - WPL

DATE	TIME	PRES	HT	TEMP	RH	MIXRAT	DIR	SPEED	POTT
MODYYR	HHMMSS	MB	M	C	%	G/KG	DEG	M/S	K
110783	235845	872.30	0.0	-2.7	71.9	2.5	308.2	0.2	281.2
110783	2359 0	872.30	0.0	-2.7	71.2	2.5	286.8	0.3	281.2
110783	235916	872.40	-0.9	-2.6	67.9	2.4	268.3	0.4	281.4
110783	235931	872.30	0.0	-2.2	63.4	2.3	247.2	0.4	281.7
110783	235946	872.40	-0.9	-2.0	62.2	2.3	272.9	0.3	281.9
110883	0 0 2	872.40	-0.9	-2.0	63.6	2.3	277.3	0.2	281.9
110883	0 017	872.40	-0.9	-2.1	66.0	2.4	264.5	0.3	281.8
110883	0 033	872.40	-0.9	-2.1	65.5	2.4	262.5	0.6	281.9
110883	0 048	872.40	-0.9	-2.4	70.0	2.5	236.2	0.8	281.5
110883	0 1 3	872.20	0.9	-2.1	62.9	2.3	215.8	1.1	281.8
110883	0 118	872.00	2.7	-1.8	58.0	2.2	190.5	1.1	282.2
110883	0 134	871.80	4.6	-1.2	52.9	2.1	185.1	1.4	282.8
110883	0 149	871.80	4.6	-0.2	44.6	1.9	173.7	1.3	283.9
110883	0 2 4	871.40	8.2	0.2	46.8	2.1	165.7	1.4	284.3
110883	0 220	871.00	11.9	0.3	49.1	2.2	155.3	1.5	284.4
110883	0 235	870.60	15.6	0.2	51.9	2.3	166.4	1.7	284.4
110883	0 251	870.20	19.3	0.2	52.3	2.3	152.3	1.4	284.4
110883	0 3 6	869.70	23.9	0.3	51.7	2.3	179.4	2.3	284.6
110883	0 321	869.30	27.6	0.2	53.3	2.4	173.3	2.0	284.5
110883	0 337	868.90	31.3	0.4	51.7	2.3	182.7	2.0	284.8
110883	0 352	868.30	36.8	0.4	51.9	2.4	174.4	1.8	284.9
110883	0 4 7	868.00	39.6	0.5	51.6	2.4	179.9	1.7	285.0
110883	0 422	867.50	44.2	0.4	52.9	2.4	174.3	2.2	284.9
110883	0 438	867.10	47.9	0.4	53.3	2.4	179.4	2.0	284.9
110883	0 453	866.30	55.3	0.4	52.4	2.4	178.1	2.3	285.1
110883	0 5 9	866.00	58.1	0.7	50.5	2.3	180.8	2.1	285.3
110883	0 524	865.30	64.6	1.0	48.8	2.3	188.8	2.3	285.7
110883	0 539	864.80	69.2	1.1	48.7	2.3	190.0	2.4	285.9
110883	0 555	864.30	73.9	1.0	49.9	2.4	203.0	2.3	285.9
110883	0 610	863.60	80.4	1.0	50.6	2.4	198.4	2.3	285.9
110883	0 625	863.00	86.0	1.0	51.3	2.4	203.4	2.5	285.9
110883	0 641	862.00	95.3	0.9	52.3	2.5	193.0	2.5	286.0
110883	0 656	861.70	98.1	1.0	51.8	2.5	218.1	2.3	286.0
110883	0 712	861.10	103.7	0.9	52.8	2.5	227.0	1.7	286.1
110883	0 727	860.60	108.3	0.9	54.0	2.6	217.2	1.6	286.1

TABLE 21. FILE NUMBER 14: ARLFRD TETHERSONDE DATA SAMPLE PRINTOUT

PRELIMINARY FULL SCALE PLUME STUDY - TRACY, NEVADA
NOVEMBER 8-19, 1983
TETHERSONDE DATA - ARLFRD

DAY	RUN	TIME HHMMSS	HT M	T C	SPD M/S	DIR DEG	PRESS MB
8.	1.	10559.	0.00	11.64	0.20	111.00	874.58
8.	1.	11022.	21.00	12.49	0.10	359.00	872.18
8.	1.	11156.	47.00	12.63	0.50	311.00	869.52
8.	1.	11311.	73.00	12.81	0.40	296.00	866.85
8.	1.	11426.	99.00	12.77	0.00	261.00	864.18
8.	1.	11522.	122.00	13.00	0.40	232.00	861.78
8.	1.	11637.	148.00	13.14	0.30	310.00	859.12
8.	1.	11734.	168.00	13.05	0.50	255.00	857.12
8.	1.	11849.	201.00	13.01	1.00	224.00	853.79
8.	1.	12004.	225.00	13.07	0.40	243.00	851.25
8.	1.	12119.	246.00	13.18	1.10	312.00	849.12
8.	1.	12234.	273.00	13.12	1.20	320.00	846.46
8.	1.	12408.	297.00	13.25	0.80	326.00	844.06
8.	1.	12657.	270.00	13.30	0.90	326.00	846.72
8.	1.	12850.	250.00	13.37	1.20	301.00	848.72
8.	1.	13023.	226.00	13.24	0.80	296.00	851.12
8.	1.	13216.	200.00	13.27	0.50	306.00	853.79
8.	1.	13446.	173.00	13.41	0.10	297.00	856.59
8.	1.	13735.	149.00	13.37	0.80	199.00	858.99
8.	1.	13947.	125.00	13.38	1.70	195.00	861.39
8.	1.	14254.	101.00	13.34	1.30	207.00	863.92
8.	1.	14736.	75.00	13.10	0.40	199.00	866.72
8.	1.	15102.	51.00	12.79	0.00	227.00	869.12
8.	1.	15506.	24.00	12.27	0.00	8.00	871.92
8.	1.	15910.	0.00	11.82	0.00	289.00	874.45
8.	2.	23216.	0.00	-5.69	0.30	205.00	874.58
8.	2.	23505.	33.00	-3.41	1.30	23.00	870.98
8.	2.	23524.	50.00	-3.15	1.20	17.00	868.98
8.	2.	23601.	80.00	-1.92	1.00	10.00	865.65
8.	2.	23620.	99.00	-1.71	1.10	10.00	863.78
8.	2.	23658.	138.00	-1.78	0.00	337.00	859.52
8.	2.	23717.	159.00	-1.74	0.60	151.00	857.25
8.	2.	23735.	180.00	-1.45	0.20	158.00	854.85
8.	2.	23754.	199.00	-1.28	0.70	236.00	852.99
8.	2.	23813.	220.00	-1.16	0.40	194.00	850.59

SECTION 4

150-M TOWER CLIMATOLOGICAL DATA

4.1 PERIODS OF DATA COLLECTION

ERT erected and instrumented the 150-m tower at four levels and supplied a data acquisition system for the tower in October 1983, a month before the preliminary FSPS began. Data were recorded continuously through the preliminary FSPS until July 1984, a month before the FSPS was to begin. Data summaries were 1-hour averages of the same meteorological instrumentation in operation at the preliminary FSPS. Data recorded for this extended period are stored on ten files, 15 to 24, on tape number 007654, following the preliminary FSPS data. Table 22 presents an index of the ten files.

4.1.1 150-m Tower Tape File Records

Data record formats are the same as those used for 150-m tower data from the preliminary FSPS, table 4, except each record is a 1-hour average instead of a 5-minute average. File number 16 contains the 1-hour averages of data recorded during the preliminary FSPS. Table 23 is sample printout from file 21 to illustrate how the data are stored.

TABLE 22. 150-M CLIMATOLOGICAL DATA TAPE FILE DATA

File No.	Data
15	October 14-31, 1983
16	November 1983
17	December 1983
18	January 1984
19	February 1984
20	March 1984
21	April 1984
22	May 1984
23	June 1984
24	July 1-10, 1984

TABLE 23. FILE NUMBER 21: 150-M TOWER CLIMATOLOGICAL DATA SAMPLE PRINTOUT

FULL SCALE PLUME STUDY - TRACY, NEVADA
150-METER TOWER HOURLY METEOROLOGICAL DATA 10/83 TO 7/84
EPA TRACY TOWER MET DATA APRIL, 1984

	WIND DIR(DEG)				WIND SPD(M/S)				SIGMA-THETA(DEG)				T(C)	DELTA-T(C)			W(M/S)				SIGMA-W(M/S)			
YRMODYHR	5M	10M	100M	150M	5M	10M	100M	150M	5M	10M	100M	150M	5M	10M	100M	150M	5M	10M	100M	150M	5M	10M	100M	150M
84 4 1 1253.	249.	246.	254.		3.9	4.7	10.6	10.2	8.5	8.1	3.9	4.6	.8	-.11	-.37	-.38	.08	.10	.06	.51	.18	.33	.19	.32
84 4 1 2253.	249.	239.	246.		3.8	4.4	9.5	9.3	23.1	22.0	9.1	9.8	1.8	-.09	-.34	-.70	.08	.09	.05	.92	.27	.34	.36	.89
84 4 1 3271.	266.	251.	257.		3.0	3.5	8.7	8.5	8.5	10.1	5.0	5.0	1.7	-.07	-.37	-.61	.08	.10	.21	.78	.18	.26	.20	.42
84 4 1 4271.	268.	253.	259.		3.8	4.3	9.3	9.3	10.9	11.0	5.0	4.6	1.9	-.09	-.38	-.66	.08	.09	.21	.83	.18	.27	.20	.42
84 4 1 5273.	270.	260.	268.		4.7	5.5	9.5	9.5	7.7	8.1	6.7	8.2	2.2	-.09	-.52	-.79	.09	.10	.13	.51	.17	.27	.28	.42
84 4 1 6271.	270.	260.	268.		4.6	5.2	9.1	8.9	7.7	7.8	7.1	9.1	2.4	-.09	-.58	-.87	.17	.10	.12	.60	.17	.26	99.99	.59
84 4 1 7266.	262.	262.	272.		3.8	4.2	8.1	7.8	7.7	7.7	6.4	7.0	2.5	-.07	-.45	-.70	.09	.03	.13	.35	.17	.18	.19	.32
84 4 1 8271.	270.	269.	276.		4.7	5.5	9.3	9.1	9.0	9.7	10.4	11.0	3.2	-.09	-.69	-.98	.16	.09	.20	.51	.17	.27	.20	.32
84 4 1 9273.	275.	281.	288.		3.8	4.2	6.9	6.8	11.7	11.7	7.9	6.7	3.9	-.10	-.85	-1.20	.08	.04	.13	.36	.18	.26	.28	.48
84 4 110306.	305.	305.	309.		4.7	5.2	6.6	6.6	13.1	12.1	8.2	7.8	5.2	-.28	-1.35	-1.75	.22	.09	.13	.20	.18	.18	.35	.42
84 4 111300.	296.	296.	298.		4.7	5.2	6.6	6.6	7.5	7.3	5.4	5.9	5.3	-.19	-1.15	-1.57	.22	.10	.13	.15	.11	.18	.28	.32
84 4 112305.	303.	298.	301.		4.7	5.5	7.0	7.0	7.5	6.9	5.0	5.9	5.1	-.18	-1.12	-1.52	.22	.10	.13	.20	.11	.19	.28	.33
84 4 113300.	301.	296.	301.		5.7	6.3	7.4	7.4	12.3	11.7	8.2	7.8	6.7	-.34	-1.71	-2.16	.22	.10	.06	.03	.18	.18	.35	.42
84 4 114308.	310.	305.	305.		5.9	6.7	7.6	7.3	15.5	15.4	11.5	10.9	7.5	-.32	-1.58	-2.06	.22	.09	.12	.20	.18	.19	.51	.65
84 4 115321.	318.	314.	319.		5.5	6.0	7.3	7.1	12.3	11.3	8.7	7.7	7.7	-.28	-1.46	-1.86	.22	.09	.12	.02	.18	.18	.43	.48
84 4 116339.	341.	337.	342.		4.6	5.1	6.0	6.0	12.9	13.5	7.4	9.1	8.1	-.30	-1.52	-1.96	.23	.10	.06	-.13	.17	.27	.51	.58
84 4 117310.	310.	311.	317.		4.3	4.8	6.2	6.3	16.5	16.3	14.5	12.2	8.3	-.18	-1.21	-1.64	.16	.09	.28	.35	.18	.18	.60	.65
84 4 118321.	318.	318.	322.		4.3	4.9	6.2	6.0	9.8	10.2	9.1	8.5	8.1	-.10	-.95	-1.36	.22	.10	.21	.20	.10	.18	.43	.48
84 4 119325.	322.	321.	326.		4.1	4.7	7.0	7.1	7.7	8.1	7.9	5.9	7.7	-.01	-.55	-.90	.23	.10	.21	.20	.18	.18	.27	.33
84 4 120323.	322.	321.	328.		3.2	3.6	5.4	5.6	15.7	16.6	14.5	15.5	7.2	.04	-.45	-.78	.16	.10	.13	.03	.10	.11	.28	.33
84 4 121339.	341.	346.	348.		2.2	2.7	4.8	5.0	7.4	6.9	7.1	5.0	5.5	.19	.47	.19	.08	.03	.13	-.04	.11	.12	.19	.26
84 4 122302.	305.	335.	338.		3.0	3.5	5.6	5.6	27.8	28.9	17.8	10.6	4.7	.14	.92	.74	.16	.03	.12	.15	.11	.12	.20	.18
84 4 123275.	270.	274.	288.		2.4	2.7	5.0	4.7	18.7	17.5	7.9	13.1	4.8	-.02	-.09	-.29	.08	.03	.20	.36	.11	.12	.28	.42
84 4 124271.	270.	281.	292.		2.0	2.5	5.0	4.7	11.7	11.3	6.4	9.1	4.4	-.04	.18	-.03	.08	.03	.20	.36	.11	.12	.20	.26
84 4 2 1277.	275.	279.	290.		2.0	2.5	4.1	4.4	19.4	18.4	9.0	7.0	4.1	-.08	-.20	-.25	.08	-.12	.36	.60	.11	.12	.20	.18
84 4 2 2253.	250.	250.	260.		1.8	2.3	3.8	3.3	32.5	28.1	8.7	13.5	3.5	.04	.10	-.23	.02	.03	.13	.20	.11	.12	.35	.48
84 4 2 3279.	279.	272.	277.		2.0	2.5	3.4	3.1	25.7	24.2	14.9	11.7	3.8	.10	-.17	-.46	.08	.03	.05	.15	.11	.12	.20	.26
84 4 2 4266.	268.	267.	270.		1.4	1.7	2.7	2.5	20.2	20.0	9.5	10.1	3.5	.11	.05	-.23	.08	.04	-.08	.02	.02	.03	.13	.27
84 4 2 5261.	261.	264.	276.		1.6	2.1	3.2	2.5	24.3	20.0	15.7	25.8	3.0	.09	.35	.13	.09	.03	.12	.20	.11	.12	.28	.41
84 4 2 6285.	276.	267.	276.		.8	1.2	3.3	3.2	56.3	49.1	5.8	7.8	.7	.34	1.67	1.63	.09	.04	.21	.29	.10	.11	.19	.18
84 4 2 7 73.	80.	255.	263.		1.0	1.2	2.1	3.2	18.1	21.7	19.9	7.8	.7	-.03	.95	1.37	.02	.03	.21	.36	.10	.12	.19	.11
84 4 2 8250.	257.	253.	263.		.8	.9	1.9	2.7	88.0	85.2	16.2	8.5	4.5	-.36	-1.41	-1.68	.02	.03	.12	.30	.18	.18	.28	.26
84 4 2 9261.	257.	258.	263.		1.6	1.9	2.3	2.3	27.0	24.6	13.3	14.6	6.3	-.36	-1.73	-2.16	.08	.02	.05	.02	.18	.19	99.99	.48
84 4 210300.	301.	281.	280.		1.4	1.2	1.9	2.0	44.1	42.4	23.3	24.0	7.6	-.34	-1.59	-2.03	.08	.03	-.14	-.20	.17	.26	.66	.64
84 4 211219.	218.	237.	248.		1.5	1.7	1.9	2.1	84.1	83.9	55.3	53.7	8.7	-.32	-1.71	-2.29	.02	-.12	.05	.03	.17	.33	.82	.80

SECTION 5

FULL SCALE PLUME STUDY

5.1 PERIODS OF DATA COLLECTION

The FSPS comprised 14 experiments and a total of 128 hours of data collection. Table 24 lists the dates and durations of the 14 experiments. Experiment hours encompassed a variety of meteorological conditions ranging from very stable with very light winds to morning inversion breakup and fumigation. On several evenings early in an experiment, strong winds from the west produced near-neutral flow in the valley. Prolonged periods of stable plume impaction on the targeted terrain to the east frequently occurred. Figure 4 shows the field experiment layout of instrumentation around the Tracy Power Plant.

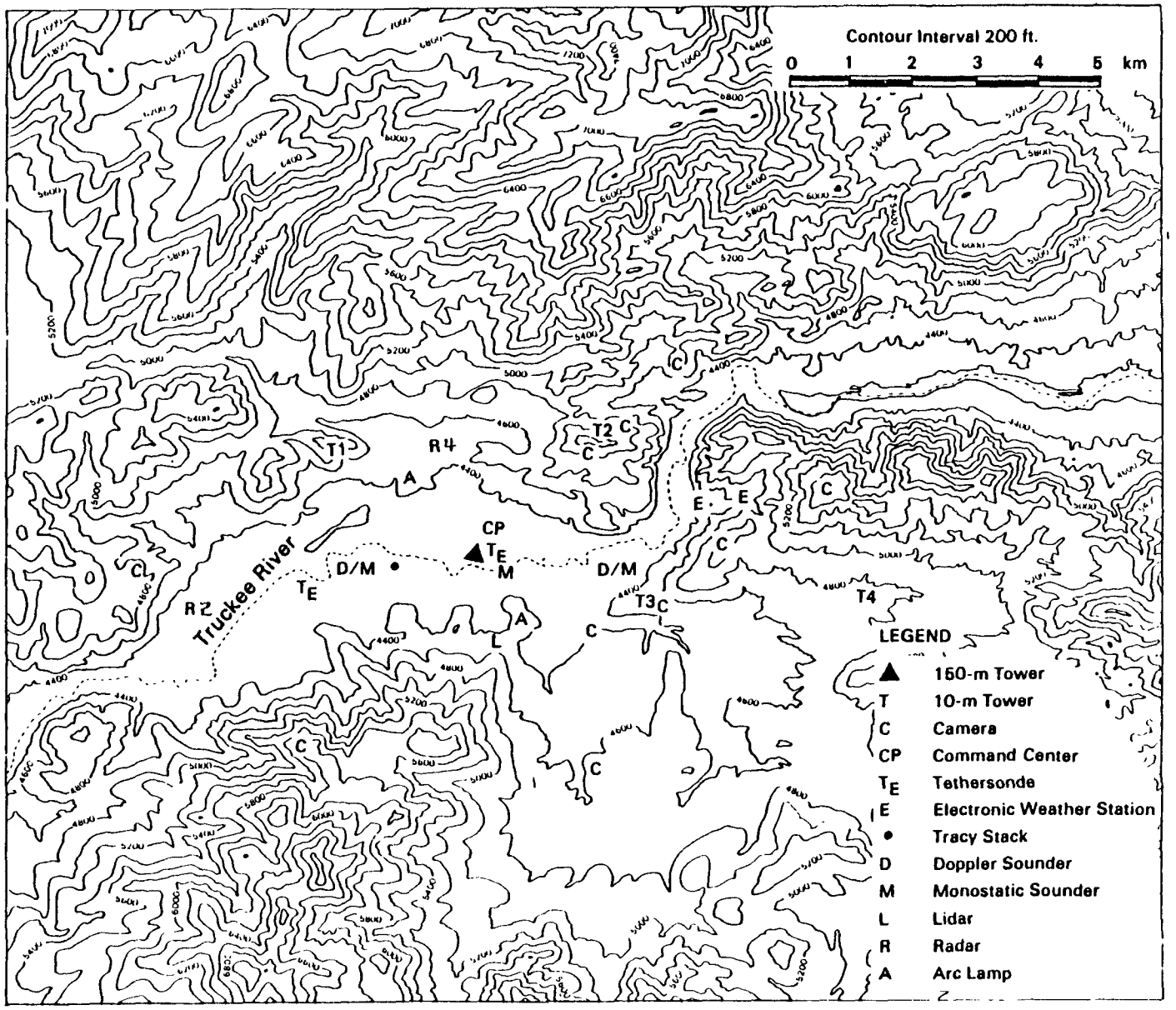

Figure 4. FSPS experiment layout (From DiCristofaro et al., 1985)

TABLE 24. FSPS EXPERIMENT HOURS OF TRACER RELEASE AND SAMPLING

Exp no.	Date (AUG 84)	Time (PDT)	Release		Sampling	
			SF6	CF3Br	SF6	CF3Br
1	6	0300-0700	4	4	4	
2	7	0300-0700	4	4	4	4
3	9 - 10	2000-0600	10	10	10	10
4	10 - 11	2000-0600	10	10	10	10
5	11 - 12	2000-0600	10	9	10	10
6	15 - 16	2200-0800	10	10	10	10
7	16 - 17	2200-0800	10	10	10	10
8	17 - 18	2200-0800	11	11	10	10
9	20 -21	2200-0800	10	10	10	10
10	21 - 22	2300-0900	10	10	10	10
11	22 - 23	2300-0900	10	10	10	10
12	25	0000-1000	10	10	10	10
13	26	0000-1000	10	10	10	10
14	27	0000-1000	10	10	10	10

5.1.1 DATA TAPE FILES

Data are stored at the National Computer Center, Environmental Research Center, Research Triangle Park, North Carolina on Sperry UNIVAC 1100/83 systems magnetic tape, nine track, odd parity, ASCII-quarter word mode, density 6250 BPI, tape number 007654. Record length is 132 characters, and the block size is 1320 words or 40 records per block. All data recorded at the FSPS are contained in files 25 to 140, following files of the 150-m tower climatological data.

5.2 FSPS 150-m TOWER METEOROLOGICAL DATA

The same 150-m tower used in the preliminary FSPS and in the ten-month climatological collection period was instrumented with additional sensors at seven levels. Table 25 presents an index of the FSPS meteorological data from the 150-m tower, files 25 to 56, and table 26 defines the measure codes.

TABLE 25. FULL SCALE PLUME STUDY 150-M TOWER TAPE FILE INDEX

File no.	Measures
	150-m tower meteorological data; 5-minute avg.
25	1-m; SR,NR;
26	10-m; U,V,W,IXP,IYP,IZP,SPV,DPV,UCS,VCS
27	10-m; SCS,DCS,SDR,IYS,T,DVS,SDV,FVC,SFV,SUP
28	10-m; SVP,SWP
29	50-m; U,V,W,IXP,IYP,IZP,SPV,DPV,TD,TC
30	50-m; SUP,SVP,SWP
31	75-m; UCS,VCS,SCS,DCS,SRD,IYS,TD,TC,SDS,DVS
32	75-m; SDV
33	100-m; U,V,W,IXP,IYP,IZP,SPV,DPV,UCV,VCV
34	100-m; UCS,VCS,SCV,DCV,SCS,DCS,IXC,IYC,SDR,IYS
35	100-m; TD,TC,SDS,DVS,SDV,SUP,SVP,SWP,SUC,SVC
36	125-m; U,V,W,IXP,IYP,IZP,SPV,DPV,TD,TC
37	125-m; SUP,SVP,SWP
38	150-m; U,V,W,IXP,IYP,IZP,SPV,DPV,UCV,VCV
39	150-m; UCS,VCS,SCV,DCV,SCS,DCS,IXC,IYC,SDR,IYS
40	150-m; TD,TC,SDS,DVS,SDV,SUP,SVP,SWP,SUC,IYS
	150-m tower meteorological data; 1-hour avg.
41	1-m; same as files 25 to 40
42	10-m;
43	10-m;
44	10-m;

(Continued)

TABLE 25. FULL SCALE PLUME STUDY 150-M TOWER TAPE FILE INDEX (Continued)

File No.	Measures
45	50-m;
46	50-m;
47	75-m
48	75-m;
49	100-m;
50	100-m;
51	100-m;
52	125-m;
53	125-m;
54	150-m;
55	150-m;
56	150-m;

TABLE 26. DEFINITION OF MEASURES

Code	Definition	Units
U,V,W	Vector averaged wind components - props	m/s
UCV,VCV	Vector averaged wind components - cup & vane	m/s
UCS,VCS	Scalar averaged wind components - cup & vane	m/s
SPV	Vector averaged wind speed - props	m/s
DPV	Vector averaged wind direction - props	deg
SCV	Vector averaged wind speed - cup & vane	m/s
DCV	Vector averaged wind direction - cup & vane	deg

(Continued

TABLE 26. DEFINITION OF MEASURES (Continued)

Code	Definition	Units
SCS	Scalar averaged wind speed - cups	m/s
DCS	Scalar averaged wind direction - vane	deg
IXP*	Alongwind intensity of turbulence - props	percent
IYP**	Crosswind intensity of turbulence - props	percent
IZP***	Vertical intensity of turbulence - props	percent
IXC*	Alongwind intensity of turbulence - cup & vane	percent
IYC**	Crosswind intensity of turbulence - cup & vane	percent
IYS+	Scalar crosswind intensity of turbulence - vane	percent
SDR	Standard deviation of wind direction - vane	deg
T	Ambient air temperature - RTD	C
TD	Temperature difference - RTD	C
TC	Calculated temperature, TC = T + TD	C
SDS	Standard deviation of wind speed - cups	m/s
DVS	Scalar averaged of vane output signal	deg
SDV	Standard deviation of vane output signal	deg
FVC	Fixed voltage constant	volts
SVC	Standard deviation of fixed voltage constant	volts
SR	Solar radiation	langleys/min
NR	Net radiation	langleys/min

Direct measures are values calculated from instrument output voltages; U,V,W,IXP,IYP,IZP,UCV,VCV,UCS,VCS,SCV,DCV,SCS,IXC,IYC,IYS,T,TD,SDS,DVS, SDV,FVC,SVC,SR,NV.

Formulae:

$$^{*}IX = \left\{\frac{1}{N}\left[\frac{(\Sigma u)^2\,\Sigma u^2 + (\Sigma v)^2\,\Sigma v^2 + 2\Sigma u\Sigma v\Sigma uv}{(\Sigma u)^2 + (\Sigma v)^2} - \frac{(\Sigma u)^2 + (\Sigma v)^2}{N}\right]\right\}^{1/2} \div \bar{U}$$

$$^{**}IY = \left\{\frac{1}{N}\left[\Sigma u^2 + \Sigma v^2 - \frac{(\Sigma u)^2\,\Sigma u^2 + (\Sigma v)^2\,\Sigma v^2 + 2\Sigma u\Sigma v\Sigma uv}{(\Sigma u)^2 + (\Sigma v)^2}\right]\right\}^{1/2} \div \bar{U}$$

$$^{***}IZ = \left\{\frac{\Sigma w^2 - (\Sigma w)^2}{N}\right\}^{1/2} \div \bar{U},$$

where $\bar{U} = \frac{[(\Sigma v)^2 + (\Sigma v)^2]^{1/2}}{N}$ is the vector resultant mean wind speed, N is the number of samples in the calculations, u and v are the instantaneous wind component speeds from the propeller anemometers or cup and vane, and w is the vertical instantaneous wind component speed from the propeller anemometer.

$$^{+}IYS = SDR \cdot \frac{\pi}{180} \cdot 100$$

Derived measures are values calculated by computer from direct measures;

SPV,DPV,DCS,SDR,TC.

SPV,DPV = vector resultants of speed and direction computed from direct cup & vane components, UCS,VCS

DCS = mean of vector resultant directions computed from direct cup & vane components, UCS,VCS

SDR = Sigma theta, cup & vane (Yamartino method)

e = SQRT[1- (USC2 + VCS2)]

SDR = SIN-1(e)(1.0 + 0.1547e3)

TC = T + TD

5.2.1 Quality Assurance of 150-m Tower data

Quality assurance of the meaurements on the 150-m tower relied on operational checks before shipment to the site, calibration at installation and takedown, frequent documented checks of alignment of the translator electronics, and a comprehensive audit. The alignment checks and the audit results show that the uncertainties in the outputs are quite narrow in range for most instruments.

5.2.2 Refinement and Flagging of the 150-m Tower Data

The data have been subjected to a refinement process as done following tracer studies numbers 1 and 2. Because of the configuration of the data acquisition system, only 5-minute averaged values were available instead of the raw 1-sec values archived in SHIS #2. The UVW-propeller data, had to be corrected for non-cosine response in an average sense, as was done in SHIS #1. Table 27 lists the changes made to the 5-minute and 1-hour instrument outputs to improve their accuracy by correcting for audited errors in orientation to true north and consistent errors in translator alignment. Table 28 presents upper and lower range limits for measured values. If the value was greater than the maxiumum range limit, a data flag next to the value in the tape data record was set to "O" for over the limit. If the value were less than the minimun range, the data flag was set to "U" for under the minimum range limit.

TABLE 27. CORRECTIONS MADE TO 150-M TOWER DATA

Level (m)	U-Prop	V-Prop	W-Prop	DCS, DCV
10	0.00 m/s	-0.02 m/s	0.00 m/s	3.6 deg
50	0.00	-0.02	-0.02	-
75	-	-	-	1.6
100	-0.02	-0.02	0.00	1.8
125	-0.03	-0.03	-0.02	-
150	0.00	-0.03	-0.03	-

TABLE 28. RANGE LIMITS FOR 150-M TOWER DATA

Measure	Lower Limit	Upper Limit
U, V	-15.0 m/s	15.0 m/s
W	-0.8 m/s	0.8 m/s
IXP, IYP	2.0 %	99.9 %
IZP	1.0 %	39.9 %
SPV	0.0 m/s	15.0 m/s
DPV	0.0 deg	360.0 deg
UCV, VCV	-15.0 m/s	15.0 m/s
UCS, VCS	-25.1 m/s	25.1 m/s
SCV	0.0 m/s	15.0 m/s
DCV	0.0 deg	360.0 deg
SCS	0.1 m/s	15.0 m/s
DCS	0.0 deg	360.0 deg
IXC, IYC	2.0 %	99.9 %
SDR	1.5 deg	103.9 deg
IYS	2.0 %	99.9 %
T	-3.0 C	30.0 C
TD	-3.0 C	10.0 C
TC	-3.0 C	30.0 C
SDS	0.05 m/s	4.0 m/s
DVS	0.0 deg	540.0 deg
SDV	1.5 deg	103.9 deg
SR	0.0 ly/min	1.50 ly/min
NR	-0.12 ly/min	0.65 ly/min
FVC	2.487 volts	2.497 volts
SVC	0.000 volts	0.002 volts

The propeller anemometer wind component data were corrected by iterative applications of the cosine response corrections at every 5-minute scan, provided both horizontal props showed good data. The iterations were terminated when the wind direction resolved from the corrected components changed less than one degree from one iteration to the next.

Data quality flags have been appended to the 150-m tower 5-minute values as follows:

blank - good data

"C" - instrument may have been in calibration mode

"O" - over maximum range limit

"U" - under minimum range limit

"P" - potentiometer failure, cup & vane

"F" - instrument failure

"M" - missing data

"B" - bad value

"N" - no response from INTEL microprocessor

5.3 150-M TOWER DATA TAPE FILES

Data are contained in files 25 to 56 on tape number 007654. Inspection of table 25, the tape file index for the 150-m tower, reveals how the data are grouped by tower level, type of measure and averaging time of 5-minutes or 1-hour. Instruments started recording one hour before the start of each experiment and ended one hour after the end. Each file has a record of measures for all experiments, from beginning to end of the FSPS.

5.3.1 150-m Tower Tape File Records

Header records occupy the first 7 records, which include 2-blank

records. Data records that follow are at 5-minute or 1-hour intervals, and can contain from 10 to 2 data fields and appended quality control flags. Data records have data fields arranged as shown in table 29.

TABLE 29. 150-M TOWER DATA RECORDS FORMAT

Position	Contents	Format
1 to 4	Year	I4
5 to 6	Month	I2
7 to 8	Day	I2
9 to 10	Hour (PDT)	I2
11 to 12	Minute	I2
13 to 14	Second	I2
16 to 23	Data	F8.3
24	QA-Flag	A1
25 to 32	Data	F8.3
33	QA-Flag	F8.3
.		
.		
.		
97 to 104	Data	F8.3
105	QA-Flag	A1

Table 30 is a sample printout of the first block, 40 records from file number 26, data from the 10-m level to illustrate how the data are available on the tape.

TABLE 30. FILE NUMBER 26: 150-M TOWER DATA SAMPLE PRINTOUT

FULL SCALE PLUME STUDY - TRACY POWER PLANT, NEVADA
AUGUST 6 - 27, 1984
150-M TOWER METEOROLOGICAL DATA

YYYYMMDDHHMMSS	U	V	W	IXP	IYP	IZP	SPV	DPV	UCS	VCS
	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M	10 M
1984 8 6 2 5 0	-.609	.064	.200	36.300	46.489	12.700	.612	96.031	-23.700	-2.600
1984 8 6 210 0	-.234	-.562	.100	61.300	59.815	12.500	.609	22.589	-13.800	-16.900
1984 8 6 215 0	-.252	-.193	.100	100.0000	-999.900B	18.800	.317	52.550	-15.800	-13.000
1984 8 6 220 0	.263	.375	.100	69.800	53.306	11.400	.458	215.013	-.200	16.700
1984 8 6 225 0	-.475	.364	.100	76.800	31.980	15.800	.599	127.487	-17.300	.800
1984 8 6 230 0	.016	-.240	.100	100.0000	47.148	23.700	.241	356.260	-12.900	-16.700
1984 8 6 235 0	.016	-.290	.100	79.200	50.074	18.800	.291	356.802	-6.700	-23.100
1984 8 6 240 0	.594	.311	.100	46.900	42.922	11.500	.670	242.378	12.200	-4.400
1984 8 6 245 0	.911	.070	.100	50.200	24.133	11.400	.914	265.595	22.100	-7.600
1984 8 6 250 0	.370	.391	.000	63.000	35.663	17.000	.539	223.406	15.000	14.900
1984 8 6 255 0	-.401	.253	.100	39.500	69.831	25.700	.474	122.315	-22.000	.200
1984 8 6 3 0 0	-.368	-.302	.100	100.0000	41.674	37.300	.476	50.589	-17.200	-14.800
1984 8 6 3 5 0	.479	.123	.000	26.700	34.424	15.000	.494	255.608	19.700	-9.600
1984 8 6 310 0	.923	.537	.100	25.700	18.384	11.300	1.068	239.830	23.300	6.100
1984 8 6 315 0	.588	.524	.100	48.300	29.240	12.300	.788	228.316	18.200	10.900
1984 8 6 320 0	.805	.059	.000	18.600	20.559	11.900	.807	265.796	23.300	-7.200
1984 8 6 325 0	.995	.177	.100	15.300	27.719	7.300	1.010	259.930	23.600	-1.200
1984 8 6 330 0	1.080	.336	.000	11.100	16.132	6.600	1.131	252.711	24.400	3.300
1984 8 6 335 0	1.668	-.068	.000	8.000	7.316	3.900	1.670	272.348	24.200	-5.700
1984 8 6 340 0	1.489	.338	.000	26.500	22.951	7.400	1.527	257.219	24.100	1.100
1984 8 6 345 0	.206	.463	.100	50.000	56.853	13.300	.507	204.042	3.600	18.100
1984 8 6 350 0	-.436	.183	.100	100.0000	32.979	14.400	.473	112.836	-.700	1.900
1984 8 6 355 0	-1.304	.879	.200	16.900	21.281	5.200	1.573	123.974	-22.000	10.800
1984 8 6 4 0 0	-.542	.245	.100	55.700	25.814	11.900	.595	114.367	-24.000	4.400
1984 8 6 4 5 0	-1.318	-.246	.200	41.100	14.415	8.700	1.341	79.408	-23.800	-3.500
1984 8 6 410 0	-1.640	.010	.200	17.200	11.555	3.600	1.640	90.358	-24.600	-3.600
1984 8 6 415 0	-1.400	-.146	.200	23.700	15.238	9.300	1.407	84.045	-24.300	-5.100
1984 8 6 420 0	-.250	.195	.100	100.0000	-999.900B	40.0000	.317	127.877	-10.600	-.100
1984 8 6 425 0	-.191	-.600	.100	60.200	57.479	15.300	.630	17.688	-6.900	-19.800
1984 8 6 430 0	.259	.288	.100	100.0000	29.532	26.800	.387	222.005	-5.800	-11.300
1984 8 6 435 0	.717	.736	.100	30.600	30.654	6.400	1.028	224.254	14.700	16.900
1984 8 6 440 0	.629	.954	.100	22.500	9.965	6.200	1.143	213.409	11.500	21.800
1984 8 6 445 0	.275	.469	.100	63.200	51.174	9.400	.544	210.446	.200	16.100

SECTION 6

FSPS TRACER GAS DATA

6.1 TRACER GAS RELEASE SYSTEM

Two tracer gases,SF6 and CF3Br (Freon 13B1), were employed. SF6 tracer gas along with and oil-fog vapor was injected into the duct leading from the Unit's number 3 boiler to the 91.4-m stack just downstream of the air preheater section. The boiler's forced draft fan maintained a steady flow of air through the duct regardless of generating load, and the plume downwash at the top of the stack occurred on the infrequent occassions when the wind at that level exceeded 6 m/s. There were apparent periods of building induced downwash with strong winds during a few experiments, but most times the tracer and oil-fog plume was lofted to some height above the stack-top. Thus, the height of SF6 tracer released had to be determined by detection for the oil-fog plume with lidar beam transects. Hourly heights and emission rates (Q) are presented in table 31. Hours of undetected oil-fog plume are indiby a dash, '-'.

The second tracer gas, CF3Br, was released from the 150-m tower at one of three levels, 100.0, 125.0 and 140.0 m above the ground. The tracer was injected into the side of a Climatronics aspirated temperature shield with the fan motor mounted backwards so that the air was blown out the nozzle extension of the aspirator. The intent of this system was to dilute the heavy tracer with a relatively large volume of air, both to alleviate problems of negative bouyancy and to force the tracer away from the tower's elevated samplers at 43.7, 104.8 and 145 m above the ground. This system

seems to have worked since only 8 of 128 hours of tracer concentration data have had abnormally high CF3Br readings on tower samplers.

TABLE 31. TRACER RELEASE DATA

Exp No.	Hour End	SF6 Q g/s	SF6 Height m	CF3BR Q g/s	CF3BR Height m
1	0400	1.41	186.0	5.86	100.0
	0500	1.41	186.0	5.46	"
	0600	1.44	184.0	5.40	"
	0700	1.44	184.0	5.47	"
2	0400	1.53	155.0	5.80	"
	0500	1.52	134.0	5.81	"
	0600	1.52	148.0	5.84	"
	0700	1.52	163.0	5.61	"
3	2100	1.42	-	5.51	"
	2200	1.42	-	5.51	"
	2300	1.41	-	5.46	"
	2400	1.38	-	5.44	"
	0100	1.35	213.0	5.40	"
	0200	1.36	213.0	5.43	"
	0300	1.36	212.0	5.48	"
	0400	1.38	164.0	5.38	"
	0500	1.34	148.0	5.00	"
	0600	1.34	186.0	4.32	"
4	2100	1.34	-	2.81	"
	2200	1.34	-	2.79	"
	2300	1.32	-	2.73	"
	2400	1.31	134.0	2.79	"
	0100	1.31	134.0	2.64	"
	0200	1.30	-	2.66	"
	0300	1.31	-	2.65	"
	0400	1.33	164.0	2.67	"
	0500	1.34	164.0	2.68	"
	0600	1.35	166.0	2.69	"
5	2100	1.27	169.0	5.37	140.0 m
	2200	1.26	-	5.05	"
	2300	1.26	138.0	4.96	"
	2400	1.26	-	4.97	"
	0100	1.28	-	4.98	"
	0200	1.26	158.0	4.99	"
	0300	1.27	161.0	5.12	"
	0400	1.28	171.0	5.17	"
	0500	1.28	167.0	5.25	"
	0600	1.28	171.0	5.24	"

(Continued)

TABLE 31. TRACER RELEASE DATA (Continued)

Exp No.	Hour End	Q g/s	Height m	Q g/s	Height m
6	2300	1.24	120.0	4.52	100 m
	2400	1.23	106.0	4.51	"
	0100	1.24	113.0	4.42	"
	0200	1.23	91.0	4.51	"
	0300	1.22	91.0	4.53	"
	0400	1.23	91.0	4.52	"
	0500	1.23	110.0	4.55	"
	0600	1.23	116.0	4.56	"
	0700	1.23	152.0	4.48	"
	0800	1.23	138.0	4.44	"
7	2300	1.26	125.0	4.91	"
	2400	1.27	125.0	4.92	"
	0100	1.27	149.0	4.94	"
	0200	1.25	152.0	5.07	"
	0300	1.28	140.0	4.98	"
	0400	1.28	167.0	5.03	"
	0500	1.27	132.0	5.05	"
	0600	1.27	145.0	5.06	"
	0700	1.27	163.0	5.08	"
	0800	1.28	153.0	4.98	"
8	2300	1.26	-	4.95	125 m
	2400	1.26	123.0	4.95	"
	0100	1.27	123.0	5.00	"
	0200	1.26	159.0	5.00	"
	0300	1.27	132.0	4.98	"
	0400	1.26	135.0	4.99	"
	0500	1.26	164.0	5.15	"
	0600	1.26	163.0	4.91	"
	0700	1.27	158.0	5.10	"
	0800	1.27	-	4.94	"
9	2300	1.28	180.0	5.11	100 m
	2400	1.27	180.0	5.11	"
	0100	1.28	129.0	5.10	"
	0200	1.28	130.0	5.21	"
	0300	1.28	116.0	5.22	"
	0400	1.26	125.0	5.09	"
	0500	1.28	139.0	5.16	"
	0600	1.28	174.0	5.03	"
	0700	1.27	155.0	5.25	"
	0800	1.27	152.0	5.17	"

(Continued)

TABLE 31. TRACER RELEASE DATA (Continued)

Exp No.	Hour End	Q g/s	Height m	Q g/s	Height m
10	2400	1.30	182.0	5.08	100 m
	0100	1.30	182.0	5.02	"
	0200	1.31	285.0	5.11	"
	0300	1.31	285.0	5.09	"
	0400	1.31	-	5.07	"
	0500	1.31	175.0	5.04	"
	0600	1.28	-	5.11	"
	0700	1.30	168.0	5.04	"
	0800	1.30	168.0	5.07	"
	0900	1.31	-	5.06	"
11	2400	1.28	133.0	5.19	"
	0100	1.29	133.0	5.22	"
	0200	1.29	139.0	5.31	"
	0300	1.30	229.0	5.27	"
	0400	1.29	229.0	5.21	"
	0500	1.30	172.0	5.24	"
	0600	1.31	172.0	5.13	"
	0700	1.30	198.0	5.13	"
	0800	1.29	226.0	5.11	"
	0900	1.30	-	5.08	"
12	0100	1.26	263.0	3.74	"
	0200	1.27	263.0	3.74	"
	0300	1.26	-	3.75	"
	0400	1.27	261.0	3.76	"
	0500	1.27	261.0	3.67	"
	0600	1.27	252.0	3.85	"
	0700	1.28	237.0	3.75	"
	0800	1.28	-	3.82	"
	0900	1.25	-	3.76	"
	1000	1.27	-	3.78	"
13	0100	1.29	198.0	3.90	"
	0200	1.29	198.0	3.85	"
	0300	1.29	182.0	3.86	"
	0400	1.30	229.0	3.93	"
	0500	1.30	230.0	3.88	"
	0600	1.29	244.0	3.90	"
	0700	1.30	208.0	3.89	"
	0800	1.29	206.0	3.91	"
	0900	1.28	211.0	3.90	"
	1000	1.29	-	3.84	"

(Continued)

TABLE 31. TRACER RELEASE DATA (Continued)

Exp No.	Hour End	Q g/s	Height m	Q g/s	Height m
14	0100	1.24	161.0	3.82	100 m
	0200	1.23	196.0	3.78	"
	0300	1.23	184.0	3.85	"
	0400	1.24	186.0	3.83	"
	0500	1.23	188.0	3.79	"
	0600	1.24	188.0	3.83	"
	0700	1.24	-	3.87	"
	0800	1.20	195.0	3.87	"
	0900	1.26	195.0	3.83	"
	1000	1.26	-	3.82	"

6.1.1 Tracer Sampling

Tracer concentrations were sampled at 110 sites, including the three elevated samplers on the 150-m tower and the one at its base, by modified ASQ-III bag samplers used at tracer studies number 1, CCB, and number 2, HBR. All samplers operated in the 1-hour mode and filled 2-liter Tedlar bags with an inlet height about 0.5 m above the local ground surface. Figure 5 shows the deployment of the FSPS tracer gas sampling sites.

6.1.2 Tracer Analysis

Chromatographic analysis for SF6 and CF3Br collected in the Tedlar bags was done by ARLFRD in their laboratory in Idaho Falls, Idaho, using the same procedures employed in the first two tracer studies. Boxes of sampler bags were shipped to Idaho Falls, and analysis was generally completed within 48 hours of the end of each experiment.

Tracer concentrations were produced as normalized values, Chi/Q (ns/m3), rather than Chi (ppt) as was the procedure in the preliminary FSPS.

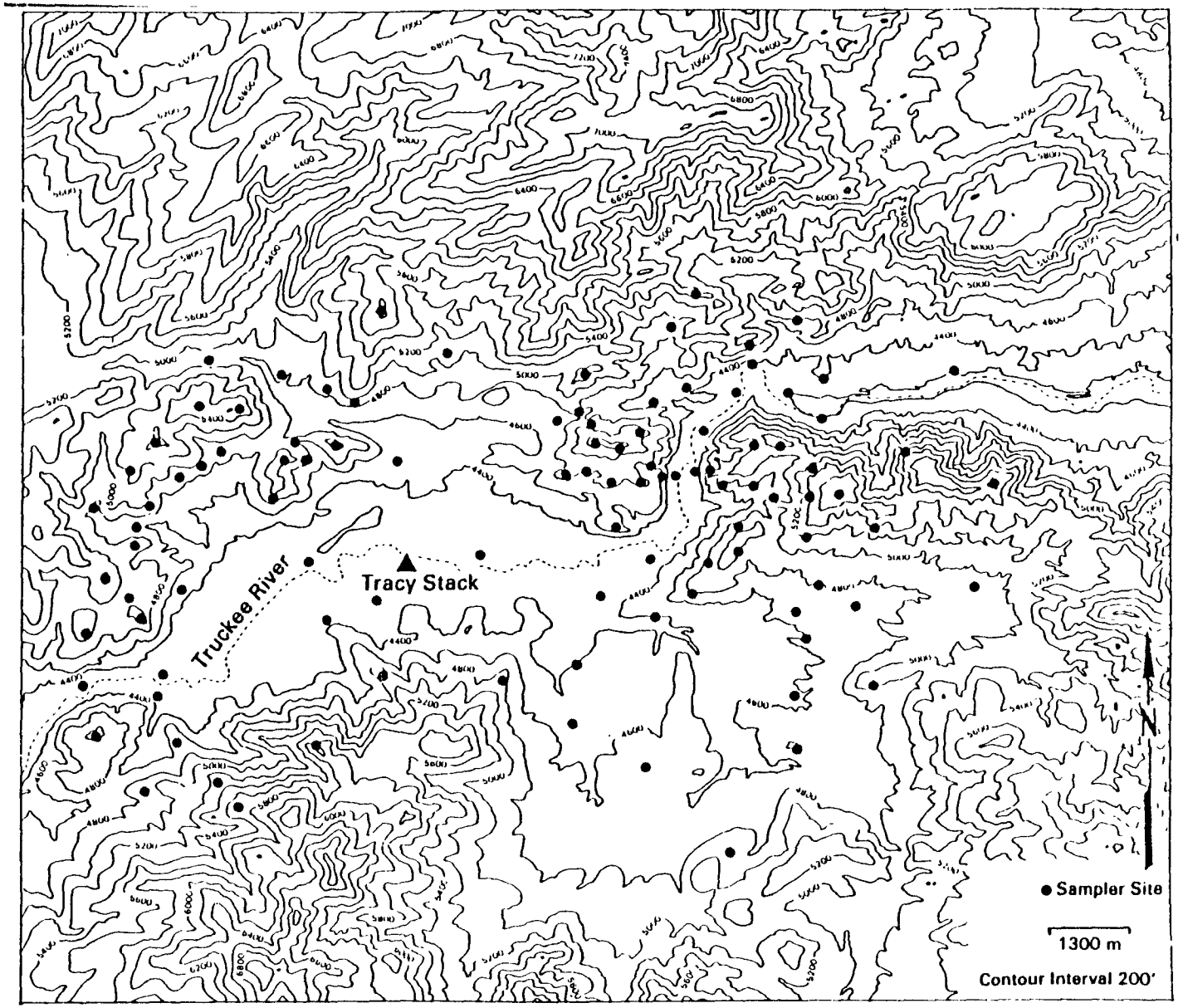

Figure 5. FSPS tracer gas sampler locations (From DiCristofaro et al., 1985)

6.2 TRACER GAS DATA TAPE FILES

Tracer concentration data are contained on the FSPS data base tape on files 57 to 84. Files 57 to 70 are hourly concentrations of SF6 for experiments 1 to 14, one file per experiment, and files 71 to 84 have hourly concentrations for CF3Br tracer for experiments 1 to 14. Each record in the tracer gas data tape files, besides the hourly concentration, lists the sampler identification, date and time of observation, a data quality flag, and the X and Y coordinates of the sampler and the elevation with the base of the Tracy stack as origin and datum. Time of observation refers to the hour ending the 1-hour sampling period.

Data quality flags are as follows:

G - good data

O - sampler off in time by more than 10 minutes

S - security seals broken

L - low bags

T - bag sampling time of 10-minute interval rather than 60 minutes

C - clock erratic

D - bad value as determined by the QA officer

6.2.1 Tracer Gas Data Tape File Records

Six alphabetic header records precede the data records. The first five identify the file and experiment and the sixth provides column headings. Each data record has the detected tracer concentration for a single sampler for one hour along with the coordinates and elevation of the sampler. Table 32 illustrates the arrangement of data fields in files 57 to 84.

TABLE 32. TRACER CONCENTRATION RECORDS FORMAT

Position	Contents	Format
1 to 3	Sampler ID	I3
4 to 6	Gas	A3
7 to 10	Year	I4
11 to 14	Julian day	I4
15 to 17	Hour ending, PDT	I3
18 to 23	Seconds	I6
29 to 35	Concentration, Chi/Q (ns/m3)	F7.0
36 to 38	Data flag	A3
45 to 54	X-coordinate, m	F10.3
55 to 64	Y-coordinate, m	F10.3
65 to 74	Z-elevation, m	F10.3

Table 33 is a sample printout of file 57, the first file of SF6 concentrations from experiment number 1.

TABLE 33. FILE NUMBER 57: TRACER GAS CONCENTRATION DATA SAMPLE PRINTOUT

FULL SCALE PLUME STUDY - TRACY POWER PLANT, NEVADA
AUGUST 6 - 27, 1984
SF6 AND CF3BR TRACER GAS FILES
EXP# 1

SMP ID	GAS	YR	JDY	HR	SEC	CHI/Q NS/M3	FLG	#	X,Y ORIGIN TRACY STACK; Z DATUM 1300.2M MSL X	Y	Z
21	SF6	1984	219	4	0	12.	G	0	9006.250	2966.330	-20.060
22	SF6	1984	219	4	0	12.	G	0	8127.391	1813.710	274.080
42	SF6	1984	219	4	0	12.	G	0	9561.820	-399.080	218.160
121	SF6	1984	219	4	0	19.	G	0	7098.051	2837.580	-.720
122	SF6	1984	219	4	0	12.	G	0	6340.730	2788.670	-15.680
123	SF6	1984	219	4	0	12.	G	0	7043.719	2369.110	-22.070
124	SF6	1984	219	4	0	705.	G	0	6095.500	1994.680	308.180
131	SF6	1984	219	4	0	77.	G	0	6651.109	1620.140	266.710
132	SF6	1984	219	4	0	132.	G	0	6136.422	1145.080	158.620
134	SF6	1984	219	4	0	43.	G	0	7166.559	1026.340	451.310
135	SF6	1984	219	4	0	390.	G	0	6469.609	441.060	280.100
136	SF6	1984	219	4	0	157.	G	0	7732.590	557.000	356.590
142	SF6	1984	219	4	0	28.	G	0	6503.609	-468.460	153.100
143	SF6	1984	219	4	0	12.	G	0	7532.570	-567.690	151.790
144	SF6	1984	219	4	0	12.	G	0	6517.609	-1128.120	103.220
151	SF6	1984	219	4	0	12.	G	0	6238.930	-2291.770	99.210
152	SF6	1984	219	4	0	12.	G	0	7519.031	-2020.340	255.160
153	SF6	1984	219	4	0	12.	G	0	6384.129	-2964.760	172.340
211	SF6	1984	219	4	0	12.	G	0	4870.961	4297.352	341.950
213	SF6	1984	219	4	0	41.	G	0	4343.828	3967.860	203.490
215	SF6	1984	219	4	0	143.	G	0	5693.820	3588.370	236.930
221	SF6	1984	219	4	0	12.	G	0	5553.898	3126.910	-2.800
222	SF6	1984	219	4	0	193.	G	0	4479.699	2739.790	53.700
223	SF6	1984	219	4	0	12.	G	0	5461.910	2889.500	-7.390
224	SF6	1984	219	4	0	25.	G	0	4980.180	2235.350	-15.100
225	SF6	1984	219	4	0	575.	G	0	5838.980	2538.870	79.000
226	SF6	1984	219	4	0	569.	G	0	5357.430	1754.180	129.880
231	SF6	1984	219	4	0	83.	G	0	4538.770	1627.800	-5.050
232	SF6	1984	219	4	0	166.	G	0	4769.449	1528.550	-13.280
233	SF6	1984	219	4	0	24.	G	0	4841.789	1524.760	20.240
235	SF6	1984	219	4	0	18.	G	0	5734.012	1249.170	164.060
236	SF6	1984	219	4	0	607.	G	0	5357.840	621.820	164.890
241	SF6	1984	219	4	0	313.	G	0	5001.520	54.130	170.810
242	SF6	1984	219	4	0	85.	G	0	4612.410	-362.190	157.380

SECTION 7

FSPS 10-M TOWER DATA

7.1 10-M TOWER METEOROLOGICAL DATA

Four 10-m towers were installed in the terrain surrounding the Tracy stack, figure 4. Tower 1 was located on a hill top to the northwest of the stack, tower 2 on Beacon Hill, tower 3 at the foot of Target Mountain, and tower 4 at the head of Target Mountain Draw. Table 34 shows the instrumentation and measures observed on the 10-m towers. Measures are defined as the same as those on the 150-m tower, table 26, with the addition of SDT, standard deviation of temperature, and SDD, standard deviation of temperature change. Measures are averaged at 5-minute intervals for towers 1, 2, and 3, but at 2-minute intervals at tower 4.

TABLE 34. 10-M TOWER INSTRUMENTATION AND MEASURES

Site	Instrumentation	Direct Measure	Derived Measure
Tower 1 (Tower base = 1512 m)			
Level 1 (10-m)	cup-and-vane RTD	DCS,SDS T	DCS,SDR,SDT
Tower 2 (Tower base = 1598 m)			
Level 1 (10-m)	cup-and-vane RTD	SCS,SDS T	DCS,SDR,SDT
Tower 3 (Tower base = 1401 m)			
Level 1 (10-m)	cup-and-vane RDT	DCS,SDS T	DCS,SDR,SDT
Tower 4 (Tower base = 1451 m)			
Level 1 (1-m)	cup-and-vane RDT	DCS,SDS TD	SDD
Level 2 (10-m)	cup-and-vane RDT	DCS,SDS T	

7.2 10-M TOWER METEOROLOGICAL DATA TAPE FILES

Data are stored in files 85 to 92 on the FSPS data base magnetic tape. Files 85 to 87 have 5-minute values from towers 1, 2 and 3; files 88 to 90 have 1-hour averages from tower 1, 2 and 3. File 91 has 2-minute averages from tower 4, and file 92 holds 1-hour averages from tower 4.

7.2.1 10-m Tower Tape File Records

Six alphabetic header records precede the data records to identify the date and time and to place column headings. Table 33 indicates the arrangement of data fields in the data records for files 85 to 92.

TABLE 35. 10-M TOWER DATA RECORDS FORMAT

Position	Contents	Format
1 to 2	Year	I2
3 to 4	Month	I2
5 to 6	Day	I2
7 to 8	Hour, PDT	I2
9 to 10	Minute	I2
11 to 12	Second	I2
15 to 21	SCS, Scalar avg. speed - cups, m/s	F7.3
22	Flag	A1
24 to 30	DCS, Scalar avg. dir - vane, deg	F7.3
31	Flag	A1
33 to 39	T, temperature, C	F7.3
40	Flag	A1
42 to 48	SDS, Standard dev. speed - cups, m/s .3	F7
49	Flag	A1
51 to 57	SDR, Standard dev. dir - vane, deg	F7.3
58	Flag	A1
60 to 66	SDT, standard deviation of T, C	F7.3
67	Flag	A1

Table 36 is a sample printout of file 85, data from tower 1.

TABLE 36, FILE NUMBER 85: 10-M TOWER DATA
SAMPLE PRINTOUT

FULL SCALE PLUME STUDY - TRACY POWER PLANT, NEVADA
AUGUST 6 - 27, 1984
10-M TOWER 1; 5-MIN VALUES

YYMMDDHHMMSS	SCS 10 M	DCS 10 M	T 10 M	SDS 10 M	SDR 10 M	SDT 10 M
TOWER	1	1	1	1	1	1
84 8 6 3 5 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 310 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 315 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 320 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 325 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 330 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 335 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 340 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 345 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 350 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 355 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 4 0 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 4 5 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 410 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 415 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 420 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 425 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 430 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 435 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 440 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 445 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 450 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 455 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 5 0 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 5 5 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 510 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 515 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 520 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 525 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 530 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 535 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 540 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 545 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M
84 8 6 550 0	99.900M	999.000M	99.900M	99.990M	999.900M	9.990M

SECTION 8

FSPS 150-M TOWER SONIC ANEMOMETER DATA

8.1 SONIC ANEMOMETER SYSTEM

Sonic anemometer systems, comprising U,V,W components and very fast temperature (T) response platinum wire thermistors, were installed by WPL and ERT at the 10, 100, and 150 m levels on the 150-m tower. These instruments were sampled 20 times per second. Vector resultant wind speeds (WS) and directions (WD) and alongwind, crosswind, and vertical turbulence intensities (SU,SV,SW), were calculated for 5-minute and 1-hour averaging periods. Additional flow parameters, including correlation of prop speed (U) and W-component (UW), corrrelation between V-component and W-component (VW), vertical temperature flux (WT), and standard deviation of fast temperature response (ST), were calculated as well. WPL was responsible for collection and archival of all sonic data. Formulae used to compute UW, VW and WT are as follows;

Correlation between prop speed and W-component

$$UW = \frac{1}{N} \left[\Sigma(w\ \mathrm{SQRT}(u^2+v^2)) - \frac{1}{N}\ \Sigma\ \mathrm{SQRT}(u^2+v^2)\Sigma w\right]$$

Correlation between V-component and W-component

$$VW = \frac{1}{N} \left(\Sigma vw - \frac{1}{N}\ \Sigma w \Sigma v\right)$$

Vertical Temperature flux

$$WT = \frac{1}{N} \left(\Sigma wt - \frac{1}{N}\ \Sigma w \Sigma t\right)$$

Standard Deviation of T

$$ST = SQRT\ [\frac{1}{N}\ (\Sigma T^2 - \frac{1}{N}\ (\Sigma T)^2]$$

8.2 SONIC ANEMOMETER DATA TAPE FILES

Data recorded on the sonic anemometer system are contained on the FSPS magnetic tape data base on files number 93 to 98. Files 93 to 95 hold 5-minute averages, and files 96 to 98 have 1-hour averages. Each file has data from one of the three levels on the 150-m tower. Ten parameters, WS,WD,U,V,W,SU, SV,SW,ST,UW, are listed in order for all observations, followed by three parameters, VW, WT and T.

8.2.1 Sonic Anemometer Tape File Records

Eight header records precede the data records to identify the files and present column headings. Six alphabetic header records serve to separate and introduce data records of the following last three parameters, VW, WT and T. Table 37 shows the arrangement of data fields in the data records for files 93 to 98.

TABLE 37. SONIC DATA RECORDS FORMAT

Position	Contents	Format
1 to 2	Year	I2
3 to 4	Month	I2
5 to 6	Day	I2
7 to 8	Hour, PDT	I2
9 to 10	Minute	I2
11 to 12	Seconds	I2
13 to 17	Time of running, Min.sec	F5.1
20 to 26	WS, Vector resultant spd., m/s or VW, Correlation of V&W, (m/s)2	F7.3
29 to 35	WD, Vector resultant dir., deg or WT, Vertical temperature flux., m/s C	F7.3
38 to 44	U, Westerly wind component, m/s or T, Fast response temperature, C	F7.3
47 to 53	V, Southerly wind component, m/s	F7.3
56 to 62	W, Vertical wind component, m/s	F7.3
65 to 71	SU, Alongwind measure of turbulence, %	F7.3
74 to 80	SV, Crosswind measure of turbulence, %	F7.3
89 to 98	SW, Vertical measure of turbulence, %	F7.3
101 to 107	UW, Correlation between U&W, (m/s)2	F7.3

Table 38 is a sample printout of file 93, sonic data from the 10-m level from the 150-m tower, 5-minute averages.

TABLE 38. FILE NUMBER 94: SONIC ANEMOMETER DATA SAMPLE PRINTOUT

FULL SCALE PLUME STUDY - TRACY POWER PLANT, NEVADA
AUGUST 6 - 27, 1984
150-M TOWER SONIC DATA; 5-MIN VALUES

YYMMDDHHMMSS	WS	WD	U	V	W	SU	SV	SW	ST	UW
	100 M	100 M	100 M	100 M	100 M	100 M	100 M	100 M	100 M	100 M
84 8 6 220 0 5.0	.830	225.000	.590	.590	-.270	.350	.430	.201	.184	.009
84 8 6 225 0 5.0	1.470	118.800	-1.290	.710	-.220	.438	.259	.363	.204	.061
84 8 6 230 0 5.0	1.910	116.000	-1.720	.840	-.080	.528	.348	.161	.153	.008
84 8 6 235 0 5.0	2.260	111.300	-2.110	.820	-.100	.223	.140	.163	.157	.002
84 8 6 240 0 5.0	1.950	116.300	-1.750	.870	-.050	.496	.244	.185	.186	.026
84 8 6 245 0 5.0	.850	116.700	-.760	.380	-.260	.358	.184	.136	.145	.009
84 8 6 250 0 5.0	.540	114.200	-.500	.220	-.330	.945	.299	.230	.238	.032
84 8 6 255 0 5.0	.900	113.100	-.830	.350	.230	.492	.189	.342	.194	.129
84 8 6 3 0 0 5.0	.670	115.200	-.600	.280	-.400	.436	.232	.261	.182	.037
84 8 6 3 030 .5	.920	124.500	-.760	.520	-.040	.575	.300	.142	.203	-.006
84 8 6 3 5 0 5.0	.500	3.500	-.030	-.490	-.230	.558	.323	.213	.291	-.016
84 8 6 310 0 5.0	.210	88.500	-.210	-.010	-.270	.366	.469	.192	.281	.006
84 8 6 315 0 5.0	.080	356.200	.010	-.080	-.060	.334	.191	.256	.339	.003
84 8 6 320 0 5.0	1.200	290.600	1.120	-.420	-.210	.660	.420	.324	.140	-.046
84 8 6 325 0 5.0	2.560	262.200	2.540	.350	-.170	.615	.691	.404	.171	-.036
84 8 6 330 0 5.0	4.070	247.900	3.770	1.530	-.030	.500	.289	.235	.168	-.014
84 8 6 335 0 5.0	5.100	251.900	4.850	1.580	.150	.222	.262	.238	.283	.010
84 8 6 340 0 5.0	3.020	282.400	2.950	-.650	-.160	.628	.778	.315	.387	-.015
84 8 6 345 0 5.0	2.390	294.000	2.190	-.970	-.070	.292	.470	.293	.418	-.005
84 8 6 350 0 5.0	2.480	275.000	2.470	-.220	.040	.446	.594	.226	.132	.035
84 8 6 355 0 5.0	3.300	251.600	3.130	1.040	-.080	.517	.445	.341	.416	-.008
84 8 6 4 5 0 5.0	2.440	197.200	.720	2.330	-.040	.495	.783	.408	.218	-.005
84 8 6 410 0 5.0	2.440	167.900	-.510	2.390	.140	.465	.768	.396	.243	.026
84 8 6 415 0 5.0	2.050	171.500	-.300	2.030	-.300	.812	1.140	.682	.357	.000
84 8 6 420 0 5.0	1.410	136.300	-.980	1.020	.130	.594	.913	.416	.245	.064
84 8 6 425 0 5.0	.460	101.500	-.450	.090	.010	.691	.647	.272	.175	-.046
84 8 6 430 0 5.0	.570	314.900	.400	-.400	.040	.384	.300	.304	.123	.047
84 8 6 435 0 5.0	1.530	317.500	1.030	-1.130	-.200	.187	.159	.134	.102	.009
84 8 6 440 0 5.0	1.730	327.100	.940	-1.450	-.110	.316	.236	.154	.111	.001
84 8 6 445 0 5.0	1.950	318.800	1.280	-1.460	-.010	.205	.448	.142	.118	-.008
84 8 6 450 0 5.0	1.820	306.300	1.460	-1.080	-.020	.133	.358	.118	.137	.004
84 8 6 455 0 5.0	2.010	288.900	1.900	-.650	-.050	.308	.340	.079	.237	.004
84 8 6 5 0 0 5.0	2.550	260.700	2.520	.410	-.010	.341	.287	.195	.111	.001

SECTION 9

FSPS DOPPLER ACOUSTIC SOUNDER DATA

9.1 DOPPLER ACOUSTIC SOUNDER SYSTEMS

WPL installed two doppler acoustic sounding systems that provided data for the FSPS data base. One system was a few hundred yards west of the Tracy stack, and the other was located at the east end of the valley near the Eagle Pitcher Industries, Inc. plant. Profiles of wind speed and direction were taken at 25 m levels from 50 m to 400 m above the ground. Each sounder was mini-computer based with digital output of 20-minute profiles.

9.2 DOPPLER ACOUSTIC SOUNDER DATA TAPE FILES

Data are stored in files 99 and 100 on the FSPS data base tape. File 99 hold data from the Tracy stack sounder and file 100 refers to data from the Eagle Pitcher sounder. Each file has wind speed (WS) and wind direction (WD) listed in three groups of five 25 m levels from 50 m to 400 m. Quality flags are appended to each data field as;

blank - good data

B - bad value

M - missing data

F - instrument failure

9.2.1 Doppler Acoustic Tape File Records

Eight alphabetic header records precede each set of data records to

identify the date and time and to place column headings. The appearance of alphabetic header records separate the three groups of data levels. Table 39 indicates the arrangement of data fields in the data records for files 99 and 100.

TABLE 39. DOPPLER ACOUSTIC SOUNDER RECORDS FORMAT

Position	Contents	Format
1 to 2	Year	I2
3 to 4	Month	I2
5 to 6	Day	I2
7 to 8	Hour, PDT	I2
9 to 10	Minute	I2
11 to 12	Second	I2
13 to 15	Time of profile, minutes	I3
18 to 24	Wind speed, m/s; 50, 175, 300 m	F7.3
25	Flag	A1
27 to 33	Wind direction, deg; 50, 175, 300 m	F7.3
34	Flag	A1
36 to 42	Wind speed, m/s; 75, 200, 325 m	F7.3
43	Flag	A1
45 to 52	Wind direction, deg; 75, 200, 325 m	F7.3
53	Flag	A1
54 to 60	Wind speed, m/s; 100, 225, 350 m	F7.3
61	Flag	A1
63 to 69	Wind direction, deg; 100, 225, 350 m	F7.3
70	Flag	A1
72 to 78	Wind speed, m/s; 125, 250, 375 m	F7.3
79	Flag	A1

(Continued)

TABLE 39. DOPPLER ACOUSTIC SOUNDER RECORDS FORMAT (Continued)

Position	Contents	Format
81 to 87	Wind direction, deg; 125, 250, 375 m	F7.3
88	Flag	A1
90 to 96	Wind speed, m/s; 150, 275, 400 m	F7.3
97	Flag	A1
99 to 105	Wind direction, deg; 150, 275, 400 m	F7.3
106	Flag	A1

Table 40 is a sample printout of file 99, data from the doppler acoustic sounder at the Tracy stack.

TABLE 40. FILE NUMBER 99: DOPPLER ACOUSTIC SOUNDER DATA SAMPLE PRINTOUT

FULL SCALE PLUME STUDY - TRACY POWER PLANT, NEVADA
AUGUST 6 - 27, 1984
TRACY STACK SODAR DATA

YYMMDDHHMMSS	WS 50 M	WD 50 M	WS 75 M	WD 75 M	WS 100 M	WD 100 M	WS 125 M	WD 125 M	WS 150 M	WD 150 M
84 8 6 150 0 10	3.200	239.000	2.900	246.000	2.400	251.000	2.000	262.000	1.600	280.000
84 8 6 2 0 0 10	3.800	242.000	3.600	251.000	3.000	258.000	2.300	256.000	2.000	255.000
84 8 6 210 0 10	3.300	247.000	3.200	259.000	2.900	266.000	2.600	271.000	2.500	279.000
84 8 6 220 0 10	4.200	256.000	3.800	257.000	3.200	258.000	2.700	263.000	1.900	270.000
84 8 6 230 0 10	1.400	243.000	3.600	257.000	4.600	266.000	4.200	270.000	3.400	281.000
84 8 6 240 0 10	3.200	270.000	4.800	260.000	5.300	260.000	5.000	260.000	4.500	265.000
84 8 6 310 0 10	.400	326.000	1.300	268.000	2.700	247.000	4.000	248.000	4.200	256.000
84 8 6 320 0 10	2.600	232.000	3.800	241.000	4.600	248.000	4.600	252.000	4.000	251.000
84 8 6 330 0 10	2.300	242.000	3.400	246.000	3.700	257.000	3.800	260.000	3.300	261.000
84 8 6 340 0 10	3.800	256.000	3.500	263.000	2.900	269.000	3.200	263.000	3.500	266.000
84 8 6 350 0 10	5.400	252.000	4.000	255.000	4.100	258.000	4.300	259.000	3.800	255.000
84 8 6 4 0 0 10	7.700	257.000	7.200	262.000	5.800	270.000	5.100	276.000	4.600	278.000
84 8 6 410 0 10	2.700	252.000	4.900	263.000	6.400	268.000	6.500	272.000	5.700	276.000
84 8 6 420 0 10	1.900	310.000	3.500	278.000	4.600	267.000	4.800	267.000	4.900	271.000
84 8 6 430 0 10	1.200	6.000	.800	293.000	1.600	235.000	2.600	234.000	3.400	243.000
84 8 6 440 0 10	1.000	69.000	.600	122.000	1.000	197.000	2.000	228.000	3.000	241.000
84 8 6 450 0 10	.700	9.000	.700	318.000	1.200	272.000	1.700	268.000	2.600	267.000
84 8 6 520 0 20	1.400	240.000	1.200	242.000	.800	257.000	1.200	274.000	1.800	277.000
84 8 6 540 0 20	1.700	265.000	2.300	255.000	2.200	254.000	1.400	253.000	1.000	268.000
84 8 6 6 0 0 20	.200	37.000	1.300	252.000	2.600	251.000	2.800	256.000	1.900	267.000
84 8 6 620 0 20	.800	11.000	.800	317.000	1.400	269.000	2.000	256.000	2.500	261.000
84 8 6 640 0 20	.500	347.000	1.600	268.000	2.700	263.000	3.200	263.000	3.600	266.000
84 8 6 7 0 0 20	.900	89.000	.300	28.000	.800	280.000	1.500	252.000	2.200	250.000
84 8 6 720 0 20	.500	69.000	.200	181.000	1.100	219.000	1.900	240.000	2.700	249.000
84 8 6 740 0 20	1.300	48.000	.600	31.000	.500	271.000	.800	231.000	.900	217.000
84 8 6 8 0 0 20	.300	261.000	.400	254.000	.600	253.000	.200	270.000	-9.900B	999.000B
84 8 6 820 0 20	1.200	257.000	1.500	256.000	1.700	259.000	2.100	265.000	2.400	273.000
84 8 6 840 0 20	2.100	276.000	2.000	280.000	2.000	282.000	2.000	281.000	1.900	276.000
84 8 6 9 0 0 20	2.000	313.000	2.200	308.000	2.100	305.000	1.700	306.000	1.300	304.000
84 8 6 920 0 20	.600	345.000	.600	338.000	.400	323.000	.300	289.000	.500	215.000
84 8 6 940 0 20	1.400	319.000	1.300	316.000	.900	316.000	.300	302.000	.300	200.000
84 8 610 0 0 20	.600	83.000	1.000	134.000	1.300	143.000	1.300	137.000	1.100	130.000
84 8 61020 0 20	.800	15.000	.600	29.000	.400	81.000	.600	111.000	1.000	131.000

SECTION 10

RADAR WIND DATA

10.1 RADAR WIND SYSTEMS

ARLFRD operated two radar-tracked balloon (RABAL) systems north, site R-4, and west, site R-2, of the Tracy stack. Wind profiles were obtained up to 2,000 meters altitude. The radars used were Western Electric model M33 automatic tracking radars with 30 gram pilot balloons and foil targets. RABAL information consisted of 15 minute data collection periods with collection points acquired every 10 seconds, scheduled at 30-minute intervals throughout the 14 experiments.

10.2 RADAR WIND DATA TAPE FILES

Data are stored on files 101 to 113 for site R-2, and files 114 to 125 for site R-4. Each file holds data from one experiment. Experiment 7 is missing from site R-2, and experiments 1 and 2 are missing at site R-4. Each file presents values of wind speed and direction and altitude at 10-second intervals. Quality flags are appended next to data fields as;

blank - good data

B - bad point

M - missing data

F - error on adjacent point

R - estimated ascent rate, range error

10.2.1 Radar Wind Tape File Records

Four alphabetic header records precede the data records. Table 41 indicates the arrangement of data fields in the data records for files 101 to 125.

TABLE 41. RADAR WIND DATA RECORDS FORMAT

Position	Contents	Format
1 to 2	Year	I2
3 to 4	Month	I2
5 to 6	Day	I2
7 to 8	Hour, PDT	I2
9 to 10	Minute	I2
11 to 12	Second	I2
13 to 16	Observation number	I4
17 to 23	Minutes elapsed	F7.3
25 to 31	Height above stack base, m	F7.1
34 to 40	Wind speed, m/s	F7.3
41	Flag	A1
43 to 49	Wind direction, deg	F7.3
50	Flag	A1

Table 42 is a sample printout from the first file of RABAL data, file number 101.

TABLE 42. FILE NUMBER 101: RADAR WIND DATA SAMPLE PRINTOUT

FULL SCALE PLUME STUDY - TRACY POWER PLANT, NEVADA
AUGUST 6 - 27, 1984
EXP # 1 RADAR WINDS - RABAL #2

YYMMDDHHMMSS	OB	MIN	HT(M)	WS	WD
84 8 6 32945	1	.167	76.3	.000	.000
84 8 6 32945	2	.333	110.3	2.467	267.700
84 8 6 32945	3	.500	141.9	2.215	260.100
84 8 6 32945	4	.667	176.4	1.740	261.600
84 8 6 32945	5	.833	204.1	1.328	266.700
84 8 6 32945	6	1.000	231.4	.935	287.400
84 8 6 32945	7	1.167	257.4	.920	327.900
84 8 6 32945	8	1.333	282.3	1.205	347.500
84 8 6 32945	9	1.500	311.6	1.448	352.100
84 8 6 32945	10	1.667	339.5	1.652	350.900
84 8 6 32945	11	1.833	369.8	1.860	345.000
84 8 6 32945	12	2.000	407.2	2.222	336.600
84 8 6 32945	13	2.167	436.7	2.701	329.900
84 8 6 32945	14	2.333	473.5	3.173	326.300
84 8 6 32945	15	2.500	496.8	3.615	325.300
84 8 6 32945	16	2.667	521.9	3.984	325.400
84 8 6 32945	17	2.833	546.7	4.182	325.700
84 8 6 32945	18	3.000	569.5	4.299	326.000
84 8 6 32945	19	3.167	594.8	4.384	324.700
84 8 6 32945	20	3.333	620.4	4.375	322.400
84 8 6 32945	21	3.500	647.8	4.310	319.900
84 8 6 32945	22	3.667	678.6	4.201	316.700
84 8 6 32945	23	3.833	708.5	3.992	313.400
84 8 6 32945	24	4.000	737.2	3.688	310.800
84 8 6 32945	25	4.167	769.5	3.370	308.100
84 8 6 32945	26	4.333	803.8	2.984	303.500
84 8 6 32945	27	4.500	837.1	2.599	297.400
84 8 6 32945	28	4.667	868.6	2.383	290.400
84 8 6 32945	29	4.833	896.6	2.284	282.600
84 8 6 32945	30	5.000	934.5	2.244	271.800
84 8 6 32945	31	5.167	960.8	2.479	260.200
84 8 6 32945	32	5.333	995.7	2.931	249.900
84 8 6 32945	33	5.500	1035.3	3.637	240.400
84 8 6 32945	34	5.667	1074.7	4.584	234.700
84 8 6 32945	35	5.833	1107.0	5.597	232.100
84 8 6 32945	36	6.000	1143.8	6.517	230.700

SECTION 11

FSPS TETHERSONDE DATA

11.1 FSPS TETHERSONDE SYSTEMS

Two tethersondes manufactured by A.I.R., Inc. were flown during the FSPS experiments, one operated by ARLFRD about 0.8m 50 west of the Tracy stack and one operated by WPL next to the 150-m tower. ARLFRD elected to delete the tethersonde data from the FSPS tape archive when data quality proved unreliable, so only WPL's data are available.

Tethersondes were flown to give wind and temperature profiles near the 150-m tower to complement both the tower's values and the doppler acoustic sounder's data recorded nearby. Parameters recorded include, date, time, balloon elevation, pressure, temperature, relative humidity, mixing ratio, wind speed and wind direction and potential temperature. Relative humidity and mixing ratios were calculated from wet bulb measures. Tethersonde operations were coincident with tracer releases for each experiment, and were taken at a frequency intended to define variability in the atmospheric structure during the experiment. Table 43 lists the parameter specifications of the instruments employed.

TABLE 43. A.I.R.-3A TETHERSONDE SPECIFICATIONS

Parameter	Range and Accuracy
Temperature	+50 C to -80 C +- 0.2 C
Wet/Dry Bulb Match	+35 C to 20 C +-0.1 C
Pressure	1050 to 600 mb +- 1.0 mb
Wind speed	0 to 20 m/s +-0.2 m/s
Wind direction	0 to 360 deg +-5 deg

11.2 TETHERSONDE DATA TAPE FILES

WPL tethersonde data are stored on files 126 to 139 on the FSPS magnetic tape archive. There are 14 files, one file for each experiment. Each data record represents one level of ascent or descent taken about 1-m intervals of balloon altitude.

11.2.1 Tethersonde Tape File Records

Five alphabetic header records precede the data records to identify the experiment and place column headings. Table 44 shows the aggangement of data fields in data records for files 126 to 139.

TABLE 44. TETHERSONDE DATA RECORDS FORMAT

Position	Contents	Format
2 to 3	Month	I2
4 to 5	Day	I2
6 to 7	Year	I2
8 to 10	Hour, PDT	I3
11 to 12	Minute	I2
13 to 14	Second	I2
16 to 21	Barometric pressure, mbs	F6.1
23 to 27	Altitude, m	F5.1
29 to 34	Temperature, C	F6.2
37 to 40	Relative humidity, %	F4.1
42 to 45	Mixing ratio	F4.1
47 to 51	Wind direction, deg	F5.1
53 to 57	Wind speed, m/s	F5.2
59 to 63	Potential temperature, K	F5.1

Table 45 is a sample printout of file 126, the first file of tethersonde data.

TABLE 45. FILE NUMBER 126: TETHERSONDE DATA SAMPLE PRINTOUT

FULL SCALE PLUME STUDY - TRACY POWER PLANT, NEVADA
AUGUST 6 - 27, 1984
EXP # 1 TETHERSONDE DATA - WPL

MODDYY	HRMMSS	PRES. (MBS)	ALT (M)	T (C)	RH (%)	M.F.	WD (DEG)	WS (M/S)	P.T. (K
80684	25231	871.4	0.0	11.56	55.7	5.5	115.1	0.78	296.1
80684	25241	871.4	0.0	11.39	56.9	5.5	108.1	0.59	296.0
80684	25250	871.4	0.0	10.90	60.1	5.6	108.4	0.49	295.5
80684	25259	871.4	0.0	10.44	62.9	5.7	113.0	0.37	295.0
80684	25308	871.4	0.0	10.12	64.0	5.7	115.4	0.51	294.6
80684	25318	871.4	0.0	9.97	64.4	5.7	115.4	0.28	294.5
80684	25327	871.4	0.0	9.62	66.1	5.7	116.2	0.25	294.1
80684	25337	871.5	-1.0	9.65	65.4	5.6	127.2	0.19	294.1
80684	25346	871.5	-1.0	9.51	65.7	5.6	144.6	0.14	294.0
80684	25355	871.4	0.0	9.41	65.9	5.6	139.7	0.05	293.9
80684	25404	871.5	-1.0	9.51	64.8	5.5	148.0	0.07	294.0
80684	25413	871.4	0.0	9.92	61.8	5.4	153.9	0.07	294.4
80684	25423	871.4	0.0	10.23	59.9	5.4	155.3	0.07	294.8
80684	25432	871.4	0.0	10.46	58.6	5.3	153.3	0.05	295.0
80684	25441	871.4	0.0	10.78	56.6	5.3	149.5	0.06	295.3
80684	25450	871.4	0.0	10.59	58.3	5.4	138.1	0.02	295.1
80684	25500	871.4	0.0	10.17	61.1	5.5	101.5	0.08	294.7
80684	25509	871.4	0.0	10.61	57.3	5.3	81.3	0.47	295.2
80684	25519	871.4	0.0	10.23	60.3	5.4	68.3	0.67	294.8
80684	25528	871.4	0.0	9.44	66.0	5.6	59.4	1.09	293.9
80684	25537	871.4	0.0	9.55	63.9	5.5	58.1	1.05	294.1
80684	25546	871.4	0.0	9.87	60.7	5.3	63.9	0.90	294.4
80684	25556	871.4	0.0	10.99	52.4	4.9	68.6	0.82	295.5
80684	25605	871.2	1.9	11.19	51.7	4.9	76.6	0.76	295.8
80684	25614	871.1	2.9	12.81	41.2	4.4	71.5	0.58	297.5
80684	25623	871.0	3.8	13.60	37.6	4.2	65.8	0.33	298.3
80684	25633	870.9	4.8	13.91	37.0	4.2	56.3	0.39	298.6
80684	25642	870.8	5.8	14.05	36.9	4.3	48.2	0.49	298.8
80684	25652	870.5	8.7	14.07	37.3	4.3	43.0	0.57	298.8
80684	25701	870.5	8.7	14.00	38.1	4.4	37.9	0.65	298.8
80684	25710	870.2	11.6	14.28	36.5	4.3	29.5	0.81	299.1
80684	25719	869.9	14.5	14.80	33.2	4.0	17.0	1.17	299.7
80684	25729	869.7	16.4	15.20	31.3	3.9	1.6	1.29	300.1
80684	25738	869.5	18.4	15.50	30.3	3.8	357.8	0.94	300.4
80684	25747	869.4	19.4	15.68	30.0	3.8	352.3	0.81	300.6

SECTION 12

FSPS ELECTRONIC WEATHER STATION DATA

12.1 ELECTRONIC WEATHER STATIONS

Two electronic weather stations were installed on the north slope of Target Mountain facing the Truckee River Valley. These locations differed from sites in the preliminary FSPS where the electronic weather stations were positioned in Target Mountain draw, on the west slope. The upper station is at 1399 m msl and the lower at 1326 m. Wind and temperature measures are taken on a 1.5-m mast, and averaged at 1-hour intervals.

12.2 ELECTRONIC WEATHER STATIONS DATA TAPE FILE

Data from the electronic weather stations are stored on file 140, the last file in the FSPS tape archive. Hourly data from both stations are stored side by side beginning on August 9, experiment 3, to the end of FSPS, August 27, 1984.

12.2.1 Electronic Weather Station Data Tape File

Eight header records begin each day's data to identify the date and time and to head the following data records. Table 46 identifies the data fields in the data records.

TABLE 46. ELECTRONIC WEATHER STATIONS DATA RECORDS FORMAT

Position	Contents	Format
9 to 10	Month	I2
11 to 12	Day	I2
13 to 14	Year	I2
17 to 18	Hour, PST	I2
20 to 21	Minute	I2
26 to 29	Upper station, Wind direction, deg	F4.0
35 to 38	" " Wind speed, m/s	F4.1
44 to 47	" " Temperature, C	F4.1
58 to 61	Lower station, Wind direction, deg	F4.0
67 to 70	" " Wind speed, m/s	F4.1
76 to 79	" " Temperature, C	F4.1

Table 47 is a sample printout of file 140.

TABLE 47. FILE NUMBER 140: ELECTRONIC WEATHER STATION DATA SAMPLE PRINTOUT

EPA COMPLEX TERRAIN EXPERIMENT
AUGUST 9TH THROUGH 27TH, 1984
----------EWS DATA----------

		----------UPPER----------			----------LOWER----------		
MODYYR	HOUR ENDG. (PST)	WIND DIRECTION (DEGREES)	WIND SPEED (MPS)	TEMP. (DEG C)	WIND DIRECTION (DEGREES)	WIND SPEED (MPS)	TEMP. (DEG C
80984	1:00	999.	99.9	99.9	999.	99.9	99.9
80984	2:00	999.	99.9	99.9	999.	99.9	99.9
80984	3:00	999.	99.9	99.9	999.	99.9	99.9
80984	4:00	999.	99.9	99.9	999.	99.9	99.9
80984	5:00	999.	99.9	99.9	999.	99.9	99.9
80984	6:00	999.	99.9	99.9	999.	99.9	99.9
80984	7:00	999.	99.9	99.9	999.	99.9	99.9
80984	8:00	999.	99.9	99.9	999.	99.9	99.9
80984	9:00	216.	.4	25.0	234.	.4	25.6
80984	10:00	216.	.4	28.9	270.	.4	29.4
80984	11:00	216.	.4	32.2	297.	.9	32.8
80984	12:00	234.	1.3	34.4	297.	.9	35.0
80984	13:00	207.	1.8	35.6	288.	1.8	35.6
80984	14:00	245.	1.3	35.0	286.	1.8	35.6
80984	15:00	207.	2.7	33.3	288.	4.0	33.3
80984	16:00	248.	.9	35.6	360.	1.3	35.6
80984	17:00	252.	.9	35.6	252.	.9	36.7
80984	18:00	225.	1.8	33.3	288.	1.8	33.3
80984	19:00	201.	2.2	32.8	279.	3.1	32.8
80984	20:00	201.	1.8	31.7	279.	2.7	31.7
80984	21:00	201.	2.7	30.0	279.	3.6	30.6
80984	22:00	213.	2.7	29.4	279.	3.1	29.4
80984	23:00	225.	1.3	28.3	288.	1.8	27.8
80984	24:00	285.	.9	27.8	216.	.9	26.7

EPA COMPLEX TERRAIN EXPERIMENT
AUGUST 9TH THROUGH 27TH, 1984
----------EWS DATA----------

		----------UPPER----------			----------LOWER----------		
MODYYR	HOUR ENDG. (PST)	WIND DIRECTION (DEGREES)	WIND SPEED (MPS)	TEMP. (DEG C)	WIND DIRECTION (DEGREES)	WIND SPEED (MPS)	TEMP. (DEG C

SECTION 13

SUMMARY

13.1 FSPS DATA BASE TAPE INDEX

Table 48 is a listing of file numbers in the FSPS data base tape 007654, with identification of contents. Anyone intending to use the data base can inspect table 48 and determine what data are available and the particular files that hold the data on the FSPS tape.

TABLE 48. FSPS DATA BASE TAPE INDEX

File number	Contents
	Preliminary FSPS, Nov. 7 - 19, 1983 Files 1 - 14
1	150-m tower meteorological data
2	Sampler locations
3	SF6 tracer concentrations, week 1
4	SF6 tracer concentrations, week 2
5	Minisonde data, TDSC, week 1
6	Minisonde data, TSDR, week 1
7	Minisonde data, TDSC, week 2
8	Minisonde data, TSDR, week 2
9	10-m tower meteorological data
10	Optical crosswind anemometer data
11	Electronic Weather station data
12	Doppler acoustic sounder data
13	Tethersonde data - WPL
14	Tethersonde data - ARLFRD

(Continued)

TABLE 48. FSPS DATA BASE TAPE INDEX (Continued)

File number	Contents
	150-m tower climatological data, 1-hour avg. files 15 to 24
15	October 14 - 31, 1983
16	Nov.
17	Dec.
18	January, 1984
19	Feb.
20	Mar.
21	Apr.
22	May
23	Jun.
24	July 1 -10, 1984
	FSPS, August 6 -27, 1984; files 25 - 140
	150-m tower meteorological data, 5-min avg. files 25 to 40
25	1-m level
26	10-m "
27	10-m "
28	10-m "
29	50-m "
30	50-m "
31	75-m "
32	75-m "
33	100-m "
34	100-m "
35	100-m "
36	125-m "
37	125-m "
38	150-m "
39	150-m "
40	150-m "

TABLE 48. FSPS DATA BASE TAPE INDEX (Continued)

File number	Contents
	150-m tower, 1-hour averages files 41 to 56
41	1-m level
42	10-m "
43	10-m "
44	10-m "
45	50-m "
46	50-m "
47	75-m "
48	75-m "
49	100-m "
50	100-m "
51	100-m "
52	125-m "
53	125-m "
54	150-m "
55	150-m "
56	150-m "
	SF6 Tracer concentration data, 1-hour avg files 57 to 70
57	Exp. 1
58	2
59	3
60	4
61	5
62	6
63	7
64	8
65	9
66	10
67	11
68	12
69	13
70	14

(Continued)

TABLE 48. FSPS DATA BASE TAPE INDEX (Continued)

File number	Contents
	CF3Br Tracer concentration data, 1-hour avg. files 71 to 84
71	Exp. 1
72	2
73	3
74	4
75	5
76	6
77	7
78	8
79	9
80	10
81	11
82	12
83	13
84	14
	10-m towers 1, 2 & 3 data, 5-min avg. files 85 to 87
85	Tower 1
86	2
87	3
	10-m towers 1, 2 & 3 data, 1-hour avg. files 88 to 90
88	Tower 1
89	2
90	3
	10-m tower 4, 2-minute & 1-hour avg. files 91 to 92
91	Tower 4, 2-minute avg.
92	" 1-hour avg.
	150-m tower sonic anemomter data, 5-min avg. files 93 to 95
93	10-m level
94	100-m "
95	150-m "

(Continued)

TABLE 48. FSPS DATA BASE TAPE INDEX (Continued)

File number	Contents
	150-m tower sonic anemometer data, 1-hr avg. files 96 to 98
96	10-m level
97	100-m "
98	150-m "
	Doppler acoustic sounder data, 10-min avg. files 99 to 100
99	Tracy stack site
100	Eagle Pitcher site
	Radar wind data, Site R-2 files 101 to 113
101	Exp. 1
102	2
103	3
104	4
105	5
106	6
107	8
108	9
109	10
110	11
111	12
112	13
113	14

(Continued)

TABLE 48. FSPS DATA BASE TAPE INDEX (Continued)

File number	Contents
	Radar wind data, site R-4 files 114 to 125
114	Exp. 3
115	4
116	5
117	6
118	7
119	8
120	9
121	10
122	11
123	12
124	13
125	14
	WPL tethersonde data, 150-m tower site files 126 to 139
126	Exp. 1
127	2
128	3
129	4
130	5
131	6
132	7
133	8
134	9
135	10
136	11
137	12
138	13
139	14
	Electronic weather stations data, 1-hour avg. file 140
140	Exp. 1 to 14

13.2 LIDAR DATA

WPL operated a lidar system in the Truckee River Valley about 2.2 km east-southeast of the Tracy stack. The lidar was a yttrium-aluminum garnet (YAG) crystal doped with neodymium. It made vertical transects of the oil-fog and SF6 plume at five azimuths ranging from near the stack to the target areas to the east when the flow was from the west. When the plume blew towards the west, it was hidden from the lidar by terrain after a few kilometers, and when the plume blew towards the high terrain to the northwest, the lidar sections were almost along the axis of the smoke. A series of transects was made approximately every 5 minutes, the data being recorded on 9-track tape for later processing. From these data WPL has produced a magnetic tape archive of 2-D oil-fog plume cross-sections and plume statistics for the individual scans. This lidar data base is available in the same manner as the FSPS data base.

13.3 CONCLUSION

The lidar found the height of the SF6/oil-fog plume from the Tracy stack was often greater than the 150-m tower, and because the flow in the Truckee Valley was sheared at these elevations in very stable conditions, meteorological data relevant to the plume will have to be derived for many periods from measurements made by the WPL tethersonde, doppler acoustic sounding system and the radar wind systems. In particular, the WPL tethersonde and doppler sounder located near the 150-m tower can provide good estimates of wind speed and direction. Radar data extended the vertical range of wind observations well above plume height on a quasi-instantaneous basis and will be most useful for

evaluation of spatial variability within the valley. These considerations imply that the development of a special Modeler's Data Archive for FSPS will be more complex than those for CCB and HBR. When a Modeler's Data Archive is completed, the tape files will be appended to the FSPS data base.

The audit of the meteorological tower systems indicated that the quality of data from those instruments is excellent and no major noise problems have been discovered. The principal effort in the refinement of these data was the correction of the averaged speeds and directions from the UVW propellers for noncosine response.

All things considered, the FSPS at Tracy Power Plant developed a valuable data base of meteorological and tracer measurements under realistic operating conditions at an active power generating site. The plumes observed and the resulting tracer concentrations detected on surrounding terrain should present valuable data for testing or modifying Complex Terrain Dispersion Models.

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