WIND TUNNEL STUDY OF STACK GAS DISPERSAL AT THE AVON LAKE POWER PLANT

by

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EXECUTIVE SUMMARY

Tests were conducted in the Colorado State University Environmental and Meteorological Wind Tunnel facilities, to study the gaseous plumes released from stacks associated with the Avon Lake Power Plant of the Cleveland Electric Illuminating Company, Ohio. The tests were conducted over a model power plant to scale 1/400 including all significant structures, topography, and roughness elements in the vicinity. Effects of wind orientation, stack height, load, precipitator location, wind velocity, and stratification were established. Data obtained included photographs and color motion pictures of smoke plume trajectories and contaminant concentration downwind of the power plant at ground level sampling positions. On the basis of the experimental measurements reported herein, the following comments may be made:

Neutral Flow:

1) Stacks for Units 6, 7, 8 and 9 do not entrain directly into the building complex cavity for any wind angle, velocity, or load condition studies. Stacks for Units 1-5, being shorter, may entrain for wind velocities greater than 30 mph.

2) When the new precipitators proposed for Units 6 and 7 are elevated next to the north face of the boiler units the resulting wake adversely affects plume rise for stacks from Units 1-5, 8 and 9 for wind angles of 285° and 300° true. This position of the new precipitators also adversely affects plume rise for Units 6 and 7 for wind angles 30° and 45° true.

3) No significant reduction in ground-level concentration for the new stack proposed for Units 6-7 would be gained for neutral flow situations by increasing the height from 500 to 600 ft.

4) Concentration measurements show that maximum ground-level concentrations will result from Unit 8 at full load for onshore wind flow. However, similar concentration levels are also reached by the effluent from Unit 9. Ground concentrations for Units 6-7 reach maximum concentrations for full load, high wind (>30 mph), onshore wind angle conditions.

Onshore Breeze with Stably Stratified Flow

5) Plumes from all stacks are entrained into the low-level mixing layer as it grows over the land. This results in greater ground-level concentrations for each stack than found in the equivalent neutral situation. The result is most severe for plumes released from the shorter stack heights.

6) The highest ground-level concentration for any stack during the stratified condition is three times greater than the worst neutral flow situation.

7) For Units 6-7 high vertical-mixing rates may increase ground-level concentrations six times over the worst neutral condition. This statement must be tempered by the realization that the neutral maximum is itself not very large.

8) Increasing the stack height for Units 6 and 7 from 500 to 600 ft reduces the ground-level concentration maximum by only one-third.

This report is supplemented by a motion picture (in color) which shows the plume behavior for all stacks for all operating levels, wind directions and meteorological conditions investigated during the course of this study (see Table II for motion picture sequences). A set of black-and-white photographs of each plume realization further supplements the material presented in this paper.

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Symbol	Definition	
A	Area of the projection of the power station building on a plane transverse to the upstream flow direction	(L^2)
C	Entrainment parameter	(-)
C_p	Specific heat capacity	$(L^2T^{-2}\theta^{-1})$
D	Stack diameter	(L)
Fr	Froude Number $\frac{V^2}{g\frac{\Delta\rho}{\rho}D}$	(-)
g	Gravitational constant	(L/T^2)
H	Stack height	(L)
ΔH	Plume rise	(L)
HR	Heating ratio $\frac{\Delta T}{\Delta\theta}$	(-)
H	Power station effective building height	(L)
k	von Karman constant	(-)
K	Concentration isopleth	(-)
L_{MO}	Monin-Obukhov stability length	(L)
L	Reference length D_s/H_s	
M	Molecular weight	(-)
Q	Source strength	(Curies/T)
Re	Reynolds number $\frac{VL}{\nu}$	(-)
Ri	Richardson number $\frac{g\Delta TH}{T\ V^2}$	(-)
S	Stability parameter $\frac{g}{T}\ \frac{d\theta}{dz}$	$(1/T^2)$
T	Temperature	(θ)
$\Delta T, \Delta\theta$	Temperature difference across some reference distance or layer	(θ)

LIST OF SYMBOLS (Continued)

Symbol	Definition	
U_*	Friction velocity	(L/T)
V	Mean velocity	(L/T)
x,y,z	General coordinates - downwind, lateral, upwind	(L)
z_o	Surface roughness parameter	(L)

Greek Symbols

Symbol	Definition	
χ	Local concentration	(Curies/L^3)
τ	Sampling time	(T)
θ	Potential temperature	(θ)
or	Azimuth angle of upwind direction measured from plant north	(-)
σ	Standard deviation of either plume dispersion or wind angle fluctuations	(L) (-)
ν	Kinematic viscosity	(L^2/T)
δ	Boundary layer thickness	(L)
γ	Specific weight	M/(T^2L^2)
ρ	Density	(M/L^3)
Ω	Angular velocity	(1/T)
μ	Dynamic viscosity	M/(TL)
δ	Length scale of boundary layer	(L)

Subscripts

a	Free stream
s	Stack
m	Model
p	Prototype
max	Maximum

1.0 INTRODUCTION

A wind tunnel study of the Avon Power Plant, Cleveland Illuminating Company, Ohio, was motivated by the desire to determine the optimum height of stacks and location of precipitators which would eliminate downwash and reduce the concentration of sulfur dioxide at ground level such that the plant can meet state and federal ambient air quality standards. The power plant is located west of Cleveland near Lake Erie. Its particular location is such that the ambient wind may carry stack exhaust over the land mass. In addition on intermittent occasions a lake breeze exists which combined with unstable stratification over the heated land mass may cause stronger vertical mixing.

Commercial fossil fuel steam electric generating stations generally require an analysis of the potential behavior of gaseous effluents emitted to the atmosphere as a result of combustion processes. The proposed new design incorporates processes to reduce particulate emissions and ground level concentrations of gaseous chemical effluents to a minimum. Used wisely the atmospheric reservoir permits disposal without damage or nuisance; used without due consideration for its widely damage or nuisance; used without due consideration for its widely varying dispersion capacity, pollutants may at times remain at sufficiently high concentrations near the ground to cause annoyance.

A primary factor in determining whether these gaseous products are to be a nuisance is the stack design. Under certain conditions it may be necessary to make a release in meteorologically unfavorable situations. Hence, it is necessary to design gas exhaust systems such that adequate dispersal of gaseous materials will occur under any reliastic meteorological condition.

It has been a traditional design technique to release the various gases through the top of a tall stack located near the power station, where the stack is at least two and one-half times taller than nearby buildings. Calculation of peak and mean ground concentrations of these gases are then based on some semi-empirical model which relates the release rate from an elevated point source to the concentration at some point downwind. Mathematical models have been suggested by Sutton, Hay and Pasquill, Roberts and Cramer.[50,37,40,10] These mathematical models require the assumptions of plane homogeneous atmospheric turbulence and constant mean lateral and mean vertical velocities. These assumptions are satisfied for a point release over a flat undisturbed terrain.

In addition, considerable effort has been made to determine the effects of vertical stack velocity and gas buoyancy on the effective stack release height. Recently Carson and Moses[4] have reviewed over 15 plume rise formulas constructed to calculate effective stack heights for conditions where there are no effects from local terrain or buildings. They concluded that no available plume rise equation can be expected to accurately predict short-term plume rise. More recent results produced by Briggs (1969) are more optimistic concerning isolated plumes suggesting error bounds for plume rise of ±20%.

Often, it is necessary, due to aesthetics cost, and public relation reasons, to utilize a short to medium height stack. In these cases plume dispersion is sufficiently modified by the presence of the local building structure or ground topography that the only approach available is one of wind tunnel model tests.[33,15]

A number of wind tunnel studies have considered the effects of variations in a single building geometry on plume entrainment and dispersion.[16,49,12,23] These studies have permitted the specification of pertinent scaling criteria for model studies of plume excursions near buildings. Model laws will be discussed in greater detail in Section 2.

Since each arrangment of the power plant and auxiliary buildings or terrain may have separate effects on the generation of mechanical turbulence and mean flow movement, any specific gas dispersion problem will require individual tests. Hence, there exist in the literature descriptions of a variety of different model studies on reactor and industrial plants.[15,24,11,44,19,29,30,32,7] These studies are significant in that their results have been essentially confirmed by either direct prototype measurements or the absence of the gases or dusts the study was directed to remove. References 24, 11, 19, and 29 incorporate such comparisons within their text. Reference 15 has recently been compared with prototype measurements at the National Reactor Testing Station in Southeast Idaho.[12] Agreement of the diffusion concentration results were very satisfactory. Martin[29] favorably compared his wind tunnel study measurements about a model of the Ford Nuclear Reactor at the University of Michigan with prototype measurements. Finally, Munn and Cole[35] have taken diffusion measurements on a power station complex at the National Research Council, Ottawa, Canada, to confirm the general entrainment criteria suggested by the model studies of Davies and Moore.[11]

The purpose of this study is to determine the behavior of plumes created by gases discharged from a proposed new stack for Units 6 and 7 and existing stacks for Units 1-5, Unit 8 and Unit 9 of the Cleveland Electric Illuminating Company Avon Lake Plant (Figs. 1 and 2). Using a 1:400 scale model of the plant in a wind tunnel capable of simulating the appropriate meteorological conditions downwind ground-level stack-gas concentrations were determined by sampling concentrations of tracer gas (Krypton 85) released from the model stacks and overall plume geometry was obtained by photographing smoke plumes created by releasing smoke (titanium oxide) from the model stacks.

The general scope includes determination of how plume behavior is affected by stack location, height and precipitator location for Units 6 and 7 by loading level, wind direction, wind speed and thermal stratification of the atmosphere for plumes originating from stacks serving Units 1-5, Units 6 and 7, Unit 8 and Unit 9. A wide range of meteorological conditions can be simulated in the meteorological and environmental wind tunnel of the Fluid Dynamics and Diffusion Laboratory (FDDL) at Colorado State University. The conditions simulated for this study included the adiabatic lapse rate (thermally neutral flow) and the onshore breeze with a stably stratified lake breeze flowing onto a heated land surface.

The modeling criteria necessary to simulate atmospheric motions over such a site are presented in Section 2. Details of the model construction and the experimental equipment are described in Section 3. Finally, Sections 4 and 5 discuss the results obtained and their significance.

This report is supplemented by a motion picture (in color) which shows the plume behavior for all stacks for all operating levels, wind directions and meteorological conditions investigated during the course of this study (see Table 11 for motion picture sequences). A set of black-and-white photographs of each plume realization further supplements the material presented in this report.

2.0 SIMULATION OF ATMOSPHERIC MOTION

The use of a wind-tunnel for model tests of gas diffusion by the atmosphere is based upon the concept that nondimensional concentration coefficients will be the same at contiguous points in the model and the prototype and will not be a function of the length scale ratio. Concentration coefficients will only be independent of scale if the wind-tunnel boundary layer is made similar to the atmospheric boundary layer by satisfying certain similarity criteria. These criteria are obtained by inspectional analysis of physical statements for conservation of mass, momentum and energy. Detailed discussions have been given by Halitsky[16], Martin[29] and Cermak[8]. Basically the model laws may be divided into requirements for geometric, dynamic, thermic and kinematic similarity. In addition, similarity of upwind flow characteristics and ground boundary conditions must be achieved.

For the Avon Lake Power Plant study, geometric similarity is satisfied by an undistorted model of length ratio 1:400. This scale was chosen to facilitate ease of measurements, provide a boundary layer equivalent to 800-1000 feet for the atmosphere and minimize wind tunnel blockage. (The ratio of projected area to the area of the wind tunnel cross section should not exceed 5 percent. The model of the Avon Lake Power Plant at a scale of 1:400 produced a blockage of 2.7 percent in the MWT and 1.0 percent in the EWT.)

2.1 Modeling the Neutral Atmosphere Case

When interest is focused on the vertical motion of plumes of heated gases emitted from stacks into a thermally neutral atmosphere the following variables are of primary significance:

ρ_a = density of ambient air

$\Delta\gamma$ = $(\rho_a - \rho_s)g$--difference in specific weight of ambient air and stack gas

Ω = local angular velocity component of earth

μ_a = dynamic viscosity of ambient air

V_a = speed of ambient wind at stack height

V_s = speed of stack gas emission

H = stack height

D = stack diameter

δ_a = thickness of planetary boundary layer

z_o = roughness heights for upward surface

Grouping the independent variables into dimensionless parameters with ρ_a, V_a and H as reference variables yields the following parameters upon which the dependent quantities of interest must depend:

$$\frac{V_a}{H\Omega}, \frac{\delta_a}{H}, \frac{z_o}{H}, \frac{D}{H}, \frac{V_a \rho_a H}{\mu_a}, \frac{\rho_s V_s^2}{\rho_a V_a^2}, \frac{\rho_a V_a^2}{\Delta\gamma D}, \frac{\Delta\gamma}{g\rho}$$

The laboratory boundary-layer-thickness parameter δ_a/H was made approximately equal to that for the atmosphere. A value for this ratio of at least 1.5 was established for the highest stacks. Equality of the surface parameter z_o/H for model and prototype was achieved through geometrical scaling of the stacks and upwind roughness. Likewise the stack parameter D/H was equal for model and prototype.

Dynamic similarity is achieved in a strict sense if a Reynolds number $\frac{\rho_a V_a H}{\mu_a}$ and a Rossby number $\frac{V_a}{H\Omega}$ for the model is equal to its counterpart for the atmosphere. The model Rossby number cannot be made equal to the atmospheric value. However, over the short distances considered (up to 15,000 ft), the Coriolis acceleration has little influence upon the flow. Accordingly, the standard practice is to relax the requirement of equal Rossby numbers.[8]

Kinematic similarity requires the scaled equivalence of streamline movement of the air over prototype and model. It has been shown by Golden[15] that flow around geometrically similar sharp-edged buildings at ambient temperatures in a neutrally stratified atmosphere should be dynamically and kinematically similar when the approaching flow is kinematically similar. This approach depends upon producing flows in which the flow characteristics become independent of Reynolds number if a lower limit of the Reynolds number is exceeded. For example, the resistance coefficient for flow in a sufficiently rough pipe as shown in Schlicting (42, p. 521) is constant for a Reynolds number larger than $2x10^4$. This implies that surface or drag forces are directly proportional to the mean flow speed squared. In turn, this condition is the necessary condition for mean turbulence statistics such as root-mean square value and correlation coefficient of the turbulence velocity components to be equal for the model and the prototype flow.[16,8]

Golden, as cited by Halitsky[15,16], found that for flow about a cube for Reynolds numbers above 11,000, there was no change in concentration measurements. The minimum Reynolds number encountered in the present study was 14,000 based on the model scale of 1.0 ft and a minimum velocity of 2 fps. Correlation tests of flow about the Rock of Gibraltar flow over Pt. Arguello, California, and flow over San Nicolas Island, California, may be cited as examples of large Reynolds number flows which have been modeled successfully in a wind tunnel.[14,5,31]

Buildings and building complexes produce nonuniform fields of flow which perturb the regular upstream atmospheric wind profiles. Around each building a boundary layer exists, where the velocity is zero at the surface but increases rapidly to a relatively constant value a short distance from the building wall. Outside of the boundary layer and downstream there exists a region of low velocities and pressures called the cavity. In this region circulations are such that flow may actually reverse with respect to the upstream winds. Surrounding the cavity but extending further downstream is a parabolic region called the wake in which the presence of the building is still evident in terms of deviations of velocity, turbulence, and pressure from conditions found in the upstream atmospheric boundary layer.

The formation of the wake and cavity regions are associated with a phenomena called boundary-layer separation. Under certain conditions the boundary layer actually detaches and enters the flow streaming about the building. This may occur at the corner of a sharp-edged building or on a curved surface if the pressure increases due to a decelerating flow field. The separated boundary layer forms a sheet which completely surrounds the cavity region which contains relatively stagnant fluid. The extent of the cavity region for the Avon Lake Power Station building may be approximated by $5H \cong 1000$ ft. Based on the measurements of Evans[13] the effect of alternate wind approach angles to an elongated rectangular complex may extend this to $6H \cong 1200$ ft.

The need for scaling of the atmospheric mean wind profile was demonstrated by Jensen[23]. Substitutions of a uniform velocity profile for a logarithmic profile results in threefold variation in the dimensionless pressure coefficient downstream of a model building.

Such variance in the pressure fields indicates a strong effect of the upstream wind profile on the kinematic behavior of the fluid near the building complex. One of the few tunnels currently capable of generating a turbulent boundary layer thick enough for a 1:400 model scale is the Meteorological Wind Tunnel at Colorado State University. Other investigators have attempted to generate logarithmic profiles in short tunnels by inserting special grids upstream of the test section; however, this technique normally creates a nontypical turbulence field which decays rapidly downstream.

The length scale used for scaling the velocity profile is the roughness height z_o.[8] For the Avon Lake site typical roughness lengths for land to sea breezes is assumed to be less than 3 ft, while sea to land winds may be typified by a length less than 1/2 in.[51] This means the critical sea to land wind velocities could be modeled in the wind tunnel by a roughness length of less than 1/400 in., or essentially a smooth upstream surface. A turbulent boundary layer approximately 2 ft thick was produced by an upstream fetch of 40 ft in the wind tunnel.

Equality of the parameter $\rho_a V_a^2/(\Delta\gamma D)$ for model and prototype in essence determines the relationship between the atmospheric wind speed and the model wind speed once the geometric scale has been selected (1:400 in this case). Often this criteria results in $(V_a)_m$ being too small to satisfy the minimum Reynolds number requirement. When this happens to the specific weight difference for the model $(\Delta\gamma)_m$ can be made larger than $(\Delta\gamma)_p$ to compensate for the effect of small geometric scale.

Using the lowest stack height (280 ft) and a wind speed of 15 mph or 22 ft/sec and a scale of 1:400, the Froude number equality gives

$$\frac{(V_a)_m^2}{(V_a)_p^2} = \left(\frac{1}{400}\right) \frac{(\Delta\gamma)_m}{(\Delta\gamma)_p}$$

or

$$(V_a)_m = \frac{1}{20} \left[(\Delta\gamma)_M / (\Delta\gamma)_p\right]^{\frac{1}{2}} \quad 22$$

When the specific weight-difference ratio is unity

$$(V_a)_m = 1.08 \text{ ft/sec.}$$

The corresponding model Reynolds number then becomes approximately

$$\left(\frac{V_a \rho_a H}{\mu_a}\right)_m = \frac{1.08\text{x}1}{1.5\text{x}10^{-4}}$$

$$= 7200 < 11{,}000.$$

Accordingly the model wind speed would need to be increased to attain the desired minimum Reynolds number.

When the prototype stack gas temperature is 300°F, the foregoing expression for Froude number equality requires that the model stack gas temperature should be approximately 600°F to reach model Reynolds number of 11,000. This temperature is not a practical level for modeling; however, helium may be used to attain the proper density differences $(\Delta\gamma_m)$. The minimum Reynolds number of 11,000 can be obtained if the ratio of specific weight difference is adjusted to 2.33. The permissible minimum wind speed $(V_a)_M$ then becomes 1.67 ft/sec.

By decreasing the density of the plume gas in the model it is thus possible to increase the velocity scale factor and still keep buoyancy scaling at the stack exit. Downstream of the stack exit, however, as the light plume gas mixes with the much denser surrounding air, its buoyancy is depleted at too high a rate to maintain correct scale conditions relative to the prototype plume, for which the density difference ratio between plume and surroundings is less. Yet the above procedure represents the closest approach to correct buoyancy scaling that can be achieved with a model plume which is spreading at the correct rate at the stack exit.

The interaction of the emitted effluent with the wind is governed by the ratio of their respective momenta.[15,16,49,11,29] When the prototype and model plumes have the same density this reduces to a ratio of velocities. When one reduces the plume density there is the problem that its momentum flux relative to that of the surrounding air is too low if the efflux velocity, V_s, is scaled by the same factors as the surrounding air velocity, V_a. This could be corrected by increasing the efflux velocity according to

$$V_{sm} = V_{am} \frac{V_{sp}}{V_{ap}} \sqrt{\frac{\rho_{sp}}{\rho_{sm}}} \sqrt{\frac{\rho_{am}}{\rho_{ap}}} \quad .$$

Unfortunately, now one finds repercussions on the rate of mixing of the plume and hence on its rise on the initial phase.

To resolve the stack velocity scaling dilemma a series of smoke tests were made for plume trajectory utilizing different velocity ratio factors. These tests were compared with the predictive equations developed by Hoult.[21] It became apparent that given the Froude number, $\rho_a V_a^2/(\Delta\gamma D)$, is scaled exactly, requiring equality in $\rho_s V_s^2/\rho_a V_a^2$ when $\Delta\gamma/\rho g$ is distorted results in too early a dominance of buoyancy, a raised total trajectory, and an overly optimistic prediction of ground level concentration. On the other hand if one requires equality of only the V_s/V_a ratio the initial stack momentum is too low, the trajectory issuing from the stack exit falls beneath the prototype behavior, and slightly conservative estimate of potential ground concentrations is obtained. A sketch is provided in Fig. 3 to illustrate these points. Since early entrainment was not expected for the new stack produced for Units 6-7, Avon Power Plant, the trajectories and mixing ratio associated with the equality of $(V_s/V_a)_p = (V_s/V_a)_m$ was chosen as most suitable.

To summarize the following scaling criteria were applied for the neutral boundary layer situation:

1/ $Re = \frac{\rho_a V_a H}{\mu_a} > 11,000$

2/ $Fr = \frac{\rho_a V_a^2}{\Delta\gamma D}$; $(Fr)_m = (Fr)_p$

3/ $R = \frac{V_s}{V_a}$; $R_m = R_p$

4/ $(z_o)_m = (z_o)_p$

5/ Similar velocity and turbulence profiles upwind.

Operating conditions for the Avon Lake Power Plant have been supplied by Commonwealth Associates, Inc. for the various units at full and one-third load burning Ohio Coal. (See Table 1). Meteorological data converted to the form of wind rose patterns (Fig. 4) suggest tests at eight primary wind orientations. Modeled wind velocities, stack velocities, and plume densities based upon the selected scaling criteria are tabulated together in Table 2.

2.2 Modeling the Stratified Atmosphere Case

When air follows a trajectory over a cold water surface, the lower layers of the atmosphere are cooled and an inversion develops to a depth of from 100 to 1000 ft. During an onshore wind this stable marine air layer is heated from below by the land surface - assuming a neutral superadiabatic lapse rate in the lower levels while retaining a stable condition above. With increased distance from the shoreline the heated region, or mixed layer, grows vertically until the original stable layer is destroyed.

When a tall stack associated with a power plant that is located near the shoreline discharges into the elevated stable layer, the plume initially disperses slowly as it moves downwind. At some point inland the mixing layer extends upward to the plume level. At this point material in the plume mixes rapidly downward to cause "fumigation" and high concentrations at ground level.[48,1,25-28,53,9]

When vertical motion of plumes takes place in an atmosphere with thermal stratification, additional requirements must be met to achieve similarity of the atmospheric motion. These requirements have been discussed previously by Cermak[6], Yamada and Meroney[51], and SethuRaman and Cermak.[43] Similarity of the stably stratified flow approaching the power plant from Lake Erie can be achieved by requiring equality of the bulk Richardson number

$$Ri = \frac{\Delta T}{\overline{T}} \frac{H}{V_a^2} g$$

for the laboratory flow and the atmosphere. In this expression, $\Delta\overline{T}$ is the difference between mean temperature (potential temperature for the atmosphere) at the surface and at the height H, $\overline{T}$ is the average temperature over the layer of depth H and g is the acceleration due to gravitational attraction.

In order to simulate the phenomenon of fumigation resulting from destabilization of the stable lake breeze similarity must be attained for heat transfer from the warm land surface to the atmosphere. The Monin-Obukhov length scale

$$L_{MO} = \frac{-U_*^3}{(kg/T)(q/\rho C_p)}$$

for similarity of the atmospheric surface layer provides a good gross parameter when combined with the stack height H to form a dimensionless ratio H/L. In this expression U_* is the shear velocity $(\tau_o/\rho)^{\frac{1}{2}}$, τ_o is the surface shear stress, ρ is the average air density, C_p is the average specific heat for unit mass, q is the surface heat flux and k is the von Kármán constant (0.4). To obtain equality of H/L for the laboratory flow and the atmosphere L must be 400 times smaller for the laboratory flow than for the atmosphere. This is accomplished by testing at a low velocity V_a of about 1 mi/hr (this results in a low value for U_*) and heating the land surface to a high temperature relative to the actual land surface (about 250°F) in order to make q large compared to the atmosphere.

Although one can thus obtain an order of magnitude estimate of laboratory simulation conditions it is expected that the Monin-Obukhov length scale may vary locally as one moves inland from the shoreline. In addition momentum and heat flux information do not appear to be conveniently available for the field or model case.

The similarity between the flow generating mechanisms of sea breezes and flow over "urban heat islands" suggest alternative parameters. Linear numerical analysis of Olfe and Lee[36] and experimental and numerical studies by Yamada and Meroney[54] suggest the intensity of locating by the land surface may be characterized by a heating ratio

$$HR = \frac{(T_{land} - T_{sea})}{(T_{z=H} - T_{z=z_1})_{over\ sea}} \cdot \frac{H}{L_{Horizontal}}$$

Since the vertical to horizontal modeling scale is undistorted the parameter reduces to a single temperature ratio.

A survey was made of available meteorological data which typified "sea breeze - fumigation" situations in the Great Lakes area.[25-28] Only two of four experimental realizations appeared complete enough to estimate the required parameters Ri and HR. Table 3 summarizes the field conditions considered and the resulting range of parameters typical of fumigation. It would appear that laboratory values to examine are:

$$(HR)_p = 1.3 \sim 1.9$$

$$(Ri_{Bulk})_p = 1.25 \sim 1.5 \text{ at } H \sim 400'.$$

Laboratory conditions were chosen to simulate these situations as closely as possible. Table 4 lists the tunnel conditions and parameter values examined.

3.0 TEST APPARATUS

3.1 Wind-Tunnels

The environmental wind tunnel (EWT) shown in Fig. 5 was used for the neutral flow study, and the meteorological wind tunnel (MWT) shown in Fig. 6 was used for the onshore breeze - fumigation study. These wind tunnels, specially designed to study atmospheric flow phenomena, incorporate special features such as adjustable ceilings, rotating turntables, temperature controlled boundary walls, and long test sections to permit adequate reproduction of micrometeorological behavior. Mean wind speeds of 0.2 to 50 ft/sec (0.14 to 40 mi/hr) in the EWT and 0.2 to 130 ft/sec (0.14 to 90 mi/hr) in the MWT can be obtained. In the EWT boundary layers 3 ft thick over the downstream 20 ft can be obtained with the use of the vortex generators at the test section entrance. Boundary-layer thickness up to 4 ft can be developed "naturally" over the downstream 20 ft of the MWT test section. Thermal stratification in the MWT is provided by the heating and cooling systems in the section passage and the test section floor. The flexible test section roof on both the EWT and MWT are adjustable in height to permit the longitudinal pressure gradient to be set at zero.

3.1.1 Test Configuration in the EWT

Vortex generators were installed at the tunnel entrance together with an initial roughness to accelerate the preliminary growth of the modeled boundary layer. The Avon Power Plant model was centered on a 6 ft diameter turntable placed 18 ft from the entrance configuration (Fig. 5). The model was placed on a false floor which simulated the shoreline height rise from the average lake level. The floor of the tunnel was pierced by 58 taps arranged in sampling arrays to measure ground level concentrations. The false floor was precut in a series of segments to permit orienting the shoreline - breeze angle to eight cases.

The upwind tunnel floor was smooth to simulate the lake roughness. Blocks of plastic model trees were arranged on shore to simulate additional roughness due to wooded areas on built up construction downwind. The density of these model trees was related to photographs taken of the area (See Fig. 7).

3.1.2 Test Configuration in the MWT

Only two and approach angles were examined for the fumigation study - 315° and 345°. The upwind flow thus approached over the lake. A set of vortex generators were installed 2 ft downwind of the entrance to give the simulated boundary an initial impulse of growth. From 6 to 40 ft a set of 12 roll-bond aluminum panels (Fig. 8) were placed on the tunnel floor. These panels were connected to the facility refrigeration system and cooled to approximately 32°F. Fillets were installed in the bottom tunnel corners to cover the plumbing connections and reduce resulting wake turbulence. From 40 ft to the end of the test section a permanently installed set of electric heaters were used to raise the aluminum floor temperature to a level prescribed by the heating ratio, HR. (See Fig. 9). An array of ground level sampling tubes permitted concentration measurements downwind to an equivalent field distance of 8,000 ft.

3.2 Model

The model consisted of the power station, the stacks, and the auxilliary buildings constructed from aluminum to a linear scale of 1:400. (See Fig. 10). The basic flat topography was reproduced by fixing the model to a 1/4 in. thick aluminum plate. Aluminum was chosen to allow model heating during the onshore-breeze fumigation study phase.

The model was built to dimensions taken from Cleveland Illuminating Company Drawing 5BV-149 and sketches of Scheme 2 and Scheme 5 for the new stack-precipitator arrangement provided by Commonwealth Associates, Inc. Two stacks were constructed for Units 6 and 7 - one 500 ft and one 600 ft in height. The top exit consisted of two 12 ft diameter exhaust flues which extended 12 ft from the chimney base structure. Precipitators were movable so that tests could be made in alternative positions - one at the base of the proposed stack and another elevated to the north side of the boiler units. In the EWT all connections to the stacks were made from beneath through the base plate. In the MWT the permanent aluminum tunnel floor required the addition of fittings at the base of each stack.

Metered quantities of gas were allowed to flow from each stack to simulate the exit velocity and also account for buoyancy effects due to the temperature difference between the stack gas and the ambient atmosphere. Helium and compressed air were mixed in metered amounts to adjust the specific weight as proposed in Section 2. Fischer-Porter flow rator settings were adjusted for pressure, temperature, and molecular weight effects as necessary. When a visible plume was required the gas was bubbled through titanium tetrachloride before emission. When a traceable plume was required a high pressure mixture of Krypton-85 and air was used in place of the compressed air.

3.3 Flow Visualization Techniques

Smoke was used to define plume behavior over the power plant complex. The smoke was produced by passing the air mixture through a container of titanium tetrachloride located outside the wind tunnel and transported through the tunnel wall by means of a tygon tube terminating at the stack inlet within the model complex. The plume was illuminated with arc-lamp beams. A visible record was obtained by means of pictures taken with a Speed Graphic camera utilizing Polaroid film for immediate examination. Additional still pictures were obtained with a Hasselbland camera. Stills were taken with camera speeds of both 1/30 and 30 seconds - the first to capture characteristic plume excursions on the short time scale, the second to identify mean plume boundaries. A complete series of color motion pictures were also taken with a Bolex motion picture camera mounted on a movable dolly which was traversed the length of the tunnel parallel to the plume trajectory at the average wind speed. Complete sets of these still pictures and motion picture sequences were provided to Commonwealth Associates as a separate part of this final report.

3.4 Wind Profiles, Temperature, and Turbulence Measurement

A DISA Type 55DO constant-temperature hot-wire anemometer system was utilized to measure the up and downstream velocity profiles (Fig. 11) in the EWT. Thermal stratification in the MWT precluded straightforward use of the hot-wire system; hence, an eddy shedding system based on the Strouhol shedding frequency of a cylinder in a cross flow was constructed.[20]

The device requires a "hot-wire" probe positioned in the cylinder wake to measure the eddy shedding frequency. The trace of the anemometer signal was observed on storage oscilloscope and the probe position adjusted so that only the frequency of vortex shedding from one side of this cylinder was counted. The signal appeared in wave form and could be counted by means of constructing Lissajous figures on the oscilloscope (Fig. 12). Velocity was determined from Roshko's data relating Strouhol number to Reynolds number (See Table 5). Previous comparison of velocity measurement so measured with a smoke wire technique suggests accuracies to 3 percent.

Measurement of temperature was made with a miniature thermister (Fennal glass coated bead) system constructed by Yellowsprings, Corp. (YSI Model 42 SC). Figure 13 displays the thermometer and eddy shedding equipment. Thermocouples mounted in the MWT aluminum floor were used to monitor boundary temperatures and set electric heater controls. Table 6 lists all the instrumentation and materials employed in this study.

3.5 Gas Tracer Technique

After the flow in a tunnel was stabilized, a mixture of Kr-85 of predetermined concentration was released from model stacks at a required rate (Table 2). Samples of air were withdrawn from the sample points on the wind-tunnel floor and analyzed. The flow rate of Kr-85 mixture was controlled by a pressure regulator at the supply cylinder outlet and monitored by Fischer and Porter precision flow meters. Source concentration was from .23 to .48 μc_i/cc of Kr-85, a beta emitter (half lifetime = 10.3 years). The sampling and detection systems are shown in Fig. 14a and 14b and described in Ref. 7. A sampling grid of sample points was spaced on the wind-tunnel floor (Figs. 7 and 15) at suitable locations to establish the plume axis and locate the points of maximum ground-level concentrations. A reference sample point was located in the free stream, upwind of the model to measure the background concentration in the tunnel. The general arrangement of the sample points for the eight directions investigated in the EWT is shown in Fig. 7.

3.5.1 Analysis of Data

Krypton-85 is a radioactive noble gas with a half life of 10.6 years. The gas decays by emission of beta particles with small amounts of gamma rays. The gas has many advantages over the other tracers used in wind-tunnel dispersion studies. It is diluted with air about a million times before use, and as such, has properties very similar to those of air. Its detection procedure is fairly simple and direct.

The procedure for analyzing the concentration data was as follows:

1) Counts of the pulses generated in the G.M. tubes and displayed by the ultra scaler counter were recorded for each sample location

2) These counts were transformed into concentration values by the following steps:□

$$\text{Cpm} - \text{Background (Cpm)} = \text{Cpm*}$$

$$\text{Cpm*} \times \text{Counting Yield (p Curie/cc/Cpm)} = \chi(\mu\mu \text{ Curie/cc})$$

3) For counts over 1,000 a dead time correction[Δ] had to be applied to the readings, and in this case the correction is,

$$\text{Cpm} - \text{Background} = \text{Cpm*}$$

$$\frac{\text{Cpm*}}{1 - 1.77 \times 10^{-6} \times \text{Cpm*}} = \text{Cpm*}$$

$$\text{Cpm*} \times \text{Counting Yield} = \chi(\text{p Curie/cc}).$$

□ p Curie: pico curie (10^{-12} curie)

Δ The time taken for the positive space charge to move sufficiently far from the anode for further pulses to occur.

4) Average concentration values were determined for the known probe position and then displayed at the proper locations.

5) The concentration parameter $\chi \bar{V}/Q$ was then computed at all locations. A sample computation is shown below:

$$q = 600 \text{ cc/min} = 10 \text{ cc/sec}$$

$$Q_{total} = 1.8 \ \mu \text{ Curie/cc} \times 10 \text{ cc/sec}$$
$$= 18.0 \ \mu \text{ Curie/sec}$$

Let $V = 2$ fps $= 60.96$ cm/sec, and $\chi = 80$ p Curie/cc. Then

$$\frac{\chi V}{Q} = \frac{80 \times 10^{-6} \times 60.96}{18} \times 10^4 = 2.71 \text{ m}^{-2}$$
$$(= .25 \text{ ft}^{-2})$$

6) So far the values of the concentration parameter apply to the model and it is desirable to express these values in terms of the field. At the present time there is no set procedure for accomplishing this transformation. The simplest and most straightforward procedure is to make this transformation using the scaling factor of the model. Since

$$1 \text{ ft}|_m = 400 \text{ ft}|_p \ (= 122 \ ^m|_p),$$

one can write

$$\frac{\chi V}{Q}\Big|_p \ (\text{ft}^{-2}) = \frac{1}{400^2} \times \frac{\chi V}{Q}\Big|_m (\text{ft}^{-2})$$

or

$$\frac{\chi V}{Q}\Big|_p \ (\text{m}^{-2}) = \frac{1}{400^{-2}} \times \frac{\chi V}{Q}\Big|_m \ (\text{m}^{-2})$$

or in terms of the above example,

$$\frac{\chi V}{Q}\Big|_p \ (ft^{-2}) = \frac{1}{400^2} \times .25 = 1.57 \times 10^{-6} \ (ft^{-2})$$

or

$$(\frac{\chi V}{Q}\Big|_p \ (m^{-2}) = \frac{1}{400^2} \times 2.71 = 16.94 \times 10^{-6} \ (m^{-2}))$$

This sample scaling of the concentration parameter from model to field appears to give reasonable results.

(7) To convert these results to concentration in ppm of SO_2 requires specific information concerning the prototype SO_2 source strength. If the source strength of Unit 6-7 is say 944.6 gm/sec-SO_2 and the mean wind speed is 22 ft/sec then

$$\chi_p = \frac{\chi V}{Q}\Big|_p \times \frac{Q}{V}\Big|_p = 1.57 \times 10^{-6} \times (\frac{944.61/454}{22})$$

$$= 0.148 \times 10^{-6} \ 16/ft^3 - SO_2$$

$$(\text{or } \chi_p = 16.94 \times 10^{-6} \times (\frac{944.6}{22 \times 0.30}) = 2.42 \times 10^{-3} \ g/m^3$$

$$= 2.42 \times 10^3 \ mg/m^3 \times 0.375 \times 10^{-3}$$

$$= .91 \ ppm - SO_2$$

3.5.2 Errors in Concentration Measurements

Where data is obtained with a scaler counter, the apparent activity of a radioactive source is found by subtracting the background rate from the observed sample-plus-background rate. The background rate is measured separately and has an uncertainty of its own due to random radioactive sources.

If the background is present, the standard deviation in the net counting rate σ_{R_s} for a sample is

$$\sigma_{R_s} = \left(\frac{R_{s+b}}{t_s} + \frac{R_b}{t_b}\right)^{1/2}$$

where R_{s+b} s the observed sample-plus-background rate, R_b is the background rate, t_s and t_b are the measurement time for the sample and background, respectively. The standard deviation in the sample rate depends, then, upon both the time for sample measurement and that for background-rate measurement. When R_{s+b} is large in comparison with R_b, a long background measurement is not needed to make the error contribution from the background rate negligible. On the other hand, when R_{s+b} is comparable to R_b, both t_s and t_b must be very long for small values of σ_{R_s}. In the present experiments, an effort was made to keep the probable errors in concentration measurements within 10 percent. For this reason the sample counting time and background counting time were manipulated with this end in view. More detailed information on errors in radioactivity measurements can be found in Yang and Meroney.[55]

3.5.3 Test Results: Concentration Measurements

Since the conventional point-source diffusion equations cannot be used for predicting diffusion near objects which cause the wind to be nonuniform and nonhomogeneous in velocity and turbulence, it is necessary to calculate gaseous concentrations on the basis of experimental data. It is convenient to report dilution results in terms of a nondimensional factor independent of model to prototype scale.

In Refs. 8 and 16 the problem of similarity for diffusion plumes is discussed in detail. It is suggested that concentration measurements be transformed to K-isopleths by the formula

$$K = \frac{\chi}{Q/AV_a}$$

where

χ = sample volume concentration

A = frontally projected area of power plant complex

V_a = mean wind velocity at some references height

Q = gas source release rate

This expression is specifically suitable for measurements within the near-wake and cavity region. Data reported herein, however, represent measurements made at equivalent distances of 8,000 ft from the power plant.

Concentration measurements were made at various downwind distances in the vertical and horizontal planes. Count rates were corrected to concentration in picocuries and compensation was made for Geiger Mueller tube dead time. Since measurements were made at a variety of wind approach angles, wind velocities, and stack positions, the ground level concentration data has also been reported to Commonwealth Associates under separate cover in terms of the ratio $V_a\chi/Q$ which has units of length squared. For dispersion in a homogeneous flow this should produce similarity for various V_a and Q values. The significance of all results are discussed in the following section.

When interpreting model diffusion measurements it is important to remember that there can be considerable difference between the instantaneous concentration in a plume and the average concentration due to horizontal meandering. The average dilution factors near a building complex will correlate well with wind tunnel dilution factors since the mechanical turbulence of the wake and cavity region dominate the dispersion. In the wind tunnel a plume does not generally meander due to the absence of large scale eddies. Thus, it is found that field measurements of peak concentrations which effectively eliminate horizontal meandering, should correlate with the wind tunnel data.[18] In order to compare downwind measurements of dispersion to predict average field concentrations it is necessary to use data on peak-to-mean concentration ratio as gathered by Singer, et al. Their data is correlated in terms of the gustiness categories suggested by Pasquill for a variety of terrain conditions.[45] It is possible to determine the frequency of different gustiness categories for a specific site.[46] Direct use of wind-tunnel data at points removed from the building cavity region may underestimate the dilution capacity of a site by a factor of 4 unless these adjustments are considered.[29]

An alternate technique has also been suggested by Hino who argues the relationship between the maximum of time-mean ground concentration χ_{max} and the sampling time is $\chi_{max} \sim \tau^{-\frac{1}{2}}$.[18] Field experiments may be compared with wind-tunnel data by the formula:

$$(\chi_a)_p = \frac{(\chi_a)_m \, Q_p \, V_p^{-1} \, h_p^{-2}}{Q_m \, V_m^{-1} \, h_m^{-2}} \left(\frac{\tau_p}{\tau_m}\right)^{-1/2}$$

where χ_a is the maximum axial concentration, Q discharge rate of gases from a stack, V wind speed, h effective height of stack, τ sampling time, and subscripts p and m represent values for a prototype and model respectively.[18] One may assume that τ_m corresponds to 3 to 5 minutes in the atmosphere for the wind tunnel experiment. Pasquill's suggested values for the standard deviations σ_z and σ_y correspond to 10 minute averages.[52,37] Hence tunnel concentrations could be high by a factor of 1.7 if a 10 minute average is desired, or by a factor of 21.9 if a 24 hour average is desired.

An examination of Singer's results for peak-to-mean concentration ratios suggests the ratio is a function of both stability and boundary surface roughness. Hence for a variation of stratification from unstable to moderately stable the peak/mean concentration ratio may be nearly equal though the sampling time might vary from 30 minutes to 3 minutes respectively and the power law coefficient in Hino's equation above would vary from -0.6 to -0.3. It is not likely that a decisive interpretation of the effects of plume meandering will be available in the near future; hence, the conservative assumption has been made herein that the wind tunnel measurements correspond to a 30 minute averaging time and, when correcting results to alter sampling periods, a power law coefficient of -1/2 was utilized. (A 5 minute wind tunnel equivalent sampling time results in 24 hour equivalent concentrations 50 percent smaller.

4.0 TEST PROGRAM AND RESULTS

4.1 Test Program

The test program consisted of (1) a qualitative study of the flow field around the power plant by visual observation of the smoke plume trajectory released from the stacks; and (2) a quantitative study of gas concentrations produced by the release of Kr-85 from the stacks. The test conditions are summarized in Tables 2 and 4. The test program was accomplished in two parts: Phase A involved neutral stratification and Phase B involved stable stratification.

Angular locations of the approach winds are referred to in terms of angles from a nominal north which is perpendicular to the shoreline. Downwind distances refer to lengths as measured from the roof mounted stack as marked in Fig. 2. Unless otherwise noted, the term wind velocity refers to the velocity in the free stream above the tunnel boundary layer; however, a velocity at any reference height is available by referring to the velocity profiles. (Figs. 11 and 12)

4.2 Phase A: Neutral Stratification

4.2.1 Test Results: Characteristics of Flow

All the experiments were carried out in the EWT over the range of conditions shown in Table 2. The atmospheric boundary layer was modeled to produce a velocity profile equivalent to flow over the open lake. Figure 11 shows the development of the velocity profile over the model for an onshore wind. The profile is conditioned by the building complex as the wind passes over the plant. No comparison of model velocity data with that in the prototype is possible because the latter is not available over a range of height. However, as the model velocity profiles were carefully produced over roughness tailored to reflect the characteristics of the site, it is expected that the prototype flow is adequately represented in the model.

4.2.2 Test Results: Visualization

The test results consist of photographs and sketches showing the general nature of air flow and diffusion in the vicinity of the power station, (Fig. 16). A general understanding of wake and cavity flows is necessary for an intepretation of the plume behavior (see Ref. 16).

The sequences of photographs shown in Fig. 16 show side views of the behavior of a smoke plume released from Unit 6-7 at wind angle 285° for full load at various wind velocities. At low wind speeds the plume lofts high above the separation cavity and aerodynamic wake generated by the power plant complex. The gas behaves as a plume released at an elevated point and is convected well downstream. As the wind speed increases the stack effluent plume is bent over and behaves as though it were released at increasingly lower effective heights. At a sufficiently large free stream velocity the plume intermittently entrains behind the stack itself, the plume may intersect the building wake, and gas is brought to the ground at points near the building. For the shortest set of stacks (Units 1-5) at high wind speeds the plume may become completely entrained in the building complex cavity. Entrainment, as utilized herein, will be understood as the presence of any of the gas released from the stack in the power station cavity. A small amount of entrainment usually first occurs under conditions where the gas plume follows the cavity separation streamline to the downstream cavity stagnation point from which it diffuses upstream into the cavity proper. Downwash will be understood as severe entrainment where the plume does not penetrate the separation streamline but rather ventilates directly into the cavity region. A decrease in load from full to one-third has the same effect on the plume behavior as an increase in wind speed. In general lower load aggravates plume behavior; however one must consider the reduced pollutant burden is any assessment of the net significance. Figure 17 displays the effect of change in load for Unit 6-7, wind angle 15°, when the mean effective wind speed is 15 mph.

It is instructive to examine the plume behavior for both instantaneous effluent boundary location and when averaged over a larger time period. Figure 18 depicts the plume outlines when the camera is released after 1/32 and 30 seconds respectively. In an instantaneous sense a plume may contact the ground yet result in rather low ground average concentrations. The longer averaging time tends to emphasize locations beyond which extensive ground contact will occur.

For most wind approach angles the building complex appears to have a similar effect on plume behavior or entrainment. However, for Unit 6-7 a wind direction of 315°True$^{(-30^\circ)}$ seems most critical over all wind speed and load conditions. Units 1-5, 8, and 9 are sensitive to wind orientations of 315°True$^{(-30^\circ)}$ or 45°True$^{(+30^\circ)}$ representing slight inclination between wind and shoreline or building force.

When the precipitators for the new Unit 6-7 system are placed in an alternate position elevated beside the north face of the boiler units the plumes emitted from Units 1-5 and Unit 8 are entrained severely.

The observed "touchdown" distances evaluated from the flow visualization tests are summarized in Table 7. Touchdown is defined during observation as that point where the plume encounters the ground more than 10 percent of the time. Such an interpretation is necessarily qualitative but different observers do not vary by more than 500 ft. Smoke photographs tend to confirm the initial opinion. Complete sets of instantaneous (speed 1/32 sec) and average (shutter speed 1 sec) still photographs supplement this report. Color motion pictures have been arranged into titled sequences, and the sets available are summarized in Table 11.

4.2.3 Test Results: Concentration Measurements

Turbulent diffusion of gaseous effluent released at four different stack locations were studied. Three represented effluents from existing units (1-5,8, and 9) while the fourth represents the presence of a new stack and its precipitators (6,7). Krypton-85 concentrations at ground level and in the vertical were measured at distances equivalent to 250 ft to 8,000 ft downwind; the latter depended on total model extent. In the initial stage of measurements 50 samples were taken over the model including six elevated samples at 6,000 ft downwind. It was found, however, that the plumes behaved in a predictable manner and to conserve time the sample locations were limited to 25, eliminating the unnecessary outlying measurements and the vertical sample wake.

All concentration data have been converted into equivalent levels of SO_2 in ppm. The source concentrations assumed for each stack and load condition are summarized in Table 1 based on the assumed use of Ohio coal as provided by Commonwealth Associates, Inc. Under separate cover the data has been provided in the dimensional form $\chi V/Q(m^{-2})$ where χ is the concentration over the assumed and tunnel averaging time, Q is the source strength, and U is the mean wind at stack height. In addition results were reported therein in terms of micrograms of SO_2/meter cubed.

The results for various sources, loads, wind directions, and wind velocities are presented in Table 12. The coordinates x and y shown in the tables are explained in the definition sketch in Fig. 7. The maximum concentration measured and its respective downwind location for each situation have been gathered together in Table 8.

For full load, Units 6-7, maximum 24 hour concentrations occur at ground level for 15^{o}True($+30^{o}$), 30 mph; 15^{o}True($+30^{o}$), 45 mph; 45^{o}True ($+60^{o}$), 45 mph; and $+275^{o}$True(-60^{o}), 30 mph. Values appear to range as .069, .050, .075, and .041 ppm respectively. For one-third load, Units 6-7, maximum ground concentrations occur for 15^{o}True($+30^{o}$), 30 mph; and 275^{o}True(-60^{o}), 30 mph with values of .040 and .047 ppm respectively. An appendix is included which gives a short discourse on plume calculational techniques pertinent to the cases examined herein. The example case supplied would suggest a marked effect on downwind diffusion of effluent as a result of an intense wake resulting from the building complex. A single plot of concentration levels as contoured by a microfilm plotter is provided in Fig. 19 for comparison to the tabulated results. It is hoped this will provide mental guidance to the expected variation of ground concentration when examining the many tables.

The cumulative effect on ground concentrations for simultaneous releases from all stacks for the same load, wind direction, and wind speed are found in Table 13. These results must be considered at best representative since it is unlikely all units will be operated simultanesouly at full or one-third load. In some configurations plumes from about nine failed to touch ground over the model extent and thus they make no contribution to the total concentration level.

4.3 Phase B: Stable Stratification with Fumigation

4.3.1 Test Results: Characteristics of Flow

All experiments were carried out in the MWT over the range of conditions shown in Table 4. The atmospheric boundary layer was modeled to produce a velocity and temperature profile equivalent to flow over an open lake. Figure 12 shows the initial upwind profiles of velocity and temperature. Turbulence was essentially absent as evidence by the behavior of smoke plumes released over the cooled model lake surface. The profiles are conditioned by the heated land surface and the presence of the building complex. An inner surface flow of turbulent well mixed characters grows beneath the capping stable lake air. Figures 20 and 21 display the eroding effect of unstable air. The small thermister utilized had a short time constant; thus the temperature fluctations displayed are an indicator of the intensity of turbulence.

Figure 22 displays the inner boundary layer growth for the three surface heating intensities studied. Initially the region grows at a rate proportional to downwind distance to the 0.8 power. Subsequently beyond about 1,000 - 2,000 ft the growth rate is proportional to downwind distance to the 0.5 power. The behavior of the initial region corresponds to previous experience for measurements over slightly roughened surfaces. The later growth rate corresponds to behavior noted by Prophet for sea and lake breeze systems.[39]

When the model is in place the building complex wake displaces the inner boundary layer upwards significantly. Thus the maximum ground level concentration occurs closer to the plant site than if all emissions were from an isolated stack.

4.3.2 Test Results: Visualization

The test results consist of photographs and movie sequences showing the nature of the air flow and diffusion in the vicinity of the power station. (Fig. 23 to Fig. 24). One should refer to Section 4.2.2 for a discussion on building wake and cavity effects.

The sequence of photographs shown in Fig. 23 show side views of the behavior of a smoke plume released from Unit 6-7 at wind angle 345° for full load at various land surface heating rates. The more intense heating (HR = 1.5) accelerates the mixed layer growth and the entrainment of the plume. A decrease in load from full to one-third has the same effect on the initial plume as an increase in wind speed; however the small mixed layer character remains the same. (See Fig. 24).

The observed "touchdown" distances evaluated from the flow visualization tests are summarized in Table 9. These distances represent locations where the visual impression is gained that the plume resides greater than 10 percent of the time. Once the plume intercepts the inner boundary layer the smoke is mixed downward at a rate which gives a lower plume boundary of about 30 to 45°. Hence the plume is not brought immediately to the surface after it enters the mixing layer as suggested by the simplified physical model.

4.3.3 Test Results: Concentration Measurements

Twenty-five ground level sampling locations were prepared at distances equivalent to 1,000 ft to 8,000 ft downwind. Measurements of Krypton-85 activity at these locations have been converted to equivalent SO_2 concentration in ppm per the earlier discussions. The results for various sources, loads, wind angles, wind velocities, and surface heating rates are presented in Table 14. The maximum concentration measured and its respective downwind location for each situation have been accumulated into Table 10. For full load, Units 6-7, maximum 24 hour concentrations occurred for a 500 ft stack at 315°True(-30°) - i.e. 0.403 ppm. A 600 ft stack provided enough additional plume elevation to reduce this to one-third the level - i.e., 0.147 ppm. For a one-third load situation the 500 and 600 ft stacks develop ground level concentrations of 0.193 and 0.171 ppm respectively.

The Appendix titled Dispersion Calculations also contains a critique of current understanding for dispersion during fumigation situations. Again it is found that the building wake produces a marked increase in ground level concentrations not accounted for in the state-of-the-art calculation procedures.

4.4 Alternative Stack Location

After all visualization and concentration measurements were completed it was learned that the stack for Units 6 and 7 would be constructed at a slightly different location at the eastern edge of the plant site (see Figure 2). Visualization studies were performed for Units 6-7 stack in this new location for wind angles -60°and -90°. No indication was found that this new location would aggravate the plume behavior for these worst possible approach flow directions.

5.0 CONCLUSIONS

The investigation was undertaken to determine the dispersion of exhaust gases released from stacks of the Avon Lake Power Plant operated by the Cleveland Electric Illuminating Company, Ohio. The primary aim of the study was to determine the optimum height of stack to replace previous stacks for Units 6 and 7 and determine the effect of building complex wake on ground-level concentrations of sulfur-dioxide.

On the basis of the experimental measurements reported herein, the following comments may be made:

5.1 Phase A: Neutral Flow

1) Stacks for Units 6, 7, 8 and 9 do not entrain directly into the building complex cavity for any wind angle, velocity, or load condition studied. Stacks for Units 1-5, being shorter, may entrain for wind velocities greater than 30 mph.

2) When the new precipitators proposed for Units 6 and 7 are elevated next to the north face of the boiler units the resulting wake adversely affects plume rise for stacks from Units 1-5, 8 and 9 for wind angles of 285° and 300° true. This position of the new precipitators also adversely affects plume rise for Units 6 and 7 for wind angles 30° and 45° true.

3. No significant reduction in ground-level concentration for the new stack proposed for Units 6-7 would be gained for neutral flow situations by increasing the height from 500 to 600 ft.

4. Concentration measurements show that maximum ground-level concentrations will result from Unit 8 at full load for onshore wind flow. However, similar concentration levels are also reached by the effluent from Unit 9. Ground concentrations for Units 6-7 reach

maximum concentrations for full load, high wind (>30 mph), onshore wind-angle conditions.

5.2 Phase B: Stable Stratification with Fumigation

5) Plumes from all stacks are entrained into the low level mixed layer as it grows over the land. This results for each stack in greater ground-level concentrations than found in the equivalent neutral situation. The result is most severe for plumes released from the shorter stack heights.

6) The highest ground-level concentration for any stack during the stratified condition is three times greater than the worst neutral flow situation.

7) For Units 6-7 high vertical mixing may increase ground-level concentrations six times over the worst neutral condition. This statement must be tempered by the understanding the neutral maximum is itself not very large.

8) Increasing the stack height for Units 6 and 7 from 500 to 600 ft may reduce the ground concentration maximum by only one-third.

Since specific maximum source levels may vary depending on the source of coal or the load, dimensionless prediction tables have been prepared in the manner of Pasquill for the Avon Lake station configuration and forwarded under separate cover. If percent frequency of winds and stability conditions at various wind approach angles are known for the Avon Lake site, average annual concentrations are 24 hour averages including the effects of wind angle frequency distribution may be calculated in the manner of Turner[52] or Sherlock and Lesher.[44] If one desires the meteorological significant situations such as looping, fanning, fumigation, or trapping one may combine the experimental results developed herein with the expressions suggested by Bierly and Hewson or Slade, Chapter 3, Section 3.5.[47]

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APPENDIX: DISPERSION CALCULATIONS

Industrial designers must rely upon generalized dispersion formulae to predict concentrations in the vicinity of pollutant releases from tall stacks. Unfortunately one cannot depend upon the accuracy of such relations when nearby buildings are tall enough to cause aerodynamic perturbations upon the theoretical plume behavior. Hence, it is considered good practice to utilize wind-tunnel model studies to determine the range of validity of particular formulae and the necessity for correction coefficients for a particular application. It is with these thoughts in mind that the measurements over the Avon Power Plant complex are interpreted. Corrections applied to plume rise near the source may provide a more reliable prediction of contamination at extended distances downstream by means of analytical expressions.[35,38,40,42,43,44]

The latest publications summarizing the "state-of-the-art" for atmospheric diffusion estimates are very similar in detail.[35,44,47] There are some reasons however, to prefer some calculation methods over others; thus some of the relations will be discussed in detail below.

Effective Plume Height

While a smoke plume quickly attains the wind speed in the horizontal direction, its rise is determined by its vertical momentum and buoyancy. Numerous formulae have been published to correlate field measurements of plume rise; none is universally accepted, partially due to observational difficulties, and partially due to the fact that some plumes never really appear to level off.

Although Turner[52] recommends the use of Holland's plume rise formula it may be judged unnecessarily conservative. Stümke recommended the

Holland formula be multiplied by a correction factor of 3.0. In addition more recent dimensional analysis formulas for buoyant sources give consistently good results for all source sizes and distances downwind and take into account atmospheric stability. The formulae below are conservative but not so severely conservative as other formulas. The A.E.C.-1968 monograph by Slade suggests the following expressions: (Eqs. (5.19) and (5.20)):

$$\text{Neutral:} \quad \frac{\Delta H}{D} = 100 \frac{R}{Fr} + 1.5R \qquad \text{(A)}$$

$$\text{Stable with wind:} \quad \frac{\Delta H}{D} = 1.63 \left[\frac{RL^2}{Fr\ Ri}\right]^{1/3} \qquad \text{(B)}$$

where $R = \frac{V_s}{V_a}$

$$L = \frac{H_s}{D_s}$$

$$Fr \cong \frac{V_a^2}{g \frac{\Delta T}{T_s} D_s}$$

$$Ri = \frac{g\ (d\theta/dz)}{T_s\ (V_a^2/H_s^2)}$$

Maximum Ground Concentration

Often the limiting criteria for a particular stack release system is the maximum allowed ground concentration. Since the plume rise formulae recommended above incorporate the effect of atmospheric stability on plume rise it is possible to include their results in expressions which calculate the maximum probable concentration conditions directly. Again the A.E.C. monograph suggests: (Eq. 5.28):

$$\frac{\chi_{max} V_a D_s^2}{Q} = 0.01 \left(\frac{Fr}{R}\right)^{1/3} \frac{1}{(L + \frac{\Delta H}{D_s})^{5/3}} \qquad (C)$$

at an acutal velocity associated with

$$\frac{Fr}{R} = \frac{500}{(L + \frac{\Delta H}{D_s})} \qquad (D)$$

or

$$V_a = 7.94 \left(\frac{\frac{\Delta T}{T_s} g V_s D_s^2}{H_s + \Delta H} \right)^{1/3} \qquad (E)$$

for a buoyant source in a neutral atmosphere.

When a plume initially emitted into a stable environment intercepts a mixing layer growing from beneath it, "fumigation" of the plume directly to the ground may occur. A number of authors have suggested means to estimate the magnitude of the ground concentration resulting from such behavior.[9,25-27,48] As summarized by Collins[9] the method consists of determining the downwind distance at which a plume traveling horizontally at the effective stack height first intercepts the growing mixing layer. As a first approximation one may then assume that the maximum of the elevated plume concentrations at the downwind location will now occur at ground level.

Alternatively one may estimate the concentrations assuming a uniform vertical distribution throughout the layer of depth H, is

$$\frac{\chi_{max} V_a H^2}{Q} = \frac{1}{(2\pi)^{1/2}} \left(\frac{H}{\sigma_y}\right) \qquad (F)$$

where from Fig. A.2 Ref. 46 for stable flow (Pasquill stability Category F)

$$\frac{\sigma_y}{H} = 0.04 \left(\frac{X}{H}\right)$$

Lyons discusses a somewhat more complicated procedure which attempts to correct for rate of plume entrainment and rate of spreading in the mixing layer.[27]

In the Nuclear Safety Journal of 1967 Vander Hoven[53] has presented a graphical plot based on the report of Prophet[39] for determining the depth of the mixing layer as a function of initial overwater stability and overland travel distance. An equation which fits his results is:

$$H = 8.8 \sqrt{\frac{X}{V_a \Delta\theta}} \qquad \text{(G)}$$

where χ(m) = distance overland

H(m) = height of mixed layer

V_a(m/sec) = mean velocity

$\Delta\theta$(°C) = overwater vertical difference in potential temperature within inversion layer.

As Prophet notes the inland penetration distance is a function of the initial overwater stability and the rate of which the air is heated as it moves inland. In the trials considered he observes "the same amount of heating over the land cannot be assessed, ..."; nevertheless "it is entirely possible that the intensity of the heat source over the land, as defined by the initial air-land temperature differential, may have been somewhat similar during the various trials."[39] Additional evidence for flow of cool air over the warmer water of Hudson Bay, Canada, clearly indicate greater mixing heights occur when the temperature differential between air and water is greatest.

Dimensional analysis techniques suggests that if the pertinent variables required to describe mixing layer growth are

$$f(\chi, H, V_a, \Delta\theta, g, T, \Delta T, \delta) = 0$$

where new variables listed are

T = absolute temperature

ΔT = land-water temperature difference

δ = characteristic height over which $\Delta\theta$ and V_a vary upstream.

Then appropriate dimensionless parameters might be

$$\frac{H}{\delta} = f\left(\frac{\chi}{\delta}, \frac{\Delta T}{\Delta\theta}, g\frac{\Delta\theta\delta}{T\,V_a^2}, \frac{V_a}{(g\delta)^{1/2}}\right)$$

$$= f\left(\frac{\chi}{\delta}, HR, Ri_B, Fr_\delta\right).$$

Examination of the mixing layer growth results for this wind tunnel study reveals that initially $H \propto \chi^{0.8}$ followed by $H \propto \chi^{0.5}$. The initial region corresponds to behavior frequently observed for inner boundary layer growth over change of roughness. The subsequent region confirms the conclusions reached by Prophet. In addition it is found that $H \propto HR^6$. When these results are combined with Prophets conclusion that $H \propto (V_a\Delta\theta)^{-1/2}$ it is found that

$$\frac{H}{\delta} = K\left(\frac{\chi}{\delta}\right)^{1/2}(HR)^6(Ri_B)^{-1/2}(Fr_\delta)^{-3/2}. \qquad \text{(H)}$$

When this result is compared to Eq. (G) for $T \simeq 300°K$, $\delta \simeq 100$ m, and $g = 9.86\ m/sec^2$ it is found that $K \simeq .01$. If the constant is based on measurements made herein $K \simeq 0.015$.

Ground Level Concentration Distributions

Correct calculation of ground level dilution profiles depends, of course, on an accurate estimate of the effective stack height. Assuming such information is available the most popular expression is the Gaussian plume formulae:

$$\frac{\chi}{Q} = \frac{1}{\pi\sigma_y\sigma_z V} \exp[-(\frac{y^2}{2\sigma_y^2} + \frac{h^2}{2\sigma_z^2})] \quad \text{where} \quad h = h_s + \Delta h \quad \text{and}$$

where the variance terms σ_y or σ_z are evaluated in terms of downwind distance and the stability condition. Authors such as Sutton, Calder, Pasquill, Smith, and many others have suggested variance coefficient evaluation techniques.[47,48]

Probably the most convenient method currently is that developed by Pasquill where σ_y and σ_z figures have been prepared for simply defined stability categories. See Figs. A.2 and A.3 and Table A.1 from the A.E.C. monograph.[47] Figures 3-2 through 3-9 in Turner's workbook also provide a convenient summary of ground level dilution for various height releases and atmospheric stability conditions.[52]

Typical Concentration Results

Montgomery and Cain have compared the adherence of sulfur dioxide concentrations in the vicinity of a steam plant to plume dispersion models.[34] They concluded that general dispersion models cannot accurately predict specific pollutant concentrations that can be expected to occur at a particular station at a specific time, but they can predict the range of concentrations likely to occur. Dispersion models generally incorporate a conservative bias, hence they also were found to successfully estimate maximum concentrations 93 to 99 percent of the time. Finally, the same mathematical model using different diffusion coefficients may yield very different results, hence the diffusion coefficients should be developed for the model at the particular site of application (if possible).

The effects of SO_2 pollutant on vegetation and human health are extensively reviewed in Volume 1 of Air Pollution edited by Stern. It appears that it is desirable to maintain maximum 24 hour levels below 0.10 ppm and annual average levels below 0.02 ppm for a desirable environment. Criteria such as these must be utilized to evaluate the dispersion of gaseous wastes in the atmosphere. It should also be recognized that other sources exist in the environment not under the control of the power station.

Example Calculation

Unit 6-7: full load.

	R	Fr	Ri_B	Fr_s	$Q(\frac{gm}{sec})$	V_a(mph)	H(ft)	χ ppm 10 minute
Neutral	1.59	21.5	0.0	--	944.6	30	617	0.020
Stable (Fumigation)	3.18	5.36	1.0	0.39	944.6	15	697	0.830

This may be compared with a maximum concentration from the model study of 0.521 ppm for comparable neutral case and 2.80 ppm for the comparable fumigation

Turner has suggested that estimates based on a Pasquill-Gifford type approach are probably accurate to within a fraction of three assuming the plume rise is correctly estimated. This accuracy is limited to three cases:

(1) for all stabilities for distances of travel out to a few hundred meters.

(2) for neutral to moderately unstable conditions for distances out to a few kilometers; and

(3) unstable conditions in the lower 1000 meters of the atmosphere with a marked inversion above for distances out to 10 kilometers or more.[52]

Based on the work of Briggs one expects plume rise results to be accurate within ±19 percent.[47] However experience is very varied and some calculators have been conservative by a factor of five or optimistic by a factor of nearly two.

For a source which emits at constant rate from hour to hour one may estimate a 24 hour probability of dispersion based on stability wind "rose" data. A stability wind "rose" gives the frequency of occurrence for each wind direction (usually 16 points) of each wind speed class and stability category.

If the effluent is assumed uniformly distributed in each angular sector an appropriate equation for average concentration is then:

$$\frac{\chi(x,\theta)}{Q} = \sum_S \sum_N \left\{ \frac{2\ f\ (\theta,S,N)}{\sqrt{2\pi}\ \sigma_{zs}\ V_N\ (\frac{2\pi x}{16})} \ \exp\left[\frac{1}{2} \left(\frac{h_V}{\sigma_{zs}}\right)^2 \right] \right\}$$

where $f(\theta,S,N)$ is the frequency during the period of interest that the wind is from the direction θ, for the stability condition, S, and wind speed class N.

$(\sigma_z)_S$ is the vertical dispersion parameter evaluated at the distance x for the stability condition S.

V_N is the representative wind speed for class N.

h_V is the effective height of release for the wind speed V_N.

When stability wind rose information is unavailable a first-order approximation may be made of diurnal concentrations by using the appropriate 24 hour wind rose and assuming all releases occur in neutral stability class, Pasquill D.

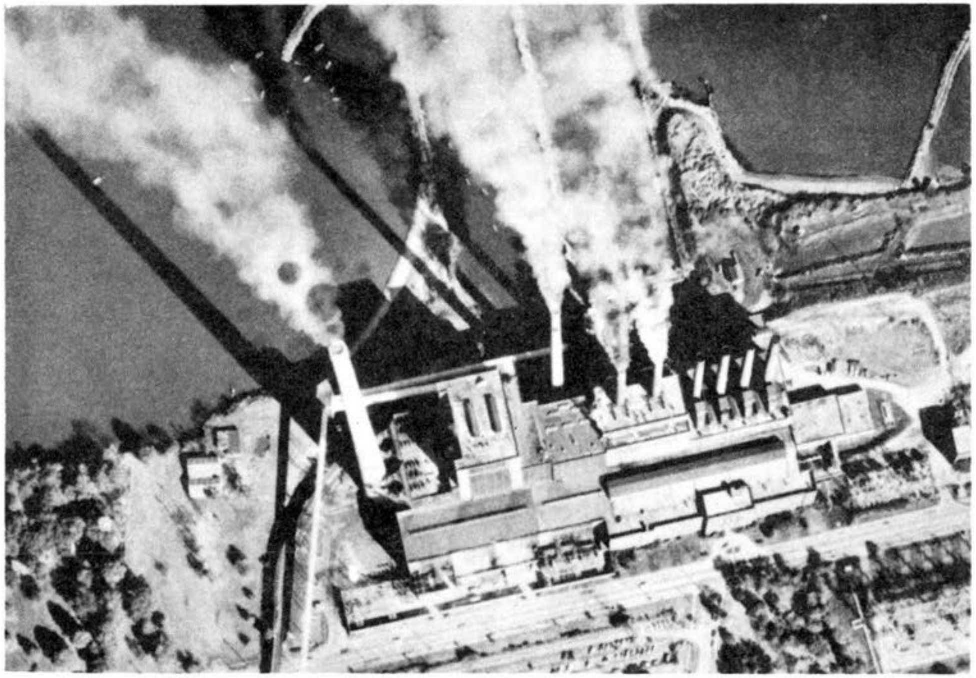


Fig. 1a. Avon Lake Power Plant, looking north.

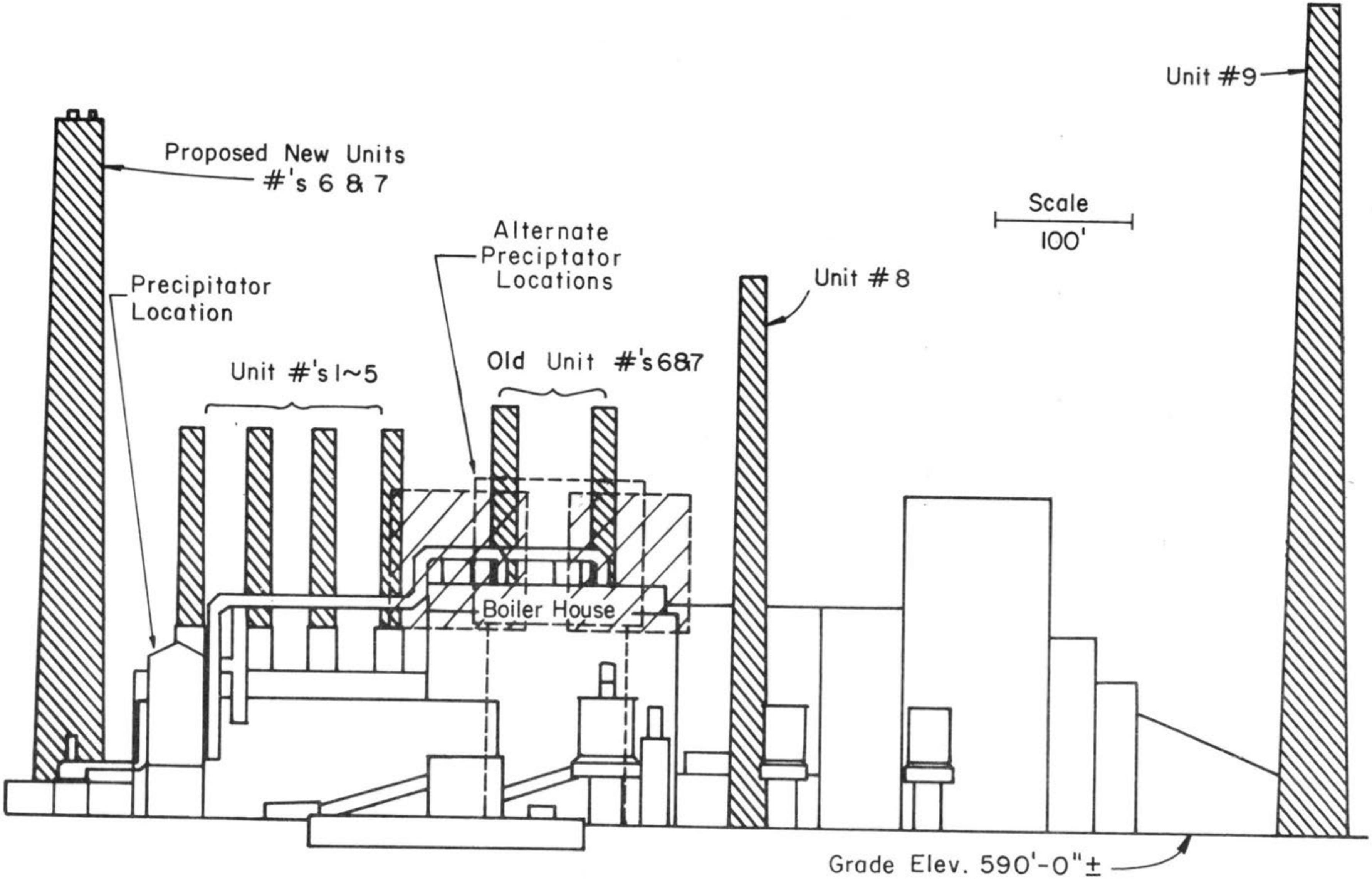


Fig. 1b. Avon Lake Power Plant, looking south.

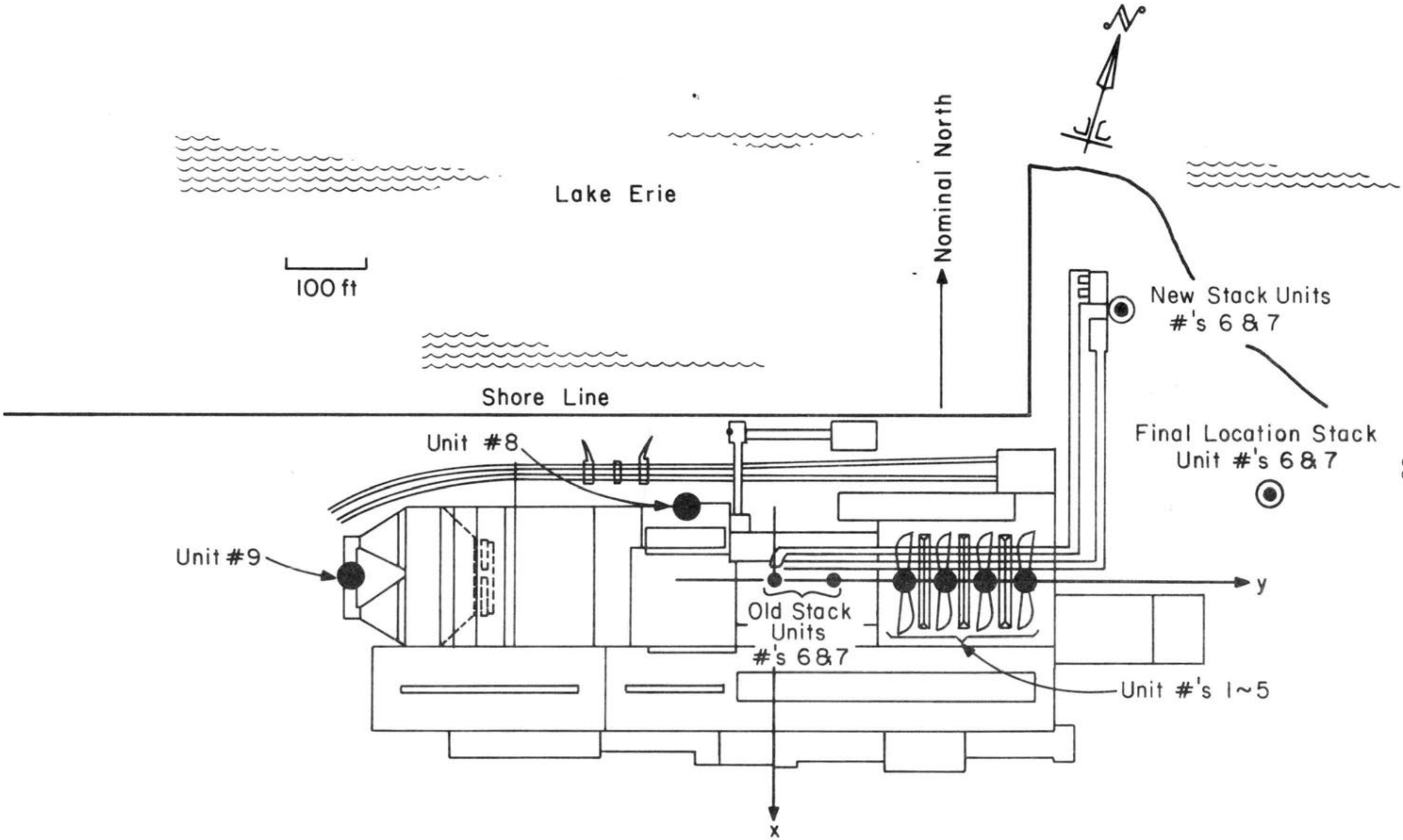


Fig. 2. Plan view - Avon Lake Power Plant.

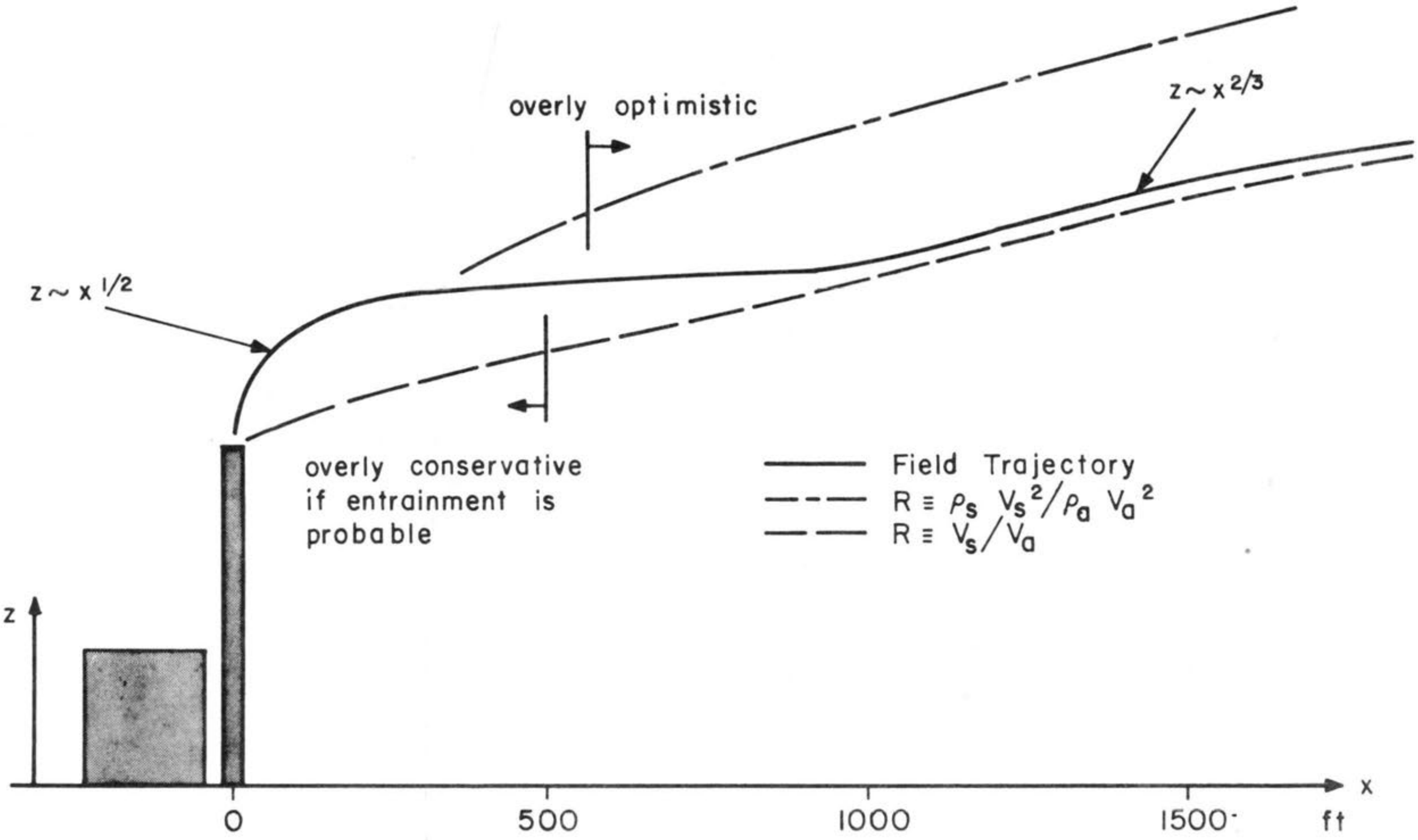


Fig. 3. Plume trajectories for various momentum ratios.

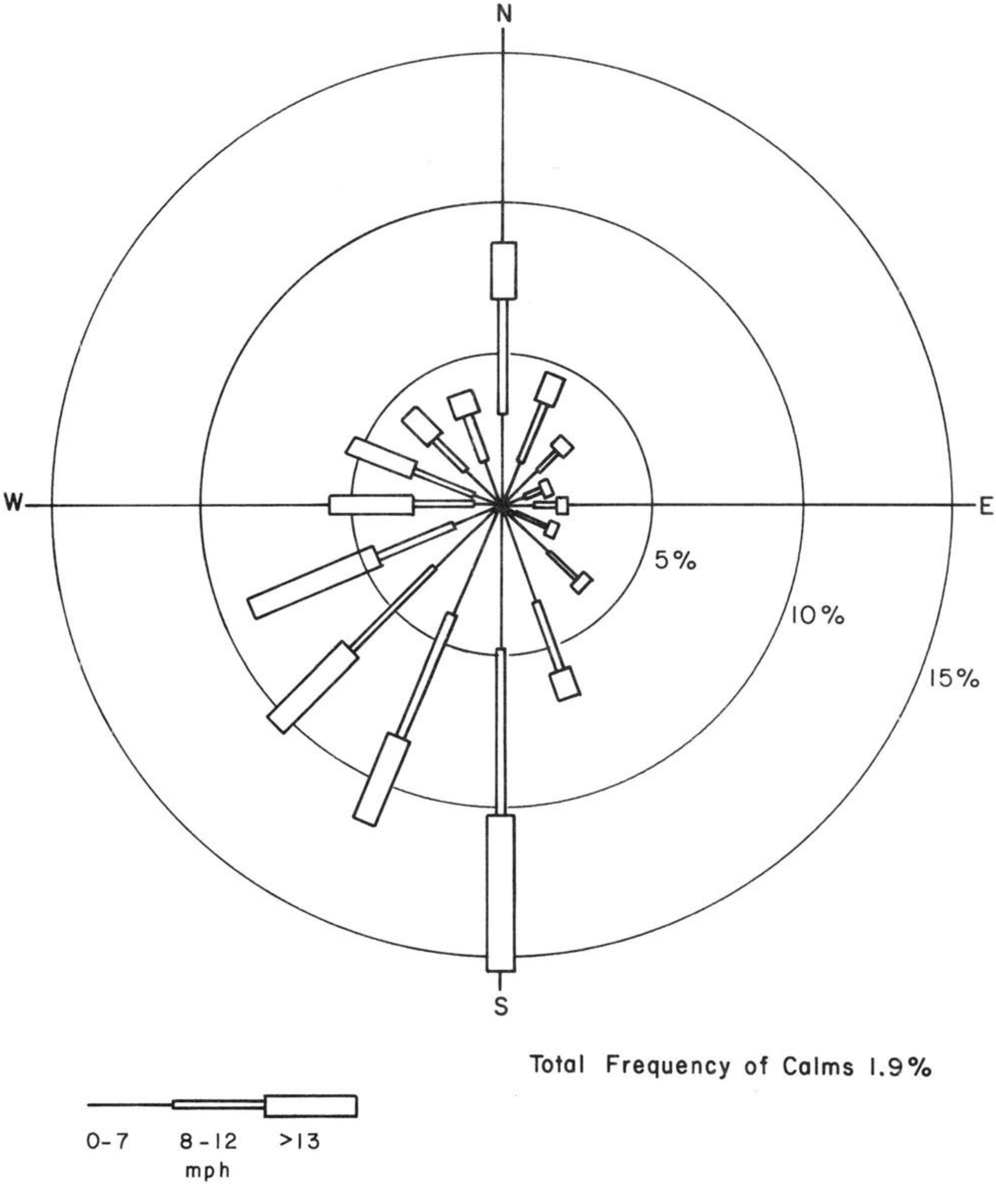


Fig. 4a. Wind Rose (positions on spokes show direction from which wind is blowing, the length of the segments indicate percentage of speeds in each group) Cleveland, Ohio/Hopkins Airport Annual Average 1/67-12/71.

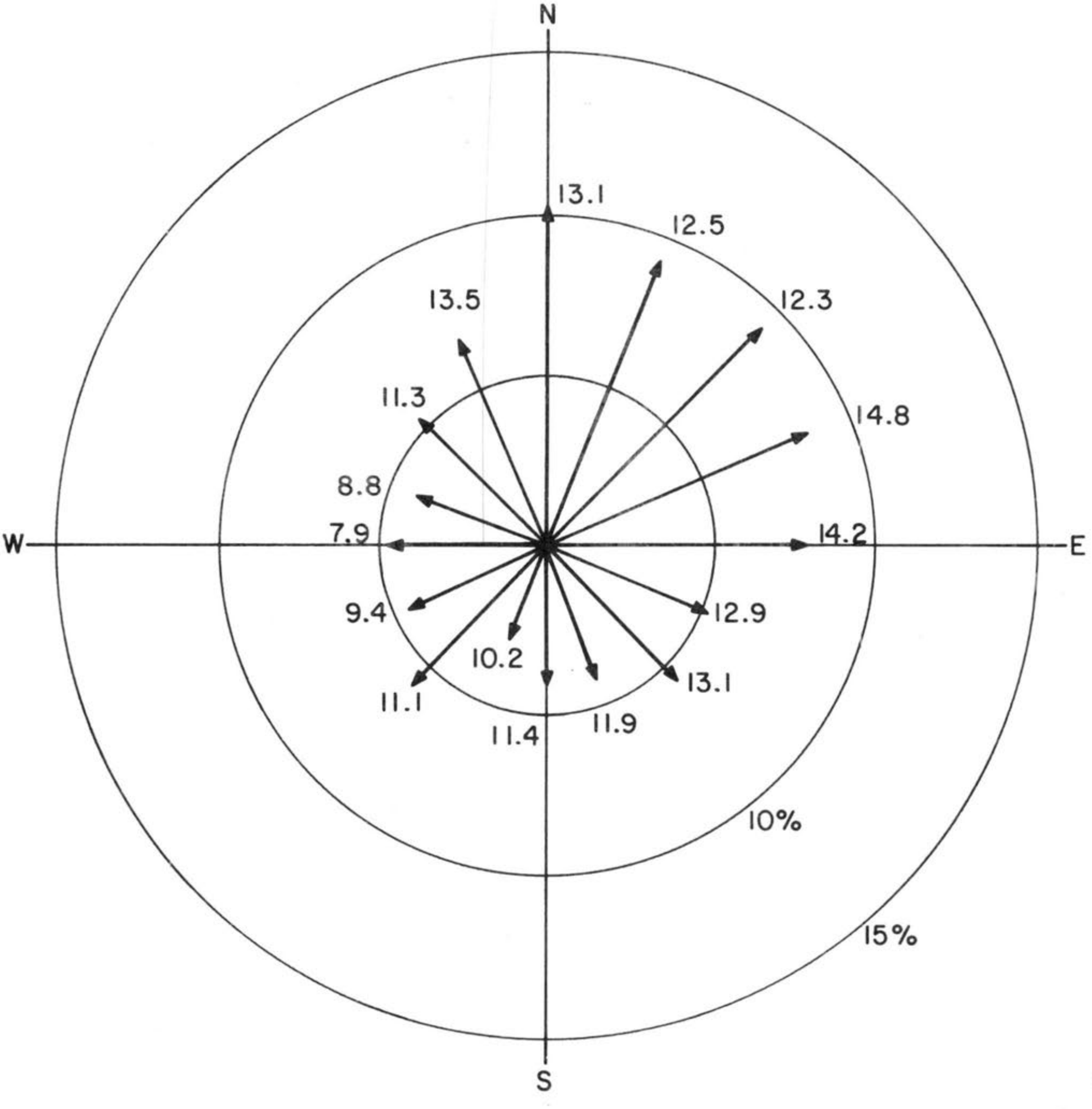


Fig. 4b. Wind Rose (Arrows point in direction of wind, numbers at end of velocities in mph. Length of arrows and concentric circles reflect frequency of wind direction.) Perry Nuclear Site, Ohio-200 ft.

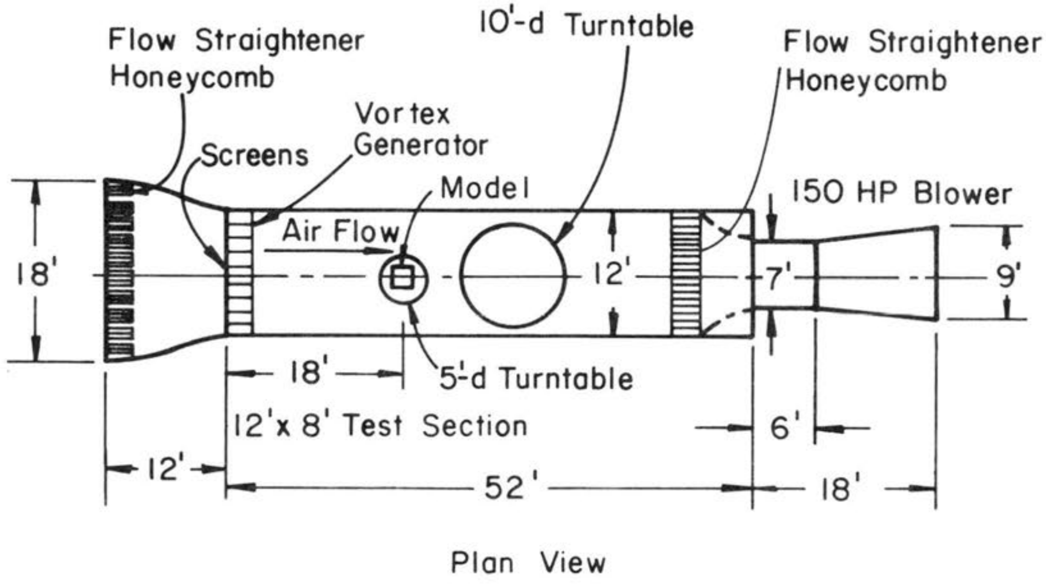


Fig. 5. Environmental Wind Tunnel (EWT) - Fluid Dynamics and Diffusion Laboratory, Colorado State University.

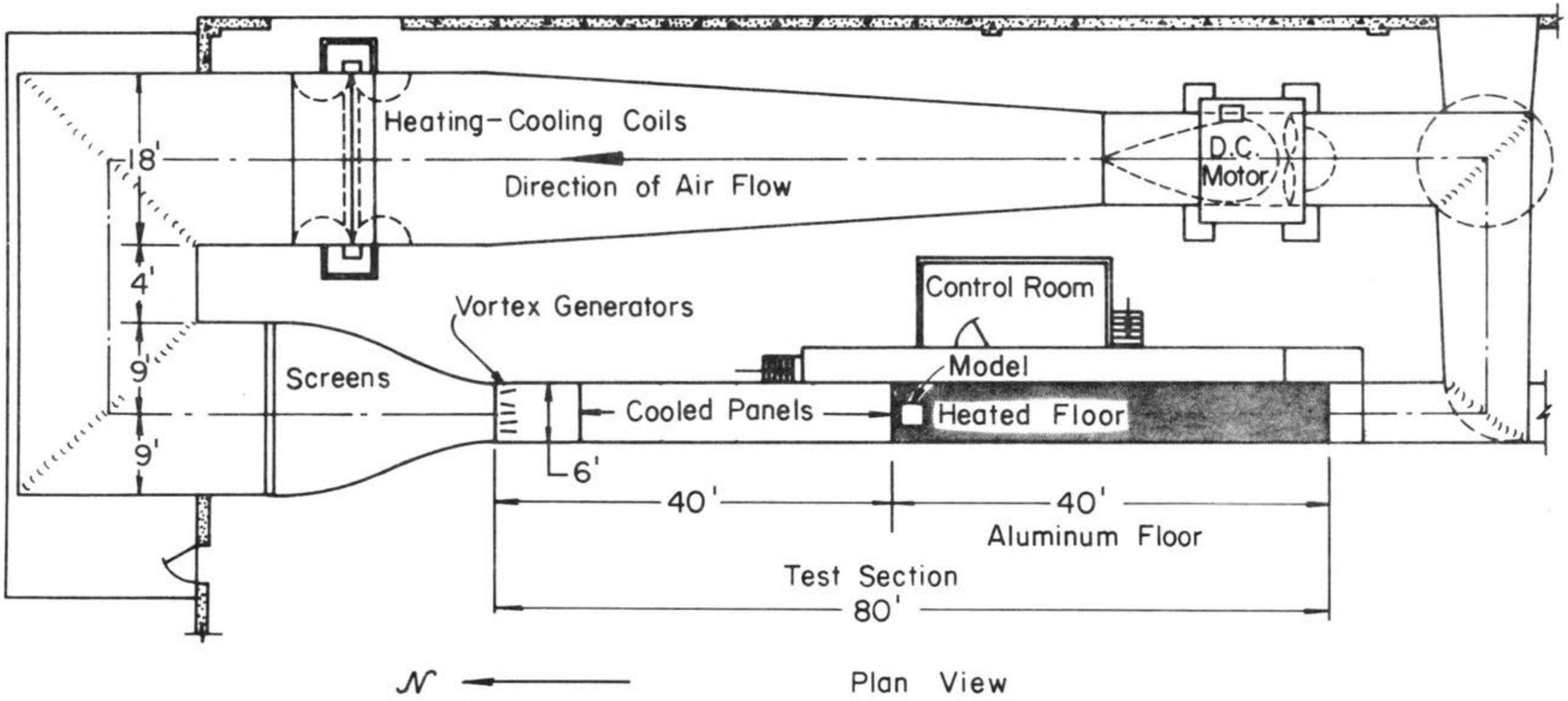


Fig. 6. Meteorological Wind Tunnel (MWT) - Fluid Dynamics and Diffusion Laboratory, Colorado State University.

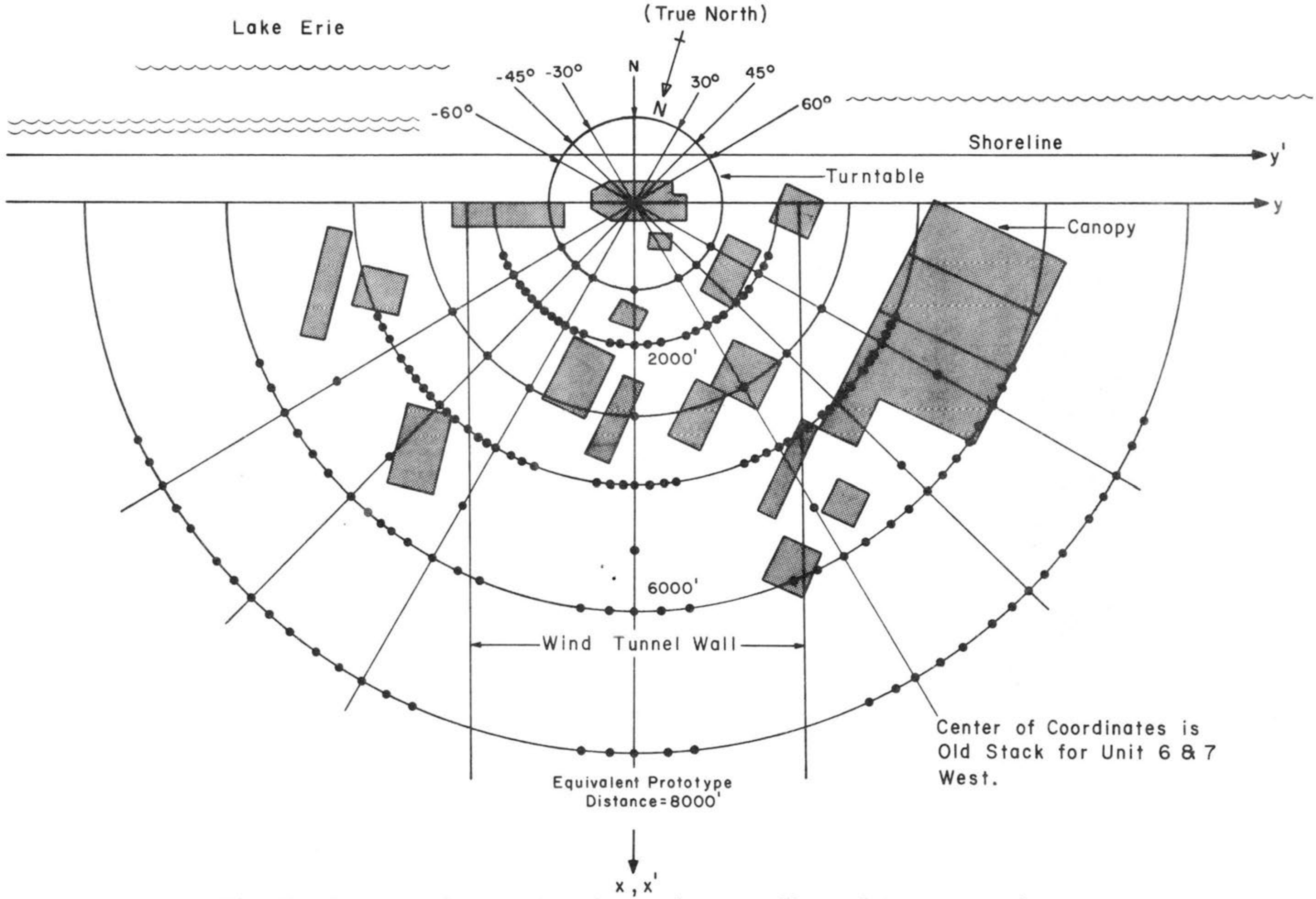


Fig. 7. Concentration sample points and surrounding model tree canopies.

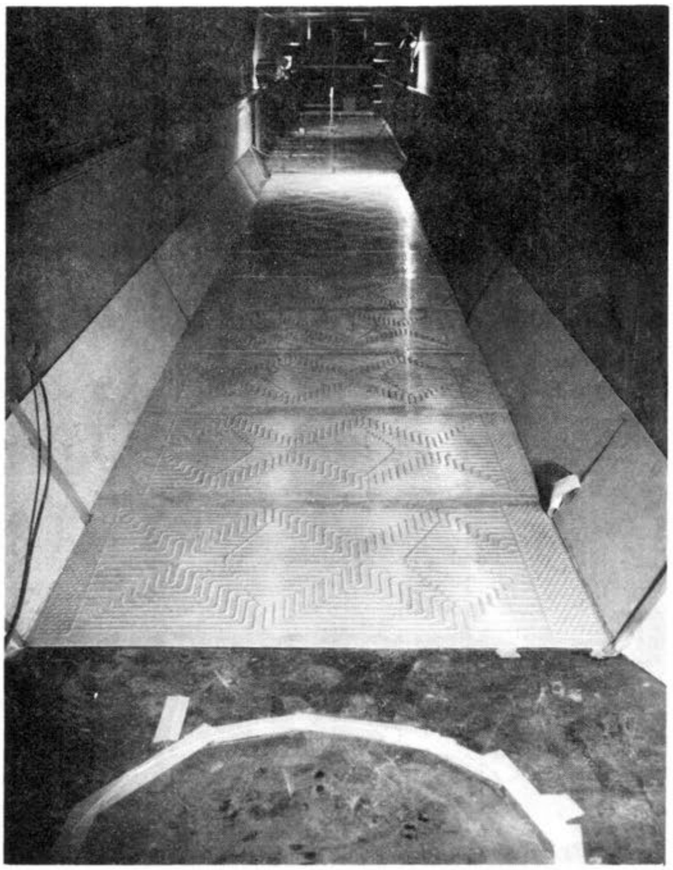


Fig. 8. Aluminum cooling panels installed on floor of the Meteorological Wind Tunnel, (looking downstream).

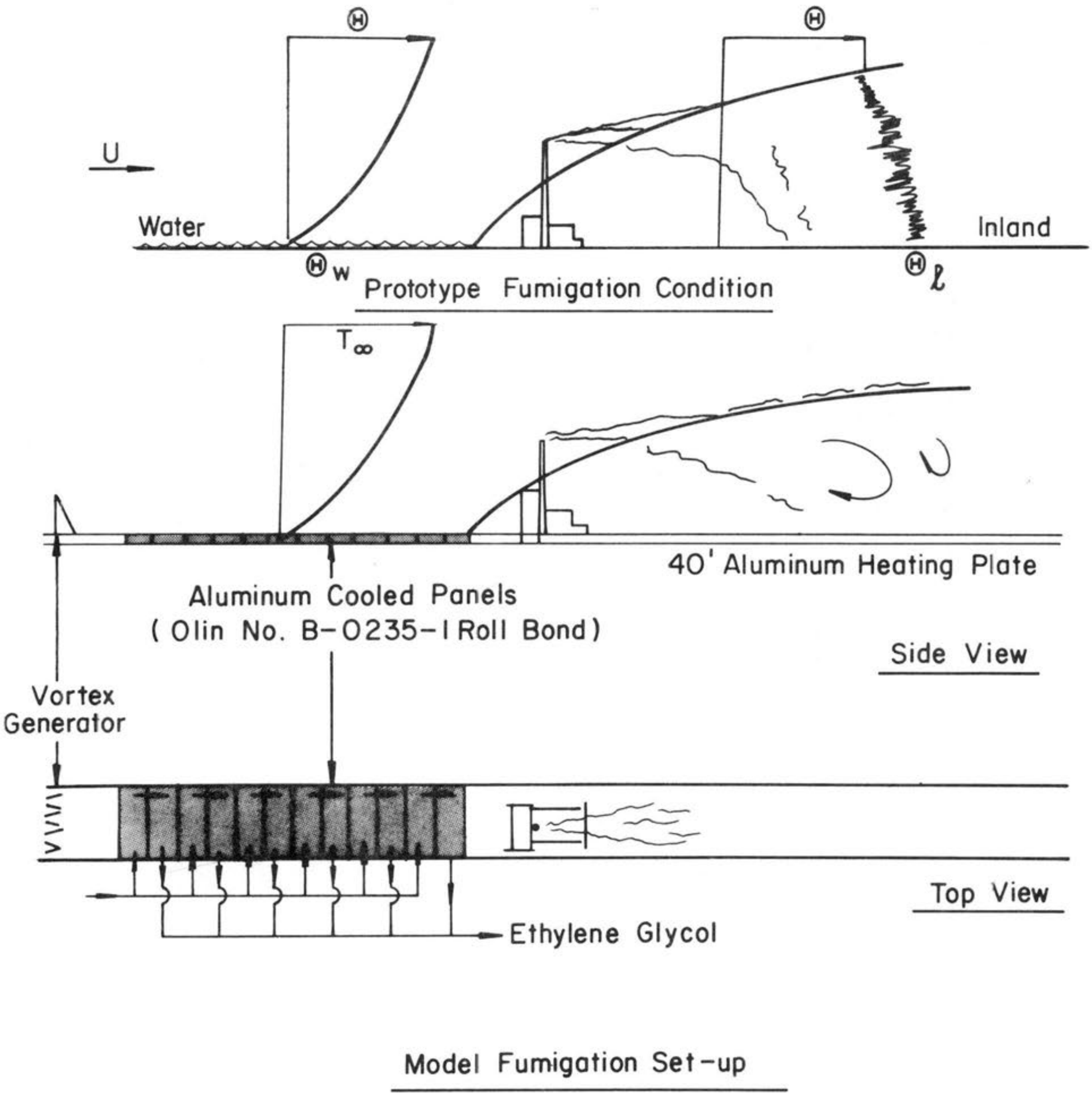


Fig. 9. Schematic digram of model study of fumigation dispersion.

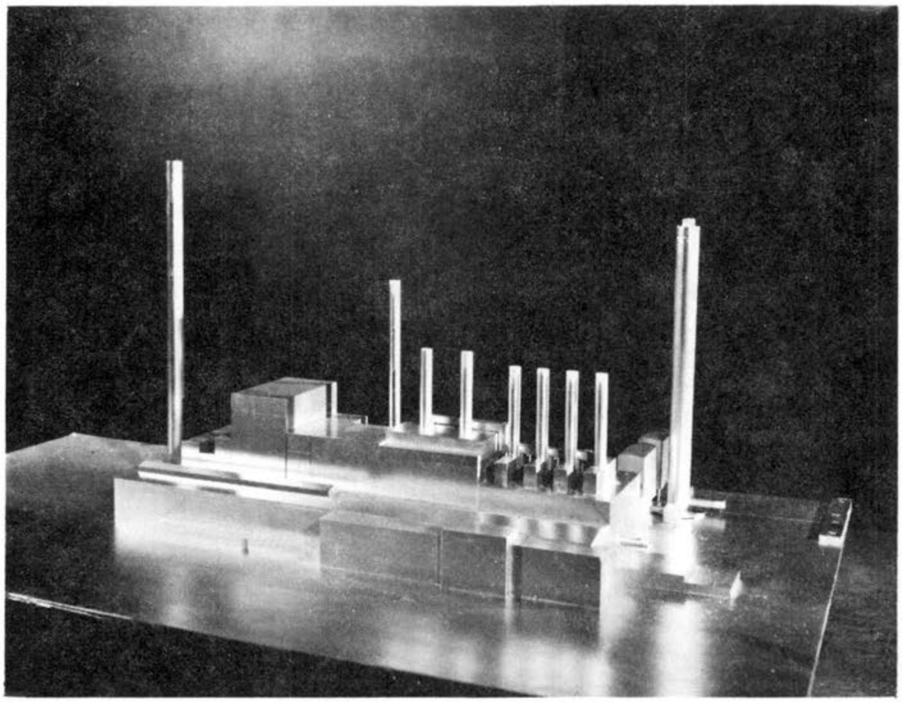


Fig. 10. Picture of the model of Avon Lake Power Plant.

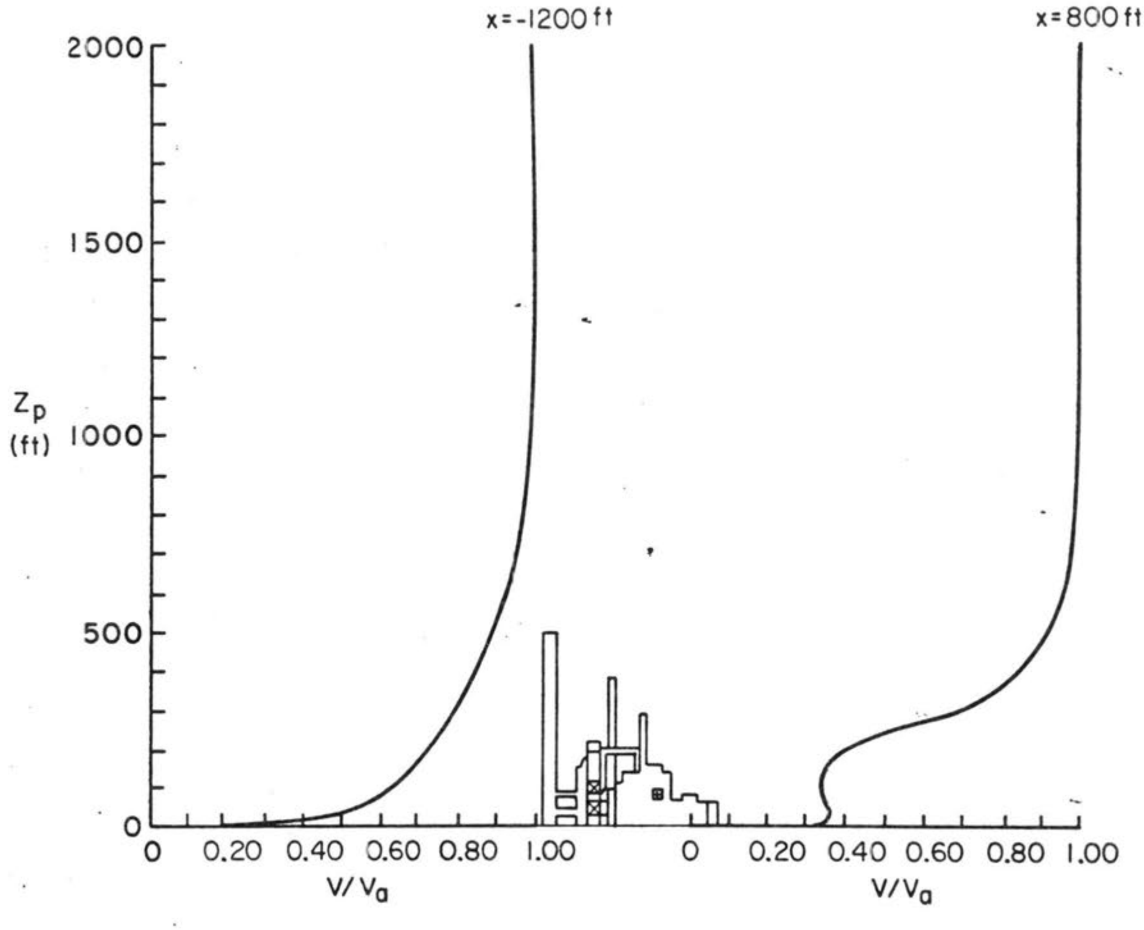


Fig. 11. Velocity profiles at neutral condition.

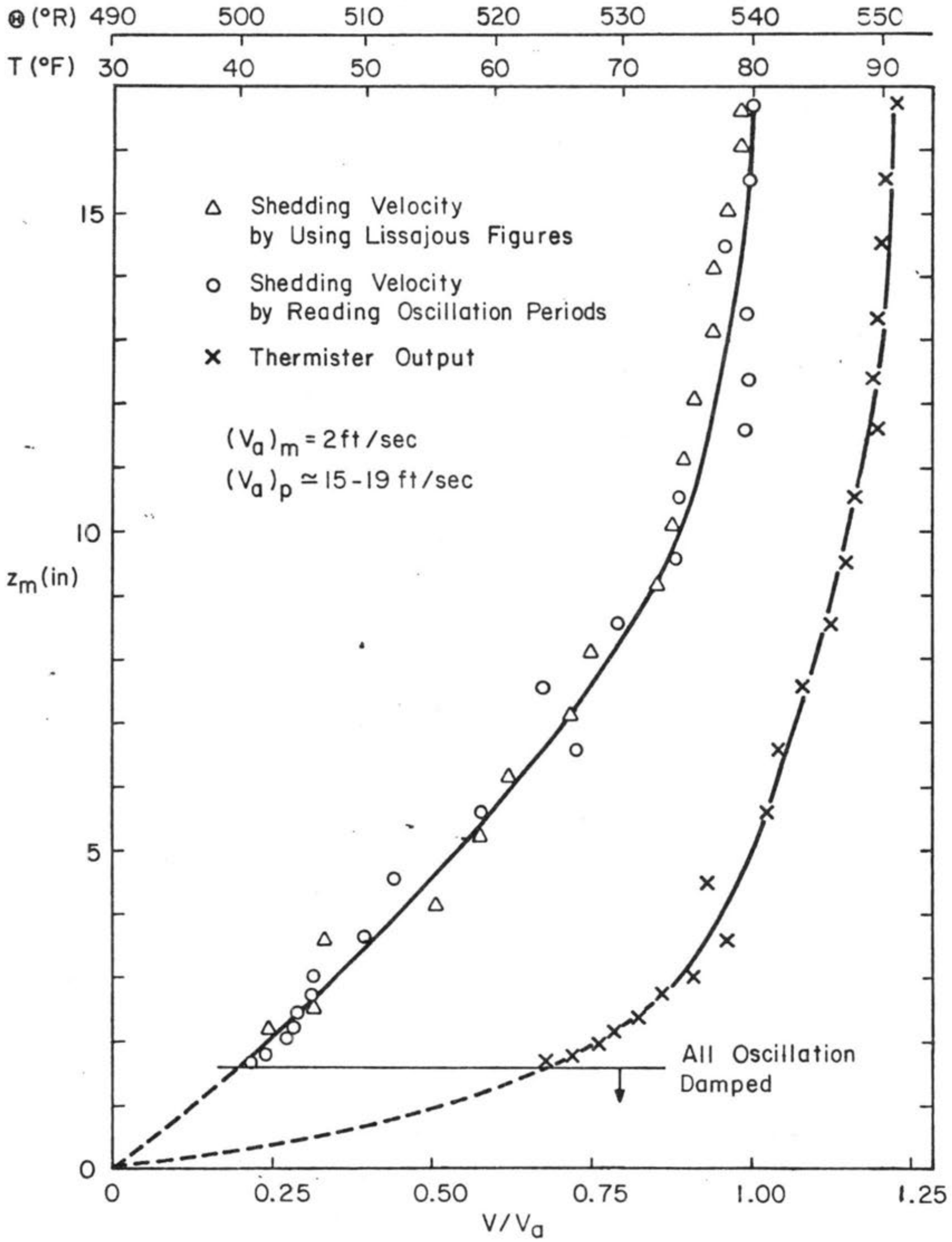


Fig. 12. Velocity profiles: fumigation conditions.

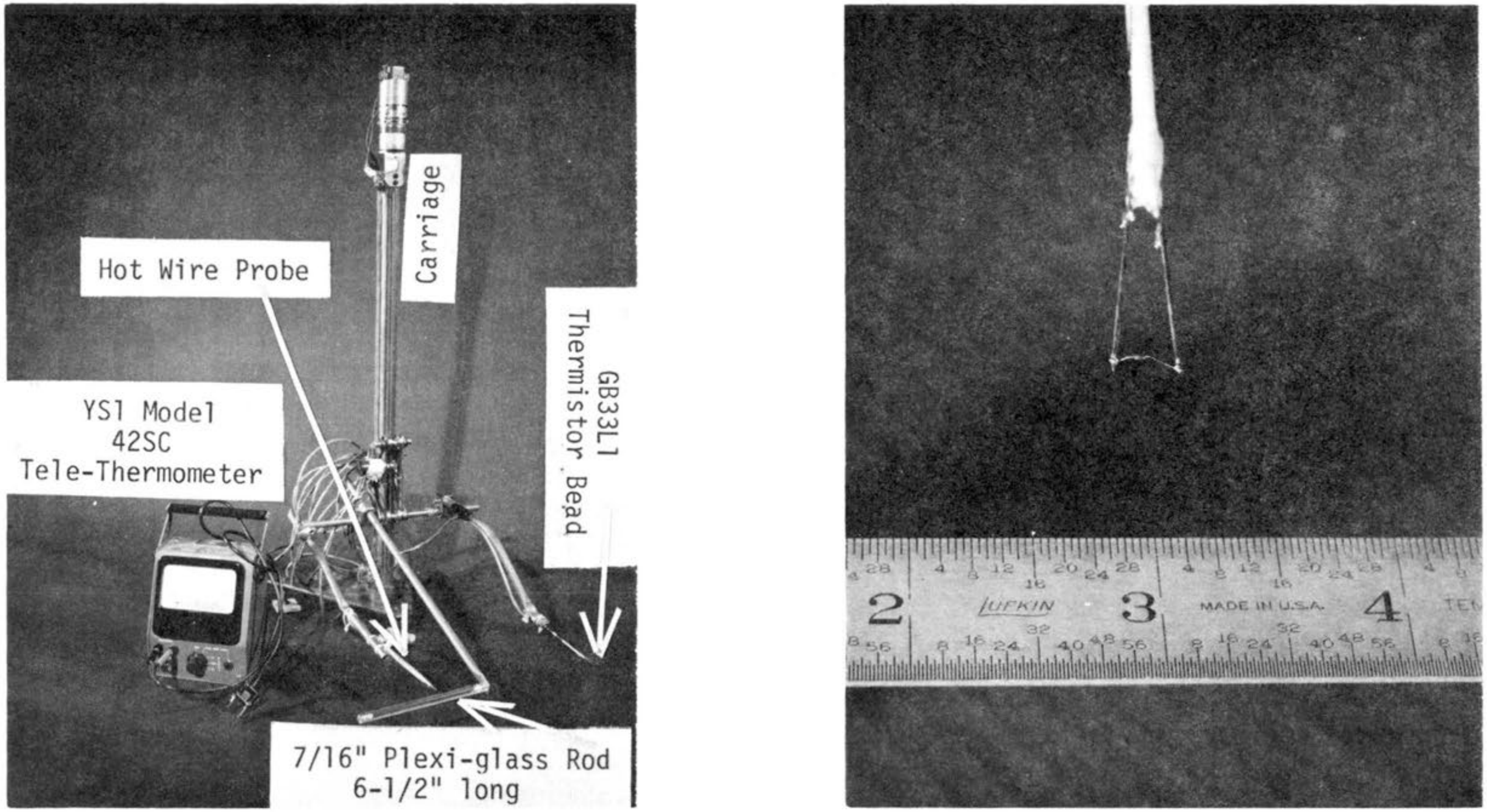


Fig. 13. Instruments for velocity and temperature measurements.

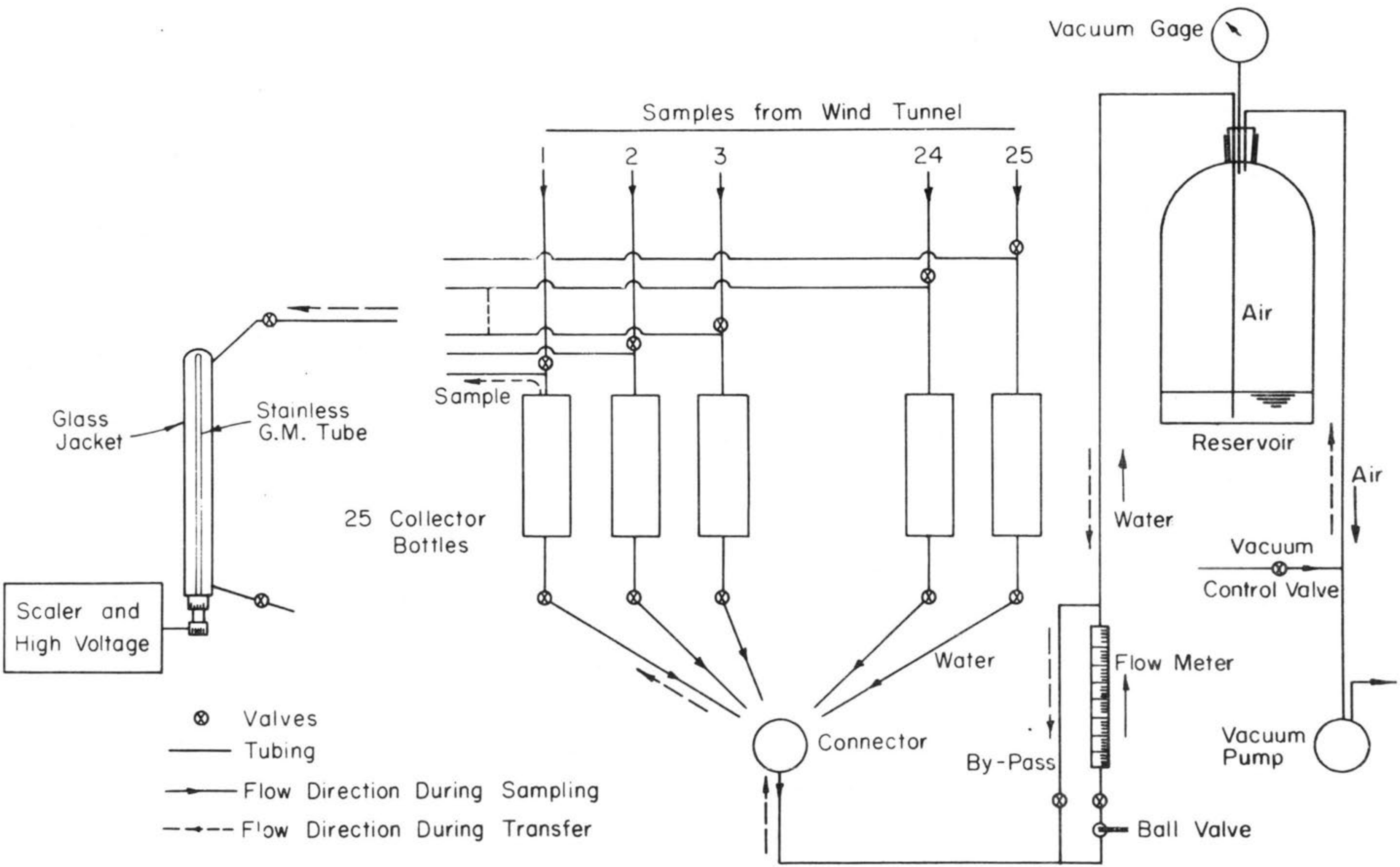


Fig. 14a. Tracer-gas sampling and analysis system - schematic.

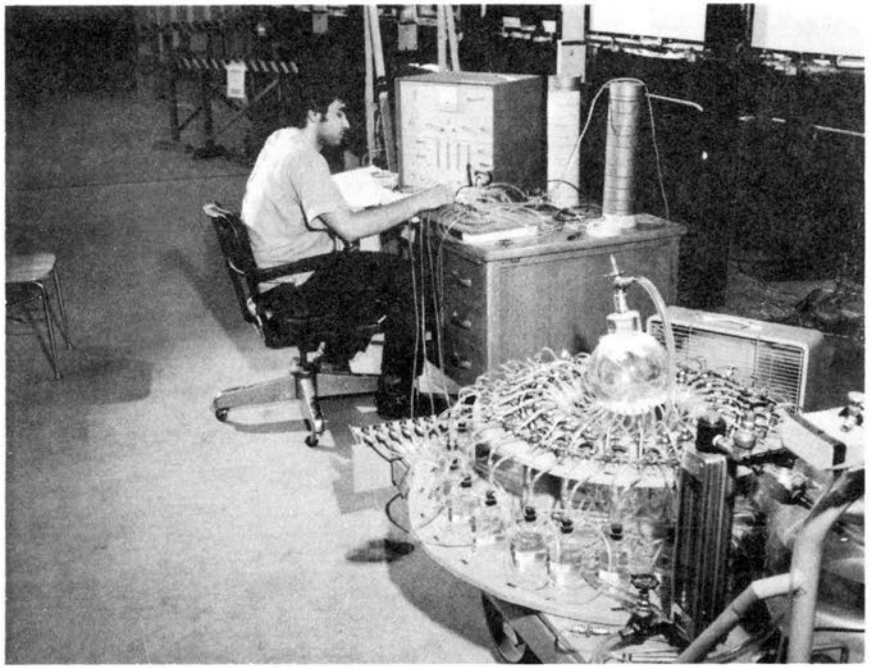


Fig. 14b. Tracer gas and analysis system.

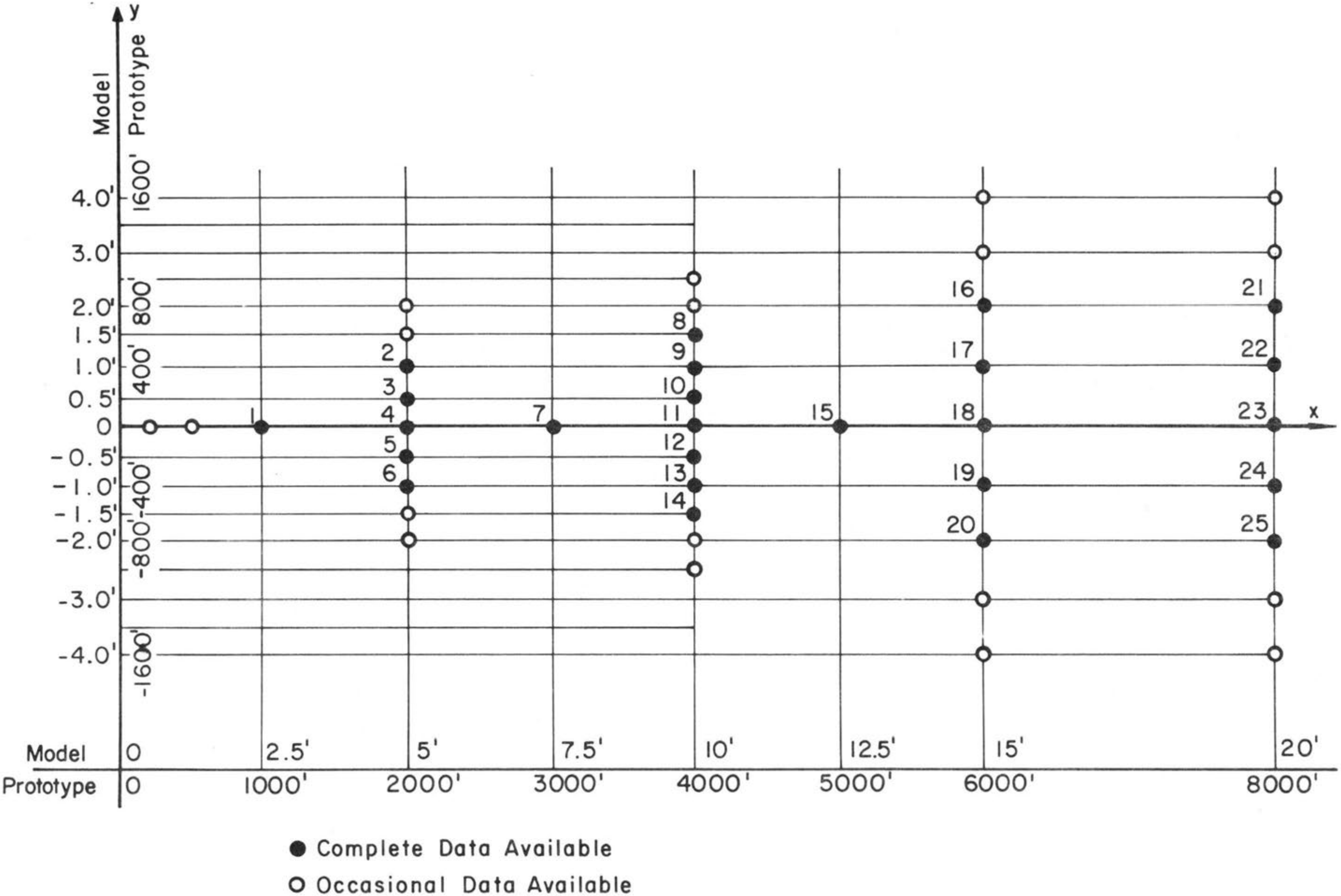


Fig. 15. Coordinates for concentration measuring locations.

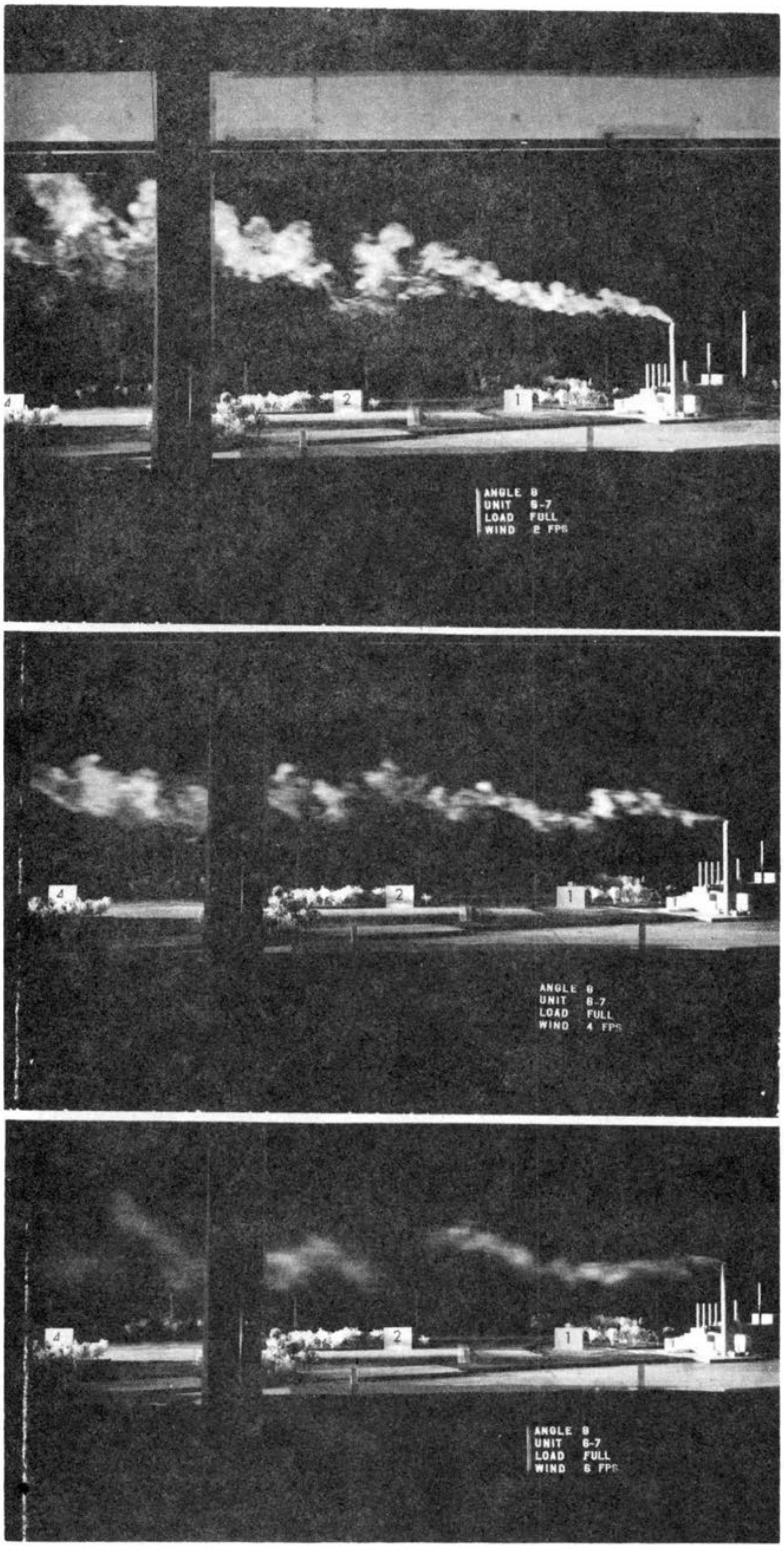
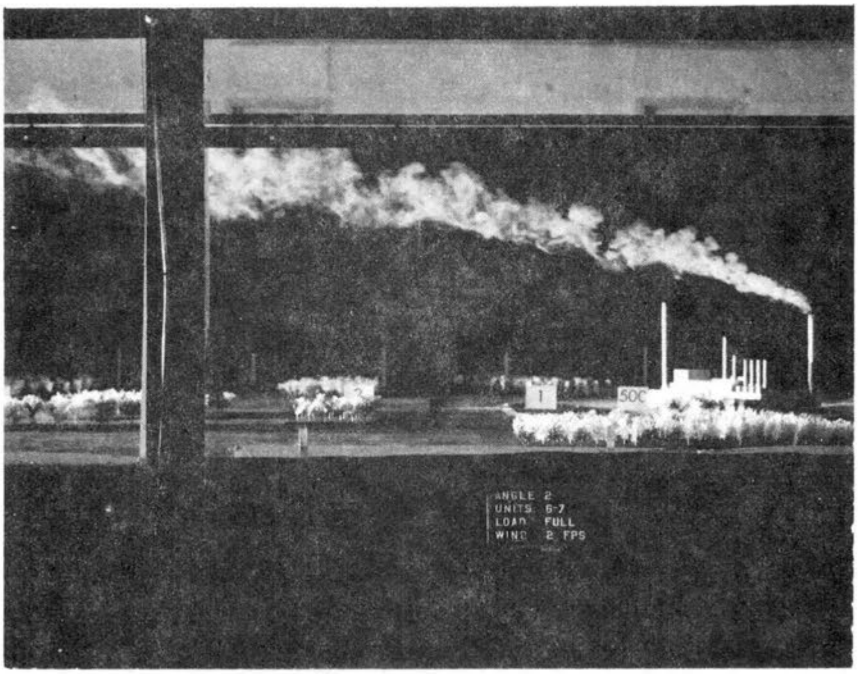


Fig. 16. Flow visualization unit 6-7, full load, wind angle 285°, wind speed 15,30,45 mph (shutter speed 1/32 second).



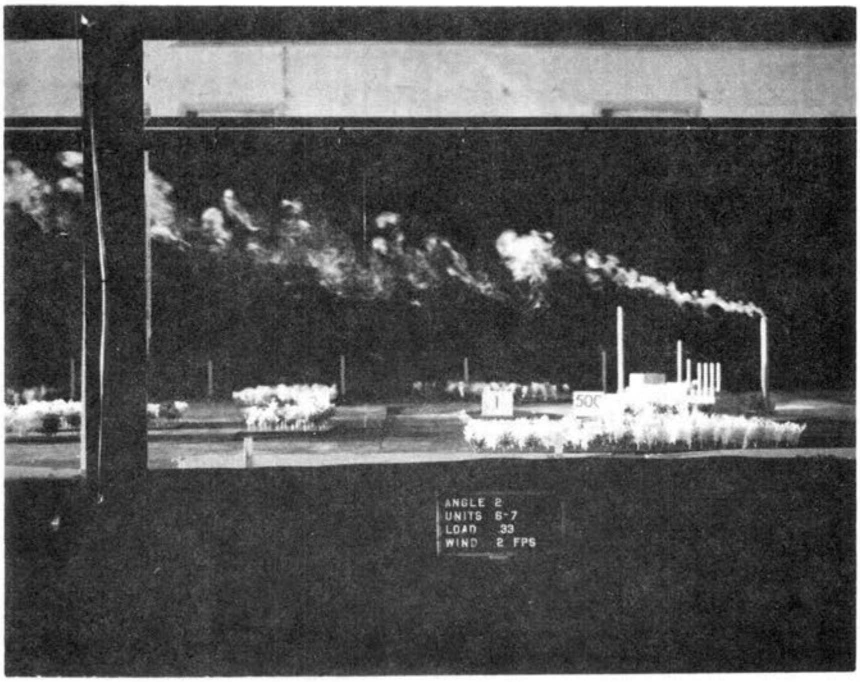
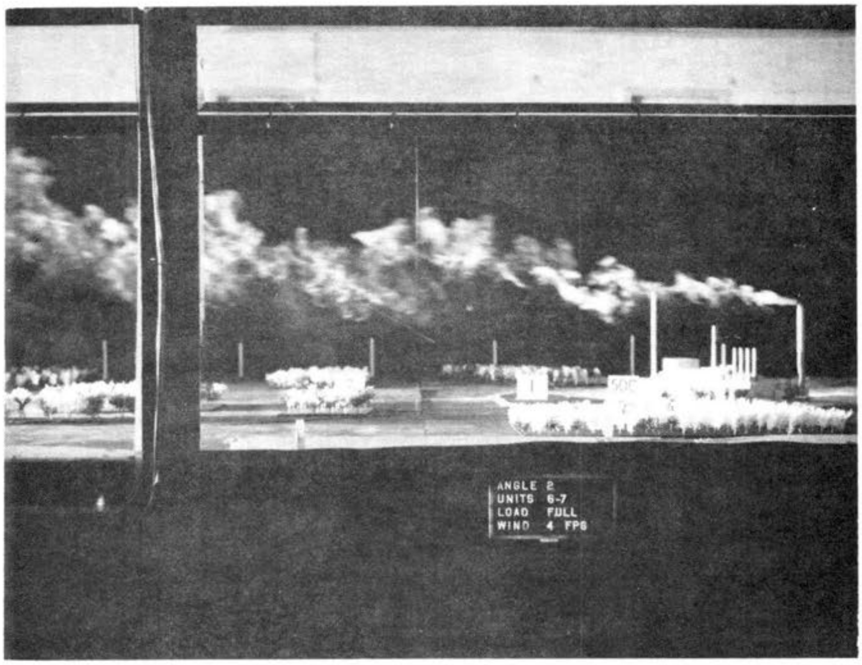


Fig. 17. Flow visualization unit 6-7, full and one-third load, wind speed 15 mph, wind angle 15° (shutter speed 1/32 second).



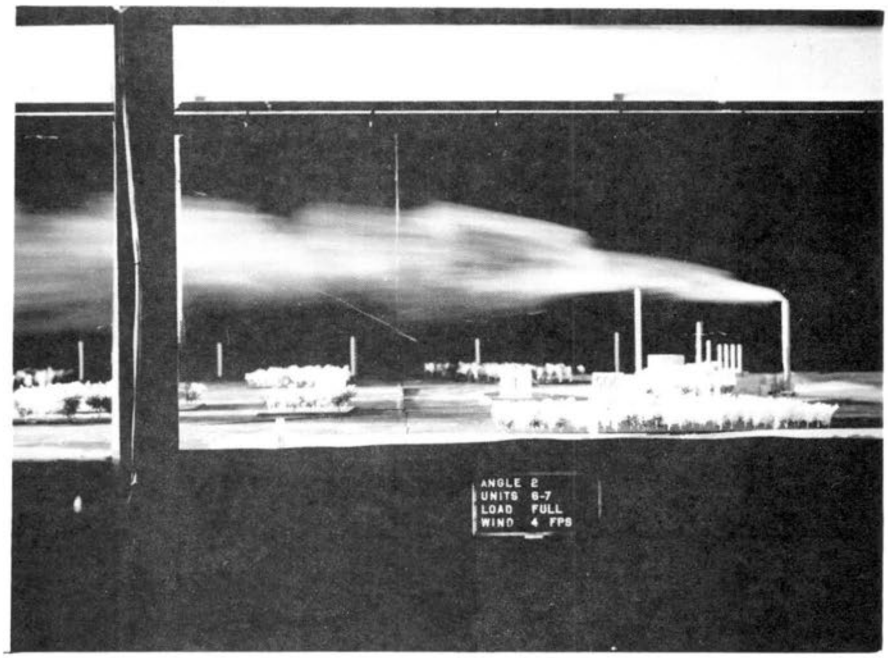


Fig. 18. Flow visualization unit 6-7, full load, wind speed 30 mph, wind angle 15° shutter speeds of 1/32 and 30 seconds.

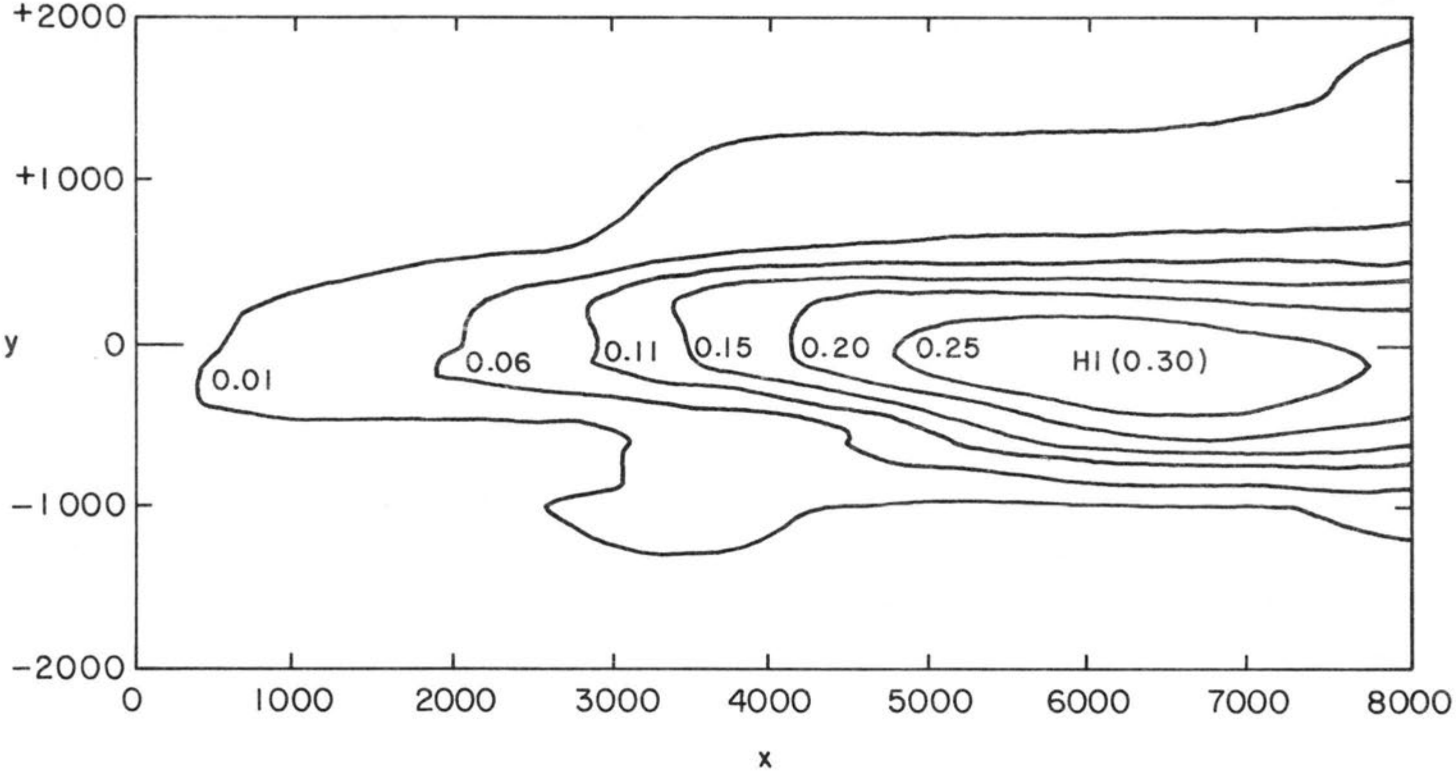


Fig. 19. Unit 6&7, full load, wind angle +30°, wind speed 45 mph, concentration SO_2 ppm.

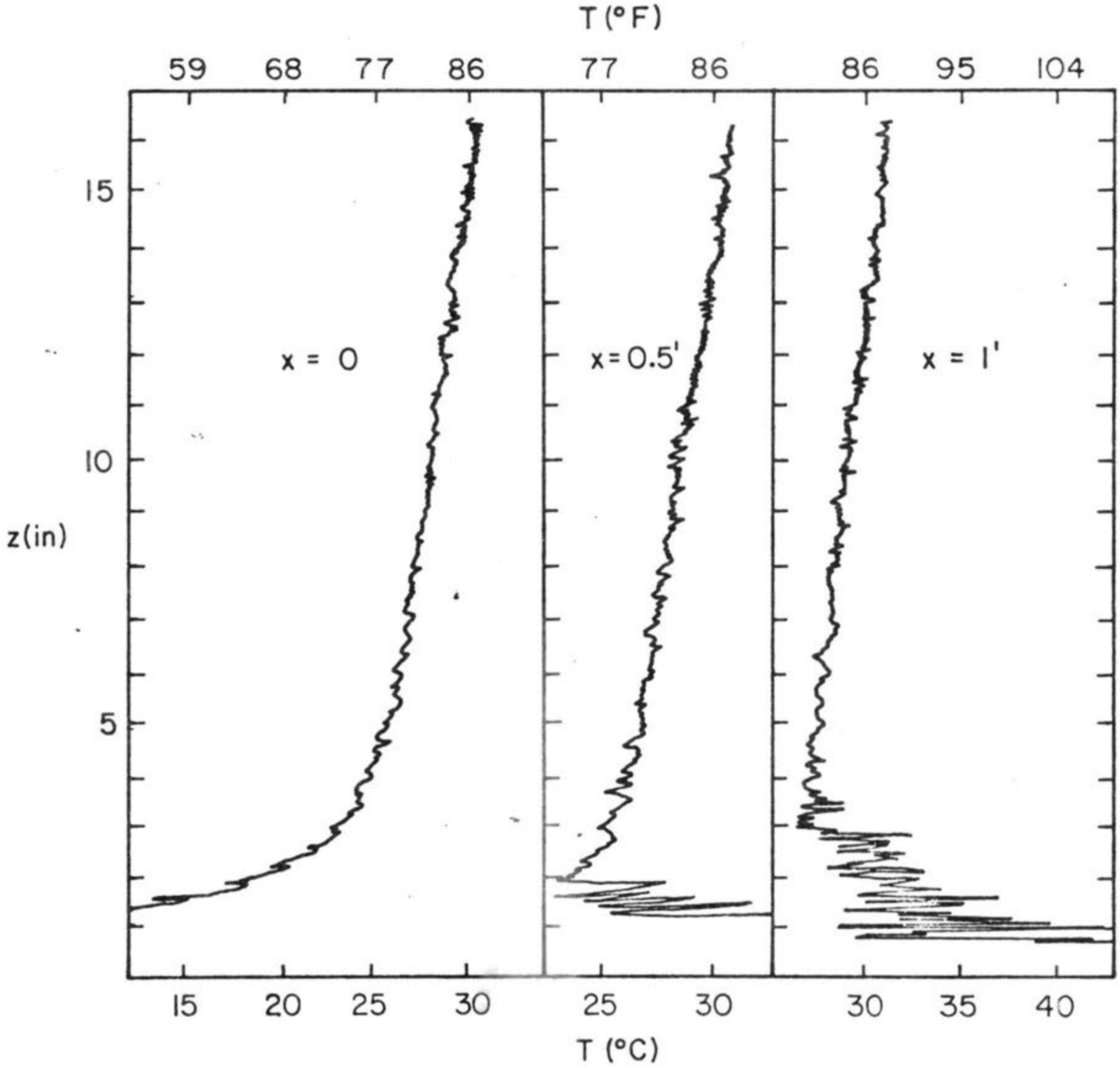


Fig. 20. Temperature profiles growing over simulated lake and level surfaces, $V_m \simeq 2$ ft/sec. T_a = 110°F, T_w upwind ≃ 32°F, T_w downstream ≃ 260°F.

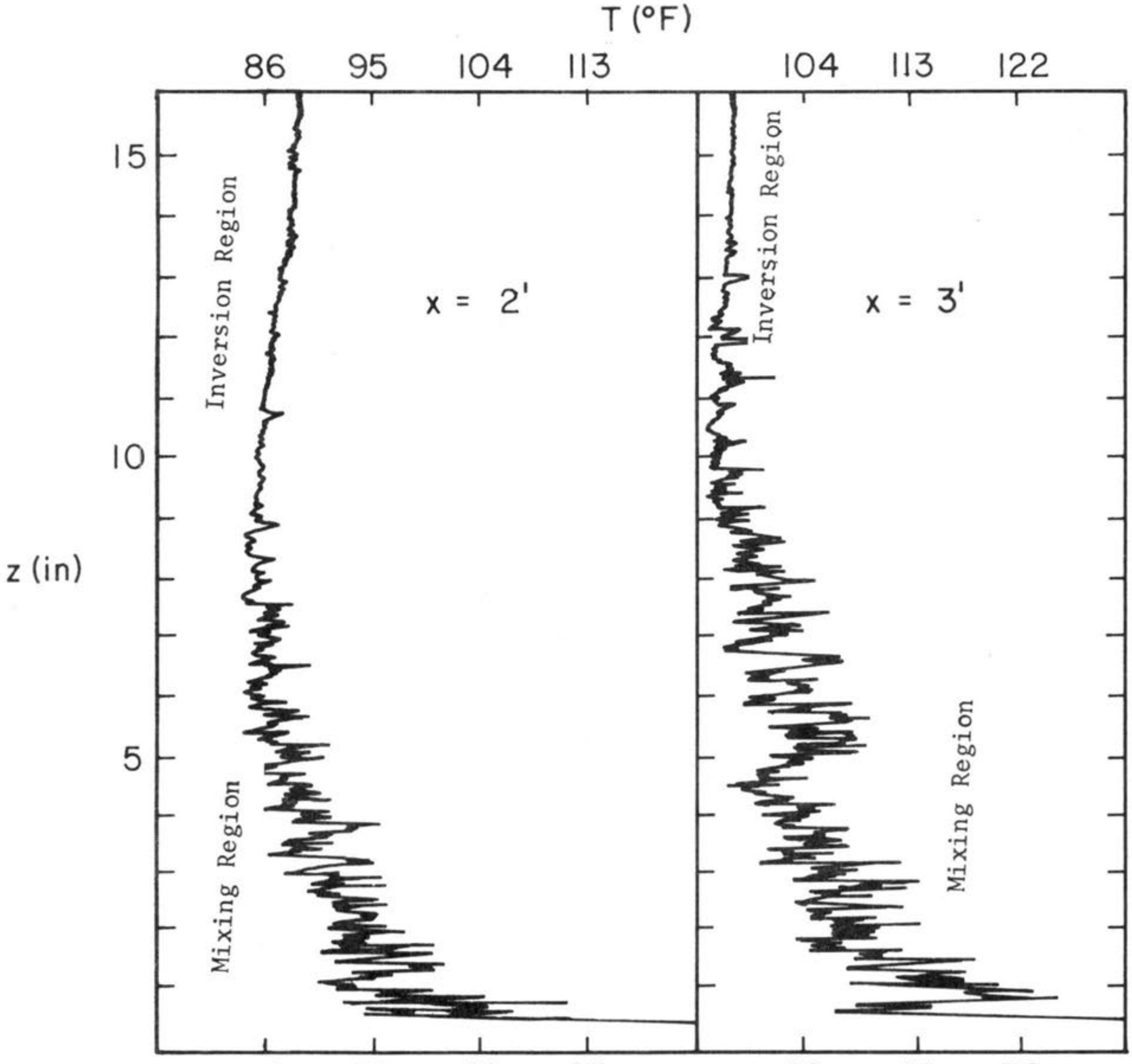


Fig. 20 (Continued)

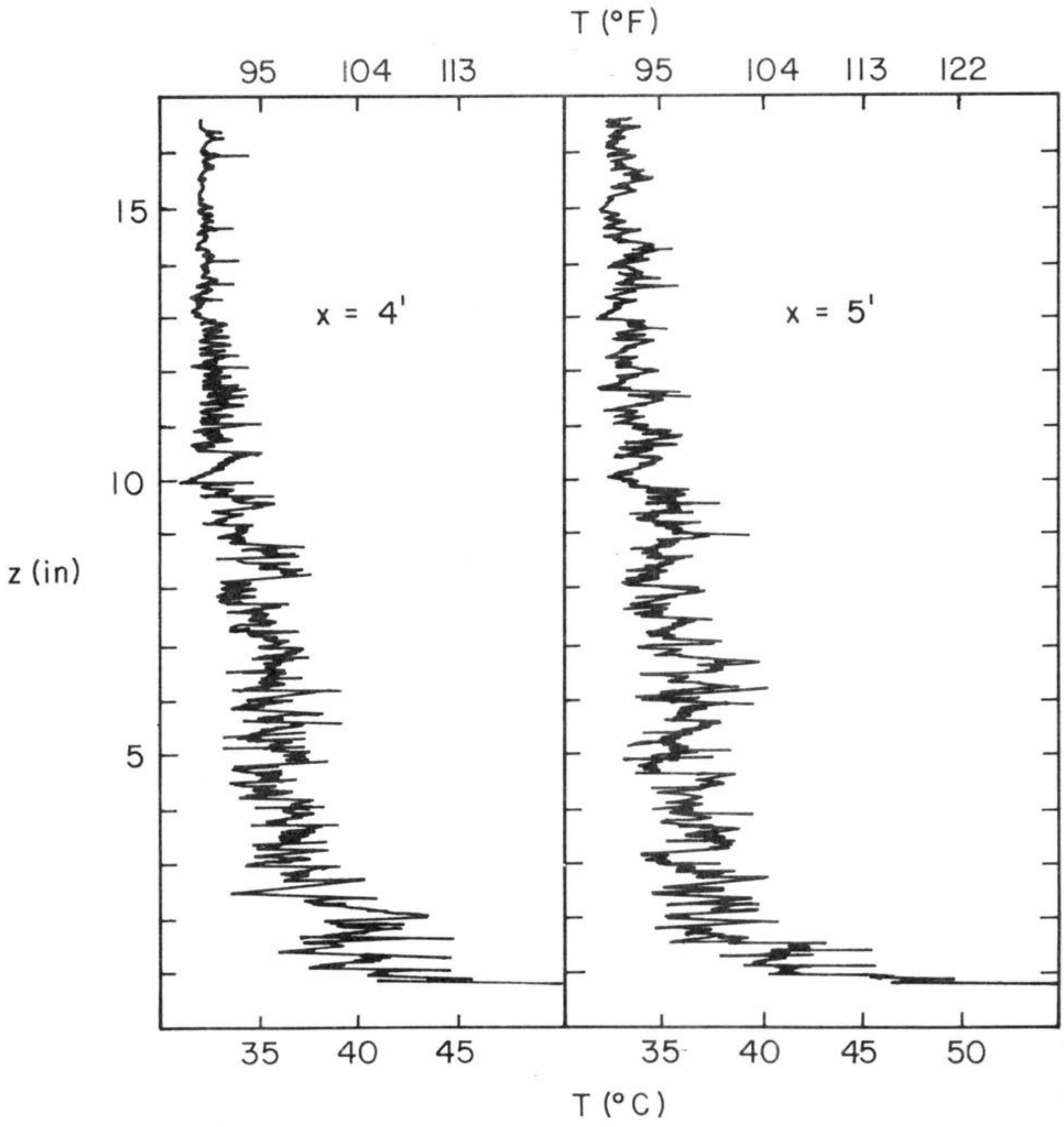


Fig. 20 (Continued)

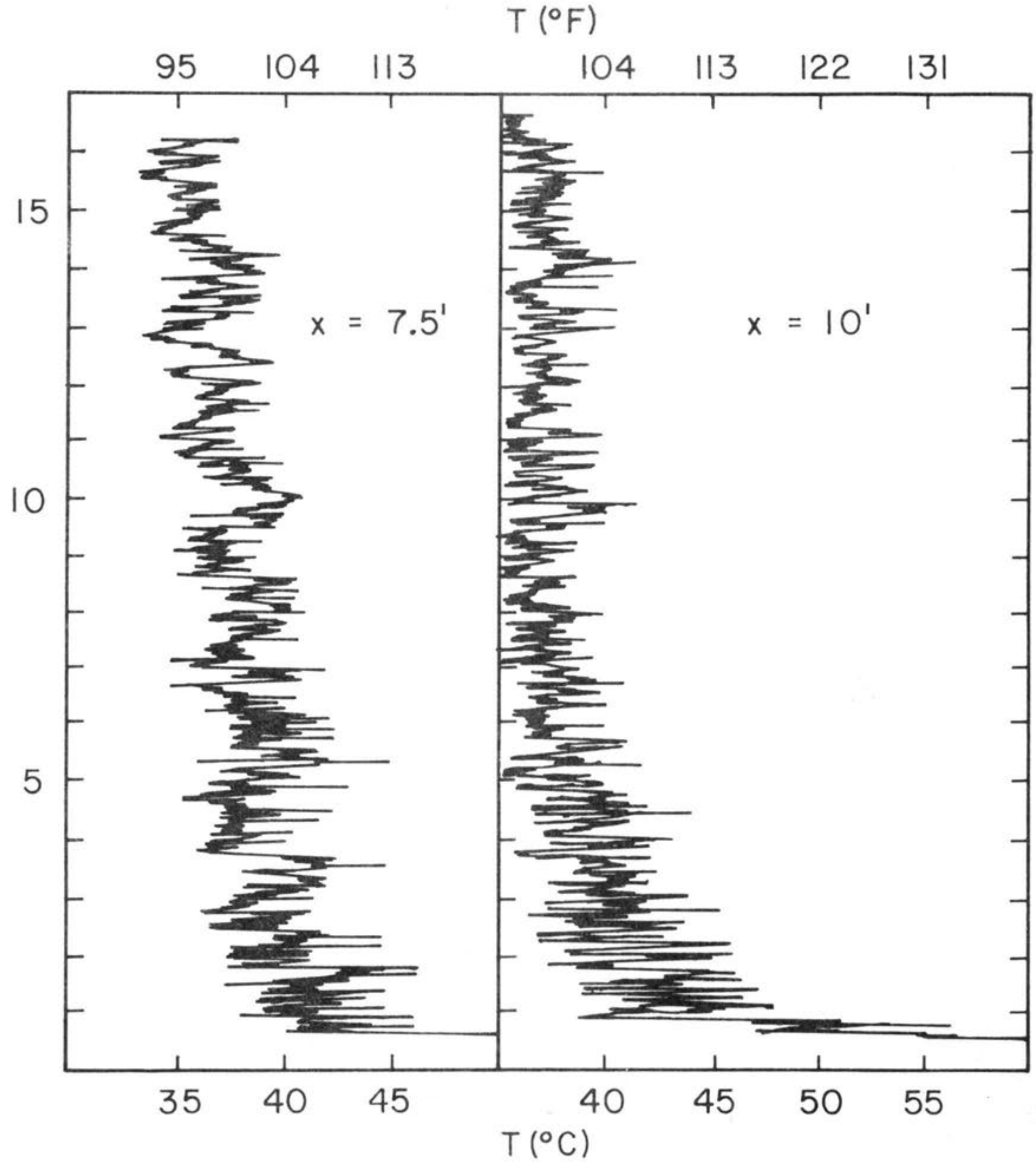


Fig. 20 (Continued)

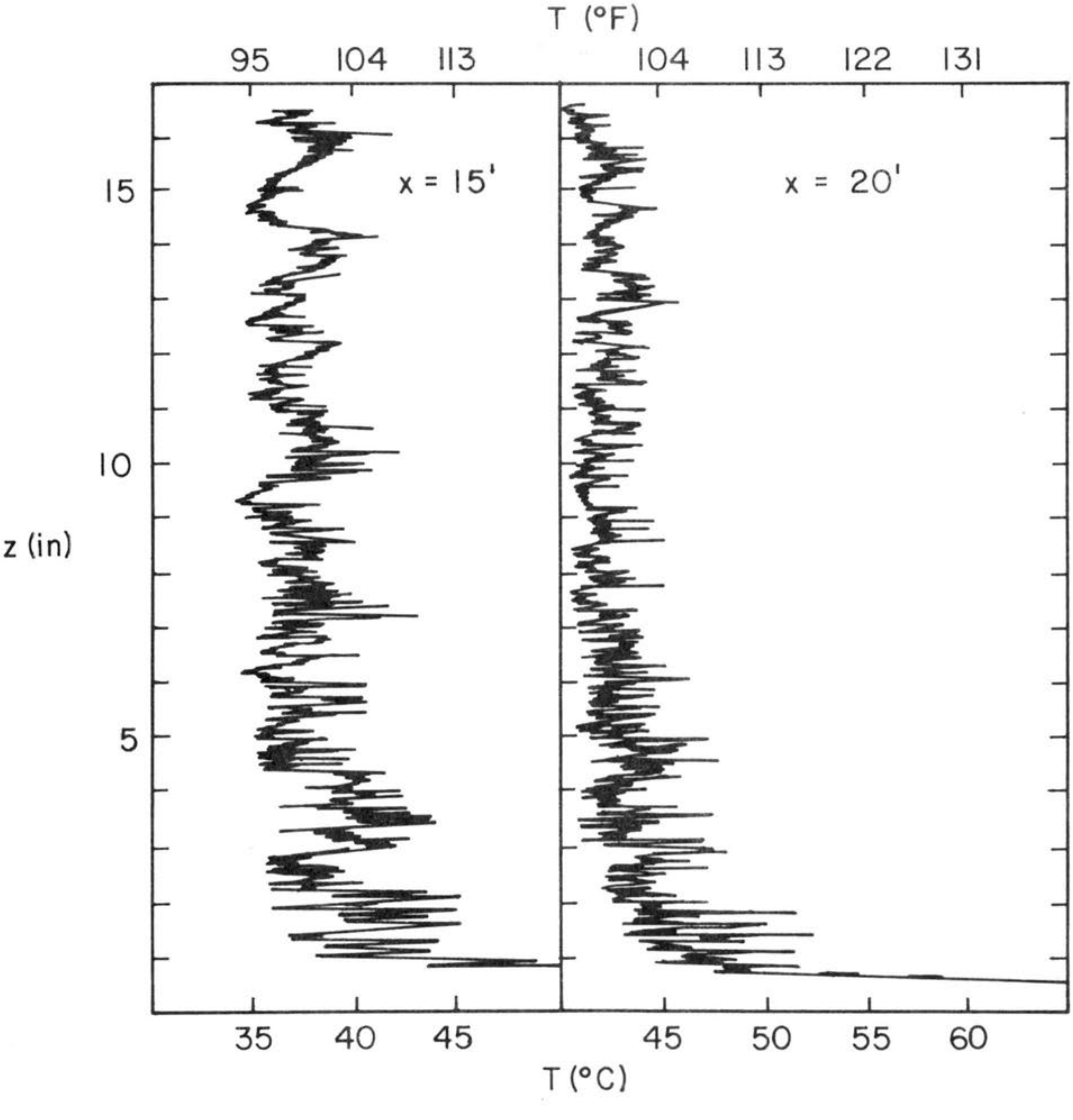


Fig. 20 (Continued)

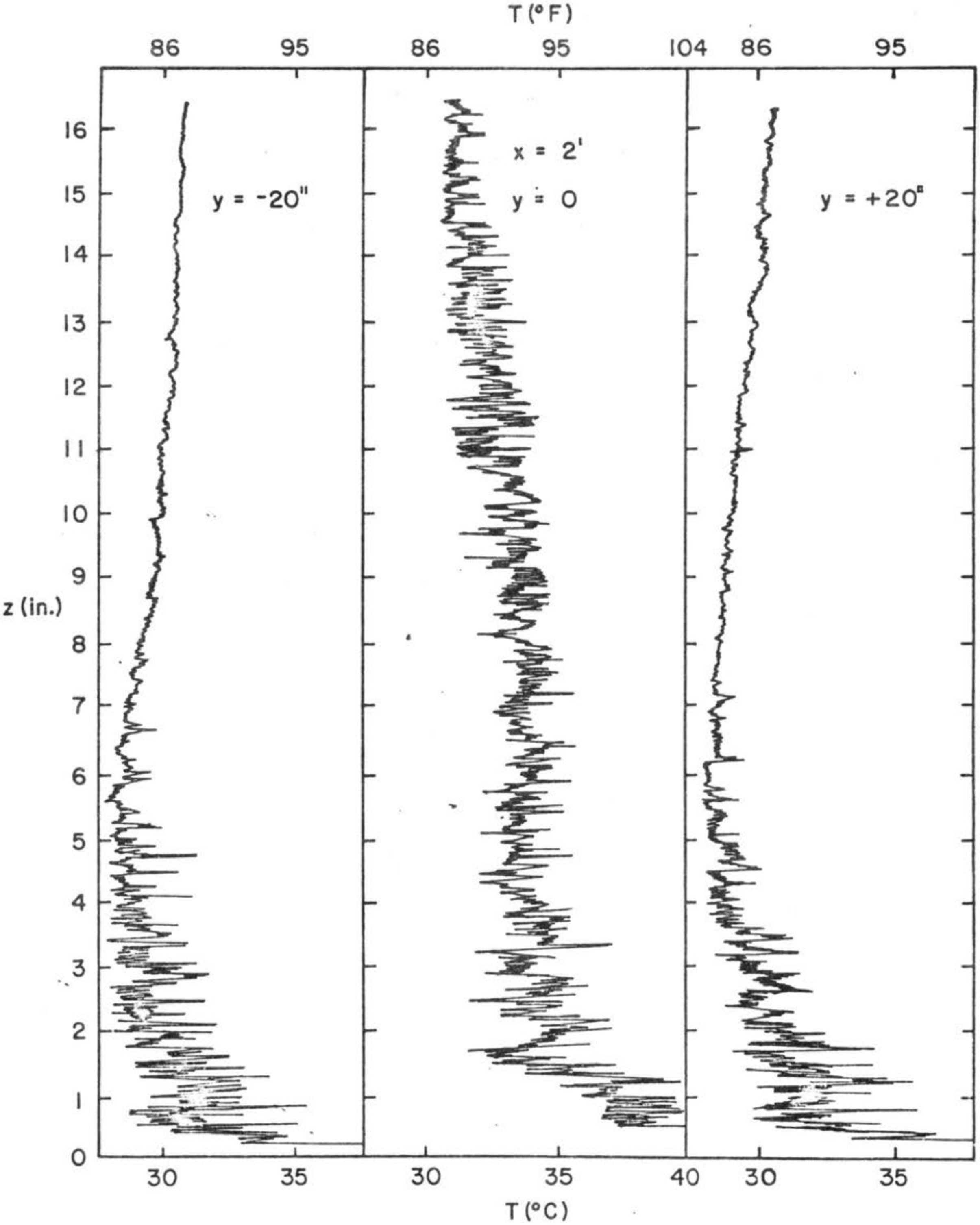


Fig. 21. Lateral temperature variation over simulated land surface.

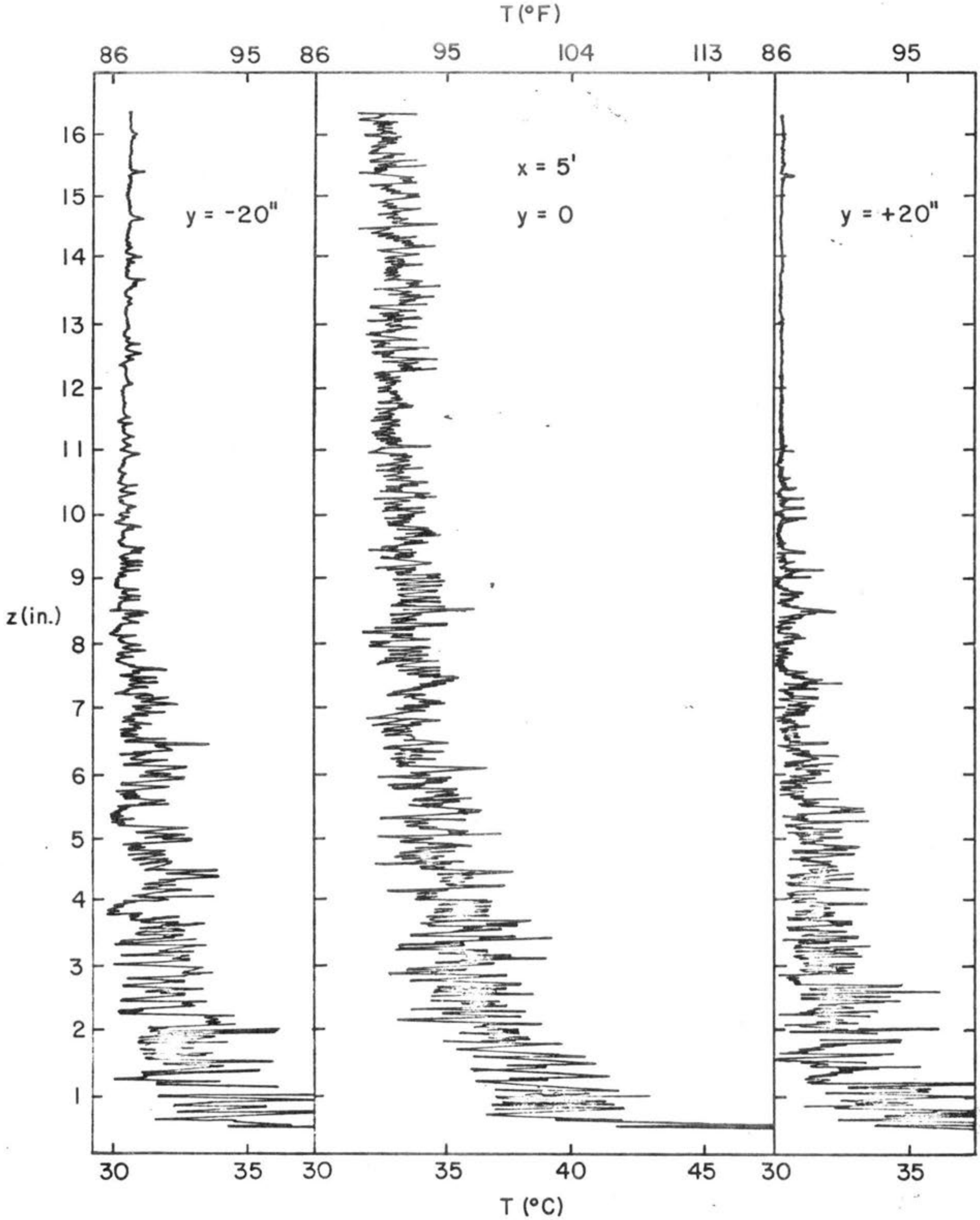


Fig. 21 (Continued)

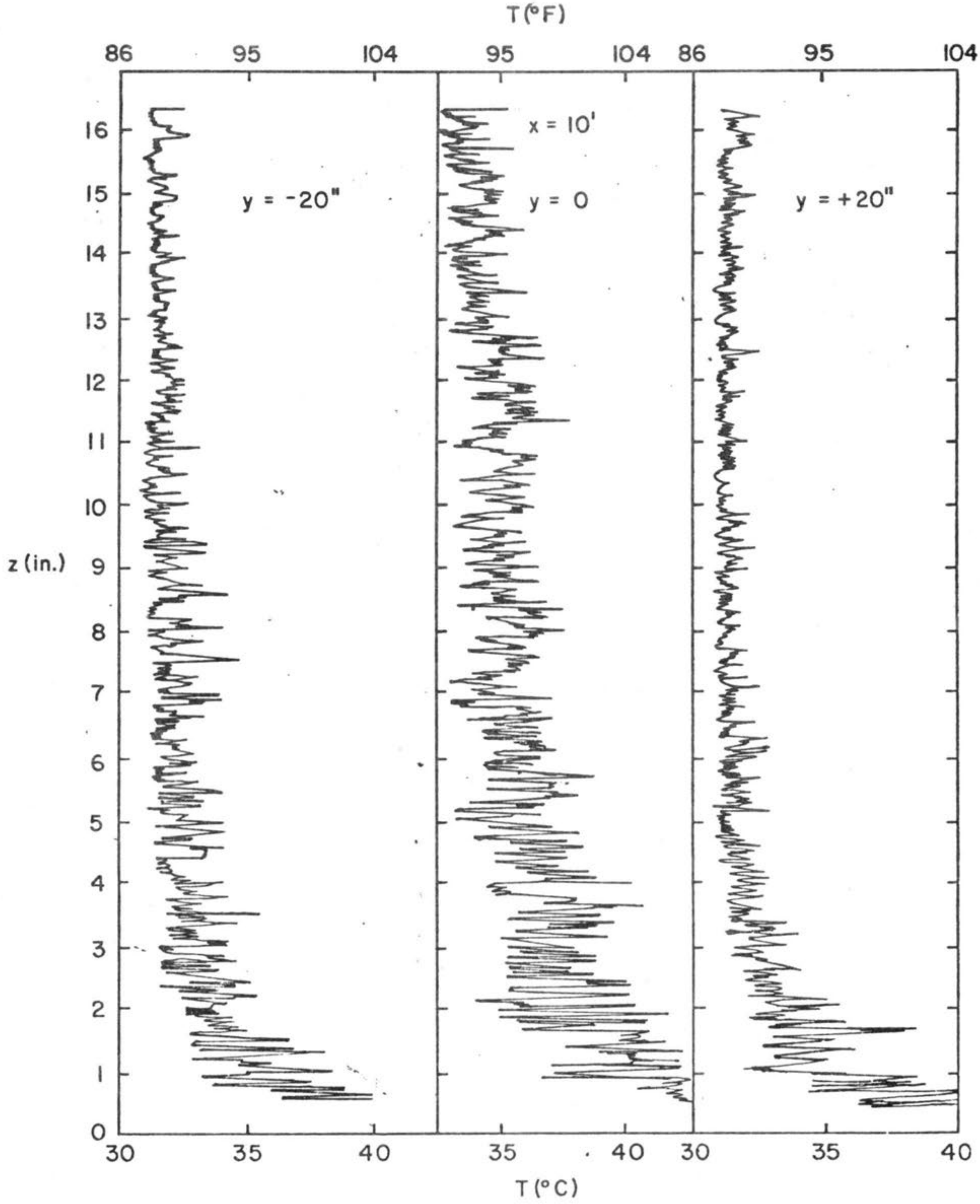


Fig. 21 (Continued)

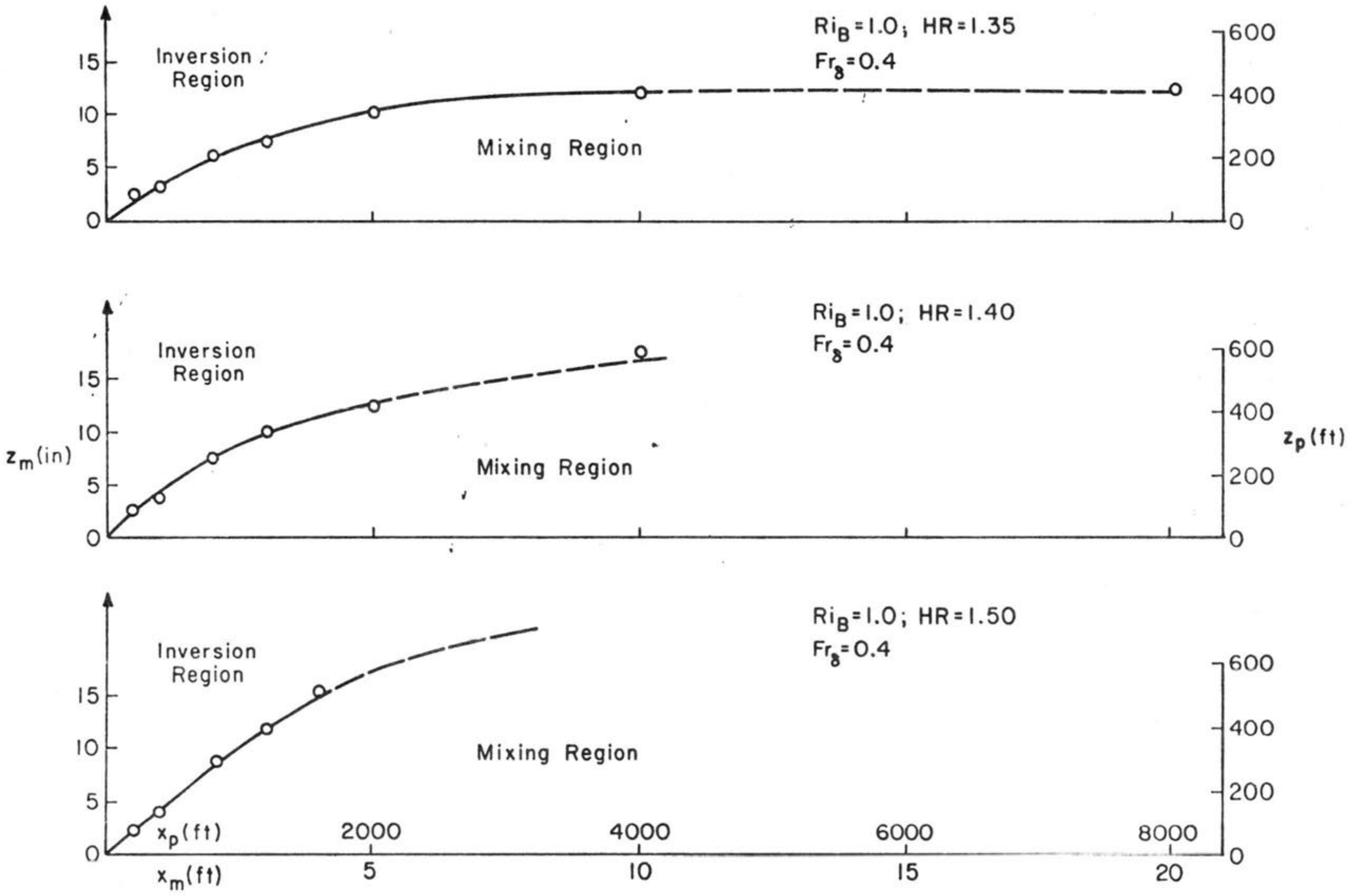
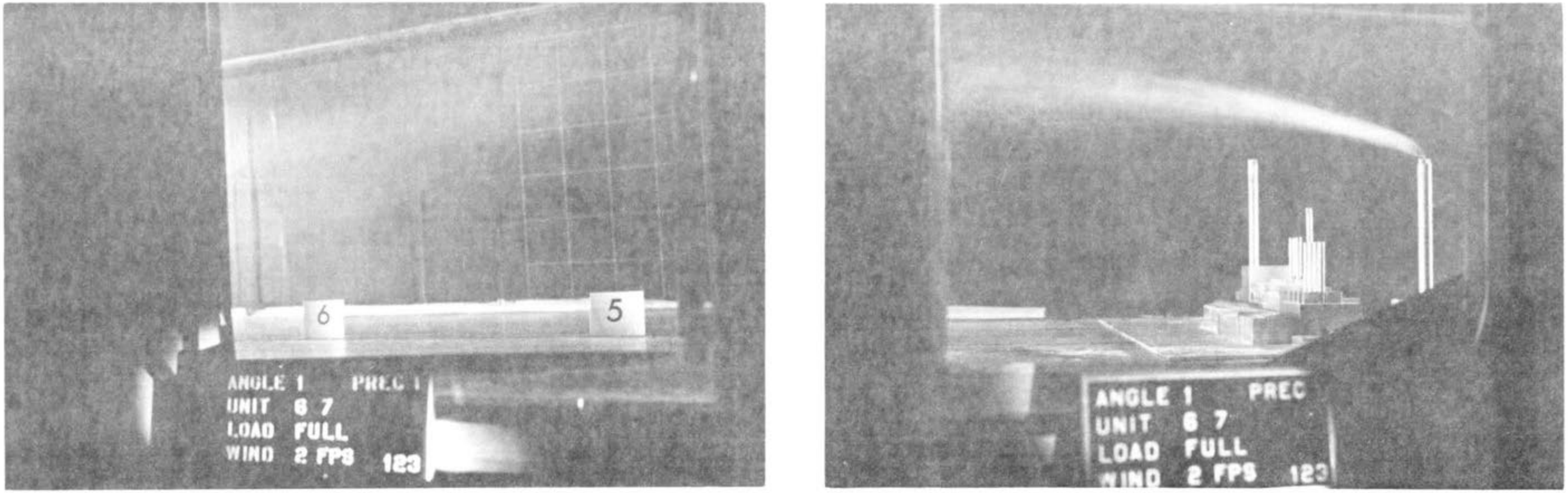
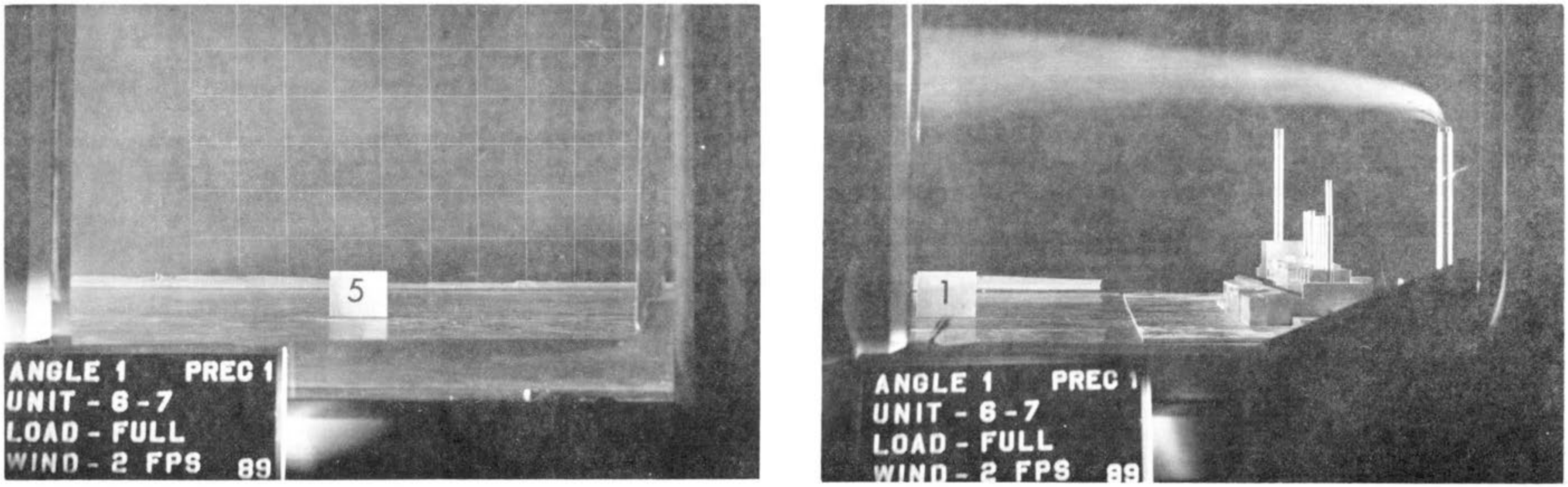


Fig. 22. Growth of the mixing layer at various floor temperatures.



HR = 1.4



HR = 1.5

Fig. 23. Flow visualization, fumigation, unit 6-7, full load, wind angle 345°, wind speed 15 mph, HR = 1.5, 1.4.

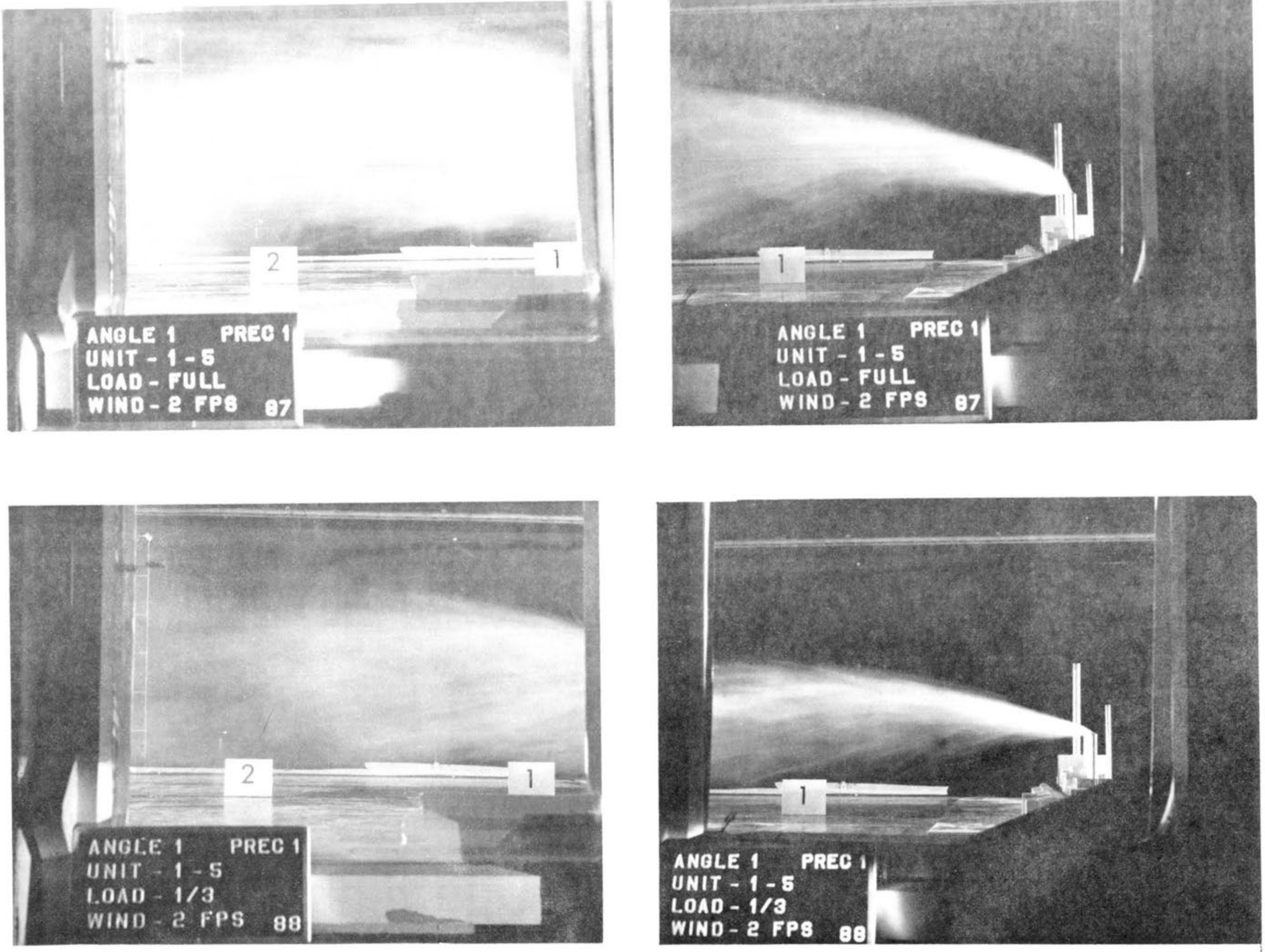


Fig. 24. Flow visualization, fumigation, unit 1-5, wind angle 345°, wind speed 15 mph, load full and one-third. HR = 1.5.

Table 1 Prototype Emission Parameters of Avon Lake Plant*

Units	1-5		6,7		8		9	
Boilers	1-8		9,10		11		12	
Load	Full	1/3	Full	1/3	Full	1/3	Full	1/3
$Q(gm/sec^{-SO_2})$	396	132	1890	630	1500	515.0	4628.0	1543
I. D. (ft)	17		12**		16.67		24	
Area (ft^2)	224		113		218		452	
V_s(fps)	16.9	5.3	70.0	24.5	39.0	12.2	62.3	19.6
$\chi_s(gm/m^{3-SO_2})$	0.92	0.98	4.21	4.01	6.44	6.83	5.82	6.15
T_s(°F)	383	361.3	391.4	363.6	388.5	363.6	394.5	370.9
H_s(ft)	383		500 (600)		400		600	
$q(ft^3/sec)$	3836	1187	7910	2769	8502	2660	28,024	8859

* Commonwealth Assoc. Inc., letter Sept 11, 1973.
** Unit (6-7) has 2 flues at top of stack.

Table 2 Model Emission Parameters of Avon Lake Plant

Units	1-5		6,7		8		9	
Boilers	1-8		9,10		11		12	
Load	Full	1/3	Full	1/3	Full	1/3	Full	1/3
q (CFM)	.1305	.0409	.2695	.0945	.2881	.0909	.9615	.3021
q_{He} (CFM)	.1084	.0266	.2414	.0634	.2517	.0609	.8833	.2215
$q_{air+Kr-85}$ (CFM)	.0220	.0143	.0281x2	.0311x2	.0364	.0299	.0781	.0806
V_s (fps)	1.52	.48	6.36	2.24	3.52	1.12	5.68	1.8
Molecular Wt (air = 28.8)	8.22	12.72	6.61	12.22	7.15	12.22	6.03	10.66

Table 2 (Continued)

Units	Load	V_a = 15 mph		V_a = 30 mph		V_a = 45 mph	
		R	Fr	R	Fr	R	Fr
1-5	Full	0.77	4.08	0.38	16.32	0.26	36.72
	1/3	.24	5.21	0.12	20.84	0.08	46.9
6,7	Full	3.18	5.36	1.59	21.46	1.06	48.27
	1/3	1.11	7.16	0.56	28.64	0.37	64.45
8	Full	1.77	4.00	0.88	15.84	0.59	35.62
	1/3	0.55	5.15	0.28	20.62	0.19	46.39
9	Full	2.83	2.61	1.42	10.46	0.94	23.53
	1/3	0.89	3.28	0.46	13.11	0.30	29.49

Note:

V_{ap}	V_{am}
15 mph	2 ft/sec
30 mph	4 ft/sec
45 mph	6 ft/sec

Table 3 Fumigation Conditions: Great Lake Area

Reference	Inversion Top (ft)	Wind (ft/sec) Velocity	Temperature Sea Surfaces (°F)	Temperature Inland (°F)	Temperature Upwind z=L (°C)	L (ft)	Ri_B	HR*
3 June 1966 (60,61)	~ 330	~16	10	27	19	330	1.51	1.89
12-13 August, 67 (61)	~1640	15-19	12	24	21	330	1.45	1.33
25 June 1970 (60)	~1640 (low level mixing depth ~492)	~19	11-13	16 (~5 miles inland)	?	?	?	?
12-13 August, 73 (61)	?	15-19	?	?	?	?	?	?

* H = 330 feet

Table 4 Wind Tunnel Conditions for Fumigation

$(V_a)_m$ (ft/sec)	$(T_{water})_m$ (°F)	$(T_H)_m$ (°F)	$(T_{land})_m$ (°F)	Ri_B	HR*
2	32 (z=0) 40 (z=15')	100	260 (z=0) 130 (z=15')	1.0	1.5
2	32 (z=0) 40 (z=15')	100	200 (z=0) (z=15')	1.0	1.4
2	32 (z=0) 40 (z=15')	100	150 (z=0) (z=15')	1.0	1.35
4	32 (z=0) 40 (z=15')	100	260 (z=0) 130 (z=15')	0.25	1.5

* $H_m \simeq 1$ foot

Table 5 Computation of Velocity Based Vortex Shedding

z(in)	Frequency (Hz)	*V(fps)	T(°F)
1.65	2.5	.43	64.4
1.81	2.78	.48	66.2
2.02	3.13	.54	68.0
2.21	3.23	.56	68.9
2.42	3.33	.58	71.6
2.81	3.57	.62	73.4
3.01	3.57	.62	75.2
3.63	4.55	.79	78.1
4.55	5.0	.87	76.2
5.53	6.67	1.16	80.9
6.55	8.33	1.45	82.4
7.51	7.69	1.34	84.2
8.50	9.10	1.58	86.0
9.48	10.0	1.74	87.4
10.49	10.2	1.77	87.8
11.59	11.4	1.98	89.6
12.35	11.4	1.98	89.6
13.37	11.4	1.98	89.9
14.39	11.0	1.91	90.0
15.53	11.4	1.98	90.1
16.72	11.6	2.01	91.2

D = 7/16" = .036'

$$*V = \frac{n \times D}{0.21} = \frac{n \times 0.036'}{0.21} \text{ fps} = .174\ n \text{ fps}$$

Table 6 Instrumentation and Materials Employed

<u>Camera</u>	movie:	Bolex 16 mm camera lens
	still:	Speed Graphic Camera 4" x 5" & Hasselblad 2" x 3"
<u>Film</u>	movie:	Ectachrome - 7242, ASA 125 - Forced developed ASA 500
	still:	Tri-X-Pan-4164 Kodak film, Polaroid
<u>Exposure</u>	movie:	f-1.9, 18 frames per second
	still:	f = 8-11, t = 1/30 sec or 30 sec

<u>Flow meters</u>

1) Fischer & Porter Co. Precision flow rator No. B4-21-10 float B SVT-45

2) Fischer & Porter Co. Precision flow rator No. FP1/4-09-G-G3/4 / 4 / 61

3) Fischer & Porter Co. Precision flow rator No. 2F-1/4-20-5/70

<u>Counters</u> Ultra scaler - model 192A by Nuclear Chicago

<u>Hot-Wire Anemometer</u> Disa 55D0 constant temperature anemometer.

<u>Hot Wire</u> Pt (80%) Ir (20%) wire, diameter - 0.1 mm

<u>Traversing Mechanism</u> Made at CSU, with remote control, range 17"

<u>Recorder</u> Hewlett and Packard X-Y Recorder Model 7035B

<u>Meter</u> HP Integrating digital voltmeter model 2401C

<u>Sampling Panels</u>

1) Made at CSU, 25 sample point capacity as shown in Fig.

2) Radioactive gas samplers
   a) Nooo14-68-A-0493-0001-65234
   b) Nooo14-68-A-0493-0001-65227

<u>Thermister</u> Fennal Glass coated bead #GB33L1, time constant in air ~2 sec

<u>Thermometer</u> Yellow Springs Corp., YS1 Model 42 SC, Tele - Thermometer, range - 40°C ~150°C.

Table 7 Observed Touchdown Distances (ft) from Flow Visualization Tests

	Units	Wind Direction (azimuth angle)	Full Load			1/3 Load		
			15 mph	30 mph	45 mph	15 mph	30 mph	45 mph
Precipitator Down	1-5	15°	2000	800	600	1000	500	300E
		30°	1000	500	300E*	600E	300E	300E
		45°	2000	500	500E	300E	500E	500E
		315°	1500	500E	300E	1000E	1300E	300E
		300°	1500	1000E	0E	800E	700E	0E
		285°	2000	1000	800	1000	800E	900
	6-7	345°	∞	4500	2000	6000	2000	1800
		15°	∞	2000	2000	6000	2000	2500
		30°	∞	2500	2000	2200	2000	2200
		45°	4000	3000	2000	2500	3000	2000
		165°	∞	4000	3500	4500	2500	2500
		315°	∞	1800	1800	2500	1800	2000
		300°	∞	2000	2000	2500	2700	2200
		285°	∞	4000	2000	3500	3000	2500
	8	15°	6000	2000	1800	3000	1500	2100
		30°	2500	1500	1300	1000	1800	1500
		45°	3000	1800	1300	1000	1300	2500
		315°	3000	1300	1500	1500	1500	1500
		300°	2000	2000	1500	1000	1500	1800
		285°	∞	2000	2000	1500	1500	2000
	9	15°	∞	6000	5000	∞	4000	4500
		30°	∞	4000	3700	4700	3500	3500
		45°	8000	6000	3800	4000	4500	3400
		315°	∞	3700	2800	4500	3000	2500
		300°	∞	5500	2800	4500	3000	2200
		285°	∞	5000	2500	∞	3000	2200
Precipitator Up	1-5	300°	1000	500	0E	500	500	0E
		285°	1000	800	300	900	500	600
	6-7	30°	∞	2500	1800	2000	2000	2000
		45°	∞	2000	2000	2600	2400	2200
	8	300°	∞	1200	1200	1500	1000	1100
	9	285°	∞	1500	1000	2000	1500	1200

*E: Downwash entrainments observed

Table 8 Summary of Maximum Ground Level SO_2 Concentrations and Distances

Run No.	Units	Nominal Wind Direction	Wind Speed (mph)	Load	Max G. L. Concentration Distance (feet)	ppm SO_2 1/2-hr Equivalent	ppm SO_2 24-hr Equivalent	Precipitator Location
1	1-5	30	30	Full	2,000	.366	.053	Down
2	1-5	30	30	1/3	1,000	.294	.042	Down
3	1-5	30	45	Full	1,000	.455	.066	Down
4	1-5	30	45	1/3	1,000	.277	.040	Down
5	1-5	45	30	Full	4,000	.173	.025	Down
6	1-5	45	30	1/3	1,000	.260	.038	Down
7	1-5	45	45	Full	2,000	.463	.067	Down
8	1-5	45	45	1/3	1,000	.258	.037	Down
9	1-5	60	30	Full	2,000	.523	.075	Down
10	1-5	60	30	1/3	2,000	.319	.046	Down
11	1-5	60	45	Full	2,000/4,000	.459	.066	Down
12	1-5	60	45	1/3	2,000	.310	.045	Down
13	1-5	-30	15	Full	8,000	.053	.008	Down
14	1-5	-30	15	1/3	6,000	.065	.009	Down
15	1-5	-30	30	Full	4,000/7,000	.136	.020	Down
16	1-5	-30	30	1/3	2,000	.117	.017	Down
17	1-5	-30	45	Full	2,000	.226	.033	Down
18	1-5	-30	45	1/3	2,000	.104	.015	Down
19	1-5	-45	30	Full	2,000	.329	.047	Down
20	1-5	-45	30	1/3	2,000	.147	.021	Down
21	1-5	-45	45	Full	3,000	.358	.052	Down
22	1-5	-45	45	1/3	2,000	.166	.024	Down
23	1-5	-60	30	Full	3,000	.302	.044	Down
24	1-5	-60	30	1/3	2,000	.225	.032	Down
25	1-5	-60	45	Full	2,000	.400	.058	Down
26	1-5	-60	45	1/3	2,000	.191	.028	Down
27	6-7	30	15	Full	8,000	.067	.010	Down
28	6-7	30	30	Full	8,000	.484	.069	Down
29	6-7	30	30	1/3	8,000	.274	.040	Down
30	6-7	30	45	Full	7,000	.344	.050	Down
31	6-7	30	45	1/3	8,000	.193	.028	Down
32	6-7	45	30	Full	8,000	.306	.044	Down
33	6-7	45	30	1/3	8,000	.211	.030	Down
34	6-7	45	45	Full	8,000	.521	.075	Down
35	6-7	45	45	1/3	8,000	.167	.024	Down
36	6-7	60	30	Full	8,000	.243	.035	Down
37	6-7	60	30	1/3	8,000	.182	.026	Down
38	6-7	60	45	Full	8,000	.245	.035	Down
39	6-7	60	45	1/3	5,000	.138	.020	Down
40	6-7	-30	15	Full	8,000	.190	.027	Down
41	6-7	-30	30	Full	8,000	.185	.027	Down
42	6-7	-30	30	1/3	7,000	.180	.026	Down
43	6-7	-30	45	Full	8,000	.165	.024	Down
44	6-7	-30	45	1/3	6,000	.199	.029	Down
45	6-7	-45	30	Full	6,000	.205	.030	Down
46	6-7	-45	30	1/3	8,000	.125	.018	Down
47	6-7	-45	45	Full	6,000	.250	.036	Down
48	6-7	-45	45	1/3	6,000	.110	.016	Down
49	6-7	-60	30	Full	8,000	.287	.041	Down
50	6-7	-60	30	1/3	8,000	.324	.047	Down
51	6-7	-60	45	Full	8,000	.240	.035	Down
52	6-7	-60	45	1/3	4,000	.099	.014	Down
53	8	30	30	Full	4,000	.915	.132	Down
54	8	30	30	1/3	4,000	.340	.049	Down
55	8	30	45	Full	4,000	.662	.096	Down
56	8	30	45	1/3	4,000	.281	.040	Down
57	8	45	30	Full	4,000	.940	.136	Down
58	8	45	30	1/3	4,000	.436	.063	Down
59	8	45	45	Full	4,000	.824	.119	Down
60	8	45	45	1/3	4,000	.386	.056	Down
61	8	60	30	Full	4,000	.802	.116	Down
62	8	60	30	1/3	4,000	.425	.061	Down
63	8	60	45	Full	4,000	.716	.103	Down
64	8	60	45	1/3	4,000	.120	.017	Down

Table 8 (Continued)

Run No.	Units	Nominal Wind Direction	Wind Speed (mph)	Load	Max. G. L. Concentration: Distance (feet)	ppm SO_2: 1/2-hr Equivalent	ppm SO_2: 24-hr Equivalent	Precipitator Location
65	8	-30	30	1/3	4,000	.414	.059	Down
66	8	-30	45	Full	2,000	.702	.101	Down
67	8	-30	45	1/3	4,000	.254	.037	Down
68	8	-45	30	Full	4,000	.691	.100	Down
69	8	-45	30	1/3	4,000	.434	.063	Down
70	8	-45	45	Full	4,000	.696	.100	Down
71	8	-45	45	1/3	4,000	.288	.042	Down
72	8	-60	30	Full	4,000	.877	.127	Down
73	8	-60	30	1/3	3,000	.528	.076	Down
74	8	-60	45	Full	4,000	.865	.125	Down
75	8	-60	45	1/3	4,000	.372	.054	Down
76	9	30	30	Full	8,000	.145	.021	Down
77	9	30	30	1/3	8,000	.323	.047	Down
78	9	45	30	1/3	6,000	.786	.113	Down
79	9	45	45	Full	8,000	.236	.034	Down
80	9	45	45	1/3	4,000	.697	.100	Down
81	9	60	45	Full	8,000	.310	.045	Down
82	9	60	45	1/3	8,000	.111	.016	Down
83	9	-30	30	Full	6,000	.185	.027	Down
84	9	-30	30	1/3	6,000	.351	.051	Down
85	9	-30	45	Full	8,000	.464	.067	Down
86	9	-45	30	1/3	6,000	.315	.045	Down
87	9	-45	45	Full	8,000	.555	.080	Down
88	9	-45	45	1/3	8,000	.259	.037	Down
89	9	-60	30	1/3	6,000	.833	.077	Down
90	9	-60	45	Full	8,000	.307	.044	Down
91	9	-60	45	1/3	8,000	.178	.026	Down
92	1-5	-45	30	Full	2,000	.706	.102	Up
93	1-5	-45	30	1/3	1,000	.278	.040	Up
94	1-5	-45	45	Full	2,000	.760	.110	Up
95	1-5	-45	45	1/3	2,000	.252	.036	Up
96	1-5	-60	45	Full	2,000	.906	.101	Up
97	8	-45	30	Full	4,000	.777	.112	Up
98	8	-45	30	1/3	4,000	.807	.116	Up
99	8	-45	45	Full	4,000	.789	.114	Up
100	8	-45	45	1/3	4,000	.588	.085	Up
101	8	-60	45	Full	4,000	.807	.116	Up
102	8	-60	45	1/3	4,000	.721	.104	Up

Table 9 Observed Touchdown Distance (ft) from Flow Visualization Test at Fumigation Conditions

Units	Nominal Wind Angle (degree)	Load Full 15 mph	Load Full 30 mph	Load 1/3 15 mph	Load 1/3 30 mph	Heating Plate Temperature
1-5	N	1,500	-	1,000	-	~ 260°F
	-30	1,000		1,500		
6-7 (500')	N	3,900	5,000	2,000	3,000	
	-30	4,000	4,500	2,500	3,000	
6-7 (600')	N	4,500	7,000	3,500	4,000	
	-30	4,500	5,500	2,500	2,500	
8	N	3,000		1,200		
	-30	2,200		1,200		
9	N	6,000	4,000	3,000	3,000	
	-30	6,500		3,200		
6-7 (500')	N	5,500		3,000		~ 200°F
	-30	5,000		3,000		
6-7 (600')	N	6,500		3,000		
	-30	5,000		3,000		

T_∞ ~ 110°F

Cooling Plate Temperature ~ 32°F

Table 10 Summary of Maximum Ground Level SO_2 Concentrations and Distance at Fumigation Conditions

Run No.	Units	Nominal Wind Direction	Wind Speed (mph)	Load	Max. G.L. Concentration: Distance (ft)	ppm SO_2: 1/2-hr Equiv.	ppm SO_2: 3-hr Equiv.	Floor Temp. (°F)
1	6-7(500')	-30	15	F	6,000	2.80	1.143	260
2	6-7(500')	-30	15	1/3	4,000	1.34	0.547	260
3	6-7(500')	N	15	F	6,000	.735	0.300	260
4	6-7(500')	N	15	1/3	4,000	1.18	0.482	260
5	6-7(600')	N	30	F	8,000	.299	0.122	260
6	6-7(600')	N	30	1/3	6,000	.500	0.204	260
7	6-7(600')	-30	15	F	8,000	1.02	0.416	260
8	6-7(600')	-30	15	1/3	4,000	1.19	0.486	260
9	1-5	-30	15	F	5,000	.081	0.033	260
10	1-5	-30	15	1/3	3,000	.035	0.014	260
11	8	-30	15	F	4,000	.553	0.226	260
12	8	-30	15	1/3	2,000	.951	0.388	260
13	9	-30	15	F	8,000	3.32	1.355	260
14	9	-30	15	1/3	5,000	2.98	1.217	260
15	6-7(500')	-30	15	F	8,000	1.38	0.563	200
16	6-7(500')	-30	15	1/3	5,000	.838	0.342	200
17	6-7(600')	-30	15	F	8,000	.164	0.067	200
18	6-7(600')	-30	15	1/3	8,000	.613	0.250	200
19	6-7(500')	-30	15	F	8,000	.234	0.096	150
20	6-7(500')	-30	15	1/3	6,000	.798	0.326	150
21	6-7(600')	-30	15	1/3	6,000	.470	0.192	150
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Table 11 Avon Lakes Plant, Cleveland Electric Illuminating Co., Motion Picture Log, Reel #1 - Neutral Conditions - Environmental Wind Tunnel

Run No.	Wind Angle	Unit	Load	Wind Speed	Precipitators	Run No.	Wind Angle	Unit	Load	Wind Speed	Precipitators
1	8	6-7	1/3	2	1	44	6	8	1/3	4	1
2	8	6-7	Full	2	1	45	6	8	Full	4	1
3	8	6-7	Full	4	1	46	6	6-7	Full	4	1
4	8	6-7	1/3	4	1	47	6	6-7	1/3	4	1
5	8	6-7	1/3	6	1	48	6	1-5	1/3	4	1
6	8	6-7	Full	6	1	49	6	1-5	Full	4	1
7	7	6-7	1/3	6	1	50	6	1-5	Full	2	1
8	4	6-7	Full	4	1	51	6	1-5	1/3	2	1
9	4	6-7	Full	6	1	52	6	6-7	1/3	2	1
10	4	6-7	1/3	6	1	53	6	6-7	Full	2	1
11	3	6-7	1/3	6	1	54	6	8	Full	2	1
12	3	6-7	1/3	6	2	55	6	8	1/3	2	1
13	3	6-7	Full	6	2	56	6	9	1/3	2	1
14	3	6-7	Full	6	1	57	6	9	Full	2	1
15	3	6-7	Full	4	1	58	2	1-5	Full	2	1
16	3	6-7	Full	4	2	59	2	1-5	1/3	2	1
17	3	6-7	1/3	4	2	60	2	6-7	1/3	2	1
18	3	6-7	1/3	4	1	61	2	6-7	Full	2	1
19	3	6-7	1/3	2	1	62	2	8	Full	2	1
20	3	6-7	1/3	2	2	63	2	8	1/3	2	1
21	3	6-7	Full	2	2	64	2	9	1/3	2	1
22	3	6-7	Full	2	1	65	2	9	Full	2	1
23	2	6-7	Full	2	1	66	4	6-7	Full	2	1
24	2	6-7	1/3	2	1	67	4	6-7	1/3	2	1
25	2	6-7	1/3	4	1	68	4	6-7	1/3	4	1
26	2	6-7	Full	4	1	69	7	6-7	Full	4	1
27	2	6-7	Full	6	1	70	7	6-7	1/3	4	1
28	2	6-7	1/3	6	1	71	7	6-7	1/3	2	1
29	1	6-7	1/3	6	1	72	7	6-7	Full	2	1
30	1	6-7	Full	6	1	73	7	6-7	Full	6	1
31	1	6-7	Full	4	1	74	5	6-7	1/3	2	1
32	6	6-7	Full	6	1	75	5	6-7	Full	2	1
33	6	6-7	1/3	6	1	76	5	6-7	Full	4	1
34	6	6-7	Full	6	1	77	5	6-7	1/3	4	1
35	6	6-7	1/3	6	1	78	5	6-7	1/3	6	1
36	6	1-5	1/3	6	1	79	5	6-7	Full	6	1
37	6	1-5	Full	6	1	80	6	6-7	Full	2	1
38	6	8	1/3	6	1	81	6	6-7	1/3	2	1
39	6	8	Full	6	1	82	6	6-7	1/3	4	1
40	6	9	1/3	6	1	83	6	6-7	Full	4	1
41	6	9	Full	6	1	84	1	6-7	1/3	4	1
42	6	9	Full	4	1	85	1	6-7	1/3	2	1
43	6	9	1/3	4	1	86	1	6-7	Full	2	1

AVON LAKES POWER PLANT MET. TUNNEL THERMAL RUNS

Run No.	Wind <	Unit	Load	Wind Speed	Stack Mtn.		Floor Temp.
87	1	1-5	Full	2			
88	1	1-5	1/3	2			
89	1	6-7	Full	2			
90	1	6-7	1/3	2			
91	1	8	Full	2			
92	1	8	1/3	2			
93	1	9	Full	2			
94	1	9	1/3	2			
95	1	6-7	Full	2	600		
96	1	6-7	1/3	2	600		
97	6	6-7	1/3	2	600		
98	6	6-7	Full	2	600		
99	6	9	1/3	2			
100	6	9	Full	2			
101	6	8	1/3	2			
102	6	8	Full	2			
103	6	6-7	1/3	2			
104	6	6-7	Full	2			
105	6	1-5	1/3	2			
106	6	1-5	Full	2			
107	6	6-7	Full	4			
108	6	6-7	1/3	4			
109	6	6-7	Full	4	600		
110	6	6-7	1/3	4	600		
111	1	6-7	1/3	4	600		
112	1	6-7	Full	4	600		
113	1	9	Full	4			
114	1	9	1/3	4			
115	1	6-7	Full	4			
116	1	6-7	1/3	4			
117	6	6-7	Full	2			
118	6	6-7	1/3	2			
119	6	6-7	Full	2	600		
120	6	6-7	1/3	2	600		
121	1	6-7	Full	2	600		
122	1	6-7	1/3	2	600		
123	1	6-7	Full	2			
124	1	6-7	1/3	2			
125	--	--	Full	2	500	Isolated Stack	150°
126	--	--	Full	2	600	"	150°
127	--	--	Full	2	600	"	200°
128	--	--	Full	2	500	"	200°
129	--	--	Full	2	500	"	250°
130	--	--	Full	2	600	"	250°

Table 12 Ground Level Concentration Results for Neutral Flow Conditions

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5 WIND ANGLE = +30 WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.244E-02		.183E-02
1200								.467E-02		.873E-02
1000						.386E-02				
800				.426E-02		.134E-01		.236E-01		.406E-01
600				.589E-02		.148E-01				
400				.528E-02		.678E-01		.117E+00		.110E+00
200				.176E+00		.141E+00				
0	.447E-02	.101E+00	.239E+00	.366E+00	.951E-01	.197E+00	.240E+00	.174E+00	.178E+00	.148E+00
-200				.172E+00		.217E+00				
-400				.136E+00		.102E+00		.178E+00		.947E-01
-600				.530E-01		.954E-02				
-800				.215E-01		.487E-02		.874E-01		.104E+00
-1000						0.				
-1200								.231E-01		.392E-01
-1600								.650E-02		.146E-01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5 WIND ANGLE = 30. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.404E-01		.623E-01
600				0.		.684E-01				
400				.729E-01		.151E+00		.124E+00		.952E-01
200				.264E+00		.901E-02				
0	0.	0.	.294E+00	.255E+00	.245E+00	.204E+00	.910E-01	.106E+00	0.	.868E-01
-200				.135E+00		.177E+00				
-400				.110E+00		.118E+00		.103E+00		.829E-01
-600				0.		.114E-02				
-800				0.		0.		.514E-01		.593E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5 WIND ANGLE = 30. WIND SPEED (MPH) =45.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.124E-01		.282E-01
600				0.		.240F-01				
400				.689E-01		.129F+00		.900E-01		.790E-01
200				.317E+00		.106F-01				
0	0.	0.	.445E+00	.420E+00	.415E+00	.352E+00	.153E+00	.121E+00	0.	.164E+00
-200				.215E+00		.323F+00				
-400				.231E+00		.235E+00		.193E+00		.165E+00
-600				0.		.152F-01				
-800				0.		0.		.104E+00		.134E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = 30.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.503E-02		.693E-02
600				0.		.835E-02				
400				.301E-01		.503E-01		.368E-01		.310E-01
200				.170E+00		.304E-02				
0	0.	0.	.227E+00	.179E+00	.166E+00	.125E+00	.562E-01	.444E-01	0.	.577E-01
-200				.947E-01		.127E+00				
-400				.109E+00		.948E-01		.764E-01		.588E-01
-600				0.		.408E-02				
-800				0.		0.		.403E-01		.525E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

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AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = 45.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.754E-02		.135E-01
600				0.		.179E-01				
400				.288E-01		.591E-01		.606E-01		.539E-01
200				.112E+00		.108E+00				
0	0.	0.	.128E+00	.156E+00	.156E+00	.173E+00	.171E+00	.133E+00	0.	.136E+00
-200				.118E+00		.162E+00				
-400				.677E-01		.118E+00		.115E+00		.130E+00
-600				0.		.563E-01				
-800				0.		0.		.542E-01		.824E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = 45.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.518E-02		.582E-02
600				0.		.564F-01				
400				.358F-01		.701E-01		.462E-01		.384E-01
200				.198E+00		.113F+00				
0	0.	0.	.260E+00	.234E+00	.180E+00	.151E+00	.132F+00	.842E-01	0.	.790E-01
-200				.180E+00		.154F+00				
-400				.137E+00		.122E+00		.873E-01		.729E-01
-600				0.		.684F-01				
-800				0.		0.		.440E-01		.525E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = 45.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.228E-02		.297E-02
600				0.		.743F-02				
400				.346E-01		.291E-01		.165F-01		.149E-01
200				.288E+00		.104E+00				
0	0.	0.	.442E+00	.463E+00	.365E+00	.339F+00	.247F+00	.906F-01	0.	.120E+00
-200				.334E+00		.389F+00				
-400				.254E+00		.309F+00		.247E+00		.179E+00
-600				0.		.194F+00				
-800				0.		0.		.107F+00		.156E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5 WIND ANGLE = 45. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.187E-02		.235E-02
600				0.		.470E-02				
400				.321E-01		.298E-01		.180E-01		.143E-01
200				.214E+00		.738E-01				
0	0.	0.	.258E+00	.257E+00	.184E+00	.167E+00	.136E+00	.546E-01	0.	.608E-01
-200				.161E+00		.160E+00				
-400				.126E+00		.115E+00		.938E-01		.668E-01
-600				0.		.736E-01				
-800				0.		0.		.418E-01		.568E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = 60.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.537E-02		.674E-02
600				0.		.903E-02				
400				.599E-01		.104E+00		.470E-01		.470E-01
200				.402E+00		.368E+00				
0	0.	0.	.313E+00	.523E+00	.196E+00	.445E+00	.372E+00	.187E+00	0.	.206E+00
-200				.414E+00		.427E+00				
-400				.138E+00		.198E+00		.238E+00		.216E+00
-600				0.		.552E-01				
-800				0.		0.		.519E-01		.116E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = 60.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.304E-02		.240E-02
600				0.		.475E-02				
400				.434E-01		.704F-01		.250F-01		.145E-01
200				.263E+00		.201F+00				
0	0.	0.	.302E+00	.319E+00	.104E+00	.207F+00	.170E+00	.818F-01	0.	.772E-01
-200				.222F+00		.229F+00				
-400				.767E-01		.113F+00		.131F+00		.914E-01
-600				0.		.411F-01				
-800				0.		0.		.378F-01		.772F-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = 60.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.400E-02		.857E-02
600				0.		.322F-01				
400				.872E-01		.168F+00		.106E+00		.796E-01
200				.403E+00		.450E+00				
0	0.	0.	.348E+00	.436E+00	.166E+00	.459F+00	.375E+00	.179E+00	0.	.193E+00
-200				.386F+00		.427F+00				
-400				.138E+00		.180F+00		.226E+00		.189E+00
-600				0.		.694E-01				
-800				0.		0.		.529F-01		.886E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = 60.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .135E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.382E-03		.333E-02
600				0.		.115E-01				
400				.603E-01		.794E-01		.277E-01		.164E-01
200				.254E+00		.161E+00				
0	0.	0.	.305E+00	.310E+00	.638E-01	.186E+00	.143E+00	.607E-01	0.	.643E-01
-200				.209E+00		.192E+00				
-400				.842E-01		.101E+00		.913E-01		.746E-01
-600				0.		.365E-01				
-800				0.		0.		.219E-01		.481E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.244E-02		.244E-02
1200								.893E-02		.162E-02
1000						.203E-02				
800				.122E-02		.609E-03		.181E-01		.507E-02
600				.913E-02		.609E-03				
400				0.		.304E-02		.491E-01		.296E-01
200				.386E-02		.995E-02				
0	.650E-02	.792E-02	.548E-02	.995E-02	.203E-02	.223E-02	.459E-01	.266E-01	.333E-01	.526E-01
-200				.150E-01		.215E-01				
-400				.136E-01		.361E-01		.197E-01		.223E-01
-600				.609E-03		.893E-02				
-800				0.		.568E-02		.913E-02		.913E-02
-1000						.386E-02				
-1200								.386E-02		.467E-02
-1600								.467E-02		.183E-02

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.209F-02		.730E-02
1200								.151E-01		.127E-01
1000						0.				
800				0.		.379F-03		.421E-01		.435E-01
600				0.		.474F-03				
400				0.		.275F-02		.647E-01		.487E-01
200				.104E-01		.136F-01				
0	.171E-02	.142F-02	.126E-01	.214F-01	.124E-01	.247F-02	.200E-01	.219E-01	.188F-01	.327E-01
-200				.300E-01		.258F-01				
-400				.105E-01		.187F-01		.203E-01		.150E-01
-600				.104E-02		.104F-02				
-800				.104E-02		.569E-03		.109F-01		.749E-02
-1000						.759F-03				
-1200								.740E-02		.436E-02
-1600								.379F-03		.854E-03

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5 WIND ANGLE = -30. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.609E-03		.193E-01
1200								.304E-02		.248E-01
1000						.162E-02				
800				.101E-02		.238E-01		.211E-01		.601E-01
600				.380E-01		.233E-01				
400				.183E-02		.886E-01		.914E-01		.813E-01
200				.309E-01		.949E-01				
0	.138E-01	.853E-02	.634E-01	.136E+00	.363E-01	.244E-02	.105E+00	.115E+00	.117E+00	.116E+00
-200				.129E+00		.136E+00				
-400				.449E-01		.689E-01		.851E-01		.920E-01
-600				.751E-02		.345E-02				
-800				.142E-02		.386E-02		.225E-01		.236E-01
-1000						.122E-02				
-1200								.406E-02		.873E-02
-1600								0.		.264E-02

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5 WIND ANGLE = -30. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.379E-03		.142E-02
1200								.218E-02		.683E-02
1000						0.				
800				.142E-02		.209E-02		.138E-01		.272E-01
600				.219E-01		.313E-02				
400				.672E-01		.486E-01		.494E-01		.524E-01
200				.117E+00		.838E-01				
0	0.	.232E-01	0.	.850E-01	.692E-01	.114E-02	.669E-01	.533E-01	.576E-01	.484E-01
-200				.440E-01		.551E-01				
-400				.172E-01		.373E-01		.575E-01		.504E-01
-600				.474E-03		.664E-03				
-800				.569E-03		.379E-03		.264E-01		.346E-01
-1000						0.				
-1200								.730E-02		.140E-01
-1600								.759E-03		.417E-02

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -30.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.244E-02		0.
1200								.122F-02		.406E-02
1000						.974F-02				
800				.792E-02		0.		.108E-01		.181E-01
600				.236F-01		.244F-02				
400				.142E-02		.106E+00		.697F-01		.514E-01
200				.233E+00		.166F+00				
0	.455E-01	.473F-01	.159E+00	.266E+00	.210E+00	.264F-02	.188E+00	.987E-01	.127E+00	.833E-01
-200				.159E+00		.179F+00				
-400				.534F-01		.957E-01		.123E+00		.109E+00
-600				.629E-02		.203F-03				
-800				.304F-02		.345E-02		.504F-01		.609E-01
-1000						.183E-02				
-1200								.365E-02		.150E-01
-1600								.467F-02		.325E-02

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -30.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) =   .132E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.133E-02		0.
1200								0.		.247E-02
1000						.341E-02				
800				.408E-02		.104E-02		.655E-02		.806E-02
600				.176E-01		.123E-02				
400				.323E-01		.398E-01		.278E-01		.277E-01
200				.104E+00		.542E-01				
0	.279E-01	.183E-01	.584E-01	.746E-01	.736E-01	.104E-02	.581E-01	.325E-01	.440E-01	.334E-01
-200				.471E-01		.613E-01				
-400				.182E-01		.347E-01		.361E-01		.165E-01
-600				.332E-02		.569E-03				
-800				.228E-02		.133E-02		.133E-01		.154E-01
-1000						.759E-03				
-1200								.209E-02		.522E-02
-1600								.218E-02		.949E-03

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -45.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.185F-01		.328E-01
600				0.		.331F-01				
400				.250E-01		.663E-01		.758E-01		.797E-01
200				.215E+00		.107F+00				
0	0.	0.	.111E+00	.329E+00	.313E+00	.294F+00	.103E+00	.165F+00	0.	.145E+00
-200				.160E+00		.252F+00				
-400				.351E-01		.179F+00		.167E+00		.162E+00
-600				0.		.238F-01				
-800				0.		0.		.102F+00		.118E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -45.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.321E-02		.620E-02
600				0.		.636E-02				
400				.780E-02		.169E-01		.143E-01		.158E-01
200				.520E-01		.509E-01				
0	0.	0.	.102E+00	.147E+00	.126E+00	.986E-01	.334E-01	.428E-01	0.	.494E-01
-200				.951E-01		.109E+00				
-400				.304E-01		.801E-01		.628E-01		.574E-01
-600				0.		.343E-01				
-800				0.		0.		.269E-01		.350E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5 WIND ANGLE = -45. WIND SPEED (MPH) =45.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.288E-01		.326E-01
600				0.		.621E-01				
400				.436E-01		.101E+00		.115E+00		.105E+00
200				.287E+00		.904E-01				
0	0.	0.	.163E+00	.339E+00	.358E+00	.318E+00	.119E+00	.132E+00	0.	.138E+00
-200				.174E+00		.244E+00				
-400				.239E-01		.159E+00		.115E+00		.130E+00
-600				0.		.925E-02				
-800				0.		0.		.179E-01		.458E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -45.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.363E-02		.433E-02
600				0.		.116E-01				
400				.146E-01		.274E-01		.234E-01		.159E-01
200				.885E-01		.691E-01				
0	0.	0.	.963E-01	.166E+00	.142E+00	.113E+00	.364E-01	.442E-01	0.	.480E-01
-200				.116E+00		.105E+00				
-400				.275E-01		.717E-01		.604E-01		.530E-01
-600				0.		.393E-01				
-800				0.		0.		.244E-01		0.
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5 WIND ANGLE = -60. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.147E-01		.191E-01
600				0.		.380F-01				
400				.619E-01		.917F-01		.481E-01		.575E-01
200				.233E+00		.242E+00				
0	0.	0.	.819E-01	.301E+00	.302E+00	.271F+00	.226E+00	.142E+00	0.	.159E+00
-200				.218E+00		.233E+00				
-400				.636E-01		.129F+00		.161E+00		.149E+00
-600				0.		.518E-01				
-800				0.		0.		.574E-01		.989E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -60.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.978E-02		.106E-01
600				0.		0.				
400				.479E-01		.580E-01		.239E-01		.305E-01
200				.164E+00		.120E+00				
0	0.	0.	.226E-01	.225E+00	.186E+00	.163E+00	.101E+00	.579E-01	0.	.528E-01
-200				.145E+00		.136E+00				
-400				.501E-01		.882E-01		.866E-01		.689E-01
-600				0.		.375E-01				
-800				0.		0.		.404E-01		.521E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -60.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.118F-01		.190E-01
600				0.		.381F-01				
400				.935F-01		.132E+00		.613E-01		.805E-01
200				.358F+00		.345E+00				
0	0.	0.	.128E+00	.400E+00	.391E+00	.327F+00	.290E+00	.113F+00	0.	.148E+00
-200				.272F+00		.232F+00				
-400				.398E-01		.118F+00		.141E+00		.139E+00
-600				0.		.323E-01				
-800				0.		0.		.275F-01		.581E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -60.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.598E-02		.850E-02
600				0.		.210E-01				
400				.538E-01		.661E-01		.252E-01		.278E-01
200				.151E+00		.132E+00				
0	0.	0.	.442E-01	.191E+00	.171E+00	.137E+00	.110E+00	.578E-01	0.	.552E-01
-200				.987E-01		.966E-01				
-400				.254E-01		.480E-01		.493E-01		.433E-01
-600				0.		.123E-01				
-800				0.		0.		.823E-02		.200E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = +30. WIND SPEED (MPH) =15.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		.150E-01
1200								0.		0.
1000						0.				
800				0.		0.		.449E-01		.674E-01
600				0.		0.				
400				0.		0.		.599E-01		.474E-01
200				0.		0.				
0	0.	0.	0.	0.	0.	0.	0.	.524E-01	.424E-01	.374E-01
-200				0.		0.				
-400				0.		0.		.749E-01		.200E-01
-600				0.		0.				
-800				0.		0.		.424E-01		.125E-01
-1000						0.				
-1200								.399E-01		.250E-02
-1600								.998E-02		.499E-02

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = +30. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.749E-02		.349E-01
1200								.250E-01		.122E+00
1000						.150E-01				
800				.749E-02		.250E-01		.157E+00		.399E+00
600				.250E-02		.399E-01				
400				.274E-01		.130E+00		.319E+00		.407E+00
200				.524E-01		.147E+00				
0	.150E-01	0.	.250E-01	.649E-01	.574E-01	.162E+00	.280E+00	.447E+00	.482E+00	.484E+00
-200				.524E-01		.252E+00				
-400				.549E-01		.212E+00		.319E+00		.324E+00
-600				.175E-01		.200E-01				
-800				.274E-01		.225E-01		.724E-01		.120E+00
-1000						.225E-01				
-1200								.299E-01		.898E-01
-1600								.175E-01		0.

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = 30.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.401E-01		.475E-01
600				0.		.279E-01				
400				0.		.113E+00		.128E+00		.157E+00
200				.214E-01		.838E-02				
0	0.	0.	.149E-01	.615E-01	.113E+00	.214E+00	.159E+00	.182E+00	0.	.267E+00
-200				.298E-01		.191E+00				
-400				.373E-01		.145E+00		.250E+00		.272E+00
-600				0.		.652E-02				
-800				0.		0.		.117E+00		.230E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = +30.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		.250E-01
1200								.524E-01		.299E-01
1000						.125E-01				
800				.749E-02		.225E-01		.399E-01		.499E-01
600				0.		.549E-01				
400				.250E-01		.160E+00		.167E+00		.142E+00
200				.499E-01		.185E+00				
0	0.	0.	.749E-02	.524E-01	.150E-01	.182E+00	.157E+00	.292E+00	.344E+00	.235E+00
-200				.599E-01		.155E+00				
-400				.200E-01		.324E-01		.235E+00		.207E+00
-600				0.		.125E-01				
-800				.225E-01		.299E-01		.624E-01		.873E-01
-1000						0.				
-1200								0.		.749E-02
-1600								.374E-01		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = 30.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.559E-02		.652E-02
600				0.		.838F-02				
400				.932E-03		.410E-01		.373E-01		.447E-01
200				.242F-01		0.				
0	0.	0.	.102E-01	.643E-01	.120E+00	.140F+00	.130E+00	.913F-01	0.	.193E+00
-200				.363E-01		.149F+00				
-400				.289E-01		.110F+00		.177E+00		.195E+00
-600				0.		.186F-02				
-800				0.		0.		.578E-01		.146E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = 45. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		.262E-01
600				0.		0.				
400				.157E-01		.157E-01		.420E-01		.105E-01
200				0.		.699E-01				
0	0.	0.	.874E-02	.682E-01	.997E-01	.133E+00	.150E+00	.787E-01	0.	.150E+00
-200				.129E+00		.208E+00				
-400				.717E-01		.180E+00		.282E+00		.227E+00
-600				0.		.101E+00				
-800				0.		0.		.191E+00		.306E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = 45.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		0.
600				0.		0.				
400				0.		.682E-02		.131E-01		.944E-02
200				.163E-01		.220E-01				
0	0.	0.	.315E-02	.477E-01	.740E-01	.819E-01	.100E+00	.651E-01	0.	.120E+00
-200				.603E-01		.147E+00				
-400				.456E-01		.150E+00		.207E+00		.103E+00
-600				0.		.121E+00				
-800				0.		0.		.132E+00		.211E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = 45.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.157E-01		.245E-01
600				0.		.262E-01				
400				0.		.559E-01		.664E-01		.664E-01
200				.315E-01		.117E+00				
0	0.	0.	.402E-01	.114E+00	.185E+00	.278E+00	.360E+00	.196E+00	0.	.521E+00
-200				.839E-01		.308E+00				
-400				.612E-01		.285E+00		.553E+00		.474E+00
-600				0.		.126E+00				
-800				0.		0.		.149E+00		.310E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = 45. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.262E-02		.420E-02
600				0.		0.				
400				.472E-02		.420E-02		.115E-01		.231E-01
200				.157E-02		.346E-01				
0	0.	0.	.367E-02	.205E-01	.404E-01	.913E-01	.119E+00	.777E-01	0.	.147E+00
-200				.304E-01		.117E+00				
-400				.173E-01		.966E-01		.151E+00		.167E+00
-600				0.		.535E-01				
-800				0.		0.		.593E-01		.997E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = 60. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		0.
600				0.		0.				
400				0.		.350E-02		.332E-01		.524E-02
200				0.		.140E-01				
0	0.	0.	.524E-02	.332E-01	.192E-01	.315E-01	.577E-01	.315E-01	0.	.717E-01
-200				.332E-01		.577E-01				
-400				.332E-01		.138E+00		.170E+00		.129E+00
-600				0.		.752E-01				
-800				0.		0.		.117E+00		.243E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = 60. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.997E-02		.252E-01
600				0.		.682E-02				
400				.787E-02		.315E-01		.420E-01		.514E-01
200				.252E-01		.110E-01				
0	0.	0.	.734E-02	.645E-01	.698E-01	.116E+00	.108E+00	.861E-01	0.	.114E+00
-200				.876E-01		.146E+00				
-400				.399E-01		.166E+00		.151E+00		.175E+00
-600				0.		.100E+00				
-800				0.		0.		.144E+00		.182E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = 60. WIND SPEED (MPH) =45.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.262E-01		0.
600				0.		0.				
400				0.		.210E-01		.105E-01		0.
200				0.		0.				
0	0.	0.	.350E-02	.140E-01	.420E-01	.191E+00	.224E+00	.115E+00	0.	0.
-200				.350E-01		.219E+00				
-400				.245E-01		.115E+00		.304E+00		0.
-600				0.		.402E-01				
-800				0.		0.		.804E-01		.124E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = 60.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.472E-02		0.
600				0.		.210E-02				
400				.577E-02		.152E-01		.226E-01		.310E-01
200				.420E-02		.645E-01				
0	0.	0.	.682E-02	.362E-01	.504E-01	.971E-01	.138E+00	.855E-01	0.	.121E+00
-200				.331E-01		.115E+00				
-400				.173E-01		.567E-01		.140E+00		.150E+00
-600				0.		.184E-01				
-800				0.		0.		.362E-01		.997E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30 WIND SPEED (MPH) =15.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.175E-01		0.
1200								.274E-01		0.
1000						.998E-02				
800				.250E-01		.299E-01		.125E-01		.324E-01
600				.374E-01		.250E-01				
400				.250E-02		.274E-01		.399E-01		.374E-01
200				.299E-01		.424E-01				
0	.150E-01	.250E-01	.175E-01	.749E-01	.225E-01	.175E-01	.190E+00	.474E-01	.799E-01	.674E-01
-200				.998E-02		0.				
-400				.299E-01		.250E-01		.424E-01		.150E-01
-600				.399E-01		.125E-01				
-800				.749E-02		.200E-01		.150E-01		.499E-02
-1000						.449E-01				
-1200								.225E-01		.299E-01
-1600								.225E-01		.225E-01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -30.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

NEUTRAL, X=133FT.Y=400FT.

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.944E-01		.115E+00
600				0.		.577E-01				
400				.472E-01		.629E-01		.126E+00		.185E+00
200				.367E-01		.112E+00				
0	0.	0.	.280E-01	.280E-01	.402E-01	.472E-01	.752E-01	.108E+00	0.	.149E+00
-200				.629E-01		.455E-01				
-400				.297E-01		.227E-01		.402E-01		.157E-01
-600				0.		.490E-01				
-800				0.		0.		.280E-01		.367E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .185E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.745E-02		.932E-02
1200								.466E-02		.559E-02
1000						0.				
800				.745E-02		.252E-01		.252E-01		.354E-01
600				.932E-03		.363E-01				
400				0.		.172E+00		.118E+00		.112E+00
200				.652E-01		.155E+00				
0	0.	.745E-02	.745E-02	.335E-01	.978E-01	.652E-02	.154E+00	.155E+00	.180E+00	.147E+00
-200				.466E-02		.671E-01				
-400				.838E-02		.242E-01		.885E-01		.133E+00
-600				.652E-02		.102E-01				
-800				.186E-02		.279E-02		.578E-01		.829E-01
-1000						.559E-02				
-1200								.102E-01		.289E-01
-1600								.186E-02		.932E-03

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = + 6-7   WIND ANGLE = -30.   WIND SPEED (MPH) =45.00   LOAD = FULL   PRECIPITATOR POSITION = DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.374E-01		.175E-01
1200								.125E-01		.399E-01
1000						.274E-01				
800				.349E-01		.299E-01		.449E-01		.155E+00
600				0.		.225E-01				
400				0.		.973E-01		.162E+00		.110E+00
200				.225E-01		.998E-01				
0	.274E-01	0.	.349E-01	.324E-01	.574E-01	.274E-01	.574E-01	.120E+00	.152E+00	.165E+00
-200				.549E-01		.374E-01				
-400				.749E-02		.998E-02		.624E-01		.102E+00
-600				.125E-01		.250E-02				
-800				.125E-01		.150E-01		.125E-01		.374E-01
-1000						0.				
-1200								.250E-01		.250E-01
-1600								.250E-01		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.168E-01		.838E-02
1200								.158E-01		.140E-01
1000						0.				
800				0.		.838E-02		.699E-01		.792E-01
600				.186E-01		.932E-03				
400				.652E-02		.136E+00		.199E+00		.170E+00
200				.326E-01		.103E+00				
0	.102E-01	.652E-02	.559E-02	.345E-01	.550E-01	.149E-01	.876E-01	.126E+00	.144E+00	.116E+00
-200				0.		.391E-01				
-400				.373E-02		.643E-01		.503E-01		.634E-01
-600				.838E-02		.373E-02				
-800				.112E-01		.279E-02		.466E-02		.270E-01
-1000						.149E-01				
-1200								0.		.214E-01
-1600								.466E-02		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -45.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.324E-01		.117E+00
600				0.		.225E-01				
400				0.		.122E+00		.205E+00		.250E+00
200				.349E-01		.749E-01				
0	0.	0.	.225E-01	.474E-01	.399E-01	.774E-01	.274E-01	.107E+00	0.	.200E+00
-200				.274E-01		.424E-01				
-400				.749E-02		.474E-01		.873E-01		.374E-01
-600				0.		.998E-02				
-800				0.		0.		.349E-01		.130E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -45. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.307E-01		.307E-01
600				0.		.186E-01				
400				.214E-01		.717E-01		.876E-01		.885E-01
200				.196E-01		.755E-01				
0	0.	0.	0.	.121E-01	.484E-01	.913E-01	.503E-01	.932E-01	0.	.125E+00
-200				.102E-01		.457E-01				
-400				.466E-02		.391E-01		.717E-01		.116E+00
-600				0.		.745E-02				
-800				0.		0.		.335E-01		.606E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -45.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.699E-01		.898E-01
600				0.		.102E+00				
400				.524E-01		.190E+00		.250E+00		.237E+00
200				.674E-01		.122E+00				
0	0.	0.	.250E-01	.749E-01	.115E+00	.220E+00	.948E-01	.973E-01	0.	.202E+00
-200				.649E-01		.998E-01				
-400				0.		.499E-01		.110E+00		.175E+00
-600				0.		.250E-01				
-800				0.		0.		.574E-01		.424E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -45. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.394E-01		.740E-01
600				0.		.561E-01				
400				.157E-01		.771E-01		.110E+00		.104E+00
200				.236E-01		.394E-01				
0	0.	0.	0.	.110E-01	.519E-01	.876E-01	.414E-01	.525E-01	0.	.913E-01
-200				.420E-02		.446E-01				
-400				.472E-02		.273E-01		.336E-01		.619E-01
-600				0.		0.				
-800				0.		0.		0.		.178E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -60.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.524E-02		.594E-01
600				0.		.315F-01				
400				.395E-01		.699E-01		.927E-01		.140E+00
200				.122E-01		.154E+00				
0	0.	0.	.699E-02	0.	.524E-01	.979F-01	.156E+00	.124F+00	0.	.287E+00
-200				.280E-01		.944E-01				
-400				.699E-02		.507F-01		.114E+00		.219E+00
-600				0.		.175E-01				
-800				0.		0.		.542F-01		.114E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -60.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.169E+00		.197E+00
600				0.		.255E+00				
400				.866E-01		.263E+00		.262E+00		.324E+00
200				.661E-01		.219E+00				
0	0.	0.	0.	.142E-01	.540E-01	.128E+00	.225E+00	.193E+00	0.	.227E+00
-200				.367E-02		.414E-01				
-400				.105E-02		.231E-01		.598E-01		.167E+00
-600				0.		.787E-02				
-800				0.		0.		.210E-01		.572E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -60.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.262E-01		.524E-01
600				0.		.594E-01				
400				0.		.117E+00		.769E-01		.108E+00
200				.245E-01		.159E+00				
0	0.	0.	.140E-01	.262E-01	.629E-01	.117E+00	.178E+00	.115E+00	0.	.240E+00
-200				.157E-01		.184E+00				
-400				.210E-01		.892E-01		.110E+00		.203E+00
-600				0.		.157E-01				
-800				0.		0.		.122E-01		.114E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -60. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.310E-01		.299E-01
600				0.		.341E-01				
400				.147E-01		.997E-01		.467E-01		.876E-01
200				.346E-01		.934E-01				
0	0.	0.	0.	.121E-01	.446E-01	.588E-01	.682E-01	.504E-01	0.	.745E-01
-200				.472E-02		.357E-01				
-400				.367E-02		.472E-02		.241E-01		.630E-01
-600				0.		.472E-02				
-800				0.		0.		.105E-01		.997E-02
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = +30 WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		.160E-01
1200								.120E-01		.722E-01
1000						.562E-01				
800				.441E-01		.522E-01		.602E-01		.193E+00
600				.481E-01		.120E+00				
400				.120E-01		.241E+00		.329E+00		.478E+00
200				.843E-01		.502E+00				
0	.682E-01	.160E-01	.441E-01	.329E+00	.156E+00	.642E-01	.911E+00	.678E+00	.730E+00	.642E+00
-200				.421E+00		.915E+00				
-400				.421E+00		.783E+00		.642E+00		.498E+00
-600				.165E+00		.281E-01				
-800				.802E-01		0.		.546E+00		.506E+00
-1000						.120E-01				
-1200								.923E-01		.273E+00
-1600								.401E-02		.963E-01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = 30.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		.157E-02
600				0.		.141F-01				
400				.784E-02		.157E-01		.439F-01		.627E-01
200				0.		.627E-01				
0	0.	0.	.784E-02	.113E+00	.124E+00	.187E+00	.831E-01	.127E+00	0.	.151E+00
-200				.248E+00		.340E+00				
-400				.279E+00		.331E+00		.246E+00		.162E+00
-600				0.		.334F+00				
-800				0.		0.		.237F+00		.188E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = 30. WIND SPEED (MPH) =45.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.401E-02		.883E-01
600				0.		.201E-01				
400				0.		.401E-01		.923E-01		.963E-01
200				.201E-01		.148E+00				
0	0.	0.	.883E-01	.128E+00	.165E+00	.441E+00	.209E+00	.241E+00	0.	.345E+00
-200				.345E+00		.662E+00				
-400				.385E+00		.598E+00		.526E+00		.429E+00
-600				0.		.518E+00				
-800				0.		0.		.417E+00		.470E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = 30. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.172E-01		.157E-01
600				0.		.172F-01				
400				0.		.157E-01		.596F-01		.127E+00
200				0.		.140E+00				
0	0.	0.	.345E-01	.815E-01	.140E+00	.166E+00	.102E+00	.113E+00	0.	.184E+00
-200				.196E+00		.268F+00				
-400				.105E+00		.281E+00		.240E+00		.201E+00
-600				0.		.184E+00				
-800				0.		0.		.111E+00		.160E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = 45.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		.903E-02
600				0.		.294F-01				
400				.655E-01		.406E-01		.745E-01		.790E-01
200				.745E-01		.145E+00				
0	0.	0.	.474E-01	.219E+00	.242E+00	.474F+00	.479F+00	.291F+00	0.	.330E+00
-200				.468E+00		.940F+00				
-400				.404E+00		.793F+00		.798E+00		.474E+00
-600				0.		.662F+00				
-800				0.		0.		.619E+00		.567E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = 45.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.106E-01		0.
600				0.		.132E-01				
400				.194E-01		.353E-01		.423E-01		.564E-01
200				.397E-01		.847E-01				
0	0.	0.	.115E-01	.166E+00	.216E+00	.282E+00	.233E+00	.154E+08	0.	.191E+00
-200				.380E+00		.436E+00				
-400				.293E+00		.429E+00		.361E+00		.226E+00
-600				0.		.350E+00				
-800				0.		0.		.212E+00		.277E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = 45.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.248E-01		.158E-01
600				0.		.452E-02				
400				.181E-01		.361E-01		.655E-01		.181E-01
200				0.		.406E-01				
0	0.	0.	.104E+00	.192E+00	.309E+00	.316E+00	.348E+00	.126E+00	0.	.271E+00
-200				.418E+00		.804E+00				
-400				.398E+00		.743E+00		.438E+00		.391E+00
-600				0.		.587E+00				
-800				0.		0.		.332E+00		.499E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = 45. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.970E-02		.291E-01
600				0.		0.				
400				.150E-01		.309E-01		.238E-01		.609E-01
200				.415E-01		.547E-01				
0	0.	0.	.970E-02	.732E-01	.146E+00	.260E+00	.261E+00	.137E+00	0.	.195E+00
-200				.229E+00		.386E+00				
-400				.159E+00		.362E+00		.290E+00		.228E+00
-600				0.		.204E+00				
-800				0.		0.		.131E+00		.188E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = 60. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.452E-02		0.
600				0.		0.				
400				.248E-01		.154E+00		.149E+00		.926E-01
200				.926E-01		.583E+00				
0	0.	0.	.113E+00	.427E+00	.352E+00	.775E+00	.746E+00	.761E+00	0.	.438E+00
-200				.429E+00		.802E+00				
-400				0.		.621E+00		.759E+00		.569E+00
-600				0.		.309E+00				
-800				0.		0.		.287E+00		.461E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = 60.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.794E-02		.882E-02
600				0.		.229E-01				
400				.794E-02		.891E-01		.573E-01		.794E-01
200				.891E-01		.189E+00				
0	0.	0.	0.	.255E+00	.160E+00	.339E+00	.283E+00	.160E+00	0.	.172E+00
-200				.342E+00		.425E+00				
-400				.119E+00		.304E+00		.287E+00		.209E+00
-600				0.		.135E+00				
-800				0.		0.		.173E+00		.213E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = 60.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.135E-01		.203E-01
600				0.		.452E-02				
400				.452E-02		.151E+00		.129E+00		.723E-01
200				.113E-01		.368E+00				
0	0.	0.	0.	.219E+00	0.	.716E+00	.529E+00	.366E+00	0.	.488E+00
-200				.280E+00		.599E+00				
-400				.138E+00		.445E+00		.630E+00		.544E+00
-600				0.		.208E+00				
-800				0.		0.		.145E+00		.334E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = 60.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.424E-02		.783E-02
600				0.		.101E-01				
400				.424E-02		.290E-01		.365E-01		.261E-01
200				.179E-01		.911E-01				
0	0.	0.	.489E-02	.548E-01	.617E-01	.120E+00	.104E+00	.705E-01	0.	.626E-01
-200				.656E-01		.112E+00				
-400				.297E-01		.581E-01		.976E-01		.826E-01
-600				0.		.189E-01				
-800				0.		0.		.258E-01		.470E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVCN POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = -30. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.282E-01		.172E-01
600				0.		.267E-01				
400				.329E-01		.172E-01		.549E-01		.674E-01
200				.925E-01		.157E-01				
0	0.	0.	.226E+00	.362E+00	.279E+00	.259E+00	0.	.114E+00	0.	.100E+00
-200				.334E+00		.414E+00				
-400				.198E+00		.329E+00		.306E+00		.223E+00
-600				0.		.157E-01				
-800				0.		0.		.184E+00		.213E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = -30.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.682E-01		.441E-01
1200								.602E-01		.441E-01
1000						0.				
800				.802E-01		.100E+00		.148E+00		.156E+00
600				.963E-01		.140E+00				
400				.883E-01		.349E+00		.361E+00		.470E+00
200				.285E+00		.405E+00				
0	.281E-01	0.	.124E+00	.389E+00	.265E+00	.678E+00	.742E+00	.401E+00	.478E+00	.453E+00
-200				.702E+00		.125E+01				
-400				.209E+00		.686E+00		.574E+00		.634E+00
-600				.682E-01		.682E-01				
-800				.401E-01		.201E-01		.787E+00		.670E+00
-1000						.201E-01				
-1200								.213E+00		.429E+00
-1600								.321E-01		.209E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = -30. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.251E-01		.188E-01
600				0.		.204E-01				
400				.282E-01		.518E-01		.314E-01		.345E-01
200				.470E-01		.235E-01				
0	0.	0.	.439E-01	.158E+00	.180E+00	.144E+00	.376E-01	.753E-01	0.	.910E-01
-200				.815E-01		.254E+00				
-400				.768E-01		.138E+00		.187E+00		.122E+00
-600				0.		0.				
-800				0.		0.		.878E-01		.110E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = -45. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		.271E-01
600				0.		.339E-01				
400				.271E-01		.768E-01		.111E+00		.113E+00
200				.135E+00		.237E+00				
0	0.	0.	.610E-01	.418E+00	.556E+00	.452E+00	.169E+00	.278E+00	0.	.388E+00
-200				.407E+00		.689E+00				
-400				.156E+00		.691E+00		.619E+00		.479E+00
-600				0.		.479E+00				
-800				0.		0.		.517E+00		.581E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = -45. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.344E-01		.432E-01
600				0.		.459F-01				
400				.882E-02		.785F-01		.109E+00		.105E+00
200				.213E+00		.279F+00				
0	0.	0.	.847E-01	.354E+00	.424E+00	.418F+00	.139E+00	.206F+00	0.	.208E+00
-200				.276F+00		.434F+00				
-400				.114E+00		.347E+00		.293E+00		.230E+00
-600				0.		.280F+00				
-800				0.		0.		.246E+00		.163E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = -45.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		.452E-02
600				0.		0.				
400				.474E-01		.723E-01		.858E-01		.113E+00
200				.903E-01		.271E+00				
0	0.	0.	.497E-01	.291E+00	.499E+00	.558E+00	.156E+00	.278E+00	0.	.355E+00
-200				.393E+00		.696E+00				
-400				.122E+00		.438E+00		.208E+00		.364E+00
-600				0.		.242E+00				
-800				0.		0.		.187E+00		.355E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = -45.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.970E-02		.176E-01
600				0.		.282E-01				
400				0.		.326E-01		.344E-01		.158E+00
200				.741E-01		.130E+00				
0	0.	0.	.626E-01	.188E+00	.215E+00	.263E+00	.829E-01	.148E+00	0.	.167E+00
-200				.155E+00		.288E+00				
-400				.326E-01		.205E+00		.188E+00		.161E+00
-600				0.		.856E-01				
-800				0.		0.		.520E-01		.882E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = -60.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.542E-01		.406E-01
600				0.		.677E-01				
400				.294E-01		.176E+00		.768E-01		.196E+00
200				.316E+00		.587E+00				
0	0.	0.	.768E-01	.474E+00	.829E+00	.877E+00	.791E+00	.511E+00	0.	.567E+00
-200				.395E+00		.831E+00				
-400				.174E+00		.513E+00		.685E+00		.637E+00
-600				0.		.233E+00				
-800				0.		0.		.407E+00		.556E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = -60. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.362E-01		.732E-01
600				0.		.873E-01				
400				.829E-01		.251E+00		.124E+00		.163E+00
200				.259E+00		.421E+00				
0	0.	0.	.847E-01	.429E+00	.528E+00	.482E+00	.410E+00	.196E+00	0.	.254E+00
-200				.396E+00		.472E+00				
-400				.273E+00		.312E+00		.246E+00		.234E+00
-600				0.		.139E+00				
-800				0.		0.		.111E+00		.174E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = -60.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.655E-01		.632E-01
600				0.		.138E+00				
400				.115E+00		.445E+00		.206E+00		.314E+00
200				.296E+00		.854E+00				
0	0.	0.	.677E-01	.454E+00	.761E+00	.865E+00	.827E+00	.492E+00	0.	.551E+00
-200				.248E+00		.635E+00				
-400				.406E-01		.256E+00		.400E+00		.461E+00
-600				0.		.429E-01				
-800				0.		0.		.361E-01		.126E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = -60. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.238E-01		.415E-01
600				0.		.476E-01				
400				.617E-01		.199E+00		.105E+00		.131E+00
200				.165E+00		.372E+00				
0	0.	0.	.185E-01	.217E+00	.299E+00	.301E+00	.326E+00	.138E+00	0.	.161E+00
-200				.142E+00		.252E+00				
-400				.176E-01		.108E+00		.131E+00		.170E+00
-600				0.		.362E-01				
-800				0.		0.		.273E-01		.265E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9 WIND ANGLE = +30 WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .463E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.250E-01		.949E-01
1200								0.		.499E-01
1000						0.				
800				0.		0.		.949E-01		.300E-01
600				0.		0.				
400				0.		0.		.699E-01		.599E-01
200				0.		0.				
0	0.	0.	0.	0.	0.	0.	0.	.449E-01	.799E-01	.599E-01
-200				0.		0.				
-400				0.		0.		.399E-01		.250E-01
-600				0.		0.				
-800				0.		0.		.749E-01		.145E+00
-1000						0.				
-1200								.749E-01		.120E+00
-1600								.300E-01		.699E-01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = 30.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.868E-02		.347E-02
600				0.		.191E-01				
400				.139E-01		0.		.868F-02		.226E-01
200				.122E-01		0.				
0	0.	0.	0.	.226E-01	.122E-01	0.	.330F-01	.365F-01	0.	.120E+00
-200				.122E-01		.260F-01				
-400				0.		.101F+00		.153F+00		.177E+00
-600				0.		.538F-01				
-800				0.		0.		.188E+00		.323E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = 45,   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.166E-01		.547E-01
600				0.		0.				
400				.293E-02		.606E-01		.224E+00		.320E+00
200				.586E-02		.249E+00				
0	0.	C.	.977E-02	.192E+00	.266E+00	.480E+00	.632E+00	.587E+00	0.	.698E+00
-200				.270E+00		.604E+00				
-400				.211E+00		.647E+00		.786E+00		.700E+00
-600				0.		.473E+00				
-800				0.		0.		.369E+00		.516E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = 45.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .463E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.460E-01		0.
600				0.		.276E-01				
400				.245E-01		.613E-02		.245E-01		.123E-01
200				.920E-01		.153E-01				
0	0.	0.	.181E+00	.107E+00	.245E-01	.613E-01	.766E-01	.736E-01	0.	.126E+00
-200				.858E-01		.307E-01				
-400				.766E-01		.674E-01		.104E+00		.156E+00
-600				0.		.337E-01				
-800				0.		0.		.123E+00		.236E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = 45.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		0.
600				0.		0.				
400				0.		.293F-02		.371F-01		.235E-01
200				.127E-01		.586F-01				
0	0.	0.	.977E-03	.919E-01	.166E+00	.344E+00	.441E+00	.221E+00	0.	.415E+00
-200				.309E+00		.690E+00				
-400				.290E+00		.697E+00		.609F+00		.472E+00
-600				0.		.477F+00				
-800				0.		0.		.275E+00		.434E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9 WIND ANGLE = 60. WIND SPEED (MPH) =45.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .463E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.368E-01		.552E-01
600				0.		.245E-01				
400				.582E-01		.306E-02		.245E-01		.705E-01
200				.644E-01		.613E-01				
0	0.	0.	.307E-01	.153E-01	.644E-01	0.	.613E-01	.920E-01	0.	.212E+00
-200				0.		.521E-01				
-400				.123E-01		.705E-01		.218E+00		.218E+00
-600				0.		.919E-02				
-800				0.		0.		.797E-01		.310E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9 WIND ANGLE = 60. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.880F-02		.684E-02
600				0.		0.				
400				.977E-02		.186F-01		.586F-02		.166E-01
200				.880E-02		.293F-02				
0	0.	0.	.205E-01	.117E-01	.391E-02	.147E-01	.274F-01	.313E-01	0.	.880E-01
-200				.782E-02		.127F-01				
-400				.127E-01		.254F-01		.733E-01		.831E-01
-600				0.		.362E-01				
-800				0.		0.		.469E-01		.111E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9 WIND ANGLE = -30. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .463E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.200E-01		.349E-01
600				0.		.599E-01				
400				0.		.200E-01		0.		.300E-01
200				.300E-01		.599E-01				
0	0.	0.	.250E-01	0.	.749E-01	.749E-01	0.	.105E+00	0.	.135E+00
-200				.998E-01		.499E-01				
-400				.499E-01		0.		.115E+00		.180E+00
-600				0.		.599E-01				
-800				0.		0.		.185E+00		.165E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = -30.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.191E-01		.226E-01
600				0.		.868E-02				
400				0.		.695E-02		.208E-01		.260E-01
200				0.		.278F-01				
0	0.	0.	.104E-01	.208F-01	.156E-01	.625F-01	.226E-01	.781F-01	0.	.188E+00
-200				.486E-01		.142E+00				
-400				.122E-01		.179F+00		.351E+00		.299E+00
-600				0.		.347F-01				
-800				0.		0.		.316F+00		.313E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = -30.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .463E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.200E-01		.349E-01
600				0.		.549E-01				
400				.250E-01		.549E-01		0.		.799E-01
200				.150E-01		.399E-01				
0	0.	0.	0.	.749E-01	.549E-01	.349E-01	.449E-01	.150E+00	0.	.255E+00
-200				.300E-01		.160E+00				
-400				.250E-01		0.		.394E+00		.434E+00
-600				0.		.549E-01				
-800				0.		0.		.295E+00		.464E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = -45.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.107E-01		.254E-01
600				0.		.684E-02				
400				.147E-01		.107E-01		.205E-01		.274E-01
200				.489E-02		.127E-01				
0	0.	0.	.117E-01	.684E-02	.205E-01	.723E-01	.704E-01	.929E-01	0.	.137E+00
-200				0.		.128E+00				
-400				.880E-02		.115E+00		.279E+00		.240E+00
-600				0.		.101E+00				
-800				0.		0.		.315E+00		.475E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = -45.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .463E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		.337E-01
600				0.		.460E-01				
400				.368F-01		.307E-01		.552E-01		.107E+00
200				.245F-01		.107F+00				
0	0.	0.	.221E+00	.544E-01	.104E+00	.123F+00	.644E-01	.129E+00	0.	.294E+00
-200				.113F+00		.644F-01				
-400				.120E+00		.129E+00		.322E+00		.337E+00
-600				0.		.101E+00				
-800				0.		0.		.221F+00		.555E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = -45.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.215E-01		.137E-01
600				0.		.977E-03				
400				.137E-01		.127E-01		0.		.195E-01
200				.127E-01		.235E-01				
0	0.	0.	.684E-02	.166E-01	.264E-01	.323E-01	.606E-01	.772E-01	0.	.101E+00
-200				.107E-01		.116E+00				
-400				.156E-01		.938E-01		.208E+00		.198E+00
-600				0.		.538E-01				
-800				0.		0.		.131E+00		.259E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9 WIND ANGLE = -60. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		.137E-01
600				0.		.147E-01				
400				0.		.147E-01		.127E-01		.235E-01
200				.489E-02		.205E-01				
0	0.	0.	.586E-02	.176E-01	.518E-01	.635E-01	.684E-01	.870E-01	0.	.196E+00
-200				.977E-02		.182E+00				
-400				.489E-02		.257E+00		.482E+00		.392E+00
-600				0.		.197E+00				
-800				0.		0.		.533E+00		.619E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9 WIND ANGLE = -60. WIND SPEED (MPH) =45.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .463E+10

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.276E-01		.460E-01
600				0.		.521E-01				
400				.674E-01		.337E-01		.674E-01		.705E-01
200				0.		.828E-01				
0	0.	0.	.613E-01	.215E-01	.644E-01	.766E-01	.215E+00	.138E+00	0.	.307E+00
-200				.245E-01		.153E+00				
-400				.398E-01		.110E+00		.208E+00		.297E+00
-600				0.		.674E-01				
-800				0.		0.		.490E-01		.138E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9   WIND ANGLE = -60.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		.147E-01
600				0.		.195E-01				
400				.782E-02		.195E-02		.391E-02		.215E-01
200				.489E-02		.489E-01				
0	0.	0.	.391E-02	.586E-02	.176E-01	.410E-01	.860E-01	.108E+00	0.	.131E+00
-200				.215E-01		.831E-01				
-400				0.		.557E-01		.170E+00		.178E+00
-600				0.		.313E-01				
-800				0.		0.		.381E-01		.144E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

Table 13 Grouped Concentration Data at Neutral Conditions

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6,7 WIND ANGLE = +30. WIND SPEED (MPH) =15.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		.150E-01
1200								0.		0.
1000						0.				
800				0.		0.		.449E-01		.674E-01
600				0.		0.				
400				0.		0.		.599E-01		.474E-01
200				0.		0.				
0	0.	0.	0.	0.	0.	0.	0.	.524E-01	.424E-01	.374E-01
-200				0.		0.				
-400				0.		0.		.749E-01		.200E-01
-600				0.		0.				
-800				0.		0.		.424E-01		.125E-01
-1000						0.				
-1200								.399E-01		.250E-02
-1600								.998E-02		.499E-02

MAXIMUM CONCENTRATION= .749E-01PPM

Table 13 Grouped Concentration Data at Neutral Conditions

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5,6,7, 8,9 WIND ANGLE = +30 WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.349E-01		.148E+00
1200								.417E-01		.253E+00
1000						.750E-01				
800				.559E-01		.905E-01		.336E+00		.663E+00
600				.565E-01		.175E+00				
400				.448E-01		.438E+00		.836E+00		.105E+01
200				.313E+00		.790E+00				
0	.876E-01	.117E+00	.308E+00	.760E+00	.309E+00	.423E+00	.143E+01	.134E+01	.147E+01	.133E+01
-200				.646E+00		.138E+01				
-400				.613E+00		.110E+01		.118E+01		.942E+00
-600				.235E+00		.576E-01				
-800				.129E+00		.273E-01		.780E+00		.874E+00
-1000						.345E-01				
-1200								.220E+00		.522E+00
-1600								.579E-01		.181E+00

MAXIMUM CONCENTRATION= .147E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = 30.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.892E-01		.115E+00
600				0.		.130E+00				
400				.946E-01		.279E+00		.304E+00		.338E+00
200				.298E+00		.801E-01				
0	0.	0.	.317E+00	.452E+00	.494E+00	.605E+00	.367E+00	.451E+00	0.	.624E+00
-200				.424E+00		.735E+00				
-400				.426E+00		.695E+00		.752E+00		.694E+00
-600				0.		.396E+00				
-800				0.		0.		.593E+00		.801E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .801E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7,8,9 WIND ANGLE = 30. WIND SPEED (MPH) =45.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		.250E-01
1200								.524E-01		.299E-01
1000						.125E-01				
800				.749E-02		.225E-01		.563E-01		.166E+00
600				0.		.989E-01				
400				.938E-01		.329E+00		.349E+00		.318E+00
200				.387E+00		.344E+00				
0	0.	0.	.541E+00	.601E+00	.595E+00	.975E+00	.519E+00	.654E+00	.344E+00	.744E+00
-200				.620E+00		.114E+01				
-400				.637E+00		.866E+00		.954E+00		.802E+00
-600				0.		.545E+00				
-800				.225E-01		.299E-01		.583E+00		.691E+00
-1000						0.				
-1200								0.		.749E-02
-1600								.374E-01		0.

MAXIMUM CONCENTRATION= .114E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7,8,9 WIND ANGLE = 30. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.279E-01		.291E-01
600				0.		.340E-01				
400				.310E-01		.107E+00		.134E+00		.203E+00
200				.194E+00		.143E+00				
0	0.	0.	.271E+00	.325E+00	.426E+00	.431E+00	.289E+00	.249E+00	0.	.434E+00
-200				.327E+00		.544E+00				
-400				.243E+00		.486E+00		.493E+00		.454E+00
-600				0.		.189E+00				
-800				0.		0.		.209E+00		.359E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .544E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7,8,9   WIND ANGLE = 45.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.754E-02		.487E-01
600				0.		.473E-01				
400				.110E+00		.115E+00		.177E+00		.143E+00
200				.186E+00		.322E+00				
0	0.	0.	.184E+00	.443E+00	.497E+00	.780E+00	.800E+00	.503E+00	0.	.616E+00
-200				.715E+00		.131E+01				
-400				.544E+00		.109E+01		.119E+01		.831E+00
-600				0.		.820E+00				
-800				0.		0.		.864E+00		.955E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .131E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = 45.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.324E-01		.606E-01
600				0.		.696E-01				
400				.581E-01		.173E+00		.326E+00		.424E+00
200				.260E+00		.469E+00				
0	0.	0.	.285E+00	.639E+00	.736E+00	.101E+01	.110E+01	.891E+00	0.	.109E+01
-200				.889E+00		.134E+01				
-400				.687E+00		.135E+01		.144E+01		.110E+01
-600				0.		.101E+01				
-800				0.		0.		.756E+00		.106E+01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .144E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = 45.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.324F-01		.606E-01
600				0.		.696E-01				
400				.581F-01		.173F+00		.326F+00		.424E+00
200				.260E+00		.469E+00				
0	0.	0.	.285E+00	.639E+00	.736E+00	.101E+01	.110E+01	.891F+00	0.	.109E+01
-200				.889E+00		.134F+01				
-400				.687E+00		.135F+01		.144F+01		.110E+01
-600				0.		.101F+01				
-800				0.		0.		.756E+00		.106E+01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION=   .144E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = 45.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.888E-01		.433E-01
600				0.		.658E-01				
400				.772E-01		.127E+00		.173E+00		.112E+00
200				.411E+00		.277E+00				
0	0.	0.	.767E+00	.876E+00	.884E+00	.994E+00	.103E+01	.486E+00	0.	.104E+01
-200				.921E+00		.153E+01				
-400				.789E+00		.141E+01		.134E+01		.120E+01
-600				0.		.941E+00				
-800				0.		0.		.710E+00		.120E+01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .153E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9 WIND ANGLE = 45. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.142E-01		.357E-01
600				0.		.470E-02				
400				.519E-01		.678E-01		.905E-01		.122E+00
200				.270E+00		.222E+00				
0	0.	0.	.272E+00	.442E+00	.537E+00	.863E+00	.957E+00	.490E+00	0.	.817E+00
-200				.729E+00		.135E+01				
-400				.592E+00		.127E+01		.114E+01		.934E+00
-600				0.		.808E+00				
-800				0.		0.		.507E+00		.779E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .135E+01PPM

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY.　　CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7,8,9　　WIND ANGLE = 60.　　WIND SPEED (MPH) =30.0　　LOAD = FULL　　PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.989E-02		.674E-02
600				0.		.903E-02				
400				.848E-01		.261E+00		.229E+00		.145E+00
200				.494E+00		.965E+00				
0	0.	0.	.431E+00	.983E+00	.567E+00	.125E+01	.118E+01	.980E+00	0.	.716E+00
-200				.877E+00		.129E+01				
-400				.171E+00		.957E+00		.117E+01		.914E+00
-600				0.		.440E+00				
-800				0.		0.		.456E+00		.820E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .129E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7,8,9 WIND ANGLE = 60. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

X = Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.209E-01		.364E-01
600				0.		.345E-01				
400				.592E-01		.191E+00		.124E+00		.145E+00
200				.377E+00		.400E+00				
0	0.	0.	.309E+00	.639E+00	.334E+00	.662E+00	.562E+00	.328E+00	0.	.363E+00
-200				.651E+00		.800E+00				
-400				.236E+00		.584E+00		.569E+00		.475E+00
-600				0.		.276E+00				
-800				0.		0.		.354E+00		.472E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .800E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9 WIND ANGLE = 60. WIND SPEED (MPH) =45.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.805E-01		.841E-01
600				0.		.613E-01				
400				.150E+00		.343E+00		.270E+00		.222E+00
200				.478E+00		.880E+00				
0	0.	0.	.382E+00	.684E+00	.273E+00	.137E+01	.119E+01	.752E+00	0.	.892E+00
-200				.701E+00		.130E+01				
-400				.312E+00		.811E+00		.138E+01		.951E+00
-600				0.		.327E+00				
-800				0.		0.		.358E+00		.857E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .138E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = 60.   WIND SPEED (MPH) =45.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.181E-01		.180E-01
600				0.		.237E-01				
400				.801E-01		.142E+00		.927E-01		.901E-01
200				.285E+00		.319E+00				
0	0.	0.	.338E+00	.412E+00	.180E+00	.417E+00	.412E+00	.248E+00	0.	.336E+00
-200				.315E+00		.432E+00				
-400				.144E+00		.241E+00		.402E+00		.390E+00
-600				0.		.110E+00				
-800				0.		0.		.131E+00		.306E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .432E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = , 1-5, 6,7 WIND ANGLE = -30 WIND SPEED (MPH) =15.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.199E-01		.244E-02
1200								.364E-01		.162E-02
1000						.120E-01				
800				.262E-01		.306E-01		.305E-01		.375E-01
600				.466E-01		.256E-01				
400				.250E-02		.305E-01		.891E-01		.671E-01
200				.338E-01		.524E-01				
0	.215E-01	.329E-01	.229E-01	.848E-01	.245E-01	.197E-01	.236E+00	.740E-01	.113E+00	.120E+00
-200				.250E-01		.215E-01				
-400				.435E-01		.611E-01		.621E-01		.373E-01
-600				.405E-01		.214E-01				
-800				.749E-02		.256E-01		.241E-01		.141E-01
-1000						.488E-01				
-1200								.263E-01		.346E-01
-1600								.271E-01		.243E-01

MAXIMUM CONCENTRATION= .236E+00PPM

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.209E-02		.730E-02
1200								.151E-01		.127E-01
1000						0.				
800				0.		.379E-03		.421E-01		.435E-01
600				0.		.474E-03				
400				0.		.275E-02		.647E-01		.487E-01
200				.104E-01		.136E-01				
0	.171E-02	.142E-02	.126E-01	.214E-01	.124E-01	.247E-02	.200E-01	.219E-01	.188E-01	.327E-01
-200				.300E-01		.258E-01				
-400				.105E-01		.187E-01		.203E-01		.150E-01
-600				.104E-02		.104E-02				
-800				.104E-02		.569E-03		.109E-01		.749E-02
-1000						.759E-03				
-1200								.740E-02		.436E-02
-1600								.379E-03		.854E-03

MAXIMUM CONCENTRATION= .647E-01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 9 WIND ANGLE = -30. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

X = / Y	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.609E-03		.193E-01
1200								.304E-02		.248E-01
1000						.162E-02				
800				.101E-02		.238E-01		.292E+00		.455E+00
600				.380E-01		.369E+00				
400				.515E-01		.590E+00		.784E+00		.859E+00
200				.145E+00		.689E+00				
0	.138E-01	.853E-02	.104E+00	.198E+00	.245E+00	.347E+00	.673E+00	.816E+00	.117E+00	.813E+00
-200				.319E+00		.335E+00				
-400				.117E+00		.128E+00		.482E+00		.697E+00
-600				.751E-02		.727E-01				
-800				.142E-02		.386E-02		.266E+00		.306E+00
-1000						.122E-02				
-1200								.406E-02		.873E-02
-1600								0.		.264E-02

MAXIMUM CONCENTRATION= .859E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = -30.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.783E-02		.107E-01
1200								.684E-02		.124E-01
1000						0.				
800				.888E-02		.272E-01		.862E-01		.102E+00
600				.229E-01		.748E-01				
400				.100E+00		.245E+00		.243E+00		.258E+00
200				.275E+00		.282E+00				
0	0.	.307E-01	.244E+00	.502E+00	.462E+00	.329E+00	.243E+00	.401E+00	.238E+00	.484E+00
-200				.431E+00		.679E+00				
-400				.235E+00		.570E+00		.803E+00		.705E+00
-600				.700E-02		.613E-01				
-800				.243E-02		.317E-02		.584E+00		.643E+00
-1000						.559E-02				
-1200								.176E-01		.429E-01
-1600								.262E-02		.511E-02

MAXIMUM CONCENTRATION= .803E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = -30.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.108E+00		.616E-01
1200								.739E-01		.881E-01
1000						.372E-01				
800				.123E+00		.130E+00		.224E+00		.364E+00
600				.120E+00		.220E+00				
400				.115E+00		.607E+00		.593E+00		.711E+00
200				.555E+00		.711E+00				
0	.101E+00	.473E-01	.319E+00	.763E+00	.587E+00	.743E+00	.103E+01	.770E+00	.757E+00	.956E+00
-200				.946E+00		.163E+01				
-400				.295E+00		.792E+00		.115E+01		.128E+01
-600				.870E-01		.126E+00				
-800				.556E-01		.385E-01		.114E+01		.123E+01
-1000						.219E-01				
-1200								.241E+00		.469E+00
-1600								.617E-01		.212E+00

MAXIMUM CONCENTRATION= .163E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7,8,9 WIND ANGLE = -30. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								.181E-01		.838E-02
1200								.158E-01		.164E-01
1000						.341E-02				
800				.408E-02		.943E-02		.102E+00		.106E+00
600				.363E-01		.226E-01				
400				.670E-01		.228E+00		.259E+00		.232E+00
200				.184E+00		.181E+00				
0	.381E-01	.248E-01	.108E+00	.267E+00	.309E+00	.160E+00	.183E+00	.234E+00	.188E+00	.240E+00
-200				.129E+00		.355E+00				
-400				.988E-01		.237E+00		.273E+00		.202E+00
-600				.117E-01		.430E-02				
-800				.135E-01		.412E-02		.106E+00		.152E+00
-1000						.157E-01				
-1200								.209E-02		.266E-01
-1600								.684E-02		.949E-03

MAXIMUM CONCENTRATION= .355E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7,8,9   WIND ANGLE = -45.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.510E-01		.177E+00
600				0.		.895F-01				
400				.521E-01		.265E+00		.391E+00		.442E+00
200				.385E+00		.419E+00				
0	0.	0.	.194E+00	.795E+00	.908E+00	.823F+00	.300E+00	.550E+00	0.	.733E+00
-200				.594E+00		.983E+00				
-400				.198E+00		.917F+00		.873F+00		.678E+00
-600				0.		.513E+00				
-800				0.		0.		.655F+00		.828E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .983E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = -45.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.791E-01		.106E+00
600				0.		.777E-01				
400				.527E-01		.178E+00		.232E+00		.237E+00
200				.289E+00		.418E+00				
0	0.	0.	.199E+00	.520E+00	.619E+00	.680E+00	.293E+00	.435E+00	0.	.519E+00
-200				.382E+00		.717E+00				
-400				.158E+00		.581E+00		.706E+00		.643E+00
-600				0.		.422E+00				
-800				0.		0.		.622E+00		.734E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .734E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = -45.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.987E-01		.161E+00
600				0.		.210E+00				
400				.180E+00		.394E+00		.505E+00		.562E+00
200				.469E+00		.591E+00				
0	0.	0.	.459E+00	.770E+00	.108E+01	.122E+01	.434E+00	.636E+00	0.	.989E+00
-200				.745E+00		.110E+01				
-400				.265E+00		.776E+00		.754E+00		.101E+01
-600				0.		.377E+00				
-800				0.		0.		.483E+00		.998E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .122E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9 WIND ANGLE = -45. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.742E-01		.110E+00
600				0.		.969E-01				
400				.440E-01		.150E+00		.168E+00		.298E+00
200				.199E+00		.262E+00				
0	0.	0.	.166E+00	.381E+00	.436E+00	.496E+00	.221E+00	.322E+00	0.	.407E+00
-200				.287E+00		.553E+00				
-400				.805E-01		.397E+00		.490E+00		.474E+00
-600				0.		.179E+00				
-800				0.		0.		.207E+00		.365E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .553E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7,8,9   WIND ANGLE = -60.   WIND SPEED (MPH) =30.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.742E-01		.119E+00
600				0.		.137E+00				
400				.130E+00		.338E+00		.218E+00		.394E+00
200				.561E+00		.983E+00				
0	0.	0.	.166E+00	.775E+00	.118E+01	.125E+01	.117E+01	.776E+00	0.	.101E+01
-200				.641E+00		.116E+01				
-400				.244E+00		.693E+00		.959E+00		.101E+01
-600				0.		.302E+00				
-800				0.		0.		.518E+00		.768E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .125E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9 WIND ANGLE = -60. WIND SPEED (MPH) =30.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.214E+00		.294E+00
600				0.		.357E+00				
400				.217E+00		.587E+00		.422E+00		.541E+00
200				.494E+00		.781E+00				
0	0.	0.	.113E+00	.686E+00	.820E+00	.837E+00	.804E+00	.533E+00	0.	.729E+00
-200				.555E+00		.832E+00				
-400				.329E+00		.680E+00		.875E+00		.862E+00
-600				0.		.380E+00				
-800				0.		0.		.706E+00		.902E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .902E+00PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9   WIND ANGLE = -60.   WIND SPEED (MPH) =45.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.131E+00		.181E+00
600				0.		.287E+00				
400				.276E+00		.728E+00		.411E+00		.573E+00
200				.679E+00		.144E+01				
0	0.	0.	.271E+00	.902E+00	.128E+01	.139E+01	.151E+01	.858E+00	0.	.125E+01
-200				.560E+00		.120E+01				
-400				.141E+00		.584E+00		.859E+00		.110E+01
-600				0.		.158E+00				
-800				0.		0.		.125E+00		.436E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .151E+01PPM

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5, 6,7, 8, 9 WIND ANGLE = -60. WIND SPEED (MPH) =45.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.608E-01		.945E-01
600				0.		.122E+00				
400				.138E+00		.367E+00		.181E+00		.268E+00
200				.356E+00		.647E+00				
0	0.	0.	.667E-01	.426E+00	.532E+00	.537E+00	.590E+00	.354E+00	0.	.421E+00
-200				.267E+00		.468E+00				
-400				.467E-01		.217E+00		.375E+00		.454E+00
-600				0.		.845E-01				
-800				0.		0.		.842E-01		.200E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAXIMUM CONCENTRATION= .647E+00PPM

Table 14 Concentration Data at Fumigation Conditions

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

THERMAL, FLOOR TEM=150F, STACK HT=600FT, X=33FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.186E-01		.186E-01
600				0.		.143E-01				
400				.860E-02		.631E-01		.185E+00		.165E+00
200				.143E-02		.153E+00				
0	0.	0.	.158E-01	.287E-02	.430E-02	.112E+00	.285E+00	.470E+00	0.	.455E+00
-200				.143E-01		.115E-01				
-400				0.		0.		.280E+00		.394E+00
-600				0.		.573E-02				
-800				0.		0.		.100E-01		.229E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .470E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

THERMAL, FLOOR TEM =150F, STACK HT=500FT, X=33FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.874E-01		.602E-01
600				0.		.272E-01				
400				.287E-02		.153E+00		.320E+00		.227E+00
200				0.		.426E+00				
0	0.	0.	0.	.186E-01	.702E-01	.433E+00	.743E+00	.798E+00	0.	.664E+00
-200				.115E-01		.211E+00				
-400				.717E-02		.344E-01		.574E+00		.791E+00
-600				0.		.860E-02				
-800				0.		0.		0.		.229E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .798E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

THERMAL, FLOOR TEM=150F, STACK HT=500FT, X=33FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.909E-01		0.
600				0.		.574E-01				
400				.430E-01		.478E-01		.670E-01		.861E-01
200				.478E-02		.813E-01				
0	0.	0.	0.	.670E-01	.191E-01	.574E-01	.430E-01	.182E+00	0.	.177E+00
-200				.670E-01		.861E-01				
-400				0.		.526E-01		.383E-01		.234E+00
-600				0.		.478E-02				
-800				0.		0.		0.		.478E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .234E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

THERMAL, FLOOR TEM=200F, STACK HT=600FT, X=33FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.310E-01		.383E+00
600				0.		.131E-01				
400				.262E-02		.315E-01		.223E+00		.613E+00
200				.787E-02		.129E+00				
0	0.	0.	.525E-02	.839E-02	.178E-01	.140E+00	.369E+00	.504E+00	0.	.591E+00
-200				.525E-02		.651E-01				
-400				.315E-02		.734E-02		.855E-01		.194E+00
-600				0.		0.				
-800				0.		0.		.682E-02		.136E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .613E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

THERMAL, FLOOR TEM=200F, STACK HT=600FT, X=33FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600							0.			0.
1200							0.			0.
1000						0.				
800				0.		0.		.175F-01		.133E+00
600				0.		.140F-01				
400				0.		.612F-01		.699E-01		.143E+00
200				.699F-02		.315F-01				
0	0.	0.	.105F-01	.175F-02	0.	.647F-01	.524E-01	.350F-01	0.	.164E+00
-200				0.		0.				
-400				.874F-02		.175F-01		.122F-01		.149E+00
-600				0.		.175F-02				
-800				0.		0.	0.			.699E-02
-1000						0.				
-1200							0.			0.
-1600							0.			0.

MAX. GROUND LEVEL CONC.= .164F+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

THERMAL, FLOOR TEM=200F, STACK HT=500FT, X=33FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.116E+00		.138E+00
600				0.		.178E-01				
400				.121E-01		.135E+00		.502E+00		.245E+00
200				.157E-01		.501E+00				
0	0.	0.	.105E-01	.997E-02	.146E+00	.633E+00	.838E+00	.727E+00	0.	.361E+00
-200				.472E-02		.163E+00				
-400				.630E-02		.105E-01		.477E-01		.190E+00
-600				0.		.787E-02				
-800				0.		0.		0.		.472E-02
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .838E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

THERMAL, FLOOR TEM=200F, STACK HT=500FT, X=33FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.717E-01		.138E+01
600				0.		.367E-01				
400				.699E-02		.402E-01		.210E+00		.124E+01
200				.365E-01		.822E-01				
0	0.	0.	.297E-01	.472E-01	.402E-01	.101E+00	.175E+00	.327E+00	0.	.950E+00
-200				.210E-01		.192E-01				
-400				.157E-01		.297E-01		.804E-01		.149E+00
-600				0.		.699E-02				
-800				0.		0.		.245E-01		.332E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .138E+01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .154E+10

THERMAL, FLOOR TEM=260F

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.196E+00		.345E+00
600				0.		.128E+00				
400				0.		.168E+01		.141E+01		.223E+00
200				.489E-02		.280E+01				
0	0.	0.	.694E-02	.127E-01	.199E+00	.235E+01	.298E+01	.120E+01	0.	.210E+00
-200				.880E-02		.142E+01				
-400				.489E-02		.657E+00		.121E+01		.241E+00
-600				0.		.195E+00				
-800				0.		0.		.428E+00		.195E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .298E+01

AVON POWER PLANT. CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 9 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .463E+10

THERMAL. FLOOR TEM=260F

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.307E-01		.251E+00
600				0.		0.				
400				.123E-01		0.		.484E+00		.114E+01
200				.613E-02		.123E-01				
0	0.	0.	.307E-01	0.	.215E-01	.245E-01	.457E+00	.214E+01	0.	.270E+01
-200				0.		.153E-01				
-400				.919E-02		.919E-02		.247E+01		.304E+01
-600				0.		0.				
-800				0.		0.		.129E+01		.332E+01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .332E+01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .515E+09

THERMAL, FLOOR TEM=260F

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		0.		.247E-01
600				0.		0.				
400				.441E-02		.176E-02		.362E-01		.388E-01
200				.121E+00		.979E-01				
0	0.	0.	.256E-01	.951E+00	.653E+00	.270E+00	.129E+00	.829E-01	0.	.547E-01
-200				.138E+00		.190E+00				
-400				0.		.106E+00		.617E-01		.662E-01
-600				0.		.300E-01				
-800				0.		0.		.353E-01		.459E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .951E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 8   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .155E+10

THERMAL. FLOOR TEM=260F

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.677E-02		.339E-01
600				0.		.294E-01				
400				.113E-01		.113E-01		0.		.497E-01
200				0.		.154E+00				
0	0.	0.	.135E-01	.334E-01	.495E+00	.553E+00	.501E+00	.364E+00	0.	.156E+00
-200				.316E-01		.524E+00				
-400				0.		.230E+00		.339E+00		.215E+00
-600				0.		.406E-01				
-800				0.		0.		.406E-01		.104E+00
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .553E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .132E+09

THERMAL, FLOOR TEM=260F

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.374E-02		.678E-02
600				0.		.662E-02				
400				.294E-02		.145E-01		.908E-02		.967E-02
200				.315E-02		.211E-01				
0	0.	0.	.486E-02	.177E-01	.351E-01	.336E-01	.266E-01	.203E-01	0.	.133E-01
-200				.153E-01		.203E-01				
-400				.224E-02		.138E-01		.121E-01		.175E-01
-600				0.		.454E-02				
-800				0.		0.		.556E-02		.119E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .351E-01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 1-5   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .396E+09

THERMAL, FLOOR TEM=260 F

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.606E-02		.130E-01
600				0.		.800E-02				
400				.183E-02		.274E-01		.141E-01		.185E-01
200				.343E-02		.594E-01				
0	0.	0.	.194E-02	.174E-01	.389E-01	.716E-01	.807E-01	.584E-01	0.	.433E-01
-200				.491E-02		.619E-01				
-400				.240E-02		.337E-01		.323E-01		.495E-01
-600				0.		.111E-01				
-800				0.		0.		.101E-01		.329E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .807E-01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY. CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

THERMAL, FLOOR TEM=260F, STACK HT=600FT, X=0FT, Y=266FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.110E-01		.178E-01
600				0.		.777E-01				
400				.577E-02		.326E+00		.198E+00		.289E-01
200				.262E-02		.976E+00				
0	0.	0.	.734E-02	.420E-02	.134E+00	.119E+01	.892E+00	.478E+00	0.	.997E-01
-200				0.		.276E+00				
-400				.525E-03		0.		.252E-01		.357E-01
-600				0.		.525E-03				
-800				0.		0.		0.		.210E-02
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .119E+01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

THERMAL, FLOOR TEM=260F, STACK HT=600FT, X=0FT, Y=266FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.559E-01		.922E+00
600				0.		0.				
400				.140E-01		.787E-01		.210E+00		.102E+01
200				.280E-01		.247E-01				
0	0.	0.	.227E-01	.192E-01	.385E-01	.315E-01	.278E+00	.430E+00	0.	.822E+00
-200				.192E-01		.315E-01				
-400				.105E-01		.132E-01		.350E-01		.944E-01
-600				0.		.262E-01				
-800				0.		0.		0.		.350E-02
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .102E+01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = 0.   WIND SPEED (MPH) =30.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

THERMAL, FLOOR TEM=260F, STACK HT=600FT, X=0, Y=133FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.184E-01		.493E-01
600				0.		.136E-01				
400				.142E-01		.110E-01		.163E+00		.300E+00
200				.892E-02		.598E-01				
0	0.	0.	.126E-01	.944E-02	.310E-01	.124E+00	.316E+00	.500E+00	0.	.485E+00
-200				.147E-01		.170E+00				
-400				.472E-02		.609E-01		.269E+00		.413E+00
-600				0.		.944E-02				
-800				0.		0.		.152E-01		.163E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .500E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = 0. WIND SPEED (MPH) =30.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

THERMAL, FLOOR TEM=260F, STACK HT=600 FT, X=0FT, Y=133FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.577E-01		.699E-01
600				0.		.629E-01				
400				.857E-01		.437E-01		.119E+00		.213E+00
200				.594E-01		.927E-01				
0	0.	0.	.769E-01	.629E-01	.629E-01	.979E-01	.110E+00	.187E+00	0.	.299E+00
-200				.507E-01		.979E-01				
-400				.639E-01		.101E+00		.131E+00		.262E+00
-600				0.		.472E-01				
-800				0.		0.		.822E-01		.699E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .299E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY,   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = 0.   WIND SPEED (MPH) =15.0   LOAD = 1/3   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

THERMAL, FLOOR TEM=260F, STACK HT=500 FT, X=133FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.414E-01		.320E-01
600				0.		.199E+00				
400				.315E-02		.517E+00		.122E+00		.472E-01
200				.767E-02		.833E+00				
0	0.	0.	.839E-02	.116E+00	.674E+00	.118E+01	.488E+00	.191E+00	0.	.645E-01
-200				.131E-01		.543E+00				
-400				.262E-02		.734E-02		.205E-01		.299E-01
-600				0.		.472E-02				
-800				0.		0.		.367E-02		.283E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .118E+01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = 0. WIND SPEED (MPH) =15.0 LOAD = FULL PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .189E+10

THERMAL, FLOOR TEM.=260F, STACK HT=500FT, X=133FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.559E-01		.436E+00
600				0.		.315E-01				
400				.472E-01		.752E-01		.577E+00		.710E+00
200				.262E-01		.150E+00				
0	0.	0.	.175E-01	.175E-01	.315E-01	.131E+00	.516E+00	.735E+00	0.	.735E+00
-200				.210E-01		.559E-01				
-400				.262E-01		.385E-01		.175E-01		.185E+00
-600				0.		.140E-01				
-800				0.		0.		.105E-01		.332E-01
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .735E+00

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY, CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7 WIND ANGLE = -30. WIND SPEED (MPH) =15.0 LOAD = 1/3 PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .630E+09

THERMAL, FLOOR TEM=260F, STACK HT=500FT, X=133FT, Y=400FT.

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.771E-01		.383E-01
600				0.		.317E+00				
400				.357E-01		.129E+01		.223E+00		.708E-01
200				.304E-01		.134E+01				
0	0.	0.	.472E-02	.525E-03	.420E-02	.294E-01	.582E-01	.409E-01	0.	.420E-01
-200				.105E-02		0.				
-400				.105E-02		.420E-02		0.		.147E-01
-600				0.		.367E-02				
-800				0.		0.		0.		.525E-03
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .134E+01

AVON POWER PLANT, CLEVELAND ILLUMINATING COMPANY.   CONCENTRATION = PARTS PER MILLION

UNIT NUMBER = 6-7   WIND ANGLE = -30.   WIND SPEED (MPH) =15.0   LOAD = FULL   PRECIPITATOR POSITION =DOWN

SOURCE STRENGTH (MICRO GRAMS/SEC) = .199E+10

THERMAL, FLOOR TEM=260F, STACK HT=500FT, X=133FT, Y=400FT

Y \ X =	250	500	1000	2000	3000	4000	5000	6000	7000	8000
1600								0.		0.
1200								0.		0.
1000						0.				
800				0.		0.		.280E+01		.796E+00
600				0.		.297E-01				
400				.874E-02		.874E-01		.267E+01		.980E+00
200				.524E-02		.128E+00				
0	0.	0.	.227E-01	.524E-02	.874E-02	.332E-01	.822E-01	.341E+00	0.	.621E+00
-200				.157E-01		.350E-02				
-400				.192E-01		0.		.874E-02		.874E-02
-600				0.		0.				
-800				0.		0.		0.		.175E-02
-1000						0.				
-1200								0.		0.
-1600								0.		0.

MAX. GROUND LEVEL CONC.= .280E+01