SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2

1984
ANNUAL ENVIRONMENTAL OPERATING REPORT (NONRADIOLOGICAL)

FACILITY OPERATING LICENSE NO. NPF-14 & NPF-22
DOCKET NOS. 50-387 & 50-388

prepared by
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FOREWORD

The Susquehanna Steam Electric Station (Susquehanna SES) consists of two boiling water reactors, each with a net electrical generating capacity of 1,050 megawatts. The site of approximately 1,300 acres is located in Salem Township, Luzerne County, Pennsylvania, approximately five miles northeast of Berwick, Pa. Under terms of an agreement finalized in January, 1978, 90% of the Susquehanna SES is owned by the Pennsylvania Power and Light Company (Licensee) and 10% by Allegheny Electric Cooperative, Inc.

The 1984 Annual Environmental Operating Report (nonradiological) for Units 1 and 2 describes the programs necessary to meet requirements of Section 2F of the Operating License, Protection of the Environment, and Appendix B, Environmental Protection Plan, as well as requirements of the Final Environmental Statement related to operation (NUREG-0564), June, 1981. Also, the Operating License, Appendix A, Technical Specifications requires an Annual Radiological Environmental Operating Report.

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1.0 OBJECTIVES

The Licensee submitted an Environmental Report--Operating License Stage for the Susquehanna SES to the U.S. Nuclear Regulatory Commission (NRC) in May, 1978. This report reviewed the results of the preoperational impacts of construction, preoperational and proposed operational environmental monitoring programs. The NRC and other agencies reviewed this report and made recommendations for operational environmental monitoring programs which were listed in the Final Environmental Statement (FES) related to the operation of the Susquehanna SES, Units 1 and 2, NUREG-0564, June, 1981. In addition, the Licensee has developed procedures and guidelines to assure that operation of the Susquehanna SES does not adversely affect the environment in the vicinity of the station.

The Licensee has developed procedures for environmental responsibilities and interfaces necessary in monitoring environmental impacts. This includes coordination of NRC requirements and consistency with other federal, state and local requirements for environmental protection. To keep the NRC informed of other agency activities, the NRC is being provided copies of environmental correspondence. In addition, this 1984 Annual Environmental Operating Report provides a summary of both operational environmental programs and procedures as required in the FES and Appendix B, Environmental Protection Plan (EPP) of the Operating License, No. NPF-14 (Ref. 1.1-1) and NPF-22 (Ref. 1.1-2).

This 1984 report is the third Annual Environmental Operating Report submitted to meet EPP requirements. The 1983 report was submitted to the NRC in April, 1984 (Ref. 1.1-3).

REFERENCES

1.1-1 Facility Operating License No. NPF-14, Susquehanna Steam Electric Station, Unit 1, Appendix B, Environmental Protection Plan (Non-Radiological), July 17, 1982.

1.1-2 Facility Operating License No. NPF-22, Susquehanna Steam Electric Station, Unit 2, Appendix B, Environmental Protection Plan (Non-Radiological), March 23, 1984.

1.1-3 Susquehanna Steam Electric Station, Unit 1, 1983 Annual Environmental Operating Report (nonradiological), Pennsylvania Power and Light Co., Allentown, PA, April, 1984.

2.0 ENVIRONMENTAL ISSUES

2.1 AQUATIC ISSUES

The aquatic monitoring program for the operation of the Susquehanna SES is divided into two phases. Phase 1 includes effluent monitoring required by two National Pollutant Discharge Elimination System (NPDES) permits issued by the Pennsylvania Department of Environmental Resources (PA DER). Monthly discharge monitoring reports are submitted to the PA DER as part of the permitting requirements. The two permits are the Sewage Treatment Plant NPDES permit No. PA0027448, dated September 14, 1982, and the station operational NPDES permit No. PA0047325 dated July 31, 1979. These two permits were combined into one permit in early 1985. Phase 2 of the aquatic monitoring program deals with programs listed in the FES involving aquatic environmental biological monitoring.

The PA DER, in Phase 1, is responsible for issuing water quality permits for the Susquehanna SES. The NPDES permit No. PA0027448 deals with discharge parameters for the Susquehanna SES sewage treatment plant. These parameters include the following:

Flow
Biochemical oxygen demand (BOD-5)
Total suspended solids
Fecal coliforms
pH
Chlorine residual (Free available chlorine)
Percentage removal of total suspended solids
Percentage removal of BOD-5

The second NPDES permit No. PA0047325 deals with operational discharges from the station. This includes the cooling tower blowdown to the Susquehanna River and also various sumps and drains that discharge through storm sewers into Lake Took-a-while, the recreation pond, and finally into the River. Parameters monitored for this permit include the following:

Free available chlorine
Total suspended solids
Total iron
Oil and grease
Flow
pH

Part C of this permit includes additional parameters to be monitored such as 316(b) impingement and entrainment and chlorination of the cooling water system. The impingement and entrainment requirements were completed in 1982.

Phase 2 of aquatic monitoring programs required by the NRC in the operating license and FES for the Susquehanna SES includes monitoring algae and benthic macroinvertebrates, both above the intake and below the discharge. This information is summarized in Section 4.2.5 of this report.

An impingement study for American Shad was undertaken in 1984 in response to a request by the U.S. Fish and Wildlife Commission. This study meets requirements of Section 5.3.4, Aquatic Monitoring of the Final Environmental Statement (Ref. 2.1-1). The Susquehanna River Anadromous Fish Restoration Committee of which the Licensee is a member, reintroduced American Shad to the Susquehanna River during 1984.

Prespawned adults were collected from the Hudson and Connecticut Rivers in May, 1984, and approximately 4,700 were transported to the upper Susquehanna River (Ref. 2.1-2). Between August 22 and October 14, the Licensees' biological consultant Ichthyological Associates, Inc., monitored fish impingement on the station intake screens. No juvenile shad were collected on the screens during 1984 (Exhibit 1).

2.2 TERRESTRIAL ISSUES

2.2.1 MONITORING BIRD IMPACTION ON COOLING TOWERS

Systematic searches were conducted by Ichthyological Associates for impacted birds at the Unit 1 and 2 cooling towers of the Susquehanna SES in 1984 during spring and autumn migrations. A total of 24 birds of at least 11 species was collected; 11 birds were found in the spring and 13 in the autumn. Almost all impacted birds were small passerines known to be nocturnal migrants. Typically, spring impactions were associated with the passage of warm fronts and autumn impactions with the passage of cold fronts. Almost all impactions occurred when at least one of the cooling towers was operational. Fewer impacted birds were collected in 1984 than in previous years, but it is uncertain if this was due to operation of the cooling towers or other factors.

2.2.2 OPERATIONAL SOUND LEVEL SURVEY

An environmental sound survey was conducted in September, 1984, by Bolt, Beranek and Newman. Both daytime and nighttime measurements were taken in the vicinity of the Susquehanna SES. Exhibit 2, Sound Level Measurements Near Susquehanna SES, Operation 1984, discusses the program and gives results. In addition, Section 4.2.3, Sound Level Survey lists sound survey parameters.

2.2.3 MAINTENANCE OF TRANSMISSION LINE CORRIDORS

The maintenance program for transmission line corridors for the Susquehanna SES is discussed in detail in Subsection 4.2.2 of this report. During 1984, there was maintenance of transmission line corridors by manual clearing. There was no selective herbicide application in 1984. The terrestrial monitoring program for the Susquehanna transmission lines was initiated in response to requirements in Section 5.3.5 of the FES. The three transmission lines associated with the Susquehanna SES are the Stanton-Susquehanna No. 2 500 kV Line, Sunbury-Susquehanna No. 2 500 kV Line and the Susquehanna-Wescosville 500 kV Line. Originally, the Susquehanna-Wescosville 500 kV Line was called the Susquehanna-Siegfried Line. These lines may be operated at either 230 kV or 500 kV.

After their construction, areas around the transmission structures and along access roads were seeded and regraded to prevent soil erosion. The schedule

for conducting periodic erosion control inspections of these lines and access roads is based on the age of the line. During the first five years, helicopter patrols will be conducted three times a year. Thereafter, foot-patrols will be conducted every two years and overhead patrols conducted every five years. The dates of patrols and the information collected are logged and recorded by the Licensee, which is responsible for this activity. An audit of the transmission lines in 1984 indicated that there was some erosion along the Stanton-Susquehanna No. 2 500 kV line at a former generating station ash basin. This area will be stabilized in 1985.

2.3 CULTURAL RESOURCES ISSUES

In accordance with Title 36, Code of Federal Regulations, Part 800, Protection of Historic and Cultural Properties, the Licensee has taken efforts to mitigate any impacts from either plant construction or operation to sites eligible for inclusion to the National Register of Historic Places. A mitigation plan for the four sites (Site SES-3, Site SES-6, Site SES-8, and Site SES-11) was completed in 1983 (Ref. 1.1-3).

REFERENCES

2.1-1 Final Environmental Statement related to the operation of Susquehanna Steam Electric Station, Units 1 and 2, Docket Nos. 50-387 and 50-388, Pennsylvania Power and Light Co. and Allegheny Electric Cooperative, Inc., U.S. Nuclear Regulatory Commission, June, 1981.

2.1-2 Restoration of American Shad to the Susquehanna River, Annual Progress Report - 1984, Susquehanna River Anadromous Fish Restoration Committee, January, 1985.

3.0 CONSISTENCY REQUIREMENTS

3.1 PLANT DESIGN AND OPERATION

In accordance with the EPP, the Licensee has prepared and recorded an environmental evaluation of any proposed change in plant design or operation or performance of any test or experiment which may significantly affect the environment. Activities which do not affect the environment are not included in this environmental report.

Activities which concern (1) a significant increase in any adverse environmental impact previously evaluated by the NRC or Atomic Safety & Licensing Board, (2) a significant change in effluents or power level or (3) a matter not previously evaluated which may have a significant adverse environmental impact, shall be deemed to involve an unreviewed environmental question. For such activities, the Licensee shall provide a written evaluation of the activity and obtain prior approval from the Director, Office of Nuclear Reactor Regulation.

The Licensee has developed a Nuclear Department Instruction procedure to evaluate unreviewed environmental questions. If it is determined that a particular action will meet any of the three NRC criteria for an unreviewed environmental question, the NRC will be notified. If the change, test or experiment does not meet any of these criteria, the Licensee will provide an environmental approval to the group requesting the action.

During the operation of the Susquehanna SES in 1984, there were five actions that the Licensee reviewed as part of its unreviewed environmental questions program. These five actions were as follows:

1. New Diesel Generator Building Construction and Waste Site 1 (Construction).
2. Dye Study of the Susquehanna River.
3. Demolition of Houses at the Susquehanna SES.
4. Waste Disposal Sites 2 and 3 (Construction).
5. Vegetation Management Specification (Update).

These activities were determined not to be an unreviewed environmental question since there was not a significant environmental impact associated with them.

Records of environmental evaluations are maintained by the Licensee in the Susquehanna Records Management System. These records include brief descriptions, analyses, interpretations, and evaluations of the changes, tests and experiments.

3.2 REPORTING RELATED TO NPDES PERMITS & STATE CERTIFICATIONS

Violations of NPDES Permits have been reported to the NRC by submittal of reports required by the NPDES Permits. It should be noted that Pennsylvania is a NPDES Permitting agreement State with the U.S. Environmental Protection Agency, and State Certification pursuant to Section 401 of the Clean Water Act is not required. All changes to the operational NPDES Permit No. PA0047325 or application for renewals have been submitted to the NRC within the required 30-day period.

3.3 CHANGES REQUIRED FOR COMPLIANCE WITH OTHER ENVIRONMENTAL REGULATIONS

During 1984, the only change in plant design or operation and performance tests or experiments was approval to construct and/or operate air contamination sources or air cleaning devices. The Pennsylvania Department of Environmental Resources approved the following permits:

- Operating Permit - Permit No. 40-311-012, Concrete Batch Plant, issued June 13, 1984, expires August 31, 1989.
- Operating Permit - Permit No. 40-306-005, Four Diesel Generators, issued June 13, 1984, expires August 31, 1989.

4.0 ENVIRONMENTAL CONDITIONS

4.1 UNUSUAL OR IMPORTANT ENVIRONMENTAL EVENTS

During 1984, there were no unusual or important events that resulted in significant environmental impacts from Susquehanna SES operation.

4.2 ENVIRONMENTAL MONITORING

4.2.1 GENERAL MONITORING PROGRAM FOR BIRD IMPACTION

Preoperational studies of bird impaction were conducted during spring and autumn migrations at the Unit 1 cooling tower since autumn 1978 and at the Unit 2 cooling tower since spring 1981. These studies (Refs. 4.2-1 through 4.2-5) provided data on bird mortality during tower construction. Operational studies were begun in the autumn of 1982 and continued in 1983 (Refs. 4.2-5 and 4.2-6). The basic objective of the operational studies is to monitor and to evaluate bird impaction mortality during operation of the cooling towers.

Collections of impacted birds were made at the Unit 1 and 2 cooling towers during 1984 spring and autumn migrations. Each hyperbolic natural draft tower is 165 m tall with diameters at the base, throat, and top of 128 m, 86 m, and 92 m, respectively. Both towers are illuminated with five, 480-volt aircraft warning strobe lights on the top and seven, 480-volt high-intensity mercury vapor lamps around the lintel, about 12 m above ground level. The strobe lights were installed immediately upon completion of each tower. The towers are about 100 m apart and aligned south to north with Unit 1 the more northerly (Fig. 4.2-1). They are located approximately 1,400 m west of the Susquehanna River and 650 m south of a ridge which extends east and west along the site boundary. The top of the Unit 1 tower is 381 m above mean sea level, 6 m higher than the Unit 2 tower (375 m). Within 1 km of the towers, ground elevations vary from 160 m above mean sea level near the river to 326 m on the ridge. Both towers exceed the highest point on the ridge by at least 49 m. Systematic searches for impacted birds were usually begun prior to 0900 h on weekdays, excluding holidays, from March 19 through June 8 and from August 20 through November 9. Each search included the tower base, cold water outlet, basin interior, and an area extending at least 10 m out from the base. Impacted birds were tagged to record date and point of discovery. Floating specimens were collected with a dip net and those impinged on the trash screens were removed with a rake. Birds were usually identified in the laboratory with the aid of keys detailed in Reference 4.2-6. Bird nomenclature follows the revised American Ornithologists' Union Checklist (Ref. 4.2-7). Impacted species were checked against the federal List of Endangered and Threatened Wildlife and Plants (Ref. 4.2-8) and the Pennsylvania Game Commission Wildlife Classification (Ref. 4.2-9).

An attempt was made to collect all impacted birds during each search; however, some specimens recovered from the turbulent, discolored water in the cooling tower basins were impacted one or more days before collection. All data were, therefore, tabulated in 5-day groups to reduce day-to-day carryover of impacted birds.

Weather conditions were noted daily at the Susquehanna SES site. These notes were augmented with data recorded at the Biological Laboratory, at the Susquehanna SES Meteorological Tower, at Avoca, Pennsylvania by the National Oceanic and Atmospheric Administration (Ref. 4.2-10), and at locations in eastern Pennsylvania by Weather Services Corporation. Barometric pressure was monitored constantly at the Biological Laboratory with a Taylor Weather-Hawk Stormscope Barometer adjusted to equivalent sea level pressure.

In 1984, 24 birds of at least 11 species were collected during systematic searches for impacted birds at Unit 1 and 2 cooling towers of the Susquehanna SES. Since September 1, 1978, 1,431 birds of at least 63 species (Table 4.2-1) have been collected at the towers. During spring migration in 1984, 11 birds of eight species were collected from March 19 through June 8 (Table 4.2-2); one specimen was found at the Unit 1 tower and 10 specimens at the Unit 2 tower. During autumn migration, 13 birds of at least 7 species were collected from August 20 through November 9 (Table 4.2-3); nine specimens were found at the Unit 1 tower and four specimens at the Unit 2 tower. In addition to these birds, three bats were collected. A big brown bat (Eptesicus fuscus) and a little brown myotis (Myotis lucifugus) were found at the Unit 2 tower in the spring and a little brown myotis was found in the autumn at the Unit 1 tower (Ref. 4.2-11 and 4.2-12).

Almost all bird species were small passerines known to be nocturnal migrants (Ref. 4.2-13). Most of these birds migrate long distances to wintering grounds in the American tropics. The three most commonly collected species were the red-eyed vireo (5), the Blackburnian warbler (4), and the common yellowthroat (4). Together they composed 54% of the birds collected. A Cooper's hawk, a Pennsylvania "species of concern" (Ref. 4.2-9) was found on April 4, 1984, in the water of the Unit 2 cooling tower basin adjacent to an impacted rock dove (pigeon). Both birds had large cranial bruises with crown feathers missing indicating that they probably impacted head-on into the tower during a high-speed pursuit of the pigeon by the Cooper's hawk. No federally listed threatened or endangered species were collected in 1984, nor have any been found since the study began in 1978.

The total number of spring impactions was less in 1984 than in any previous year (Fig. 4.2-2). No more than three birds were collected on any morning and no more than three specimens were found of any species. Most spring impactions were associated with warm fronts entering Pennsylvania from the west or south. In spring, the northern movement of birds often follows a warm front when warm moist air flows from the Gulf of Mexico and the Caribbean accompanied by a falling barometer (Ref. 4.2-14). All spring impactions occurred when only the Unit 1 tower was operating with a visible plume.

Fewer birds impacted on the cooling towers in the autumn of 1984 than in any previous year (Fig. 4.2-2). No more than four specimens were collected on any of the nine days birds were found. This contrasts markedly with the large daily collections of 79 and 81 birds made in 1981 (Ref. 4.2-4) or 26 and 34 birds in 1982 (Ref. 4.2-4). But similar to past years, most autumn impactions were associated with the passage of cold fronts moving through Pennsylvania from the northwest. South-bound migration is heaviest in this region during cold front movement (Ref. 4.2.-14). All but one of the autumn impactions at the Unit 1 tower occurred when the tower was functional, but three of the four

impactions at the Unit 2 tower apparently occurred when it was not creating a plume.

The low numbers of bird impactions in the autumns of 1983 and 1984 occurred when at least one of the towers was operating throughout most of the migration season. At least three factors associated with operation may warn approaching birds of the towers: 1) visible plume, 2) air turbulence, and 3) noise. The plume can be several hundred meters in length and is well-illuminated by aircraft warning lights which make it visible at the high altitudes where migrant birds usually fly. Wind currents and the resulting air turbulence caused by the operation of a natural draft tower probably make flight difficult for lightweight birds and may discourage them from flying too close. Generally, noise levels near an operating medium or large cooling tower range from 80 to 90 dBA and are caused principally by the resonance of air drafts and waterfalls in the tower (Ref. 4.2-15). This broad-band low-frequency noise is within the hearing range of most birds (Ref. 4.2-13) and may alert them to the presence of the towers.

The cooling tower lights may attract night-flying birds to the towers, but apparently not from great distances. Night-flying birds are sometimes attracted to, then blinded by, bright lights, accounting for impactions on tall buildings (Ref. 4.2-14). When cloud ceiling is low and birds tend to fly below the clouds at low altitudes, nocturnal migrants are confused by tower lights (Ref. 4.2-16). However, it seems that the direction of movement by nocturnally migrant birds flying at higher altitudes is not overtly affected by nuclear power plant lights and the birds are not drawn to operating towers from great distances (Ref. 4.2-17).

Although at this point, it might be concluded that operation of the cooling towers deters bird impaction; the number of impactions recorded during the preoperational phase showed high variability, and operational phase data may eventually demonstrate a similar pattern. Furthermore, this variability may be caused by factors not associated with tower operation. For example, fewer bird impactions may have occurred in the autumns of 1983 and 1984 because of the lack of strong cold fronts normally associated with waves of nocturnal migrants. Limited additional data collection is planned, particularly when both towers are commercially operational before any conclusions are made about the effect of tower operation on bird mortality.

4.2.2 MAINTENANCE OF TRANSMISSION LINE CORRIDORS

4.2.2.1 HERBICIDES USED

All herbicides utilized to control incompatible vegetation within the transmission line corridors from Susquehanna SES conform to approved uses as registered by the Environmental Protection Agency. In addition, major manufacturers or formulators all have had these products registered for distribution by the Commonwealth of Pennsylvania under the authority of the Pennsylvania Pesticide Control Act of 1973.

The following is a list of the approved herbicides specified for use in the Licensee's programs. All are applied within the instructions designated on the label.

Commercial Name	Active Ingredient(s)	EPA Registration Number
Krenite	Fosamine	352-376
Krenite S	Fosamine	352-395
Tordon 101	2,4-D Picloram	464-306
Garlon 3A	Triclopyr	464-546
Garlon 4	Triclopyr	464-554

Additional herbicides may be added to this list in the future depending on new technology and/or other advancements in the state of the art. All herbicides will have an approved EPA registration number.

4.2.2.2 RECORDS

Records are maintained for a period of at least 5 years in the appropriate Division Offices of the Licensee. These include the following:

1. Copies of labels of specified herbicides which designate commercial names, active ingredients, rates of application, warnings, storage and handling.

2. Concentrations of active ingredient formulations diluted for field use.

3. Diluting substances (carriers).

4. Rates of application.

5. Methods of application.

6. Locations and dates of application.

4.2.2.3 TYPES OF MAINTENANCE REPORTED

A. Selective Herbicide Applications

There was no heribicide application for vegetation control along the transmission corridors in 1984.

B. Vegetation Maintenance by Manual Methods

Table 4.2-4, Sheets 1-7, summarizes vegetation maintenance activities other than the utilization of herbicides. The four types of manual methods used in 1984 are as follows:

1. Selective Reclearing - utilized to manually cut incompatible vegetation, where herbicide applications are restricted.

2. Danger Tree Removals - cutting those trees outside of the cleared right-of-way which are of such a height and position that they create a potentially hazardous condition which could interrupt the line.

3. Side-Trimming - trimming of trees on the edge of the right-of-way which through yearly growth encroach on the line conductors.

4. Screen Trimming - trimming of trees left intentionally on the right-of-way for aesthetic purposes or otherwise to maintain safe clearances to the line conductors.

4.2.3 SOUND LEVEL SURVEY

An environmental sound survey was conducted in September, 1984. Sound Level Measurements Near Susquehanna SES Operation 1984, Exhibit 2 was prepared by Bolt, Beranek & Newman. It includes the following information:

1. Existing on-site and nearby off-site sources and barriers,

2. Noise sensitive land uses in site vicinity,

3. Daytime and nighttime measurements,

4. Equipment selection and dates of calibration,

5. Background and intrusion sound levels measured,

6. Description of pure tones included in this 1984 survey.

4.2.4 CULTURAL RESOURCES

The Licensee submitted a mitigation plan for four historic sites (Site SES-3, Site SES-6, Site SES-8 and SES-11) in the 1983 Annual Environmental Operating Report (Ref. 1.1-3). This plan was approved by the Pennsylvania State Historic Preservation Offices and, therefore, this EPP requirement has been completed.

4.2.5 AQUATIC PROGRAMS

4.2.5.1 ALGAE

The basic objective in 1984, as it has been since February 1977, was to describe seasonal changes in the periphyton and phytoplankton communities at two sites (Fig. 4.2-1) near the Susquehanna SES (data collected prior to September 1, 1982 are considered "preoperational" and data since that date are "operational"). One sampling site (SSES) was 460 m upriver from the Susquehanna SES intake structure and 135 m from the west bank; the other site (Bell Bend) was 400 m downriver from the discharge diffuser and 30 m from the west bank.

Periphyton substrates consisted of 8 sandblasted plates of clear acrylic (22 x 30 cm) in "detritus-free" holders similar to those of Gale et al. (Ref. 4.2-18). Two holders with four plates each were placed on the river bottom at each site near the main channel, where water depth ranged at SSES in 1984 from 1.9 to 8.9 m. From April through October 1984, two plates were sampled bimonthly at each site. Each plate was exposed to colonization for 12 months. Three replicate samples were taken from each plate by a scuba diver using a bar-clamp sampler (Ref. 4.2-19). Sampled plates were replaced with clean plates to be sampled later. The schedule for plate removal was a continuation of a plan established in 1977 by random selection.

The 415 mm^2 area of the plate delimited by each bar-clamp sampler was cleaned by scraping and vibration (Ref. 4.2-19) with an ultrasonic dental cleaning probe for 10 minutes. Dislodged cells were carried to a collection jar by water sprayed inside the collecting cup through the cleaning probe. As a result, loosened cells were not subjected to unnecessary vibration. Vibration may have destroyed some cells, but Gale (Ref. 4.2-19) reported that more cells per unit area were obtained by scraping and vibration than by scraping and brushing. Samples (250 ml) were preserved with formalin and, after settling 10 days, were concentrated to 50 ml by siphoning. One half of the concentrate was sent to Dr. Rex L. Lowe, Department of Biology, Bowling Green State University, Bowling Green, Ohio, for identification and enumeration of algae. The other half of the concentrate was placed in our reference collection to be retained for at least 12 months.

A 1-liter phytoplankton sample was collected near the river surface at each periphyton sampling site on the same days that periphyton samples were collected. After the samples were preserved and allowed to settle for 10 days, the algae in them was concentrated in a similar manner to that used for periphyton samples. The main difference in procedures was that phytoplankton samples, because of their greater initial volume, were siphoned three times instead of once (10 days settling time was allowed between each siphoning).

Algal cells in periphyton and phytoplankton samples that contained chloroplasts were enumerated as "units" (Ref. 4.2-20). In most instances, at least 1,500 units were enumerated and identified in each sample (about 500 per each of 3 subsamples). Extremely low algal densities in some subsamples made it impractical to count 500 units, and fewer were counted. Counts were made using a microscope (430X) and a Palmer counting cell. Higher magnification, including electron microscopy, was used for some identifications. Algae were identified by Dr. Lowe to genus and the more abundant forms to species using keys by Hustedt (Ref. 4.2-21) and Prescott (Ref. 4.2-22).

In 1984, a total of 42 genera of algae was collected in 24 samples from acrylic plates upstream from the intake (SSES); 44 genera were found in 24 samples taken downstream from the discharge (Bell Bend). Thirty-six of the genera were found at both sites. None of the 14 genera that occurred at only one site composed more than 1% of the total units counted in any replicate. These data are summarized in Tables 4.2-5 and 4.2-6.

At SSES and Bell Bend, 30 species of periphytic algae were identified that composed 5% or more of the total units counted in at least one replicate

sample (Table 4.2-7). For the third consecutive year, green algae (Chlorophyta) was less abundant than it was in 1981 (Fig. 4.2-3), and it was relatively less abundant in 1984 (14% of the total standing crop) than it was in 1983, when it composed 50% of the total. The mean standing crop of green algae decreased from 1,400 units/mm^2 in 1981 to 600 units/mm^2 in 1982 and remained at the same level in 1983. In 1984, there were only 100 units/mm^2. One of the main causes of the high standing crop of green algae in 1981 was due to an unexpected abundance (55% of the total) of Oocystis spp. (primarily O. parva), a species that usually occurs in lakes (Ref. 4.2-22). From 1977 through 1980, O. parva composed less than 1% of the total standing crop annually. In 1982, Oocystis spp. remained the most abundant green alga, but composed just 16% of the total algae found. In 1984, as in 1983, the genus once again composed less than 1% of the total standing crop. The most abundant species of green algae were Scenedesmus spp. (mostly S. quadricauda) and Ankistrodesmus spp. (mostly A. falcatus), which composed 7% and 2% of the total standing crop at the two sites combined, respectively.

The mean standing crop of diatoms (Bacillariophyta) fluctuated again in 1984 as it has throughout the study. In 1981, for example, the standing crop was 800 units/mm^2; it increased slightly to 900 units/mm^2 in 1982 and then decreased to 500 units/mm^2 in 1983. In 1984, diatom density increased to 600 units/mm^2. Diatoms were relatively more abundant at SSES in 1984 (86% of the total) than at Bell Bend (76% of the total). Overall, diatoms composed 82% of the total periphyton at the two sites. In 1981, diatoms composed 37% of the total algae collected (Ref. 4.2-23); in 1982, they composed 58% (Ref. 4.2-24), and in 1983, 42% (Ref. 4.2-25). The most abundant forms included Cyclotella spp. and Navicula spp., which each composed 29% and 23% of the total standing crop at the two sites, respectively. Cyclotella spp. was much more abundant at SSES (44%) than at Bell Bend (6%). Navicula spp., on the other hand, was much more abundant at Bell Bend (42%) than at SSES (11%).

Numbers of blue-green algae (Cyanophyta) decreased from 9% of the total standing crop in 1983 to 4% in 1984. In 1981 and 1982, blue-greens composed less than 1% of the total. Schizothrix calcicola was the most abundant species in 1984 (Table 4.2-7).

Most of the algae found were "clean water" forms and only seven of the 30 abundant species in the samples were among the top 20 species listed by Palmer (Ref. 4.2-26) as being most tolerant of heavy organic pollution. These were Nitzschia palea, N. acicularis, Scenedesmus quadricauda, Ankistrodesmus falcatus, Melosira varians, Navicula cryptocephala, and Gomphonema parvulum. Nearly one-half of the 25 species of abundant diatoms (Table 4.2-7) were rated as "alkaliphilous" by Lowe (Ref. 4.2-27); one was acidophilous, five were rated "indifferent," and eight were "unknown."

In 1982, periphyton abundance on acrylic plates was about equal at Bell Bend and SSES, with an average of 1,500 units/mm^2. In 1983, much more periphyton occurred at Bell Bend (1,700 units/mm^2) than at SSES (600 units/mm^2). In 1984, periphyton density was higher at SSES (1,000 units/mm^2) than at Bell Bend (600 units/mm^2). Density peaked at SSES in October at 3,700 units/mm^2. The largest differences in standing crop occurred in October when there was over 2-fold more algae at SSES than at Bell Bend. Such large differences are not unusual and have occurred many times since the study began (Fig. 4.2-3).

Overall, the mean density of periphyton at SSES and Bell Bend in 1984 (800 units/mm^2) decreased from the 1,100 units/mm^2 found in 1983 (Fig. 4.2-3); the 1984 mean was the lowest recorded since the study began in 1977. The results of the 1984 sampling program do not indicate any impact upon the periphyton community resulting from operation of the Susquehanna SES; the decrease in abundance of periphyton at both sites was probably due to unusually high turbidities resulting from construction on the watershed in New York. High turbidity can affect the periphyton community by shading (i.e., reduction of cell growth and lowered reproduction) and by providing a silty, less stable substrate for colonization (Ref. 4.2-28). In previous years (Ref. 4.2-29), it was observed that periods of high river discharge, prior to sampling, washed away much of the periphyton which had colonized soft, silty sediments on river stones.

Phytoplankton in samples collected at SSES in 1984 was nearly identical to that in samples taken at Bell Bend, as it has been in previous years (Fig. 4.2-4). There was a total of 41 genera of algae in 4 samples at SSES and 43 genera in 4 samples from Bell Bend (Tables 4.2-8 and 4.2-9). Thirty-four genera were found at both sites. None of the 16 genera that occurred at only one site composed more than 1% of the total units counted.

In 1984, as in 1983, green algae was the major component of the phytoplankton composing 65% of the total standing crop. Scenedesmus spp. was the most abundant green algae at both sites in 1984 with a mean density of 600 units/ml (Tables 4.2-8 and 4.2-9). Scenedesmus composed about 16% of the total standing crop; S. quadricauda was the most abundant species. Ankistrodesmus spp. was also abundant (11% of the total) with a mean density of 400 units/ml at Bell Bend and SSES; A. falcatus was the most abundant species.

Diatoms composed 31% of the total standing crop. Cyclotella spp. and Nitzschia spp. were the main diatoms at both sites and composed about 16% of the total standing crop.

In 1984, blue-green algae were less abundant at SSES and Bell Bend (4% of the total standing crop) than they were in 1983 (23% of the total).

Fourteen species of phytoplankton composed 5% or more of the total units counted in at least one sample from the two sites (Table 4.2-10). Phytoplankton was much less abundant in 1984 (3,500 units/ml) than in 1983 (11,400 units/ml).

Most of the phytoplankton found were "clean water" forms and only five of the abundant species (N. palea, S. quadricauda, A. falcatus, C. meneghiniana, and N. acicularis) were among the top 20 species listed by Palmer (Ref. 4.2-26) as being most tolerant of heavy organic pollution. Most of the species of abundant diatoms were rated as "alkaliphilous" by Lowe (Ref. 4.2-27); two were rated "indifferent," and three were rated "unknown."

The 1984 phytoplankton community mean was only about one-half as great as the previous low (6,400 units/ml in 1982). Much of the decline in standing crop in 1984 was attributed to high river water turbidity caused by major construction projects upriver. No impact upon this community was produced by the operation of the Susquehanna SES since both upstream and downstream community

levels declined. Clay and silt particles can act as a "nucleus" which aggregates phytoplankton into such a large mass that it settles from the water column (Ref. 4.2-18). Some of the phytoplankton lost in this way could accumulate on the river bottom and be included in the count of cells in the periphyton sample.

4.2.5.2 BENTHIC MACROINVERTEBRATES

Density and biomass of benthic macroinvertebrates in the Susquehanna River near the Susquehanna SES were monitored since 1972 and 1975, respectively, to establish a baseline of preoperational conditions (Refs. 4.2-30 through 4.2-39). Unit 1 of the Susquehanna SES became operational in September 1982. Data collected after that date were considered operational (Refs. 4.2-40 and 4.2-41). The objective of the operational studies was to determine if the power plant had any impact on the macroinvertebrate community downriver from the discharge diffuser.

From 1978 through 1982, benthic macroinvertebrates were collected in April, June, and October at two stations (four sites) near the Susquehanna SES (Fig. 4.2-1). Two sites (SSES I and II) are 850 m upriver from the intake structure, and two (Bell Bend I and III) are 710 m downriver from the discharge diffuser (Table 4.2-11). Sampling schedule and sites in 1983 and 1984 were the same as those since 1978, except that samples were not collected in April because of high river level.

In 1984, three samples were collected by a scuba diver at each site on June 11-13 and October 8-11, using a dome suction sampler (Ref. 4.2-42). After the sampler was lowered from a boat to the river substrate, a scuba diver moved it upriver to the first undisturbed area where an adequate seal between the sampler band and the substrate could be established. The diver then vacuumed the substrate inside the sampler (0.163 m^2) for five minutes with a screened intake nozzle leading to the sampler's pump. Sediments (silt, sand, and fine gravel) and organisms were pumped into a nylon net (216-μ mesh). The diver carefully vacuumed large stones within the dome sampler and then discarded them.

One replicate from each site was used for biomass estimates. It was washed and sieved through a U.S. Standard No. 20 sieve (841-μ mesh). The biomass sample was refrigerated (or kept in ice water) until organisms were sorted. Processing was completed within 12 hours of collection. By chilling the sample, it was possible to avoid the use of preservatives which distort organism weight (Refs. 4.2-43 and 4.2-44). Before molluscs were weighed, their shells were decalcified in 1% HCl. Sorted organisms were dried in aluminum foil containers at 100 C for at least 12 hours, then cooled to room temperature, and weighed on a Mettler H10W balance.

The other two replicates from each site were used for density estimates. Soon after collection, they were washed, sieved (U.S. Standard No. 60, 250-μ mesh), and preserved (10% buffered formalin) for storage. Later, the residue was placed in white pans for sorting. Readily visible specimens (except chironomids and naidids) were removed, identified, and counted.

Estimates of the number of chironomids, naidids, and other organisms left in the sample were obtained by counting organisms in a subsample of the total residue using a dissecting microscope (10-70X). Chironomids and naidids were counted from 1/23 of the residue; other organisms were counted from 1/4 of the residue. Both the 1/23 and 1/4 subsamples were a composite of three randomly selected portions of the total residue. The number of organisms found in the subsample was multiplied by the appropriate conversion factor (23 or 4) and then added to the total number of organisms previously sorted from pans. The number of organisms per square meter was determined by multiplying the number of organisms per sample by 6.1.

Invertebrates were identified (usually to genus or species) using taxonomic keys cited in Ref. 4.2-41. Some naidids and chironomids had to be mounted on microscope slides and examined with a compound microscope (40-1000X) for identification; Mark J. Wetzel, Illinois Natural History Survey (naidids) and Dr. Robert W. Bode, New York State Department of Health (chironomids) verified organism identifications.

Macroinvertebrate sample similarity was analyzed according to abundance and taxonomic composition using BASIC computer programs and a Hewlett-Packard 9830-A computer. The Bray and Curtis index (Ref. 4.2-45) was used to calculate a between-sample similarity matrix because Chance and Deutsch (Ref. 4.2-46) found that it was the best of four similarity indexes for analysis of Susquehanna River macroinvertebrate samples. The similarity matrix was then subjected to a cluster analysis by a group-average sorting technique (Ref. 4.2-47).

The mean macroinvertebrate density in June and October 1984 (stations combined) was 27,400 org/m^2 (Table 4.2-12), a value similar to that found in 1981 (27,400 org/m^2) and 1982 (28,500 org/m^2) but 16% less than the mean density found from 1978 to 1983 (32,800 org/m^2) (Table 4.2-13). The 1984 density was 36% less than that collected in 1983 (42,600 org/m^2). Chironomids composed 45% of the total number of organisms collected in 1984; hydropsychid caddisflies and heptageniid mayflies composed 27% and 9% of the total, respectively (Table 4.2-14).

Mean density at SSES (26,300 org/m^2) was less than at Bell Bend (28,600 org/m^2) for the first time since 1977 (Fig. 4.2-5). At SSES, the total number of organisms was composed primarily of hydropsychids (39%) and chironomids (34%) (Fig. 4.2-6). At Bell Bend, 54% of the total organisms was composed of chironomids; hydropsychids and heptageniids composed 16% and 10% of the total, respectively.

A listing of the macroinvertebrates collected in dome samples since 1975 is in Table 4.2-15. Six taxa were found or identified for the first time in 1984. Changes in nomenclature of several taxa were also made this year. In Deutsch et al. (Ref. 4.2-38), the subgenus Symphitopsyche was elevated to generic status in accordance with Schuster and Etnier (Ref. 4.2-48). Many biologists believe that this elevation was premature (Patricia W. Schefter, Royal Ontario Museum, personal communication, 8 March 1985). Therefore, Symphitopsyche was redesignated as Hydropsyche. Macronema, another hydropsychid, has been

reclassified as Macrostemum (Ref. 4.2-49). The chironomid genus Eukiefferiella has been divided; E. bavarica gr. and E. discoloripes gr. now belong to the genus Tvetenia (Ref. 4.2-50).

Mean macroinvertebrate density in June (12,200 org/m^2) was 63% less than in June 1983 (33,000 org/m^2) (Ref. 4.2-41). One of the factors responsible for this may have been low river temperatures in the spring of this year. Mean river temperature for the 30-day period preceding June sampling (15 May-13 June) was 16.0 C, the lowest mean in the past ten years. From 1975 to 1983, the mean river temperature for this period was 19.7 C (range = 18.2-22.3 C). High flows which occurred in late May may have caused catostrophic drift of macroinvertebrates, lowering benthic density.

Chironomids were the most abundant macroinvertebrates (mean = 7,500 org/m^2), composing 62% of the total number collected at both stations combined (Table 4.2-12). Rheotanytarsus spp. was the most numerous chironomid at all sites (17% of total macroinvertebrate density). Microtendipes sp. and Tanytarsus spp. each composed 10% (1,200 org/m^2) of the total density. An additional 21% of the total number of macroinvertebrates was composed of heptageniids (9%), naidids (7%), and tubificids (5%). In 1983, hydropsychids composed 7% of the June total; in 1984, they composed less than 1% at each station.

At SSES, mean June density (5,800 org/m^2) was less than 20% of the mean density of the previous six years (30,100 org/m^2) (Table 4.2-13). Chironomids composed 52% of the total density; Rheotanytarsus spp. (1,100 org/m^2) and Cricotopus spp. (500 org/m^2) were the most abundant genera. Naidids (primarily Nais behningi and Piguetiella michiganensis) composed 11% of the total. Mean hydropsychid density was only 37 org/m^2, much lower than in previous years. In 1983, for example, mean hydropsychid density was 3,600 org/m^2. Both Rhame and Stewart (Ref. 4.2-51) and Deutsch (Ref. 4.2-52) found that river temperatures of 15-17 C initiated emergence of hydropsychid adults. Low mean river temperatures in spring 1984 probably delayed emergence, thereby reducing oviposition and subsequent larval density. The large number of hydropsychids collected in October dome samples, however, reveals that the delay was short term.

At Bell Bend, density in June (18,700 org/m^2) was only slightly less than the mean for the previous six years (19,800 org/m^2) (Table 4.2-13). Chironomids composed 65% of the June density; Rheotanytarsus spp. (3,000 org/m^2), Microtendipes sp. (2,200 org/m^2) and Tanytarsus spp. (2,100 org/m^2) were the most abundant types. As in 1982 and 1983, Microtendipes sp. was more abundant at site III than at site I. Heptageniids and naidids (primarily N. behningi and N. communis) composed 9% and 6% of the total, respectively.

In October, mean macroinvertebrate density (42,600 org/m^2) was over 3-fold greater than in June (Table 4.2-12), but was less than in October 1983 (52,200 org/m^2). It was slightly greater than the 1978-83 mean (40,600 org/m^2) (Table 4.2-13). Chironomids (16,900 org/m^2) and hydropsychids (14,700 org/m^2) composed almost 75% of the total number of macroinvertebrates. Rheotanytarsus spp., Thienemannimyia gr., and Microtendipes sp. composed almost 75% of the chironomids; Cheumatopsyche spp. composed 95% of the hydropsychids.

At SSES, mean density (46,800 org/m^2) in October was 16% less than the mean of the previous six years (55,900 org/m^2) (Table 4.2-13). Hydropsychids (20,300 org/m^2) and chironomids (14,800 org/m^2) composed 75% of the total. Rheotanytarsus spp. (8,500 org/m^2), Cricotopus spp. (2,500 org/m^2), and Thienemannimyia gr. (2,200 org/m^2) were the most abundant chironomids. Heptageniids composed 9% of the total density.

At Bell Bend, mean October density (38,400 org/m^2) was 52% greater than the mean of the previous six years (25,300 org/m^2) (Table 4.2-13). Chironomids (Microtendipes sp., Thienemannimyia gr., and Rheotanytarsus spp.) composed 50% of the total density. Hydropsychids and heptageniids composed 23% and 11% of the total, respectively.

In the cluster analysis, samples were grouped by season before they were grouped by station or site (Fig. 4.2-6), indicating that seasonal differences in the macroinvertebrate community were more important than station and site differences. As in 1982 and 1983 (Refs. 4.2-40 and 4.2-41), the October samples were more distinctly grouped by station and site than were those in June, meaning that there was less variability in October replicates. Since 1979, the cluster analysis usually segregated SSES samples from those at Bell Bend within a sampling period, suggesting that macroinvertebrate communities at the two stations were seasonally distinct.

The mean macroinvertebrate biomass in June and October 1984 (2.5 g/m^2) (Table 4.2-16) was slightly less than the mean of the previous six years (2.8 g/m^2) (Table 4.2-17). Trichopterans (especially Cheumatopsyche spp.) and ephemeropterans (mainly Potamanthus sp. and heptageniids) composed 61% and 28%, respectively, of the 1984 mean biomass (Table 4.2-16).

Biomass in June 1984 averaged 0.8 g/m^2 (Table 4.2-16). Organism weight at SSES (1.0 g/m^2) was twice that at Bell Bend (0.5 g/m^2). Ephemeropterans made up 63% and 86% of total weight at SSES and Bell Bend, respectively. Oligochaetes and trichopterans composed 33% of the biomass at SSES; oligochaetes and dipterans made up 8% at Bell Bend.

Biomass of macroinvertebrates in October (4.1 g/m^2) was more than 5-fold greater than in June (Table 4.2-16). Weight of organisms at SSES (5.5 g/m^2) was almost twice that at Bell Bend (2.8 g/m^2). Trichopterans and ephemeropterans composed more than 90% of the biomass at both stations.

Biomass at SSES in 1984 averaged 3.2 g/m^2 (Table 4.2-16); trichopterans (2.1 g/m^2) and ephemeropterans (0.8 g/m^2) composed almost 90% of the total. Biomass at Bell Bend in 1984 was 1.7 g/m^2. Dry weight of trichopterans (especially hydropsychids) at SSES was more than twice that at Bell Bend (0.9 g/m^2) (Table 4.2-16). Mean biomass at Bell Bend has remained relatively stable during the past seven years (Fig. 4.2-5). Since 1978, annual mean biomass at SSES has been between 2- and 5-fold greater than at Bell Bend. Differences in macroinvertebrate biomass at the two stations were largely attributed to differences in substrate and river current. For example, SSES is located in a riffle area which is more suitable than Bell Bend for rheophilic organisms, such as hydropsychids.

Macroinvertebrate density and biomass increased markedly at both stations between 1977 and 1980 (Fig. 4.2-5). This increase coincided with significant ($P<0.05$) improvement in Susquehanna River water quality (Ref. 4.2-53). In particular, there was a decrease in acid mine drainage, which was found to suppress the macroinvertebrate community in the study area (Ref. 4.2-54). Since 1980, however, density and biomass seems to have stabilized; in three of the last four years, they were generally similar at both stations. The Susquehanna SES has had no detectable impact on the macroinvertebrate community.

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Table 4.2-1

Species of birds collected at the Unit 1 and 2 cooling towers of the Susquehanna SES, 1978-84. An asterisk (*) denotes species found in 1984.

Accipitridae
* Accipiter cooperii - Cooper's hawk

Columbidae
* Columba livia - rock dove

Picidae
Picoides pubescens - downy woodpecker
Colaptes auratus - northern flicker

Tyrannidae
Contopus virens - eastern wood-pewee
Empidonax flaviventris - yellow-bellied flycatcher
E. virescens - Acadian flycatcher
E. minimus - least flycatcher

Sittidae
Sitta canadensis - red-breasted nuthatch
S. carolinensis - white-breasted nuthatch

Certhiidae
Certhia americana - brown creeper

Troglodytidae
Troglodytes aedon - house wren

Muscicapidae
Regulus satrapa - golden-crowned kinglet
R. calendula - ruby-crowned kinglet
Catharus guttatus - hermit thrush
Hylocichla mustelina - wood thrush

Mimidae
* Dumetella carolinensis - gray catbird
Toxostoma rufum - brown thrasher

Vireonidae
Vireo griseus - white-eyed vireo
* V. solitarius - solitary vireo
* V. flavifrons - yellow-throated vireo
* V. philadelphicus - Philadelphia vireo
V. gilvus - warbling vireo
* V. olivaceus - red-eyed vireo
Vireo spp. - vireo spp.

Emberizidae
Vermivora pinus - blue-winged warbler
V. peregrina - Tennessee warbler
V. ruficapilla - Nashville warbler
Parula americana - northern parula
Dendroica petechia - yellow warbler
D. pensylvanica - chestnut-sided warbler
* D. magnolia - magnolia warbler
D. tigrina - Cape May warbler
* D. caerulescens - black-throated blue warbler
D. coronata - yellow-rumped warbler
D. virens - black-throated green warbler
* D. fusca - Blackburnian warbler
D. pinus - pine warbler
D. discolor - prairie warbler
D. palmarum - palm warbler
D. castanea - bay-breasted warbler
* D. striata - blackpoll warbler
Mniotilta varia - black-and-white warbler
Setophaga ruticella - American redstart
Helmitheros vermivorus - worm-eating warbler
* Seiurus aurocapillus - ovenbird
Oporornis formosus - Kentucky warbler
O. agilis - Connecticut warbler
* Geothlypis trichas - common yellowthroat
Wilsonia pusilla - Wilson's warbler
W. canadensis - Canada warbler
Icteria virens - yellow-breasted chat
* Parulinae spp. - warbler spp.

Emberizidae (cont.)
Piranga olivacea - scarlet tanager
Piranga sp. - tanager sp.
Pheucticus ludovicianus - rose-breasted grosbeak
Guiraca caerulea - blue grosbeak
Spiza americana - dickcissel
Spizella pusilla - field sparrow
Melospiza lincolnii - Lincoln's sparrow
M. georgiana - swamp sparrow
Zonotrichia leucophrys - white-crowned sparrow
Junco hyemalis - dark-eyed junco
Ammodramus savannarum - grasshopper sparrow
Icterus galbula - northern oriole

Fringillidae
Carpodacus purpureus - purple finch

Table 4.2-2

Weekly bird impaction totals from Unit 1 and 2 cooling towers, 19 March through 8 June 1984.

FAMILY/SPECIES	MAR 19-23	26-30	APR 2-6	9-13	16-20	23-27	30-4	MAY 7-11	14-18	21-25	28-1	JUN 4-8	TOTAL
UNIT 1													
VIREONIDAE													
YELLOW-THROATED VIREO	0	0	0	0	0	0	0	0	1	0	0	0	1
TOTAL INDIVIDUALS	0	0	0	0	0	0	0	0	1	0	0	0	1
TOTAL SPECIES	0	0	0	0	0	0	0	0	1	0	0	0	1
UNIT 2													
ACCIPITRIDAE													
COOPER'S HAWK	0	0	1	0	0	0	0	0	0	0	0	0	1
COLUMBIDAE													
ROCK DOVE	0	0	1	0	0	0	0	0	0	0	0	0	1
VIREONIDAE													
RED-EYED VIREO	0	0	0	0	0	0	0	0	0	1	0	0	1
EMBERIZIDAE													
MAGNOLIA WARBLER	0	0	0	0	0	0	0	0	0	2	0	0	2
BLACKBURNIAN WARBLER	0	0	0	0	0	0	0	0	0	2	0	0	2
COMMON YELLOWTHROAT	0	0	0	0	0	0	0	0	1	1	1	0	3
TOTAL INDIVIDUALS	0	0	2	0	0	0	0	0	1	6	1	0	10
TOTAL SPECIES	0	0	2	0	0	0	0	0	1	4	1	0	6

Table 4.2-3

Weekly bird impaction totals from Unit 1 and 2 cooling towers, 20 August through 9 November 1984.

FAMILY/SPECIES	AUG 20-24	AUG 27-31	SEP 4-7	SEP 10-14	SEP 17-21	SEP 24-28	OCT 1-5	OCT 8-12	OCT 15-19	OCT 22-26	29-2	NOV 5-9	TOTAL
UNIT 1													
MIMIDAE													
GRAY CATBIRD	0	0	0	0	1	0	0	0	0	0	0	0	1
VIREONIDAE													
RED-EYED VIREO	0	0	0	0	0	0	0	3	0	0	0	0	3
EMBERIZIDAE													
BLACKBURNIAN WARBLER	0	1	1	0	0	0	0	0	0	0	0	0	2
BLACKPOLL WARBLER	0	0	0	0	1	0	0	0	0	0	0	0	1
COMMON YELLOWTHROAT	0	0	0	0	1	0	0	0	0	0	0	0	1
UNIDENTIFIABLE WARBLER	0	1	0	0	0	0	0	0	0	0	0	0	1
TOTAL INDIVIDUALS	0	2	1	0	3	0	0	3	0	0	0	0	9
TOTAL SPECIES	0	2	1	0	3	0	0	1	0	0	0	0	6
UNIT 2													
VIREONIDAE													
SOLITARY VIREO	0	0	0	0	0	0	1	0	0	0	0	0	1
RED-EYED VIREO	0	0	0	0	1	0	0	0	0	0	0	0	1
EMBERIZIDAE													
BLACKPOLL WARBLER	0	0	0	0	0	0	0	0	1	0	0	0	1
OVENBIRD	0	0	0	0	1	0	0	0	0	0	0	0	1
TOTAL INDIVIDUALS	0	0	0	0	2	0	1	0	1	0	0	0	4
TOTAL SPECIES	0	0	0	0	2	0	1	0	1	0	0	0	4

TABLE 4.2-4
SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

Sheet 1

1984 — Year

Susquehanna - Wescosville 500 KV — Line Names

Lehigh — Division

Selective Reclearing

Dates From	Dates To	Grid Location From	Grid Location To	Acres

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	
8/20/84	8/21/84	60780 /S47042	60745/S47155	

Supv. Distribution Services — Title

215-398-4336 — Phone

Rts. 309 & 22, R.D. 2, Box 811B, Allentown, Pa. 18106 — Address

TABLE 4.2-4
SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

Sheet 2

1984 — Year | Susquehanna - Wescosville — Line Names | Central — Division

Selective Reclearing

Dates From	Dates To	Grid Location From	Grid Location To	Acres

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	
10/10/84	10/12/84	48020N34034	48256N34015	100'

Supv. Distribution Services — Title | 717-454-7414 — Phone | 344 South Poplar Street, Hazleton, Pa. 18201 — Address

TABLE 4.2-4
SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

Sheet 3

1984 (Year)   Stanton -- Susquehanna (Line Names)   Central (Division)

Selective Reclearing

Dates From	Dates To	Grid Location From	Grid Location To	Acres
10/16/84	10/26/84	44858N34287	44966N34249	1.5
10/16/84	10/26/84	44972N34140	44980N34247	1.5

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees
10/16/84	10/26/84	44858N34287	44966N34249	6
10/16/84	10/26/84	44972N34140	44980N34247	6
10/16/84	10/26/84	44977N34122	45029N34131	4
10/16/84	10/26/84	45081N34136	45090N34102	14

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	

Supv. Distribution Services (Title)   717-454-7414 (Phone)   344 South Poplar Street, Hazleton, Pa. 18201 (Address)

TABLE 4.2-4
SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

Sheet 4

Year: 1984 | Line Names: Stanton - Susquehanna | Division: Central

Selective Reclearing

Dates From	Dates To	Grid Location From	Grid Location To	Acres
10/16/84	10/26/84	44858N34287	44966N34249	1.5
10/16/84	10/26/84	44972N34140	44980N34247	1.5

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees
10/16/84	10/26/84	44858N34287	44966N34249	12
10/16/84	10/26/84	44972N34140	44980N34247	6

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	

Title: Supv. Distribution Services | Phone: 717-454-7414 | Address: 344 South Poplar Street, Hazleton, Pa. 18201

TABLE 4.2-4
SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

Sheet 5

Year: 1984 | Line Names: Stanton - Susquehanna | Division: Susquehanna

Selective Reclearing

Dates From	Dates To	Grid Location From	Grid Location To	Acres
7/20/84	7/21/84	44069N34259	Tup 419	1.8

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees
8/3/84	8/3/84	44224N34273	44290N34277	60

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To	
7/18/84	7/19/84	43971N34394	Tup 419	
7/20/84	7/21/84	44493N34285	Rt. 11	
8/3/84	8/4/84	44655N34288	River	

Title	Phone	Address
Supv. Distribution Services	717-327-5306	Old U.S. Rt.220, P.O.Box 158, Montoursville, Pa. 17754

TABLE 4.2-4
SUSQUEHANNA SES
MAINTENANCE OF TRANSMISSION LINE CORRIDORS

Sheet 6

Year: 1984 | Line Names: Transformer Tap #20 | Division: Susquehanna

Selective Reclearing

Dates From	Dates To	Grid Location From	Grid Location To	Acres
7/26/84	7/31/84	44280N34050	44460N34056	.5

Side Trimming

Dates From	Dates To	Grid Location From	Grid Location To	Lin. Ft.
7/26/84	7/31/84	44280N34050	44617N34064	3,200

Danger Tree Removals

Dates From	Dates To	Grid Location From	Grid Location To	Trees

Screen Trimming

Dates From	Dates To	Grid Location From	Grid Location To

Title: Supv. Distribution Services
Phone: 717-327-5306
Address: Old U.S. Route 220, P.O.Box 158, Montoursville, Pa. 17754

Table 4.2-5

Mean density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at SSES on the Susquehanna River, 1984.

TAXON	30 APR	15 JUN	20 AUG	15 OCT	% TOTAL
CHLOROPHYTA					
ACTINASTRUM	0.0	10.8	0.0	1.1	0.3
ANKISTRODESMUS	0.0	15.4	0.0	58.4	1.9
ARTHRODESMUS	0.0	1.9	0.0	0.0	<0.1
CHLAMYDOMONAS	0.1	0.9	0.0	2.7	0.1
COELASTRUM	0.0	0.0	0.0	24.4	0.6
COSMARIUM	0.0	0.0	0.0	1.1	<0.1
CRUCIGENIA	0.0	0.3	0.0	1.1	<0.1
DICTYOSPHAERIUM	0.0	3.4	0.0	0.0	0.1
KIRCHNERIELLA	0.0	0.0	0.0	1.1	<0.1
MICRACTINIUM	0.0	4.0	0.0	0.0	0.1
OOCYSTIS	0.0	0.3	0.0	4.3	0.1
PEDIASTRUM	0.0	0.0	0.1	1.6	<0.1
SCENEDESMUS	0.0	12.6	0.1	254.3	6.9
SCHROEDERIA	0.0	0.0	0.0	0.6	<0.1
STAURASTRUM	0.0	0.0	0.0	1.1	<0.1
TETRAEDRON	0.0	0.3	0.0	0.0	<0.1
TETRASTRUM	0.0	0.0	0.0	4.8	0.1
UNIDENTIFIED CHLOROPHYTA	0.0	6.8	0.1	92.2	2.6
BACILLARIOPHYTA					
ACHNANTHES	0.0	1.5	0.0	0.0	<0.1
ASTERIONELLA	1.3	0.6	0.0	0.0	0.1
COCCONEIS	0.0	0.0	0.3	50.3	1.3
CYCLOTELLA	0.0	4.6	0.1	1678.5	43.7
CYMBELLA	0.0	0.3	0.0	13.2	0.4
DIATOMA	0.0	0.0	0.0	3.7	0.1
EPITHEMIA	0.0	0.0	0.0	1.1	<0.1
FRAGILARIA	0.1	0.0	0.4	0.0	<0.1
GOMPHONEMA	0.3	0.6	1.2	40.3	1.1
GYROSIGMA	0.0	0.0	0.1	17.1	0.4
MELOSIRA	0.3	0.0	4.5	40.8	1.2
MERIDION	0.1	0.0	0.0	0.0	<0.1
NAVICULA	0.5	9.3	3.3	409.4	11.0
NITZSCHIA	0.5	18.8	4.3	213.9	6.2
PINNULARIA	0.1	0.0	0.0	0.0	<0.1
RHIZOSOLENIA	0.0	0.3	0.0	0.0	<0.1
RHOICOSPHENIA	0.0	0.0	0.0	16.4	0.4
STEPHANODISCUS	0.0	15.1	0.0	287.1	7.9
SURIRELLA	0.2	0.0	0.0	1.1	<0.1
SYNEDRA	0.1	17.3	0.1	2.1	0.5
THALASSIOSIRA	0.0	0.0	0.0	442.8	11.5
CYANOPHYTA					
CHROOCOCCUS	0.0	3.7	0.0	2.1	0.2
OSCILLATORIA	0.0	0.0	0.0	24.3	0.6
SCHIZOTHRIX	0.0	2.2	0.0	5.8	0.2
RHODOPHYTA					
RHODOCHORTON	0.1	0.0	0.0	0.0	<0.1
TOTAL	3.6	131.0	14.8	3698.4	

Table 4.2-6

Mean density (units/mm^2) of periphytic algae on two acrylic plates submerged for 12 months at Bell Bend on the Susquehanna River, 1984.

TAXON	30 APR	15 JUN	20 AUG	15 OCT	% TOTAL
CHLOROPHYTA					
ACTINASTRUM	0.0	41.3	0.0	0.0	1.7
ANKISTRODESMUS	0.0	46.6	0.6	16.7	2.6
CHLAMYDOMONAS	0.0	0.9	0.0	3.0	0.2
CLADOPHORA	0.0	0.0	0.3	0.0	<0.1
COELASTRUM	0.0	0.0	0.0	3.1	0.1
COSMARIUM	0.0	0.0	1.5	0.7	0.1
CRUCIGENIA	0.0	0.0	1.2	4.8	0.2
DICTYOSPHAERIUM	0.0	0.3	0.0	0.0	<0.1
GOLENKINIA	0.0	0.3	0.0	0.0	<0.1
KIRCHNERIELLA	0.0	3.1	0.3	2.2	0.2
MICRACTINIUM	0.0	0.6	0.0	0.0	<0.1
OOCYSTIS	0.0	0.3	0.0	22.9	0.9
PEDIASTRUM	0.0	0.3	0.6	0.7	0.1
POLYEDRIOPSIS	0.0	0.9	0.0	0.0	<0.1
SCENEDESMUS	0.0	92.2	2.5	57.1	6.2
SELENASTRUM	0.0	0.3	0.0	0.0	<0.1
STAURASTRUM	0.0	0.0	0.3	0.0	<0.1
TETRAEDRON	0.0	0.6	0.0	0.0	<0.1
TETRASTRUM	0.0	2.2	0.0	1.3	0.1
UNIDENTIFIED CHLOROPHYTA	0.1	18.8	3.1	24.0	1.9
BACILLARIOPHYTA					
ACHNANTHES	0.0	3.4	0.9	23.3	1.1
AMPHORA	0.0	0.0	0.0	0.6	<0.1
ASTERIONELLA	1.3	0.0	0.0	0.0	0.1
COCCONEIS	0.0	0.3	6.8	4.2	0.5
CYCLOTELLA	0.0	49.3	6.2	94.7	6.1
CYMBELLA	0.0	5.6	3.7	5.4	0.6
EUNOTIA	0.0	0.0	0.6	0.0	<0.1
FRAGILARIA	0.1	0.0	0.0	0.0	<0.1
FRUSTULIA	0.0	0.0	0.3	0.0	<0.1
GOMPHONEMA	0.3	1.5	19.4	13.9	1.4
GYROSIGMA	0.0	0.0	0.6	10.7	0.5
MELOSIRA	0.0	0.6	19.1	1.7	0.9
MERIDION	0.0	0.3	0.3	0.0	<0.1
NAVICULA	0.7	51.2	40.7	949.8	42.4
NITZSCHIA	0.4	104.2	43.2	147.0	12.0
PINNULARIA	0.0	0.0	0.3	0.0	<0.1
RHOICOSPHENIA	0.0	0.3	0.9	0.7	0.1
STEPHANODISCUS	0.0	115.3	0.9	61.4	7.2
SURIRELLA	0.1	0.0	0.3	0.0	<0.1
SYNEDRA	0.1	68.1	0.6	2.4	2.9
THALASSIOSIRA	0.0	0.0	0.0	16.8	0.7
CYANOPHYTA					
CHROOCOCCUS	0.0	3.7	0.0	1.1	0.2
OSCILLATORIA	0.0	0.0	3.7	3.5	0.3
SCHIZOTHRIX	0.0	113.2	38.2	58.0	8.5
CHRYSOPHYTA					
MALLOMONAS	0.0	0.3	0.0	0.0	<0.1
TOTAL	3.1	726.1	197.3	1531.6	

Table 4.2-7

Species of periphytic algae composing 5% or more of the total units counted in at least one replicate sample from SSES or Bell Bend on the Susquehanna River, 1984; pH affinity as rated by Lowe (Ref. 4.2-27): 1 = alkaliphilous, 2 = acidophilous, 3 = indifferent, and 4 = unknown.

Species	pH Affinity	SSES	Bell Bend
CHLOROPHYTA			
Actinastrum hantzschii		Jun	Jun
Ankistrodesmus falcatus		Jun	Jun
Chlamydomonas sp.		Apr	
Micractinium pusillum		Jun	
Scenedesmus quadricauda		Jun, Oct	Jun
BACILLARIOPHYTA			
Achnanthes minutissima	(1,3)		Oct
Asterionella formosa	(1)	Apr	Apr
Cocconeis placentula	(1)	Aug	
Cyclotella atomus	(4)	Oct	Oct
C. pseudostelligera	(1,3)	Oct	Jun
Fragilaria crotonensis	(1)		Apr
F. vaucheriae	(1,2)	Apr	
Gomphonema angustatum	(1,4)	Apr	
G. olivaceum	(1)	Aug	
G. parvulum	(1,4)		Apr
Gomphonema sp.			Apr
Melosira granulata	(1)	Apr	
M. varians	(1)	Aug	Aug
Meridion circulare	(1)	Apr	
Navicula cryptocephala	(1)		Apr
N. gregaria	(4)		Aug
N. salinarum var. *intermedia*	(4)	Oct	Aug, Oct
N. symmetrica	(4)		Oct
N. viridula	(1,3)	Apr, Jun	Apr, Jun
Nitzschia acicularis	(1)	Jun	Jun
N. dissipata	(1)	Apr	Apr
N. palea	(1,3)	Aug	Aug, Oct
Pinnularia sp.		Apr	
Stephanodiscus invisitatus	(4)	Jun, Oct	Jun
Surirella ovata	(1)	Apr	Apr
Synedra acus	(1,4)	Apr	Apr
Synedra sp.		Jun	Jun
Thalassiosira pseudonana	(3)	Oct	
CYANOPHYTA			
Schizothrix calcicola			Jun, Aug, Oct
RHODOPHYTA			
Rhodochorton sp.		Apr	

Table 4.2-8

Density (units/ml) of phytoplankton in bimonthly samples (indicated by date and collection number) at SSES on the Susquehanna River, 1984.

TAXON	16 APR AJG-84-001	15 JUN AJG-84-025	20 AUG AJG-84-051	15 OCT AJG-84-102	MEAN	% TOTAL
CHLOROPHYTA						
ACTINASTRUM	0	240	0	94	83.4	2.5
ANKISTRODESMUS	2	510	42	854	351.9	10.5
CHLAMYDOMONAS	2	20	22	1115	289.6	8.7
COELASTRUM	0	20	0	52	18.0	0.5
COSMARIUM	0	0	3	0	0.7	<0.1
CRUCIGENIA	2	0	3	21	6.3	0.2
DICTYOSPHAERIUM	0	430	6	156	148.0	4.4
GOLENKINIA	0	150	0	0	37.5	1.1
KIRCHNERIELLA	2	10	0	0	2.9	0.1
MICRACTINIUM	0	240	0	42	70.4	2.1
OOCYSTIS	0	60	6	10	19.0	0.6
POLYEDRIOPSIS	0	20	0	0	5.0	0.1
SCENEDESMUS	5	1060	142	1115	580.2	17.4
SCHROEDERIA	0	0	6	0	1.4	<0.1
SELENASTRUM	0	10	0	0	2.5	0.1
STAURASTRUM	0	0	0	83	20.8	0.6
TREUBARIA	0	790	0	0	197.5	5.9
UNIDENTIFIED CHLOROPHYTA	6	420	150	729	326.3	9.8
BACILLARIOPHYTA						
ACHNANTHES	6	0	19	0	6.4	0.2
AMPHORA	0	0	11	0	2.8	0.1
ASTERIONELLA	5	0	0	0	1.2	<0.1
COCCONEIS	0	0	42	0	10.4	0.3
CYCLOTELLA	5	60	103	917	271.0	8.1
CYMBELLA	25	0	0	0	6.2	0.2
FRAGILARIA	12	0	0	0	3.1	0.1
GOMPHONEMA	78	10	25	0	28.4	0.9
MELOSIRA	32	0	86	42	40.0	1.2
MERIDION	25	0	0	0	6.2	0.2
NAVICULA	23	0	117	73	53.2	1.6
NITZSCHIA	75	590	231	146	260.4	7.8
RHOICOSPHENIA	0	0	47	0	11.8	0.4
STEPHANODISCUS	18	460	86	104	167.2	5.0
SURIRELLA	2	0	3	0	1.1	<0.1
SYNEDRA	11	550	0	0	140.2	4.2
THALASSIOSIRA	0	0	0	73	18.2	0.5
CYANOPHYTA						
CHROOCOCCUS	0	30	3	458	122.8	3.7
MICROCYSTIS	0	60	0	0	15.0	0.4
OSCILLATORIA	0	0	6	0	1.4	<0.1
SCHIZOTHRIX	0	0	17	0	4.2	0.1
CHRYSOPHYTA						
DINOBYRON	0	0	3	0	0.7	<0.1
SYNURA	2	0	0	0	0.4	<0.1
RHODOPHYTA						
RHODOCHORTON	0	10	0	0	2.5	0.1
TOTAL	335	5750	1175	6084	3336.0	

Table 4.2-9

Density (units/ml) of phytoplankton in bimonthly samples (indicated by date and collection number) at Bell Bend on the Susquehanna River, 1984.

TAXON	16 APR AJG-84-003	15 JUN AJG-84-017	20 AUG AJG-84-043	15 OCT AJG-84-094	MEAN	% TOTAL
CHLOROPHYTA						
ACTINASTRUM	0	280	3	21	75.9	2.1
ANKISTRODESMUS	3	900	25	792	429.9	11.9
CHLAMYDOMONAS	2	40	22	1281	336.3	9.3
COELASTRUM	0	10	0	0	2.5	0.1
CRUCIGENIA	0	0	11	0	2.8	0.1
DICTYOSPHAERIUM	0	550	6	73	157.1	4.4
GOLENKINIA	0	200	0	10	52.6	1.5
KIRCHNERIELLA	0	70	6	0	18.9	0.5
MICRACTINIUM	0	140	0	52	48.0	1.3
OOCYSTIS	0	60	0	0	15.0	0.4
PANDORINA	0	0	3	0	0.7	<0.1
POLYEDRIOPSIS	0	10	0	10	5.1	0.1
SCENEDESMUS	6	1140	128	938	552.9	15.4
SCHROEDERIA	0	20	0	0	5.0	0.1
SELENASTRUM	0	20	0	0	5.0	0.1
TETRAEDRON	0	20	0	0	5.0	0.1
TETRASTRUM	0	20	3	146	42.2	1.2
TREUBARIA	0	850	0	0	212.5	5.9
UNIDENTIFIED CHLOROPHYTA	3	640	83	760	371.7	10.3
BACILLARIOPHYTA						
ACHNANTHES	0	0	19	10	7.5	0.2
ASTERIONELLA	5	0	0	0	1.2	<0.1
COCCONEIS	0	0	81	0	20.1	0.6
CYCLOTELLA	2	100	175	792	267.1	7.4
CYMBELLA	17	0	8	0	6.3	0.2
DIATOMA	5	0	0	0	1.2	<0.1
FRAGILARIA	17	0	0	0	4.2	0.1
GOMPHONEMA	58	0	11	21	22.6	0.6
GYROSIGMA	0	0	3	0	0.7	<0.1
MELOSIRA	3	0	36	21	15.0	0.4
MERIDION	43	0	0	0	10.8	0.3
NAVICULA	45	0	100	31	44.0	1.2
NEIDIUM	0	0	3	0	0.7	<0.1
NITZSCHIA	88	700	272	63	280.6	7.8
RHOICOSPHENIA	0	0	31	0	7.6	0.2
STEPHANODISCUS	0	770	106	94	242.3	6.7
SURIRELLA	8	0	0	0	1.9	0.1
SYNEDRA	0	670	0	0	167.5	4.7
THALASSIOSIRA	0	0	0	52	13.0	0.4
CYANOPHYTA						
CHROOCOCCUS	0	70	0	354	106.0	2.9
MERISMOPEDIA	0	10	3	0	3.2	0.1
MICROCYSTIS	0	120	0	0	30.0	0.8
SCHIZOTHRIX	0	0	6	0	1.4	<0.1
CHRYSOPHYTA						
MALLOMONAS	0	10	0	0	2.5	0.1
EUGLENOPHYTA						
TRACHELOMONAS	2	0	6	0	1.8	<0.1
TOTAL	305	7420	1147	5521	3598.2	

Table 4.2-10

Species of phytoplankton composing 5% or more of the total units counted in at least one sample from SSES or Bell Bend on the Susquehanna River, 1984; pH affinity as rated by Lowe (Ref. 4.2-27): 1 = alkaliphilous, 2 = acidophilous, 3 = indifferent, and 4 = unknown.

Species	pH Affinity	SSES	Bell Bend
CHLOROPHYTA			
Ankistrodesmus falcatus		Jun, Oct	Jun, Oct
Chlaymdomonas sp.		Oct	Oct
Dictyosphaerium pulchellum		Jun	Jun
Scenedesmus quadricauda		Jun, Aug, Oct	Jun, Aug, Oct
Treubaria crassispina		Jun	Jun
BACILLARIOPHYTA			
Cocconeis placentula			Aug
Cyclotella atomus	(4)	Oct	Oct
C. meneghiniana	(1)	Aug	Aug
Gomphonema olivaceum	(1)	Apr	Apr
Meridion circulare	(1)	Apr	Apr
Navicula viridula	(1,3)		Apr
Nitzschia acicularis	(1)	Apr, Jun	Apr, Jun
N. palea	(1,3)	Aug	Aug
Stephanodiscus invisitatus	(4)	Jun, Aug	Jun, Aug
Synedra acus	(1,4)	Jun	Jun

Table 4.2-11

Description and location of benthic macroinvertebrate sampling sites on the Susquehanna River, 1984.

Station	SSES		BELL BEND	
Site	I	II	I	III
Depth[a]	0.6	1.0	1.3	1.3
Substrate Type[b]	gravel-pebble	pebble-cobble	gravel-pebble with boulders[c]	gravel-pebble with boulders[c]
Location	850 m upriver from the center of the intake structure; 30 m from the west bank	850 m upriver from the center of the intake structure; 100 m from the west bank	710 m downriver from the center of the discharge diffuser; 40 m from the west bank	710 m downriver from the center of the discharge diffuser; 70 m from the west bank

[a]Site depth (m) when river surface elevation is 148.6 m above mean sea level (river discharge about 120 m^3/s) at the Susquehanna SES Biological Laboratory.

[b]Based on predominant particle size (Ref. 4.2-55).

[c]There tended to be accumulations of fine sediments downstream from boulders.

Table 4.2-12

Density (org/m²) and percent total of major groups of benthic macroinvertebrates collected in four dome samples at each station on the Susquehanna River in June and October, 1984.

SITE TAXA	JUN ORG/M^2	JUN % TOTAL	OCT ORG/M^2	OCT % TOTAL	MEAN ORG/M^2	MEAN % TOTAL
SSES						
OLIGOCHAETA	1139.5	19.7	1450.9	3.1	1295.2	4.9
EPHEMEROPTERA	1059.8	18.3	6622.3	14.2	3841.0	14.6
HYDROPSYCHIDAE	36.8	0.6	20340.3	43.5	10188.6	38.8
CHIRONOMIDAE	3010.7	52.0	14772.6	31.6	8891.6	33.8
OTHER	544.4	9.4	3570.1	7.6	2057.3	7.8
TOTAL	5791.4		46757.7		26274.5	
BELL BEND						
OLIGOCHAETA	1935.6	10.4	1343.5	3.5	1639.5	5.7
EPHEMEROPTERA	3453.8	18.5	5829.5	15.2	4641.6	16.3
HYDROPSYCHIDAE	96.6	0.5	9003.0	23.4	4549.8	15.9
CHIRONOMIDAE	12067.0	64.7	19004.1	49.5	15535.6	54.4
OTHER	1111.9	6.0	3255.9	8.5	2183.9	7.7
TOTAL	18665.6		38437.1		28551.4	
COMBINED						
OLIGOCHAETA	1537.5	12.6	1397.2	3.3	1467.4	5.4
EPHEMEROPTERA	2256.7	18.5	6225.8	14.6	4241.2	15.5
HYDROPSYCHIDAE	66.7	0.5	14671.3	34.5	7369.0	26.9
CHIRONOMIDAE	7538.8	61.7	16887.3	39.7	12213.1	44.6
OTHER	828.2	6.8	3412.6	8.0	2120.4	7.7
TOTAL	12228.5		42597.4		27413.0	

Table 4.2-13

Mean density of benthic macroinvertebrates (org/m²) collected in dome samples at SSES and Bell Bend on the Susquehanna River in June and October, 1978-84.

YEAR	JUN SSES	JUN BELL BEND	JUN COMBINED	OCT SSES	OCT BELL BEND	OCT COMBINED	MEAN
1978	16131	9459	12795	40473	15465	27969	20382
1979	22968	17241	20104	67546	35647	51596	35850
1980	54359	36037	45198	58593	18629	38611	41905
1981	36080	12199	24139	41377	20129	30753	27446
1982	18084	10897	14490	60251	24655	42453	28472
1983	33089	32979	33034	66919	37436	52177	42605
MEAN (1978-83)	30118	19802	24960	55860	25327	40593	32777
1984	5791	18666	12228	46758	38437	42597	27413

Table 4.2-14

Mean density (org/m²) and percent total of benthic macroinvertebrates collected in four dome samples at each site on the Susquehanna River, 1984.

STATION	SSES		PERCENT	BELL BEND		PERCENT
SITE	I	II	TOTAL	I	III	TOTAL
TAXON						
HYDRA SP.	6	0	<0.1	0	0	0.0
ALLOEOCOELA	9	21	<0.1	17	0	<0.1
TRICLADIDA	8	5	<0.1	0	0	<0.1
PROSTOMA SP.	44	51	0.2	81	34	0.2
NEMATODA	179	345	1.0	709	319	1.8
NAIDIDAE	0	0	0.0	35	107	0.2
NAIS SPP.	0	0	0.0	106	35	0.2
NAIS BEHNINGI	396	1113	2.9	540	463	1.8
NAIS COMMUNIS	35	0	<0.1	107	359	0.8
PIGUETIELLA MICHIGANENSIS	0	110	0.2	0	0	0.0
TUBIFICIDAE	385	495	1.7	753	732	2.6
BOTHRIONEURUM VEJDOVSKYANUM	2	0	<0.1	0	2	<0.1
ISOCHAETIDES FREYI	2	0	<0.1	0	0	0.0
LIMNODRILUS HOFFMEISTERI	2	2	<0.1	0	6	<0.1
QUISTADRILUS MULTISETOSUS	2	0	<0.1	2	6	<0.1
LUMBRICULIDAE	34	11	<0.1	5	17	<0.1
STYLODRILUS HERINGIANUS	3	0	<0.1	0	0	0.0
GLOSSIPHONIIDAE	0	2	<0.1	3	0	<0.1
ASELLIDAE	0	0	0.0	6	0	<0.1
AMPHIPODA	0	0	0.0	0	6	<0.1
GAMMARIDAE	2	0	<0.1	0	0	0.0
CRANGONYX SP.	0	0	0.0	2	0	<0.1
PLECOPTERA	20	0	<0.1	35	0	<0.1
NEMOURIDAE	2	0	<0.1	0	0	0.0
LEUCTRA SP.	0	0	0.0	3	0	<0.1
PERLIDAE	67	17	0.2	9	8	<0.1
ACRONEURIA SPP.	5	2	<0.1	2	21	<0.1
NEOPERLA SP.	2	0	<0.1	0	0	0.0
PHASGANOPHORA SP.	26	31	0.1	0	5	<0.1
PERLESTA SP.	2	0	<0.1	0	0	0.0
EPHEMEROPTERA	2	0	<0.1	0	0	0.0
EPHORON SP.	144	103	0.5	212	482	1.2
POTAMANTHUS SPP.	1267	916	4.2	807	1104	3.3
CAENIS SP.	130	74	0.4	400	304	1.2
EPHEMERELLIDAE	6	6	<0.1	25	0	<0.1
DRUNELLA WALKERI	8	0	<0.1	2	6	<0.1
EPHEMERELLA SPP.	0	0	0.0	0	2	<0.1
EPHEMERELLA INVARIA	3	0	<0.1	0	0	0.0
SERRATELLA DEFICIENS	11	12	<0.1	5	0	<0.1
BAETIDAE	52	2	0.1	6	2	<0.1
BAETIS SP.	14	2	<0.1	0	0	0.0
ISONYCHIA SP.	328	55	0.7	78	61	0.2
HEPTAGENIIDAE	1210	541	3.3	1038	1287	4.1
HEPTAGENIA SPP.	97	90	0.4	233	179	0.7
RHITHROGENA SP.	9	0	<0.1	0	0	0.0
STENACRON SPP.	0	11	<0.1	58	31	0.2
STENACRON INTERPUNCTATUM	41	23	0.1	9	2	<0.1
STENONEMA SPP.	48	6	0.1	14	6	<0.1
STENONEMA ITHACA	29	14	<0.1	3	20	<0.1
STENONEMA PULCHELLUM	1416	730	4.1	787	1675	4.3
STENONEMA TERMINATUM	221	58	0.5	150	296	0.8
STENONEMA VICARIUM	5	0	<0.1	2	0	<0.1
GOMPHIDAE	0	0	0.0	3	0	<0.1
COENAGRIONIDAE	15	8	<0.1	5	3	<0.1
SIALIS SP.	8	2	<0.1	9	17	<0.1
CORYDALUS SP.	5	0	<0.1	0	0	0.0
GLOSSOSOMATIDAE	3	0	<0.1	0	0	0.0
CHIMARRA SP.	72	0	0.1	2	0	<0.1
POLYCENTROPODIDAE	0	0	0.0	6	6	<0.1
NEURECLIPSIS SP.	233	15	0.5	57	18	0.1
POLYCENTROPUS SP.	0	2	<0.1	2	0	<0.1
HYDROPSYCHIDAE (PUPAE)	0	2	<0.1	0	2	<0.1
CHEUMATOPSYCHE SPP.	11305	7778	36.3	2479	6419	15.6
CHEUMATOPSYCHE SPP.(PUPAE)	0	2	<0.1	2	0	<0.1
HYDROPSYCHE SPP.	20	5	<0.1	2	0	<0.1
HYDROPSYCHE SPP.(PUPAE)	0	2	<0.1	17	0	<0.1
HYDROPSYCHE BIFIDA GR.	15	5	<0.1	0	0	0.0
HYDROPSYCHE MOROSA	52	9	0.1	0	2	<0.1
HYDROPSYCHE PHALERATA	675	486	2.2	49	130	0.3
MACROSTEMUM SPP.	12	9	<0.1	0	0	0.0
MACROSTEMUM SPP.(PUPAE)	0	2	<0.1	0	0	0.0
HYDROPTILA SPP.	0	0	0.0	0	6	<0.1

Table 4.2-14 (cont.)

STATION	SSES		PERCENT	BELL BEND		PERCENT
SITE	I	II	TOTAL	I	III	TOTAL
TAXON						
LEPTOCERIDAE	2	14	<0.1	18	34	<0.1
CERACLEA SPP.	8	11	<0.1	46	23	0.1
CERACLEA ANCYLUS	0	3	<0.1	2	0	<0.1
CERACLEA MENTIEA	0	8	<0.1	2	0	<0.1
MYSTACIDES SPP.	0	0	0.0	6	6	<0.1
NECTOPSYCHE SP.	123	256	0.7	281	414	1.2
OECETIS SPP.	14	40	0.1	60	58	0.2
OECETIS AVARA	29	15	<0.1	25	12	<0.1
OECETIS CINERASCENS	2	6	<0.1	55	71	0.2
LEPIDOSTOMA SP.	0	0	0.0	0	3	<0.1
BEROSUS SP.	2	0	<0.1	0	0	0.0
PSEPHENUS SP.	8	0	<0.1	0	0	0.0
DUBIRAPHIA SP.	8	5	<0.1	9	2	<0.1
OPTIOSERVUS SP.	28	15	<0.1	6	14	<0.1
STENELMIS SP.	673	592	2.4	434	566	1.8
STENELMIS SP.(ADULTS)	26	11	<0.1	2	3	<0.1
TIPULIDAE	0	2	<0.1	0	0	0.0
SIMULIIDAE	9	6	<0.1	0	0	0.0
HEMERODROMIA SP.	482	163	1.2	80	140	0.4
CERATOPOGONIDAE	15	0	<0.1	55	21	0.1
CHIRONOMIDAE	0	35	<0.1	0	0	0.0
CHIRONOMIDAE (PUPAE)	143	216	0.7	216	396	1.1
TANYPODINAE	0	0	0.0	35	71	0.2
ABLABESMYIA SPP.	0	0	0.0	35	35	0.1
ABLABESMYIA MALLOCHI	143	107	0.5	143	360	0.9
NILOTANYPUS SP.	35	0	<0.1	0	35	<0.1
PROCLADIUS SP.	0	35	<0.1	0	0	0.0
THIENEMANNIMYIA GR.	719	1546	4.3	2121	3018	9.0
CHIRONOMINAE	0	0	0.0	0	35	<0.1
CHIRONOMUS SPP.	0	0	0.0	468	0	0.8
CRYPTOCHIRONOMUS SPP.	0	0	0.0	1115	179	2.3
DICROTENDIPES SPP.	0	35	<0.1	647	143	1.4
DICROTENDIPES NEOMODESTUS	0	0	0.0	35	0	<0.1
ENDOCHIRONOMUS SPP.	0	0	0.0	107	35	0.2
GLYPTOTENDIPES SP.	0	0	0.0	215	143	0.6
MICROTENDIPES SP.	143	431	1.1	4745	2876	13.3
PARACHIRONOMUS ABORTIVUS	35	0	<0.1	0	35	<0.1
POLYPEDILUM CONVICTUM	35	107	0.3	178	178	0.6
POLYPEDILUM NR. SCALAENUM	0	72	0.1	216	35	0.4
RHEOTANYTARSUS SPP.	4926	4710	18.3	2121	4747	12.0
STENOCHIRONOMUS SP.	0	35	<0.1	0	0	0.0
TANYTARSUS SPP.	71	143	0.4	755	1546	4.0
ZAVRELIA GR.	35	0	<0.1	575	791	2.4
SYMPOTTHASTIA SP.	0	0	0.0	35	0	<0.1
ORTHOCLADIINAE	0	0	0.0	71	35	0.2
CORYNONEURA SPP.	35	107	0.3	0	215	0.4
CRICOTOPUS SPP.	971	1115	4.0	466	683	2.0
CRICOTOPUS BICINCTUS	466	468	1.8	179	178	0.6
EUKIEFFERIELLA SPP.	216	0	0.4	0	0	0.0
EUKIEFFERIELLA COERULESCENS GR.	72	0	0.1	0	0	0.0
NANOCLADIUS SPP.	0	107	0.2	322	429	1.3
THIENEMANNIELLA SPP.	0	35	<0.1	35	0	<0.1
TVETENIA DISCOLORIPES GR.	324	107	0.8	35	0	<0.1
HELISOMA SP.	0	0	0.0	2	0	<0.1
FERRISSIA SP.	23	58	0.2	17	40	<0.1
PISIDIUM SP.	20	12	<0.1	60	40	0.2
SPHAERIUM SPP.	73	152	0.4	190	158	0.6

Table 4.2-15

Benthic macroinvertebrates collected in dome samples at SSES (SS) and Bell Bend (BB) on the Susquehanna River, 1975-84. An asterisk (*) denotes macroinvertebrates collected or identified for the first time in 1984.

	SS	BB
Coelenterata		
Hydroida		
Hydridae		
Hydra sp.	X	X
Platyhelminthes		
Turbellaria		
Alloeocoela	X	X
Tricladida	X	X
Nemertinea		
Tetrastemmatidae		
Prostoma sp.	X	X
Nematoda	X	X
Entoprocta		
Urnatella gracilis	X	X
Annelida		
Oligochaeta		
Lumbricidae	X	
Naididae		
Nais behningi	X	X
N. bretscheri	X	X
N. communis	X	X
N. elinguis	X	
N. pardalis	X	
N. simplex	X	X
Nais spp.	X	X
Piguetiella michiganensis	X	X
Slavina appendiculata	X	X
Tubificidae		
Aulodrilus limnobius	X	
Bothrioneurum vejdovskyanum	X *	X*
Isochaetides freyi	X *	
Limnodrilus hoffmeisteri	X	X
Quistadrilus multisetosus	X	X
Lumbriculidae		
Lumbriculus sp.	X	X
Stylodrilus heringianus	X	X
Hirudinea		
Glossiphoniidae		
Actinobdella inequiannulata		X
Erpobdellidae	X	
Arthropoda		
Crustacea		
Isopoda		
Asellus sp.	X	X
Amphipoda		
Crangonx sp.		X*
Gammarus sp.	X	X
Decapoda		
Astacidae	X	X
Insecta		
Collembola		
Isotomidae		
Isotomurus palustris	X	X
Plecoptera		
Nemouridae	X*	
Taeniopterygidae		
Strophopteryx fasciata	X	
Taeniopteryx sp.	X	X
Leuctridae		
Leuctra sp.	X	X*
Perlidae		
Acroneuria abnormis	X	
A. lycorias	X	
Acroneuria spp.	X	X
Neoperla clymene	X	X
Neoperla sp.	X	X
Phasganophora capitata	X	X
Phasganophora sp.	X	X
Perlestà sp.	X	
Perlodidae	X	
Ephemeroptera		
Ephemeridae		
Ephemera sp.		X
Hexagenia limbata	X	X
Hexagenia sp.	X	X
Polymitarcidae		
Ephoron sp.	X	X
Potamanthidae		
Potamanthus spp.	X	X
Caenidae		
Caenis sp.	X	X
Tricorythidae		
Tricorythodes albilineatus gr.	X	
Tricorythodes sp.	X	X
Ephemerellidae		
Drunella cornutella	X	X
D. walkeri	X	X
Drunella spp.	X	X
Ephemerella dorothea	X	X
E. excrucians		X
E. invaria	X	X
E. needhami	X	
E. septentrionalis	X	
Ephemerella spp.	X	X
Eurylophella bicolor	X	X
E. coxalis		X
E. lutulenta		X
Eurylophella spp.	X	X
Serratella deficiens	X	X
S. sordida	X	
Serratella spp.	X	X
Leptophlebiidae		
Paraleptophlebia adoptiva		X
Paraleptophlebia sp.		X
Baetidae		
Baetis macdunnoughi		X
B. nr. *propinquus*	X	
B. tricaudatus	X	
Baetis spp.	X	X
Heterocloeon curiosum	X	
Pseudocloeon carolina	X	
Pseudocloeon sp.	X	X
Siphlonuridae		
Isonychia sp.	X	X
Heptageniidae		
Epeorus sp.	X	X
Heptagenia spp.	X	X
Rhithrogena sp.	X	X
Stenacron interpunctatum	X	X
Stenacron spp.	X	X
Stenonema ithaca	X	X
S. mediopunctatum	X	X
S. modestum	X	X
S. pulchellum	X	X
S. terminatum	X	X
S. vicarium	X	X
Stenonema spp.	X	X
Odonata		
Anisoptera		
Gomphidae		X*
Stylogomphus albistylus	X	
Zygoptera		
Coenagrionidae		
Argia sp.	X	X
Hemiptera		X
Veliidae		
Microvelia sp.	X	
Megaloptera		
Sialidae		
Sialis sp.	X	X
Corydalidae		
Chauliodes sp.	X	
Corydalus cornutus	X	
Corydalus sp.	X	X

	SS	BB
Trichoptera		
Glossosomatidae		
Agapetus sp.	X	
Glossosoma sp.	X	
Protoptila sp.	X	
Philopotamidae		
Chimarra obscura	X	X
Chimarra sp.	X	X
Polycentropodidae		
Neureclipsis sp.	X	X
Polycentropus sp.	X	X
Hydropsychidae		
Cheumatopsyche spp.	X	X
Hydropsyche bifida gr.	X	X
H. hageni	X	
H. morosa	X	X
H. phalerata	X	X
H. simulans	X	
H. sparna	X	
H. valanis	X	
Hydropsyche spp.	X	X
Macrostemum carolina	X	
M. zebratum	X	X
Macrostemum spp.	X	X
Hydroptilidae		
Agraylea sp.	X	
Hydroptila sp.	X	X
Ochrotrichia sp.	X	
Phryganeidae		
Ptilostomis sp.	X	
Leptoceridae		
Ceraclea alagma	X	X
C. ancylus	X	X *
C. flava	X	X
C. maculata	X	X
C. mentiea	X	X
C. neffi	X	X
C. nepha	X	X
C. tarsipunctata	X	X
Ceraclea sp. #1	X	X
Ceraclea spp.	X	X
Mystacides nr. *alafimbriata*		X
Mystacides spp.	X	X
Nectopsyche sp.	X	X
Oecetis avara	X	X
O. cinerascens	X	X
O. inconspicua	X	X
O. nocturna		X
Oecetis spp.	X	X
Lepidostomatidae		
Lepidostoma sp.	X	X
Lepidoptera	X	X
Noctuidae	X	
Coleoptera		
Gyrinidae	X	X
Dineutus sp.		X
Hydrophilidae	X	X
Berosus sp.	X	X
Psephenidae		
Psephenus herricki	X	
Psephenus sp.	X	X
Elmidae		
Dubiraphia vittata	X	X
Dubiraphia sp.	X	X
Macronychus sp.	X	
Optioservus trivittatus	X	
Optioservus sp.	X	X
Stenelmis bicarinata	X	X
S. mera	X	
Stenelmis spp.	X	X
Diptera		
Tipulidae	X	X
Antocha saxicola	X	X
Antocha sp.	X	X
Hexatoma sp.	X	
Psychodidae		X
Simuliidae	X	X
Simulium spp.	X	X

	SS	BB
Diptera (cont.)		
Tabanidae	X	X
Athericidae		
Atherix sp.	X	
Empididae	X	X
Hemerodromia spp.	X	X
Ceratopogonidae	X	X
Chironomidae		
Tanypodinae		
Ablabesmyia mallochi	X	X
A. ornata	X	X
A. peleensis	X	
A. rhamphe	X	X
Ablabesmyia spp.	X	X
Labrundinia sp.	X	X
Macropelopia sp.	X	
Nilotanypus sp.	X	X
Procladius sp.	X	X
Psectrotanypus sp.	X	
Thienemannimyia gr.	X	X
Chironominae		
Chironomus decorus gr.		X
Chironomus spp.	X	X
Cryptochironomus blarina	X	X
C. fulvus gr.	X	X
Cryptochironomus spp.	X	X
Demicryptochironomus sp.		X
Dicrotendipes neomodestus	X	X
Dicrotendipes spp.	X	X
Endochironomus nigricans	X	X
Endochironomus sp.	X	X
Glyptotendipes sp.	X	X
Harnischia gr.		X
Microtendipes sp.	X	X
Nilothauma sp.		X
Parachironomus abortivus	X	X
P. carinatus	X	X
P. frequens	X	X
Parachironomus spp.	X	X
Paralauterborniella elachista	X	
Phaenopsectra sp.	X	X
Polypedilum convictum	X	X
P. fallax gr.	X	X
P. illinoense	X	
P. nr. *scalaenum*	X	X
Polypedilum spp.	X	X
Rheotanytarsus distincticsimus gr.	X	X
R. exiguus gr.	X	X
Rheotanytarsus spp.	X	X
Stenochironomus sp.	X	
Stictochironomus sp.		X
Tanytarsus coffmani	X	
Tanytarsus spp.	X	X
Tribelos fuscicornis	X	X
T. jucundus	X	X
Zavrelia gr.	X	X
Diamesinae		
Diamesa sp.		X
Pseudodiamesa sp.	X	
Sympotthastia sp.	X	X
Orthocladiinae		
Brillia sp.	X	
Cardiocladius sp.	X	
Corynoneura celeripes	X	X
C. taris	X	X
Corynoneura spp.	X	X
Cricotopus bicinctus	X	X
C. tremulus	X	X
Cricotopus spp.	X	X
Eukiefferiella coerulescens gr.	X *	
Eukiefferiella spp.	X	
Heterotrissocladius gr.	X	X
Nanocladius spp.	X	X
Orthocladius sp.	X	X

	SS	BB
Orthocladiinae (cont.)		
Parametriocnemus sp.	X	X
Rheocricotopus spp.	X	X
Synorthocladius sp.	X	X
Thienemanniella spp.	X	X
Tvetenia bavarica gr.	X	X
T. discoloripes gr.	X	X
Tvetenia spp.	X	X
Mollusca		
Gastropoda		
Physidae		
Physa sp.	X	X
Lymnaeidae		
Lymnaea sp.	X	X
Planorbidae		
Gyraulus sp.	X	X
Helisoma ancepts	X	
Helisoma sp.	X	X
Ancylidae		
Ferrissia sp.	X	X
Pleuroceridae		
Goniobasis virginica	X	
Pelecypoda		
Sphaeriidae		
Pisidium casertanum	X	X
Pisidium sp.	X	X
Sphaerium transversum	X	X
Sphaerium spp.	X	X
Unionidae		X

Table 4.2-16

Dry weight (g/m^2) and percent total of major groups of benthic macroinvertebrates collected in two dome samples at each station on the Susquehanna River in June and October, 1984.

SITE TAXA	JUN		OCT		MEAN	
	G/M²	% TOTAL	G/M²	% TOTAL	G/M²	% TOTAL
SSES						
OLIGOCHAETA	0.2	19.6	<0.1	0.5	0.1	3.4
EPHEMEROPTERA	0.6	62.8	0.9	16.1	0.8	23.3
TRICHOPTERA	0.1	13.0	4.1	75.4	2.1	65.7
DIPTERA	<0.1	1.4	<0.1	0.9	<0.1	1.0
OTHER	<0.1	3.2	0.4	7.1	0.2	6.6
TOTAL	1.0		5.5		3.2	
BELL BEND						
OLIGOCHAETA	<0.1	4.0	<0.1	0.9	<0.1	1.4
EPHEMEROPTERA	0.5	86.2	0.8	28.8	0.6	38.2
TRICHOPTERA	<0.1	1.1	1.7	61.7	0.9	51.8
DIPTERA	<0.1	4.4	0.1	4.5	<0.1	4.5
OTHER	<0.1	4.3	0.1	4.1	<0.1	4.1
TOTAL	0.5		2.8		1.7	
COMBINED						
OLIGOCHAETA	0.1	14.1	<0.1	0.6	<0.1	2.7
EPHEMEROPTERA	0.6	71.1	0.8	20.4	0.7	28.4
TRICHOPTERA	<0.1	8.8	2.9	70.7	1.5	61.0
DIPTERA	<0.1	2.5	<0.1	2.1	<0.1	2.2
OTHER	<0.1	3.5	0.3	6.2	0.1	5.7
TOTAL	0.8		4.1		2.5	

Table 4.2-17

Mean dry weight of benthic macroinvertebrates (g/m^2) collected with a dome sampler at SSES and Bell Bend on the Susquehanna River in June and October, 1978-84.

YEAR	JUN			OCT			MEAN
	SSES	BELL BEND	COMBINED	SSES	BELL BEND	COMBINED	
1978	0.8	0.5	0.7	3.9	1.0	2.4	1.6
1979	0.5	0.7	0.6	8.5	2.9	5.7	3.2
1980	1.3	1.5	1.4	4.6	1.6	3.1	2.2
1981	2.7	1.1	1.9	4.5	2.2	3.4	2.6
1982	2.7	1.4	2.0	9.7	2.4	6.0	4.0
1983	2.1	1.4	1.8	6.6	2.3	4.5	3.1
MEAN (1978-83)	1.7	1.1	1.4	6.3	2.1	4.2	2.8
1984	1.0	0.5	0.8	5.5	2.8	4.1	2.5

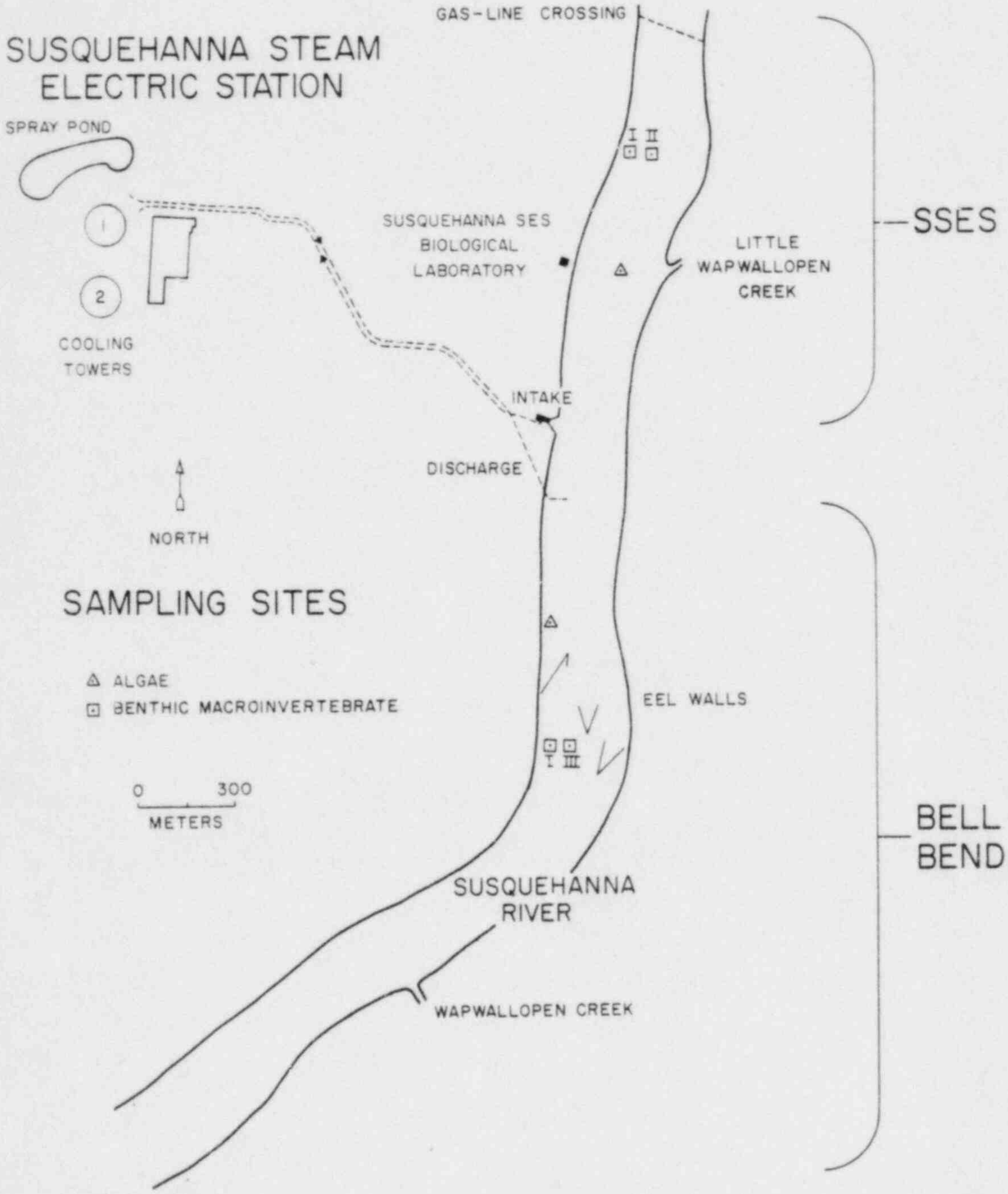

Fig. 4.2-1

Algae and benthic macroinvertebrate sampling sites at SSES and Bell Bend on the Susquehanna River, 1984.

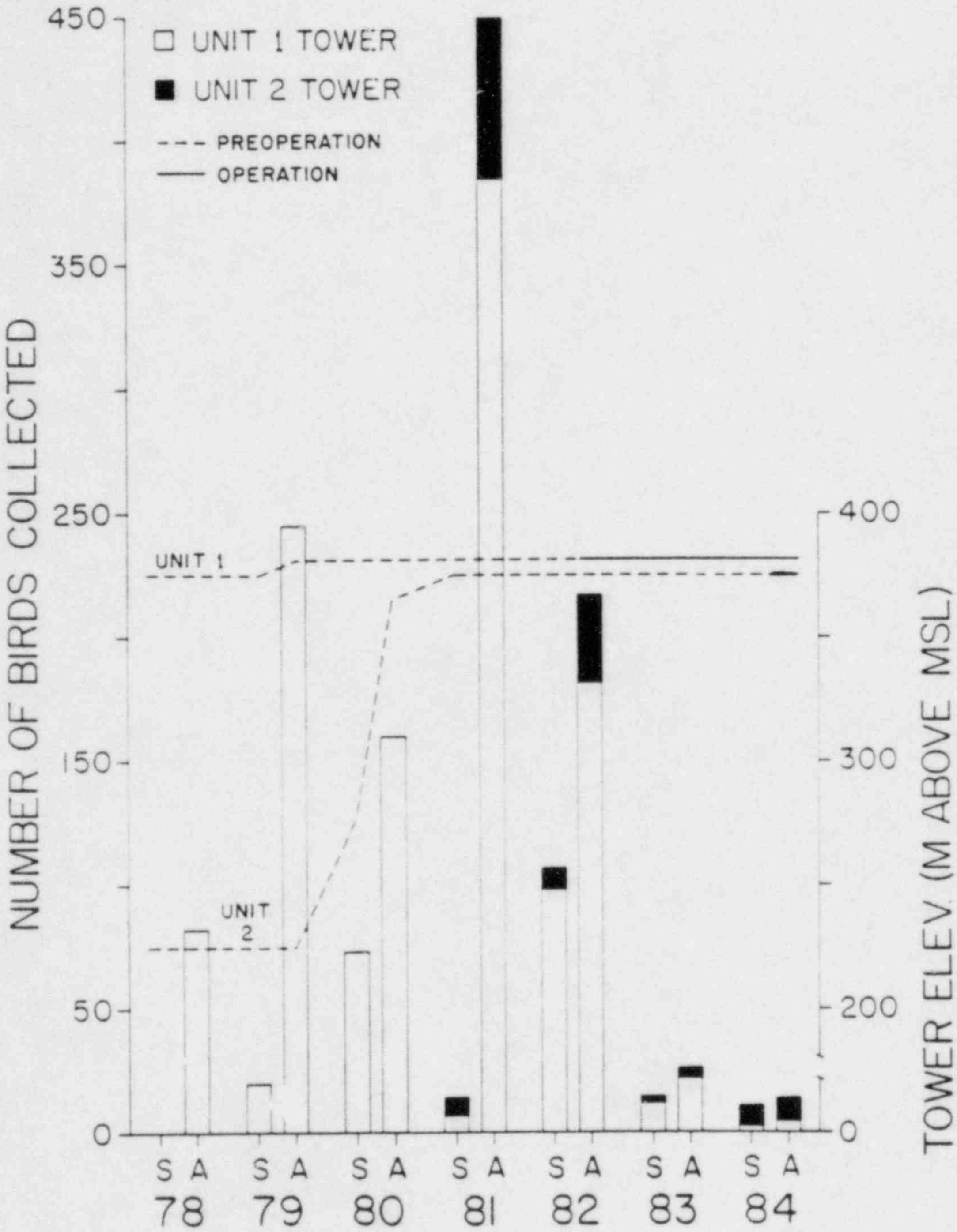

Fig. 4.2-2

Total number of impacted birds collected at the Unit 1 and 2 cooling towers of the Susquehanna SES during spring and autumn migrations from 1978 through 1984 with the elevation of each tower during the same period. No data were collected at the Unit 1 tower before autumn 1978 and at the Unit 2 tower before spring 1981.

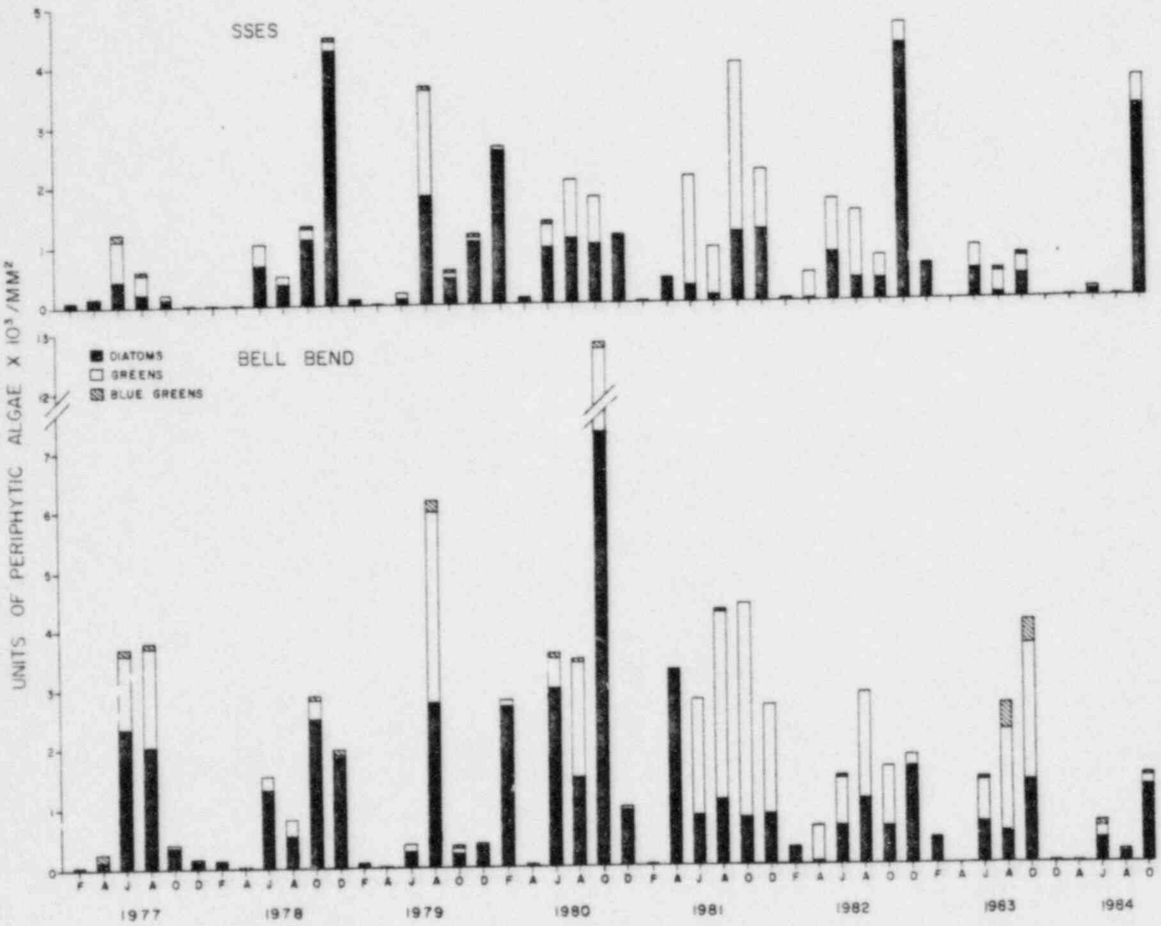

Fig. 4.2-3

Standing crop of periphytic algae (units/mm^2) on cumulative acrylic plates at SSES and Bell Bend on the Susquehanna River, 1977-84.

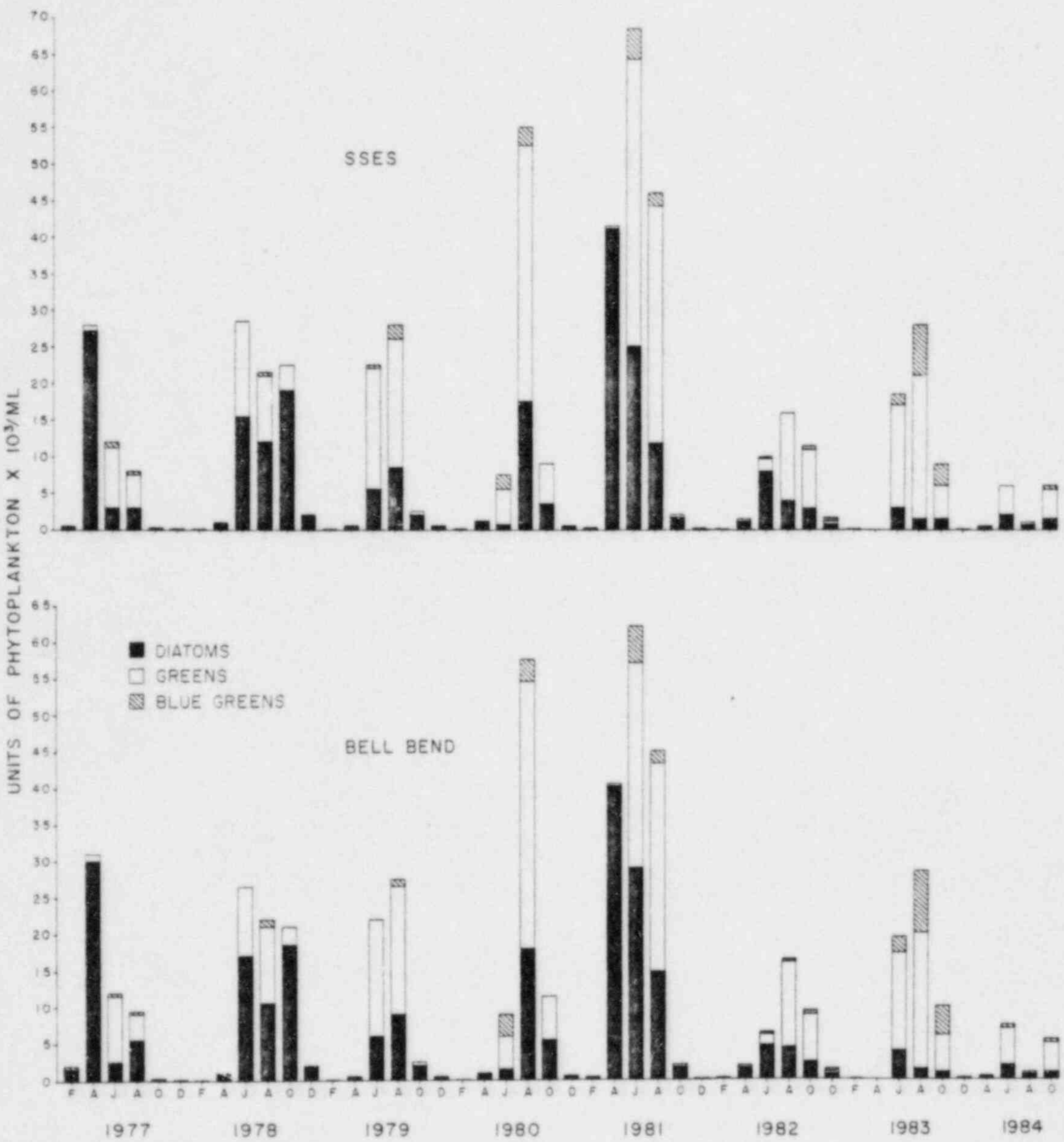

Fig. 4.2-4

Standing crop of phytoplankton (units/ml) from bimonthly samples taken at SSES and Bell Bend on the Susquehanna River, 1977-84.

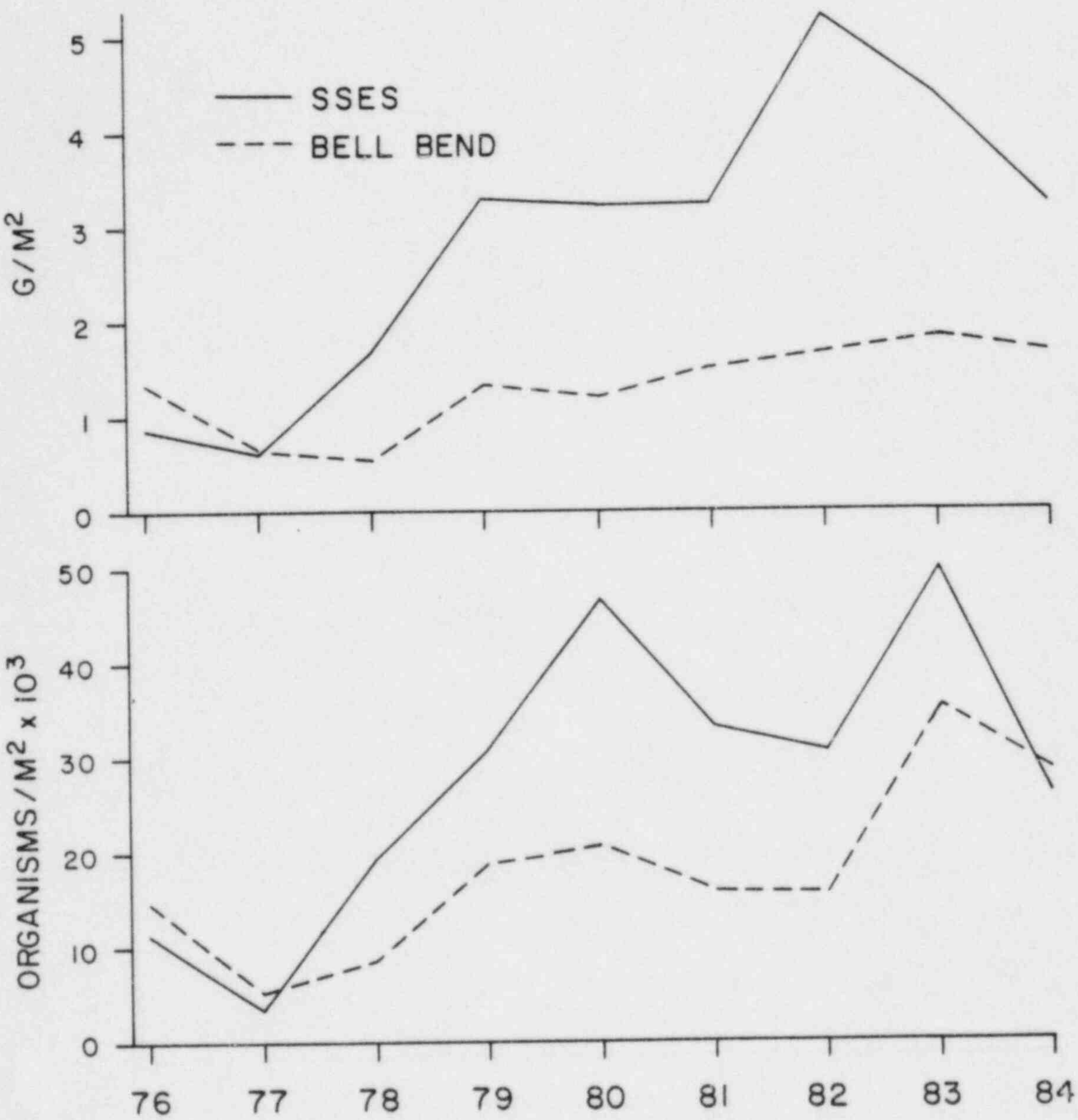

Fig. 4.2-5

Annual mean biomass (g/m²) and density (org/m²) of benthic macroinvertebrates at SSES and Bell Bend on the Susquehanna River, 1976-84. The 1983 and 1984 means are based on June and October samples.

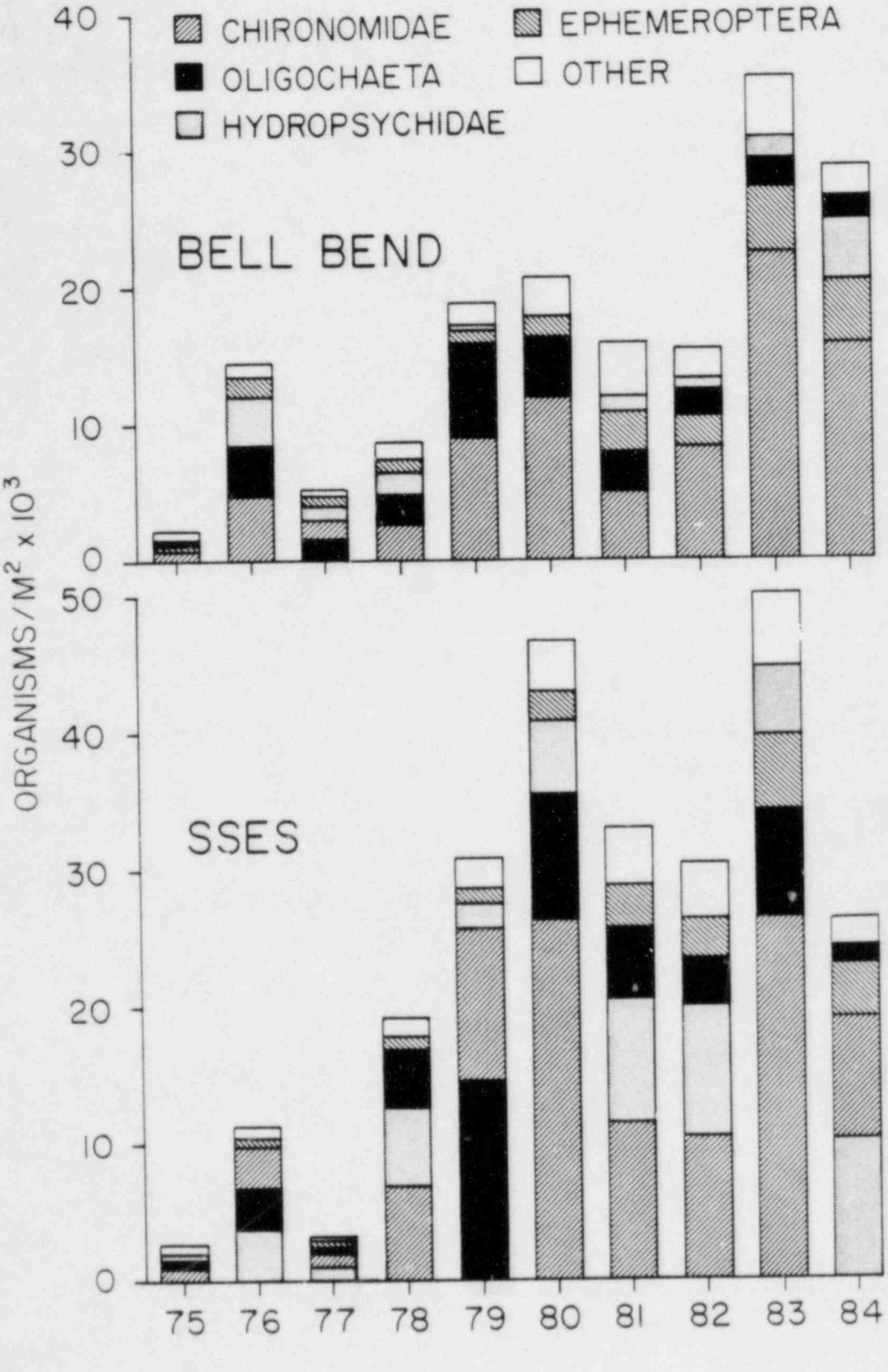

Fig. 4.2-6

Annual mean density (org/m^2) of benthic macroinvertebrates at SSES and Bell Bend on the Susquehanna River, 1975-84. At Bell Bend, only site I was sampled from 1975-77.

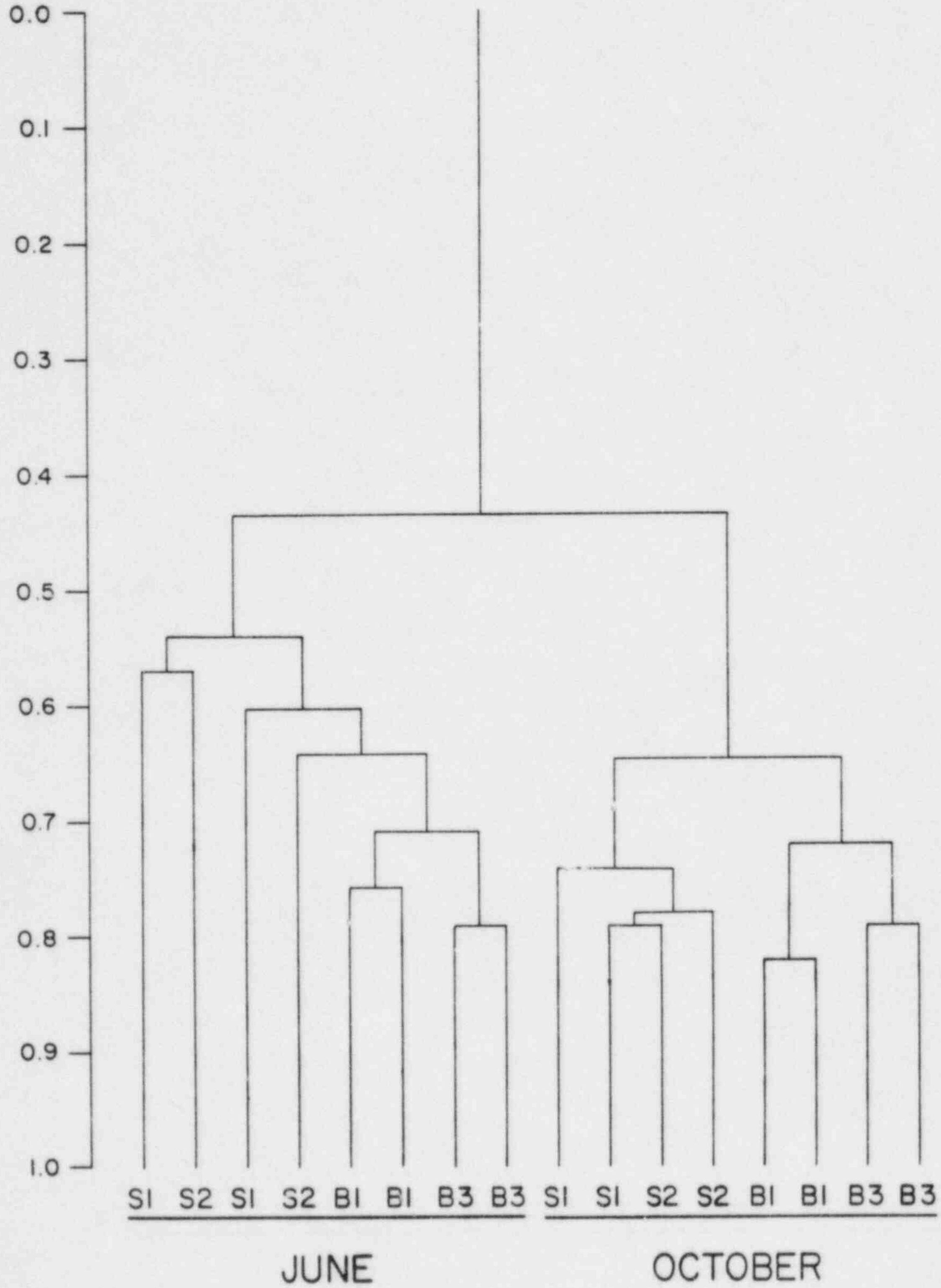

Fig. 4.2-7

Dendrogram of the cluster analysis of Bray-Curtis similarity matrices for 1984 benthic macroinvertebrate data at SSES I (S1), SSES II (S2), Bell Bend I (B1), and Bell Bend III (B3) on the Susquehanna River in June and October 1984.

5.0 ADMINISTRATIVE PROCEDURES

5.1 REVIEW AND AUDIT

The Licensee has established procedures for an independent group to review and audit compliance with the EPP. Audits of EPP compliance were conducted by the Nuclear Quality Assurance Department with support from the Environmental Management Department in 1984. All findings identified were satisfactorily resolved and did not indicate a significant deterioration of the activities being audited.

The Manager-Nuclear Support is responsible for off-site environmental matters and for providing any related support concerning licensing. In addition, the Superintendent of Plant-Susquehanna is responsible for on-site environmental matters. The Manager-Nuclear Quality Assurance with support from the Supervisor-Environmental Planning/Auditing is responsible for verifying compliance with the EPP. Figure 5.1-1, Auditing Organizational Chart, lists the various groups utilized in environmental reviewing and auditing of the Susquehanna SES Environmental Monitoring Programs.

5.2 RECORDS RETENTION

Records and logs relative to the environmental aspects of plant operation and audit activities are retained in the Susquehanna Records Management System. This system provides for a convenient review and inspection of environmental documents which shall be made available to the NRC upon request.

Records of modifications to the plant structures, systems and components determined to potentially affect the continued protection of the environment shall be retained for the life of the plant. All other records, data and logs relating to the environmental programs and monitoring shall be retained for five years or, where applicable, in accordance with the requirements of other agencies.

5.3 CHANGES IN ENVIRONMENTAL PROTECTION PLAN

There were no requests for changes in the EPP during 1984.

5.4 PLANT REPORTING REQUIREMENTS

5.4.1 ROUTINE REPORTS

This Annual Environmental Operating Report was prepared to meet routine reporting requirements of the EPP for 1984. This report provides summaries and analyses of environmental protection activities required in Subsection 4.2 of the EPP for the reporting period. Included in Subsection 4.2 of this report are environment comparisons with nonradiological preoperational studies, and an assessment of observed impacts of plant operation on the environment. During 1984, there were no significant effects or evidence of trends towards irreversible damage to the environment.

5.4.2 NONROUTINE REPORTS

All nonroutine events that were reportable during 1984 were reported to either federal, state or local agencies in accordance with their reporting requirements in lieu of requirements of Subsection 5.4.2 of the EPP. The NRC was provided with a copy of these reports.

FIGURE 5.1-1

AUDITING ORGANIZATION CHART

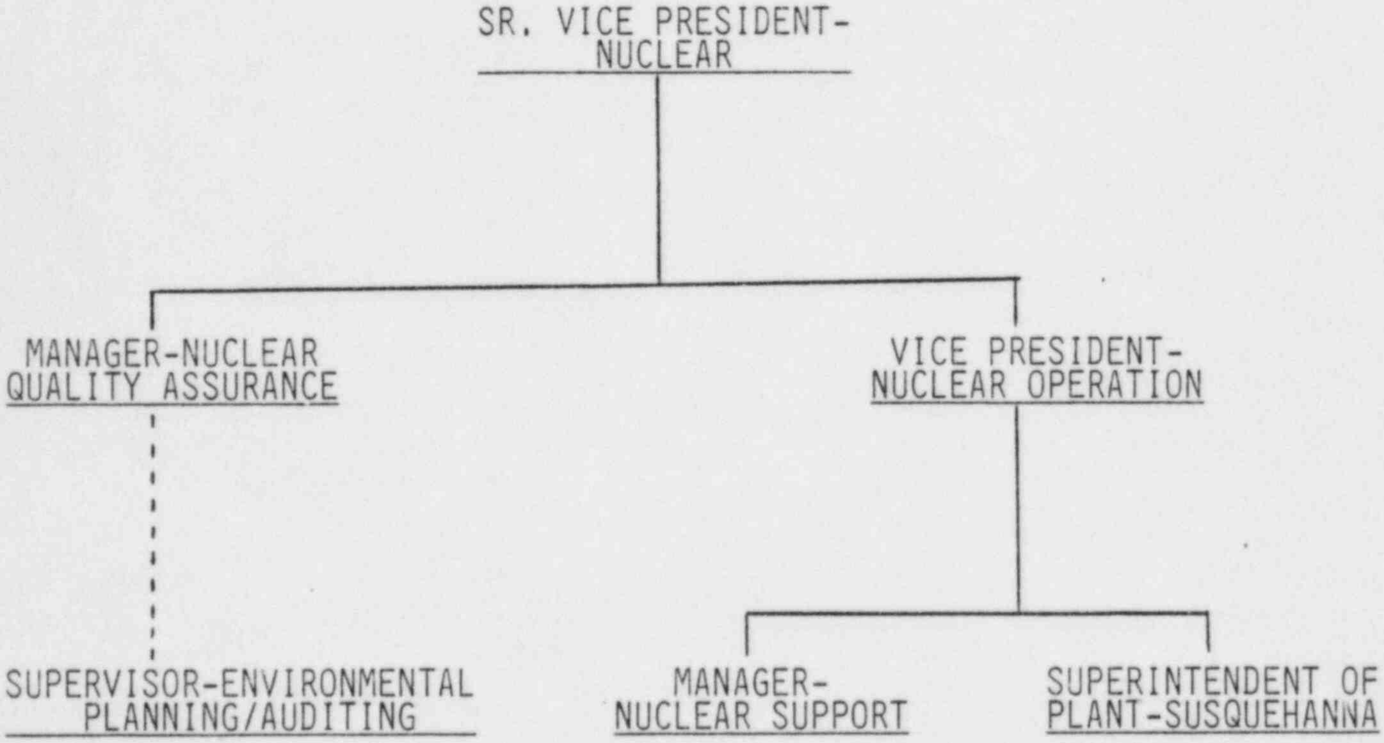

EXHIBIT 1

- Shad Impingement Survey

ICHTHYOLOGICAL ASSOCIATES, INC.

SUSQUEHANNA SES BIOLOGICAL LABORATORY

HOMA, JR.
President

301 Forest Drive
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THEODORE V. JACOBSEN, M.S.
Vice-President and Project Director

WILLIAM F. GALE, Ph.D.
Aquatic Research Director

JAMES D. MONTGOMERY, Ph.D.
Terrestrial Research Director

WILLIAM G. DEUTSCH, M.S.
Research Coordinator

23 October 1984

Richard St. Pierre
U.S. Fish & Wildlife Service
PO Box 1673
Harrisburg, PA 17105-1673

Dear Dick:

No juvenile American shad were collected during surveys of the intake screens at the Susquehanna Steam Electric Station (4 Sep-12 Oct) and the Hunlock Steam Electric Station (24 Aug-12 Oct). Personnel from Ichthyological Associates conducted the survey at the Susquehanna SES and plant staff from UGI monitored their own screens at the Hunlock SES. At Susquehanna, screen checks were made once each day, Monday through Friday (washes from Saturday and Sunday were included in the Monday wash). At Hunlock, checks were made daily.

Unfortunately, routine maintenance at both generating stations conflicted with the survey this year. PP&L removed silt from the intake bays at the Susquehanna SES from 4 through 17 September. During this period, the station was on-line and river water was drawn through the screens, but screen washes were not done daily. In addition, our sampling baskets twisted during the washes which may have reduced sampling efficiency. The Hunlock SES was off-line from 5 September through 12 October when only a fraction of the on-line amount of river water was drawn through the screens. Because of these situations, it is doubtful that many juvenile shad would have been collected even if they were very abundant in this stretch of the Susquehanna River.

If you have any questions or comments, please contact me at your convenience.

Respectfully yours,

T. V. Jacobsen

Theodore V. Jacobsen,
Project Director

TVJ/msh

copy to: J. S. Fields
T. Robbins

EXHIBIT 2

- Sound Level Measurements Near Susquehanna Steam Electric Station Site 1984

Bolt Beranek and Newman Inc.

Report No. 3024A-9

Sound Level Measurements Near Susquehanna Steam Electric Station Site 1984

Operation Noise Progress Report

J.D. Barnes and E.W. Wood

April 1985

Prepared for:
Pennsylvania Power and Light Company

Report No. 3024A-9

SOUND LEVEL MEASUREMENTS NEAR SUSQUEHANNA STEAM ELECTRIC STATION SITE 1984

Operation Noise Progress Report

J.D. Barnes and E.W. Wood

April 1985

Prepared by:

Bolt Beranek and Newman Inc.
10 Moulton Street
Cambridge, MA 02238

Prepared for:

Pennsylvania Power and Light Company
Two North Ninth Street
Allentown, PA 18101

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1. INTRODUCTION

Pennsylvania Power and Light Company (PPL) has sponsored an environmental noise monitoring program at the Susquehanna Steam Electric Station (Susquehanna SES) since 1972. This is the tenth report in the series of progress reports that present the results of the environmental noise measurements made in the vicinity of the site. The first seven reports in this series summarize the ambient and construction noise measurements in the years 1972 through 1981. The eighth report presents data obtained with Unit 1 in the operation phase and undergoing testing, and Unit 2 in the latter stages of construction; the ninth report contains the data collected with Unit 1 in operation and Unit 2 in the final stages of construction. This report summarizes the acoustic data and observations obtained with Unit 1 in operation and Unit 2 in the precommercial operation phase. Bolt Beranek and Newman Inc. (BBN) obtained these measurements during the week of 24-28 September 1984 to update the acoustic description of the community near the site and to provide sufficient data for the Susquehanna SES Annual Operating Report.

Similar to our procedures for conducting the previous surveys, BBN reviewed the community measurement locations to verify that they continue to represent the noise sensitive land uses in the areas near Susquehanna SES. The dominant noise sensitive land uses near the site remain rural and low density residential housing. The selected measurement locations considered the existing on-site and nearby off-site noise sources in addition to topographical barriers. For the purpose of satisfying the requirements of PPL's Environmental Protection Plan (EPP) Non-Radiological, dated 17 July 1982, BBN again selected three locations near the site for primary measurements and two locations farther from the site for secondary measurements. In

addition to EPP requirements, five locations distant from the site that were employed in previous surveys were also retained for supplemental measurements.

Unit 1 operated at 87% - 100% and Unit 2 at 48% - 98% of rated load during the week of 24-28 September 1984. The Unit 1 cooling tower water flow rate during the survey was approximately 7000 gpm, with the Unit 2 cooling tower water flow rate less than that figure during lower load operation.

Construction of Unit 1 was 100% complete and Unit 2 was 99% complete with commercial operation scheduled for early 1985. Approximately 100 construction people from outside contractors were working on first shift and none on second or third shifts. Site work outdoors included minor earthmoving on the east and south sides of the plant. Indoor work involved mostly PPL employees performing final work on Unit 2.

A total of 1000 people are employed for the operation of Units 1 and 2. This total includes office and administration, plant operation, and security personnel. This number is expected to increase by about 1000 people during times of scheduled outages, which may last 2 to 3 months. Other than the construction work described above, little outdoor activity was observed by the measurement team during the survey period.

The weather conditions varied during the measurement period with generally clear or light overcast skies, daytime temperatures of 75° to 80°F and light breezes early in the week, yielding to cooler and breezier weather and cloudy skies later in the week and with intermittent light rain on Thursday night (27 - 28 September 1984).

Figure 1 illustrates the current primary and secondary measurement locations near the site. A photo of the main power

block, taken in August 1984 with Unit 1 in operation and Unit 2 in precommercial operation is presented in Fig. 2.

The field measurement and calibration techniques employed in the September 1984 survey were similar to those used in the 1982 and 1983 surveys. Table 1 lists the measurement instruments that the field team used for the 1984 survey and includes their latest laboratory calibration dates. These instruments were selected to be appropriate for the required field measurements. They conform to applicable standards issued by the American National Standards Institute[1,2] (ANSI) and meet the Society of Automotive Engineers[3] (SAE) recommended sound data acquisition requirements. Acoustic calibrations that are performed periodically in the laboratory are traceable to the National Bureau of Standards (NBS). Figure 3 in our previous report[4] summarizes the overall check and calibration procedures that are used for each instrument.

At each primary location, the field team obtained 24-hour measurements with a continuous sound level monitoring system. The team also performed hand-held measurements at the primary locations, as well as the secondary locations. These hand-held measurements involved tape recording the sound, noting the audible sound sources, and observing the weather conditions

[1]ANSI S1.4 - 1971 (R1983) American National Standard for Sound Level Meters.

[2]ANSI S1.11 - 1966 (R1976) American National Standard Specification for Octave, Half-Octave, and Third-Octave Band Filter Sets.

[3]SAE J184A-1970 (R1978) Qualifying a Sound Data Acquisition System.

[4]"Sound Level Measurements Near Susquehanna Steam Electric Station Site 1983," BBN Report No. 3024A-8, April 1984.

audible sound sources, and observing the weather conditions during each sampling period at the selected locations. Each sampling period was approximately ten minutes long. After returning from the field, the measurement team analyzed the tape recordings to yield narrowband and octave band sound pressure level and A-weighted sound level data for each time period. In addition to collecting data at the primary and secondary locations, the field team obtained supplemental hand-held tape recordings and observations at the five locations more distant from Susquehanna SES, illustrated in Fig. M-1 in Appendix M. The following sections present the results of the sound level measurements.

2. SOUND LEVEL MEASUREMENTS AT PRIMARY AND SECONDARY LOCATIONS

The field team obtained continuous sound level measurements during 24-hr periods in the community at the primary locations 2', 3, and 4 shown in Fig. 1. The sound levels and sound sources noted during the 1984 survey are similar to those identified in the previous year's survey. Table II summarizes the sound level data collected at these locations and presents the L_{90}, L_{10}, L_{eq} and range of sound levels for the daytime and nighttime periods. The notes below the table explain the various sound level descriptors and how the data were averaged. The daytime L_{eq} sound levels at these locations ranged from 40 dB(A) to 50 dB(A), while the nighttime L_{eq} values ranged from 37 dB(A) to 49 dB(A). The table also presents the 24-hr L_{eq} and L_{dn} values and shows the 24-hr L_{eq} ranging from 41 dB(A) to 50 dB(A) and the L_{dn} values ranging from 45 dB(A) to 55 dB(A). The field measurement team observed that the background sound levels were generally controlled by off-site sources, such as insects, and that on-site sources, including transformers, backup alarms, and paging were sometimes audible. Appendix L identifies specific sound sources together with additional hand-held tape recorded data.

Figure 1 also shows the secondary measurement locations 5 and 7 where the field team obtained hand-held tape recorded data. These secondary locations are farther from Susquehanna SES than are the primary locations. Table III summarizes the secondary sound level measurements and includes notes on how the data were averaged. The daytime L_{eq} sound levels varied from 48 dB(A) at location 5 to 50 dB(A) at location 7, while the nighttime L_{eq} sound levels increased at location 5 to 56 dB(A) and decreased at location 7 to 45 dB(A). The 24-hr L_{eq} sound levels ranged from 52 dB(A) at location 5 to 49 dB(A) at location 7 and the L_{dn} sound levels were 61 dB(A) at location 5 and 53 dB(A) at location 7. The field team observed that local sound sources, including insects and traffic, generally controlled the background levels at these locations. The detailed data obtained from the tape

recordings and the field team's identification of sound sources are presented in Appendix L for these secondary measurement locations.

The field team also noted the tonal sounds produced by Susquehanna SES that were audible at off-site locations. The two sources identified during the survey include the transformers in the southwest switchyard and the cooling towers near the west side of the main plant. Figures 3-7 present A-weighted narrow-band sound pressure level data that were analyzed from selected nighttime tape recordings at the primary and secondary measurement locations. Figure 3 illustrates the tonal sounds at 97.5 and 107.5 Hz produced by the cooling towers and the tonal sounds at 120, 240, and 360 Hz produced by the transformers that were measured at location 2'. This year's on-site measurements aided in identifying the cooling towers as the sources of the low frequency tones. Figures 3-7 illustrate other tonal sounds, however, these were masked by other background sounds, such as insects, and were not noticeable to the field team during the survey.

3. SUPPLEMENTAL SOUND LEVEL MEASUREMENTS

During previous surveys at locations quite distant from the Susquehanna SES, the field team has conducted supplemental sound level measurements. These measurements were performed to increase the existing data base of background sound levels for locations up to five miles from the site. Figure M-1 in Appendix M shows the supplemental measurement locations where the field team obtained hand-held tape recordings. These recordings were for approximately ten minutes at each location. The sound pressure level data analyzed from the tapes, the field team's notes on sound sources, and a legend are also presented in Appendix M, in the same format as Appendix L.

4. ASSESSMENT

The field team contacted the PPL Special Office of the President in Berwick, PA, to identify and review any community complaints due to plant noise. The Office records indicated that no noise related complaints had been received to date during the operation of Unit 1 and precommercial operation of Unit 2 in 1984. Based upon this information, and our acoustic measurements and field observations, we find no reason to recommend additional noise control treatments at this time. We shall review and update this opinion following the completion of the survey that is scheduled for Fall 1985.

FIG. 1. MAP OF GENERAL AREA NEAR THE SUSQUEHANNA SES SITE SHOWING PRIMARY AND SECONDARY SOUND LEVEL MEASUREMENT LOCATIONS AND SITE PROPERTY LINE.

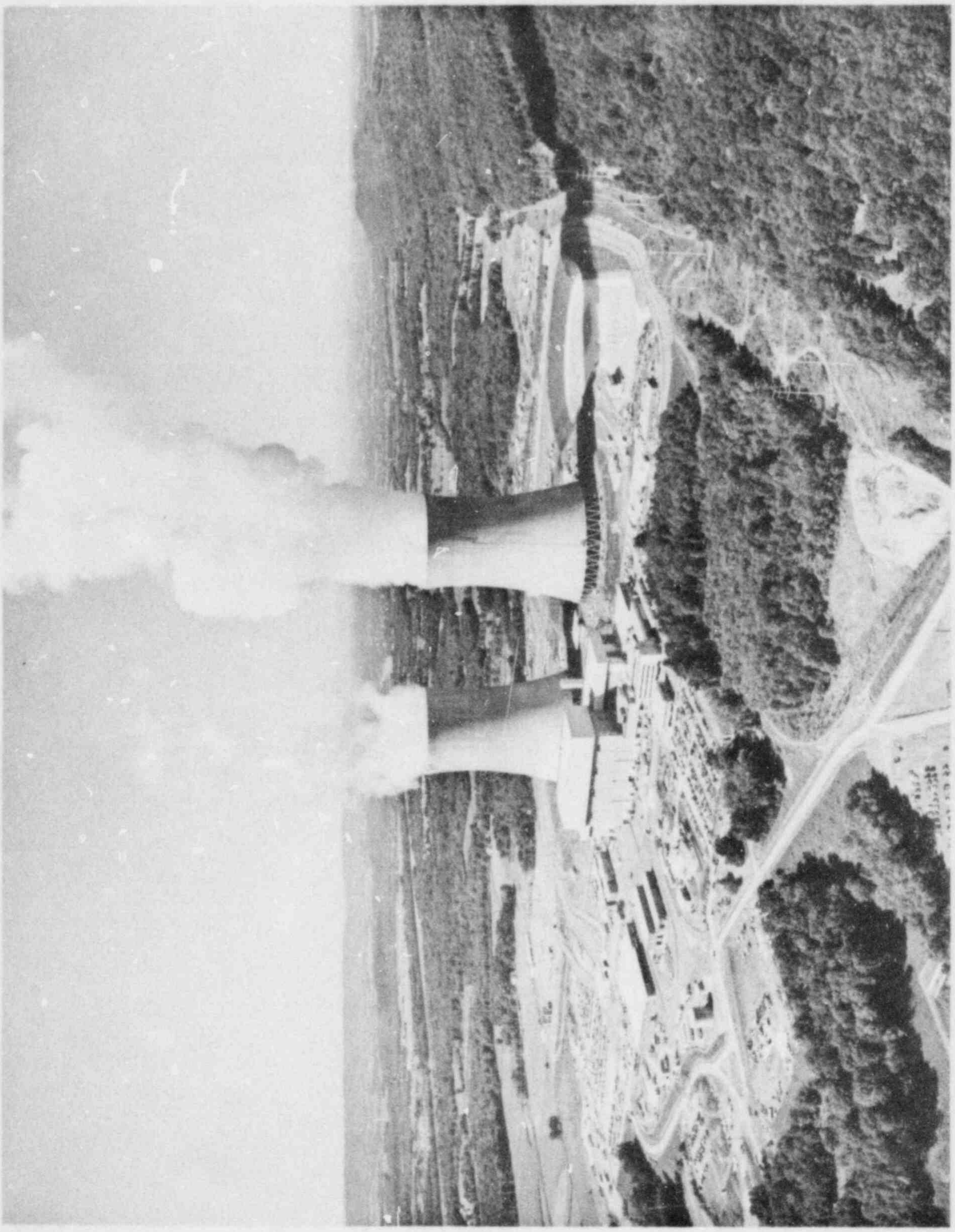

FIG. 2. PHOTOGRAPH OF MAIN STATION COMPLEX TAKEN IN AUGUST 1984.
VIEW LOOKING TO THE SOUTHWEST.

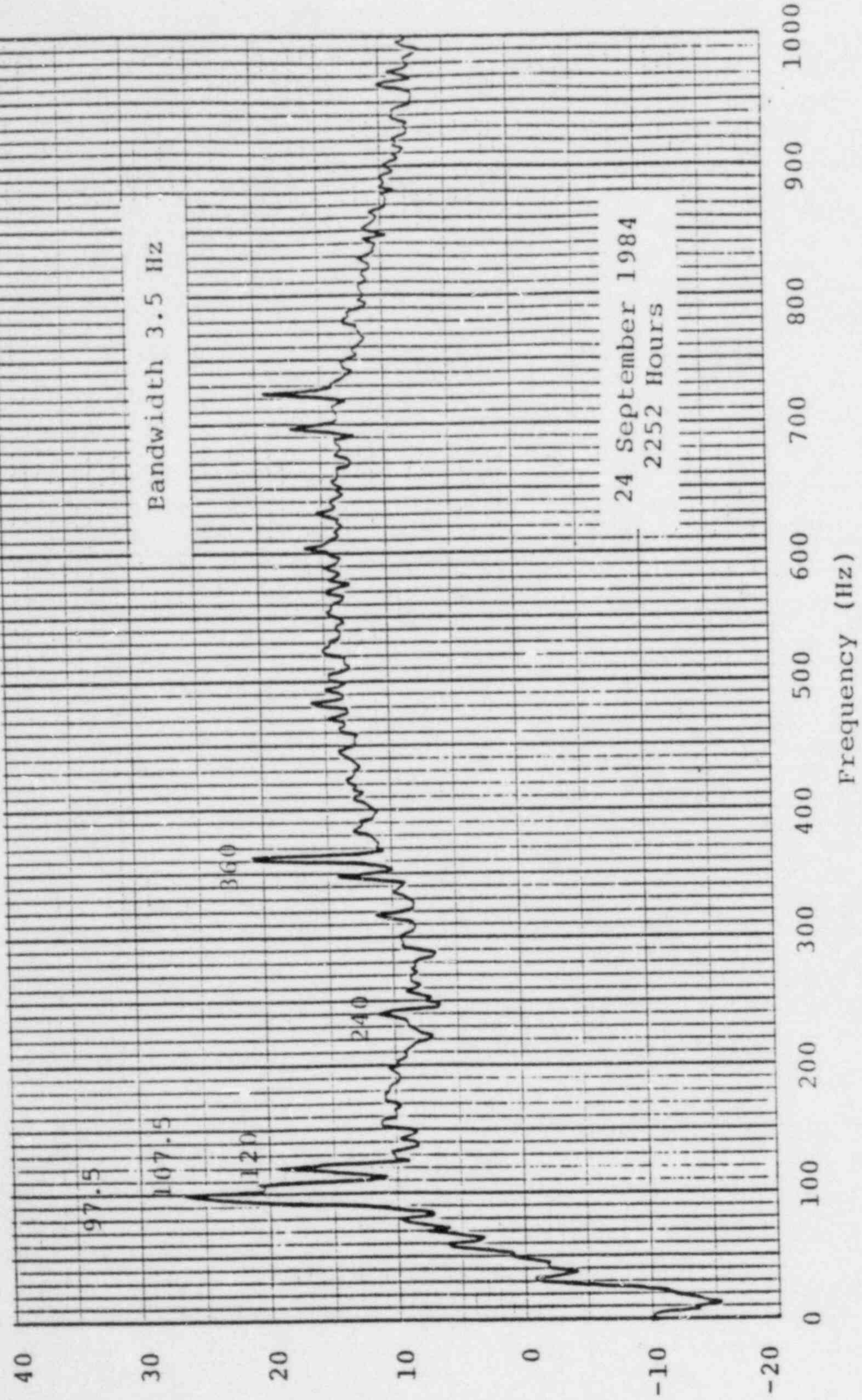

FIG. 3. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVELS (SPL) OBTAINED AT LOCATION 2' - 1984 OPERATION.

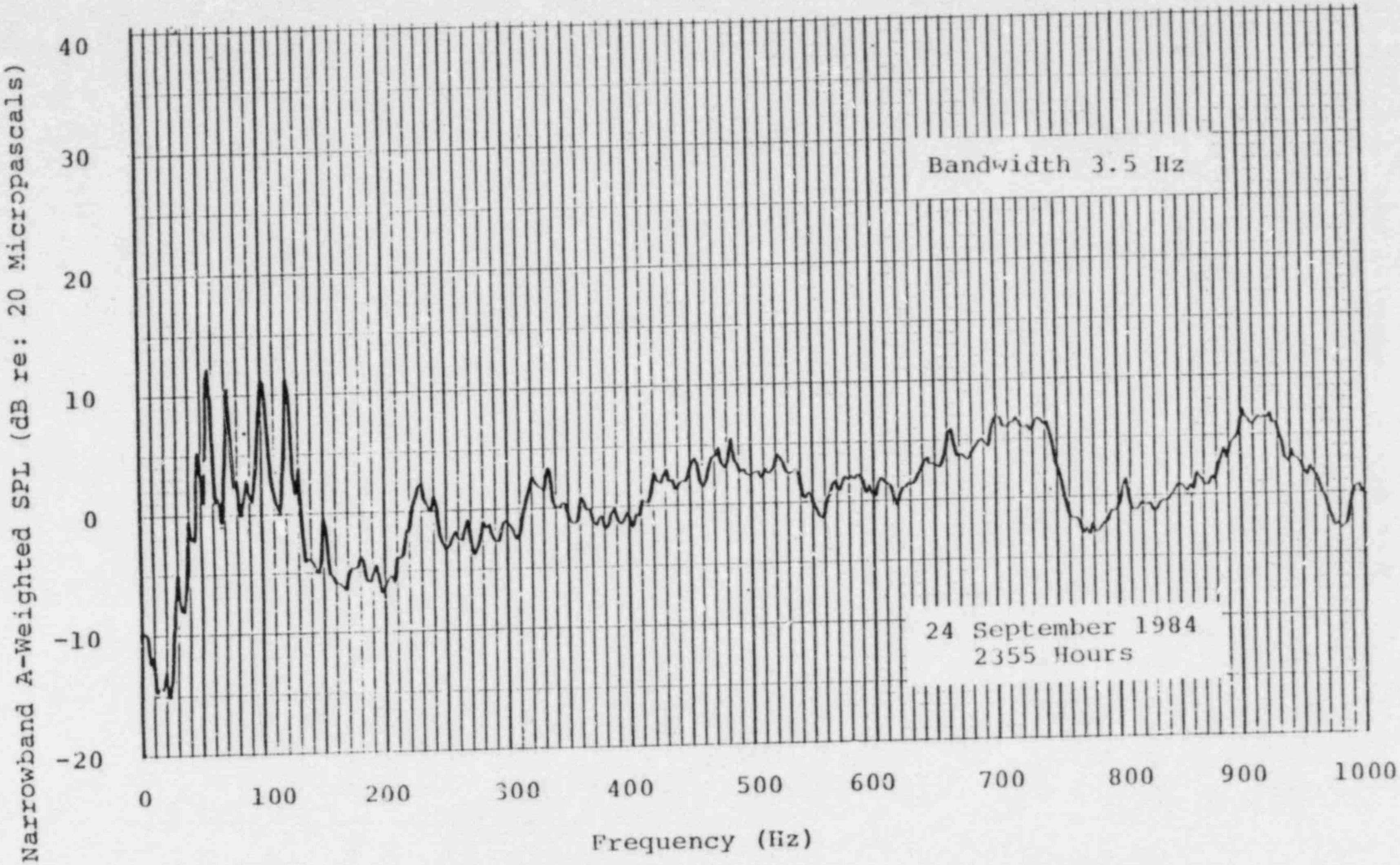

FIG. 4. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVELS (SPL) OBTAINED AT LOCATION 3 - 1984 OPERATION.

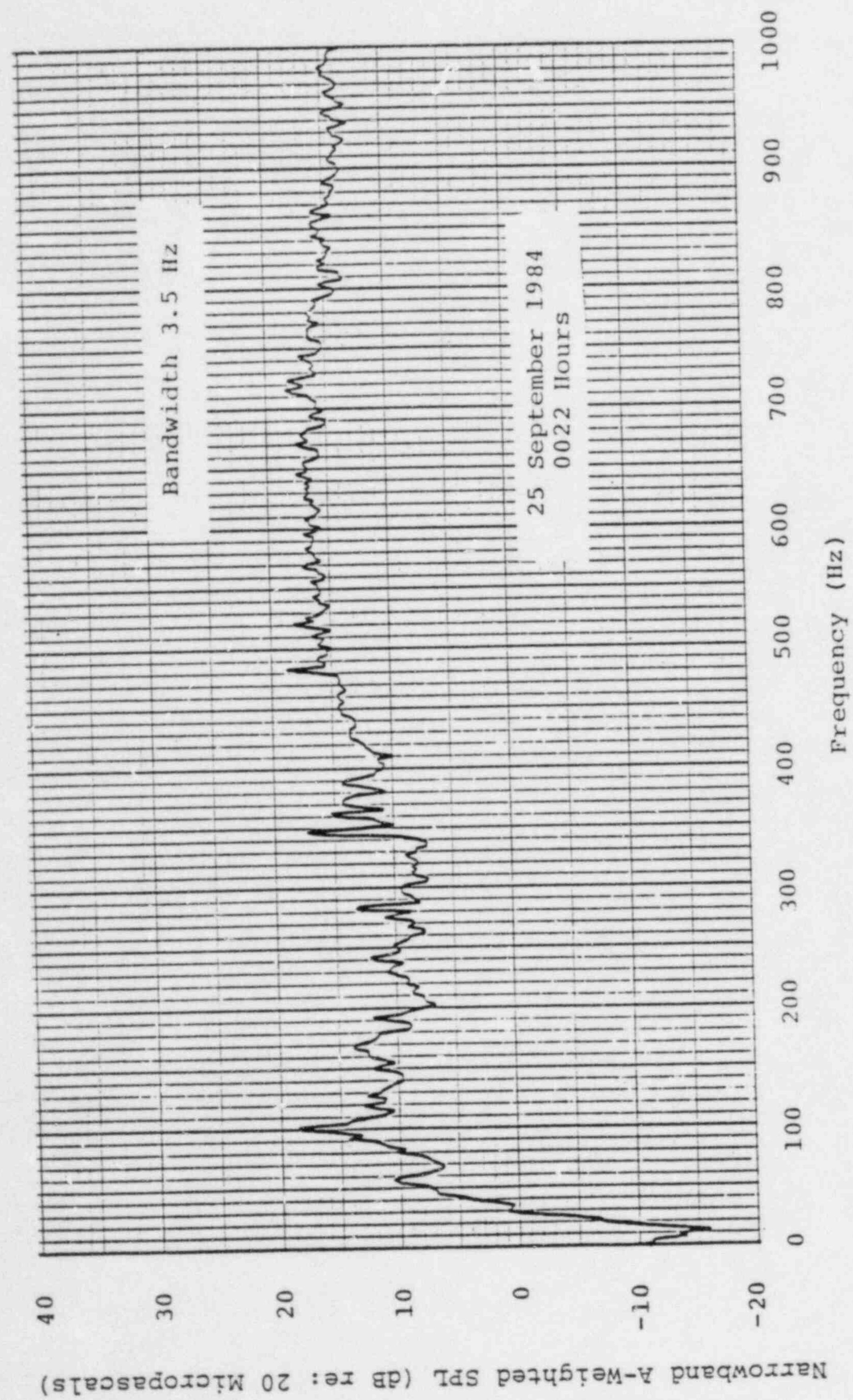

FIG. 5. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVELS (SPL) OBTAINED AT LOCATION 4 - 1984 OPERATION.

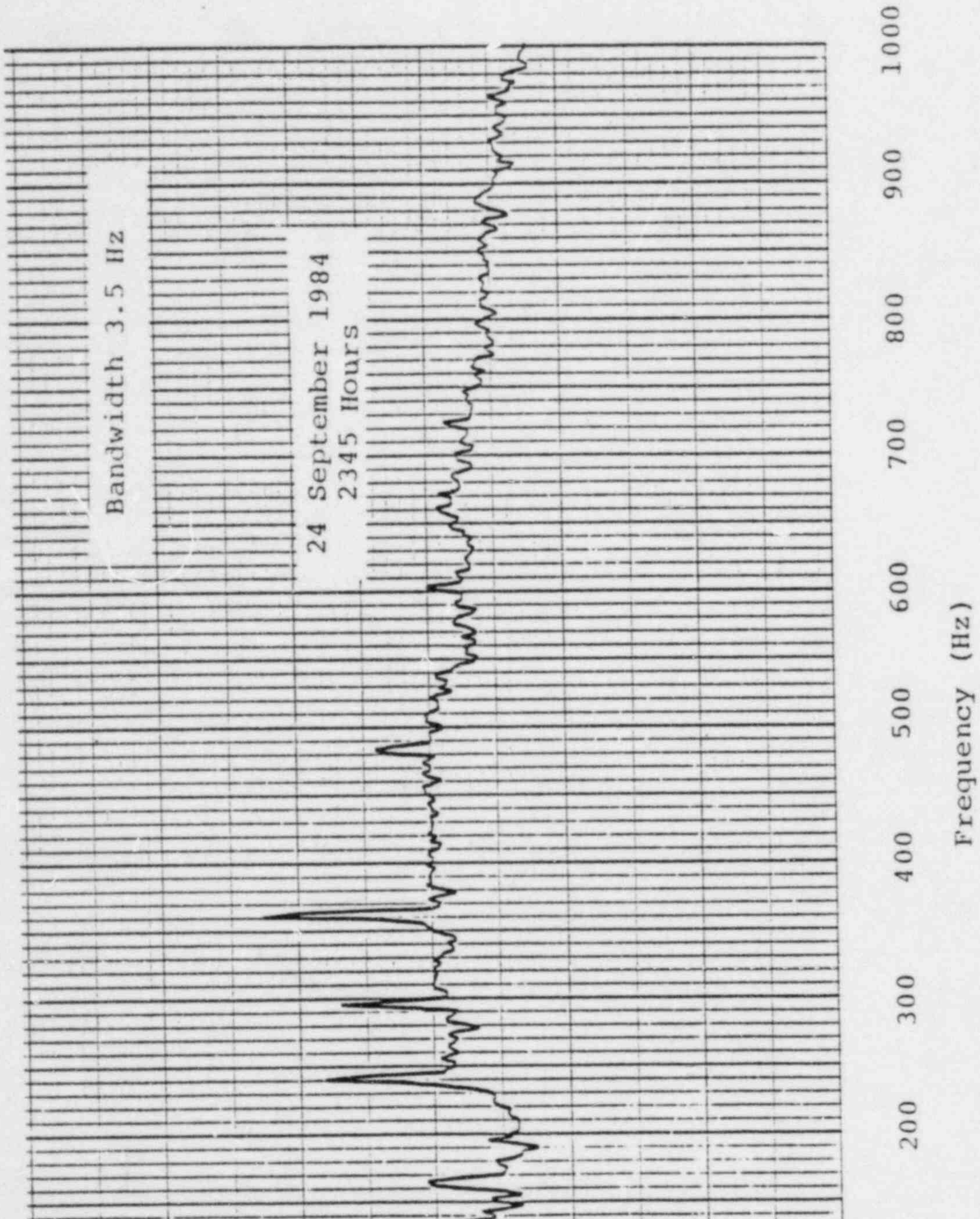

FIG. 6. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVELS (SPL) OBTAINED AT LOCATION 5 - 1984 OPERATION.

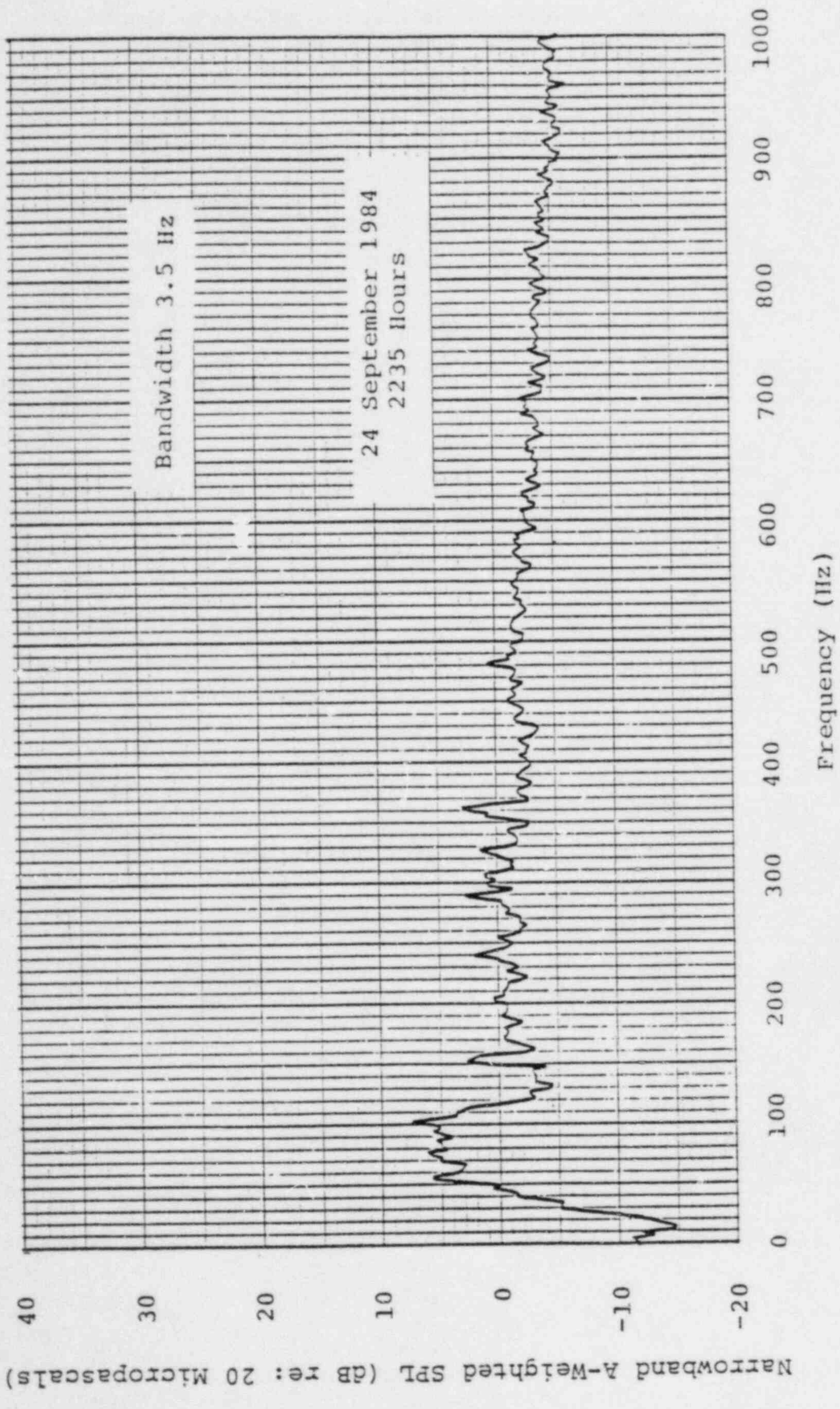

FIG. 7. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVELS (SPL) OBTAINED AT LOCATION 7 - 1984 OPERATION.

TABLE I. LIST OF INSTRUMENTS USED DURING TRIP SHOWING DATES OF LABORATORY CALIBRATION.

Date of Trip	Type*	Make†	Model	Serial Number	Typical Calibration Schedule	Date of Calibration Before Trip
9/24/84	SLM	BK	2203	96864	3 mos.	9/21/84
	OBF	BK	1613	83856	3 mos.	9/21/84
	PC	BK	4220	284859	3 mos.	8/23/84
	SLM	BK	2204	266518	3 mos.	7/19/84
	OBF	BK	1613	87967	3 mos.	7/19/84
to	PC	BK	4220	894102	3 mos.	7/19/84
	TR	KN	III	BH669164	3 mos.	8/08/84
	TR	KN	III	B621789	3 mos.	7/16/84
	PSMS	BBN	614	772022	6 mos.	8/23/84
9/28/84	ACAL	GR	1567	17866	3 mos.	8/22/84

*SLM - Sound Level Meter
OBF - Octave Band Filter
PC - Pistonphone Calibrator
TR - Tape Recorder
PSMS - Portable Sound Monitor System
ACAL - Acoustic Calibrator

†BK - Bruel and Kjaer
KN - Kudelski Nagra
BBN - Bolt Beranek and Newman
GR - GenRad

Note: The scheduled frequency of laboratory calibration is based on experience with the particular instrument type. Typically, an instrument is scheduled for laboratory calibration every 3, 6, or 12 months when the item is in active service.

TABLE II

SUMMARY OF CONTINUOUS SOUND LEVEL MEASUREMENTS AT PRIMARY LOCATIONS NEAR SUSQUEHANNA SES SITE - 1984 [dB(A)]

Position	Time*	Daytime (0700 - 2200)				Nighttime (2200-0700)				24-Hr.	
		Background L_{90}	Intrusive L_{10}	Equivalent L_{eq}	Range L_{99} to L_1	Background L_{90}	Intrusive L_{10}	Equivalent L_{eq}	Range L_{99} to L_1	Equivalent $L_{eq}(24)$	Day-Night L_{dn}
2'	9/24 @ 1400 - 9/25 @ 1400	44	49	50	36-67	45	47	47	38-52	49	54
3	9/26 @ 1800 - 9/27 @ 1800	36	44	44	29-56	29	37	37	26-52	42	45
3	9/27 @ 1400 - 9/28 @ 1400	30	39	40	26-53	32	40	43	24-55	41	49
4	9/25 @ 1700 - 9/26 @ 1700	46	51	50	40-59	46	50	49	44-55	50	55

*Date and time of continuous 24-hr measurements. Note that the two 24-hr measurement times for Pos. 3 data overlap.

Notes:

- L_{90} is defined as the sound level that is exceeded ninety percent of the time in a sampling period. Similarly, L_{10} is defined as the sound level that is exceeded ten percent of the time. Data were measured continuously for each hour and the arithmetic average of the daytime and nighttime L_{90} and L_{10} data are presented in this table.
- L_{eq} is defined as the energy average sound level for a sampling period. The energy average of the hourly L_{eq} values for the daytime and nighttime are presented in this table.
- L_{99} and L_1 are defined as the sound levels that are exceeded for ninety-nine and one percent of the time period, respectively. The total range of the measured L_{99} and L_1 values are presented in this table.
- $L_{eq}(24)$ is the energy average sound level that averages over the daytime and nighttime hours. L_{dn} is defined similarly, but includes a weighting factor of +10 dB for the nighttime hours.

TABLE III

SUMMARY OF NON-CONTINUOUS SOUND LEVEL MEASUREMENTS AT SECONDARY LOCATIONS NEAR SUSQUEHANNA SES SITE - 1984 [dB(A)]

Position	Time*	Daytime (0700 - 2200)				Nighttime (2200-0700)				24-Hr.	
		Background L_{90}	Intrusive L_{10}	Equivalent L_{eq}	Range L_{99} to L_1	Background L_{90}	Intrusive L_{10}	Equivalent L_{eq}	Range L_{99} to L_1	Equivalent $L_{eq}(24)$	Day-Night L_{dn}
5	9/24 - 9/27	40	50	48	31-61	55	56	56	53-57	52	61
7	9/24 - 9/27	42	47	50	32-61	44	46	45	42-48	49	53

*Dates on which the field team obtained tape recorded samples. Additional tape recorded data presented in Appendix L.

Notes:

- L_{90} defined as the sound level that is exceeded ninety percent of the time in a sampling period. Similarly, L_{10} is defined as the sound level that is exceeded ten percent of the time. This table presents the arithmetic average L_{90} and L_{10} values for the daytime and nighttime samples.
- L_{eq} is defined as the energy average sound level for a sampling period. This table presents the energy average L_{eq} values for the daytime and nighttime samples.
- L_{99} and L_1 are defined as the sound levels that are exceeded for ninety-nine and one percent of the time respectively. This table presents the total range of the L_{99} and L_1 values for the daytime and nighttime samples.
- $L_{eq}(24)$ is the energy average sound level that averages over the daytime and nighttime periods. L_{dn} is defined similarly, but includes a weighting factor of +10 dB for the nighttime period.
- Since the above values are calculated from tape recorded samples that are not continuous, they are considered estimates for the daytime and nighttime periods.
- Measured sound levels at these positions were controlled by non-plant sound sources. See sound sources in Appendix L.

APPENDIX L

HAND-HELD TAPE RECORDED DATA

SEPTEMBER 1984 OPERATION SOUND PRESSURE LEVELS

(dB re: 20 Micropascals)

TAPE RECORDED DATA
(Statistical Analysis)

SOUND SOURCE LEGEND

a	aircraft
b	birds
ba	backup alarms on mobile equipment
c	cow
ct	cooling towers
d	dog(s) barking
eng	gas and diesel engine equipment
i	insects and crickets
j	jackhammer
p	page system
t	local traffic
t(a)	traffic on plant access road
t(d)	distant traffic
t(11)	traffic on U.S. Route 11
tfr	transformers
tra	tractor
trn	train
w	wind in brush and trees
99% 95% 90% 50% 10% 5% 1%	percent of sample period sound level was exceeded
Leq	energy average sound level
OA	overall sound pressure level
dBA	A-weighted sound level

Note: Sound pressure level data presented in appendix include a major contributor, insects and crickets, in addition to the on-site and other off-site activities.

LOCATION 2'

24 September 1984 1338 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	56	37	28	27	25	22	29	38	61	40
95%	57	38	29	28	26	23	30	38	62	40
90%	58	39	30	28	27	24	31	38	62	41
50%	59	41	31	31	29	28	32	40	63	42
10%	60	44	34	35	34	32	36	50	64	49
5%	60	45	35	37	35	34	36	50	65	49
1%	60	47	37	42	46	41	38	50	67	51
Leq	59	42	34	34	33	31	33	44	63	45

sound sources: t(d), tra, i, d

24 September 1984 2252 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	41	42	31	34	31	42	40	29	50	46
95%	42	43	32	34	31	43	41	30	51	47
90%	42	44	32	35	32	43	41	30	51	47
50%	43	47	34	36	33	44	42	34	52	48
10%	46	49	36	39	36	45	43	41	54	49
5%	51	50	37	39	37	45	43	42	55	49
1%	55	51	38	40	38	46	44	44	56	50
Leq	46	47	35	37	34	44	42	37	53	48

sound sources: i, t(d), ct, tfr

25 September 1984 1146 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	41	-	30	29	-	-	42	37	50	46
95%	41	37	30	29	-	-	43	41	50	46
90%	42	38	31	30	27	-	43	42	50	46
50%	44	41	34	32	30	27	44	43	52	47
10%	50	50	48	39	35	32	46	45	57	49
5%	52	51	52	43	39	36	46	47	59	49
1%	56	56	57	46	46	41	47	47	63	52
Leq	47	46	44	41	39	35	44	43	54	49

sound sources: t, d, i, a, j

LOCATION 2' (Cont'd)

26 September 1984 0041 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	41	37	32	25	21	42	40	33	49	46
95%	41	38	32	26	22	42	41	34	50	46
90%	42	39	33	27	22	43	42	34	50	47
50%	45	41	36	30	26	44	43	35	52	48
10%	51	47	42	37	32	45	44	39	55	49
5%	52	48	45	40	33	45	44	41	56	49
1%	59	53	53	44	37	45	44	43	61	50
Leq	48	44	40	34	28	44	43	37	53	48

sound sources: d, t(11), i, a, tfr

26 September 1984 1823 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	48	47	31	36	33	25	27	17	56	39
95%	49	49	31	36	34	27	29	18	56	40
90%	49	50	32	36	34	28	29	18	57	41
50%	51	54	35	38	36	31	32	31	60	43
10%	56	59	46	41	50	48	34	27	70	54
5%	73	63	54	49	52	54	44	45	-	59
1%	76	66	58	53	56	58	50	52	-	63
Leq	63	57	46	42	45	46	37	37	-	51

sound sources: t, ct, d, i, w, b

27 September 1984 1240 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	51	48	33	35	36	25	22	33	59	41
95%	51	51	35	37	37	26	24	35	60	42
90%	52	52	35	37	37	27	24	37	60	43
50%	54	59	38	42	41	30	27	40	63	47
10%	57	63	43	45	44	35	31	42	65	50
5%	58	64	44	46	45	36	34	43	66	50
1%	62	65	46	48	47	41	40	44	68	52
Leq	55	60	40	42	42	33	30	40	65	48

sound sources: i, w, d, t, t(11), tfr, eng.

LOCATION 2' (cont'd)

27 September 1984 1645 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	44	56	31	36	39	25	20	21	58	43
95%	45	57	32	37	40	26	21	21	59	44
90%	45	57	32	38	40	26	21	22	59	44
50%	47	60	33	39	41	29	23	24	61	46
10%	50	63	41	41	42	32	27	27	63	47
5%	51	63	45	41	43	33	28	29	64	48
1%	53	65	49	41	43	35	32	31	65	49
Leq	48	60	39	40	41	30	24	25	61	46

sound sources: ct, t, f(11), i, d, ba

LOCATION 3

24 September 1984 1423 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	55	35	28	26	25	21	40	46	61	48
95%	56	36	28	26	25	22	41	48	61	48
90%	56	37	28	27	25	22	44	48	61	48
50%	58	39	30	28	26	24	44	48	63	49
10%	59	49	46	33	27	27	46	48	64	50
5%	60	54	50	38	28	27	46	48	64	51
1%	60	60	56	45	29	30	46	50	65	52
Leq	58	47	43	33	26	25	45	48	63	49

sound sources: i, w, a, ba

24 September 1984 2355 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	40	31	23	21	20	47	45	38	52	52
95%	41	33	23	22	21	48	46	40	52	52
90%	41	33	24	23	22	48	47	40	52	52
50%	43	36	26	26	23	49	47	43	53	53
10%	45	39	29	29	27	50	48	48	54	54
5%	45	39	29	31	29	50	48	50	55	55
1%	47	41	31	35	32	50	49	53	56	55
Leq	43	37	31	27	25	49	47	45	53	53

sound sources: i, t(11)

25 September 1984 1120 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	42	34	28	27	26	25	39	47	50	46
95%	43	35	28	28	27	25	40	47	51	48
90%	43	35	29	28	27	25	40	47	51	48
50%	46	38	31	29	28	27	41	47	52	48
10%	49	46	38	33	31	31	43	49	54	49
5%	52	52	40	37	32	33	43	49	56	49
1%	59	56	45	42	36	35	45	49	62	51
Leq	49	45	35	32	30	29	47	48	54	50

sound sources: t, a, i, w

LOCATION 3 (cont'd)

26 September 1984 0016 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	43	38	30	31	27	47	48	41	53	52
95%	44	39	30	32	29	48	48	42	54	52
90%	45	40	31	32	29	49	48	42	54	53
50%	47	42	32	33	30	49	49	44	55	54
10%	50	46	35	35	32	49	50	46	56	55
5%	51	48	37	36	33	49	50	47	56	55
1%	54	52	38	38	37	50	50	50	59	55
Leq	48	43	34	34	31	49	49	44	55	54

sound sources: i, tfr, t(11), ct

26 September 1984 1730 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	44	35	31	32	29	26	27	21	51	36
95%	45	35	31	33	29	28	29	22	52	36
90%	46	36	32	33	30	28	29	22	52	37
50%	48	40	35	36	33	32	31	25	54	40
10%	53	47	40	40	37	37	36	31	57	44
5%	55	52	41	42	39	39	37	33	58	46
1%	58	56	43	49	41	41	41	36	61	48
Leq	50	44	37	38	35	34	33	28	55	41

sound sources: t(11), b, i, a, w, trn

27 September 1984 1145 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	48	37	30	28	26	22	23	27	53	34
95%	49	38	31	30	27	26	24	28	53	36
90%	50	39	32	30	28	27	26	29	54	36
50%	50	43	36	34	31	31	30	30	55	39
10%	53	48	40	38	36	36	36	34	58	44
5%	54	52	43	40	38	37	37	35	59	45
1%	57	56	53	42	41	39	40	37	62	48
Leq	51	46	40	35	33	33	32	31	61	41

sound sources: w, t(11), t, a, i

LOCATION 3 (cont'd)

27 September 1984 1547 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	40	35	29	24	20	-	24	21	47	32
95%	41	36	29	25	21	-	27	22	47	32
90%	41	37	30	25	21	-	27	22	47	33
50%	44	42	33	27	23	20	30	24	50	35
10%	51	47	43	37	29	27	33	26	55	40
5%	53	49	46	40	32	29	33	28	56	42
1%	55	51	52	46	36	34	36	33	58	47
Leq	47	44	40	34	26	24	31	25	52	37

sound sources: b, i, t(11), d, a

LOCATION 4

24 September 1984 1455 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	56	40	33	35	31	27	34	39	61	42
95%	57	41	34	36	31	28	34	40	62	43
90%	57	41	34	37	32	28	34	40	62	43
50%	58	45	36	39	35	31	35	42	63	45
10%	61	50	42	43	40	35	36	44	65	47
5%	62	52	44	45	42	36	37	44	65	48
1%	64	54	46	48	47	41	37	45	67	51
Leq	59	47	39	41	38	33	35	42	64	45

sound sources: i, t(a), eng, p

25 September 1984 0022 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	43	39	32	35	33	37	33	32	51	42
95%	44	41	33	36	33	37	33	32	51	42
90%	45	42	34	36	34	37	33	32	52	42
50%	48	45	36	37	35	38	34	33	53	43
10%	53	49	42	39	37	39	35	35	56	44
5%	54	51	43	39	38	39	35	35	58	45
1%	59	59	46	41	39	41	38	36	61	47
Leq	50	48	38	37	36	38	34	34	54	43

sound sources: i, t(11), a, p, ct, t(a)

25 September 1984 1330 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	53	43	38	41	38	36	36	46	62	48
95%	54	44	39	42	39	36	36	46	63	48
90%	54	45	40	42	39	37	37	46	63	49
50%	57	47	42	46	42	39	38	48	66	50
10%	63	52	48	54	49	44	39	48	71	55
5%	64	53	49	55	51	45	39	48	72	56
1%	67	55	51	58	52	47	40	48	75	58
Leq	59	49	44	49	45	41	39	48	68	52

sound sources: i, t(a), w, eng

LOCATION 4 (cont'd)

25 September 1984 2342 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	46	45	38	43	41	39	35	33	54	46
95%	47	45	39	43	42	40	35	34	54	47
90%	48	46	40	44	42	40	36	35	55	48
50%	50	48	42	46	44	41	37	36	56	49
10%	54	57	50	48	46	43	38	37	60	51
5%	55	59	52	49	46	43	38	37	61	51
1%	56	62	54	53	48	44	38	37	64	53
Leq	51	53	46	46	44	41	37	36	58	49

sound sources: i, ct, t(11), a, tfr

26 September 1984 1630 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	50	48	37	41	39	34	25	24	58	44
95%	51	49	38	41	40	34	26	25	59	44
90%	52	50	39	42	41	35	26	25	59	45
50%	53	52	41	44	43	37	28	29	61	47
10%	58	55	43	47	45	39	30	36	66	49
5%	60	56	45	48	46	39	31	36	69	50
1%	65	60	52	52	48	42	38	37	76	52
Leq	57	53	42	45	43	37	29	33	66	47

sound sources: i, ct, t(11), b, p, eng, tfr

27 September 1984 1215 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	47	46	35	33	33	26	21	30	55	39
95%	48	47	35	34	34	26	22	31	56	39
90%	49	47	36	34	35	27	22	31	56	40
50%	52	50	39	37	38	29	23	33	58	42
10%	57	53	44	42	42	32	26	35	61	45
5%	58	54	45	43	43	35	27	35	62	47
1%	60	56	48	45	46	38	31	36	63	49
Leq	54	51	41	39	39	31	24	33	59	43

sound sources: i, b, t(11), ct, p, t

LOCATION 4 (cont'd)

27 September 1984 1704 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	47	45	33	30	30	23	-	-	54	36
95%	47	47	34	30	31	23	20	-	55	36
90%	48	48	34	31	31	24	20	-	55	37
50%	50	50	37	33	33	26	21	20	56	39
10%	56	53	44	38	37	31	25	22	60	43
5%	58	54	47	40	40	33	27	23	61	45
1%	61	57	50	43	45	37	32	27	63	49
Leq	53	51	41	35	35	29	23	22	58	40

sound sources: ct, i, b, t(11), t, a, t(a)

LOCATION 5

24 September 1984 1645 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	49	44	36	34	30	23	37	40	58	44
95%	50	45	37	35	31	25	38	40	59	44
90%	50	45	37	36	32	26	38	40	60	44
50%	55	50	44	41	39	37	38	41	62	48
10%	66	61	53	47	47	44	41	42	69	53
5%	73	65	55	49	48	46	42	43	74	55
1%	79	73	62	52	50	48	46	43	81	61
Leq	66	60	50	44	43	40	39	41	68	51

sound sources: i, t, a, d

24 September 1984 2345 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	40	39	32	31	24	50	44	41	54	53
95%	41	40	32	32	25	51	44	42	54	54
90%	41	40	33	33	25	52	44	42	54	54
50%	43	43	35	36	29	52	46	44	55	55
10%	46	45	38	39	33	53	47	47	56	55
5%	47	47	38	40	33	53	47	48	57	56
1%	49	48	40	42	38	53	48	50	58	56
Leq	44	43	36	37	30	52	46	45	55	55

sound sources: i, t, p, t(11)

25 September 1984 0905 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	48	44	38	34	28	21	36	39	58	43
95%	49	46	38	35	28	21	38	40	58	44
90%	49	47	39	35	29	22	38	40	58	44
50%	51	49	41	38	32	27	39	43	60	46
10%	58	54	47	42	43	40	40	44	63	49
5%	61	57	48	44	44	43	40	45	66	51
1%	68	70	52	46	48	46	41	45	71	56
Leq	56	57	44	40	38	36	39	43	62	47

sound sources: d, t, i, t(11), a, b

LOCATION 5 (cont'd)

26 September 1984 0050 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	48	38	33	28	22	52	45	40	63	55
95%	49	38	34	28	23	52	46	41	64	55
90%	49	39	34	29	23	52	46	41	65	55
50%	51	43	39	34	29	54	47	43	66	56
10%	54	47	45	42	38	54	48	45	68	56
5%	55	48	46	43	39	54	48	45	68	56
1%	56	50	48	45	43	54	48	48	69	57
Leq	52	45	41	39	35	54	47	43	66	56

sound sources: i, t(11), t

26 September 1984 1515 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	50	47	40	38	35	29	35	42	60	46
95%	51	48	41	39	35	30	36	43	60	46
90%	52	48	42	40	36	32	36	43	61	47
50%	54	51	45	43	42	40	38	45	62	49
10%	60	56	50	47	48	45	42	47	66	53
5%	63	59	52	48	49	46	43	47	68	54
1%	69	69	56	51	51	48	45	48	72	56
Leq	58	57	47	44	44	42	40	45	64	50

sound sources: t, t(11), p, ba, i, b, w

27 September 1984 1007 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	49	37	30	27	26	23	23	19	53	33
95%	50	39	31	28	27	25	24	22	54	35
90%	50	39	32	29	28	26	26	22	54	35
50%	51	41	34	32	31	29	28	24	55	38
10%	54	50	48	42	43	37	32	27	60	49
5%	56	53	52	47	45	42	33	29	62	51
1%	60	59	58	51	49	46	37	33	69	53
Leq	52	47	45	39	40	34	29	26	57	45

sound sources: t(11), t, i, a, w, b

LOCATION 5 (cont'd)

27 September 1984 1800 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	46	36	28	23	21	12	23	16	52	31
95%	47	36	29	24	22	13	24	17	52	31
90%	47	37	29	25	23	14	24	18	53	31
50%	50	39	32	29	29	22	26	23	54	35
10%	53	48	42	38	39	37	29	25	59	45
5%	55	52	47	41	43	41	31	27	61	49
1%	60	58	57	48	49	46	36	31	64	53
Leq	51	46	43	36	36	34	27	24	68	42

sound sources: t, t(11), b, i

LOCATION 7

24 September 1984 1533 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	45	30	22	19	18	-	31	40	53	40
95%	45	31	22	19	18	17	31	40	53	41
90%	46	31	23	20	18	18	32	41	54	41
50%	48	34	25	22	20	20	33	44	55	43
10%	49	40	31	26	24	24	35	45	56	45
5%	50	42	33	28	26	25	35	46	57	45
1%	51	45	42	33	30	28	38	46	57	45
Leq	48	37	30	24	22	22	34	43	55	43

sound sources: i, d, a

24 September 1984 2235 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	36	30	22	-	-	36	38	31	45	42
95%	37	31	23	-	-	36	39	31	45	42
90%	38	31	23	-	-	36	39	32	46	42
50%	40	33	25	21	18	37	39	34	46	43
10%	41	37	31	23	18	37	41	35	47	44
5%	42	39	35	25	19	37	41	35	47	45
1%	44	42	38	28	20	38	42	37	48	45
Leq	40	35	34	22	18	37	40	34	46	43

sound sources: i, a

25 September 1984 1150 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	48	37	33	24	23	24	29	52	60	51
95%	49	37	34	25	24	24	30	54	61	52
90%	49	38	34	25	24	24	31	54	62	53
50%	50	39	34	27	26	28	33	54	63	53
10%	53	44	36	30	31	33	35	56	66	55
5%	55	46	37	31	32	34	36	56	68	55
1%	60	49	39	35	33	35	36	56	71	55
Leq	52	41	35	30	28	29	34	55	64	54

sound sources: i, w, a, b

LOCATION 7 (cont'd)

25 September 1984 2350 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	43	34	30	28	26	38	42	38	53	46
95%	43	36	30	28	26	38	42	38	54	46
90%	44	36	31	29	26	38	42	39	54	46
50%	45	38	32	30	28	39	43	40	56	47
10%	48	41	34	36	30	40	44	41	59	47
5%	50	42	35	38	31	40	44	42	61	48
1%	54	45	37	42	32	40	44	43	65	48
Leq	46	39	32	33	28	39	43	40	57	47

sound sources: d, i

26 September 1984 1600 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	47	38	34	36	35	35	38	39	54	45
95%	48	40	36	37	36	36	39	41	55	46
90%	49	40	37	38	37	38	39	42	56	47
50%	52	45	42	43	43	42	43	44	60	50
10%	60	53	50	50	50	51	51	48	70	57
5%	63	56	52	51	52	52	52	49	73	59
1%	68	61	54	54	54	55	56	53	80	61
Leq	58	50	46	46	46	46	47	45	68	53

sound sources: i, w, d

27 September 1984 1048 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	42	35	25	20	-	-	26	25	48	32
95%	43	36	26	21	18	-	26	27	48	32
90%	43	36	27	21	19	-	26	27	48	32
50%	44	38	28	23	21	21	28	29	49	34
10%	45	41	36	35	30	28	30	31	51	38
5%	46	43	41	37	32	31	30	32	52	40
1%	47	65	51	42	36	35	33	33	65	51
Leq	44	49	37	32	26	25	28	29	52	38

sound sources: d, b, i, w, a, t

LOCATION 7 (cont'd)

27 September 1984 1613 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	41	30	21	-	-	-	31	25	46	33
95%	41	31	21	-	-	-	32	26	47	34
90%	42	32	22	-	-	-	32	26	47	35
50%	43	34	26	21	20	-	35	28	49	38
10%	47	46	42	36	32	28	37	29	53	41
5%	52	49	46	39	35	30	38	30	56	43
1%	56	53	50	44	37	35	39	33	57	46
Leq	46	42	38	33	27	24	35	28	50	39

sound sources: d, i, a, b

APPENDIX M

SUPPLEMENTAL DATA - SEPTEMBER 1984

(Sound Pressure Levels in dB re: 20 Micropascals)

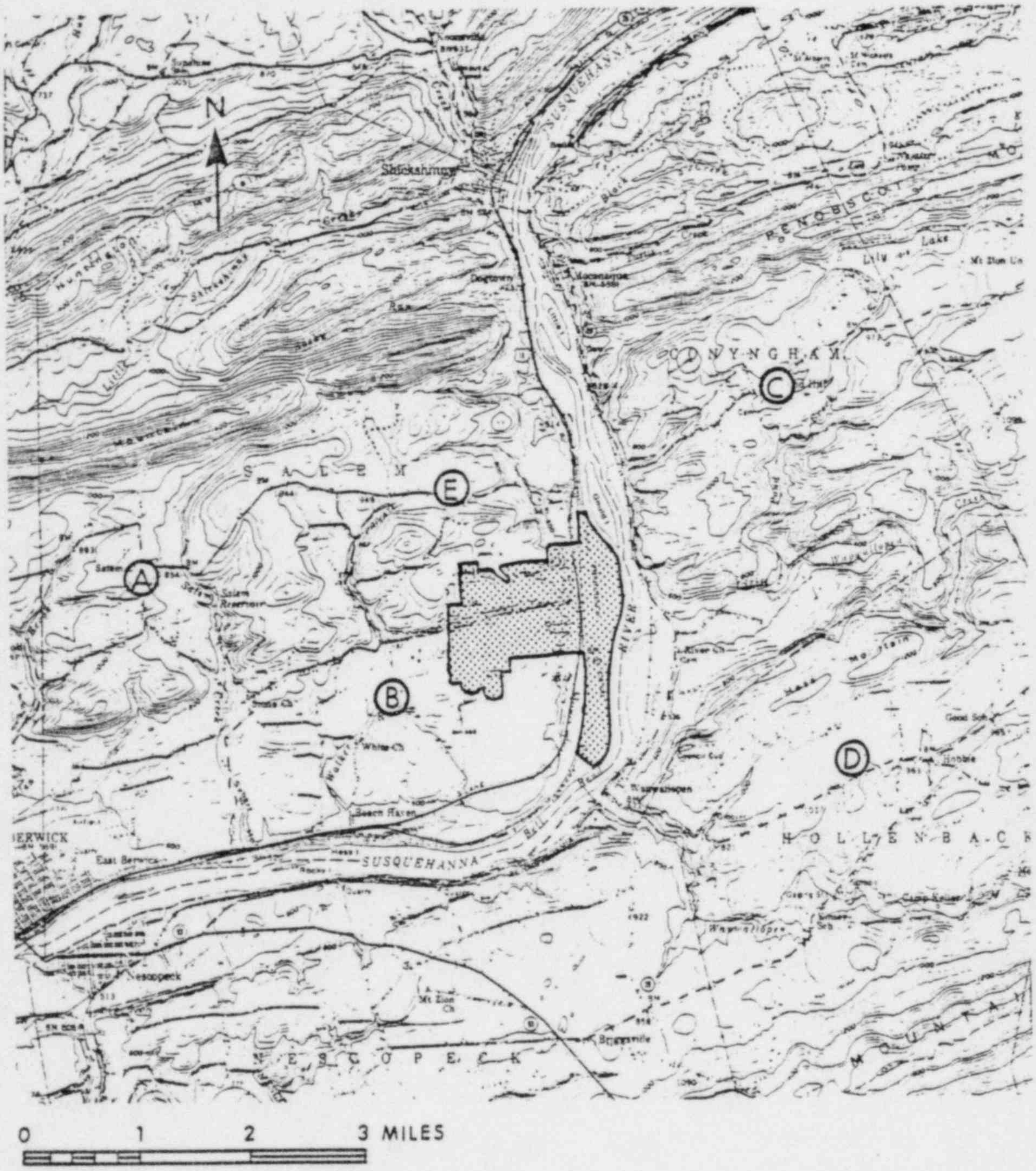

FIG. M-1. MAP OF AREA WITHIN FIVE MILES OF SUSQUEHANNA SES SITE SHOWING DISTANT SUPPLEMENTAL SOUND LEVEL MEASUREMENT LOCATIONS AND SITE PROPERTY LINES.

TAPE RECORDED DATA
(Statistical Analysis)

SOUND SOURCE LEGEND

a	aircraft
b	birds
c	cow
d	dog(s) barking
i	insects and crickets
pt	people talking
r	rooster
t	local traffic
t(d)	distant traffic
t(11)	traffic on U.S. Route 11
tra	tractor
w	wind in brush and trees

99% 95% 90% 50% 10% 5% 1%	percent of sample period sound level was exceeded
Leq	energy average sound level
OA	overall sound pressure level
dBA	A-weighted sound level

LOCATION A

24 Sep.ember 1984 1543 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	47	39	26	19	18	16	26	25	53	34
95%	50	41	27	20	19	17	28	26	54	35
90%	51	42	28	21	20	19	29	26	55	35
50%	57	48	34	26	27	24	30	28	59	39
10%	63	53	40	35	36	34	32	30	65	43
5%	65	54	41	36	38	36	33	30	67	44
1%	69	57	46	41	43	41	35	30	69	49
Leq	60	62	37	32	33	30	31	28	62	40

sound sources: i, b, t, t(d), d, tra

24 September 1984 1422 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	46	34	28	24	21	19	26	28	57	33
95%	46	35	28	24	21	19	27	30	57	34
90%	47	36	29	25	22	20	27	30	57	34
50%	48	40	31	27	24	22	31	32	57	36
10%	50	46	42	35	27	27	33	35	59	41
5%	52	53	51	41	31	28	34	36	61	46
1%	54	58	59	49	36	32	35	40	63	51
Leq	49	46	46	35	27	24	31	33	58	40

sound sources: t(11), i, t, b, a

LOCATION C

24 September 1984 1642 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	41	38	29	-	-	-	31	32	46	36
95%	42	39	31	-	-	-	32	33	48	37
90%	43	39	31	27	-	-	32	33	48	37
50%	46	41	34	31	31	27	33	35	50	41
10%	53	50	43	38	41	37	35	41	57	46
5%	55	54	48	44	44	40	36	41	60	49
1%	59	64	57	52	50	45	40	42	67	56
Leq	49	50	45	39	[illegible]	34	34	49	56	52

sound sources: t, t(d), r, d, c, i, b, tra

LOCATION D

24 September 1984 1734 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	38	34	25	21	-	-	21	32	43	34
95%	39	35	26	22	17	16	21	33	44	35
90%	39	36	26	22	18	16	22	34	44	36
50%	43	39	28	24	23	20	23	37	47	37
10%	50	47	32	29	32	30	25	38	52	39
5%	51	49	35	30	34	33	26	38	54	[illegible]
1%	60	53	41	37	39	39	34	39	60	[illegible]
Leq	47	43	35	37	29	27	24	37	50	40

sound sources: t(d), d, i, b, pt

LOCATION E

24 September 1984 1458 hours

	Octave Band Center Frequency (Hz)								
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	42	32	24	22	19	18	34	33	56	37
95%	43	32	25	23	21	19	36	38	56	40
90%	43	32	25	23	21	20	37	39	57	41
50%	44	32	26	24	23	23	39	48	57	48
10%	45	35	28	28	27	27	40	49	58	49
5%	47	36	30	29	29	29	41	50	58	49
1%	49	40	33	34	33	35	41	51	61	50
Leq	44	33	27	28	26	25	39	48	57	47

sound sources: b, i, t, t(d), w, d