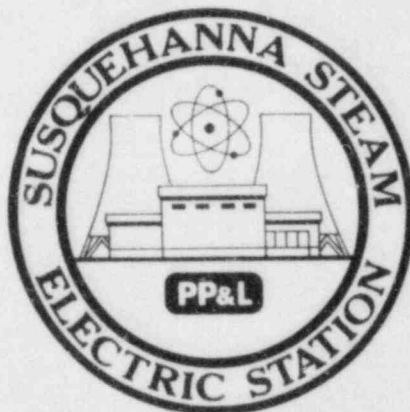


SUSQUEHANNA STEAM ELECTRIC STATION UNIT 1

1983 ANNUAL ENVIRONMENTAL OPERATING REPORT (NON-RADIOLOGICAL)



FACILITY OPERATING LICENSE NO. NPF-14
DOCKET NO. 50-387

prepared by
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APRIL 1984

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SUSQUEHANNA STEAM ELECTRIC STATION

ANNUAL ENVIRONMENTAL OPERATING REPORT

1983

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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 1,100 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 1983 Annual Environmental Operating Report (non-radiological) describes the programs necessary to meet requirements of the Operating License, Section 2F, 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. The radiological report for 1983 will be submitted under separate cover.

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SUSQUEHANNA STEAM ELECTRIC STATION ANNUAL ENVIRONMENTAL OPERATING REPORT 1983

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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 1983 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).

This 1983 report is the second Annual Environmental Operating Report submitted to meet EPP requirements. The 1982 report was submitted to the NRC in April, 1983 (Ref. 1.1-2).

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 Susquehanna Steam Electric Station, Unit 1, 1982 Annual Environmental Operating Report (non-radiological), Pennsylvania Power and Light Co., Allentown, PA, April, 1983.

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 Construction NPDES permit No. PA0027448, Sewage Treatment Plant, dated September 14, 1982, and the operational NPDES permit No. PA0047325 dated July 31, 1979. 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, temperature discharge limits 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 1983 in response to a request by the U.S. Fish and Wildlife Commission and also to meet 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 1983.

Prespawed adults were collected from the Hudson and Connecticut Rivers during May and June and 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 during this period (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 1983 during spring and autumn migrations. A total of 40 birds of at least 16 species was collected; 14 birds were found in the spring and 26 in the autumn. Of these, 85% were collected at the Unit 1 tower. 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. All spring impactions occurred during a maintenance and testing outage and all autumn impactions occurred when Unit 1 was operational. Fewer impacted birds were collected in 1983 than in previous years, but it is uncertain if this was due to operation of the Unit 1 tower or other factors.

2.2.2 OPERATIONAL SOUND LEVEL SURVEY

An environmental sound survey was conducted in September, 1983, 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 1983, 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 the months of station operation, January through December, 1983, there was maintenance of transmission line corridors with selective herbicide application and manual clearing. 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, to prevent soil erosion, areas around the transmission structures and along access roads were seeded and regraded. 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.

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 reviewed with the State Historical Preservation Office. Section 4.2.4 of this report provides a review of this plan.

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 - 1983, Susquehanna River Anadromous Fish Restoration Committee, January, 1984.

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, 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 initiated development of 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 1983, there was one action that the Licensee reviewed as part of its unreviewed environmental questions program. Reviewed was a modification in flow to Unit 1 and 2 natural draft cooling towers when air temperatures are 6°F or below. Cooling water will fall over the outside rows of fill instead of the center. The purpose of this design change was to avoid too much weight from ice forming on the fill. This change could cause higher cooling tower blowdown temperatures, however, based on station temperature data, the projected temperatures are within permitted limits. This activity was determined not to be an unreviewed environmental question because there was not a significant environmental impact.

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 which may affect the environment.

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 a Clean Water Act is not required. All changes in the operational NPDES Permit No. PA0047325 or

application for renewals will be submitted to the NRC within the required 30-day period.

3.3 CHANGES REQUIRED FOR COMPLIANCE WITH OTHER ENVIRONMENTAL REGULATIONS

During 1983, 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:

- o Operating Permit - Permit No. 40-302-00106, Unit 2 Temporary Auxiliary Boiler, issued June 1, 1983, expires May 31, 1986.
- o Plan Approval - Permit No. 40-306-004, Stand-By Diesel Generators, issued December 1, 1983, expires March 31, 1986.
- o Operating Permit - Permit No. 40-318-006, Water Wash (Paint) Spray Booth, re-issued September 16, 1983, expires September 30, 1988.

4.0 ENVIRONMENTAL CONDITIONS

4.1 UNUSUAL OR IMPORTANT ENVIRONMENTAL EVENTS

During 1983, 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 (Ref. 4.2-5). 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 1983 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 1400 m west of the Susquehanna River and 650 m south of a ridge which extends east to 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 about 50 m.

Systematic searches for impacted birds were begun prior to 0800 hr. on weekdays, excluding holidays, from March 21 through June 3 and from August 22 through November 4. Each search included the tower base, cold water outlet, basin interior, and an area extending 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 4.2-5. Bird nomenclature follows the revised American Ornithologists' Union Checklist (Ref. 4.2-6). These lists of bird species were checked against the list of Threatened and Endangered Species (Ref. 4.2-7) and the Species of Special Concern in Pennsylvania (Ref. 4.2-8).

An attempt was made to collect all impacted birds during each search; however, specimens recovered from the turbulent water in the Unit 1 basin were often

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, by the National Oceanic and Atmospheric Administration, at Avoca, Pennsylvania (Ref. 4.2-9), 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 1983, 40 birds of at least 16 species were collected during systematic searches for impacted birds at Unit 1 and 2 cooling towers of the Susquehanna SES. Since September 1, 1978, 1,407 birds of at least 61 species (Table 4.2-1) have been collected at the towers. During spring migration in 1983, 14 birds of eight species were collected from March 21 through June 3 (Table 4.2-2); 12 specimens were found at the Unit 1 tower and two specimens at the Unit 2 tower. During autumn migration, 26 birds of at least 12 species were collected from August 22 through November 4 (Table 4.2-3); 22 specimens were found at the Unit 1 tower and four specimens at the Unit 2 tower. In addition to these birds, four bats were collected. A little brown myotis (Myotis lucifugus) was found at the Unit 1 tower in the spring and two red bats (Lasiurus borealis) and one little brown myotis at the Unit 2 tower in the autumn (Ref. 4.2-10 and 4.2-11).

Almost all bird species were small passerines known to be nocturnal migrants (Ref. 4.2-12). Most of these birds migrate long distances to wintering grounds in the American tropics. The two most commonly collected species were the red-eyed vireo (9) and the common yellowthroat (8). Together they composed 42.5% of the birds collected. One grasshopper sparrow, a threatened species in Pennsylvania, was found on May 6, 1983. No federally listed threatened or endangered species were collected in 1983, nor have any been found since the study began in 1978.

The total number of spring impactions was less in 1983 than in any previous year except 1981 when 14 specimens were also collected (Fig. 4.2-2). No more than four birds were collected on any night and no more than five specimens were found of any species. It rained on four of the nine nights when impactions occurred. 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. 4.2-13). Both April and May were cooler than normal (Ref. 4.2-9) and this may have changed bird migration patterns and influenced bird impaction at the towers. All spring impactions occurred when the Unit 1 tower was not operating during a maintenance and testing outage prior to commercial operation.

Fewer birds impacted on the cooling towers in the autumn of 1983 than in any previous year (Fig. 4.2-2). No more than five specimens were collected on any of the 12 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. 4.2-5). 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. 4.2-13). All autumn impactions occurred when the Unit 1 cooling tower was functional with the Unit 1 reactor operating.

As in 1981 and 1982, approximately 85% of the impacted birds in 1983 were collected at the Unit 1 tower. In spring, impaction was 6-fold greater at the Unit 1 tower and in autumn it was 5-fold greater. The results of both seasons were unexpected but for different reasons. In spring, northbound migrants should have encountered the Unit 2 tower before Unit 1. Birds may have been more attracted by the higher lights of the Unit 1 tower (6 m) than those of Unit 2. Pettingill (Ref. 4.2-13) noted that night-flying birds are attracted to, then blinded by, bright lights, accounting for impactions on tall buildings. Cochran and Graber (Ref. 4.2-14) found that nocturnal migrants are confused by tower lights when cloud ceiling is low and birds may fly below the clouds at an altitude of less than 3,000 feet (914 m), conditions accompanying warm fronts in spring (Ref. 4.2-13). The autumn results were somewhat more expected because of the likely flight paths of southbound migrants and the location of the Unit 1 tower north of Unit 2, but still surprising because the operation of the Unit 1 tower may have discouraged birds from flying near it.

The low number of bird impactions in the autumn of 1983 occurred during the first migratory season when the Unit 1 cooling tower was fully operational (design flow of 5,000 gpm). A different sensory environment existed near the towers for nocturnally migrating birds than was present in previous seasons. 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 for long distances, especially 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. 4.2-12) and may alert them to the presence of the towers.

Although relatively few impactions occurred in the autumn of 1983 during operation of the Unit 1 tower, any conclusions as to why this happened must be viewed as very tentative. The number of bird impactions recorded during the preoperational phase showed high variability and operational phase data may demonstrate a similar pattern. Furthermore, this variability may be caused by

factors not associated with tower operation. For example, fewer bird impacts may have occurred in the autumn of 1983 because of the relatively warm and dry weather of September and October (Ref. 4.2-9). It will be necessary to collect more data particularly when both towers are operational before any conclusions can be made about the effect of tower operation on bird operation.

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.

<u>Commercial Name</u>	<u>Active Ingredient(s)</u>	<u>EPA Registration Number</u>
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

Table 4.2-4 summarizes the application of herbicides for vegetation control for each of the transmission corridors affected. This includes the individual herbicides specified, the active ingredient, its acid equivalent, the specified amount of concentrate in a designated carrier, and additives used to decrease drift and act as wetting agents.

Application data for each of the lines is presented by the number of acres on which herbicides were applied, the total amount of solution used, rate of application in gallons per acre, total amount of concentrate used, average gallons of concentrate applied per acre, the total pounds of acid equivalent and the average pounds per acre applied.

Dates and locations, by structure number, of the applications are designated along with the title of the responsible Division manager, his phone number and mailing address.

Two exhibits in the 1982 Annual Environmental Operating Report License (Ref. 1.1-2) discuss the herbicide application procedures. Exhibit 3 indicates the Licensee's Procedures for Herbicide Use on Transmission Rights-of-Way, while Exhibit 4 dictates the Procedure for Obtaining Herbicide Samples from Contractors for Laboratory Analyses.

B. Vegetation Maintenance by Manual Methods

Table 4.2-5 summarizes vegetation maintenance activities other than the utilization of herbicides. The four types of manual methods 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, 1983. Sound Level Measurements Near Susquehanna SES Operation 1983, 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 1983 survey.

4.2.4 CULTURAL RESOURCES

In March, 1983, the NRC notified the Licensee that four archeological sites (Site SES-3, Site SES-6, Site SES-8 and SES-11) were determined by the Keeper of the National Register to be eligible for inclusion in the National Register. Then, in April, 1983 the Licensee followed steps presented in 36 CFR 800.3 and 36 CFR 800.4 by recommending in a letter mitigative actions to the State Historic Preservation Officer to minimize adverse effects on the sites from the station. The State Historic Preservation Officer then determined that these mitigative actions met National Register requirements and submitted a letter to the NRC. Exhibit 3 contains the three letters discussed in this section. The Licensee has completed all NRC requirements in Section 4.2.4, Cultural Resources of the Environmental Protection Plan and will not address cultural resources for these sites unless it is determined in the future that stations activities have adversely affected these sites.

4.2.5 AQUATIC PROGRAMS

4.2.5.1 ALGAE

The basic objective in 1983, 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 (Bell Bend) was 400 m downriver from the discharge diffuser and 30 m from the west bank.

Periphyton substrates consisted of 12 sandblasted plates of clear acrylic (22 x 30 cm) in "detritus-free" holders similar to those of Gale et. al. (Ref. 4.2-16). Three holders with four plates each were placed on the river bottom near the main channel, where depths ranged in 1983 from 1.7 to 8.8 m. Starting in February, 1983 two plates were sampled bimonthly at each site (no samples were taken in April when river flows were too great). Each plate had been submerged for 12 months. Three replicate samples were taken from each plate by a scuba diver using a bar-clamp sampler (Ref. 4.2-17). Slots where plates were removed were filled 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 mm² sampling area of the plate delimited by each bar-clamp sampler was cleaned by scraping and vibration (Ref. 4.2-17) 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, these cells were not subjected to further vibration. Vibration may have destroyed some cells, but Gale (Ref. 4.2-17) reported that more cells per unit area were obtained by scraping and vibration than by scraping and brushing. Samples (up to 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 manner similar to that used for periphyton samples. The main difference was that phytoplankton samples, because of their greater initial volume, were siphoned three times instead of one (10 days settling time was allowed between each siphoning).

Algal cells in periphyton and phytoplankton samples that contained chloroplasts were enumerated in terms of units (Ref. 4.2-18). 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. Counts were made with a microscope (430X) using a Palmer counting cell. Higher magnification, including electron microscopy, was used for some identifications. Algae were identified to genus and the more abundant forms to species using keys by Hustedt (Ref. 4.2-19) and Prescott (Ref. 4.2-20).

In 1983, a total of 46 genera of algae was collected in 30 samples from acrylic plates upstream from the intake; 49 genera were found in 30 samples taken downstream from the discharge. Thirty-eight of the genera were found at both sites. None of the 19 genera that occurred at only one site composed more than 1% of the total units counted. These data are summarized in Tables 4.2-6 and 4.2-7.

At SSES and Bell Bend, 19 species of periphytic algae were identified that composed 5% or more of the total units counted during at least one sampling period (Table 4.2-8). For the second straight year, green algae (Chlorophyta) was less abundant than it was in 1981 (Fig. 4.2-3), although it was relatively more abundant in 1983 (50% of the total standing crop) than it was in 1982, when it composed 42% of the total. The mean standing crop of green algae decreased from 1,400 units/mm² in 1981 to 600 units/mm² in 1982 and remained at the same level in 1983. One of the main causes of the high standing crop of green algae in 1981 was due to an unexpected abundance of Oocystis parva, a species that usually occurs in lakes (Ref. 4.2-20). From 1977 through 1980, O. parva composed less than 1% of the total standing crop; in 1981, it composed 55% of the total. In 1982, O. parva remained the most abundant green alga, but composed just 16% of the total algae found. In 1983, the species again composed less than 1% of the total standing crop. The most abundant species of green algae included Scenedesmus quadricauda and Ankistrodesmus falcatus. These two species composed 24% and 11% of the total at the two sites, respectively.

The mean standing crop of diatoms (Bacillariophyta) in 1981 (800 units/mm²) increased slightly to 900 units/mm² in 1982 and then decreased to 500 units/mm² in 1983. Diatoms were relatively more abundant at SSES (58% of the total) in 1983 than at Bell Bend (36% of the total). Overall, diatoms composed 42% of the total periphyton at the two sites. In 1981, diatoms composed 37% of the total algae collected (Ref. 4.2-21) and in 1982 composed 58% (Ref. 4.2-22). The most abundant forms included Navicula spp. and Nitzschia spp., which each composed 15% of the total standing crop at the two sites. Both groups were much more abundant at SSES than at Bell Bend.

Numbers of blue-green algae (Cyanophyta) increased markedly to 9% of the total standing crop in 1983. In 1981 and 1982, blue-green algae composed 1% or less of the total. Chroococcus limneticus, Merismopedia tenuissima, and Schizothrix calcicola were the most abundant species.

Most of the algae found were "clean water" forms and only five of the 19 abundant species in the samples were among the 20 species listed by Palmer (Ref. 4.2-23) as being most tolerant of heavy organic pollution. These were Nitzschia palea, S. quadricauda, Synedra ulna, A. falcatus, and Navicula cryptocephala. Most of the 13 species of abundant diatoms (Table 4.2-8) were rated as "alkaliphilous" by Lowe (Ref. 4.2-24); four were rated "indifferent," and three were "unknown."

In 1982, periphyton on acrylic plates was of about equal abundance at Bell Bend and SSES with an average of 1,500 units/mm². But in 1983, more periphyton occurred at Bell Bend (1,700 units/mm²) than at SSES (600 units/mm²). Density peaked at Bell Bend in October at 4,100 units/mm². The largest difference in standing crop occurred in October when there was over a 5-fold difference between the two sites.

Overall, the mean density at SSES and Bell Bend in 1983 (1,100 units/mm²) decreased from the 1,500 units/mm² found in 1982 (Fig. 4.2-3). The results of the 1983 sampling program do not indicate any impact upon the periphyton community resulting from operation of the Susquehanna SES.

Phytoplankton in samples collected at SSES in 1983 was nearly identical to that in samples taken at Bell Bend (Fig. 4.2-4), as it has been in previous years. There was a total of 37 genera of algae in 5 samples at SSES and 41 genera in 5 samples from Bell Bend (Tables 4.2-9 and 4.2-10). Thirty-three genera were found at both sites. None of the 12 genera that occurred at only one site composed more than 1% of the total units counted.

Overall, phytoplankton density increased from 6,400 units/ml in 1982 to 11,400 units/ml in 1983. Green algae was the major component and composed 66% of the total. Scenedesmus falcatus and S. quadricauda were the most abundant green algae at both sites in 1983 with a density of 2,500 units/ml at Bell Bend (Table 4.2-10) and 2,700 units/ml at SSES (Table 4.2-9); they composed about 23% of the total standing crop (Tables 4.2-9 and 4.2-10). A. falcatus was also abundant with a density of 2,400 units/ml at Bell Bend and 2,200 units/ml at SSES. Overall, the species composed 20% of the total standing crop.

Diatoms composed 11% of the total standing crop. Stephanodiscus invisitatus and Cyclotella pseudostelligera were the main diatoms at both sites and each composed between 3% and 4% of the total standing crop.

In 1983, blue-green algae became more abundant at SSES and Bell Bend (23% of the total standing crop) than they had been since the post-Agnes flood (August, 1972) when they composed about 95% of the standing crop at each of nine sites (Ref. 4.2-25). In 1983, blue-green algae composed 20% and 25% of the standing crop at SSES and Bell Bend, respectively. The increase was brought about by large numbers of Chroococcus dispersus and C. minor. The post-Agnes pulse in 1972 was also composed of Chroococcus.

Twenty-one species of phytoplankton composed 5% or more of the total units counted in samples from the two sampling sites during one or more sampling periods (Table 4.2-11). Phytoplankton was more abundant in 1983 (11,400 units/ml) than in 1982 (6,400 units/ml). The 1982 density was by far the lowest that had been observed at either site since the study was initiated (Fig. 4.2-4). In 1983, phytoplankton density was very low in winter (93 units/ml), but increased over 300-fold between February and August, when there was an average of 28,200 units/ml at the two sites combined (Fig. 4.2-4). The density dropped sharply in December to an average of 200 units/ml at the two sites.

Most of the phytoplankton found were "clean water" forms and only three of the abundant species (N. palea, S. quadricauda, and A. falcatus) were among the 20 species listed by Palmer (Ref. 4.2-23) as being most tolerant of heavy organic pollution. Most of the species of abundant diatoms were rated as "alkali-philous" by Lowe (Ref. 4.2-24); five were rated "indifferent," and two were rated "unknown."

No impact upon the phytoplankton community was detected due to operation of the Susquehanna SES.

4.2.5.2 BENTHIC MACROINVERTEBRATES

The density and taxonomic composition of benthic macroinvertebrates of the Susquehanna River near the Susquehanna SES has been monitored from 1972 through June, 1982 to establish a baseline of preoperational conditions (Refs. 4.2-28 through 4.2-38). Macroinvertebrate biomass has been determined since 1975. Unit 1 of the Susquehanna SES became operational in September, 1982. The objective of the present study was to determine the impact, if any, of the power plant on the macroinvertebrate community located downriver from the discharge diffuser.

Since 1978, benthic macroinvertebrates have been 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 4.2-12). Sampling schedule and sites in 1983 were the same as those since 1978, except that no samples were collected in April because of high river level.

Three samples were collected by a scuba diver at each site on 13-16 June and 11-14 October, 1983 using a dome suction sampler (Ref. 4.2-39). After the sampler was lowered from a boat to the river substrate, the 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 m²) for five minutes with a screened intake nozzle leading to the sampler's bilge pump. Sediments (silt, sand, fine gravel) and organisms were pumped into a nylon net (216-μ mesh). The diver carefully vacuumed larger stones within the dome sampler and then discarded them. The samples were returned to the boat by the diver for transport to the laboratory.

One replicate from each site was used for biomass estimates. It was washed and sieved through a U.S. Standard No. 20 sieve (840- μ mesh). The biomass sample was refrigerated (or kept in ice water) until the organisms were sorted, removed, and identified. Processing was completed within 12 hours of collection. By chilling the sample, it was possible to avoid the use of preservatives which have been found to distort organism weight (Refs. 4.2-40 and 4.2-41). Before molluscs were weighed, their shells were decalcified in 1% HCl. After being sorted, organisms were placed in aluminum foil containers and dried at 100°C for at least 12 hours. Organisms were cooled to room temperature and weighed on a Mettler H10W balance.

The other two replicates were used for density estimates. Soon after collection, they were washed, sieved (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 from the residue, identified, and counted.

Estimates of the number of chironomids, naidids, and small organisms left in the sample were obtained by counting those organisms in a subsample of the total residue. 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. Subsamples were examined using a dissecting microscope (10-70X). 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 sorted from pans. Some chironomids had to be mounted on microscope slides and examined with a compound microscope (100-470X) for identification.

The number of organisms per square meter was determined by multiplying the number of organisms per sample by 6.135. Invertebrates were identified (usually to genus or species) using taxonomic keys cited in Reference 4.2-38.

The mean macroinvertebrate density in June and October, 1983 (both stations combined) was 42,600 org/m² (Table 4.2-13). Mean density at SSES (50,000 org/m²) was considerably greater than at Bell Bend (35,200 org/m²), as it has been for the previous five years (Fig. 4.2-5). Overall, mean density in June and October, 1983 was nearly 40% greater than the mean density found in June and October of the previous five years, and was 50% greater than the mean density of June and October, 1982 (Table 4.2-14). Chironomids composed 57% of the total number of organisms collected in 1983; an additional 23% of the total was composed of ephemeropterans and oligochaetes (Table 4.2-13). A list of macroinvertebrates collected in dome samples in 1983 is presented in Table 4.2-15.

In June, the mean macroinvertebrate density was 33,000 org/m² (Table 4.2-13). Macroinvertebrate density at SSES (33,100 org/m²) and Bell Bend (33,000 org/m²) was similar. Chironomids were the most abundant organisms (mean = 15,900 org/m²), composing 48% of the total number collected. Microtendipes sp. was the most numerous chironomid at both stations (up to 23,900 org/m² at Bell Bend III).

An additional 47% of the total number of organisms was composed of oligochaetes (23%), ephemeropterans (17%), and hydropsychids (7%) (Table 4.2-13). Mean density in June, 1983 was more than 2-fold greater than in June, 1982 (14,500 org/m²), primarily due to much greater numbers of Microtendipes sp. (mean = 11,200 org/m²). The June, 1983 density was less than that found in June, 1980 (45,200 org/m²) (Table 4.2-14), but was 42% greater than the mean June density of 1978-82 (23,300 org/m²).

In October, mean density (52,200 org/m²) was 58% greater than in June (Table 4.2-13). October density at SSES (66,900 org/m²) was nearly 80% greater than at Bell Bend (37,400 org/m²), mainly due to much greater numbers of the chironomid, Polypedilum spp. (up to 23,700 org/m² at SSES II). As in June, chironomids were the most abundant organisms, composing 63% of the total number of macroinvertebrates collected (Table 4.2-13). Thienemannimyia gr. was the most abundant chironomid at SSES (up to 23,300 org/m² at SSES II), and at Bell Bend (up to 15,700 org/m² at Bell Bend I). Trichopterans (primarily Cheumatopsyche spp. and Nectopsyche sp.) composed 18% of the total number of organisms in October; ephemeropterans and oligochaetes made up an additional 8% and 5% of the total number, respectively. The mean density in October, 1983 was 23% greater than in October, 1982 (42,500 org/m²), mainly due to large numbers of chironomids (especially Thienemannimyia gr. and Polypedilum spp.). The October, 1983 density was 36% greater than the mean October density of the previous five years (38,300 org/m²).

The mean macroinvertebrate biomass (dry weight) in June and October, 1983 was 3.1 g/m² (Table 4.2-16). This was less than the mean biomass found in June and October, 1982 (4.0 g/m²), but was greater than the mean found in the same months in 1978-82 (2.7 g/m²) (Table 4.2-17). Trichopterans (especially Cheumatopsyche spp.) and ephemeropterans (mainly Potamanthus sp. and heptageniids) composed 41% and 39%, respectively, of the 1983 mean biomass (Table 4.2-16). Although dipterans (mainly chironomids) were the most numerous organisms at both stations, they made up only 6% of the biomass.

Mean biomass in June, 1983 was 1.8 g/m² (Table 4.2-16). Dry weight of organisms at SSES (2.1 g/m²) was 50% higher than at Bell Bend (1.4 g/m²). Ephemeropterans made up 52% and 69% of total weight at SSES and Bell Bend, respectively. Trichopterans and molluscs composed an additional 41% of the biomass at SSES; dipterans, oligochaetes, and trichopterans made up 24% at Bell Bend.

The mean October biomass (4.5 g/m²) was more than 2-fold greater than in June (Table 4.2-16). Dry weight of organisms at SSES (6.6 g/m²) was nearly 3-fold greater than at Bell Bend (2.3 g/m²). Trichopterans composed most (55%) of the biomass at SSES, and ephemeropterans made up an additional 26%. Ephemeropterans composed 43% of the dry weight at Bell Bend, and trichopterans and dipterans composed 44%.

Mean biomass at SSES in 1983 was 4.4 g/m² (Table 4.2-16). Trichopterans (48%) and ephemeropterans (33%) composed 81% of the total weight. Mean biomass at Bell Bend in 1983 (1.9 g/m²) was less than half that found at SSES, due to the

relative scarcity of large-bodied trichopterans (especially hydropsychids); trichopteran dry weight at SSES (2.1 g/m^2) was 5-fold greater than at Bell Bend (Table 4.2-16). From 1978 through 1982, annual mean biomass at SSES has been between 2- and 3-fold greater than at Bell Bend. Differences in macroinvertebrate biomass at the two stations was largely attributed to differences in substrate and river current. For example, SSES is located in a riffle area, and is more suitable for rheophilic organisms, such as hydropsychids.

Macroinvertebrate density and biomass has generally increased at both stations since 1977 (Fig. 4.2-5). This increase has coincided with significant ($P < 0.05$) improvement in Susquehanna River water quality (Ref. 4.2-42). In particular, there has been a decrease in the harmful effects of acid mine drainage which have been shown to suppress the macroinvertebrate community in the study area (Ref. 4.2-43). The Susquehanna SES has had no detectable impact on the macroinvertebrate community at Bell Bend, the station downriver from the discharge diffuser.

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Table 4.2-1

Species of birds collected at the Unit 1 and 2 cooling towers of the Susquehanna SES, 1978-83.
An asterisk (*) denotes species found in 1983.

Picidae

- Picoides pubescens* - downy woodpecker
- Colaptes auratus* - northern flicker

Tyrannidae

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

Sittidae

- Sitta carolinensis* - 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 ustulata* - wood thrush

Mimidae

- Manotilla 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. pennsylvanica* - 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 ruticilla* - American redstart
- Helminthophila vermivora* - worm-eating warbler
- Seturus 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
- * *Parulinas* spp. - warbler spp.
- Piranga olivacea* - scarlet tanager
- Piranga* sp. - tanager sp.
- Phoebastria ludovicianus* - rose-breasted grosbeak
- Cyanococcyz parvulus* - blue grosbeak
- Spiza americana* - dickcissel
- Spizella pusilla* - field sparrow
- Melospiza lincolni* - Lincoln's sparrow
- M. georgiana* - swamp sparrow
- Zonotrichia leucophrys* - white-crowned sparrow
- Junco hyemalis* - dark-eyed junco
- * *Ammodramus saxatilis* - 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, 21 March through 3 June 1983.

FAMILY/SPECIES	MAR			APR			MAY				JUN	TOTAL
	21-23	28-1	4-8	11-15	18-22	25-29	2-6	9-13	16-20	23-27	30-3	
UNIT 1												
MUSCICAPIDAE												
GOLDEN-CROWNED KINGLET	0	0	0	1	0	0	1	0	0	0	0	2
HERMIT THRUSH	0	0	0	0	1	0	0	0	0	0	0	1
VIREONIDAE												
SOLITARY VIREO	0	0	0	0	0	0	0	1	0	0	0	1
RED-EYED VIREO	0	0	0	0	0	0	0	0	2	0	0	2
EMBERIZIDAE												
COMMON YELLOWTHROAT	0	0	0	0	0	0	0	5	0	0	0	5
GRASSHOPPER SPARROW	0	0	0	0	0	0	1	0	0	0	0	1
TOTAL INDIVIDUALS	0	0	0	1	1	0	2	6	2	0	0	12
TOTAL SPECIES	0	0	0	1	1	0	2	2	1	0	0	6
UNIT 2												
TROGLODYTIDAE												
HOUSE WREN	0	0	0	0	0	0	0	1	0	0	0	1
EMBERIZIDAE												
BLACK-AND-WHITE WARBLER	0	0	0	0	0	0	0	1	0	0	0	1
TOTAL INDIVIDUALS	0	0	0	0	0	0	0	2	0	0	0	2
TOTAL SPECIES	0	0	0	0	0	0	0	2	0	0	0	2

Table 4.2-3

Weekly bird impaction totals from Unit 1 and 2 cooling towers, 22 August through 4 November 1983.

FAMILY/SPECIES	AUG			12-16	SEP		26-30	OCT			NOV		TOTAL
	22-26	29-2	5-9		19-23	26-30		3-7	10-14	17-21	24-28	31-4	
UNIT 1													
<hr/>													
SITTIDAE													
WHITE-BREASTED NUTHATCH	0	0	0	0	0	0	0	0	1	0	0	1	
MUSCICAPIDAE													
GOLDEN-CROWNED KINGLET	0	0	0	0	0	0	0	0	0	0	1	1	
RUBY-CROWNED KINGLET	0	0	0	0	0	0	1	0	0	0	0	1	
VIREONIDAE													
SOLITARY VIREO	0	0	0	0	0	0	0	1	1	0	0	2	
PHILADELPHIA VIREO	0	0	0	0	0	0	0	1	0	0	0	1	
RED-EYED VIREO	0	0	1	0	0	1	2	1	1	0	0	6	
UNIDENTIFIABLE VIREO	0	0	0	0	0	1	0	0	0	0	0	1	
EMBERIZIDAE													
TENNESSEE WARBLER	0	0	0	0	0	1	0	0	0	0	0	1	
NORTHERN PARULA	0	0	0	0	0	0	0	0	1	0	0	1	
BLACK-THROATED BLUE WARBLER	0	0	1	0	0	0	0	1	0	0	0	2	
BLACKPOLL WARBLER	0	0	0	0	0	0	0	1	0	0	0	1	
COMMON YELLOWTHROAT	0	0	0	0	0	0	1	0	1	0	0	2	
UNIDENTIFIABLE WARBLER	0	0	0	0	0	1	0	0	1	0	0	2	
TOTAL INDIVIDUALS	0	0	2	0	0	4	4	5	6	0	1	22	
TOTAL SPECIES	0	0	2	0	0	4	3	5	6	0	1	11	
<hr/>													
UNIT 2													
<hr/>													
VIREONIDAE													
RED-EYED VIREO	0	0	0	0	0	0	1	0	0	0	0	1	
EMBERIZIDAE													
BLACKBURNIAN WARBLER	0	0	0	0	1	0	0	0	0	0	0	1	
BLACKPOLL WARBLER	0	0	0	1	0	0	0	0	0	0	0	1	
COMMON YELLOWTHROAT	0	0	0	1	0	0	0	0	0	0	0	1	
TOTAL INDIVIDUALS	0	0	0	2	1	0	1	0	0	0	0	4	
TOTAL SPECIES	0	0	0	2	1	0	1	0	0	0	0	4	

SUSQUEHANNA SES
Maintenance of Transmission Line Corridors
Selective Herbicide Application

Susquehanna-Wescosville

Lehigh
Division

Alt. No.	Commercial Name	Herbicides	Acid Equiv.	Spec. Am't. Per 100 Gal. Solution	Additives	Carrier	Spec. Am't. Per 100 Gal. Solution
1	Garlon 3A	Active Ingredient Triclopyr	3.00#/Gal.	2.00 Qts.	Commercial Name Surfel	Name Water	99.00 Gal.
	Tordon 101	Picloram 2,4-D	6.54#/Gal. 2.00#/Gal.	2.00 Qts.	Lo-Drift		
2	Krenite S	Fosamine	4.00#/Gal.	1.50 Gal.	Surfel	Water	100.00 Gal.

Application Data

Alt. No.	No. Of Acres	Total Gallons Solution	Application Rate Gal./A.	Total Gallons Concentrate	Rate Gal./A.	Total Pounds Acid Equivalent	Pounds Per Acre
1	52.80	5,800	109.8	Garlon 3A 29.0 Tordon 101 29.0	0.55 0.55	Triclopyr 87.0 Picloram 15.7	1.65 0.30
2	3.67	320	87.2	Krenite S 4.8	1.31	2,4-D 58.0 Fosamine 19.2	1.10 5.23

Alt. No.	Application Dates	Location By Grid No.
1	From 6-9-83	From 61394S53170
2	To 6-13-83	To 60729N24601
	10-7-83	60839N24038

SUSQUEHANNA SES
Maintenance of Transmission Line Corridors
Selective Herbicide Application

[illegible]

TABLE 4.2-4

SUSQUEHANNA SES
Maintenance of Transmission Line Corridors
Selective Herbicide Application

[illegible]

SUSQUHANNA RIVER MAINTENANCE OF TRANSMISSION LINE CORRIDORS

[illegible]

Table 4.2-6

Mean density (units/mm²) of periphytic algae on two acrylic plates submerged for 12 months at SSES on the Susquehanna River, 1983. Plates were sampled bimonthly (except April). Three replicates were taken per plate.

TAXON	15 FEB	15 JUN	15 AUG	13 OCT	22 DEC	% TOTAL
CHLOROPHYTA						
ACTINASTRUM	0.0	4.6	0.6	0.0	0.0	0.2
ANKISTRODESMUS	0.3	158.5	92.8	44.7	0.0	10.7
CHLAMYDOMONAS	0.0	3.7	0.0	0.0	0.0	0.1
CHODATELLA	0.0	0.0	0.3	0.0	0.0	<0.1
CLOSTERIUM	0.0	17.3	0.0	1.9	0.0	0.7
COELASTRUM	0.3	0.6	1.2	2.5	0.0	0.2
COSMARIUM	0.3	0.9	1.2	0.6	0.0	0.1
CRUCIGENIA	0.0	0.0	2.8	0.0	0.0	0.1
DICTYOSPHAERIUM	0.0	1.9	8.3	1.2	0.0	0.4
FRANCEIA	0.0	0.3	0.0	0.0	0.0	<0.1
KIRCHNERIELLA	0.6	2.8	15.7	14.5	0.0	1.2
MICRACTINIUM	0.0	0.3	0.0	0.0	0.0	<0.1
OOCYSTIS	0.0	0.3	1.9	2.5	0.0	0.2
PEDIASTRUM	0.3	0.3	4.3	11.4	0.0	0.6
POLYEDRIOPSIS	0.0	15.1	0.0	0.0	0.0	0.5
SCENEDESMUS	1.9	148.9	155.7	175.4	0.0	17.4
SELENASTRUM	0.0	1.2	0.3	0.3	0.0	0.1
STAUASTRUM	0.0	0.3	0.3	0.0	0.0	<0.1
TETRAEDRON	0.3	1.9	3.1	2.8	0.0	0.3
TETRASTRUM	0.0	4.0	0.9	1.2	0.0	0.2
UNIDENTIFIED CHLOROPHYTA	0.3	30.8	33.9	31.8	0.0	3.5
BACILLARIOPHYTA						
ACHANANES	0.6	0.6	0.9	0.6	0.0	0.1
AMPHORA	0.0	1.2	0.0	0.9	0.0	0.1
COCCONEIS	0.6	0.3	1.5	0.9	0.0	0.1
CYCLOTELLA	0.0	11.1	28.7	72.8	0.0	4.1
CYMBELLA	37.3	11.4	0.6	0.6	0.0	1.8
DIATOMA	9.6	0.0	0.0	0.0	0.0	0.3
EUNOTIA	0.0	0.3	0.0	0.0	0.0	<0.1
FRAGILARIA	3.7	0.0	0.0	0.0	0.0	0.1
FRUSTULIA	0.9	0.0	0.0	0.0	0.0	<0.1
GOMPHONEMA	4.0	2.2	2.2	9.3	0.0	0.6
GYROSIGMA	0.0	0.0	0.6	0.3	0.0	<0.1
MASTOGLDIA	0.3	0.0	0.0	0.0	0.0	<0.1
MELOSIRA	3.4	0.0	4.9	14.2	0.0	0.8
MERIDION	0.0	0.0	0.9	0.0	0.0	<0.1
NAVICULA	188.4	156.3	39.2	209.1	0.0	21.4
NEIDIUM	0.3	0.0	0.0	0.0	0.0	<0.1
NITZSCHIA	313.9	172.4	16.3	57.7	0.0	20.3
PINNULARIA	0.0	0.0	0.3	3.7	0.0	0.1
STEPHANODISCUS	4.6	58.0	19.1	23.1	0.0	3.8
SYNEORA	22.5	88.5	0.0	2.8	0.0	4.1
CYANOPHYTA						
CHROOCOCCUS	0.0	16.7	21.3	66.0	0.0	3.8
MERISMOPEDIA	0.0	0.0	38.9	2.2	0.0	1.5
MICROCYSTIS	0.0	1.2	0.9	0.0	0.0	0.1
OSCILLATORIA	0.0	0.0	0.9	0.9	0.0	0.1
SCHIZOTHRIX	0.0	0.3	0.0	0.3	0.0	<0.1
EUGLENOPHYTA						
EUGLENA	0.0	0.0	0.0	0.3	0.0	<0.1

Table 4.2-7

Mean density (units/mm²) of periphytic algae on two acrylic plates submerged for 12 months at Bell Bend on the Susquehanna River, 1983. Plates were sampled bimonthly (except April). Three replicates were taken per plate.

TAXON	15 FEB	15 JUN	15 AUG	13 OCT	22 DEC	1 TOTAL
CHLOROPHYTA						
ACTINASTRUM	0.0	6.2	0.7	0.0	0.0	0.1
ANKISTRODESMUS	1.2	306.5	467.7	203.9	0.0	11.2
CHLAMYDOMONAS	0.0	2.5	0.0	0.0	0.0	<0.1
CLOSTERIUM	0.0	0.9	0.0	0.6	0.0	<0.1
COELASTRUM	0.0	0.0	9.9	85.4	0.0	1.1
COSMARIUM	0.0	12.9	0.7	2.1	0.0	0.2
CRUCIGENIA	0.0	4.3	4.0	5.4	0.0	0.2
DICTYOSPHAERIUM	0.0	8.6	37.7	21.4	0.0	0.8
FRANCEIA	0.0	3.5	0.0	0.0	0.0	<0.1
GOLENKINIA	0.0	0.0	1.4	0.0	0.0	<0.1
KIRCHNERIELLA	0.0	0.3	111.7	113.6	0.0	2.6
OOCYSTIS	1.3	0.6	3.3	1.1	0.0	0.1
PEDIASTRUM	0.0	1.5	12.7	100.7	0.0	1.3
POLYEDRIOPSIS	0.0	6.2	0.0	0.0	0.0	0.1
SCENEDESMUS	0.9	309.4	807.4	1540.6	0.1	30.5
SCHROEDERIA	0.0	0.0	4.3	0.0	0.0	<0.1
SELENASTRUM	0.0	0.0	0.7	24.0	0.0	0.3
STAUASTRUM	0.0	0.0	6.5	0.0	0.0	0.1
TETRAEDRON	0.0	2.7	10.5	10.7	0.0	0.3
TETRASTRUM	0.0	1.9	2.2	9.1	0.0	0.2
UNIDENTIFIED CHLOROPHYTA	0.6	41.8	193.9	192.0	0.1	4.9
BACILLARIOPHYTA						
ACHNANTHES	1.2	2.4	2.2	4.3	0.0	0.1
AMPHORA	0.0	0.6	0.0	0.0	0.0	<0.1
ASTERIONELLA	0.0	0.3	0.0	0.0	0.0	<0.1
COCCONEIS	1.9	2.2	2.9	3.2	0.0	0.1
CYCLOTELLA	0.0	39.2	179.4	580.0	0.0	9.2
CYMBELLA	26.2	30.3	4.3	8.0	0.1	0.8
DIATOMA	7.1	0.0	0.0	2.1	0.0	0.1
FRAGILARIA	4.6	0.0	0.0	0.0	0.0	0.1
GOMPHONEMA	2.8	11.1	7.2	12.9	0.2	0.4
MELOSIRA	1.5	4.9	24.0	19.1	0.0	0.6
MERIDION	0.3	0.0	0.0	0.0	0.1	<0.1
NAVICULA	154.5	75.9	123.5	352.7	0.3	8.1
NITZSCHIA	238.7	212.6	73.0	257.5	0.7	9.0
PINNULARIA	0.0	0.6	2.2	1.6	0.0	0.1
RHIZOSOLENIA	0.0	0.7	0.0	0.0	0.0	<0.1
RHOICOSPHENIA	0.3	0.0	0.0	0.0	0.0	<0.1
STEPHANODISCUS	1.5	225.1	116.7	191.4	0.0	6.1
SURIELLA	0.0	0.3	0.0	0.0	0.0	<0.1
SYNEDRA	13.9	110.9	3.4	24.1	0.0	1.7
CYANOPHYTA						
CHROOCOCCUS	0.0	22.0	98.7	343.6	0.0	5.3
COELOSPHAERIUM	0.0	0.0	2.2	0.0	0.0	<0.1
MERISMOPEDIA	0.0	0.0	350.1	26.2	0.0	4.3
MICROCYSTIS	0.0	0.0	0.0	0.6	0.0	<0.1
OSCILLATORIA	0.0	0.3	4.3	1.1	0.0	0.1
SCHIZOTHRIX	0.0	0.6	0.6	4.2	0.1	0.1
SPIRULINA	0.0	0.0	0.7	0.0	0.0	<0.1
EUGLENOPHYTA						
TRACHELOMONAS	0.0	0.3	0.0	0.0	0.0	<0.1
PYRRHOPHYTA						
PERIDINIUM	0.0	0.7	0.0	0.0	0.0	<0.1
RHODOPHYTA						
RHODOSPIRIDIUM	0.0	0.0	0.7	0.0	0.0	<0.1

Table 4.2-8

Species of periphytic algae composing at least 5% of the total units counted in replicate samples at SSES and Bell Bend on the Susquehanna River, 1983. Numbers following diatoms indicate the species affinity for pH as rated by Lowe (Ref. 4.2-24): 1 = alkaliphilous, 2 = acidophilous, 3 = indifferent to pH, and 4 = unknown.

Species	pH Affinity	SSES	Bell Bend
CHLOROPHYTA			
<i>Ankistrodesmus falcatus</i>		Jun, Aug, Oct	Jun, Aug, Oct
<i>Kirchneriella contorta</i>			Aug
<i>Scenedesmus quadricauda</i>		Jun, Aug, Oct	Jun, Aug, Oct, Dec
BACILLARIOPHYTA			
<i>Cyclotella atomus</i>	(4)	Oct	Oct
<i>Cymbella minuta</i> ^a	(1, 3)	Feb	Feb, Dec
<i>Gomphonema olivaceum</i>	(1)		Dec
<i>Gomphonema</i> sp.			Dec
<i>Meridion circulare</i>	(1)		Dec
<i>Navicula cryptocephala</i>	(1)	Feb, Oct	Feb
<i>N. cryptocephala</i> var. <i>veneta</i>	(1)	Feb	Feb
<i>N. salinarum</i> var. <i>intermedia</i>	(4)	Feb, Oct	Feb, Oct, Dec
<i>N. tripunctata</i>	(1)	Feb	Feb
<i>N. viridula</i>	(1, 3)	Jun, Aug	Jun, Dec
<i>Nitzschia dissipata</i>	(1)	Feb, Jun, Oct	Feb, Jun, Dec
<i>N. palea</i>	(1, 3)	Jun, Oct	Jun, Oct
<i>Stephanodiscus inviscatus</i>	(4)	Jun, Aug	Jun, Oct
<i>Synedra ulna</i>	(1, 3)	Feb	
CYANOPHYTA			
<i>Chroococcus limneticus</i>		Oct	Oct
<i>Merismopedia tenuissima</i>		Aug	Aug
<i>Sphaerothrix calcicola</i>			Dec

^aReferred to as *Cymbella ventricosa* on page 76 in Gale and Gurzynski (Ref. 4.2-26). Reclassified as *Cymbella minuta* by Patrick and Reimer (Ref. 4.2-27).

Table 4.2-9

Density (units/ml) of phytoplankton in bimonthly samples (indicated by date and collection number) at SSES on the Susquehanna River, 1983.

TAXON	15 FEB AJG-83-009	15 JUN AJG-83-035	15 AUG AJG-83-069	13 OCT AJG-83-095	22 DEC AJG-83-131	MEAN	% TOTAL
CHLOROPHYTA						80.0	0.7
ACTINASTRUM	0	333	67	0	0	2182.5	19.5
ANKISTRODESMUS	0	5300	4800	813	0	0.3	<0.1
CERASTERIAS	0	0	0	0	2	40.0	0.4
CHLAMYDOMONAS	0	167	33	0	0	6.7	0.1
CLOSTERIUM	0	33	0	0	0	48.3	0.4
COELASTRUM	0	0	200	42	0	7.0	0.1
COSMARIUM	2	33	0	0	0	59.5	0.5
CRUCIGENIA	0	0	233	63	2	419.2	3.7
DICTYOSPHAERIUM	0	333	1700	63	0	40.0	0.4
GOLENKINIA	0	200	0	0	0	903.7	8.1
KIRCHNERIELLA	0	400	3567	552	0	53.3	0.5
MICRACTINIUM	0	267	0	0	0	8.8	0.1
PEDIASTRUM	0	0	33	10	0	13.3	0.1
POLYEDRIOPSIS	0	67	0	0	0	2695.5	24.1
SCENEDESMUS	2	4833	6500	2135	8	4.2	<0.1
SCHROEDERIA	0	0	0	21	0	28.7	0.3
SELENASTRUM	0	133	0	10	0	87.9	0.8
TETRAEDRON	0	67	300	73	0	32.1	0.3
TETRASTRUM	0	33	33	94	0		
UNIDENTIFIED CHLOROPHYTA	5	1800	2467	708	11	998.1	8.9
BACILLARIOPHYTA							
ACHNANTHES	2	0	0	0	0	0.3	<0.1
AMPHORA	0	33	0	0	0	6.7	0.1
ASTERIONELLA	3	0	0	0	20	4.6	<0.1
COCCONEIS	0	0	0	0	3	0.6	<0.1
CYCLOTELLA	12	567	667	448	0	338.7	3.0
CYMBELLA	12	0	0	0	6	3.7	<0.1
DIATOMA	0	0	0	0	6	1.2	<0.1
FRAGILARIA	0	0	0	0	6	1.2	<0.1
GOMPHONEMA	8	0	0	31	3	8.4	0.1
MERIDION	0	0	0	0	11	2.2	<0.1
NAVICULA	17	0	67	31	14	25.7	0.2
NITZSCHIA	31	600	233	177	37	215.6	1.9
STEPHANODISCUS	0	733	433	781	0	389.6	3.5
SYNEDRA	0	1133	0	0	0	226.7	2.0
CYANOPHYTA							
CHROOCOCCUS	3	967	4233	2979	0	1636.5	14.6
MERISMOPEDIA	0	0	2533	42	0	515.0	4.6
MICROCYSTIS	0	567	0	0	0	113.3	1.0
CHRYSTOPHYTA							
DINOBYRON	9	0	0	0	0	1.8	<0.1
TOTAL	105	18600	28100	9073	128	11200.9	

Table 4.2-10

Density (units/ml) of phytoplankton in bimonthly samples (indicated by date and collection number) at Bell Bend on the Susquehanna River, 1983.

TAXON	15 FEB AJG-83-001	15 JUN AJG-83-043	15 AUG AJG-83-061	13 OCT AJG-83-087	22 DEC AJG-83-123	MEAN	% TOTAL
CHLOROPHYTA							
ACTINASTRUM	0	308	0	0	0	61.5	0.5
ANKISTRODESMUS	0	6538	4600	740	0	2375.6	20.5
CHLAMYDOMONAS	0	77	100	42	0	43.7	0.4
COELASTRUM	0	0	167	42	0	41.7	0.4
COSMARIUM	0	0	0	0	2	0.3	<0.1
CRUCIGENIA	0	0	233	31	0	52.9	0.5
DICTYOSPHAERIUM	0	256	1033	83	0	274.6	2.4
FRANCEIA	0	154	0	0	0	30.8	0.3
GOLENKINIA	0	103	0	0	0	20.5	0.2
KIRCHNERIELLA	0	282	2067	781	0	626.0	5.4
MICRACTINIUM	0	359	0	0	0	71.8	0.6
MICROSPORA	0	0	0	0	2	0.3	<0.1
PELAISTRUM	0	0	167	52	2	44.1	0.4
POLYEDRIOPSIS	0	231	0	0	0	46.2	0.4
SCENEDESMUS	0	3462	7100	2000	6	2513.5	21.7
SCHROEDERIA	0	0	0	10	0	2.1	<0.1
SELENASTRUM	0	77	0	0	0	15.4	0.1
STAUASTRUM	0	0	0	10	0	2.1	<0.1
TETRAEDRON	0	308	300	31	0	127.8	1.1
TETRASTRUM	0	51	0	115	0	33.2	0.3
UNIDENTIFIED CHLOROPHYTA	3	1282	2833	948	14	1016.0	8.8
BACILLARIOPHYTA							
ACHNANTHES	2	26	0	0	22	9.7	0.1
AMPHORA	0	0	0	0	6	1.2	<0.1
ASTERIONELLA	6	0	0	0	8	2.8	<0.1
COCCONEIS	0	0	0	0	2	0.3	<0.1
CYCLOTELLA	5	846	733	281	20	377.1	3.3
CYMBELLA	11	26	0	0	8	8.8	0.1
DIATOMA	11	0	0	0	3	2.8	<0.1
GOMPHONEMA	6	0	0	0	9	3.1	<0.1
MELOSIRA	0	77	0	0	0	15.4	0.1
NAVICULA	12	26	33	52	35	31.7	0.3
NITZSCHIA	18	538	100	281	40	195.6	1.7
RHIZOSOLENIA	0	0	0	0	2	0.3	<0.1
RHOICOSPHENIA	0	0	0	0	3	0.6	<0.1
STEPHANODISCUS	0	974	500	521	0	399.0	3.4
SYNEDRA	5	1333	0	0	9	269.4	2.3
CYANOPHYTA							
CHROOCOCCUS	0	1590	5733	3708	0	2206.3	19.0
GOMPHOSPHAERIA	0	410	0	0	0	82.1	0.7
MERISMOPEDIA	0	0	2600	0	0	520.0	4.5
MICROCYSTIS	0	282	0	0	0	56.4	0.5
SCHIZOTHRIX	0	0	0	0	5	0.9	<0.1
CHRYSTOPHYTA							
DINOBYRON	3	0	0	0	6	1.8	<0.1
TOTAL	82	19615	28300	9729	201	11585.4	

4.2-11

Species of phytoplankton composing at least 5% of the total units counted in samples at SSES and Bell Bend on the Susquehanna River, 1983. Numbers following diatoms indicate the species affinity for pH as rated by Lowe (Ref. 4.2-24): 1 = alkaliphilous, 2 = acidophilous, 3 = indifferent to pH, and 4 = unknown.

Species	pH Affinity	SSES	Bell Bend
CHLOROPHYTA			
<i>Ankistrodesmus falcatus</i>		Jun, Aug, Oct	Jun, Aug, Oct
<i>Diatyosphaerium pulchellum</i>		Aug	
<i>Kirchneriella subsoletaria</i>		Aug, Oct	Aug, Oct
<i>Scenedesmus falcatus</i>			Aug, Oct
<i>S. quadricauda</i>		Jun, Aug, Oct	Jun
BACILLARIOPHYTA			
<i>Achnanthes minutissima</i>	(1, 3)		Dec
<i>Asterionella formosa</i>	(1)	Dec	
<i>Cyclotella pseudostelligera</i>	(1, 3)	Oct	
<i>Cymbella minuta</i> ^a	(1, 3)	Feb	Feb
<i>Diatoma vulgare</i>	(1)		Feb
<i>Meridion circulare</i>	(1)	Dec	
<i>Navicula cryptocephala</i> var. <i>veneta</i>	(1)	Feb	Feb
<i>N. salinarum</i> var. <i>intermedia</i>	(4)		Dec
<i>Nitzschia dissipata</i>	(1)	Feb, Dec	Feb, Dec
<i>N. palea</i>	(1, 3)	Feb	
<i>Stephanodiscus invisitatus</i>	(4)	Oct	Oct
<i>Synedra acus</i>	(1,3)		Jun
CYANOPHYTA			
<i>Chroococcus dispersus</i>		Aug	Aug
<i>C. minor</i>		Oct	Oct
<i>Chroococcus</i> sp.			Jun
<i>Merismopedia tenuissima</i>		Aug	Aug
CHRYSOPHYTA			
<i>Dinobryon divergens</i>		Feb	

^a Referred to as *Cymbella ventricosa* on page 76 in Gale and Gurzynski (Ref. 4.2-26). Reclassified as *Cymbella minuta* by Patrick and Reimer (Ref. 4.2-27).

Table 4.2-12

Description and location of benthic macroinvertebrate sampling sites on the Susquehanna River, 1983.

Station	SSES		BELL BEND	
	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

^aSite depth (m) when river surface elevation is 148.6 m above mean sea level (river discharge about 120 m³/s) at the Susquehanna SES Biological Laboratory.

^bBased on predominant particle size (Ref. 4.2-44).

^cThere tended to be accumulations of soft sediments downstream from boulders.

Table 4.2-13

Density (org/m²) and percent total of major groups of benthic macroinvertebrates collected in eight dome samples at each station on the Susquehanna River in June and October 1983.

TAXA	JUN		OCT		MEAN	
	ORG/M ²	% TOTAL	ORG/M ²	% TOTAL	ORG/M ²	% TOTAL
<u>SSES</u>						
OLIGOCHAETA	11634.8	35.2	4087.3	6.1	7861.1	15.7
EPTHEMEROPTERA	5482.6	16.6	5238.9	7.8	5360.7	10.7
HYDROPSYCHIDAE	3590.4	10.9	6472.3	9.7	5031.3	10.1
CHIRONOMIDAE	10915.2	33.0	41751.0	62.4	26333.1	52.7
OTHER	1464.6	4.4	9365.6	14.0	5415.1	10.8
TOTAL	33089.0		66918.7		50003.8	
<u>BELL BEND</u>						
OLIGOCHAETA	3551.2	10.8	681.0	1.8	2118.1	6.0
EPTHEMEROPTERA	5757.1	17.6	3659.2	9.3	4633.2	13.2
HYDROPSYCHIDAE	1162.6	3.5	1995.4	5.3	1579.0	4.5
CHIRONOMIDAE	20910.6	63.4	23866.0	63.8	22388.3	63.6
OTHER	1552.0	4.7	7422.6	19.8	4487.3	12.7
TOTAL	32978.5		37435.6		35207.1	
<u>COMBINED</u>						
OLIGOCHAETA	7595.0	23.0	2384.1	4.6	4989.5	11.7
EPTHEMEROPTERA	5639.7	17.1	4353.9	8.3	4996.8	11.7
HYDROPSYCHIDAE	2376.4	7.2	4233.8	8.1	3305.1	7.8
CHIRONOMIDAE	15912.2	48.2	32804.3	62.9	24359.3	57.2
OTHER	1908.2	4.6	8393.8	16.1	4951.0	11.6
TOTAL	33033.7		52177.1		42605.4	

Table 4.2-14

Mean density of benthic macroinvertebrates (org/m²) collected in dome samples at SSSES and Bell Bend on the Susquehanna River in June and October 1978-83.

YEAR	JUN			OCT			MEAN
	SSSES	BELL BEND	COMBINED	SSSES	BELL BEND	COMBINED	
1978	16131	9459	12795	40473	15465	27969	20382
1979	22968	17241	20104	67586	35647	51596	35850
1980	54359	36037	45198	58593	18629	38611	41905
1981	76080	12199	24139	41377	20129	30753	27446
1982	18084	10897	14490	60251	24655	42453	28472
MEAN (1978-82)	29524	17166	20345	53648	22905	38277	30811
1983	33089	32979	33034	66919	37436	52177	42605

Table 4.2-15

Mean density (org/m²) and percent total of benthic macroinvertebrates collected in four dome samples at each site on the Susquehanna River, 1983.

STATION SITE	SSES		PERCENT TOTAL	BELL BEND		PERCENT TOTAL
	I	II		I	III	
TAXON						
HYDRA SP.	6	0	<0.1	0	0	0.0
ALLOEOCOELA	43	69	0.1	61	49	0.2
TRICLADIDA	229	94	0.3	6	26	<0.1
PROSTOMA SP.	29	3	<0.1	20	8	<0.1
NEMATODA	459	420	0.9	285	290	0.8
LUMBRICIDAE	0	2	<0.1	0	0	0.0
NAIDIDAE	3741	8455	12.2	791	1006	2.6
TUBIFICIDAE	2121	1275	3.4	741	1537	3.2
LUMBRICULIDAE	78	51	0.1	28	133	0.2
HIRUDINEA	0	2	<0.1	0	0	0.0
ASELLUS SP.	3	0	<0.1	3	2	<0.1
GAMMARIDAE	2	2	<0.1	0	0	0.0
ASTACIDAE	0	0	0.0	2	2	<0.1
PLECOPTERA	29	20	<0.1	0	0	0.0
TAENIOPTERYGIDAE	0	0	0.0	0	2	<0.1
PERLIDAE	35	11	<0.1	14	25	<0.1
ACRONEURIA SPP.	0	2	<0.1	5	0	<0.1
PHASGANOPHORA SP.	18	6	<0.1	0	3	<0.1
EPHEMEROPTERA	66	18	<0.1	75	26	0.1
EPHEMERIDAE	0	0	0.0	5	0	<0.1
EPHORON SP.	340	74	0.4	179	229	0.6
POTAMANTHUS SPP.	1322	834	2.2	1049	798	2.6
CAENIS SP.	1587	590	2.2	839	1144	2.8
TRICORYTHODES SP.	0	3	<0.1	2	0	<0.1
EPHEMERELLIDAE	89	8	<0.1	6	0	<0.1
DRUNELLA CORNUPELLA	0	0	0.0	2	0	<0.1
DRUNELLA WALKERI	3	9	<0.1	2	0	<0.1
EPHEMERELLA SPP.	0	0	0.0	0	2	<0.1
EPHEMERELLA NEEDHAMI	0	2	<0.1	0	0	0.0
SERRATELLA DEFICIENS	5	32	<0.1	2	0	<0.1
PARALEPTOPHLEBIA SP.	0	0	0.0	0	2	<0.1
BAETIDAE	183	78	0.3	25	20	<0.1
BAETIS SP.	12	0	<0.1	2	0	<0.1
PSEUDOCLOEON SP.	3	0	<0.1	0	0	0.0
ISONYCHIA SP.	60	74	0.1	38	40	0.1
HEPTAGENIIDAE	2026	1175	3.2	1285	1979	4.6
HEPTAGENIA SPP.	172	87	0.3	224	301	0.7
RHITHROGENA SP.	8	2	<0.1	0	2	<0.1
STENACRON SPP.	14	57	<0.1	3	0	<0.1
STENACRON INTERPUNCTATUM	29	20	<0.1	11	84	0.1
STENONEMA SPP.	51	0	<0.1	0	28	<0.1
STENONEMA ITHACA	63	40	0.1	5	9	<0.1
STENONEMA PULCHELLUM	548	221	0.8	75	135	0.3
STENONEMA TERMINATUM	425	394	0.8	163	482	0.9
COENAGRIONIDAE	0	3	<0.1	0	2	<0.1
ARGIA SP.	8	2	<0.1	2	0	<0.1
SIALIS SP.	0	2	<0.1	5	11	<0.1
TRICHOPTERA	8	14	<0.1	14	0	<0.1
TRICHOPTERA (PUPAE)	6	74	<0.1	8	9	<0.1
TRICHOPTERA (ADULTS)	0	6	<0.1	2	0	<0.1
CHIMARRA SP.	6	0	<0.1	0	0	0.0
POLYCENTROPODIDAE	78	187	0.3	35	2	<0.1
NEURECLIPSIS SP.	90	236	0.3	11	14	<0.1
POLYCENTROPUS SP.	41	123	0.2	48	41	0.1
HYDROPSYCHIDAE	296	204	0.5	51	34	0.1
CHEUMATOPSYCHE SPP.	4821	3377	8.2	1980	917	4.1
HYDROPSYCHE SPP.	121	20	0.1	0	15	<0.1
HYDROPSYCHE PHALERATA	788	357	1.1	103	51	0.2
MACRONEMA SPP.	38	26	<0.1	3	2	<0.1
SYMPHITOPSYCHE SPP.	0	2	<0.1	0	0	0.0
SYMPHITOPSYCHE BIFIDA GR.	0	8	<0.1	3	0	<0.1
SYMPHITOPSYCHE MOROSA	3	2	<0.1	0	0	0.0
HYDROPTILIDAE	0	2	<0.1	0	0	0.0
HYDROPTILA SPP.	149	90	0.2	6	0	<0.1
OCHROTRICHIA SP.	2	0	<0.1	0	0	0.0

Table 4.2-15 (cont.)

STATION	SSES		PERCENT	BELL BEND		PERCENT
SITE	I	II	TOTAL	I	III	TOTAL
TAXON						
LEPTOCERIDAE	143	538	0.7	354	560	1.3
LEPTOCERIDAE (PUPAE)	0	0	0.0	0	2	<0.1
CERACLEA SPP.	9	29	<0.1	26	8	<0.1
CERACLEA ALAGHA	3	15	<0.1	3	0	<0.1
CERACLEA MACULATA	2	5	<0.1	0	0	0.0
CERACLEA MENTIEA	15	6	<0.1	2	2	<0.1
CERACLEA NEFFI	0	2	<0.1	0	0	0.0
CERACLEA TARSIPUNCTATA	0	0	0.0	3	0	<0.1
MYSTACIODES SPP.	3	0	<0.1	8	0	<0.1
NECTOPSYCHE SP.	462	1882	2.3	819	2876	5.2
OECETIS SPP.	51	35	<0.1	281	64	0.5
OECETIS AVARA	275	207	0.5	84	121	0.3
OECETIS CINERASCENS	160	78	0.2	25	6	<0.1
OECETIS INCONSPICUA	8	3	<0.1	49	126	0.2
LEPIDOPTERA	0	6	<0.1	0	0	0.0
PSEPHENUS SP.	2	0	<0.1	2	0	<0.1
DUBIRAPHIA SP.	3	0	<0.1	5	5	<0.1
OPTIOSERVUS SP.	46	49	<0.1	5	8	<0.1
STENELMIS SP.	670	488	1.2	184	397	0.8
STENELMIS SP.(ADULTS)	75	12	<0.1	0	2	<0.1
DIPTERA (PUPAE)	8	40	<0.1	0	0	0.0
TIPULIDAE	0	0	0.0	0	2	<0.1
HEXATOMA SP.	2	0	<0.1	0	0	0.0
SIMULIIDAE	0	20	<0.1	0	0	0.0
SIMULIIDAE (PUPAE)	0	2	<0.1	0	0	0.0
SIMULIUM SP.	14	12	<0.1	2	0	<0.1
HEMERODROMIA SP.	273	230	0.5	38	14	<0.1
HEMERODROMIA SP.(PUPAE)	3	6	<0.1	5	0	<0.1
CERATOPOGONIDAE	49	17	<0.1	67	37	0.1
CHIRONOMIDAE	72	0	<0.1	216	250	0.7
CHIRONOMIDAE (PUPAE)	103	144	0.2	324	35	0.5
TANYPODINAE	35	35	<0.1	0	35	<0.1
ABLABESMYIA SPP.	72	647	0.7	144	37	0.3
LABRUNDINIA SP.	0	107	0.1	0	35	<0.1
NILOTANYPUS SP.	0	0	0.0	0	35	<0.1
THIENEMANNIMYIA GR.	4574	9279	13.9	5356	4100	13.4
CHIRONOMINAE	503	1509	2.0	683	143	1.2
CHIRONOMUS SPP.	0	107	0.1	359	35	0.6
CRYPTOCHIRONOMUS SPP.	35	0	<0.1	0	0	0.0
CRYPTOCHIRONOMUS FULVUS GR.	2	0	<0.1	216	71	0.4
DICROTENDIPES NEOMODESTUS	1474	3092	4.6	1725	468	3.1
ENDOCHIRONOMUS NIGRICANS	0	35	<0.1	35	0	<0.1
GLYPTOTENDIPES SP.	324	360	0.7	178	35	0.3
MICROTENDIPES SP.	3488	5215	8.7	7836	13876	30.8
POLYPEDILUM CONVICTUM	3347	6759	10.1	862	324	1.7
POLYPEDILUM NR. SCALAENUM	35	503	0.5	394	71	0.7
RHEOTANYTARSUS SPP.	2158	3199	5.4	2768	899	5.2
RHEOTANYTARSUS						
DISTINCTISSIMUS GR.	0	35	<0.1	0	0	0.0
TANYTARSUS SPP.	719	1617	2.3	828	719	2.2
ZAVRELIA GR.	0	0	0.0	72	0	0.1
ZAVRELIA GR.	215	287	0.5	216	252	0.7
ORTHOCLADIINAE	35	143	0.2	0	72	0.1
CORYNONEURA CELERIPES	0	144	0.1	216	179	0.6
CRICOTOPUS SPP.	71	144	0.2	71	72	0.2
CRICOTOPUS BICINCTUS	0	35	<0.1	0	0	0.0
CRICOTOPUS TREMULUS GR.	215	359	0.6	179	35	0.7
EUKIEFFERIELLA SAVARICA GR.	107	72	0.2	0	0	0.0
EUKIEFFERIELLA						
DISCOLORIPES GR.	143	360	0.5	0	0	0.0
NANOCLADIUS SPP.	215	503	0.7	106	215	0.5
SYNORTHOCCLADIUS SP.	0	35	<0.1	0	0	0.0
PHYSA SP.	11	6	<0.1	0	0	0.0
LYMNAEA SP.	0	0	0.0	0	6	<0.1
GYRAULUS SP.	0	0	0.0	0	6	<0.1
HELISOMA SP.	25	15	<0.1	0	23	<0.1
FERRISSIA SP.	98	155	0.3	80	90	0.2
PISIDIUM SP.	419	597	1.0	373	390	1.1
SPHAERIUM SPP.	363	581	0.9	305	508	1.2

Table 4.2-16

Dry weight (g/m^2) 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 1983.

TAXA	JUN		OCT		MEAN	
	G/M^2	% TOTAL	G/M^2	% TOTAL	G/M^2	% TOTAL
<u>SSES</u>						
OLIGOCHAETA	<0.1	1.8	0.3	5.0	0.2	4.2
EPHEMEROPTERA	1.1	52.1	1.7	26.3	1.4	32.6
TRICHOPTERA	0.1	25.5	3.7	55.3	2.1	48.0
DIPTERA	<0.1	1.4	0.3	5.1	0.2	4.2
MOLLUSCA	0.3	15.8	0.1	1.9	0.2	5.3
OTHER	<0.1	3.4	0.4	6.4	0.2	5.8
TOTAL	2.1		6.6		4.4	
<u>BELL BEND</u>						
OLIGOCHAETA	0.1	7.9	<0.1	2.2	<0.1	4.3
EPHEMEROPTERA	0.9	68.7	1.0	42.6	1.0	52.3
TRICHOPTERA	0.1	7.7	0.8	32.2	0.4	23.1
DIPTERA	0.1	8.7	0.3	11.3	0.2	10.3
MOLLUSCA	<0.1	2.9	0.1	5.3	<0.1	4.4
OTHER	<0.1	4.1	0.2	6.4	0.1	5.6
TOTAL	1.4		2.3		1.9	
<u>COMBINED</u>						
OLIGOCHAETA	<0.1	4.2	0.2	4.3	0.1	4.2
EPHEMEROPTERA	1.0	58.6	1.4	30.6	1.2	38.5
TRICHOPTERA	0.3	18.5	2.2	49.3	1.3	40.6
DIPTERA	<0.1	4.3	0.3	6.7	0.2	6.0
MOLLUSCA	0.2	10.7	0.1	2.8	0.2	5.0
OTHER	<0.1	3.7	0.3	6.4	0.2	5.7
TOTAL	1.8		4.5		3.1	

Table 4.2-17

Mean dry weight of benthic macroinvertebrates (g/m^2) collected with a dome sampler at SSSES and Bell Bend on the Susquehanna River in June and October 1978-83.

YEAR	JUN			OCT			MEAN
	SSSES	BELL BEND	COMBINED	SSSES	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
MEAN (1978-82)	1.6	1.1	1.3	6.2	2.0	4.1	2.7
1983	2.1	1.4	1.8	6.6	2.3	4.5	3.1

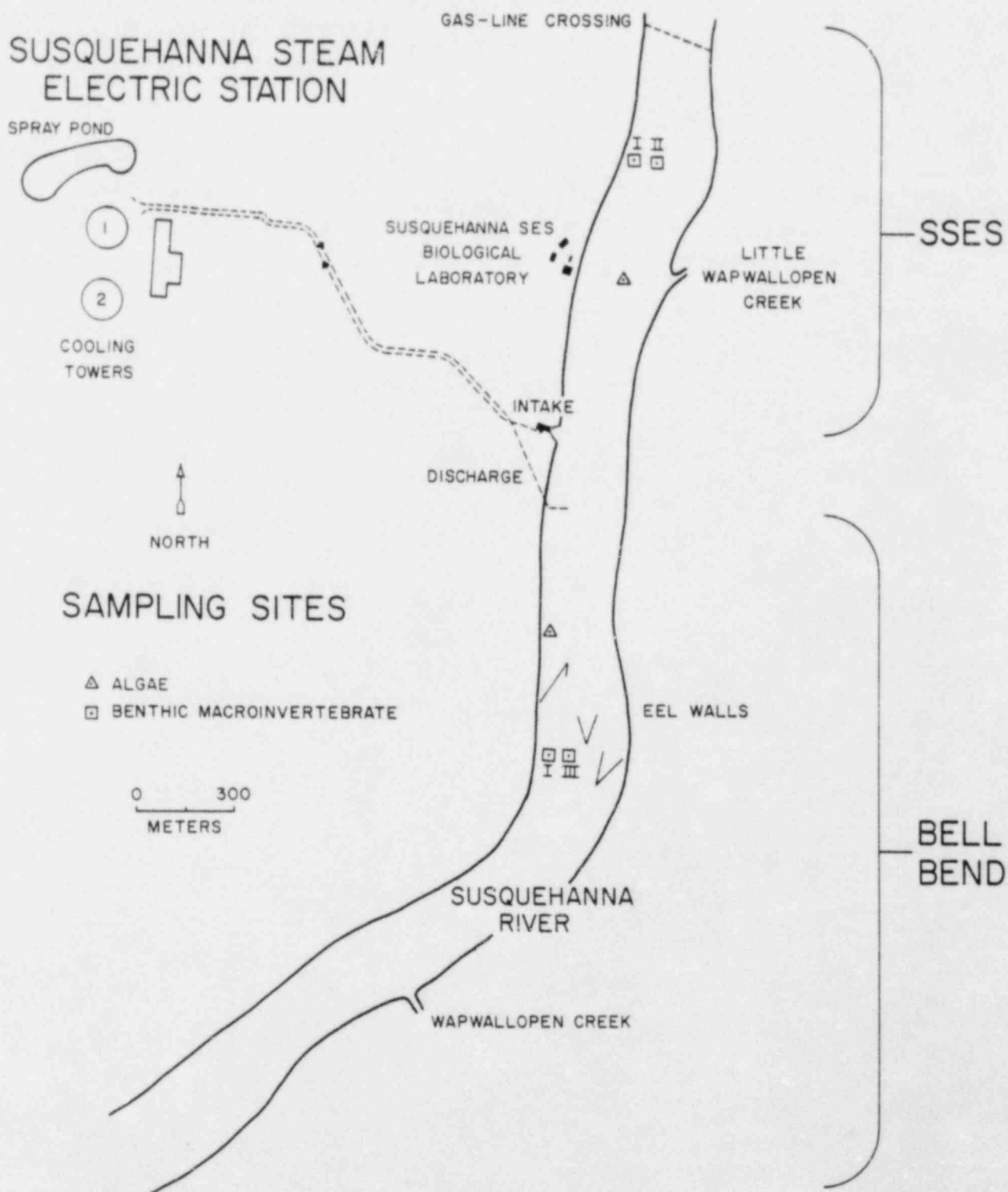


Fig. 4.2-1

Algae and benthic macroinvertebrate sampling sites at SSES and Bell Bend on the Susquehanna River, 1983.

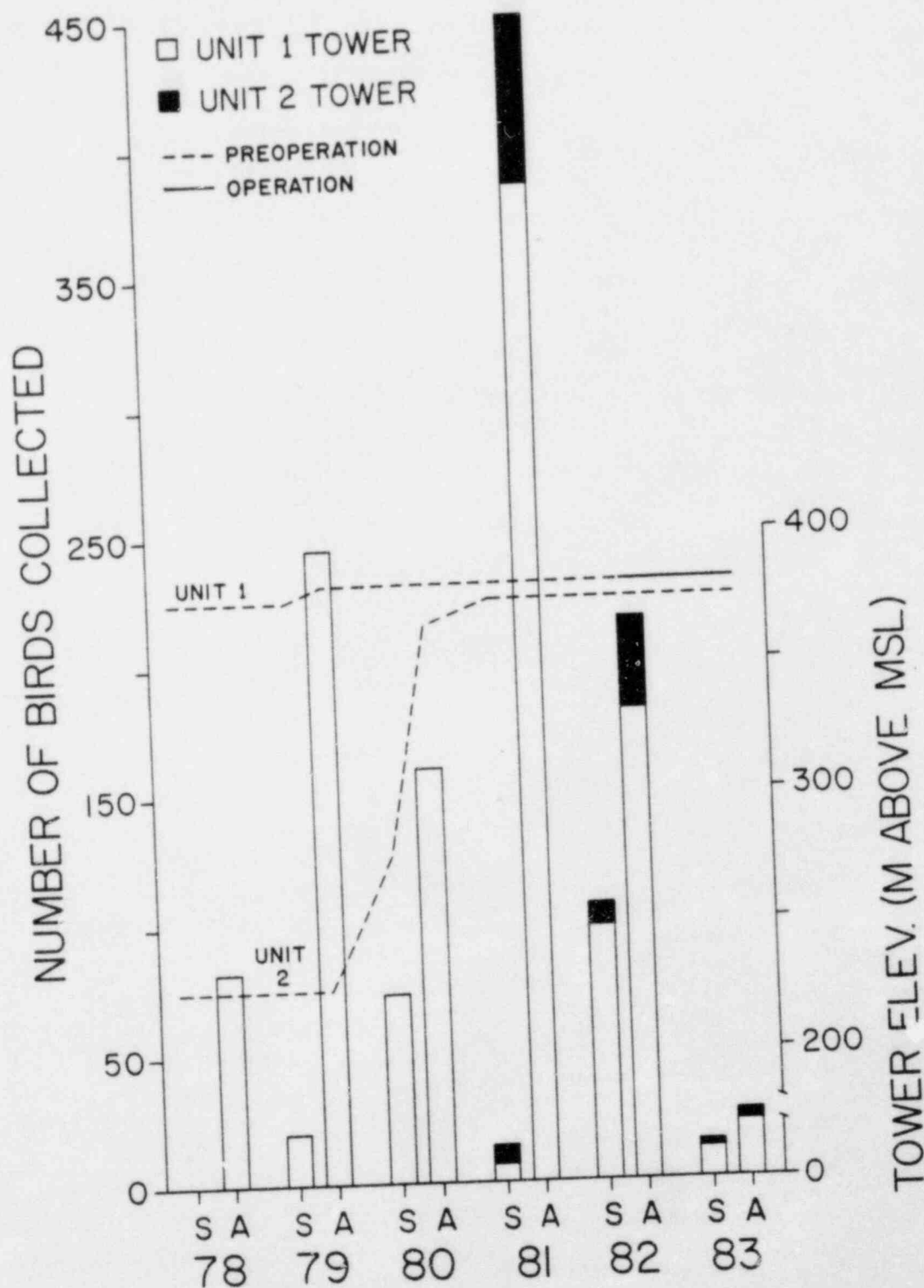


Fig. 4.2-2

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 1983 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.

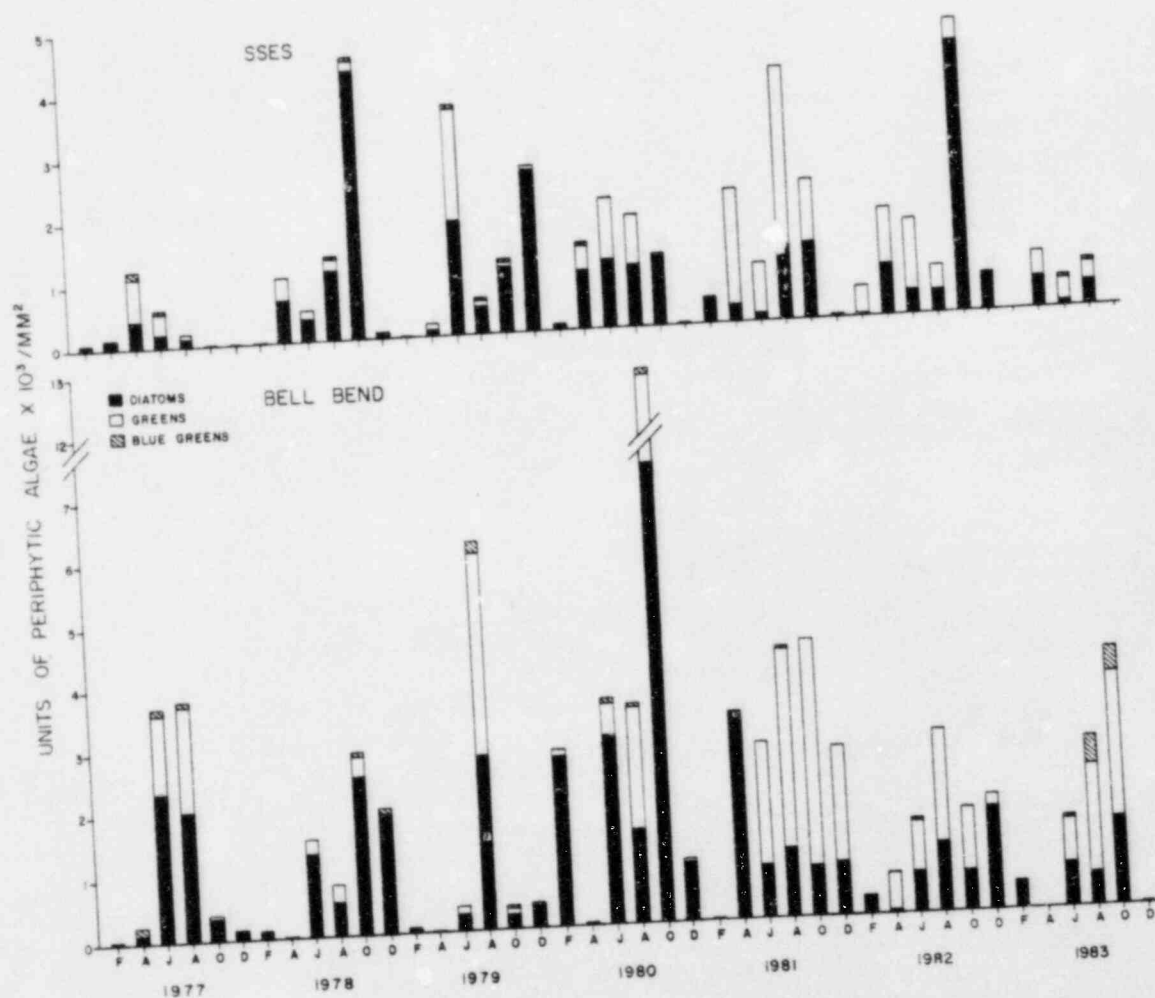


Fig. 4.2-3

Standing crop of periphytic algae (units/mm^2) on cumulative acrylic plates at SSES and Bell Bend on the Susquehanna River, 1977-83. No samples were collected in April 1983.

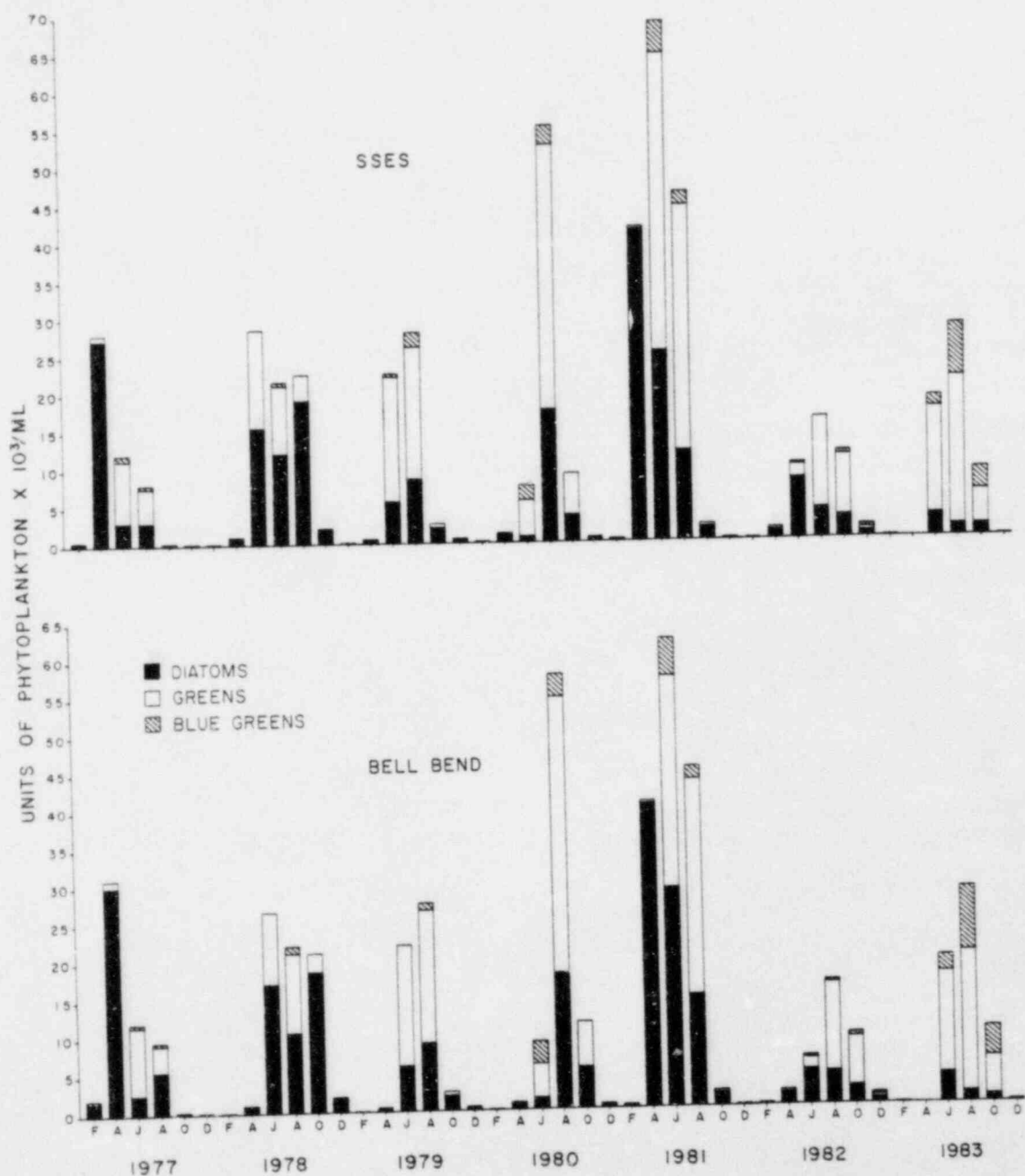


Fig. 4.2-4

Standing crop of phytoplankton (units/ml) from bimonthly samples taken at SSSES and Bell Bend on the Susquehanna River, 1977-83. No samples were collected in April 1983.

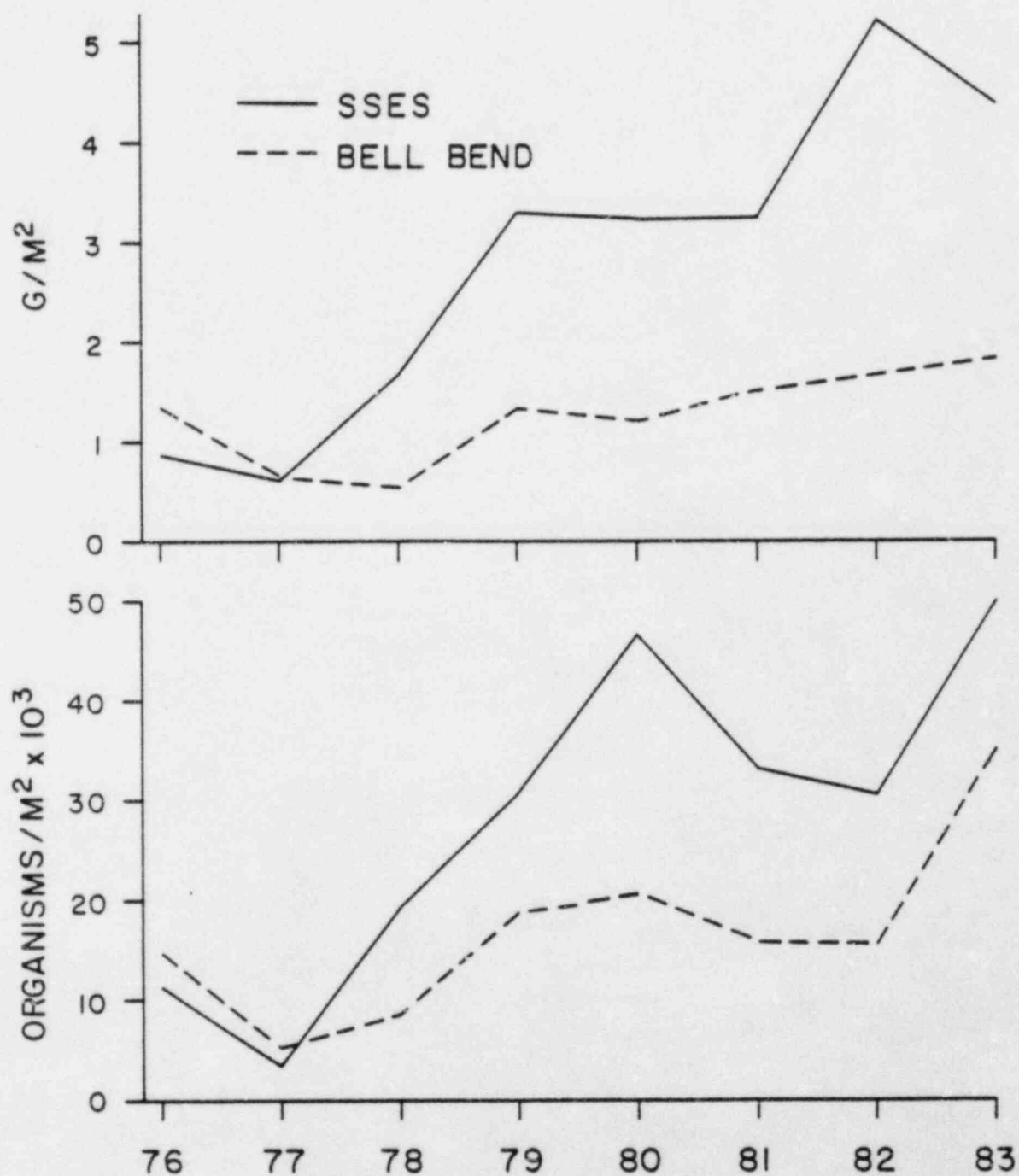


Fig. 4.2-5

Annual mean biomass (g/m^2) and density (org/m^2) of benthic macroinvertebrates collected in dome samples at SSES and Bell Bend on the Susquehanna River, 1976-83. The 1983 mean is based on June and October samples.

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 are conducted by the Nuclear Quality Assurance Department with support from the Environmental Management Department. Environmental activities audited in 1983, included:

- o monitoring and reporting requirements associated with the NPDES permit,
- o records associated with herbicide usage within the Susquehanna SES transmission line corridors.

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 Auditing/Modeling 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 5 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 1983.

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 1983. 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 non-radiological preoperational studies, and an assessment of observed impacts of plant operation on the environment. During 1983, 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 1983 were reported to other 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 ORGANIZATIONAL CHART

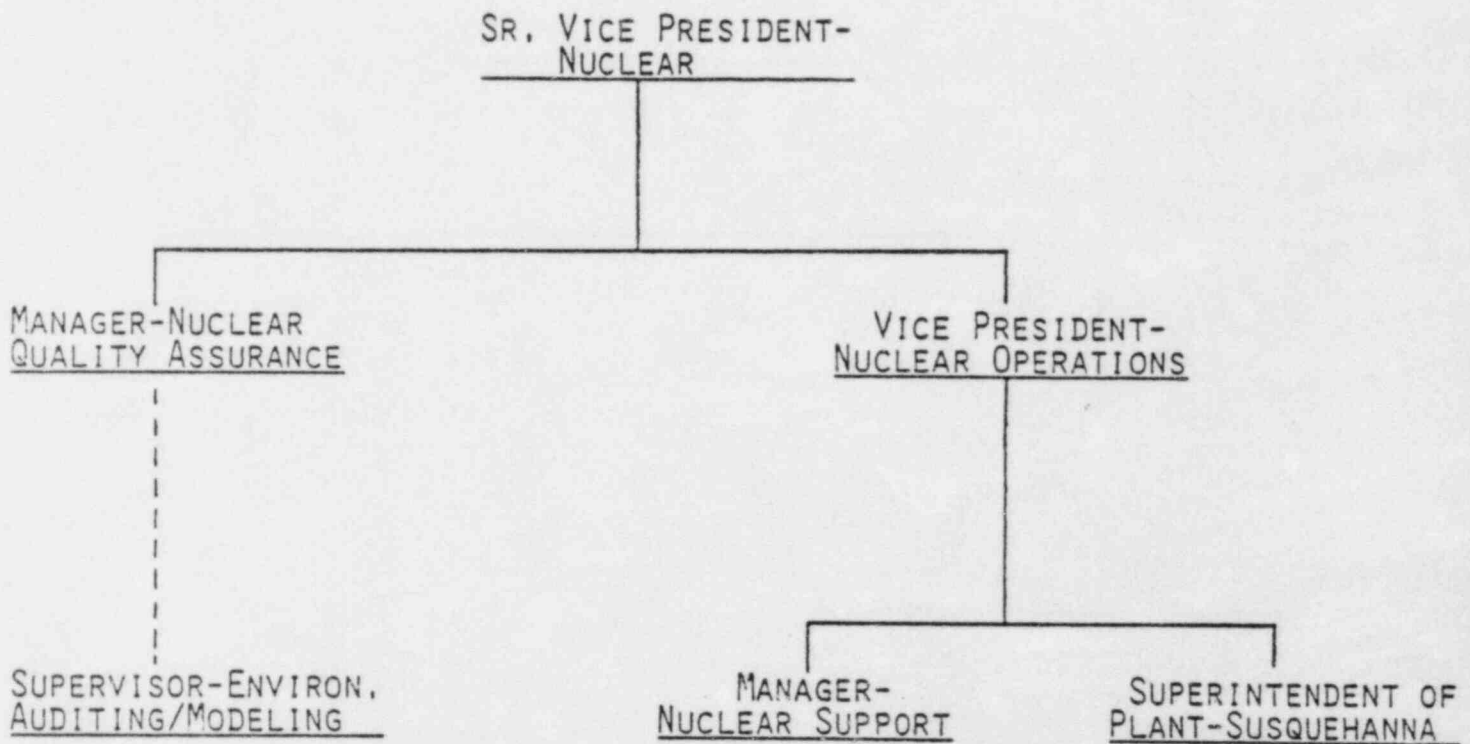


EXHIBIT 1

- o Shad Impingement Survey

ICHTHYOLOGICAL ASSOCIATES, INC.

SUSQUEHANNA RIVER ECOLOGICAL STUDY

EDWARD C. RANNEY, Ph.D.
President

301 Forest Drive
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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

7 November 1983

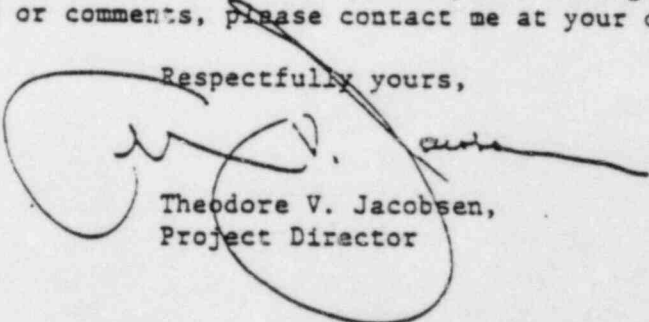
Richard St. Pierre
U.S. Fish & Wildlife Service
PO Box 1673
Harrisburg, PA 17105-1673

Dear Dick:

Pursuant to your request, checks were made for the occurrence of juvenile American shad on the intake screens of the Susquehanna Steam Electric Station (22 Aug-14 Oct 1983) and the Hunlock Steam Electric Station (17 Aug-14 Oct 1983). Personnel from Ichthyological Associates conducted the survey at Susquehanna and plant staff from UGI monitored their own screens at Hunlock. At both power plants, screens were washed three times daily (once per 8-hour shift). At Susquehanna, cumulative washes were checked for fish once each day, Monday through Friday (washes from Saturday and Sunday were included in the Monday wash). At Hunlock, each wash was checked for fish while it was in progress.

No juvenile shad were collected at either power plant during these surveys. If you have any questions or comments, please contact me at your convenience.

Respectfully yours,



Theodore V. Jacobsen,
Project Director

TVJ/msh

EXHIBIT 2

- o Sound Level Measurements Near Susquehanna Steam Electric Station
Site 1983



Report No. 3024A-8

**Sound Level Measurements Near Susquehanna Steam
Electric Station Site 1983
Operation Noise Progress Report**

J.D. Barnes and E.W. Wood

April 1984

Prepared for:
Pennsylvania Power and Light Company

Report No. 3024A-8

SOUND LEVEL MEASUREMENTS NEAR SUSQUEHANNA
STEAM ELECTRIC STATION SITE 1983

Operation Noise Progress Report

J.D. Barnes and E.W. Wood

April 1984

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 ninth 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. This report summarizes the acoustic data and observations obtained with Unit 1 in operation and Unit 2 in the final stages of construction. Bolt Beranek and Newman Inc. (BBN) obtained these measurements during the week of 26-30 September 1983 to update the acoustic description of the community near the site and to provide sufficient data for the Susquehanna SES Annual Operating Report.

Prior to performing this field program, 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 are 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 selected three locations near the site for primary measurements and two locations farther from the site for secondary measurements. Other locations close-in to the site were discontinued after PPL purchased the property at each

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

Unit 1 operated at between 1082 - 1093 MW(e) gross generation during the week of 26-30 September 1983. The design water flow rate for the unit's cooling tower blowdown is 5000 gpm. The actual cooling tower water flow rate during the survey was approximately 7000 gpm.

Unit 2 construction was more than 90% complete, with work continuing in the main power block, west laydown area, and service and administration building annex. The main power block work included installation of mechanical and electrical equipment, movement of trailers to outside the new security fenceline, and dirt hauling to the west laydown area. The west laydown work involved one dozer leveling the area to the west of the town road. Pneumatic tools were employed for constructing an addition at the service and administration building. Both cooling towers were in operation and Unit 1 was producing a visible plume, while Unit 2 was only pumping water. Miscellaneous activities included trash removal with the waste trucks leaving the site along the construction access road.

A total of approximately 1000 people are employed for the operation of Unit 1. 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. For the September 1983 activity at Unit 2, the day construction shift included approximately 1500 workers, with only about 300 workers outdoors. The great majority of the workers were pipefitters, electricians, carpenters, laborers, equipment operators,

insulators, and ironworkers. The evening construction shift consisted of approximately 400 people working in the main power block. Little outdoor activity was observed by the measurement team during the evening and nighttime periods. Noise sources associated with Unit 2 construction were noted by the team and it was judged that the construction noise was of small influence to the overall community sound measurements.

The weather conditions during the measurement survey varied, with generally clear or light overcast skies, daytime temperatures of 60° to 75°, and light breezes early in the week and gustier breezes later in the week. The wind direction was variable and the wind speed was typically less than 10 mph. The nighttime temperatures were generally 10°F less than the daytime temperatures, and light, intermittent rain fell during the morning hours on 30 September 1983.

Figure 1 illustrates the current primary and secondary measurement locations near the site. A photo of the main power block, taken on 1 September 1983 with Unit 1 in operation and Unit 2 construction almost complete, is presented in Fig. 2.

The field measurement and calibration techniques employed in the September 1983 survey were similar to those used in the 1982 survey. Table 1 lists the measurement instruments that the field team used for the 1983 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 Engineers³ (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 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 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. K-1 in Appendix K. The following sections present the results of the sound level measurements.

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

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

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

2. SOUND LEVEL MEASUREMENTS AT PRIMARY AND SECONDARY LOCATIONS

Continuous sound level measurements were obtained during 24-hr periods in the community at the primary locations 2', 3, and 4 shown in Fig. 1. Table II summarizes the sound level data obtained 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 48 dB(A) to 54 dB(A), while the nighttime L_{eq} values ranged from 37 dB(A) to 44 dB(A). The table also presents the 24-hr L_{eq} and L_{dn} values and shows the 24-hr L_{eq} ranging from 46 dB(A) to 52 dB(A) and the L_{dn} values ranging from 48 dB(A) to 54 dB(A). The field measurement team observed that the background sound levels were generally controlled by off-site sources, such as insects, and that operation and construction sources, including transformers, backup alarms, and paging were sometimes audible. Appendix J 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 50 dB(A) at location 5 to 52 dB(A) at location 7, while the nighttime L_{eq} sound levels decreased to 43 dB(A) at both locations. The 24-hr L_{eq} sound levels ranged from 48 dB(A) at location 5 to 50 dB(A) at location 7 and the L_{dn} sound levels were 51 dB(A) at location 5 and 52 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 J 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 rotating equipment near the west side of the main plant. Figures 4-8 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 4 illustrates the tonal sound at 107.5 Hz produced by the rotating equipment and the tonal sound at 120, 240, 360, and 480 Hz produced by the transformers that were measured at location 2'. The rotating equipment tone had not been present during the 1982 survey and may have been associated with temporary operations at the plant during 1983. The field team plans to further identify the equipment source if the tonal sound is present during the 1984 survey. Although other tones are shown in Figs. 5-8, these additional tones were not noticeable to the field team while at the site.

3. SUPPLEMENTAL SOUND LEVEL MEASUREMENTS

The field team has conducted supplemental sound level measurements during previous surveys at locations quite distant from the Susquehanna SES. These measurements were performed to increase the existing data base of background sound levels for locations up to five miles from the site. Figure K-1 in Appendix K 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 K, in the same format as Appendix J.

4. ASSESSMENT

The field team visited the PPL Special Office of the President in Berwick, PA, during the September 1983 survey 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. In addition, no noise related complaints were received at the Office during the balance of 1983. 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 1984.

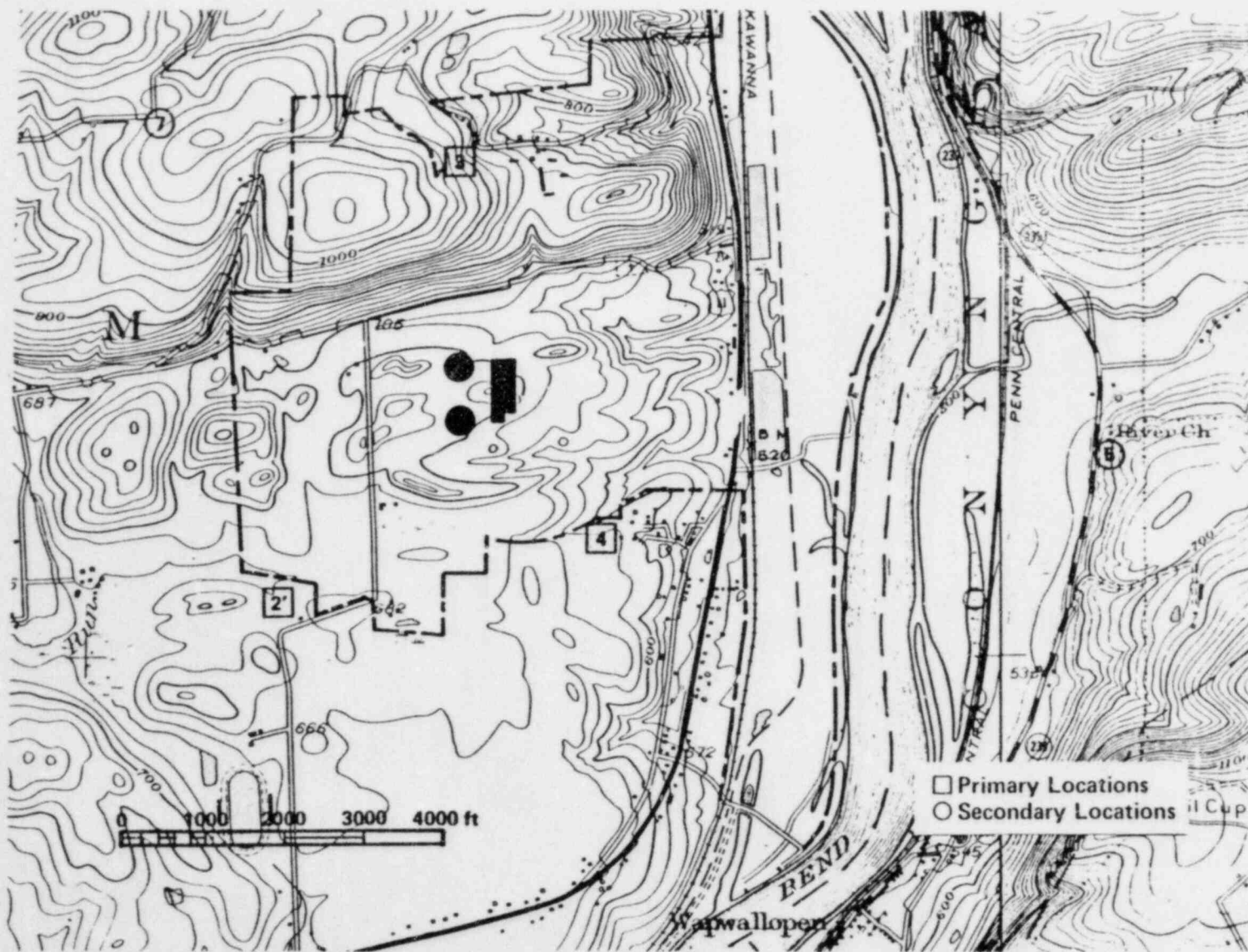
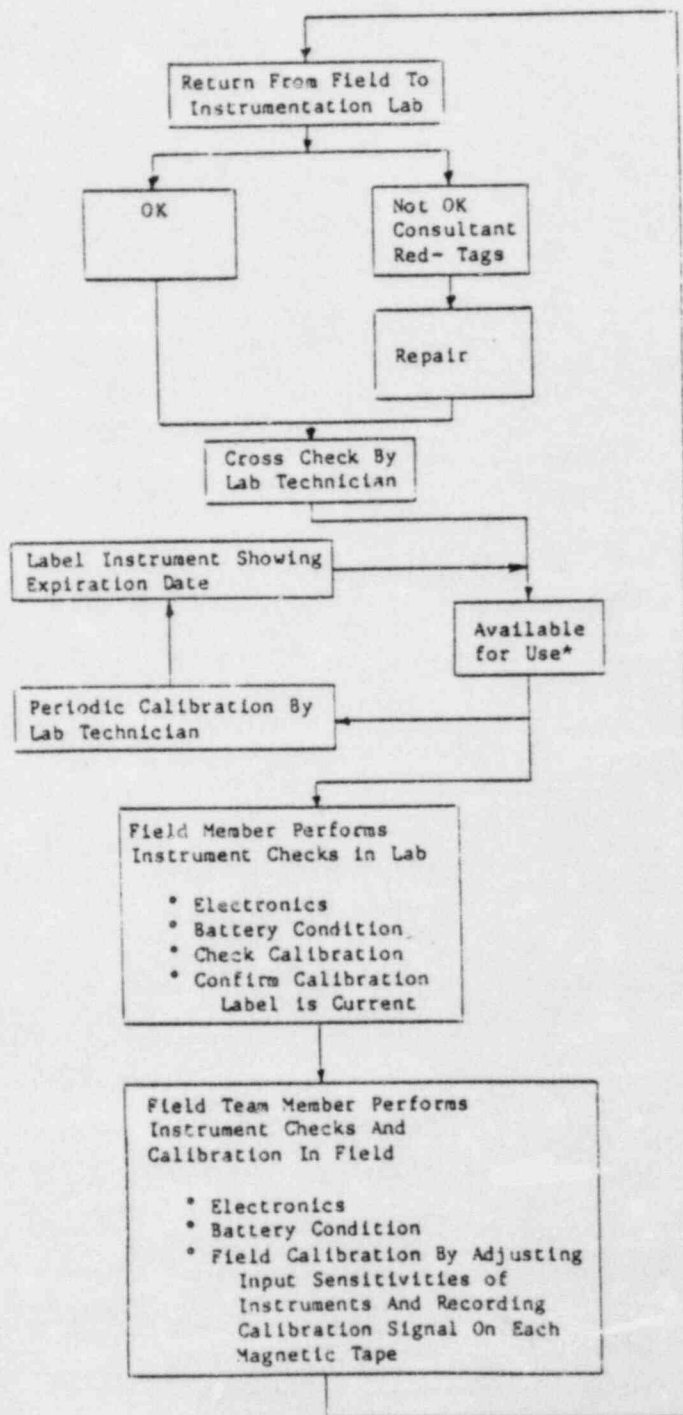


FIG. 1 MAP OF GENERAL AREA NEAR THE SUSQUEHANNA SES SITE SHOWING PRIMARY AND SECONDARY SOUND LEVEL MEASUREMENT LOCATIONS AND SITE PROPERTY LINE.



FIG. 2. PHOTOGRAPH OF MAIN STATION COMPLEX TAKEN ON 1 SEPTEMBER 1983.
VIEW LOOKING TO THE WEST.



*Rarely used instruments are calibrated as required for specific projects.

FIG. 3. SUMMARY OF OVERALL CALIBRATION AND CHECK PROCEDURES FOR ACOUSTIC INSTRUMENTATION.

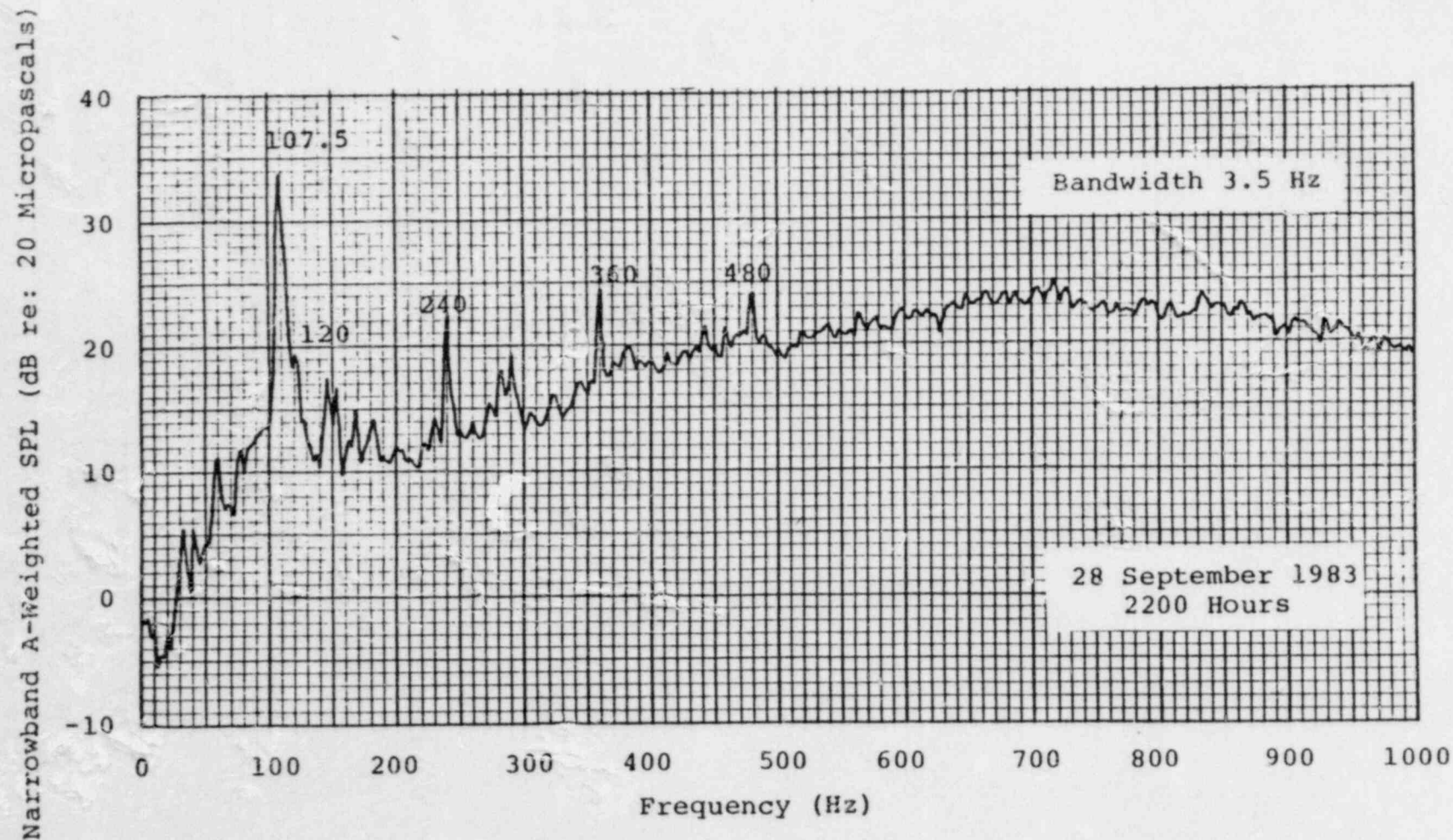


FIG. 4. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVELS (SPL) OBTAINED AT LOCATION 2' - 1983 OPERATION.

Narrowband A-Weighted SPL (dB re: 20 Micropascals)

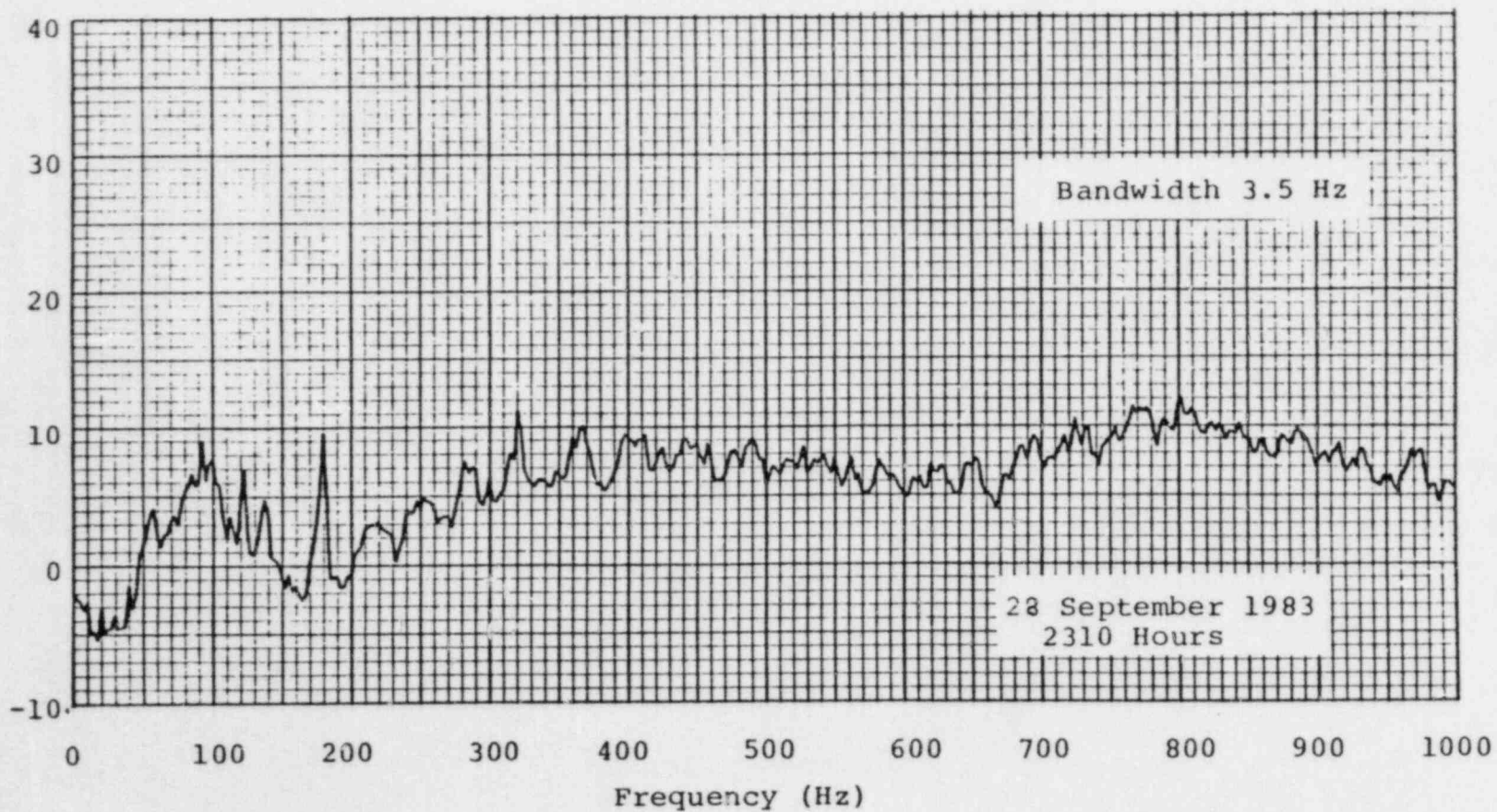


FIG. 5. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVELS (SPL) OBTAINED AT LOCATION 3 - 1983 OPERATION.

14

Narrowband A-Weighted SPL (dB re: 20 Micropascals)

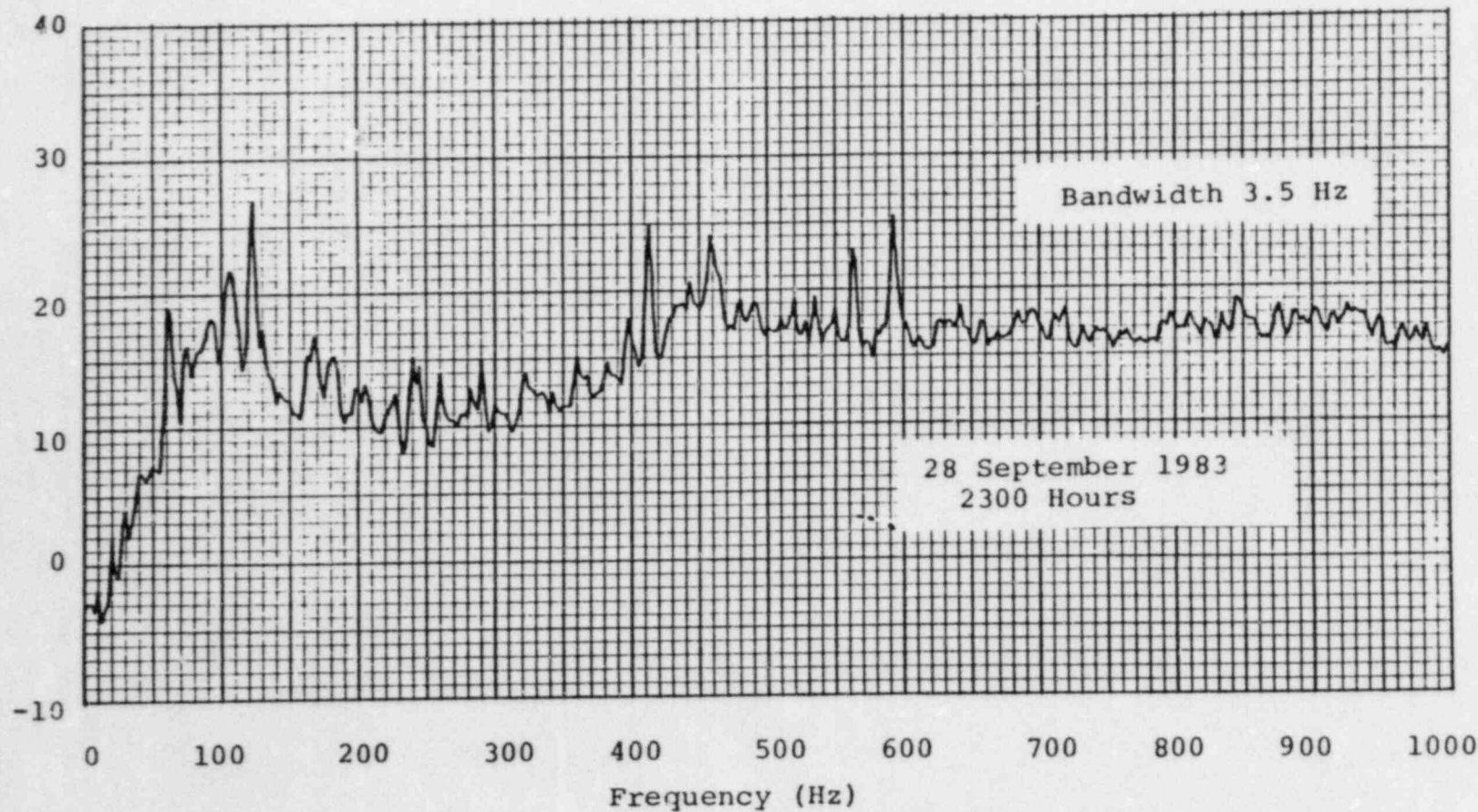


FIG. 6. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVEL (SPL) OBTAINED AT LOCATION 4 - 1983 OPERATION.

Narrowband A-Weighted SPL (dB re: 20 Micropascals)

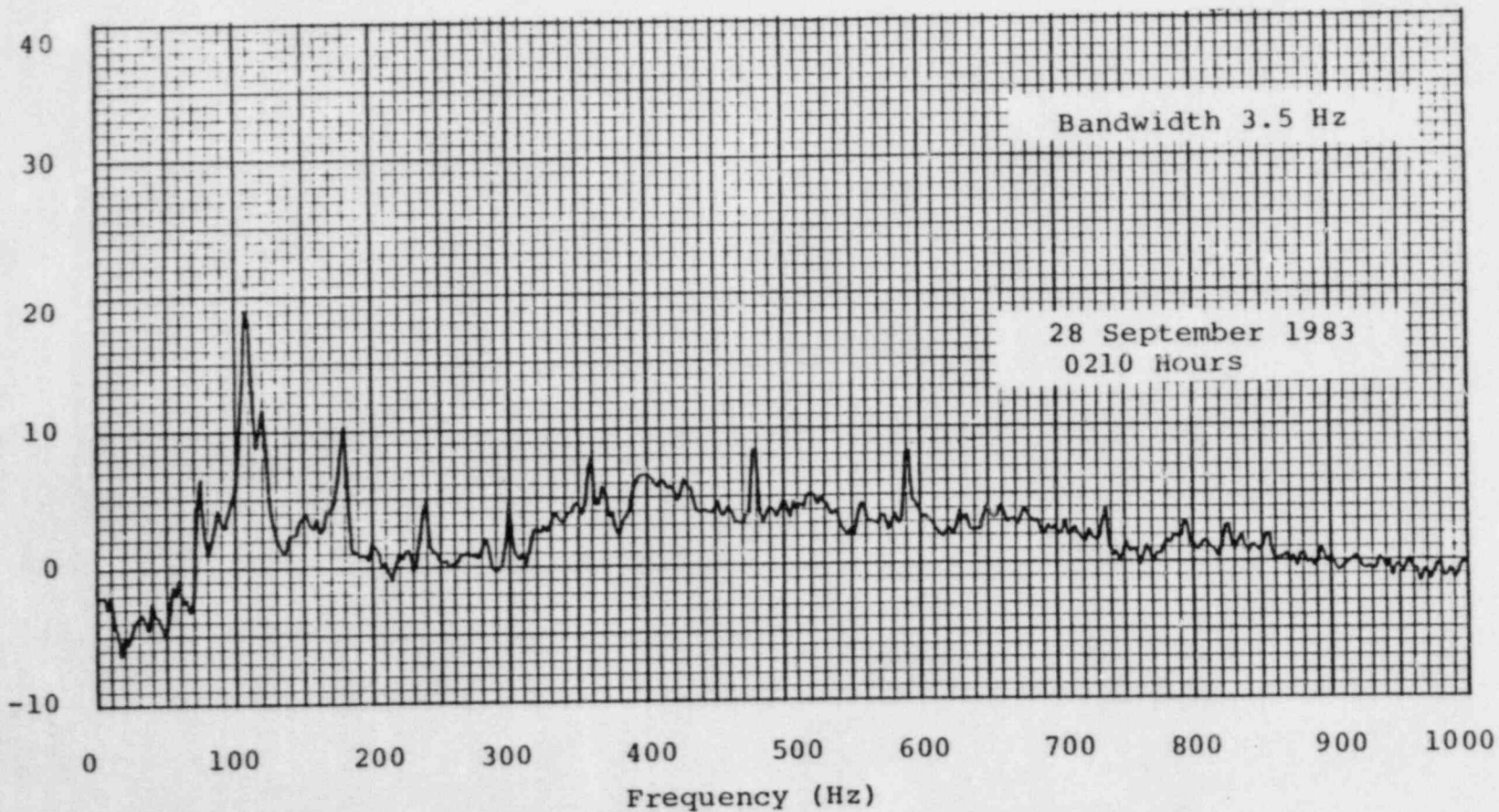


FIG. 7. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVELS (SPL) OBTAINED AT LOCATION 5 - 1983 OPERATION.

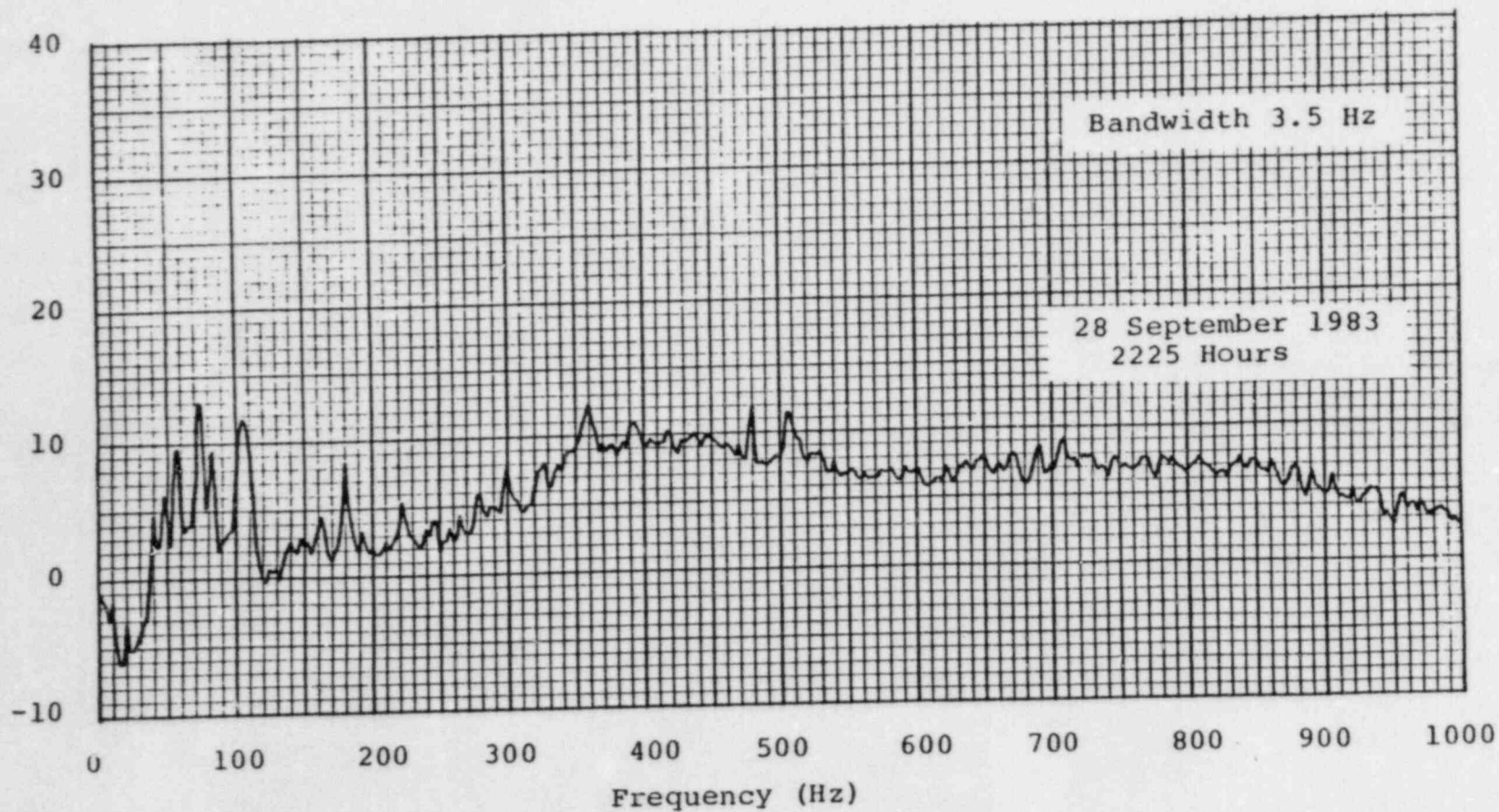


FIG. 8. NARROWBAND A-WEIGHTED SOUND PRESSURE LEVELS (SPL) OBTAINED AT LOCATION 7 - 1983 OPERATION.

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
9/26/83 to 9/30/83	SLM	BK	2203	112881	3 mos.	8/19/83
	OBF	BK	1613	151339	3 mos.	8/19/83
	SLM	BK	2204	266518	3 mos.	8/30/83
	OBF	BK	1613	87967	3 mos.	8/30/83
	PC	BK	4220	274218	3 mos.	8/19/83
	TR	KN	III	BH66 9164	3 mos.	7/25/83
	PSMS	BBN	614	773110	6 mos.	9/7/83
	ACAL	GR	1567	22640	3 mos.	9/9/83

*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 - 1983 [dB(A)]

Position	Time *	Daytime (0700 - 2200)				Nighttime (2200-0700)				24-Hr.	
		Background	Intrusive	Equivalent	Range	Background	Intrusive	Equivalent	Range	Equivalent	Day-Night
		L ₉₀	L ₁₀	L _{eq}	L ₉₉ to L ₁	L ₉₀	L ₁₀	L _{eq}	L ₉₉ to L ₁	L _{eq} (24)	L _{dn}
2'	9/26 @ 1100 - 9/27 @ 1100	35	47	49	29-70	38	44	43	33-53	48	51
3	9/28 @ 1500 - 9/29 @ 1500	46	53	54	35-60	32	39	37	28-47	52	53
3	9/29 @ 1300 - 9/30 @ 1300	40	47	48	33-57	32	38	37	27-49	46	48
4	9/27 @ 1300 - 9/28 @ 1300	48	52	54	38-59	39	45	44	34-53	52	54

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

Notes:

- * L₉₀ is defined as the sound level that is exceeded ninety percent of the time in a sampling period. Similarly, L₁₀ 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 L₉₀ and L₁₀ 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.
- * L₉₉ and L₁ 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 L₉₉ and L₁ 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 - 1983 [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	9/26 - 9/30	43	50	50	40-66	42	44	43	41-46	48	51
7	9/26 - 9/30	49	51	52	40-57	41	44	43	36-47	50	52

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

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.

APPENDIX J
HAND-HELD TAPE RECORDED DATA
SEPTEMBER 1983 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
d	dog(s) barking
eng	gas and diesel engine equipment
h	helicopter(s)
hm	hammer
i	insects and crickets
p	page system
pt	people talking
t	local traffic
t(d)	distant traffic
t(11)	traffic on U.S. Route 11
tfr	transformer
tra	tractor
trn	train
v	ventilation system
w	wind in brush and trees
99%	
95%	
90%	percent of sample period
50%	sound level was exceeded
10%	
5%	
1%	
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'

27 September 1983

1537 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	40	35	31	26	25	23	43	-	49	45
95%	41	36	31	27	26	23	44	28	49	45
90%	41	37	31	28	26	24	45	28	50	46
50%	43	40	33	30	28	26	45	33	51	47
10%	46	44	36	33	34	30	47	35	53	49
5%	48	47	38	37	38	33	47	35	54	49
1%	49	49	43	47	45	37	49	36	57	51
Leq	44	42	34	35	33	29	46	33	52	47

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

27 September 1983

2315 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	40	42	32	32	30	43	35	-	51	46
95%	42	44	32	32	31	47	37	-	52	48
90%	43	45	33	33	31	47	37	-	52	49
50%	46	47	34	35	33	47	40	27	53	50
10%	51	50	36	37	35	48	41	29	55	51
5%	52	51	37	38	36	49	41	30	56	51
1%	55	53	39	43	40	49	42	33	57	51
Leq	48	48	34	35	33	47	39	28	54	50

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

28 September 1983

1620 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	43	39	32	33	31	23	26	33	50	39
95%	44	41	33	34	32	25	26	33	51	40
90%	45	43	33	34	32	26	26	35	52	40
50%	47	47	36	37	35	29	28	37	54	41
10%	51	51	39	40	38	32	31	39	57	43
5%	52	53	41	41	40	33	32	40	58	44
1%	56	55	46	44	44	37	35	41	61	48
Leq	49	48	38	38	36	30	30	38	55	42

sound sources: i, t, d, w

LOCATION 2' (Cont'd)

28 September 1983

2200 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	43	45	36	38	36	29	24	-	52	41
95%	44	47	37	39	37	30	25	-	53	42
90%	45	48	38	40	38	31	25	-	54	42
50%	47	51	39	42	41	35	27	-	55	45
10%	49	53	42	45	44	38	28	-	57	48
5%	50	55	44	45	45	39	28	28	57	48
1%	51	57	49	49	46	40	30	29	58	49
Leq	47	51	40	43	42	36	27	-	55	45

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

29 September 1983

1010 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	46	49	37	35	33	26	-	43	55	44
95%	47	50	37	36	34	27	-	45	56	46
90%	48	50	38	36	34	27	-	45	56	46
50%	49	53	40	38	37	30	-	47	58	48
10%	52	56	45	41	39	35	25	49	61	49
5%	52	57	47	42	41	36	26	49	62	49
1%	54	58	49	44	43	38	28	49	63	51
Leq	50	54	42	39	37	32	22	47	59	48

sound sources: i, eng, tfr, w

30 September 1983

1050 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	51	48	39	37	37	33	-	-	57	42
95%	52	49	39	38	37	33	-	-	58	43
90%	52	49	40	39	38	34	31	-	58	44
50%	55	51	41	41	40	36	33	35	61	45
10%	58	54	45	43	43	40	36	37	64	48
5%	60	55	47	44	44	41	37	38	65	49
1%	61	60	50	47	47	43	39	39	67	50
Leq	56	52	43	41	41	37	34	35	62	46

sound sources: w, ba, tfr, b

LOCATION 3

26 September 1983

1408 hours

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

sound sources: a, t, ba, i, w, b, trn

27 September 1983

1425 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	43	36	27	26	26	23	31	39	48	40
95%	44	37	28	27	26	25	32	39	49	41
90%	44	38	28	27	27	26	33	40	49	41
50%	46	40	30	28	28	28	34	41	50	42
10%	55	46	38	33	32	31	35	41	56	43
5%	59	51	40	36	36	33	36	42	60	45
1%	71	58	53	42	39	37	39	42	71	51
Leq	56	45	38	32	30	29	34	41	57	46

sound sources: b, i, p, w, t, a, eng

28 September 1983

0025 hours

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

sound sources: t(11), i, w

LOCATION 3 (cont.)

28 September 1983

1545 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	-	35	29	29	26	22	36	37	46	40
95%	-	36	30	30	27	23	36	37	47	41
90%	40	37	30	30	27	25	37	37	47	42
50%	43	41	33	33	30	28	38	39	50	43
10%	48	52	43	37	33	34	39	39	55	44
5%	50	54	47	38	34	35	39	40	56	45
1%	52	57	50	40	35	36	40	40	58	46
Leq	45	47	39	34	31	30	38	39	52	43

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

28 September 1983

2300 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	-	32	26	27	23	27	27	-	43	34
95%	-	34	27	28	25	27	28	-	44	34
90%	-	34	27	29	25	28	28	-	44	35
50%	41	37	30	32	29	29	29	-	46	36
10%	45	43	38	38	35	31	31	-	50	40
5%	47	44	39	41	38	33	31	-	52	43
1%	55	49	46	46	43	36	32	29	57	47
Leq	44	40	35	36	33	30	29	-	48	38

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

29 September 1983

0935 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	42	36	27	25	22	21	26	45	49	45
95%	43	36	27	26	23	21	27	45	50	45
90%	43	37	28	27	23	21	27	46	50	46
50%	45	39	30	29	26	25	29	47	51	47
10%	48	43	33	33	33	32	32	49	52	48
5%	50	46	37	37	38	35	34	49	54	49
1%	56	54	51	44	47	42	39	49	61	52
Leq	47	43	36	33	34	30	30	47	52	47

sound sources: i, t

LOCATION 3 (cont.)

30 September 1983

1245 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	42	37	31	30	29	27	27	30	47	36
95%	43	38	32	31	29	27	28	30	48	36
90%	43	38	33	31	30	28	29	31	48	37
50%	45	40	36	34	33	32	33	32	50	40
10%	47	44	40	37	36	37	38	36	52	44
5%	50	46	42	38	37	38	39	38	55	45
1%	54	49	46	40	41	42	44	42	64	49
Leq	46	42	38	35	34	34	35	34	52	41

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

LOCATION 4

26 September 1983

1244 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	50	43	37	34	35	31	29	43	56	44
95%	52	44	38	35	35	32	30	44	57	45
90%	53	44	38	36	36	32	31	44	57	46
50%	55	46	40	38	39	35	32	44	59	46
10%	59	51	44	41	42	38	33	45	62	48
5%	60	53	46	42	42	39	34	45	63	49
1%	64	56	49	46	44	42	36	45	65	50
Leq	56	48	42	40	40	36	32	44	60	47

sound sources: p, t(a), b, i, tfr, ba, v, eng

27 September 1983

1245 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	52	46	35	34	33	29	36	48	57	49
95%	53	47	36	34	34	29	37	49	58	50
90%	53	48	37	35	35	30	37	49	58	50
50%	55	49	39	37	38	32	39	51	59	51
10%	59	52	45	40	42	36	41	51	62	51
5%	61	53	49	42	44	39	41	51	63	52
1%	65	58	51	46	48	43	41	51	65	54
Leq	57	51	43	38	40	34	39	50	60	51

sound sources: t(a), a, p, ba, i, tfr

28 September 1983

0130 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	43	43	33	35	30	28	24	-	51	38
95%	44	43	35	36	32	29	24	-	52	39
90%	45	44	36	36	33	30	25	-	52	40
50%	50	46	40	42	39	35	26	33	56	44
10%	56	51	47	50	48	40	29	38	61	51
5%	58	54	50	54	50	42	31	39	62	54
1%	65	62	58	57	55	48	45	44	69	59
Leq	55	53	50	49	46	42	38	37	61	50

sound sources: t(11), i, v

LOCATION 4 (cont.)

28 September 1983

1400 hours

	Octave Band Center Frequency (Hz)								OA	dB(A)
	63	125	250	500	1000	2000	4000	8000		
99%	51	44	36	35	33	27	32	50	57	50
95%	52	45	37	36	33	28	33	51	58	50
90%	52	45	37	37	34	29	34	51	58	50
50%	54	47	40	39	37	32	35	52	59	52
10%	57	51	45	43	41	36	37	53	62	53
5%	58	55	47	43	43	37	37	53	62	53
1%	61	63	53	45	46	41	39	53	66	59
Leq	55	51	43	40	39	33	36	52	60	52

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

28 September 1983

2300 hours

	Octave Band Center Frequency (Hz)								OA	dB(A)
	63	125	250	500	1000	2000	4000	8000		
99%	48	46	35	38	35	29	-	-	53	40
95%	49	47	36	39	36	30	-	-	54	41
90%	50	48	37	40	37	31	-	-	55	42
50%	52	51	40	43	40	34	23	-	57	45
10%	56	54	44	46	44	37	25	-	59	48
5%	57	55	46	47	45	38	26	-	60	49
1%	58	57	48	49	47	40	28	27	61	51
Leq	53	52	42	44	41	35	23	-	58	45

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

29 September 1983

1040 hours

	Octave Band Center Frequency (Hz)								OA	dB(A)
	63	125	250	500	1000	2000	4000	8000		
99%	48	44	38	36	35	32	23	49	56	49
95%	49	44	38	37	36	32	25	49	56	49
90%	51	45	39	38	36	33	25	49	57	49
50%	54	46	40	39	38	35	29	50	58	50
10%	56	50	43	43	42	38	37	51	60	51
5%	57	50	44	44	43	39	40	51	61	52
1%	60	52	47	47	46	40	42	51	64	53
Leq	54	47	41	41	40	36	33	50	59	50

sound sources: p, i, hm, t(a), b, w

LOCATION 4 (cont.)

30 September 1983

1030 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	53	47	39	38	38	33	28	32	58	44
95%	54	48	40	39	38	34	28	33	59	44
90%	55	48	41	39	39	35	29	33	60	44
50%	57	50	43	42	42	37	31	36	61	47
10%	60	54	48	48	46	40	33	38	63	50
5%	61	56	51	50	47	42	34	39	64	52
1%	65	63	58	55	52	45	41	39	69	57
Leq	58	53	46	45	43	38	32	36	62	48

sound sources: t(a), a, h, p, t(ll), b

LOCATION 5

26 September 1983

1722 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	41	42	34	32	32	28	35	27	49	40
95%	43	44	35	34	33	29	35	27	50	40
90%	44	45	36	35	34	29	36	28	51	41
50%	48	49	39	38	37	31	37	30	54	43
10%	59	57	47	43	45	42	39	33	63	50
5%	62	60	52	46	48	45	40	35	64	54
1%	66	70	61	52	51	48	42	39	72	58
Leq	56	56	48	42	41	38	37	31	60	48

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

27 September 1983

1810 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	48	43	35	35	33	33	35	27	52	41
95%	49	44	36	36	34	34	35	28	53	42
90%	50	45	36	37	35	34	35	28	53	42
50%	52	48	39	40	40	37	36	31	55	45
10%	59	57	48	44	46	43	38	33	62	51
5%	61	62	52	46	48	45	39	33	65	53
1%	64	66	60	51	51	48	43	37	69	57
Leq	56	54	48	42	43	40	37	31	59	48

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

28 September 1983

0210 hours

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

sound sources: t(11), i

LOCATION 5 (cont.)

28 September 1983

1700 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	-	29	26	25	23	23	36	38	46	41
95%	-	29	26	26	23	23	37	39	47	42
90%	-	31	27	27	24	24	38	39	48	43
50%	40	36	30	31	28	26	45	41	49	47
10%	51	49	39	39	39	37	47	43	55	49
5%	55	54	43	42	45	43	47	43	59	51
1%	60	60	55	50	56	53	47	43	67	60
Leq	48	48	41	37	42	40	45	41	54	49

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

28 September 1983

2110 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	-	39	35	35	31	38	32	-	49	43
95%	41	40	35	36	32	39	33	-	49	44
90%	42	41	36	37	33	41	34	-	50	44
50%	45	45	39	40	37	43	35	-	52	46
10%	51	52	45	46	43	45	36	28	56	49
5%	53	53	48	49	45	45	36	28	59	51
1%	61	61	53	52	57	56	44	37	65	60
Leq	49	49	43	43	42	45	36	27	55	49

sound sources: t(11), t, i

29 September 1983

1150 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	40	36	30	31	29	21	34	46	50	46
95%	42	38	32	32	30	23	34	47	51	48
90%	42	39	33	33	31	24	34	48	52	48
50%	48	45	39	39	37	31	37	49	55	50
10%	57	57	47	46	48	44	38	51	62	53
5%	59	61	52	49	53	50	41	51	65	57
1%	68	67	62	56	61	59	48	51	71	66
Leq	55	55	47	47	49	47	38	49	60	53

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

LOCATION 5 (cont.)

30 September 1983

1130 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	42	37	31	28	26	22	32	39	48	41
95%	42	38	32	29	27	24	33	39	49	42
90%	43	38	32	30	27	24	34	41	49	42
50%	45	40	35	32	31	28	35	43	50	44
10%	50	47	41	39	41	41	36	44	55	48
5%	53	51	43	42	47	45	38	45	57	51
1%	58	59	54	54	56	53	47	45	64	60
Leq	48	49	42	40	42	40	36	43	54	48

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

LOCATION 7

26 September 1983

1552 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	-	29	25	-	21	20	31	50	51	49
95%	-	30	26	22	22	23	32	50	51	50
90%	-	30	26	23	23	23	33	51	51	50
50%	-	32	27	25	26	27	35	51	52	51
10%	41	36	29	28	30	31	38	53	54	52
5%	44	39	31	32	33	32	39	53	54	52
1%	50	42	37	40	41	37	40	53	56	53
Leq	40	34	30	31	31	32	36	52	53	51

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

27 September 1983

1453 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	-	34	26	23	23	23	31	50	52	50
95%	-	35	27	24	24	25	33	51	52	50
90%	-	35	27	25	25	25	33	51	52	50
50%	40	38	31	29	29	32	35	52	53	51
10%	44	43	40	34	33	35	38	53	54	52
5%	46	45	44	35	35	36	38	53	55	53
1%	49	49	49	39	37	37	39	53	57	53
Leq	42	40	37	31	31	32	36	52	54	51

sound sources: i, w, b, a, t(d), d, pt, hm

28 September 1983

0100 hours

	Octave Band Center Frequency (Hz)									
	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	-	28	25	22	21	32	40	34	45	43
95%	-	29	26	22	21	33	40	35	45	44
90%	-	30	26	23	22	33	41	35	45	44
50%	-	31	27	25	23	34	42	37	46	45
10%	-	33	28	27	25	36	43	39	46	46
5%	-	34	29	27	27	36	43	39	46	46
1%	41	37	31	29	30	37	44	39	47	47
Leq	-	32	28	25	24	35	42	37	46	45

sound sources: i, t(11), w

LOCATION 7 (cont.)

28 September 1983

1600 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	36	29	23	-	20	-	34	49	51	49
95%	38	30	24	-	21	-	35	50	51	50
90%	38	30	24	-	21	20	36	50	51	50
50%	41	35	25	24	22	21	41	51	53	51
10%	44	41	29	26	25	24	45	53	54	53
5%	45	43	31	27	26	26	45	53	55	53
1%	49	47	32	29	28	31	45	54	55	53
Leq	42	37	27	24	23	23	42	52	53	51

sound sources: i

28 September 1983

2225 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	-	30	25	25	21	28	34	-	44	36
95%	40	32	25	25	21	29	34	27	45	38
90%	40	33	26	26	22	29	34	27	45	38
50%	44	37	29	29	25	29	36	30	48	39
10%	47	45	37	32	28	30	38	33	51	41
5%	47	48	38	34	29	31	40	33	51	42
1%	48	49	42	37	31	32	42	36	52	44
Leq	44	41	32	30	26	30	36	31	48	40

sound sources: i, a, d

29 September 1983

0950 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	41	32	25	23	21	23	33	54	55	53
95%	42	33	26	23	22	23	33	54	55	53
90%	42	34	26	24	23	23	34	54	56	54
50%	45	36	28	25	23	25	35	56	56	55
10%	48	38	30	26	25	27	36	56	57	56
5%	49	39	31	27	26	27	36	56	57	56
1%	53	40	33	28	27	31	37	57	59	57
Leq	46	36	35	27	27	26	35	55	57	55

sound sources: i, t(d), w

LOCATION 7 (cont.)

30 September 1983

1000 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	43	36	31	31	31	31	34	33	48	40
95%	44	36	32	3k	3k	3k	34	33	48	40
90%	44	36	32	31	31	31	35	35	49	40
50%	46	38	34	33	33	33	36	35	50	42
10%	48	41	36	35	35	37	38	37	51	43
5%	49	42	36	36	36	37	39	37	51	44
1%	50	44	37	37	37	40	42	39	52	47
Leq	46	39	34	33	34	34	37	36	50	42

sound sources: trn, w, i, t(d), hm, a

APPENDIX K

SUPPLEMENTAL DATA - SEPTEMBER 1983

(Sound Pressure Levels in dB re: 20 Micropascals)

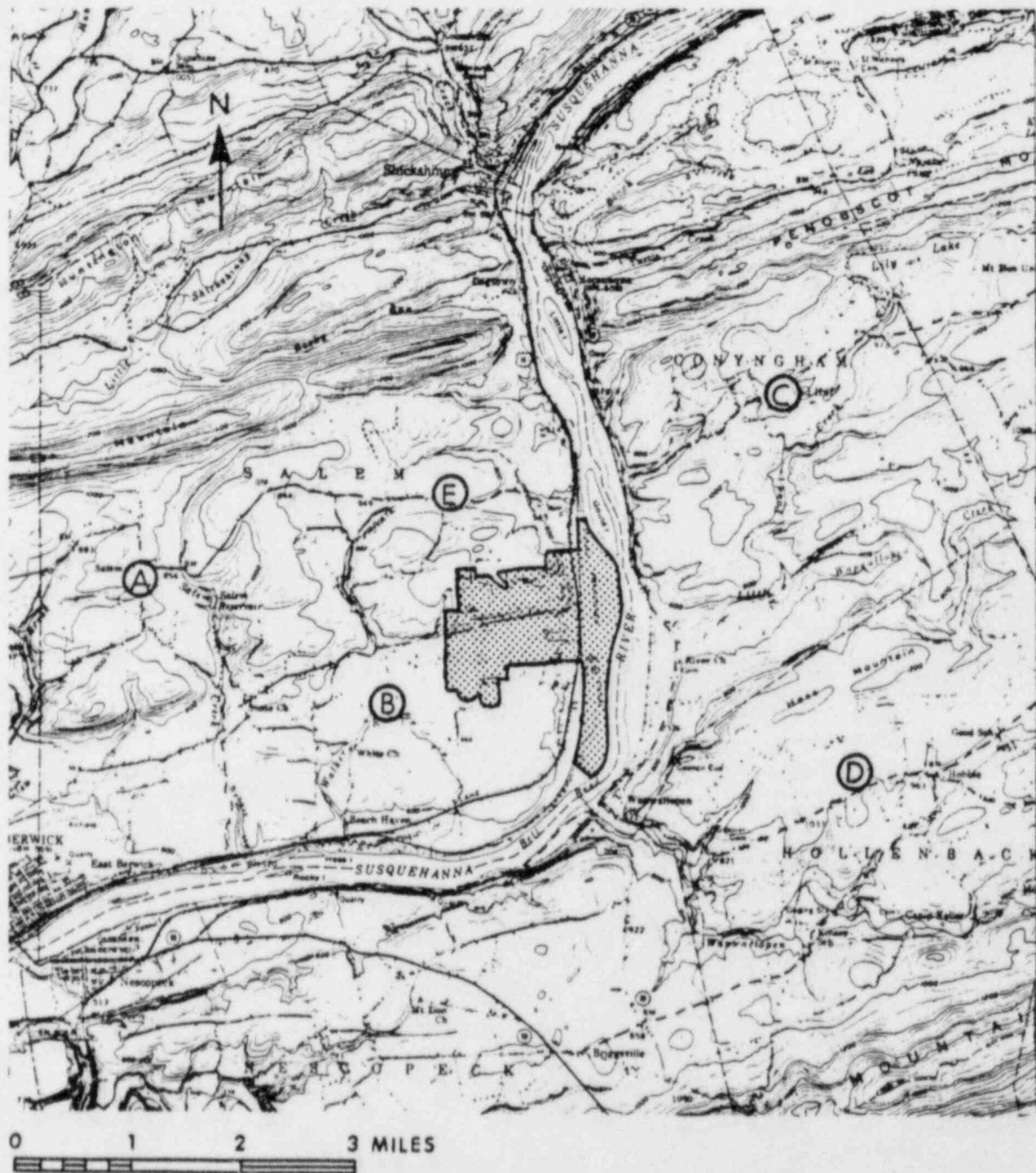


FIG. K-1. MAP OF AREA WITHIN FIVE MILES OF SUSQUEHANNA SES SITE SHOWING DISTANT SUPPLEMENTAL SOUND LEVEL MEASUREMENT LOCATIONS AND SITE PROPERTY LINES.

TAPE RECORDED DATA
(Statistical Analysis)

SOUND SOURCE LEGEND

a	aircraft
b	birds
ba	backup alarms on mobile equipment
c	cow
d	dog(s) barking
eng	gas and diesel engine equipment
h	helicopter(s)
hm	hammer
i	insects and crickets
p	page system
pt	people talking
t	local traffic
t(d)	distant traffic
t(11)	traffic on U.S. Route 11
tfr	transformer
tra	tractor
trn	train
v	ventilation system
w	wind in brush and trees

99%	
95%	
90%	percent of sample period
50%	sound level was exceeded
10%	
5%	
1%	

Leq	energy average sound level
-----	----------------------------

OA	overall sound pressure level
dBA	A-weighted sound level

LOCATION A

26 September 1983

1512 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	-	31	25	-	-	-	28	41	46	42
95%	-	31	25	-	-	-	30	43	46	42
90%	-	32	26	-	20	20	31	43	46	42
50%	42	36	29	24	24	25	33	43	49	44
10%	50	46	36	33	31	31	35	45	56	45
5%	53	48	39	36	33	32	36	45	59	45
1%	59	53	43	43	37	34	37	45	61	47
Leq	48	43	34	32	29	27	34	44	52	44

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

LOCATION B

26 September 1983

1434 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	-	35	28	24	24	21	26	40	47	40
95%	40	36	29	25	24	22	27	41	47	41
90%	41	36	29	25	25	23	27	41	48	42
50%	45	40	31	27	26	24	29	43	50	43
10%	52	47	37	31	30	29	31	45	55	45
5%	53	51	39	33	32	31	31	45	56	45
1%	56	58	49	42	34	37	37	45	61	48
Leq	48	46	38	30	28	27	30	43	52	44

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

LOCATION C

26 September 1983

1647 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	-	33	27	23	25	25	34	29	44	37
95%	40	35	28	26	27	26	34	31	45	38
90%	41	36	29	27	28	27	34	31	46	38
50%	47	41	35	31	35	33	34	32	50	41
10%	56	53	46	41	43	41	37	35	61	48
5%	60	56	51	47	46	43	39	36	63	52
1%	63	61	56	54	49	46	41	37	66	59
Leq	53	49	44	44	40	37	36	33	56	49

sound sources: i, b, c, t, d, a, pt

LOCATION D

27 September 1983

1633 hours

Octave Band Center Frequency (Hz)

	63	125	250	500	1000	2000	4000	8000	OA	dBA
99%	43	36	26	22	22	21	27	33	48	36
95%	44	37	27	23	23	21	28	34	48	36
90%	45	38	27	24	24	22	28	34	49	37
50%	47	41	30	27	28	25	31	35	52	39
10%	51	49	37	34	35	32	34	37	57	42
5%	53	52	42	38	38	36	36	38	60	43
1%	59	56	51	47	44	42	39	39	64	50
Leq	50	46	38	34	33	31	33	36	55	41

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

LOCATION E

26 September 1983

1614 hours

	Octave Band Center Frequency (Hz)								OA	dBA
	63	125	250	500	1000	2000	4000	8000		
99%	-	28	24	-	22	21	35	42	45	43
95%	-	28	25	22	23	22	36	43	45	44
90%	-	29	25	22	23	23	36	43	45	44
50%	-	31	26	25	26	27	37	44	47	45
10%	40	34	31	32	31	31	38	45	50	45
5%	42	36	34	36	33	33	38	45	50	46
1%	46	40	40	42	38	38	42	47	52	48
Leq	37	33	33	30	29	29	37	44	48	45

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

EXHIBIT 3

- o U.S. Nuclear Regulatory Commission, Letter, Subject: Susquehanna Steam Electric Station Cultural Resources, March 5, 1983.
- o Pennsylvania Power & Light Co., Letter to Dr. Lawrence Tice, State Historical Preservation Office, PLE-3098, April 19, 1983.
- o Dr. Larry E. Tise, Letter to Mr. A. Schwencer, U.S. Nuclear Regulatory Commission, Re: Susquehanna Steam Electric Station Protection of Archeological Sites, April 20, 1983.



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

RECEIVED
MAR 18 1983
NUCLEAR DEPT.

Docket Nos. 50-387/388

Mr. Norman W. Curtis
Vice President
Engineering and Construction - Nuclear
Pennsylvania Power & Light Company
2 North Ninth Street
Allentown, Pennsylvania 18101

Dear Mr. Curtis:

Subject: Susquehanna Steam Electric Station Cultural Resources

Pursuant to our responsibility under 36 CFR 800 as licensing agency for the operation of Susquehanna Steam Electric Station, Units 1 and 2, the NRC requests information with regard to completing a determination of effect which the operation and maintenance activities of the plant may have on four archeological sites on the Susquehanna property.

Site SES-3, Site SES-6, Site SES-8 and Site SES-11 were determined by the keeper to be eligible for inclusion in the National Register of Historic Places on February 10, 1983, and now require a determination of effect to be made. As discussed in a telephone conversation with Mr. C. Coddington and Jerome S. Fields on March 3, 1983, the NRC requests that you follow the steps presented in 36 CFR 800.3 and 36 CFR 800.4 in developing the information. Upon receipt of the information, the NRC, in consultation with the State Historical Preservation Office, will complete the determination of effect process.

Sincerely,

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing

cc: See next page

APR 19 1983

Dr. Lawrence Tice
State Historical Preservation Office
William Penn Memorial Museum and Archives Building
Box 1026
Harrisburg, PA

SUSQUEHANNA STEAM ELECTRIC STATION
PROTECTION OF ARCHEOLOGICAL SITES
ER 100450 FILE 991-2
PLE-3098

Dear Dr. Tice:

Four archeological sites located on the Susquehanna SES floodplain have been determined eligible for inclusion in the National Register of Historic Places by the Nuclear Regulatory Commission. The attached map shows their locations.

In accordance with 36 CFR 800.3 and 800.4 this letter describes the effects plant operation, maintenance and construction activities may have had or will have on the eligible sites and the mitigating actions taken by PP&L to protect them. These mitigation measures were recommended in the report prepared by Commonwealth Associates entitled Archeological Investigations at the Susquehanna SES: The Susquehanna SES Floodplain (March, 1981).

We believe by following these recommendations there will be no adverse effect upon the sites from the station.

Mitigative Actions

SES-3

The study recommended no major mitigation at SES-3. Only isolated portions of the original tract remain undisturbed. PP&L will cover them with fill and plant protective landscaping.

SES-6

The preservation measures taken to prevent erosion from a drainage ditch crossing it consisted of regrading exposed profiles, infilling with soil and seeding with protective planting. The northern edge of the site is cultivated which provides additional protection against erosion.

SES-8

No major disturbances are expected on this forested site. It did not warrant mitigative measures.

SES-11

This tract has been removed from cultivation. There are no plans to construct on the site.

There are no plans to disturb any of these four sites. Various PP&L Departments have been informed of their locations and requested to notify Nuclear Support about impending work in these areas. If you concur with PP&L's evaluation, we would request a letter be sent to Mr. A. Schwencer of the Nuclear Regulatory Commission (see attached letter) confirming these sites are protected.

Very truly yours,

Jerome S. Fields

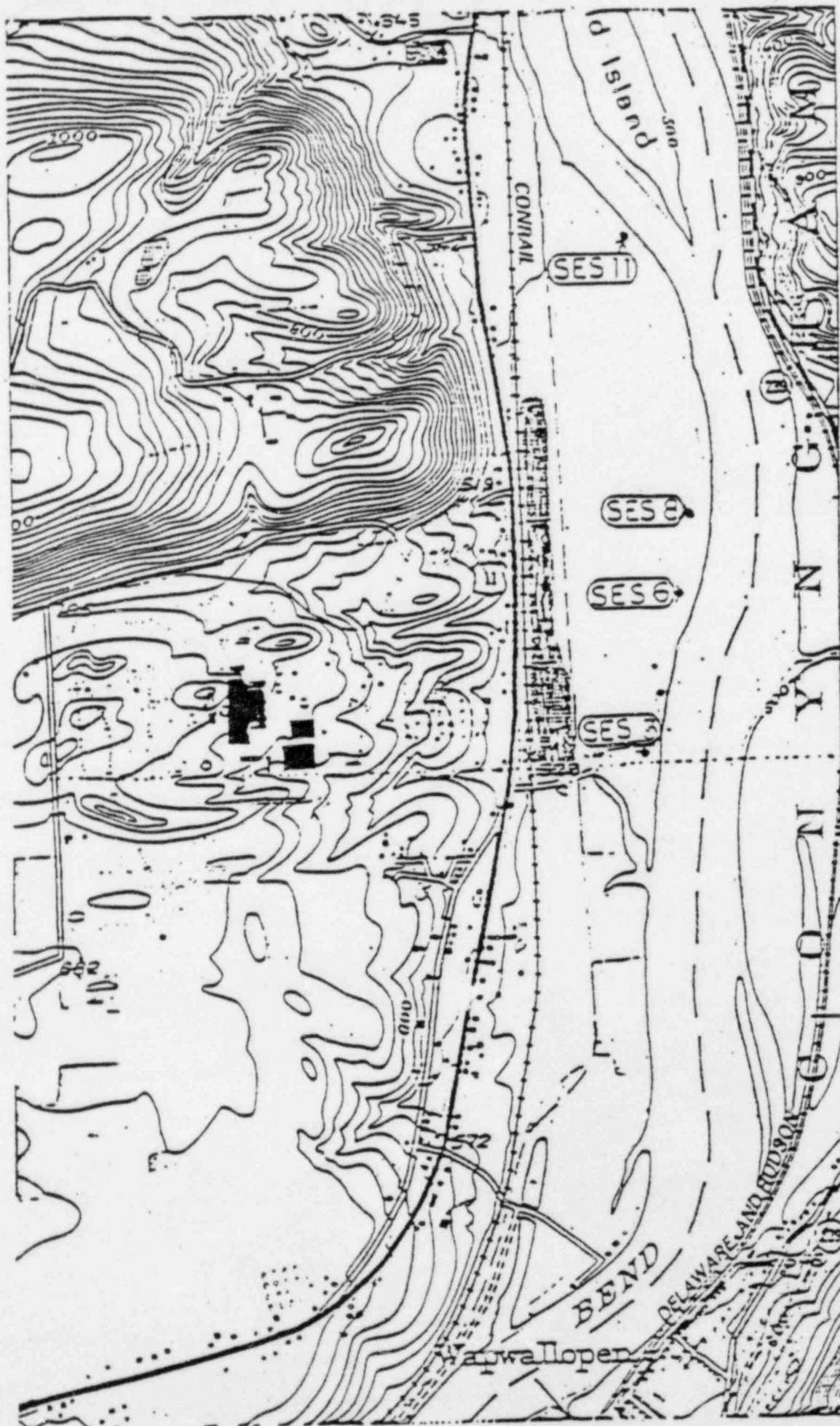
By:

Joseph B. Evans
Joseph B. Evans

JBE:mg
E-01

Attachments: Site Map
NRC Letter

bcc: M.F. Basta	A3-3
W.E. Barberich	A6-1
S.H. Cantone	N-4
J.B. Evans	N-4
J.S. Fields	N-4
D.W. Miller	N-4
K.E. Shank	N-4
Correspondence File	A6-2
Letter File	A6-2



SCALE
1"=1536'

Fig. 4.2-2

cc: Mr. Joe Evans

COMMONWEALTH OF PENNSYLVANIA
PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION
P. O. BOX 1088, HARRISBURG, PENNSYLVANIA 17103

April 20, 1983

A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
United States Nuclear Regulatory Commission
Washington, D.C. 20555

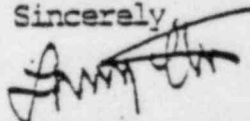
Re: Susquehanna Steam Electric Station
Protection of Archeological Sites
File 991-2, ER81 079 0658

Dear Mr. Schwencer:

The Bureau for Historic Preservation concurs with your opinion that mitigative actions proposed in your letter of April 19 will result in no adverse effect on archeological sites SES-3, SES-6, SES-8 and SES-11 which have been determined eligible for listing on the National Register.

Please be advised that regulations of the Advisory Council on Historic Preservation (36 CFR 800.13 a.) prescribe that Documentation for Determination of No Adverse Effect, including the comment of the Bureau for Historic Preservation, must be submitted to the Advisory Council on Historic Preservation, 1522 K Street, N.W. Washington, D.C. 20005.

Sincerely,



LARRY E. TISE