124-95 Short 25 Cps
6-30-85 PPPL-2220
UC20-E

I-215N

PPPL-2220

ENVIRONMENTAL MONITORING REPORT
FOR CALENDAR YEAR 1984

By

J.R. Stencel

MAY 1985

PRINCETON UNIVERSITY
PRINCETON, NEW JERSEY

PREPARED FOR THE U.S. DEPARTMENT OF ENERGY,
UNDER CONTRACT DE-AC02-76-CO-3073.
DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

Princeton University
Plasma Physics Laboratory
P.O. Box 451
Princeton, NJ 08544

PPPL--2220

DE65 013677

ENVIRONMENTAL MONITORING REPORT
FOR CALENDAR YEAR 1984

By

Joseph R. Stencel

May 1985

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

NOT FOR

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

ENVIRONMENTAL MONITORING REPORT
FOR CALENDAR YEAR 1984

Joseph R. Stencel

Plasma Physics Laboratory, Princeton University
Princeton, New Jersey 08544

ABSTRACT

The results of the environmental monitoring program for CY84 for the Princeton Plasma Physics Laboratory (PPPL) are presented and discussed. The Princeton Large Torus (PLT), Princeton Beta Experiment (PBX), and PPPL's largest tokamak, the Tokamak Fusion Test Reactor (TFTR) had a complete year of run time. In addition, the S-1 Spheromak was in operation and the RF Test Facility came on-line. The phased approach of TFTR environmental monitoring continued with the addition of neutron monitors. During CY84 there were no adverse effects to the environment resulting from any operational program at PPPL, and the Laboratory was in compliance with all applicable Federal, State, and local environmental regulations.

1.0 INTRODUCTION

1.1 General

This report gives the results of the environmental monitoring program at the Princeton University Plasma Physics Laboratory (PPPL) for Calendar Year 1984 (CY84). The report is prepared to provide the U.S. Department of Energy (DOE) and the public with information on the level of radioactive and nonradioactive pollutants, if any, added to the environment as a result of PPPL operations. The objective of the environmental monitoring report is to document that DOE facility environmental protection programs adequately protect the environment and the public health.

PPPL has engaged in fusion energy research since 1951 and currently has three large tokamak devices in operation; namely, the Princeton Large Torus (PLT), the Princeton Beta Experiment (PBX), and the Tokamak Fusion Test Reactor (TFTR). In addition, the S-1 Spheromak began operation in CY83. The goal of the Magnetic Fusion Program is to develop and demonstrate the practical application of fusion.

The Spheromak is a combination mirror/tokamak concept. The S-1 (Fig. 1) achieved its initial goal of obtaining hot (100 eV) plasmas with lifetimes of 1 msec or more. With toroidal currents of over 300 kA, electron densities in the mid to upper ¹³10 range, and with some

hardware changes, the future looks good for electron temperatures in the 200-300 eV range. The S-1 is not expected to have any potential for impact on the environment, a conclusion that is documented in its Safety Assessment Document (E184).

Another small device, the Radio Frequency Test Facility (RFTF) began operation in CY84 (Fig. 2). The conclusion of its Safety Assessment Document is that the RFTF is not expected to have any effects on the environment (Na84).

The PLT (Fig. 3) had a successful year and set a new RF heating record. The five megawatts (MW) of 30 MHz ion cyclotron radio frequency (ICRF) power applied to PLT was the highest applied to tokamaks in the fusion programs throughout the world. With approximately 4.2 MW of power actually transferred to the plasma, the ion temperature rose to around 5 keV (~ 60 million °C).

The PBX (Fig. 4) also reached one of its major milestones by achieving a >5% beta (ratio of plasma pressure/magnetic pressure). The combined prompt radiation to occupied areas from PLT/PBX was less in CY84 than in CY83 because of different operating scenarios. A Safety Assessment Document for PBX published in 1984 indicates that the PBX does not pose any potential environmental concerns (F184).

The TFTR (Fig. 5), which had its first full year of running in CY83, increased its total neutron production in CY84 to a level where radioactivity can be detected from activation of the vessel after major run periods. The TFTR is a toroidal device in which a tritium plasma will be magnetically confined at high vacuum and heated to extremely high temperatures by neutral beam injectors. The resulting D-T fusion reactions will yield an output of energy equal to the energy required to heat the plasma. Because of recent fusion program budgetary constraints, the planned introduction of tritium into TFTR will be delayed from 1986 to 1988. The potential hazards of this program are addressed in required Safety Analysis Reports (PSAR78 and PSAR82).

Since the PPPL site is, in general, open to the public, this free access has necessitated a thorough evaluation of the on-site discharges as well as the potential for off-site releases of radioactive or nonradioactive effluents. Thus, an extensive monitoring program tailored to these needs has been instituted and has been expanding over recent years. The PPPL environmental radiological monitoring program generally follows the guidance given in DOE reports A Guide for: Environmental Radiological Surveillance at U.S. Department of Energy Installations (Co81) and Environmental Dose Assessment Methods for Normal Operations at DOE Nuclear Sites (PNL-4410) (St82). This includes adherence to the standards given in DOE Orders, in particular, DOE Order 5480.1, Chapter XI (DOE81), which pertains to

permissible doses and concentration guides, and gives guidance on maintaining exposures to as low as reasonably achievable (ALARA). Specific criteria for implementing these standards on TFTR are contained in a TFTR Operational Safety Requirement (OSR/TFTR/0-2F-C) (see Table 1).

The emphasis of the monitoring program has been placed on exposure pathways appropriate to fusion energy projects. These pathways include external exposure from direct penetrating radiation and eventually airborne isotopes, such as ⁴¹Ar, ¹³N, ¹⁶N, and internal exposure from isotopes, such as ³H in air and water. Seven major critical pathways were considered (see Table 2). Prompt radiation was also considered and is measured. The monitoring program as envisioned by the TFTR Final Safety Analysis Report (FSAR82) is noted in Table 3. Gamma measurements have been eliminated from the air and particulate measurements as it is felt that the beta measurements provide sufficient data. Because of the lack of any significant number of fish in water flow from the facility and the absence of local dairy farms, DOE has agreed to let PPPL look at alternative foodstuffs, e.g., honey, spinach, etc. At present, the radioactive pollutant potential by any pathway to the environment is essentially nonexistent. Preliminary meteorological considerations and associated methodology, which were established at the time of the installation of PPPL's first meteorological tower, were reported in Sec. 14 of the TFTR FSAR. Subsequently,

improved methodologies were implemented and a new meteorological tower was installed and began operation in November 1983 (Mc83). The first year of windrose data from this new system is noted in this report (Figs. 6 and 7). The FSAR also contains accident dose calculations for future operations of TFTR with tritium. Tritium use, other than for system testing, will be delayed until 1988. The FSAR will be amended for tritium operation and will include changes since its original publication, including any update with respect to new meteorological and demographic data.

1.2

Description of the Site

PPPL is located at the James Forrestal Research Campus of Princeton University. As shown in Fig. 8, the location is in central New Jersey within Middlesex County. The site has undisturbed areas with virgin forest, open grass areas, an airplane runway, and a small brook running through its eastern boundary. The closest urban centers are New Brunswick, 14 miles to the northeast and Trenton, 12 miles to the southwest. Major metropolitan areas including New York City, Philadelphia, and Newark are within 50 miles of the site. As shown in Fig. 9, the municipalities of Princeton, Plainsboro, Kingston, Penns Neck, Princeton Junction, and Cranbury, among others, are in the immediate area of the site. Also, the main campus of Princeton University is located primarily within the borough of Princeton, approximately three miles to the

west of the site. The general layout of the facilities at the Forrestal Campus is indicated in Fig. 10, including the D-Site of the Plasma Physics Laboratory, the specific location of TFTR.

Figure 11 and Table 4 indicate the 1974 population estimates in sectors within ten miles of PPPL. Table 5 and Fig. 12 show the projected population for 1985, which was derived by calculating the percentage increase projected for municipalities in the zero-to-ten-mile region by the New Jersey State Office of Business Economics in the Department of Labor and Industry. The resident population within 10 to 50 miles of PPPL, based on the 1970 Census, is shown in Table 6. The site is in the center of a highly urbanized region from Boston, Massachusetts to Washington, D.C. The 1985 population projections for the states of New Jersey, New York, and Pennsylvania indicate a substantial population increase within 50 miles of the PPPL site. The Princeton area is experiencing a substantial increase in new business moving into the Route 1 corridor near the site. Because of delays in the tritium program, a new demographic study was also delayed until CY87.

SUMMARY

During CY84 there were no accidents, incidents, or occurrences that had an impact on PPPL facilities, its operations, or the environment. Weed control and grass fertilization were used but were the responsibility of Princeton University. These applications were done by the University or certified contractors and in accordance with EPA regulations. PCB transformers and capacitors are being phased out and disposed of in accordance with regulations. A program of inventory and disposal for PCB and other potentially toxic materials has been in force and is running smoothly.

Surface water analyses for both radioactive and nonradioactive pollutants have not shown anything above normally expected values. The initial phase of a program for ground water analysis is slated to start in June 1985. Soil and vegetation samples were collected and analyzed to establish baselines. Radiation exposure either via prompt or airborne radioactivity is still essentially nonexistent under present operations. Prompt radiation, however, is now detectable through the TFTR shield walls for the higher power pulses, and some activation of the vessel is noted after a successful day of operations. Neutron monitors were added to the environmental monitoring program in CY84, and other monitors will be added this year as part of the phased approach to meet the requirements of future operations. The radiological environmental program reviewed in CY84

by the Idaho National Engineering Laboratory (INEL), at PPPL's request, confirmed that the program was adequately planned and meeting DOE requirements. Although future off-site exposure potential is expected to be essentially nonexistent, a program to confirm this projection was recommended and is presently being planned.

3.0 MONITORING, ENVIRONMENTAL PROGRAM INFORMATION, DATA COLLECTION ANALYSES, AND EVALUATION

Monitoring implementation has been a phased approach commensurate with the potential hazards of an expanding program. Nonradioactive water pollutant monitoring has been conducted for years. A more extensive program, which began in 1979, presently includes eight surface water sampling points (four on-site and four off-site), two old on-site wells, and the potable water supply source. Monitoring of potential radiological exposures is quite extensive. Real time prompt gamma/neutron environmental monitoring began in 1981 on the TFTR site prior to its operation to establish baselines. The original station is located on the TFTR site, approximately 200 feet from the TFTR torus and 200 feet from the present northwest perimeter fence (see Fig. 13). Four monitoring stations have been located at the TFTR exclusion zone boundary (EZB) and neutron monitors were added to these locations at the end of CY84.

Radiological water samples were taken at the same locations as the nonradioactive sample points (see Figs. 13 and 14).

3.1 Radioactivity

3.1.1 Penetrating Radiation

Operation of the Princeton Large Torus (PLT) and the Princeton Beta Experiment (PBX) results in the production of some penetrating radiation (primarily bremsstrahlung X rays and neutrons). Because neither the PLT or PBX have a roof shield, skyshine radiation (primarily neutron) is seen at the TFTR baseline site monitoring station (RMS-B, Fig. 13). Shielding in place for the PLT/PBX has kept the total exposure dose equivalents in occupied areas below 200 mrem (2 mSv) in 1981 and 1982; and to 600 mrem (6mSv) in 1983 during extensive PDX runs. The integrated value decreased to below 100 mrem (1mSv) in 1984 (St85b). Actual personnel exposure is much less than any of these values since no individual occupies these areas during all the PLT or PBX runs.

The Laboratory has a policy that if occupational exposures have the potential to exceed 1000 mrem/yr (10 mSv/yr), the respective project manager must petition the PPPL Executive Safety Board (ESB) for an exemption. In addition, the Laboratory applies the DOE ALARA policy to all its operations.

In 1981 the measured exposure dose above background at the TFTR baseline monitoring station was 3.2 mrem (0.032 mSv). In 1982 the value was 3.3 mrem (0.033 mSv). In 1983 the value increased to 6.9 mrem (0.069 mSv), and in 1984 the value was 2 mrem (0.02 mSv) as the PLT/PBX operational scenario changed.

The design objective of TFTR is to stay below 10 mrem/yr (0.1 mSv/yr) above neutral background at 125 meters from the machine from all sources of radiation. The TFTR, like other tokamaks, produces bremsstrahlung X radiation from the runaway electrons at the end of a pulse. These X rays, in the range of 0 to 20 MeV, also produce photoneutrons. Neutral beam injections with deuterium began at the end of CY84. With these D-D runs the neutron fluxes will increase in CY85. While the total neutron production during CY83 was on the order of 10^{15} , the daily runs in early CY85 are now reaching this value. Additional shielding will be added to the TFTR test cell walls during CY85. No significant penetrating radiation was added to the environs due to TFTR operations in 1984. Radiation levels (uR) were recorded for some pulses outside the test cell, with the total exposure dose equivalent at the TFTR site boundary being less than 1 mrem (0.01 mSv) for CY84 (St85b).

The TFTR site boundary monitors are Reuter-Stokes Sentri 1011 pressurized ionization chambers and He-3 moderated neutron detectors. The electronics in the ionization chambers are modified to allow the integration of any TFTR machine pulse prompt radiation that may be above natural background. These data are stored and processed as part of the CICADA computer system. Four of these monitoring stations are placed at the EZB (125 meters from the TFTR) (see Fig. 13). Another eight ionization chambers of lower sensitivity are located near the TFTR (four outside the test cell wall, three in the basement, and one on the roof). These eight detector locations are for personnel safety and are not considered environmental detectors per se. Besides the moderated He-3 neutron detectors, Bonner-type-moderated Li(I) detectors were used to monitor at various locations throughout the TFTR facility. At the end of CY84 He-3 moderated neutron detectors were placed at the same eight ionization chamber locations around the test cell. Figure 15 notes the net environmental gamma and neutron measurements for CY84. The 2 mrem for PLT, PBX, and TFTR operations were subtracted from these data. This data plot essentially confirms the natural background levels expected in this part of New Jersey.

3.1.2 Special Surveys (St81)

In August 1980, EG&G, Inc., under DOE contract, conducted an aerial radiological survey of PPPL and surrounding areas. The detection system used consisted of 20 sodium iodide detectors, a multichannel analyzer, and a magnetic tape recording system. The nominal exposure rate range observed was eight to ten uR/hr. Detected radioisotopes were consistent with normal background emitters.

3.1.3 Airborne Radioactivity

Radioactivation of air and tritium in measurable concentrations is not expected until TFTR D-T operations. A real-time prototype baseline air and particulate monitor has been in use since the beginning of CY82. This system consists of two CaF(Eu)NaI(Tl) phoswich detectors which use pulse shape and time variations to give gross alpha, beta, and gamma information. A calibration has been accomplished for beta detection using a Xe-133 gas source. With the experience gained with this system, it has been decided that a simple beta scintillator will provide adequate information. In CY85 air and particulate monitors using beta detectors will be procured for installation at the EZB.

A differential tritium air monitor using an ethylene glyco bubbler concept was found to be inadequate for environmental monitoring. A modified silica gel system is under test (Gr85) and will be deployed to provide baseline data in concert with the new tritium schedules.

A review of our environmental radiation program and the possible use of available off-site monitoring by outside organizations was done by the Idaho National Engineering Laboratory (INEL) at PPPL's request in CY84. Most of the off-site monitoring stations of outside utilities located in the direction of the prevailing winds were deemed to be too far away and therefore not useful to our program. It was suggested that several simple off-site tritium and air particulate monitoring stations should be set up in local communities to provide a baseline data base to document our expected minimal release during operations with tritium. A silica-gel-type monitor is under test for this option, and contacts are expected to be made with the local communities during CY85 on placement of these monitors.

Meteorological data have been collected on-site at the original station since 1977. Lakehurst Naval Air Station data were also acquired and were the primary data used in the meteorological calculation (X/Q) for the TFTR FSAR. Discussion on the problems of building wakes has led to a reevaluation of the meteorological data collected on-site. In November 1983 a three-level, 60 meter tower was installed for gathering

meteorological data. The new windrose data from the first year of operation are shown in Figs. 6 and 7. Preliminary analysis indicates that the site is dominated by neutral to moderately stable conditions with moderately unstable to extremely unstable conditions occurring less than a few percent of the time. Average surface winds are about 2.1 m/s and rise to about 4.3 m/s at 60 m (Ko85). Based on data from this new tower, X/Q values will be recalculated for the tritium addendum to the FSAR before TFTR tritium operations.

3.1.4 Waterborne Radioactivity

3.1.4.1 Surface Water

Surface water samples at eight locations (four on-site, four off-site) have been analyzed for tritium, gamma spectroscopy, and gross alpha and beta. Five of these locations have been monitored since CY82. Starting in April 1984 these samples were collected and analyzed by PPPL.

Downstream sampling occurs after mixing of effluent and ambient water is complete. Locations are indicated on Figs. 13 and 14. In January 1984 the surface water sampling increased from five to eight locations as noted above and also included the potable water supply. Typical results are shown in Table 7.

Sample analysis has shown no unusual background radioisotopes. Tritium analysis by liquid scintillation methods has shown tritium values to be less than 100 pCi/L (13 kBq/L) on all samples analyzed to date. Tritium enrichment procedures can be used to see lower levels and are presently under study.

3.1.4.2 Ground Water

Two existing on-site wells (W4 and W5) were sampled in CY84 (see Fig. 13). A more comprehensive ground water program will be initiated in June 1985 through the U.S. Geological Survey. This program entails drilling several monitoring wells on the TETR site in order to profile the ground water system for this site.

3.1.4.3 Drinking Water

Potable water is supplied by the public utility, Elizabethtown Water Co. In April 1984 a sample point at the input to PPPL was established (E1 location, Fig. 13). Radioactive analysis has included gamma spectroscopy, tritium, and gross alpha and beta.

3.1.4.4 Foodstuffs

Because State regulatory requirements have essentially eliminated small dairy farmers in this area, milk is not a viable analysis medium around the site. Also the fish

population is very scarce in Ditch 5 and Bee Brook, which carry the run-off from the site. A request to DOE was made in CY84 to eliminate these foodstuffs from analysis. A substitute of vegetables and honey that are available from local surroundings is used. Initial sampling indicated tritium levels below 100 pCi/L (13kBq/L).

3.1.4.5 Soil, Grass, Bottom Sediment

Soil and grass samples collected in 1984 indicated tritium levels below 100 pCi/L (13 kBq/L). Laboratory techniques for doing these analyses were perfected in CY84 (Gr85). Surface soils and vegetations are one of the best indicators of tritium after a release (Jo74) (Mu77), (Mu82).

3.2 Nonradioactive Pollutants

3.2.1 Airborne Effluents (St85a)

PPPL has a New Jersey Department of Environmental Protection (NJDEP) Permit for its C-site boilers and fuel tank vents. The seven permit certificate numbers are 061294 through 061300. In January 1985 a detailed review with NJDEP was undertaken. The result of these meetings will be an amendment to the fuel tank vent permits in CY85 based on new data. Considerations are also being given to require permits for Carpenter Shop dust collectors and Print Shop exhaust.

Measurements of actual emission are not done; however, emissions are calculated using formulae supplied by NJDEP.

3.2.2 Water Utilization (St85a)

3.2.2.1 Potable Water

Potable water is supplied by the public utility, Elizabethtown Water Co. PPPL (C-site) uses on the order of 55 million gallons per year. Water quality analysis at the input to PPPL was initiated in CY84 for both radioactive and nonradioactive pollutants (Table 13).

3.2.2.2 Process (nonpotable) Water

Nonpotable water is pumped by PPPL from the Delaware & Raritan Canal through a permit agreement with the New Jersey Water Supply Authority. This agreement provides PPPL the right to withdraw up to one million gallons of water per day for process and fire fighting purposes for the period beginning July 1, 1984 and ending on September 30, 1991. Treatment consists of filtration to remove suspended solids. Table 10 indicates results of water quality analysis at the canal.

3.2.2.3 Storm Sewage

Storm sewage that includes cooling tower and boiler blowdown is discharged into surface waters. D-site storm sewage additionally goes through a detention basin. National Pollution Discharge Elimination System (NPDES) Permit No. NJ0023922 became effective 11/1/84 and expires on 10/31/89. The first quarterly water chemistry reporting, taken from data of Table 12, was submitted to the State of New Jersey in February 1985.

Cooling water treatment was changed from a chromate-based corrosion inhibitor to a non-chromate in June 1983. Water analyses (see Tables 8-18) downstream have not indicated any environmental pollutants above codes, regulations, or standards. An improvement to the detention basin is scheduled for CY85. Storm sewage waters from both C- and D- sites will then flow through the detention basin. A Spill Prevention Control and Countermeasures (SPCC) Plan update was received from an outside A/E firm in January 1985. The action items listed in this plan to satisfy Federal Regulations on pollution prevention (40 CFR 112) are under consideration for funding allocation. These include the detention basin modification, detention basin oil spill detection system, and a C-site MC basement sump oil spill detection and alarm system.

3.2.2.4 Sanitary Sewage

Sanitary sewage is discharged to the publicly owned treatment works operated by South Brunswick at Stony Brook. Flow rates are measured by the PPPL sanitary sewage metering station and average approximately 62,000 gallons per day. Sampling of PPPL discharges done by the publicly owned treatment works has determined that pretreatment is unnecessary. Therefore, PPPL is in compliance with the EPA Pretreatment Standard, 40CFR403.

3.2.3 Herbicides, Fertilizer, and Pesticides (C185)

The use of herbicides, pesticides, and fertilizers is not controlled by PPPL but by Princeton University's grounds and building maintenance personnel. These are applied in accordance with State and Federal Regulations. Herbicides are applied by a certified applicator. Table 19 lists the quantities applied during CY84.

3.2.4 Polychlorinated Biphenyls (PCB's)

Beginning in CY82 PPPL started a program to dispose of PCB capacitors, transformers, and contaminated items. All stored items in a GSA Warehouse in Belle Mead, New Jersey were disposed of through approved contractors during the early phases of the program. Remaining PCB items were labeled as required and an inventory, inspection, and status report program initiated. A

Hazardous Materiel Coordinator was appointed to ensure that any new identified leaking capacitors or transformers would be handled promptly and properly. At the beginning of CY84 PPPL still had 15 PCB transformers and 6005 large capacitors. In CY84 375 large and 54 small PCB capacitors were disposed of along with the oil and flushed carcass of two transformers (Ho85). Funding is under consideration for replacement of the other PCB transformers. PCB capacitors are being disposed of as they are taken out of service. In late CY84 a PCB capacitor sprung a leak during a removal procedure. The PCBs were contained in the room of the spill and then cleaned up and disposed of through an approved waste contractor.

3.2.5 Hazardous Wastes

Significant progress was made starting in CY82 with respect to identification, collection, and disposal of hazardous waste in an environmentally acceptable manner. Waste disposal manifests are filed as required by the New Jersey Department of Environmental Protection, Division of Waste Management. Responsibility for this program rests with the PPPL Hazardous Materiel Coordinator, under the Materiel Control Branch. A facility was set up in CY82 for temporary storage of hazardous materials. The area includes an enclosed and

covered area with a concrete containment, fire and security alarms, fire extinguishers, an eye wash, one emergency shower, and telephones. A new facility is under consideration for CY85.

3.3 Environmental Impact

3.3.1 Assessment of Radiation Dose to the Public

PPPL is located in one of the less densely populated areas in the metropolitan areas between New York City and Philadelphia. Previous census data indicate that approximately 16 million people live within 80 km (50 miles) of the site, and approximately 225,000 within 16 km (10 miles) of PPPL. This detailed distribution of population as a function of distance is given in Tables 4-6. Because of ever increasing commercial growth in this area, a demographic update was planned for CY85. However, because of delays in TFTR tritium operations, it was felt that this update should be delayed in order to obtain the most relevant data.

The overall exposure dose equivalent from all sources at the PPPL site boundary was estimated to be less than 1 mrem for CY84 (St85b). Detailed person-rem calculations for the surrounding population were not performed, since the value would be insignificant in comparison to the approximately 100 mrem (1 mSv) each individual receives from their natural background in New Jersey.

3.3.2 Assessment of Nonradioactive Pollutants

There were no activities during CY84 that created problems with respect to nonradioactive pollutants. A PCB capacitor spill and small oil spill were localized and cleaned up with no significant environmental impact. The capacitor spill was contained within a building and the oil spill had no effect on ground water.

Polychlorinated biphenyls (PCB's) continue to be disposed of in accordance with EPA requirements. Herbicides, pesticides, and fertilizers were used in very limited quantities and are not expected to have any negative impact on the environment.

4.0 QUALITY ASSURANCE FOR LABORATORY ANALYSIS IN CY84

Water samples for radioactivity, taken in the first quarter of CY84 were analyzed by Teledyne Isotopes, 50 Van Buren Avenue, Westwood, New Jersey. During the last nine months of CY84 the sample analysis was accomplished in-house. In general, in-house procedures follow the HASL-300 Manual (Vo82). Teledyne Isotopes participated in the EPA (Las Vegas) radioactive QA Program (Ki83). PPPL participates in the EPA (Las Vegas) program as well as a program provided by the DOE Environmental Measurements Laboratory (EML) in New York City. These programs provide blind samples for analysis and subsequent comparison to known values and other

participants' analysis values. During CY84 PPPL initiated a program to have its radiation counting laboratory certified by the State of New Jersey through the EPA QA program.

Water analysis for nonradioactive constituents was done in-house for the first 11 months of CY84. Standard additions were used as a check on the quality of analyses. A program of using EPA QA samples was being set up when the program was switched to an outside vendor, Princeton Aqua Science (PAS) of Edison, NJ, in December 1984. PAS participates in a State of New Jersey QA program and has a quality assurance plan (C182).

5.0 FUTURE PROGRAM EXPANSION

5.1 Meteorological

A new meteorological tower was installed in November 1983. Data from this system will be used in updating dose calculations for the FSAR and will also be used in evaluating safety-related design requirements for any new D-T device at PPPL. Several dose assessment codes are being reviewed by PPPL with respect to using the data from this tower. These codes include AIRDOSE-EPA, an Ontario Hydro version of TRITMOD, and PAVAN. Also a review of a draft report, PNL-4989, Interim Recommendations: Environmental Dose Calculations for DOE Nuclear Sites, is underway.

5.2 Water Quality

The initial phases of a ground water monitoring program is slated to begin in CY85. Water sample analysis will be added to both the radioactive and nonradioactive program once wells are drilled.

5.3 Radioactive Effluents

5.3.1.1 Air Gaseous and Particulate

A decision was made in CY84 based on data collected to limit the specific air and particulate monitors to a beta detector only. Several of these systems will be installed in CY85. An environmental tritium monitor is presently under test and will be reported on next year.

5.3.2.2 Off-Site Radiological Monitoring

Off-site grab sample water analysis is now an established program. A program for doing off-site tritium and particulate monitoring, primarily in the direction of the prevailing wind direction, is being planned.

5.4 Nonradioactive

Air effluents standards will continue to be met by following the guidelines of the State of New Jersey Department of Environmental Protection (NJDEP). Any

potential toxic materials will be monitored and disposed of in accordance with regulations and accepted guidelines. The detention basin update schedule for CY84 should become a reality in CY85. An updated SPCC Plan is in draft form and almost ready for implementation.

6.0 REGULATIONS AND SAFETY CRITERIA

The appropriate Radiation Protection Standard for penetrating radiation was taken from DOE Order 5480.1, Chapter XI. Specific criteria for implementing these standards on TFTR are contained in TFTR Operational Safety Requirements, in particular OSR/TFTR/O-2F-C. The Concentration Guides used in the analyses of surface water samples for radioactivity were taken from DOE Order 5480.1, Chapter XI, Table II, Column 2 (Water in Uncontrolled Areas). The concentration guides for airborne activity will be taken from the same DOE Order, Table II, Column 1 (Concentration in Air in Uncontrolled Areas) for future activities. Tritium, for example, is listed as 2×10^{-7} uCi/ml. The Air and Water Pollutions Standards for nonradioactive pollutants were taken from the New Jersey Administrative Code (NJAC), Department of Environmental Protection 7:9-4, et seq. The appropriate regulations for PCB's and hazardous waste are found in the U.S. Code of Federal Regulations, 40 CFR 761 and 40 CFR 260-265, respectively.

ACKNOWLEDGMENTS

J. Ives (retired), G. Mitman, and J. Gilbert compiled the data for radiation analysis; O. Griesbach performed in-house radiation analysis; and J. Pennimore worked on instrument installation and calibration. These individuals are staff members of the PPPL Project and Operational Safety Office, Health Physics Section. K. Semel, the PPPL Industrial Hygienist, reviewed nonradioactive pollutant analysis data. A. Silvestri did the nonradioactive water analysis through November 1984. N. Stecky is responsible for all water, storm, and sanitary sewage efforts. C. Pierce is involved in the specification and procurement of radiation monitoring equipment. Various other PPPL individuals reviewed the manuscript.

This work supported by U.S. Department of Energy Contract No. DE-AC02-76CH03073.

REFERENCES

- Ci82 Cirello, J., 1982, Quality Assurance Plan for the PAS Laboratory, Princeton Aqua Science, New Brunswick, NJ.
- Cl85 Clark, G.J., 1/25/85, "Chemicals," Princeton University internal memo.
- Co81 C rley, J.P., et al., 1982, A Guide for: Environmental Radiological Surveillance at U.S. Department of Energy Installations, DOE/EP-023 (National Technical Information Service).
- DOE81 DOE Order 5480.1, Ch. XI, 8/13/81, Environmental Protection, Safety and Health Protection Program for DOE Operations, U.S. Department of Energy, Operational and Environmental Safety Division.
- E184 Ellis, R., Jr. and Stencel, J.R., February 1984, Safety Assessment for the S-1 Spheromak, Princeton Plasma Physics Laboratory Report No. PPPL-2083.
- F184 Fleming, R.B., et al., February 1984, Safety Assessment Document for the Princeton Beta Experiment, Princeton Plasma Physics Laboratory (unpublished).
- FSAR82 Final Safety Analysis Report, Tokamak Fusion Test Reactor Facilities, Princeton Plasma Physics Laboratory, 1982.
- Gr85 Griesbach, O., and Stencel, J.R., January 1985, "An Environmental Monitoring Program for a Fusion Test Reactor," Proceedings of the 18th Midyear Topical Symposium of the Health Physics Society, Colorado Springs, CO.
- Ho85 Holcombe, S., 1/18/85, "Annual Environmental Report," Princeton Plasma Physics Laboratory, internal memo.
- Jo74 Jordan, C.F., Stewar, M., and Kline, J., 1974, "Tritium Movement in Soils: The Importance of Exchange and High Initial Dispersion," Health Physics, 27, 37-43.
- Ki83 King, H.G., 2/17/83, "Quality Assurance Intercomparison Study," PPPL correspondence.
- Ko85 Kolibal, J., April 1985, private communication, to be published as a PPPL report in 1985.
- Mc83 McCarthy, E.F., and Errera, L.J., 8/15/83, Final Monitoring Plan: Tokamak Fusion Test Reactor Meteorological Monitoring Program, TRC Environmental Consultants, Inc., 800 Connecticut Blvd., East Hartford, CT 06108.
- Mu77 Murphy, C.E., Jr, Watts, J.R., and Corey, J.C., 1977, "Environmental Tritium Transport from Atmospheric Release of Molecular Tritium," Health Physics, 33, 325-331.

- Mu82 Murphy, C.E., Jr., Sweet, C.W., and Fallon, R.D., 1982, "Tritium Transport Around Nuclear Facilities," Nuclear Safety, 23, 677-685.
- Na84 Nagy, A., and Beane, F., August 1984, Safety Assessment for the RF Test Facility, Princeton Plasma Physics Laboratory Report No. PPPL-2129.
- PSAR78 Preliminary Safety Analysis Report, Princeton Plasma Physics Laboratory Tokamak Fusion Test Reactor, 1978.
- St81 Steiner, P.A., 1981, An Aerial Radiological Survey of the Princeton Plasma Physics Laboratory and Surrounding Area, U.S. DOE Remote Sensing Laboratory Report, EGG-1182-1806, UC-41.
- St85a Stecky, N., 2/4/85, "Annual Environmental Report," PPPL internal memo.
- St85b Stencil, J.R., 3/20/85, "Estimate of Radiation Exposure to Occupied Areas for CY84 from PPPL Research Activities," PPPL internal report, JRS-291.
- St82 Streng, D.L., Kennedy, W.E., Jr. and Corley, J.P., 1982, Environmental Dose Assessment Methods for Normal Operations of DOE Nuclear Sites, PNL-4410/UC-11.
- Vo82 Volchok, M.L., and de Plangue, G., 1982, EML Procedures Manual HALL-300, Department of Energy, Environmental Measurements Laboratory, 376 Hudson St., NY, NY 10014.

TABLE 1

TFTR RADIATION EXPOSURE CRITERIA

The research facility radiation exposure criteria itemized in this table shall be invoked for the TFTR only and shall not be construed as being applicable to subsequent fusion test facilities, research facilities, or reactor projects. The values quoted are for whole body exposures; however, the DOE manual requirements for other organs (hands, arms, bones, etc.) and other time periods (quarterly) are also applicable to TFTR, and reductions between limits and design objectives shall be consistent with those of the table.

Condition	Off-Site >125 m		On-Site >125 m	
	Limit	Design Objective	Limit	Design Objective
Routine Operation mrem/yr [see footnotes (a) and (b)]	500 to an individual	<100 to an individual (b)	500 in an uncontrolled area	<100 in an uncontrolled area
	170 average population member	<35 average population member	5000 in a controlled area	<1000 in a controlled area
Accident rem [see footnotes (c) and (d)]	25	<5 (d)	25	25

(a) Routine operation consists of:

- (1) Normal component operation including shutdown, repair, maintenance, checkout, adjustment, etc.
- (2) Operational occurrences such as leaks, loss of power, and component malfunctions that are likely to occur once or more during the life of the facility.

(b) For normal operation, defined in (a) (1) above, the off-site design objective shall be 10 mrem/year.

(c) Accident conditions consist of:

- (1) Very low probability events such as "most intense predicted" natural phenomena.
- (2) Low probability events such as "most probable" natural phenomena and other component failure events that are not likely to occur during the life of the facility.

(d) For those accident conditions defined by (c) (1) and (2) above, 1 rem.

TABLE 2*
CRITICAL PATHWAYS

<u>Path I.D.</u>	<u>Discharge Pathway</u>
A1	Atmospheric → Whole Body Exposure
A2	Atmospheric → Inhalation Exposure
A3	Atmospheric → Deposition on Soil, Ingestion, Whole Body Exposure
L1	Liquid Water Way → Drinking Water Supply → Man
L2	Liquid Water Way → External Exposure
L3	Liquid Water Way → Sediments → External Exposure
L4	Liquid Water Way → Fish → Man

*TAKEN FROM TFTR FSAR TABLE 8.5-1

TABLE 3*

MONITORING PROGRAM COVERING CRITICAL PATHWAYS

TYPE OF SAMPLE	CRITICAL PATH I.D.	SAMPLE POINT DESCRIPTION	SAMPLING FREQUENCY	ANALYSIS
Surface	L1,L2,L4	1)Cooling Water Discharge Drainage 2)Bee Brook Upstream & Downstream 3)D&R Canal	Monthly Composite of Weekly Samples	Gross γ Gross β Isotopic if Necessary
Sediment	L3	Delaware - Raritan Canal	Biennially	Gross γ Gross β
Surface Water	L1,L2	Waste Collection Tanks	As Required By Filling	Gross γ Gross β Rate
Air	A1-A3	Test Cell	Continuous	Gross γ Gross β ^3H (Gas & Water Vapor)
Air	A1-A3	Vault	Continuous	^3H (Gas & Water Vapor)
Air	A1-A3	HVAC Discharge	Continuous	Gross γ Gross β ^3H , part- iculates
Direct Radiation		4 Locations at Site Perimeter	Continuous	$\gamma, \text{H}, ^3\text{H}$ HTO, H , particu- lates

*TAKEN FROM TFTR FSAR TABLE 8.5-2

TABLE 4*1974 POPULATION ESTIMATES WITHIN ANNULAR SECTORS, 0-10 MILES

<u>Sector</u>	<u>TOTAL</u>							<u>Sector</u>
	<u>0-1 Mile</u>	<u>1-2 Miles</u>	<u>2-3 Miles</u>	<u>3-4 Miles</u>	<u>4-5 Miles</u>	<u>5-10 Miles</u>	<u>0-10 Miles</u>	
N	7	430	289	182	164	7,869	8,941	N
NNE	0	22	144	137	3,284	10,353	13,940	NNE
NE	7	58	202	690	274	14,029	15,260	NE
ENE	11	6	0	123	271	9,561	9,972	ENE
E	0	0	55	25	43	11,796	11,919	E
ESE	6	32	63	68	123	3,705	3,997	ESE
SE	3	23	356	29	94	13,511	14,016	SE
SSE	6	2,859	49	27	71	13,837	15,849	SSE
S	0	293	400	570	198	2,839	4,300	S
SSW	0	95	688	1,221	530	26,112	28,646	SSW
SW	0	6	679	43	899	20,690	22,317	SW
WSW	0	394	71	873	253	9,850	11,441	WSW
W	3	835	5,712	5,832	695	7,586	20,663	W
WNW	0	437	2,889	1,455	294	6,788	11,863	WNW
NW	3	198	786	688	221	3,183	5,079	NW
NNW	3	415	259	144	698	2,854	4,373	NNW
TOTAL	49	6,103	12,642	12,107	8,112	163,563	202,576	TOTAL

*TAKEN FROM TFTR FSAR, TABLE 2.1.2-1

TABLE 5*1985 POPULATION PROJECTIONS WITHIN ANNULAR SECTORS, 0-10 MILES

<u>Sector</u>	<u>TOTAL</u>							<u>Sector</u>
	<u>0-1 Mile</u>	<u>1-2 Miles</u>	<u>2-3 Miles</u>	<u>3-4 Miles</u>	<u>4-5 Miles</u>	<u>5-10 Miles</u>	<u>0-10 Miles</u>	
N	9	529	355	229	205	9,850	11,177	N
NNE	0	27	177	169	4,041	13,008	17,422	NNE
NE	9	71	248	849	337	7,769	9,283	NE
ENE	16	8	0	151	333	12,406	12,914	ENE
E	1,217	0	74	31	53	13,956	15,331	E
ESE	9	46	1,600	78	144	4,157	6,034	ESE
SE	4	33	4,356	33	108	16,373	20,907	SE
SSE	9	4,117	71	35	82	16,018	20,332	SSE
S	0	548	456	650	226	3,788	5,668	S
SSW	0	137	784	1,392	604	30,893	33,810	SSW
SW	0	9	774	49	1,025	24,987	26,844	SW
WSW	0	552	81	1,126	326	12,765	14,850	WSW
W	683	3,793	6,683	6,823	897	10,252	29,131	W
WNW	0	564	3,611	1,877	379	8,815	15,246	WNW
NW	4	255	1,014	860	263	3,815	6,211	NW
NNW	4	511	326	186	893	3,433	5,353	NNW
TOTAL	1,964	11,200	20,610	14,538	9,916	192,285	250,513	TOTAL

*TAKEN FROM TFTR PSAR TABLE 2.1,2-3

TABLE 6*1970 RESIDENT POPULATION WITHIN ANNULAR SECTORS BETWEEN
10-50 MILES

<u>Sector</u>	<u>10-20 Miles</u>	<u>20-30 Miles</u>	<u>30-40 Miles</u>	<u>40-50 Miles</u>	<u>Total</u>	<u>Sector</u>
N	69,330	35,961	143,546	60,073	308,910	N
NNE	133,838	237,191	354,551	544,621	1,270,201	NNE
NE	185,569	437,917	1,483,657	3,893,770	6,000,913	NE
ENE	119,874	166,477	1,134,648	1,629,062	3,050,061	ENE
E	33,077	112,389	69,706	0	215,172	E
ESE	29,247	35,408	111,280	0	175,935	ESE
SE	6,928	52,737	108,930	2,033	170,628	SE
SSE	5,004	4,984	7,887	11,023	28,898	SSE
S	5,933	61,238	7,349	3,935	78,455	S
SSW	52,983	55,122	56,229	114,782	279,116	SSW
SW	247,409	324,276	1,368,041	1,220,152	3,159,878	SW
WSW	35,985	117,952	310,930	289,105	753,972	WSW
W	12,576	20,180	69,806	56,145	158,707	W
WNW	6,054	10,112	15,399	254,563	286,128	WNW
NW	12,819	12,698	66,455	85,836	177,808	NW
NNW	14,429	14,462	34,875	14,937	78,703	NNW
TOTAL	971,055	1,699,104	5,343,289	8,180,037	16,193,485	TOTAL

*Taken from TFTR PSAR, Table 2.1.2-4

Table 7
TELEDYNE ISGTOPES

REPORT OF ANALYSIS

RUN DATE 03/27/84

MR JOE STENCEL PRINCETON UNIVERSITY PLASMA PHYSICS LAB JAMES FORRESTAL CAMPUS P O BOX 451-HEALTH AND SAFETY C854C PRINCETON NJ	WORK ORDER NUMBER 3-0830	CUSTOMER P.O. NUMBER Y4124-10	DATE RECEIVED 02/27/84	DELIVERY DATE 03/09/84	PAGE 1
---	-----------------------------	----------------------------------	---------------------------	---------------------------	--------

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START STOP DATE TIME DATE TIME	NUCLIDE	ACTIVITY (PC/LITER)	NUCL-UNIT-1 U/M *	MID-COUNT TIME DATE TIME	VOLUME - UNITS ASH-WEIGHT-1 *	LAB.
78701	NO D-1 BASELINE TFTR		02/21	GR-A	L.T. 1. E 00		03/02		3
				GR-B	2.1 +-0.9 E 00		03/02		3
				HE-7	L.T. 3. E 01		03/01		4
				K-40	L.T. 5. E 01		03/01		4
				MN-54	L.T. 3. E 00		03/01		4
				CO-58	L.T. 3. E 00		03/01		4
				FE-59	L.T. 7. E 00		03/01		4
				CO-60	L.T. 3. E 00		03/01		4
				ZN-65	L.T. 7. E 00		02/01		4
				ZR-95	L.T. 4. E 00		02/01		4
				HU-103	L.T. 4. E 00		03/01		4
				HU-106	L.T. 3. E 01		03/01		4
				I-131	L.T. 8. E 00		03/01		4
				CS-134	L.T. 3. E 00		03/01		4
				CS-137	L.T. 4. E 00		02/01		4
				RA-140	L.T. 5. E 00		03/01		4
				CE-141	L.T. 8. E 00		03/01		4
				CE-144	L.T. 3. E 01		03/01		4
				RA-226	L.T. 8. E 01		03/01		4
				TH-228	L.T. 7. E 00		03/01		4
				H-3	L.T. 1.8 E 02		03/12		5
78702	NO D-2 BASELINE TFTR		02/21	GR-A	L.T. 2. E 00		03/02		3
				GR-B	2.6 +-1.0 E 00		03/02		3
				HE-7	L.T. 3. E 01		03/01		4
				K-40	L.T. 6. E 01		02/01		4
				MN-54	L.T. 3. E 00		03/01		4
				CO-58	L.T. 4. E 00		03/01		4
				FE-59	L.T. 7. E 00		03/01		4
				CO-60	L.T. 4. E 00		03/01		4

Table 7 (Cont'd)
TELEDYNE ISOTOPIES

REPORT OF ANALYSIS

RUN DATE 03/27/84

MR JOE STENCEL PRINCETON UNIVERSITY PLASMA PHYSICS LAB JAMES FORRESTAL CAMPUS P O BOX 451-HEALTH AND SAFETY 08540 PRINCETON NJ	WORK ORDER NUMBER 3-C830	CUSTOMER P.O. NUMBER Y4124-10	DATE RECEIVED 02/27/84	DELIVERY DATE 03/09/84	PAGE 2
---	-----------------------------	----------------------------------	---------------------------	---------------------------	--------

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE		NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-1 U/M *	MID-COLNT	VOLUME - UNITS ASH-WGT-1 *	LAB.
			START DATE	STCP TIME				TIME		
78702	NO D-2 BASELINE TFTR		02/21		ZN-65	L.T.	7. E 00	03/01		4
					ZN-95	L.T.	4. E 00	03/01		4
					RU-103	L.T.	4. E 00	03/01		4
					RU-106	L.T.	3. E 01	03/01		
					I-131	L.T.	8. E 00	03/01		
					CS-134	L.T.	4. E 00	03/01		4
					CS-137	L.T.	4. E 00	03/01		4
					RA-140	L.T.	6. E 00	03/01		4
					CE-141	L.T.	8. E 00	03/01		4
					CE-144	L.T.	2. E 01	03/01		4
					RA-226	L.T.	9. E 01	03/01		4
					TH-228	L.T.	8. E 00	03/01		4
					H-3	L.T.	1.8 E 02	03/13		5
				78703	NO D-1 BASELINE TFTR		02/21		GR-A	L.T.
	GR-B	1.5 + - 0.8 E 00	03/02						3	
	BE-7	L.T.	5. E 01					03/01		4
	K-40	1.11 + - 0.47 E 02	03/01						4	
	MN-54	L.T.	6. E 00					03/01		4
	CO-58	L.T.	6. E 00					03/01		4
	FE-59	L.T.	1. E 01					03/01		4
	CO-60	L.T.	6. E 00					03/01		4
	ZN-65	L.T.	1. E 01					03/01		4
	ZR-95	L.T.	6. E 00					03/01		4
	RU-103	L.T.	6. E 00					03/01		4
	RU-106	L.T.	5. E 01					03/01		4
	I-131	L.T.	1. E 01					03/01		4
	CS-134	L.T.	7. E 00					03/01		4
	CS-137	L.T.	4. E 00					03/01		4
	RA-140	L.T.	1. E 01					03/01		4
	CE-141	L.T.	1. E 01					03/01		4

Table 7 (Cont'd)
TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 03/27/84

MAX ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE 3
3-0830	Y4124-10	02/27/84	03/09/84	

MR JOE STENCEL
PRINCETON UNIVERSITY
PLASMA PHYSICS LAB
JAMES FORRESTAL CAMPUS
P O BOX 451-HEALTH AND SAFETY 08540
PRINCETON NJ

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE		NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-(U/M *	PID-COUNT TIME		VOLUME - UNITS ASH-WGHT-(*	LAB.
			START DATE	STOP DATE				DATE	TIME		
70703	NO 0-1 BASELINE TFTR		02/21		CE-144	L.T. 5. E 01		03/01			4
					RA-226	L.T. 1. E 02		03/01			4
					TH-228	L.T. 1. E 01		03/01			4
					H-3	L.T. 1.9 E 02		03/14			5
70704	NO 0-2 BASELINE TFTR		02/21		GR-A	L.T. 2. E 00		03/02			3
					GR-B	2.8 +-1.0 E 00		03/02			3
					DE-7	L.T. 4. E 01		03/01			4
					K-40	L.T. 7. E 01		03/01			4
					MA-54	L.T. 4. E 00		03/01			4
					CG-58	L.T. 4. E 00		03/01			4
					FE-59	L.T. 9. E 00		03/01			4
					CO-60	L.T. 4. E 00		03/01			4
					ZN-65	L.T. 1. E 01		03/01			4
					ZR-95	L.T. 4. E 00		03/01			4
					RU-103	L.T. 5. E 00		03/01			4
					RU-106	L.T. 4. E 01		03/01			4
					J-133	L.T. 9. E 00		03/01			4
					CS-134	L.T. 4. E 00		03/01			4
					CS-137	L.T. 5. E 00		03/01			4
					BA-140	L.T. 7. E 00		03/01			4
					CE-141	L.T. 7. E 00		03/01			4
					CE-144	L.T. 3. E 01		03/01			4
					RA-226	L.T. 8. E 01		03/01			4
					TH-228	L.T. 7. E 00		03/01			4
					H-3	L.T. 1.9 E 02		03/15			5

Table 7 (cont'd)
TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 03/27/84

MR JOE STENCEL PRINCETON UNIVERSITY PLASMA PHYSICS LAB JAMES FORRESTAL CAMPUS P O BOX 451-HEALTH AND SAFETY 08540 PRINCETON NJ	WORK ORDER NUMBER 3-C830	CUSTOMER P.O. NUMBER Y4124-10	DATE RECEIVED 02/27/84	DELIVERY DATE 03/09/84	PAGE 4
---	---------------------------------	--------------------------------------	-------------------------------	-------------------------------	--------

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE	STOP TIME	NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-1 U/M *	MID-COUNT TIME DATE	VOLUME - UNITS ASH-WEIGHT (*)	LAB.
78705	NO C-1 BASELINE TFTR		02/21		GR-A	L.T. 1. E 00		03/02		3
					GR-B	2.3 +/-0.9 E 00		03/02		3
					PE-7	L.T. 3. E 01		03/02		4
					K-40	L.T. 4. E 01		03/02		4
					MN-54	L.T. 4. E 00		03/02		4
					CO-58	L.T. 3. E 00		03/02		4
					FE-59	L.T. 7. E 00		03/02		4
					CO-60	L.T. 3. E 00		03/02		4
					ZN-65	L.T. 7. E 00		03/02		4
					ZR-95	L.T. 3. E 00		03/02		4
					RU-103	L.T. 4. E 00		03/02		4
					RU-106	L.T. 3. E 01		03/02		4
					T-131	L.T. 8. E 00		03/02		4
					CS-134	L.T. 3. E 00		03/02		4
					CS-137	L.T. 4. E 00		03/02		4
					BA-140	L.T. 6. E 00		03/02		4
					CE-141	L.T. 7. E 00		03/02		4
					CE-144	L.T. 2. E 01		03/02		4
					RA-226	L.T. 7. E 01		03/02		4
					TH-228	L.T. 7. E 00		03/02		4
					T-3	L.T. 1.9 E 02		03/16		5
78706	NO E-1 BASELINE TFTR		02/21		GR-A	L.T. 2. E 00		03/01		3
					GR-B	3.0 +/-1.1 E 00		03/01		3
					PE-7	L.T. 5. E 01		03/01		4
					K-40	L.T. 1. E 02		03/01		4
					MN-54	L.T. 5. E 00		03/01		4
					CO-58	L.T. 5. E 00		03/01		4
					FE-59	L.T. 1. E 01		03/01		4
					CO-60	L.T. 5. E 00		03/01		4
					ZN-65	L.T. 1. E 01		03/01		4

Table 7 (Cont'd)
TELEDYNE ISOTOPIES

REPORT OF ANALYSIS.

RUN DATE 03/27/84

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE
3-C830	Y4124-10	02/27/84	03/09/84	5

MR JOE STENCEL
PRINCETON UNIVERSITY
PLASMA PHYSICS LAB
JAMES FORRESTAL CAMPUS
P O BOX 451-HEALTH AND SAFETY 08540
PRINCETON NJ

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE		NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-1 U/M *	PID-COUNT TIME		VOLUME - UNITS ASH-WGHT-(*)	LAB.			
			START DATE	STOP DATE				DATE	TIME					
78706	ND E-1 BASELINE TFTR		02/21		ZR-95	L.T. 5. E 00		03/01			4			
					RU-103	L.T. 4. E 00		03/01		4				
					RU-106	L.T. 5. E 01		03/01		4				
					I-131	L.T. 1. E 01		03/01		4				
					CS-134	L.T. 5. E 00		02/01		4				
					CS-137	L.T. 4. E 00		03/01		4				
					BA-140	L.T. 7. E 00		03/01		4				
					CE-141	L.T. 1. E 01		03/01		4				
					CE-144	L.T. 4. E 01		03/01		4				
					RA-226	L.T. 1. E 02		03/01		4				
					TH-228	L.T. 1. E 01		02/01		4				
					H-3	L.T. 1.8 E 02		03/17		5				
				78707	ND H-1 BASELINE TFTR		02/21		GR-A	L.T. 1. E 00		03/01		3
									GR-B	4.3 ± 1.0 E 00		02/01		3
	PE-7	L.T. 3. E 01						02/02		4				
	K-40	L.T. 5. E 01						03/02		4				
	MN-54	L.T. 4. E 00						02/02		4				
	CO-58	L.T. 4. E 00						02/02		4				
	FE-59	L.T. 7. E 00						03/02		4				
	CO-60	L.T. 3. E 00						03/02		4				
	ZN-65	L.T. 0. E 00						03/02		4				
	ZR-95	L.T. 4. E 00						03/02		4				
	RU-103	L.T. 4. E 00						03/02		4				
	RU-106	L.T. 3. E 01						02/02		4				
	I-131	L.T. 9. E 00						03/02		4				
	CS-134	L.T. 4. E 00						03/02		4				
	CS-137	L.T. 4. E 00						03/02		4				
	BA-140	L.T. 4. E 00						03/02		4				
	CE-141	L.T. 8. E 00						03/02		4				
	CE-144	L.T. 3. E 01						02/02		4				

Table 7 (Cont'd)
TELEDYNE ISOTOPIES

REPORT OF ANALYSIS

RUN DATE 03/27/84

WORK ORDER NUMBER	CUSTOMER P.O. NUMBER	DATE RECEIVED	DELIVERY DATE	PAGE
3-0830	Y4124-10	02/27/84	03/09/84	1

MR JOE STENCEL
PRINCETON UNIVERSITY
PLASMA PHYSICS LAB
JAMES FORRESTAL CAMPUS
P.O. BOX 451-HEALTH AND SAFETY 08540
PRINCETON NJ

W A T E R

TELZYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE		NUCLIDE	ACTIVITY (PC1/LITER)	NUCL-UNIT-1 U/K *	MID-COUNT TIME		VOLUME - UNITS ASH-WEIGHT-(g)	LAB.			
			START DATE	STOP DATE				DATE	TIME					
78707	NO M-1 BASELINE TFR		02/21		RA-226	L.T. 8. E 01		03/02		4				
					TH-228	L.T. 7. E 00		03/02		4				
					H-3	1.4 +/- 1.3 E 02		03/18		5				
78708	NO P-1 BASELINE TFR		02/21		GR-A	L.T. 1. E 00		03/01		3				
					GR-B	1.7 +/- 0.8 E 00		02/01		3				
					OE-7	L.T. 4. E 01		03/02		4				
					K-40	L.T. 7. E 01		03/02		4				
					PN-54	L.T. 4. E 00		02/02		4				
					CO-50	L.T. 4. E 00		02/02		4				
					FE-59	L.T. 0. E 00		03/02		4				
					CO-60	L.T. 4. E 00		02/02		4				
					ZN-65	L.T. 8. E 00		02/02		4				
					ZR-95	L.T. 4. E 00		03/02		4				
					RU-103	L.T. 5. E 00		03/02		4				
					RU-106	L.T. 4. E 01		02/02		4				
					I-131	L.T. 1. E 01		03/02		4				
					CS-134	L.T. 4. E 00		03/02		4				
					CS-137	L.T. 4. E 00		02/02		4				
					BA-140	L.T. 7. E 00		03/02		4				
					CE-141	L.T. 1. E 01		03/02		4				
					CE-144	L.T. 4. E 01		02/02		4				
					RA-226	L.T. 1. E 02		02/02		4				
					TH-228	L.T. 9. E 00		03/02		4				
					H-3	1.7 +/- 1.2 E 02		03/19		5				
				78709	NO P-2 BASELINE TFR		02/21		GR-A	L.T. 1. E 00		03/01		3
									GR-B	3.3 +/- 0.9 E 00		03/01		3
	OE-7	L.T. 6. E 01						02/02		4				
	K-40	L.T. 8. E 01						02/02		4				
	PN-54	L.T. 6. E 00						03/02		4				

Table 7 (Cont'd)
TELEDYNE ISOTOPES

REPORT OF ANALYSIS

RUN DATE 03/27/84

MR JOE STENCEL PRINCETON UNIVERSITY PLASMA PHYSICS LAB JAMES FORRESTAL CAMPUS P O BOX 451-HEALTH AND SAFETY 08540 PRINCETON NJ	WORK ORDER NUMBER 3-C830	CUSTOMER P.O. NUMBER Y4124-10	DATE RECEIVED 02/27/84	DELIVERY DATE 03/09/84	PAGE 7
---	-----------------------------	----------------------------------	---------------------------	---------------------------	--------

H A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NUM	COLLECTION-DATE START DATE TIME	STEP DATE TIME	NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-(U/M *	MID-COUNT TIME DATE TIME	VOLUME - UNITS ASH-WGT-(*	LAB.
78709	NO P-2 BASELINE TFTR		02/21		CO-58	L.T. 5. E 00		03/02		4
					FE-59	L.T. 1. E 01		03/02		4
					CO-60	L.T. 6. E 00		03/02		4
					ZN-65	L.T. 9. E 00		03/02		4
					ZR-95	L.T. 6. E 00		03/02		4
					RU-103	L.T. 7. E 00		03/02		4
					RU-106	L.T. 5. E 01		03/02		4
					I-131	L.T. 2. E 01		03/02		4
					CS-134	L.T. 7. E 00		03/02		4
					CS-137	L.T. 6. E 00		03/02		4
					BA-140	L.T. 1. E 01		03/02		4
					CE-141	L.T. 1. E 01		03/02		4
					CE-144	L.T. 5. E 01		03/02		4
					RA-226	L.T. 1. E 02		03/02		4
					TH-228	L.T. 1. E 01		03/02		4
					H-3	2.4 +-1.3 E 02		03/20		5
78710	NO W-4 BASELINE TFTR		02/21		GR-A	4.6 +-2.2 E 00		03/01		3
					GR-B	4.4 +-1.1 E 00		03/01		3
					BE-7	L.T. 4. E 01		03/02		4
					X-46	L.T. 5. E 01		03/02		4
					PN-54	L.T. 4. E 00		03/02		4
					CO-58	L.T. 4. E 00		03/02		4
					FE-59	L.T. 9. E 00		03/02		4
					CO-60	L.T. 4. E 00		03/02		4
					PN-65	L.T. 1. E 01		03/02		4
					ZR-95	L.T. 4. E 00		03/02		4
					RU-103	L.T. 5. E 00		03/02		4
					RU-106	L.T. 4. E 01		03/02		4
					I-131	L.T. 1. E 01		03/02		4
					CS-134	L.T. 4. E 00		03/02		4

Table 7 (Cont'd)
TELEDYNE ISOTOPIES

REPORT OF ANALYSIS

RUN DATE 03/27/84

MR JOE STENCEL PRINCETON UNIVERSITY PLASMA PHYSICS LAB JAMES FORRESTAL CAMPUS P O BOX 451-HEALTH AND SAFETY 08540 PRINCETON NJ	WCRK ORDER NUMBER 3-CB30	CUSTOMER P.O. NUMBER Y4124-10	DATE RECEIVED 02/27/84	DELIVERY DATE 03/09/84	PAGE 8
---	-----------------------------	----------------------------------	---------------------------	---------------------------	-----------

W A T E R

TELEDYNE SAMPLE NUMBER	CUSTOMER'S IDENTIFICATION	STA NOV	COLLECTION-DATE		NUCLIDE	ACTIVITY (PCI/LITER)	NUCL-UNIT-1 U/M *	MID-COUNT TIME		VOLUME - UNITS ASH-WGHT-1 *	LAB.
			START DATE	STCP DATE				DATE	TIME		
78710	NO W-4 BASELINE TFTR		02/21		CS-137	L.T.	4. E 00		03/02		4
					BA-140	L.T.	6. E 00		03/02		4
					CE-141	L.T.	9. E 00		03/02		4
					CS-144	L.T.	3. E 01		03/02		4
					RA-226	L.T.	1. E 02		03/02		4
					TH-228	L.T.	9. E 00		03/02		4
					H-3	1.8 +-1.5	E 02		03/21		5
78711	NO W-5 BASELINE TFTR		02/21		GR-A	L.T.	1. E 00		03/02		3
					GR-B	L.T.	1. E 00		03/02		3
					BE-7	L.T.	6. E 01		03/02		4
					K-40	L.T.	2. E 02		03/02		4
					PN-54	L.T.	7. E 00		03/02		4
					CO-58	L.T.	7. E 00		03/02		4
					FE-59	L.T.	1. E 01		03/02		4
					CO-60	L.T.	7. E 00		03/02		4
					ZN-65	L.T.	1. E 01		03/02		4
					ZR-95	L.T.	7. E 00		03/02		4
					RU-103	L.T.	0. E 00		03/02		4
					RU-106	L.T.	6. E 01		03/02		4
					I-131	L.T.	2. E 01		03/02		4
					CS-134	L.T.	7. E 00		03/02		4
					CS-137	L.T.	8. E 00		03/02		4
					BA-140	L.T.	1. E 01		03/02		4
					CE-141	L.T.	1. E 01		03/02		4
					CE-144	L.T.	5. E 01		03/02		4
					RA-226	L.T.	1. E 02		03/02		4
					TH-228	L.T.	1. E 01		03/02		4
					H-3	1.9 +-1.3	E 02		03/22		5

42

LAST PAGE OF REPORT

SEND 1 COPIES TO PR2575 MR JOE STENCEL

APPROVED BY H. KING 03/27/84

2 - GAS LAB.

3 - RADIO CHEMISTRY LAB.

4 - GE(LI) GAMMA SPEC LAB.

5 - TRITIUM GAS/L.S. LAB.

Table 8

WATER QUALITY MONITORING DATA
 Forrestal Campus, Princeton University
 Station: B1
 Monitoring Station Location: Bee Brook, Location A

<u>Parameter</u>	<u>1/10/84</u> <u>9:20 a.m.</u>	<u>1/24/84</u>	<u>2/7/84</u> <u>10:00 a.m.</u>	<u>2/21/84</u> <u>9:45 a.m.</u>	<u>3/6/84</u> <u>9:51 a.m.</u>	<u>3/20/84</u> <u>10:08 a.m.</u>
Alkalinity, mg/1 CaCO ₃ eq.	44		38	--	38	--
BOD ₅ , mg/1 O ₂	6.2		1.5	--	2.4	--
Calcium Hardness, mg/1 CaCO ₃ eq.	38		36	--	28	--
Chromium						
Total, mg/1 Cr	0.05	FROZE	0.05	0.05	0.05	0.05
Hexavalent, mg/1 Cr	0.01		0.01	0.01	0.01	0.01
COD, mg/1 O ₂	6.6		6.7	--	10	--
Copper, mg/1 Cu	0.021		0.021	--	0.021	--
Dissolved Oxygen, mg/1 O ₂	13.6		12.5	--	10	--
EDTA, mg/1 Cu eq.	--		--	--	0.095	--
Fecal Coliform Count, MPN/100 ml.	6		32	36	16	24
Flow, ft ³ /sec	3.3		1.5	2.2	1.2	2.2
Iron, mg/1 Fe	0.30		0.030	42	0.34	0.43
Nitrogen						
Total Kjeldahl, mg/1 N	0.46		0.44	--	0.64	--
Nitrate, mg/1 N	0.84		1.32	--	1.25	--
Oil/Grease, mg/1	1.67		0.06	--	0.98	--
pH	7.2		7.3	7.2	7.1	7.0
Phosphate						
Total, mg/1 P	0.040	OVER	0.035	0.042	0.018	0.06
Ortho, mg/1 P	0.025		0.021	0.018	0.012	0.01
Solids						
Dissolved, mg/1	128		115	126	116	116
Suspended, mg/1	15		10	14	6	7
Sulfate, mg/1 SO ₄	22		34	32	16	24
Temperature, °C	5°C		0°C	5°C	4°C	6°C
Turbidity, NTU	7		13	16	14	8
Zinc, mg/1 Zn	0.035		0.032	--	0.026	--

Table 8 (Cont'd)

WATER QUALITY MONITORING DATA
 Forrestal Campus, Princeton University
 Station: B1
 Monitoring Station Location: Bee Brook, Location A

Parameter	4/03/84 11:14 a.m.	4/17/84 10:05 a.m.	5/8/84 11:25 a.m.	5/22/84 10:30 a.m.	6/5/84 10:00 a.m.	6/13/84 10:35 a.m.
Alkalinity, mg/l CaCO_3 eq.	18	--	44	--	32	--
BOD_5 , mg/l O_2	3.2	--	1.2	--	1.6	--
Calcium Hardness, mg/l CaCO_3 eq.	22	--	28	--	26	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O_2	13	--	18	--	32	--
Copper, mg/l Cu	0.01	--	0.01	--	0.010	--
Dissolved Oxygen, mg/l O_2	10.5	--	11.2	--	9.2	--
EDTA, mg/l Cu eq.	--	--	--	--	--	--
Fecal Coliform Count, MPN/100 ml.	56	78	114	128	170	186
Flow, ft^3/sec	1.7	1.1	0.9	1.20	1.75	no flow
Iron, mg/l Fe	0.52	0.24	0.42	0.44	0.74	0.78
Nitrogen						
Total Kjeldahl, mg/l N	0.66	--	0.32	--	0.42	--
Nitrate, mg/l N	0.38	--	0.83	--	0.94	--
Oil/Grease, mg/l	0.95	--	0.42	--	0.44	--
pH	7.0	7.0	7.0	7.1	7.0	7.0
Phosphate						
Total, mg/l P	0.66	0.46	0.04	0.032	0.06	0.04
Ortho, mg/l P	0.022	0.01	0.01	0.01	0.04	0.01
Solids						
Dissolved, mg/l	126	138	124	113	116	136
Suspended, mg/l	8	11	15	6	8	12
Sulfate, mg/l SO_4	18	18	22	20	18	15
Temperature, $^{\circ}\text{C}$	12 $^{\circ}\text{C}$	13 $^{\circ}\text{C}$	14 $^{\circ}\text{C}$	18 $^{\circ}\text{C}$	18 $^{\circ}\text{C}$	21 $^{\circ}\text{C}$
Turbidity, NTU	11	16	18	1.6	5.7	1.6
Zinc, mg/l Zn	0.044	--	0.036	--	0.025	--

Table 8 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: B1

Monitoring Station Location: Bee Brook, Location A

<u>Parameter</u>	<u>7/10/84</u> <u>9:15 a.m.</u>	<u>7/24/84</u> <u>10:00 a.m.</u>	<u>8/7/84</u> <u>10:40 a.m.</u>	<u>8/28/84</u> <u>9:45 a.m.</u>	<u>9/5/84</u> <u>10:00 a.m.</u>	<u>9/18/84</u> <u>9:45 a.m.</u>
Alkalinity, mg/l CaCO ₃ eq.	16	--	22	--	18	--
BOD ₅ , mg/l O ₂	2.5	--	1.8	--	1.2	--
Calcium Hardness, mg/l CaCO ₃ eq.	14	--	12	--	12	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O ₂	14	--	16	--	12	--
Copper, mg/l Cu	0.015	--	0.022	--	0.02	--
Dissolved Oxygen, mg/l O ₂	12	--	14	--	14	--
EDTA, mg/l Cu eq.	0.45	--	0.46	--	0.44	--
Fecal Coliform Count, MPN/100 ml.	174	200	186	136	82	78
Flow, ft ³ /sec	1.5	no flow	1.75	1.75	1.25	NF
Iron, mg/l Fe	0.72	0.62	0.68	0.42	0.50	0.46
Nitrogen						
Total Kjeldahl, mg/l N	0.54	--	0.56	--	0.50	
Nitrate, mg/l N	2.37	--	2.46	--	2.2	--
Oil/Grease, mg/l	0.46	--	0.56	--	0.48	--
pH	7.0	7.4	7.2	7.1	7.2	7.2
Phosphate						
Total, mg/l P	0.07	0.05	0.03	0.08	0.06	0.035
Ortho, mg/l P	0.024	0.02	0.01	0.03	0.01	0.01
Solids						
Dissolved, mg/l	142	128	132	122	120	116
Suspended, mg/l	10	12	10	8	6	4
Sulfate, mg/l SO ₄	16	18	22	20	18	20
Temperature, °C	20°C	22°C	21°C	22°C	19°C	19°C
Turbidity, NTU	3	2	2	1.4	1.2	2.4
Zinc, mg/l Zn	0.032	--	0.03	--	0.03	

Table 8 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: B1

Monitoring Station Location: Bee Brook, Location A

<u>Parameter</u>	<u>10/2/84</u> <u>9:30 a.m.</u>	<u>10/16/84</u> <u>10:15 a.m.</u>	<u>11/6/84</u> <u>9:45 a.m.</u>	<u>11/20/84</u> <u>9:30 a.m.</u>	<u>12/31/84</u> <u>11:00 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	16	--	18	--	34
BOD ₅ , mg/l O_2	0.9	--	0.80	--	< 2
Calcium Hardness, mg/l CaCO_3 eq.	10	--	14	--	56
Chromium					
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.03
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	< 0.01
COD, mg/l O_2	10	--	12	--	14
Copper, mg/l Cu	0.01	--	0.02	--	0.02
Dissolved Oxygen, mg/l O_2	14	--	14	--	16
EDTA, mg/l Cu eq.	0.40	--	0.40	--	< 0.08
Fecal Coliform Count, MPN/100 ml.	46	44	48	36	< 1
Flow, ft ³ /sec	0.50	NF	1.25	1.25	2
Iron, mg/l Fe	0.40	0.42	0.48	0.40	0.53
Nitrogen					
Total Kjeldahl, mg/l N	0.44	--	0.48	--	0.6
Nitrate, mg/l N	1.94	--	1.7	--	1.4
Oil/Crease, mg/l	0.42	--	0.48	--	< 1
pH	6.9	7.4	7.3	7.5	7.0
Phosphate					
Total, mg/l P	0.03	0.04	0.04	0.03	0.03
Ortho, mg/l P	0.01	0.01	0.01	0.01	0.02
Solids					
Dissolved, mg/l	118	124	212	215	83
Suspended, mg/l	2	3	18	10	3
Sulfate, mg/l SO_4	18	20	22	18	22
Temperature, °C	15°C	16°C	15°C	10°C	7°C
Turbidity, NTU	1.5	0.8	2.8	2.8	5.5
Zinc, mg/l Zn	0.02	0.02	0.03	0.02	0.02

Table 9

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: B2
Monitoring Station Location: Bee Brook, Location B

Parameter	1/10/84 9:23 a.m.	1/24/84 9:50 a.m.	2/7/84 10:02 a.m.	2/21/84 9:50 a.m.	3/6/84 9:56 a.m.	3/20/84 10:10 a.m.
Alkalinity, mg/l CaCO_3 eq.	38	--	46	--	40	--
BOD ₅ , mg/l O_2	3.8	--	9.8	--	4.4	--
Calcium Hardness, mg/l CaCO_3 eq.	36	--	34	--	38	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O_2	10.5	--	10.1	--	16	--
Copper, mg/l Cu	0.025	--	0.025	--	0.013	--
Dissolved Oxygen, mg/l O_2	12.5	--	12.6	--	14	22
EDTA, mg/l Cu eq.	0.088	--	0.035	--	0.035	.4
Fecal Coliform Count, MPN/100 ml.	2	12	16	22	14	0.43
Flow, ft ³ /sec	0.40	0.50	0.4	0.5	0.4	--
Iron, mg/l Fe	0.42	0.48	0.32	0.46	0.46	--
Nitrogen						
Total Kjeldahl, mg/l N	0.55	--	1.56	--	1.34	--
Nitrate, mg/l N	0.98	--	1.76	--	0.85	--
Oil/Grease, mg/l	1.5	--	2.1	--	9	--
pH	7.1	7.3	7.2	7.3	7.0	7.0
Phosphate						
Total, mg/l P	0.16	0.18	0.29	0.29	0.15	0.02
Ortho, mg/l P	0.088	0.065	0.16	0.064	0.032	0.013
Solids						
Dissolved, mg/l	144	136	116	128	120	112
Suspended, mg/l	16	18	12	14	10	13
Sulfate, mg/l SO_4	29	14	25	22	24	27
Temperature, °C	9°C	8°C	6°C	8°C	7°C	9°C
Turbidity, NTU	8	8	12	10	16	13
Zinc, mg/l Zn	0.034	--	0.032	--	0.032	--

Table 9 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: B2

Monitoring Station Location: Bee Brook, Location B

Parameter	4/3/84 11:15 a.m.	4/17/84 10:06 a.m.	5/8/84 11:27 a.m.	5/22/84 10:35 a.m.	6/5/84 10:15 a.m.	6/13/84 10:45 a.m.
Alkalinity, mg/l CaCO_3 eq.	20	--	36	--	28	--
BOD ₅ , mg/l O_2	2.6	--	6	--	1.3	--
Calcium Hardness, mg/l CaCO_3 eq.	26	--	36	--	32	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O_2	20	--	14	--	33.4	--
Copper, mg/l Cu	0.01	--	0.03	--	0.016	--
Dissolved Oxygen, mg/l O_2	14	--	12	--	9.6	--
EDTA, mg/l Cu eq.	--	--	--	--	0.075	--
Fecal Coliform Count, MPN/100 ml.	74	82	98	104	175	196
Flow, ft ³ /sec	0.04	0.4	0.4	0.4	0.3	0.5
Iron, mg/l Fe	0.56	0.30	0.44	1.6	0.80	0.76
Nitrogen						
Total Kjeldahl, mg/l N	0.48	--	0.74	--	0.60	--
Nitrate, mg/l N	0.66	--	0.58	--	1.3	--
Oil/Grease, mg/l	0.86	--	0.45	--	0.52	--
pH	7.6	6.9	7.1	7.2	7.0	7.1
Phosphate						
Total, mg/l P	0.60	0.42	0.25	0.055	0.20	0.05
Ortho, mg/l P	0.22	0.18	0.07	0.014	0.05	0.01
Solids						
Dissolved, mg/l	136	134	145	142	160	148
Suspended, mg/l	14	10	10.5	24	22	16
Sulfate, mg/l SO_4	16	16	28	22	28	22
Temperature, °C	13°C	15°C	14°C	18°C	18°C	21°C
Turbidity, NTU	14	14	26	1.6	5.4	1.7
Zinc, mg/l Zn	0.047	--	0.048	--	0.042	--

Table 9 (Cont'd)

WATER QUALITY MONITORING DATA
 Forrestal Campus, Princeton University
 Station: B2
 Monitoring Station Location: Bee Brook, Location B

<u>Parameter</u>	<u>7/10/84</u> <u>9:30 a.m.</u>	<u>7/24/84</u> <u>10:15 a.m.</u>	<u>8/7/84</u> <u>10:45 a.m.</u>	<u>8/28/84</u> <u>10:00 a.m.</u>	<u>9/5/84</u> <u>10:00 a.m.</u>	<u>9/18/84</u> <u>9:45 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	30	--	32	--	20	--
BOD ₅ , mg/l O_2	1.75	--	2.75	--	1.1	--
Calcium Hardness, mg/l CaCO_3 eq.	22	--	26	--	14	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O_2	28	--	20	--	12	--
Copper, mg/l Cu	0.02	--	0.03	--	0.022	--
Dissolved Oxygen, mg/l O_2	12	--	14	--	12	--
EDTA, mg/l Cu eq.	0.68	--	0.075	--	0.36	--
Fecal Coliform Count, MPN/100 ml.	182	176	184	122	90	82
Flow, ft ³ /sec	0.3	0.3	0.3	0.3	0.3	0.4
Iron, mg/l Fe	0.73	0.52	0.54	0.44	0.48	0.75
Nitrogen						
Total Kjeldahl, mg/l N	0.68	--	0.62	--	0.48	--
Nitrate, mg/l N	2.90	--	2.72	--	2.1	--
Oil/Grease, mg/l	0.58	--	0.45	--	0.44	--
pH	7.0	7.6	7.2	7.1	7.3	7.5
Phosphate						
Total, mg/l P	0.03	0.068	0.065	0.06	0.04	0.82
Ortho, mg/l P	0.02	0.015	0.02	0.02	0.01	0.038
Solids						
Dissolved, mg/l	132	122	132	118	120	445
Suspended, mg/l	12	10	14	8	10	38
Sulfate, mg/l SO_4	16	18	20	16	18	20
Temperature, °C	20°C	21°C	22°C	23°C	18°C	19°C
Turbidity, NTU	9	5	4.6	1.8	1.4	8.2
Zinc, mg/l Zn	0.35	--	0.40	--	0.038	--

Table 9 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: B2
Monitoring Station Location: Bee Brook, Location B

Parameter	10/2/84 9:45 a.m.	10/16/84 10:25 a.m.	11/6/84 10:00 a.m.	11/20/84 9:45 a.m.	12/31/84 11:15 a.m.
Alkalinity, mg/l CaCO_3 eq.	22	---	28	---	52
BOD ₅ , mg/l O_2	1.2	---	0.65	---	< 2
Calcium Hardness, mg/l CaCO_3 eq.	16	---	26	---	64
Chromium					
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.03
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	< 0.01
COD, mg/l O_2	14	---	14	---	12
Copper, mg/l Cu	0.25	---	0.015	---	0.03
Dissolved Oxygen, mg/l O_2	14	---	14	---	12
EDTA, mg/l Cu eq.	0.02	---	0.01	---	< 0.08
Fecal Coliform Count, MPN/100 ml.	44	48	40	38	< 1
Flow, ft ³ /sec	0.2	0.35	0.30	0.30	1.1
Iron, mg/l Fe	0.32	0.40	0.38	0.36	0.69
Nitrogen					
Total Kjeldahl, mg/l N	0.32	---	0.15	---	0.5
Nitrate, mg/l N	1.41	---	0.48	---	1.9
Oil/Grease, mg/l	0.42	---	0.22	---	< 1
pH	6.9	7.2	7.4	7.5	7.2
Phosphate					
Total, mg/l P	0.03	0.04	0.04	0.02	0.2
Ortho, mg/l P	0.01	0.015	0.01	0.01	0.1
Solids					
Dissolved, mg/l	126	134	197	210	120
Suspended, mg/l	8	6	20	12	10
Sulfate, mg/l SO_4	16	14	20	16	22
Temperature, °C	15°C	16°C	14°C	10°C	8°C
Turbidity, NTU	2	1.2	2.5	2.5	14
Zinc, mg/l Zn	0.02	0.025	0.01	0.01	0.07

Table 10

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: C1

Monitoring Station Location: Delaware-Raritan Canal

<u>Parameter</u>	<u>1/10/84</u> <u>9:37 a.m.</u>	<u>2/7/84</u> <u>10:19 a.m.</u>	<u>3/6/84</u> <u>10:11 a.m.</u>	<u>4/3/84</u> <u>11:30 a.m.</u>	<u>5/8/84</u> <u>11:30 a.m.</u>	<u>6/5/84</u> <u>10:45 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	26	33	28	25	26	26
Calcium Hardness, mg/l CaCO_3 eq.	34	38	32	28	30	28
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
Copper, mg/l Cu	0.010	0.037	0.022	0.01	0.015	0.01
EDTA mg/l Cu eq.	0.025	0.020	0.02	0.022	0.01	0.02
Iron, mg/l Fe	0.18	0.29	0.39	0.56	0.55	0.70
Nitrate, mg/l N	1.57	2.43	1.76	1.22	1.6	1.74
Oil and Grease, mg/l	0.10	0.12	1.2	1.95	2.3	0.20
pH	7.3	7.1	7.0	7.5	7.0	7.5
Phosphate						
Total, mg/l P	0.060	0.09	0.056	0.065	0.05	0.16
Ortho, mg/l P	0.055	0.06	0.032	0.022	0.02	0.047
Solids						
Dissolved	133	102	126	140	108	142
Suspended, mg/l	12	6	8	8	20	15
Sulfate, mg/l SO_4	20	24	26	18	20	22
Turbidity, NTU	6	7	8.8	22	28	8.2
Zinc, mg/l Zn	0.031	0.032	0.043	0.022	0.028	0.032

Table 10(Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: C1

Monitoring Station Location: Delaware-Raritan Canal

<u>Parameter</u>	<u>7/10/84</u> <u>11:10 a.m.</u>	<u>8/7/84</u> <u>11:00 a.m.</u>	<u>9/5/84</u> <u>9:15 a.m.</u>	<u>10/2/84</u> <u>10:45 a.m.</u>	<u>11/6/84</u> <u>9:00 a.m.</u>	<u>12/31/84</u> <u>11:30 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	30	28	26	25	30	16
Calcium Hardness, mg/l CaCO_3 eq.	32	34	30	30	28	60
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.07	0.05	< .01
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	< .01
Copper, mg/l Cu	0.015	0.01	0.018	0.01	0.015	< .08
EDTA mg/l Cu eq.	0.02	0.015	0.012	0.0	0.02	.70
Iron, mg/l Fe	0.35	0.55	0.22	0.39	0.38	.97
Nitrate, mg/l N	0.22	1.20	0.76	1.7	0.80	2.4
Oil and Grease, mg/l	0.35	0.42	0.32	0.30	0.32	1.0
pH	7.1	6.8	7.2	7.0	6.9	6.4
Phosphate						
Total, mg/l P	0.026	0.03	0.025	0.05	0.06	.12
Ortho, mg/l P	0.01	0.01	0.01	0.02	0.015	0.08
Solids						
Dissolved	168	148	120	118	143	100
Suspended, mg/l	14	18	12	7	15	7
Sulfate, mg/l SO_4	24	20	22	18	20	22
Turbidity, NTU	18	6.3	3.9	2.5	4.5	4.1
Zinc, mg/l Zn	0.036	0.034	0.03	0.01	0.022	0.03

Table 11

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: D1

Monitoring Station Location: Drainage Ditch #5, Location A

<u>Parameter</u>	<u>1/10/84</u> <u>9:08 a.m.</u>	<u>1/24/84</u> <u>9:30 a.m.</u>	<u>2/7/84</u> <u>9:44 a.m.</u>	<u>2/21/84</u> <u>9:15 a.m.</u>	<u>3/6/84</u> <u>9:36 a.m.</u>	<u>3/20/84</u> <u>9:53 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	30	--	44	--	32	--
BOD ₅ , mg/l O_2	4.6	--	1.8	--	1.6	--
Calcium Hardness, mg/l CaCO_3 eq.	24	--	42	--	33	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O_2	6.5	--	9.8	--	12	--
Copper, mg/l Cu	0.10	--	0.02	--	0.022	--
Dissolved Oxygen, mg/l O_2	9.2	--	10.6	--	12	--
EDTA, mg/l Cu eq.	0.025	--	0.07	--	0.018	--
Fecal Coliform Count, MPN/100 ml.	--	--	--	--	--	--
Flow, ft^3/sec	1.0	0.9	0.5	1.0	1.0	.6
Iron, mg/l Fe	0.57	0.53	0.30	0.47	0.46	1.3
Nitrogen	--					
Total Kjeldahl, mg/l N	0.29					
Nitrate, mg/l N	1.33					
Oil/Grease, mg/l	0.28	--	4.0	--	12	--
pH	7.1	7.0	7.2	7.1	6.9	7.2
Phosphate						
Total, mg/l P	0.096	0.085	0.32	0.36	0.16	0.16
Ortho, mg/l P	0.050	0.040	0.15	0.22	0.032	0.072
Solids						
Dissolved, mg/l	152	140	112	132	162	106
Suspended, mg/l	18	16	13	14	16	14
Sulfate, mg/l SO_4	16	15	40	36	22	25
Temperature, $^{\circ}\text{C}$	9 $^{\circ}\text{C}$	10 $^{\circ}\text{C}$	8 $^{\circ}\text{C}$	10 $^{\circ}\text{C}$	8 $^{\circ}\text{C}$	9 $^{\circ}\text{C}$
Turbidity, NTU	10	9	13	14	13	17
Zinc, mg/l Zn	0.032	--	0.05	--	0.049	--

Table 11 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: D1

Monitoring Station Location: Drainage Ditch #5, Location A

Parameter	4/3/84 11:02 a.m.	4/17/84 9:52 a.m.	5/8/84 11:15 a.m.	5/22/84 10:15 a.m.	6/5/84 9:00 a.m.	6/13/84 10:15 a.m.
Alkalinity, mg/l CaCO_3 eq.	32	--	32	--	28	--
BOD_5 , mg/l O_2	1.6	--	1.4	--	1.4	--
Calcium Hardness, mg/l CaCO_3 eq.	36	--	36	--	32	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O_2	10	--	9.8	--	10	--
Copper, mg/l Cu	0.024	--	0.01	--	0.024	--
Dissolved Oxygen, mg/l O_2	11	--	9.4	--	9.6	--
EDTA, mg/l Cu eq.	0.033	--	0.04	--	0.070	--
Fecal Coliform Count, MPN/100 ml.	--	--	--	--	--	--
Flow, ft^3/sec	0.5	1.0	0.5	0.5	0.3	0.6
Iron, mg/l Fe	0.68	0.56	0.72	0.98	0.74	0.62
Nitrogen						
Total Kjeldahl, mg/l N	0.46					
Nitrate, mg/l N	1.40					
Oil/Grease, mg/l	1.2	--	0.65	--	0.52	--
pH	7.1	7.4	7.6	7.2	7.5	7.2
Phosphate						
Total, mg/l P	0.75	0.68	0.055	0.049	0.096	0.078
Ortho, mg/l P	0.35	0.32	0.039	0.043	0.078	0.048
Solids						
Dissolved, mg/l	130	132	128	142	142	132
Suspended, mg/l	22	32	22	28	20	24
Sulfate, mg/l SO_4	22	20	20	18	24	20
Temperature, $^{\circ}\text{C}$	12 $^{\circ}\text{C}$	14 $^{\circ}\text{C}$	15 $^{\circ}\text{C}$	19 $^{\circ}\text{C}$	19 $^{\circ}\text{C}$	22 $^{\circ}\text{C}$
Turbidity, NTU	11	15	36	2.3	7.5	1.9
Zinc, mg/l Zn	0.044	--	0.052	--	0.038	--

Table 11 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: D1

Monitoring Station Location: Drainage Ditch #5, Location A

<u>Parameter</u>	<u>7/10/84</u> <u>8:45 a.m.</u>	<u>7/24/84</u> <u>9:30 a.m.</u>	<u>8/7/84</u> <u>10:15 a.m.</u>	<u>8/28/84</u> <u>9:15 a.m.</u>	<u>9/5/84</u> <u>9:30 a.m.</u>	<u>9/18/84</u> <u>9:15 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	30	--	34	--	32	--
BOD ₅ , mg/l O_2	2.5	--	1.9	--	0.75	--
Calcium Hardness, mg/l CaCO_3 eq.	3.4	--	34	--	30	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O_2	8	--	9	--	12	--
Copper, mg/l Cu	0.028	--	0.025	--	0.22	--
Dissolved Oxygen, mg/l O_2	10	--	11	--	12	--
EDTA, mg/l Cu eq.	0.03	--	0.04	--	0.025	--
Fecal Coliform Count, MPN/100 ml.	--	--	--	--	--	--
Flow, ft ³ /sec	0.3	0.4	0.4	0.3	0.3	0.5
Iron, mg/l Fe	0.55	0.64	0.48	0.60	0.40	0.65
Nitrogen						
Total Kjeldahl, mg/l N	0.36	--	0.42	--	0.32	--
Nitrate, mg/l N	1.28	--	1.84	--	1.40	--
Oil/Grease, mg/l	0.30	--	0.60	--	0.40	--
pH	7.0	7.3	7.1	7.0	7.0	7.2
Phosphate						
Total, mg/l P	0.86	0.72	0.076	0.35	0.40	0.95
Ortho, mg/l P	0.38	0.42	0.03	0.02	0.025	0.04
Solids						
Dissolved, mg/l	153	132	126	115	120	360
Suspended, mg/l	18	16	20	18	16	30
Sulfate, mg/l SO_4	18	12	22	16	18	26
Temperature, °C	22°C	25°C	24°C	23°C	19°C	20°C
Turbidity, NTU	9	8.6	10	2.1	1.6	4.2
Zinc, mg/l Zn	0.042	--	0.044	--	0.04	--

Table 11 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: D1

Monitoring Station Location: Drainage Ditch #5, Location A

<u>Parameter</u>	<u>10/2/84</u> <u>9:00 a.m.</u>	<u>10/16/84</u> <u>9:55 a.m.</u>	<u>11/6/84</u> <u>9:15 a.m.</u>	<u>11/20/84</u> <u>9:00 a.m.</u>	<u>12/31/84</u> <u>10:30 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	26	--	30	--	20
BOD ₅ , mg/l O_2	1.2	--	0.85	--	< 2
Calcium Hardness, mg/l CaCO_3 eq.	30	--	32	--	40
Chromium					
Total, mg/l Cr	0.05	0.05	0.05	0.05	< 0.01
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	< 0.01
COD, mg/l O_2	12	--	10	--	28
Copper, mg/l Cu	0.02	--	0.022	--	0.04
Dissolved Oxygen, mg/l O_2	14	--	12	--	15
EDTA, mg/l Cu eq.	0	--	0.03	--	< 0.08
Fecal Coliform Count, MPN/100 ml.	--	--	--	--	< 1
Flow, ft^3/sec	0.3	0.5	0.3	0.3	4
Iron, mg/l Fe	0.32	0.30	0.44	0.48	0.64
Nitrogen					
Total Kjeldahl, mg/l N	0.70	--	0.25	--	0.7
Nitrate, mg/l N	3.08	--	0.60	--	2.1
Oil/Grease, mg/l	0.42	--	0.22	--	< 1
pH	6.6	7.1	7.0	7.1	6.8
Phosphate					
Total, mg/l P	0.05	0.08	0.06	0.05	0.2
Ortho, mg/l P	0.03	0.04	0.03	0.01	0.1
Solids					
Dissolved, mg/l	120	126	220	206	85
Suspended, mg/l	8	6	25	10	30
Sulfate, mg/l SO_4	22	20	22	20	16
Temperature, °C	17°C	17°C	15°C	11°C	8°C
Turbidity, NTU	1.9	1.4	2.9	3.8	22
Zinc, mg/l Zn	0.02	0.02	0.02	0.02	0.07

Table 12

WATER QUALITY MONITORING DATA
 Forrestal Campus, Princeton University
 Station: D2
 Monitoring Station Location: Drainage Ditch #5, Location B

<u>Parameter</u>	<u>1/10/84</u> <u>9:15 a.m.</u>	<u>1/24/84</u> <u>9:44 a.m.</u>	<u>2/7/84</u> <u>9:53 a.m.</u>	<u>2/21/84</u> <u>9:30 a.m.</u>	<u>3/6/84</u> <u>9:45 a.m.</u>	<u>3/20/84</u> <u>10:03 a.m.</u>
Alkalinity	38	--	42	--	36	--
BOD ₅ , mg/l O ₂	5.0	--	1.5	--	1.8	--
Calcium Hardness, mg/l CaCO ₃ eq.	38	--	38	--	36	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O ₂	10.5	--	6.2	--	10	--
Copper, mg/l Cu	0.018	--	0.042	--	0.022	--
Dissolved Oxygen, mg/l O ₂	10.8	--	11.2	--	11.6	--
EDTA, mg/l Cu eq.	0.040	--	0.07	--	0.026	--
Fecal Coliform Count, MPN/100 ml.	--	--	--	--	--	--
Flow, ft ³ /sec	0.30	0.30	0.3	0.6	.4	.3
Iron, mg/l Fe	0.45	0.48	0.55	0.56	0.42	0.42
Nitrogen						
Total Kjeldahl, mg/l N	0.43	--	0.52	--	0.18	--
Nitrate, mg/l N	1.66	--	1.55	--	1.86	--
Oil/Grease, mg/l	0.92	--	3.2	--	11	--
pH	7.0	7.0	7.1	7.2	7.2	6.9
Phosphate						
Total, mg/l P	0.22	0.33	0.32	0.36	0.16	0.16
Ortho, mg/l P	0.045	0.04	0.21	0.18	0.062	0.10
Solids						
Dissolved, mg/l	165	154	118	126	158	126
Suspended, mg/l	25	22	12	14	8	14
Sulfate, mg/l SO ₄	18	14	18	16	16	28
Temperature, °C	10°C	10°C	8°C	9°C	8°C	9°C
Turbidity, NTU	7	8	10	12	12	17
Zinc, mg/l Zn	0.070	--	0.032	--	0.042	--

Table 12 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: D2

Monitoring Station Location: Drainage Ditch #5, Location B

Parameter	4/3/84 11:15 a.m.	4/17/84 10:01 a.m.	5/8/84 11:20 a.m.	5/22/84 10:25 a.m.	6/5/84 9:30 a.m.	6/13/84 10:25 a.m.
Alkalinity	36	--	34	--	30	--
BOD ₅ , mg/l O ₂	3.2	--	1.2	--	1.2	--
Calcium Hardness, mg/l CaCO ₃ eq.	36	--	32	--	30	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O ₂	14	--	11	--	11	--
Copper, mg/l Cu	0.022	--	0.024	--	0.026	--
Dissolved Oxygen, mg/l O ₂	10.3	--	11.4	--	10.5	--
EDTA, mg/l Cu eq.	0.065	--	0.065	--	0.065	--
Fecal Coliform Count, MPN/100 ml.	--	--	--	--	--	--
Flow, ft ³ /sec	0.03	0.04	0.4	0.4	0.3	0.5
Iron, mg/l Fe	1.2	0.42	0.65	1.34	0.88	0.80
Nitrogen						
Total Kjeldahl, mg/l N	0.68	--	0.55	--	0.40	--
Nitrate, mg/l N	1.25	--	0.72	--	1.24	--
Oil/Grease, mg/l	1.6	--	0.46	--	0.46	--
pH	6.8	6.8	7.2	7.0	6.9	7.0
Phosphate						
Total, mg/l P	0.075	0.20	0.045	0.14	0.085	0.075
Ortho, mg/l P	0.055	0.085	0.025	0.044	0.65	0.042
Solids						
Dissolved, mg/l	132	134	148	173	158	163
Suspended, mg/l	22	36	58	5	24	19
Sulfate, mg/l SO ₄	24	22	22	20	20	24
Temperature, °C	14°C	15°C	15°C	19°C	19°C	21°C
Turbidity, NTU	15	17	28	1.7	6.5	1.7
Zinc, mg/l Zn	0.038	--	0.64	--	0.032	--

Table 12 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: D2

Monitoring Station Location: Drainage Ditch #5, Location B

<u>Parameter</u>	<u>7/10/84</u> <u>9:00 a.m.</u>	<u>7/24/84</u> <u>9:45 a.m.</u>	<u>8/7/84</u> <u>10:30 a.m.</u>	<u>8/28/84</u> <u>9:30 a.m.</u>	<u>9/5/84</u> <u>9:45 a.m.</u>	<u>9/18/84</u> <u>9:30 a.m.</u>
Alkalinity	28	--	32	--	32	--
BOD ₅ , mg/l O ₂	2.75	--	2.90	--	0.90	--
Calcium Hardness, mg/l CaCO ₃ eq.	36	--	34	--	32	--
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
COD, mg/l O ₂	10	--	12	--	12	--
Copper, mg/l Cu	0.026	--	0.02	--	0.016	--
Dissolved Oxygen, mg/l O ₂	11	--	10	--	12	--
EDTA, mg/l Cu eq.	0.028	--	0.036	--	0.03	--
Fecal Coliform Count, MPN/100 ml.	--	--	--	--	--	--
Flow, ft ³ /sec	0.3	0.4	0.3	0.3	0.4	0.75
Iron, mg/l Fe	0.60	0.32	0.54	0.48	0.40	0.80
Nitrogen						
Total Kjeldahl, mg/l N	0.40	--	0.52	--	0.45	--
Nitrate, mg/l N	1.76	--	2.28	--	1.98	--
Oil/Grease, mg/l	0.28	--	0.58	--	0.30	--
pH	7.0	7.3	7.2	7.1	7.2	7.4
Phosphate						
Total, mg/l P	0.80	0.06	0.72	0.36	0.36	0.90
Ortho, mg/l P	0.32	0.036	0.24	0.15	0.18	0.035
Solids						
Dissolved, mg/l	160	155	150	146	132	500
Suspended, mg/l	22	24	24	22	16	42
Sulfate, mg/l SO ₄	24	22	22	18	20	24
Temperature, °C	22°C	23°C	22°C	23°C	19°C	19°C
Turbidity, NTU	12	5.9	5	2	1.5	0.5
Zinc, mg/l Zn	0.04	--	0.036	--	0.03	--

Table 12 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: D2

Monitoring Station Location: Drainage Ditch #5, Location B

<u>Parameter</u>	<u>10/2/84</u> <u>9:15 a.m.</u>	<u>10/16/84</u> <u>10:05 a.m.</u>	<u>11/6/84</u> <u>9:30 a.m.</u>	<u>11/20/84</u> <u>9:15 a.m.</u>	<u>12/31/84</u> <u>10:45 a.m.</u>
Alkalinity	30	--	28	--	54
BOD ₅ , mg/l O ₂	1.1	--	0.70	--	< 2
Calcium Hardness, mg/l CaCO ₃ eq.	29	--	28	--	68
Chromium					
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.02
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	< .01
COD, mg/l O ₂	13	--	12	--	42
Copper, mg/l Cu	0.02	--	0.02	--	0.04
Dissolved Oxygen, mg/l O ₂	14	--	12	--	13
EDTA, mg/l Cu eq.	0	--	0.015	--	< 0.08
Fecal Coliform Count, MPN/100 ml.	--	--	--	--	< 1
Flow, ft ³ /sec	0.3	0.55	0.3	0.3	1
Iron, mg/l Fe	0.28	0.32	0.40	0.46	1.1
Nitrogen					
Total Kjeldahl, mg/l N	0.20	--	0.20	--	0.7
Nitrate, mg/l N	0.88	--	0.50	--	2.2
Oil/Grease, mg/l	0.40	--	0.28	--	< 1
pH	6.8	7.2	7.2	7.3	6.9
Phosphate					
Total, mg/l P	0.04	0.05	0.06	0.04	0.15
Ortho, mg/l P	0.025	0.02	0.02	0.01	0.01
Solids					
Dissolved, mg/l	116	124	212	225	110
Suspended, mg/l	6	4	22	11	98
Sulfate, mg/l SO ₄	20	22	20	18	22
Temperature, °C	16°C	17°C	15°C	11°C	10°C
Turbidity, NTU	1.9	1.1	4.2	2.8	27
Zinc, mg/l Zn	0.015	0.01	0.02	0.02	0.09

Table 13

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: E1

Monitoring Station Location: On Site Elizabethtown potable water

<u>Parameter</u>	<u>4/26/84</u> <u>12:00 a.m.</u>	<u>5/22/84</u> <u>11:35 a.m.</u>	<u>6/13/84</u> <u>11:55 a.m.</u>	<u>7/24/84</u> <u>11:45 a.m.</u>	<u>8/28/84</u> <u>11:30 a.m.</u>	<u>9/18/84</u> <u>11:30 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	8	10	14	8	10	8
Calcium Hardness, mg/l CaCO_3 eq.	60	62	66	64	70	64
Copper, mg/l Cu	0.07	0.06	0.04	0.05	0.04	0.06
Fecal Coliform Count, MPN/100 ml.	0	0	0	0	0	0
Iron, mg/l Fe	0.07	0.06	0.03	0.05	0.06	0.06
Nitrogen						
Total mg/l N	2.8	2.6	2.4	2.5	2.6	2.5
Nitrate, mg/l NO_3	12.32	11.44	10.56	11	11.46	11
pH		7.2	7.2	7.1	7.1	7.1
Phosphate						
Total, mg/l P	0	0	0	0	0	0
Ortho, mg/l P	0	0	0	0	0	0
Manganese, mg/l Mn	0.015	0.015	0.012	0.015	0.015	0.014
Chloride, mg/l Cl	32	30	32	32	34	32
Solids						
Dissolved, mg/l	239.9	242	256	352	299	265
Sulfate, mg/l SO_4	8	6	4	8	6	8
Temperature, °C	13°C	15°C	19°C	22°C	20°C	19°C
Turbidity, NTU	5	0.03	0.5	0.3	0.3	0.3

Table 13 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: E1

Monitoring Station Location: On Site Elizabethtown potable water

<u>Parameter</u>	<u>10/16/84</u> <u>11:35 a.m.</u>	<u>11/20/84</u> <u>11:15 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	8	10
Calcium Hardness, mg/l CaCO_3 eq.	60	62
Copper, mg/l Cu	0.05	0.04
Fecal Coliform Count, MPN/100 ml.	0	0
Iron, mg/l Fe	0.04	0.04
Nitrogen		
Total mg/l N	2.4	2.1
Nitrate, mg/l NO_3	10.56	9.25
pH	7.0	7.1
Phosphate		
Total, mg/l P	0.0	0
Ortho, mg/l P	0.0	0
Manganese, mg/l Mn	0.01	0.01
Chloride, mg/l Cl	34	36
Solids		
Dissolved, mg/l	240	303
Sulfate, mg/l SO_4	10	12
Temperature, °C	17°C	15°C
Turbidity, NTU	0.3	0.3

Table 14

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: P1

Monitoring Station Location: Schalk Station Creek, 0.75 miles, S.E.

<u>Parameter</u>	<u>4/26/84</u> <u>11:15 a.m.</u>	<u>5/22/84</u> <u>10:55 a.m.</u>	<u>6/13/84</u> <u>11:00 a.m.</u>	<u>7/24/84</u> <u>10:45 a.m.</u>	<u>8/28/84</u> <u>10:30 a.m.</u>	<u>9/18/84</u> <u>10:30 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	6	8	12	10	8	8
Calcium Hardness, mg/l CaCO_3 eq.	20	18	20	18	20	22
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
Copper, mg/l Cu	0.04	0.06	0.08	0.05	0.06	0.04
Iron, mg/l Fe	0.35	0.56	0.62	0.44	0.40	0.36
Nitrogen						
Nitrate, mg/l N	0.7	0.66	0.78	0.72	0.60	0.74
Oil/Grease, mg/l	0.68	0.72	0.44	0.56	0.50	0.38
pH	7.7	7.2	7.3	7.6	6.5	7.3
Phosphate						
Total, mg/l P	0.025	0.035	0.028	0.032	0.03	0.03
Ortho, mg/l P	0.01	0.01	0.01	0.01	0.01	0.01
Solids						
Dissolved, mg/l	787.8	900	100	7600	100	100
Suspended, mg/l	14	4	5	4	6	8
Sulfate, mg/l SO_4	10	12	14	12	15	10
Temperature, °C	14°C	19°C	22°C	23°C	19°C	13°C
Turbidity, NTU	12	1.5	2.9	2.45	2.5	1.7
Zinc, mg/l Zn	0.025	0.03	0.01	0.015	0.02	0.02

Table 14 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: P1

Monitoring Station Location: Schalk Station Creek, 0.75 miles, S.E.

<u>Parameter</u>	<u>10/16/84</u>	<u>11/20/84</u>	<u>12/31/84</u>
	<u>10:45 a.m.</u>	<u>10:15 A.M.</u>	<u>11:45 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	10	11	14
Calcium Hardness, mg/l CaCO_3 eq.	24	22	32
Chromium			
Total, mg/l Cr	0.05	0.05	< 0.1
Hexavalent, mg/l Cr	0.01	0.01	< 0.1
Copper, mg/l Cu	0.05	0.04	0.009
Iron, mg/l Fe	0.33	0.30	1.0
Nitrogen			
Nitrate, mg/l N	0.60	0.54	1.7
Oil/Grease, mg/l	0.32	0.34	< 1
pH	6.6	7.1	7.0
Phosphate			
Total, mg/l P	0.04	0.03	0.02
Ortho, mg/l P	0.01	0.01	0.01
Solids			
Dissolved, mg/l	129	125	54
Suspended, mg/l	10	7	9
Sulfate, mg/l SO_4	11	10	12
Temperature, °C	13°C	7°C	3°C
Turbidity, NTU	1.4	1.5	3.1
Zinc, mg/l Zn	0.02	0.02	0.03

Table 15

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: P2

Monitoring Station Location: George Davison Rd, Creek, 2.6 miles, S.E.

<u>Parameter</u>	<u>4/26/84</u> <u>11:30 a.m.</u>	<u>5/12/84</u> <u>11:10 a.m.</u>	<u>6/13/84</u> <u>11:15 a.m.</u>	<u>7/24/84</u> <u>11:00 a.m.</u>	<u>8/28/84</u> <u>10:45 a.m.</u>	<u>9/18/84</u> <u>10:45 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	16	18	16	18	14	16
Calcium Hardness, mg/l CaCO_3 eq.	30	32	36	34	30	32
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
Copper, mg/l Cu	0.03	0.025	0.038	0.32	0.04	0.06
Iron, mg/l Fe	0.55	0.60	0.56	0.52	0.50	0.56
Nitrogen						
Nitrate, mg/l N	1.8	1.6	1.2	1.46	1.3	1.7
Oil/Grease, mg/l	0.55	0.60	0.56	0.58	0.52	0.54
pH	7.1	7.2	7.2	7.6	6.5	7.3
Phosphate						
Total, mg/l P	0.035	0.03	0.028	0.032	0.03	0.03
Ortho, mg/l P	0.01	0.01	0.01	0.01	0.01	0.01
Solids						
Dissolved, mg/l	130.3	135	148	140	126	132
Suspended, mg/l	12	15	18	14	8	10
Sulfate, mg/l SO_4	8	12	16	14	12	10
Temperature, °C	13°C	24°C	28°C	26°C	22°C	18°C
Turbidity, NTU	71	8	2.6	1.8	1.3	1.7
Zinc, mg/l Zn	0.027	0.025	0.02	0.022	0.02	0.025

50

Table 15 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University

Station: P2

Monitoring Station Location: George Davison Rd, Creek, 2.6 miles, S.E.

<u>Parameter</u>	<u>10/16/84</u> <u>10:45 a.m.</u>	<u>11/20/84</u> <u>10:30 a.m.</u>	<u>12/31/84</u> <u>11:55 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	18	20	10
Calcium Hardness, mg/l CaCO_3 eq.	36	34	44
Chromium			
Total, mg/l Cr	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	< .01
Copper, mg/l Cu	0.07	0.08	.006
Iron, mg/l Fe	0.60	0.62	.82
Nitrogen			
Nitrate, mg/l N	1.6	1.4	2.3
Oil/Grease, mg/l	0.52	0.50	< 1
pH	6.8	7.1	6.8
Phosphate			
Total, mg/l P	0.06	0.04	0.03
Ortho, mg/l P	0.02	0.01	0.01
Solids			
Dissolved, mg/l	184	178	100
Suspended, mg/l	12	8	3
Sulfate, mg/l SO_4	11	10	28
Temperature, °C	16°C	5°C	7°C
Turbidity, NTU	0.9	1.0	3.5
Zinc, mg/l Zn	0.02	0.02	0.02

Table 16

WATER QUALITY MONITORING DATA
 Forrestal Campus, Princeton University
 Station: M1
 Monitoring Station Location: Millstone River, 1.8 miles

<u>Parameter</u>	<u>4/26/84</u> <u>11:45 a.m.</u>	<u>5/22/84</u> <u>11:25 a.m.</u>	<u>6/13/84</u> <u>11:35 a.m.</u>	<u>7/24/84</u> <u>11:30 a.m.</u>	<u>8/28/84</u> <u>11:00 a.m.</u>	<u>9/18/84</u> <u>11:15 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	22	24	20	22	26	24
Calcium Hardness, mg/l CaCO_3 eq.	36	38	32	36	40	36
Chromium						
Total, mg/l Cr	0.05	0.05	0.05	0.05	0.05	0.05
Hexavalent, mg/l Cr	0.01	0.01	0.01	0.01	0.01	0.01
Copper, mg/l Cu	0.06	0.05	0.07	0.06	0.07	0.05
Iron, mg/l Fe	0.32	0.036	0.04	0.034	0.038	0.26
Nitrogen						
Nitrate, mg/l N	1.2	1.45	1.7	1.35	1.60	1.3
Oil/Grease, mg/l	0.35	0.60	0.54	0.45	0.50	0.38
pH	7.0	7.3	7.5	7.5	7.0	7.4
Phosphate						
Total, mg/l P	0.02	0.035	0.028	0.025	0.03	0.025
Ortho, mg/l P	0.01	0.015	0.018	0.01	0.01	0.01
Solids						
Dissolved, mg/l	120.3	142	158	145	161	140
Suspended, mg/l	8	10	14	12	16	10
Sulfate, mg/l SO_4	12	10	12	12	14	12
Temperature, °C	13°C	22°C	28°C	25°C	23°C	17°C
Turbidity, NTU	23	3.2	4.2	5	1.7	1.8
Zinc, mg/l Zn	0.022	0.028	0.022	0.024	0.026	0.02

Table 16 (Cont'd)

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: M1

Monitoring Station Location: Millstone River, 1.8 miles

<u>Parameter</u>	<u>10/16/84</u> <u>11:15 a.m.</u>	<u>11/20/84</u> <u>11:00 a.m.</u>	<u>12/31/84</u> <u>12:15 p.m.</u>
Alkalinity, mg/l CaCO_3 eq.	28	25	24
Calcium Hardness, mg/l CaCO_3 eq.	34	30	48
Chromium			
Total, mg/l Cr	0.05	0.05	< .01
Hexavalent, mg/l Cr	0.01	0.01	< .01
Copper, mg/l Cu	0.06	0.07	0.01
Iron, mg/l Fe	0.20	0.26	0.97
Nitrogen			
Nitrate, mg/l N	1.4	1.5	2.4
Oil/Grease, mg/l	0.32	0.30	1
pH	6.9	7.1	6.4
Phosphate			
Total, mg/l P	0.05	0.04	0.12
Ortho, mg/l P	0.02	0.02	0.08
Solids			
Dissolved, mg/l	194	175	100
Suspended, mg/l	12	10	7
Sulfate, mg/l SO_4	12	12	22
Temperature, °C	15°C	6°C	5°C
Turbidity, NTU	1.1	2.4	4.1
Zinc, mg/l Zn	0.02	0.02	0.03

Table 17

WATER QUALITY MONITORING DATA
 Forrestal Campus, Princeton University
 Station: W4

Monitoring Station Location: Well No. 4 at C Site (Non-operational)

<u>Parameter</u>	<u>6/13/84</u> <u>9:00 a.m.</u>	<u>9/19/84</u> <u>10:30 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	8	10
Calcium Hardness, mg/l CaCO_3 eq.	72	70
Copper, mg/l Cu	0.05	0.04
Fecal Coliform Count, MPN/100 ml.	0	0
Iron, mg/l Fe	0.95	0.86
Nitrogen		
Total mg/l N	0.6	0.75
Nitrate, mg/l NO_3	2.64	3.3
pH	7.1	7.0
Phosphate		
Total, mg/l P	0	0
Ortho, mg/l P	0	0
Manganese, mg/l Mn	0.25	0.22
Chloride, mg/l Cl	38	40
Solids		
Dissolved, mg/l	281	285
Sulfate, mg/l SO_4	11	10
Temperature, °C	16°C	13°C
Turbidity, NTU	4.1	4

Table 18

WATER QUALITY MONITORING DATA
Forrestal Campus, Princeton University
Station: W5

Monitoring Station Location: Well No. 5 at C Site (Non-operational)

<u>Parameter</u>	6/13/84	9/18/84
	<u>9:30 a.m.</u>	<u>10:45 a.m.</u>
Alkalinity, mg/l CaCO_3 eq.	42	42
Calcium Hardness, mg/l CaCO_3 eq.	34	32
Copper, mg/l Cu	0.07	0.06
Fecal Coliform Count, MPN/100 ml.	0	0
Iron, mg/l Fe	0.6	0.65
Nitrogen		
Total mg/l N	1.2	1.3
Nitrate, mg/l NO_3	5.28	5.73
pH	6.8	6.7
Phosphate		
Total, mg/l P	0	0
Ortho, mg/l P	0	0
Manganese, mg/l Mn	0.1	0.12
Chloride, mg/l Cl	8	8
Solids		
Dissolved, mg/l	135	138
Sulfate, mg/l SO_4	16	16
Temperature, °C	16°C	12°C
Turbidity, NTU	5.5	3.5

TABLE 19

FERTILIZER, PESTICIDES AND HERBICIDES APPLICATION (C185)

FERTILIZER

(Applied by University)

20-12-8 50% Organic

A Site	1000 lbs.
B Site	1200 lbs.
C Site	1000 lbs.
D Site	800 lbs.

PESTICIDES

(Applied by University)

A Site	No pesticides applied
B Site	Sevin - 600 gallons for Japanese beetle control
C Site	No pesticides applied
D Site	No pesticides applied

HERBICIDES

<u>DATE</u>	<u>MATERIAL</u>	<u>QUANTITY</u>	<u>LOCATION</u>	<u>QUANTITY</u>	<u>LOCATION</u>
5/19/84	Karmex	20 lbs.	C-Site	20 lbs.	D-Site
	Paramitol	5 Gals.	C-Site	5 Gals.	D-Site
	Round Up	1 Qt.	C-Site	2 Qts.	D-Site
5/26/84	Embark	1 1/2 Qt.	C-Site	1 Qt.	D-Site
	2-4-D	4 Qts.	C-Site	2 Qts.	D-Site
5/31/84	Pramitol 25ec	200 Gal Mix	C-Site Main Sub		
6/1/84	Pramitol 25ec	300 Gals.* Diluted Mix	Sub 18 Pole Trans. RF Sub		
6/1/84	Pramitol 25 ec	300 Gal.* Diluted Mix	Sub 2 & 3 A-Site Sub		
6/1/84	Pramitol 25 ec	300 Gals.* Diluted Mix	Subs Q10,11 Spt. 2 & 3 cy co		
6/2/84	Pramitol 25ec	100 Gals. Diluted Mix	Qpt 55, 56 58 small yards		
6/10/84	Roundup & Betasan 4e	3 Gals.	C-Site Library Patio		

*Total of 300 gallons used for all 3 sites

Table 19 (Cont'd.)

<u>DATE</u>	<u>MATERIAL</u>	<u>QUANTITY</u>	<u>LOCATION</u>	<u>QUANTITY</u>	<u>LOCATION</u>
6/18/84	Pramitol 25ec	35 Gals.	Canal Pump House		
7/28/84	Embark	1 1/2 Qts.	C-Site	1 Qt.	D-Site
	Roundup	1 Qt.	C-Site		
	Pramitol	1/2 Gal.	C-Site	2 Gals.	D-Site
	2-4-D	4 Qts.	C-Site	2 Qts.	D-Site
8/13/84	Pramitol 25ec	70 Gals. Total Mix	TFTR NBPC Sub & Switch Yard	30 Gals. Dilute	E-Site Scrap Yard
8/13/84	Pramitol 25ec	10 Gals. Diluted Mix	Oil Storage Tank Area

FIG. 1
S-1 SPIERONIAK

FIG. 2
RFTF

FIG. 3
PRINCETON LARGE TORUS (PLT)

FIG. 4
PRINCETON BETA EXPERIMENT (PBX)

FIG. 5
TOKAMAK FUSION TEST REACTOR (TFTR)

FIG. 6

Wind Rose
Joint Frequency Data for TFTR
84/ 3 to 85/ 2
Elevation 60 m
For All Stability Classes (100.0%)

Wind Speed (m/s)

0.0	and above
7.0	to 10.0
5.0	to 7.0
3.0	to 5.0
2.0	to 3.0
1.5	to 2.0
1.0	to 1.5
0.75	to 1.0
0.22	to 0.75

Center = Calm %

FIG. 7

Wind Rose
 Joint Frequency Data for TFTR
 84/ 3 to 85/ 2
 Elevation 30 m
 For All Stability Classes (100.0%)

FIG. 8
30-Km (50-MILE) RADIUS OF SITE

FIG. 9
IMMEDIATE SITE VICINITY
(5-MILE RADIUS)

#83A0021

FIG. 10
 PLASMA PHYSICS LABORATORY
 JAMES FORRESTAL CAMPUS
 PRINCETON UNIVERSITY, PRINCETON N.J.

FIG. 11
1974 POPULATION ESTIMATES WITHIN ANNULAR SECTORS 0-10 MILES*

*Taken from TFTR/FSAR
Figures 2.1.2-1

FIG. 12
1985 POPULATION ESTIMATES WITHIN ANNUAL SECTION 0-10 MILES*

*Taken from TFTR/FSAR
Figure 2.1.2-3

FIG. 13
PPPL C AND D SITES AND ENVIRONMENTAL MONITORING LOCATIONS

1. Auditorium
2. Offices
3. TFTR Control
4. Technical Shop
5. TFTR Experimental Area
6. Motor Generator
7. Maintenance & Utility
8. Pump House
9. Cooling Tower
10. New Parking
11. Detention Pond
12. Switchyard Expansion
13. Radioactive Waste
14. Field Coil P.C. Building
15. Neutral Beam P.C. Building
16. Gas Tank Farm Area

EZB	Exclusion Zone Boundary Fence
RMS-B	Baseline Radiation Monitoring Station & Old Meteorological Tower
RMS-1	Radiation Monitoring Station
RMS-2	"
RMS-3	"
RMS-4	"
D-1	Ditch 5 Surface Water Sample Location
D-2	Ditch 5 Surface Water Sample Location
B-1	Bee Brook Surface Water Sample Location
B-2	Bee Brook Surface Water Sample Location
MFT	New Meteorological Tower Location
E-1	Elizabethtown Sample Location
W-4	Well #4
W-5	Well #5

FIG. 14
MILLSTONE RIVER BASIN OFFSHORE WATER SAMPLE LOCATION

FIG. 15
CY84 NEUTRON AND GAMMA ENVIRONMENTAL BACKGROUND DATA
(LOCATION RMS-B)

EXTERNAL DISTRIBUTION IN ADDITION TO UC-20

Plasma Res Lab, Austro Nat'l Univ, AUSTRALIA
 Dr. Frank J. Paoloni, Univ of Wollongong, AUSTRALIA
 Prof. I.R. Jones, Flinders Univ., AUSTRALIA
 Prof. M.H. Brennan, Univ Sydney, AUSTRALIA
 Prof. F. Cap. Inst Theo Phys, AUSTRIA
 Prof. Frank Verheest, Inst theoretische, BELGIUM
 Dr. D. Palumbo, Og XII Fusion Prog, BELGIUM
 Ecole Royale Militaire, Lab de Phys Plasmas, BELGIUM
 Dr. P.H. Sakanaka, Univ Estadual, BRAZIL
 Dr. C.R. James, Univ of Alberta, CANADA
 Prof. J. Teichmann, Univ of Montreal, CANADA
 Dr. H.M. Skarsgard, Univ of Saskatchewan, CANADA
 Prof. S.R. Sreenivasan, University of Calgary, CANADA
 Prof. Tudor W. Johnston, INRS-Energie, CANADA
 Dr. Hannes Barnard, Univ British Columbia, CANADA
 Dr. M.P. Bachynski, MFB Technologies, Inc., CANADA
 Chalk River, Nucl Lab, CANADA
 Zhengwu Li, SW Inst Physics, CHINA
 Library, Tsing Hua University, CHINA
 Librarian, Institute of Physics, CHINA
 Inst Plasma Phys, Academia Sinica, CHINA
 Dr. Peter Lukac, Komenského Univ, CZECHOSLOVAKIA
 The Librarian, Culham Laboratory, ENGLAND
 Prof. Schatzman, Observatoire de Nice, FRANCE
 J. Rader, CEN-BP6, FRANCE
 AM Dupas Library, AM Dupas Library, FRANCE
 Dr. Tom Mui, Academy Bibliographic, HONG KONG
 Preprint Library, Cent Res Inst Phys, HUNGARY
 Dr. C. Trehan, Panjab University, INDIA
 Dr. Indra Mohan Lal Oas, Banaras Hindu Univ, INDIA
 Dr. L.K. Chavda, South Gujarat Univ, INDIA
 Dr. R.K. Chhajlani, Vikram Univ, INDIA
 Dr. B. Dasgupta, Saha Inst, INDIA
 Dr. P. Kaw, Physical Research Lab, INDIA
 Dr. Phillip Rosenau, Israel Inst Tech, ISRAEL
 Prof. S. Cuperman, Tel Aviv University, ISRAEL
 Prof. G. Rostagni, Univ Di Padova, ITALY
 Librarian, Int'l Ctr Theo Phys, ITALY
 Miss Clelia De Palo, Assoc EURATOM-ENEA, ITALY
 Biblioteca, del CNR EURATOM, ITALY
 Dr. H. Yamato, Toshiba Res & Dev, JAPAN
 Direc. Dept. Lg. Tokamak Dev. JAERI, JAPAN
 Prof. Nobuyuki Inoue, University of Tokyo, JAPAN
 Research Info Center, Nagoya University, JAPAN
 Prof. Kyoji Nishikawa, Univ of Hiroshima, JAPAN
 Prof. Sigeru Mori, JAERI, JAPAN
 Library, Kyoto University, JAPAN
 Prof. Ichiro Kawakami, Nihon Univ, JAPAN
 Prof. Satoshi Itoh, Kyushu University, JAPAN
 Dr. D.I. Choi, Adv. Inst Sci & Tech, KOREA
 Tech Info Division, KAERI, KOREA
 Bibliothek, Rijn-Inst Voor Plasma, NETHERLANDS
 Prof. B.S. Liley, University of Waikato, NEW ZEALAND
 Prof. J.A.C. Cabral, Inst Superior Tecn, PORTUGAL
 Dr. Octavian Petrus, ALI CUZA University, ROMANIA
 Prof. M.A. Hallberg, University of Natal, SO AFRICA
 Dr. Johan de Villiers, Plasma Physics, Mucor, SO AFRICA
 Fusion Div. Library, JEN, SPAIN
 Prof. Hans Wilhelmson, Chalmers Univ Tech, SWEDEN
 Dr. Lennart Stenflo, University of UMEA, SWEDEN
 Library, Royal Inst Tech, SWEDEN
 Centre de Recherches, Ecole Polytech Fed, SWITZERLAND
 Dr. V.T. Tolok, Kharkov Phys Tech Ins, USSR
 Dr. D.D. Ryutov, Siberian Acad Sci, USSR
 Dr. G.A. Eliseev, Kurchatov Institute, USSR
 Dr. V.A. Glukhikh, Inst Electro-Physical, USSR
 Institute Gen. Physics, USSR
 Prof. T.J.M. Boyd, Univ College N Wales, WALES
 Dr. K. Schindler, Ruhr Universität, W. GERMANY
 Nuclear Res Estab, Jülich Ltd, W. GERMANY
 Librarian, Max-Planck Institut, W. GERMANY
 Bibliothek, Inst Plasmaforschung, W. GERMANY
 Prof. R.K. Janev, Inst Phys, YUGOSLAVIA