FINAL
ACTION MEMORANDUM
OPERABLE UNIT III GROUNDWATER REMOVAL ACTION

April 1997

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and

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ACTION MEMORANDUM

I. PURPOSE

The purpose of this Action Memorandum is to document the decision by the U.S. Department of Energy (DOE) to conduct an interim removal action to address contamination at the south boundary for groundwater associated with Operable Unit III (OU III) at Brookhaven National Laboratory (BNL). This action is being taken in response to a plume of Volatile Organic Compounds (VOCs) detected in the groundwater both on and off-site during the Remedial Investigation (RI) of Operable Unit III. Additional remedial alternatives for source areas and groundwater remediation in Operable Unit III are being evaluated in the Feasibility Study (FS).

These actions are being undertaken as an interim removal action in accordance with the Interagency Agreement among DOE, the U.S. Environmental Protection Agency (EPA) and the New York State Department of Environmental Conservation (NYSDEC), and will be consistent with the final remedial actions that will be documented in the Operable Unit III Record of Decision. Work will be conducted in accordance with the National Contingency Plan (NCP, 40 CFR 300).

II. SITE CONDITIONS AND BACKGROUND

A. SITE DESCRIPTION

1. Removal Site Evaluation

This removal action concerns elevated levels of VOCs that were found in groundwater during the Remedial Investigation (RI) for OU III. This plume was initially discovered during the installation of a series of temporary groundwater vertical profile borings (VPB) that were installed between April 1995 and January 1996 as part of the remedial investigation for OU III. During the RI, VOC concentrations of up to 4131 parts per billion (ppb) (MW121-11) were found in on-site monitoring wells near the site boundary, and up to 5140 ppb (OSC-WC7D) in off-site monitoring wells. Figure 4 is an areal depiction of the total VOC groundwater plume in the deep glacial zone (Approximately 120 to 210 feet below land surface) with contour intervals as shown on the map. The northern and southern extent of this plume have not been completely delineated. The primary contaminants found in this plume are Tetrachloroethene (PCE), 1,1,1 Trichloroethane (TCA) and Carbon Tetrachloride with TCA and PCE being the primary contaminants on-site and Carbon Tetrachloride more prevalent in the off-site portions of the plume.

A brief description of the horizontal and vertical extent of the VOCs is as follows: The elevated levels of VOCs (>50 ppb) in the water-table zone (Approximately from land surface to 60 feet below land surface) are centered around the Waste Concentration Facility (WCF), which consists primarily of TCA and is confined to the BNL site. Other areas found to contain elevated VOCs in the water table zone are located around the Paint Shop, south of Building 464, south of the Brookhaven Graphite Research Reactor (BGRR), and near the southern end of Building 208.

In the mid-glacial groundwater zone (Approximately from 60 to 120 feet below land surface), the VOC plume extends in a north-south direction from Brookhaven Avenue off-site to Carleton Avenue. In the east-west direction, the VOC plume extends from Upton Avenue approximately 4,500 feet east to monitoring well location MW 105-24. The highest levels of VOCs in the mid-glacial zone are found at MW 113-10, which is located between Princeton Avenue and the south boundary of OU III.

The VOC plume in the deep-glacial zone with high VOC concentrations (i.e., greater than 50 ppb) is approximately 9,600 feet long and 2,000 feet wide. This is the zone where most of the high levels of VOCs are found at the south boundary and off-site. Figure 4 depicts the extent of this VOC plume.

2. Physical Location

BNL is located in the geographical center of Suffolk County on Long Island, New York, in the Town of Brookhaven as shown in Figure 1. The site contains 5,300 acres, of which 75 percent are wooded. The remainder is developed and contains office buildings, various large research facilities, parking lots, etc. as shown in Figure 2. Residential neighborhoods located down gradient of BNL are also shown in Figure 2.

The BNL site, formerly occupied by the U.S. Army as Camp Upton during World Wars I and II, was transferred to the Atomic Energy Commission in 1947, to the Energy Research and Development Administration in 1975 and to the Department of Energy (DOE) in 1977. It has been used as a national laboratory since 1947. The BNL site is owned by the DOE and is operated by Associated Universities, Incorporated.

BNL carries out basic and applied research in the fields of high-energy nuclear and solid state physics; fundamental material and structure properties and the interaction of matter; nuclear medicine; biomedical and environmental sciences; and selected energy technologies. Major operating facilities include the High Flux Beam Reactor, the Brookhaven Medical Research Reactor, the National Synchrotron Light Source, and the Alternating Gradient Synchrotron.

3. Release or Threatened Release into the Environment of a Hazardous Substance, Pollutant or Contaminant

The major threat to public health or welfare and the environment from the site consists of further off-site migration of contaminants in the groundwater, which is designated as a "sole source aquifer" under the Federal Safe Drinking Water Act. Preventing further migration of contaminants in the groundwater, potentially into residential areas, is the basis for this removal action.

The RI/RA report, which is expected to be released for public review and comment in early summer 1997 will document detailed information concerning the potential release of contaminants into the environment.

B. OTHER ACTIONS TO DATE

1. Previous Actions

The Remedial Investigation/Feasibility Study (RI/FS) Work Plan (I.T. Corp. September, 1994) identified monitoring well 130-02 as Area of Concern (AOC) 15B due to the presence of TCA above the maximum contaminant levels (MCLs) permissible by New York State regulations (greater then 5 ppb). Due to its proximity to the southwest boundary of the BNL site, there was concern regarding possible off-site migration of TCA. In addition, a significant data gap was identified from Princeton Avenue south to the site boundary in OU III (Figure 3). The entire area between Princeton Avenue and the south boundary of OU III was identified as AOC 15B.

Two objectives were identified for AOC 15B in the OU III RI/FS Work Plan. They were to evaluate the potential for off-site migration of VOCs at the southern boundary and to further characterize the hydrology and lithology between Princeton Ave. and the south boundary.

To meet these objectives, a series of 46 vertical profile borings (VPB) were drilled in three east-west trending lines on-site. This work was performed by ERM-Northeast under contract to BNL. An additional east-west line of VPB's was added south of the site based upon high levels of VOCs (greater than 4000 ppb) detected at the site boundary during this investigation. This line of test wells, located south of BNL in the industrial complex south of the Long Island Expressway, led to the discovery of off-site VOCs at concentrations greater then 5000 ppb.

In addition to this removal action, public water is being provided to the area immediately to the south of Operable Unit I and III, which is bounded by River Road on the west; Colin Drive, Moriches-Middle Island Road and Carleton Drive to the north; Sleepy Hollow Drive and Cranford Boulevard to the east and Sunrise Highway to the south. This is being done as a precautionary measure to prevent any potential future exposure to groundwater contaminants

associated with Operable Unit III. Another Action Memorandum (BNL, December 1996) has been developed to specifically address the public water hookups in OU's I and III.

2. Current Actions

Additional work has been and is being performed under the OU III RI to further delineate the extent of this VOC plume both on and off-site. Additional test wells and permanent monitoring wells installed south of the industrial complex indicate that concentrations of this plume of VOCs drops off rapidly to the south of the industrial complex. Based upon this data, it appears that the leading edge of this plume of VOCs is located just south of Waldorf Drive and Puritan Drive in North Shirley (Figure 4). Preliminary data from additional on-site investigation indicates the primary source area is located north of Weaver Street and west of Grove Avenue on the BNL site.

C. NATIONAL PRIORITIES LIST STATUS

BNL was added to the National Priorities List in 1989. An Interagency Agreement under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), and applicable New York State regulations was negotiated between DOE, EPA and NYSDEC. The Interagency Agreement became effective in May 1992 and governs the environmental restoration program at BNL.

III. THREATS TO PUBLIC HEALTH OR WELFARE AND THE ENVIRONMENT, AND STATUTORY AND REGULATORY AUTHORITIES

A. THREATS TO PUBLIC HEALTH OR WELFARE

The threats posed by groundwater contamination associated with Operable Unit III are of a non-time-critical nature, i.e., based on the existing information and the public water hookups, no imminent or substantial endangerment of public health or welfare and the environment currently exists at these sites that would necessitate cleanup within six months as defined in the National Contingency Plan for categorization of specific cleanup efforts as removal actions. The appropriateness of a removal action is based on two of the eight factors that are listed in 40 CFR 300.415(b)(2) of the regulations implementing the National Contingency Plan:

1. Actual or potential exposure to nearby populations, animals or food chain from hazardous substances, pollutants or contaminants; and

2. Actual or potential contamination of drinking water supplies or sensitive ecosystems.

The BNL site is located above a sole source aquifer as designated by the EPA under the Safe Drinking Water Act, and groundwater is the primary source of drinking water in the area. The groundwater is also classified by New York state as Class GA under 6 NYCRR Part 703. The best usage of Class GA groundwater is a source of potable water supply. Contaminants determined to be from Operable Unit III have been found in the groundwater on and off-site and have been predicted by modeling to travel beneath off-site domestic wells. While modeling does not prove that the contaminants will travel beneath residential wells, the depths of contaminants in monitoring wells at the site boundary imply the absence of an imminent threat to residential wells. Nevertheless, these concerns have been addressed through the installation of public water to any potentially impacted areas.

B. THREATS TO THE ENVIRONMENT

The major threat to the environment is further off-site migration of the plume and the contamination of groundwater resources. As stated earlier, the BNL site is located above an EPA-designated sole source aquifer.

IV. ENDANGERMENT DETERMINATION

Actual or threatened releases of pollutants and contaminants from this site, if not addressed by implementing the response action selected in this Action Memorandum, may present an imminent and substantial endangerment to the environment.

V. PROPOSED ACTIONS AND ESTIMATED COSTS

A. Proposed Actions

1. Proposed Action Description

The proposed action is the installation of a pump and treat system at the south boundary of BNL. This action is being undertaken on an accelerated schedule, prior to completion of the RI/RA Report in May 1997 and the FS Report in January 1998, in order to prevent additional migration of high level (greater then 50 ppb) VOCs from the site. The performance of an interim action for this purpose is specifically referenced in the USEPA OSWER (Office of Solid Waste and Emergency Response) Directive 9355.3-02.

The design objective for the pump and treat system at the south boundary is the containment and treatment of groundwater at the south boundary in OU III with VOCs greater than 50 ppb, while levels under 50 ppb will be studied further in the FS for OU III. Groundwater monitoring, including additional well installation, will be performed within the plume area both on and off-site. Public water has been provided to residences in the potentially impacted area.

The rationale for the proposed action is to prevent groundwater with VOCs greater then 50 ppb (i.e., greater than 4000 ppb of VOCs in well #121-11 at the south boundary) from migrating beyond the site boundary. Once this system becomes operational it will remove the off-site source of these high level VOCs. Since the primary contaminants detected on-site are PCE and TCA, and carbon tetrachloride is the primary contaminant detected in the off-site portions of the VOC plume, it is estimated that the TCA and PCE have not migrated significantly beyond the site boundary. By implementing this action as an interim removal action on an accelerated basis, it will minimize the extent of TCA and PCE that migrates off-site.

The portions of this plume at the south boundary with levels of VOCs at less then 50 ppb will be evaluated further in the OU III FS. Active pump and treat remediation would not be cost-effective for these low level VOCs (<50 ppb) because large amounts of clean water would be extracted and would need to be managed. Additional groundwater characterization will be performed and the applicability of additional treatment options (i.e. in-well sparging, additional pumping wells and natural attenuation) to reduce the contaminant residence time in the groundwater, address source areas and off-site contamination, will be evaluated in the FS.

Groundwater modeling was performed to determine the most efficient configuration of well locations, the number of wells, required pumping rates and an appropriate discharge location. It was determined that six pumping wells strategically located along the south boundary, pumping at 110 gallons per minute (GPM) each, will achieve the goal of hydraulic containment on site of dissolved VOCs greater then 50 ppb. Discharge of treated groundwater will be to a new recharge basin on the BNL site in the area of the HP basins. Treatment of contaminated groundwater will be via an air stripper tower which will be located in the vicinity of the new basin. Figure 5 shows a schematic layout of this system.

Off-Site Groundwater

Public water hookups were provided to residences in the potentially affected area to eliminate the drinking water exposure pathway and any potential risk to the public health.

Specific remedial actions to address the off-site VOC plume will be addressed in the FS for OU III.

Additional Needed Information

Further information is needed to optimize the components of the selected system. This information and other, more specific data will be generated during the design phases of the groundwater treatment system. Additional groundwater studies of the extent of the VOC plume and treatment options will be conducted and evaluated in the OU III FS.

Institutional Controls

Institutional controls will be needed on-site to prevent the installation of supply wells or other pumping wells that may mobilize remaining contaminants or otherwise interfere with the remedial action. This period of control to be provided by DOE and/or deed restrictions is expected to last for 30 years for the organic constituents.

Compliance with Off-site Policy

Off-site disposal treatment of by-products is not required.

2. Contribution to Remedial Performance

Implementation of the removal action is consistent with the overall remedial action for Operable Unit III because it initiates the remediation of contaminated groundwater migrating off-site that may impact public or private supply wells. This removal action will be integrated into the overall remedial approach for OU III, which is being addressed in the FS.

3. Description of Alternative Technologies

The use of air stripping to remove VOCs is a well documented and effective method of treatment. Alternative technologies that may enhance this system will be studied and reviewed as part of the FS for OU III and include in-situ air stripping, air sparging and natural attenuation/decay.

4. Applicable or Relevant and Appropriate Requirements

A detailed discussion of the potential Federal and State Applicable or Relevant and Appropriate Requirements (ARARs) will be provided in the RI/RA and FS report. Contaminant, location and action-specific ARARs, as well as To-Be-Considered goals will be identified. The major ARAR governing the BNL site is the classification of the groundwater at and down gradient of the site as a federal "sole source aquifer" under the Federal Safe Drinking Water Act, and containing Class GA water as defined by New York State Law. As such, federal and state MCL's and New York State Class GA groundwater quality standards were compiled to establish cleanup goals. The more stringent of the ARARs were used to establish the cleanup goals. The containment level for the pump and treat system is 50 ppb and this level is different from the cleanup goal.

If monitoring indicates that continued operation of the components of the selected remedy is not producing significant further reductions in the concentrations of contaminants, DOE, NYSDEC, and EPA will evaluate whether to discontinue the groundwater extraction and treatment system in accordance with the National Contingency Plan. The criteria for discontinuation will include an evaluation of the operating conditions and parameters as well as

a determination that the system has attained the feasible limit of contaminant reduction and that further reductions would be impracticable. It is expected that the combination of the groundwater extraction and treatment systems and natural attenuation of the remaining contaminants will ultimately meet the cleanup goal of reaching the MCLs for groundwater.

Air emissions from the groundwater treatment system are expected to meet the NYSDEC air regulations such as 6 NYCRR Part 212 "General Process Emission Sources" for volatile organic compound emissions.

Effluent waters from the treatment system are expected to meet applicable NYSDEC wastewater regulations for groundwater discharges under the New York State Pollutant Discharge Elimination System (SPDES).

5. Project Schedule

The proposed interim removal action will be performed in accordance with the schedule established under the Interagency Agreement. Major tasks include preparation of Remedial Design Work Plan, Design Documents, Bid Specifications, construction of the pump and treat system and the initiation of the removal action. This project is being undertaken under an accelerated schedule, with the goal of having the system operational in June 1997. The infrastructure (access roads, electric distribution and water piping) is being installed concurrently with the design phase of the project. The installation of the wells and the treatment system will be started in March and completed in June 1997. Completion of the pump and treat system will be followed by a two week period of start-up testing and then the initiation of routine operation and maintenance. This action will be followed by the preparation of a Close-out Report.

B. ESTIMATED COSTS

Design and construction costs: $1,950,000.00

Operation and Maintenance Costs for 15 Years: $1,600,000.00

Total estimated costs are $3,550,000.00.

Operation and maintenance (O&M) costs were projected for 15 years, based upon the currently available information. The duration of O&M will be reevaluated in the FS for OU III. The FS will determine what other remedial actions will be taken and how this will impact the duration of O&M.

VI. EXPECTED CHANGE IN THE SITUATION SHOULD ACTION BE DELAYED OR NOT TAKEN

A delayed action or no action will increase the potential for contaminant migration in on-site and off-site groundwater. Delayed action will potentially increase the scope and cost of the project as larger volumes of the aquifer are impacted.

VII. PUBLIC PARTICIPATION

Public participation activities for the Operable Unit III Groundwater Removal Action include the coordination of public notice publication, a poster session, and an article in *cleanupdate*.

These activities will coincide with the submission of the Action Memorandum aqnd the Pre-Design Report to the Administrative Record. A poster session will be scheduled prior to system startup in June 1997.

The public notice would be published on or before April 30, 1997 in Newsday (regional distribution) and in a weekly newspaper (local distribution). Simultaneously, a copy of the public notice would be sent to the BNL Office of Environmental Restoration Community Relations mailing list (approximately 1,100 addressees).

VIII. OUTSTANDING POLICY ISSUES

There are no major outstanding policy issues at this time.

IX. ENFORCEMENT

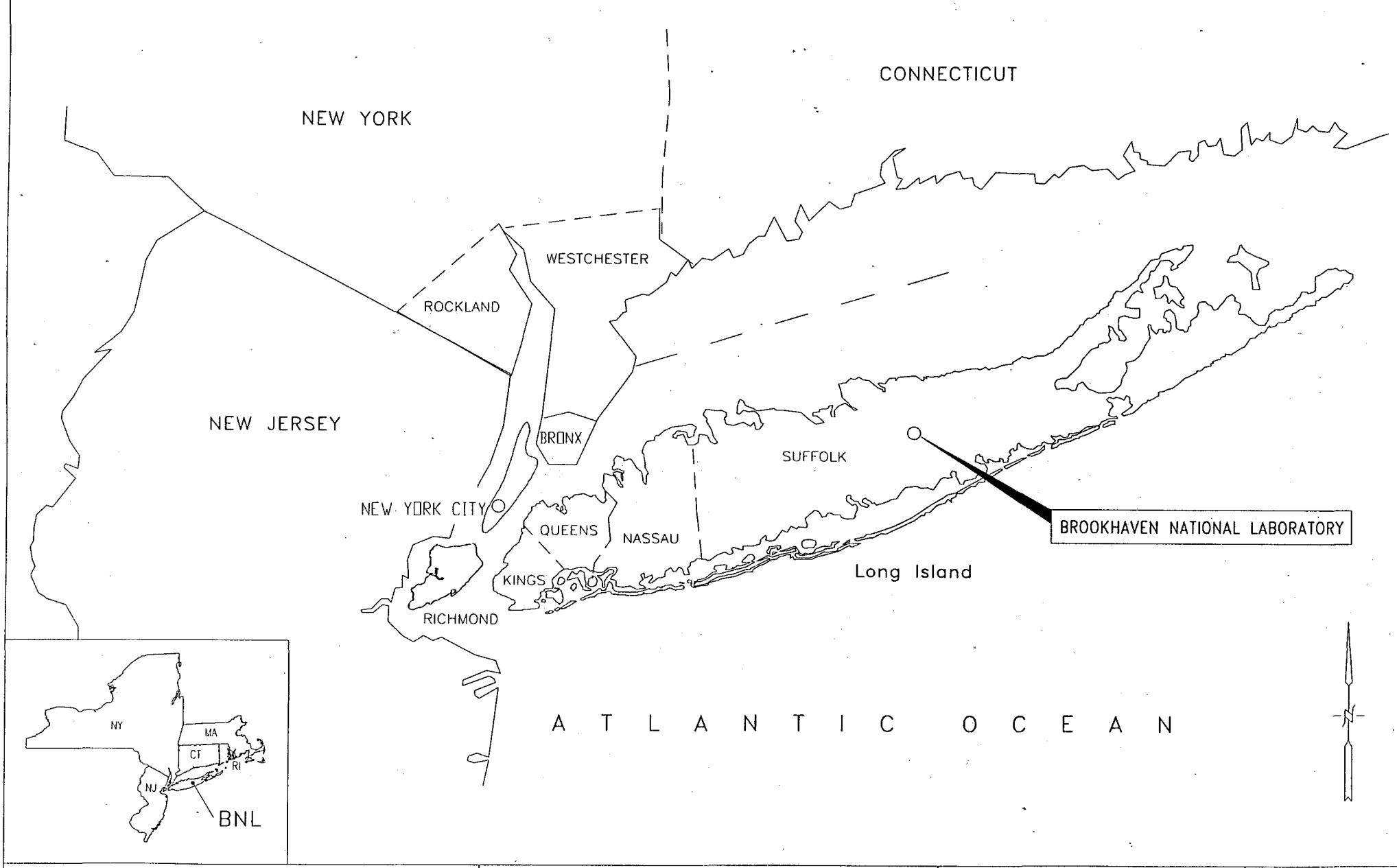
The site is owned by DOE and is operated by Associated Universities, Incorporated. The funding for source control and groundwater remediation will be provided entirely by DOE.

The removal action will be conducted in accordance with CERCLA and National Contingency Plan requirements, the Interagency Agreement, Executive Order 12580, and applicable New York State regulations.

X. RECOMMENDATION

This decision document represents part of the selected removal action for groundwater associated with Operable Unit III at the Brookhaven National Laboratory in Upton, New York, developed in accordance with CERCLA as amended, and is consistent with the National Contingency Plan.

FIGURES



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Adapted from data prepared by:
INTERNATIONAL TECHNOLOGY CORPORATION

Prepared For:
BROOKHAVEN NATIONAL LABORATORY
ASSOCIATED UNIVERSITIES, INC. UPTON, LONG ISLAND, NEW YORK 11973
UNDER CONTRACT WITH THE
UNITED STATES DEPARTMENT OF ENERGY

FIGURE 1
SITE LOCATION

JOB No.	BNL9603
DATE	10/24/96
SCALE	NOT TO SCALE
DRAWING No.	963 2 1

LEGEND

BROOKHAVEN NATIONAL LAB SITE BOUNDARY

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FIGURE 2
SITE PLAN

JOB No.	BNL9603
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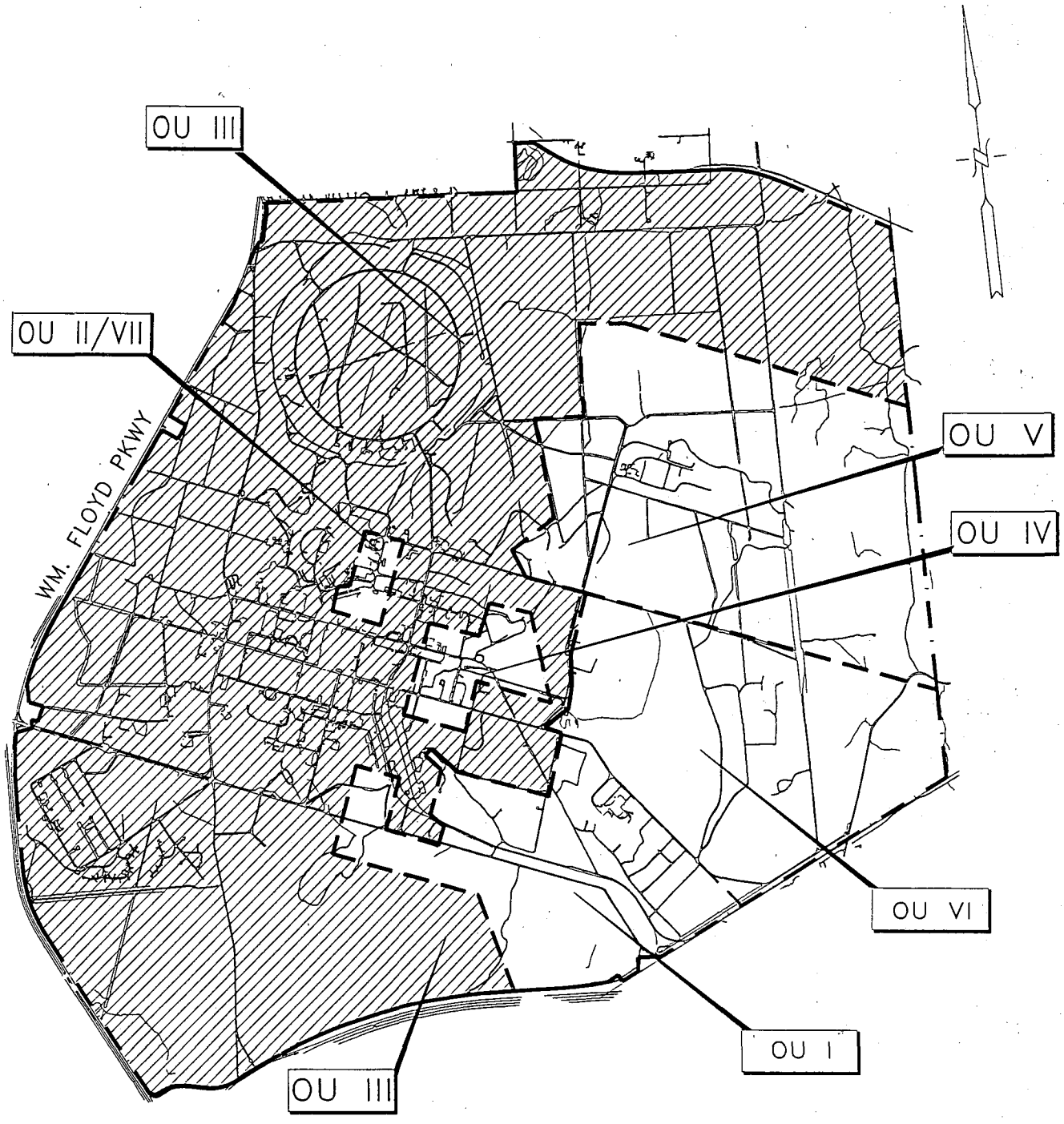
SCALE	NOT TO SCALE
DRAWING No.	963 2 2



LEGEND:

STUDY AREA

OPERABLE UNIT AREAS

BNL BOUNDARY

0 1500 3000

SCALE OF FEET

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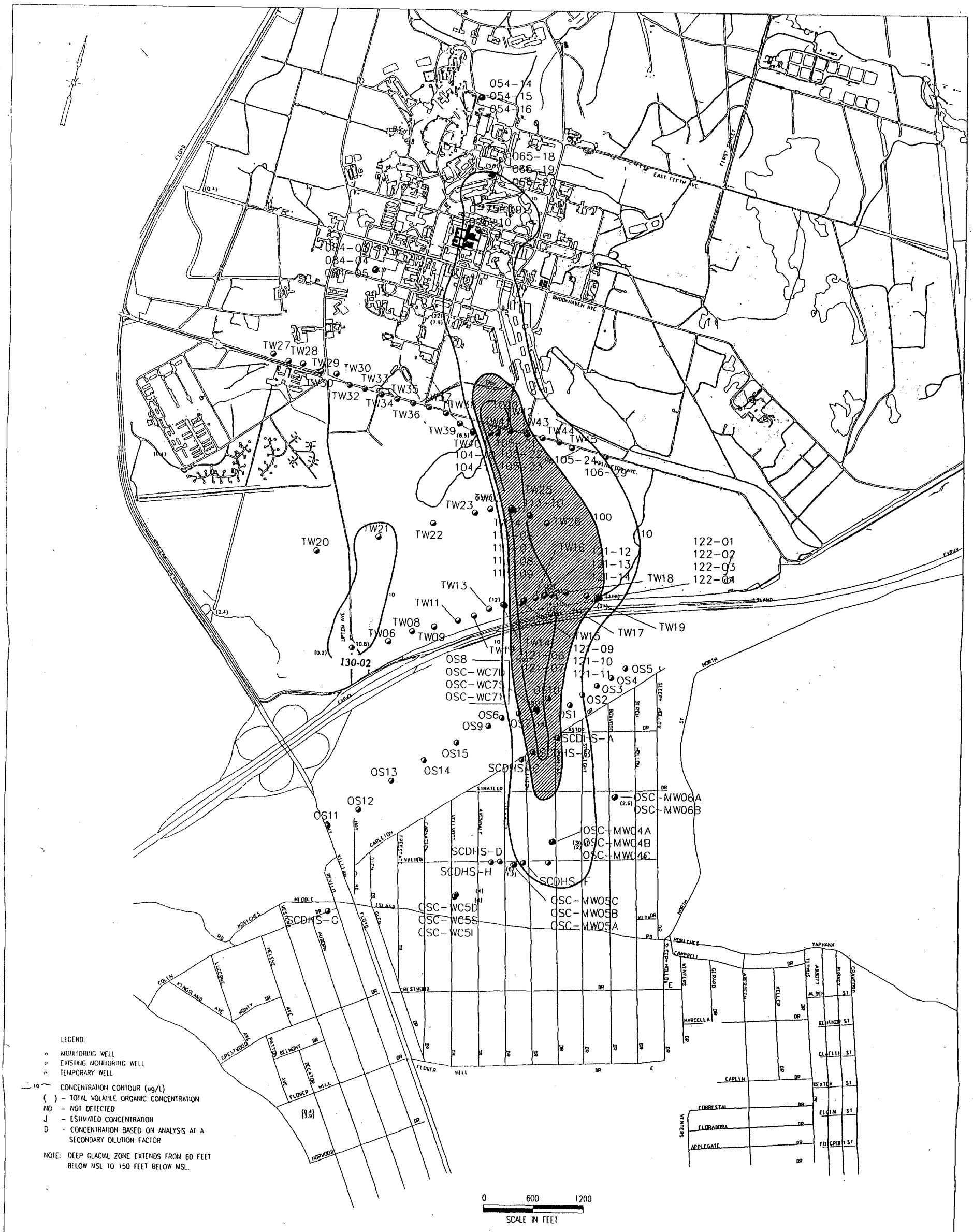
UNITED STATES DEPARTMENT OF ENERGY

FIGURE 3
OPERABLE UNITS

JOB No.	BNL9603
DATE	10/24/96
SCALE	AS SHOWN
DRAWING No.	963_2-3

ated from data prepared by:
NTERNATIONAL TECHNOLOGY CORPORATION



LEGEND:

- ○ MONITORING WELL
- ● EXISTING MONITORING WELL
- ○ TEMPORARY WELL
- 10 — CONCENTRATION CONTOUR (ug/L)
- ( ) – TOTAL VOLATILE ORGANIC CONCENTRATION
- ND – NOT DETECTED
- J – ESTIMATED CONCENTRATION
- D – CONCENTRATION BASED ON ANALYSIS AT A SECONDARY DILUTION FACTOR

NOTE: DEEP GLACIAL ZONE EXTENDS FROM 60 FEET BELOW MSL TO 150 FEET BELOW MSL.

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FIGURE 4
VOC CONCENTRATIONS
DEEP GLACIAL ZONE

JOB No.	BNL9603
DATE	10/24/96
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DRAWING No.	963_2-8

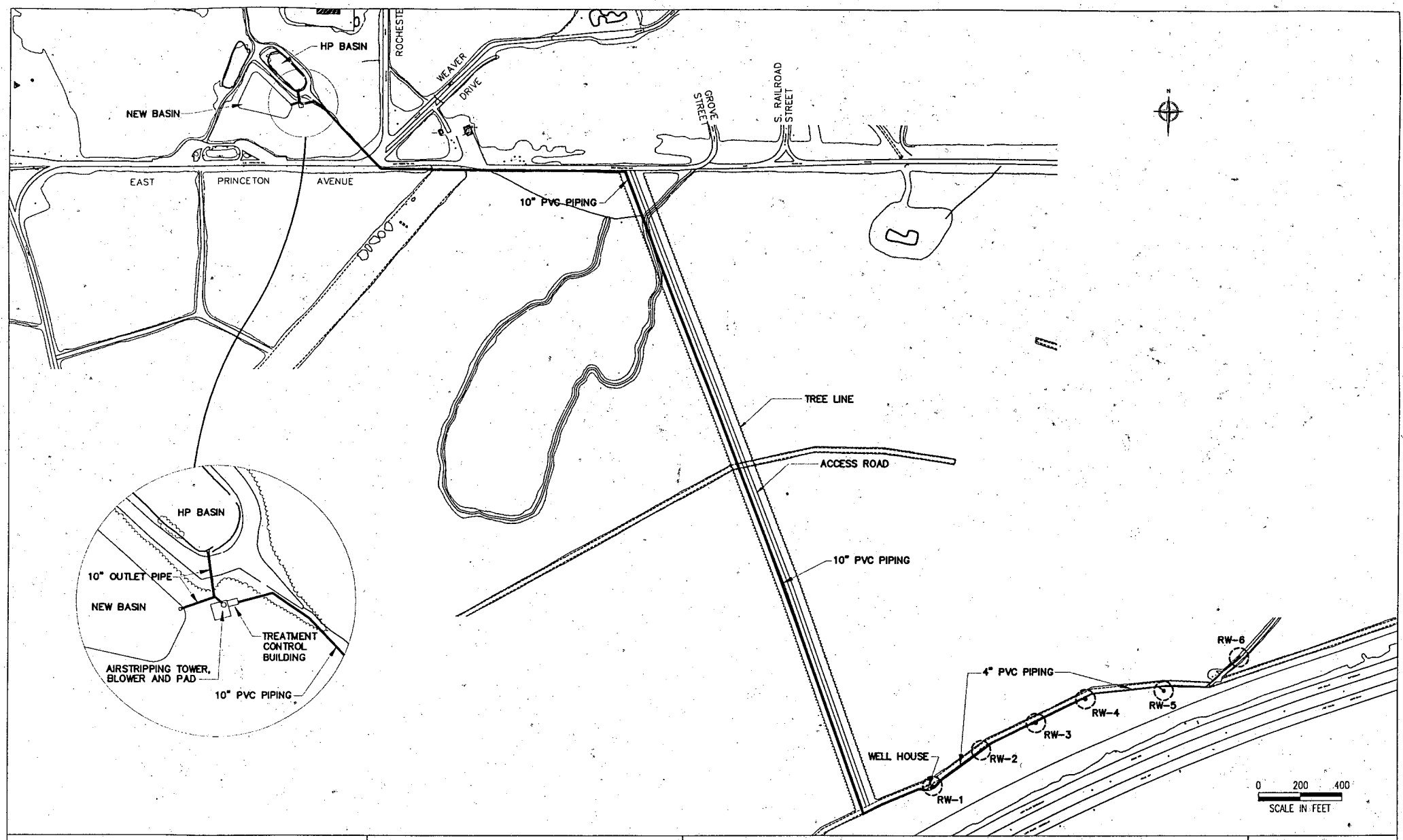

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FIGURE 5
SYSTEM LAYOUT

JOB No.	BNL9603
DATE	3/18/97
SCALE:	AS SHOWN
DRAWING No.	FIGURE5