AUG. 1 2 1988

Docket No. 040-00772 License No. STB-424 (expired)

State of New Jersey
Bureau of Environmental Radiation
ATTN: Gerald P. Nicholls, Ph.D.
Assistant Director
380 Scotch Road
CN 411
Trenton, New Jersey 08625

Gentlemen:

Subject: Special Inspection No. 99990001/88-77

This letter refers to the special safety inspection conducted by Betsy Ullrich, Lester Tripp, and David Collins of this office on March 1 and March 29, 1988 in Teterboro, New Jersey of activities formerly authorized by NRC License No. STB-424 (expired) which authorized the use of radioactive natural thorium at the present and former Bendix property. The inspection was limited to an inspection of property currently owned by MetPath, Inc. where drums containing radioactive material were discovered, property currently owned by Sumitoma Machinery Corporation where radioactive material was found in the soil, and a review of past licensed activities at Bendix which may relate to the radioactive material. This letter also refers to a subsequent telephone discussion between Mr. John Feeney of your staff and Mr. James H. Joyner of this office on August 11, 1988.

Areas examined during this inspection are described in the NRC Region I Inspection Report which is enclosed with this letter. Within these areas, the inspection consisted of selective examinations representative records, interviews with personnel, and observations and measurements by the inspectors.

As discussed during the telephone conversation between Mr. Feeney and Mr. Joyner, representatives of Bendix, MetPath and Sumitoma have been asked to attend a meeting to discuss the findings of this inspection at a conference at our office in King of Prussia, Pennsylvania, at 11:00 a.m., August 31, 1988. Since it appears that property is contaminated with natural thorium in excess of NRC limits, a copy of NRC's "Branch Technical Position", titled "Disposal or Onsite Storage of Thorium or Uranium Wastes From Past Operations" was provided to the three parties. A copy is enclosed for your information. You are welcome to attend this meeting with other members of your staff. Directions to the Region I office are enclosed.





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No reply to this letter is required. Your cooperation with us in this matter is appreciated.

Sincerely,

Stewart D. Ebneter, Director
Division of Radiation Safety
and Safeguards

Enclosures:
1. NRC Region I Inspection Report No. 99990001/88-77
2. 46FR 52061-63 "Disposal or Onsite Storage of Thorium or Uranium Wastes From Past Operations"
3. NRC Region I Inspection Report No. 99990001/81-15
4. Directions to the Region I Office

bcc:
Region I Docket Room (w/concurrences)
Management Assistant, DRMA
D. Holody, RI
R. Cunningham, NMSS
J. Kinneman, RI
B. Ullrich, RI
J. Joyner, RI
J. Gutierrez, RI
S. Ebneter, RI
J. Allan, RI

| RI:DRSS | RI:DRSS | RI:DRSS | RI:DRSS |
|---|---|---|---|
| Ullrich/bc | Kinneman | Joyner | Ebneter |
| 08/11/88 | 08/11/88 | 08/12/88 | 08/12/88 |

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 99990001/88-77

License No. STB-424 (expired) Docket No. 040-00772

Licensee: Allied Signal Aerospace - Bendix Division
Teterboro, New Jersey 07608

Facility Name: Bendix Division

Inspection At: Teterboro, New Jersey

Inspection Conducted: March 1 and March 29, 1988

Inspectors: Elizabeth Ullrich, Health Physicist — 8/12/88 date

Lester Tripp, Health Physicist — 8/12/88 date

David Collins, Health Physicist — 8/12/88 date

Approved by: John D. Kinneman, Chief
Nuclear Materials Safety Section B — 8/12/88 date

Inspection Summary: An announced special inspection on March 1 and 29, 1988 of an area formerly owned by Bendix Corporation in Teterboro, New Jersey, on which drums and soil containing radioactive material were discovered.

Areas Inspected: Samples of material from the drums and soil were taken for analysis in the NRC Region I Laboratory. Past licensed activities with regard to radioactive material were reviewed with the representatives of Bendix and the current owners of the properties, MetPath, Inc. and Sumitoma Machinery Corporation.

Results: Approximately 15-20 drums containing radioactive material are visible along a 100-foot stretch of a drainage ditch bank belonging to MetPath, Inc. Radiation levels range from 4 microroentgens (microR) per hour (background) at the fenceline, up to 800 microroentgens per hour near some drums. Analysis of samples indicate normal concentrations of thorium daughters in the soil, and higher concentrations of thorium in the samples taken from drums. Radiation levels along the drainage ditch through the Sumitoma property range from 4 microroentgens per hour, to 30 microroentgens per hour in two areas along the ditch where sediment has accumulated. Analysis of samples from these areas indicate levels of thorium slightly higher than normal. In addition, isolated spots of soil had radiation levels up to 3000 microroentgens per hour. Samples taken from these areas show no thorium contamination, but elevated levels of radium-226. Quantities of thorium requiring an NRC license exist on the MetPath, Inc. property without a valid NRC license.

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## DETAILS

1. Persons Contacted

*William A. Hooper, Manager, Plant Engineering, Allied Bendix Aerospace
*Lou Dulfur, Manager, Health and Safety, Allied Bendix Aerospace
*Anthoney P. Tumminello, Senior Attorney, Allied Corporation
*John Lonergan, Environmental Engineer, Allied Bendix Aerospace
*Mark Schwind, Environmental Engineer, Allied Bendix Aerospace
Ken Halliday, Metallurgist, Allied Bendix Aerospace
Lionel Menard, Director of Engineering and Purchasing, MetPath, Inc.
Thomas Kossl, Vice President and General Counsel, MetPath, Inc.
**William M. Lechler, Executive Vice President
Sumitoma Machinery Corporation
John Cali, Sumitoma Machinery Corporation
Nick Yanazaki, President, Sumitoma Machinery Corporation
*Duncan White, Radiation Physicist, New Jersey Bureau of
Environmental Radiation

*present at exit interview March 1, 1988
**present at exit interview March 29, 1988

2. Background

Allied Signal is the parent company of Allied Signal Aerospace - Bendix Division (Allied Bendix Aerospace or Bendix), located in Teterboro, New Jersey. Bendix is now involved in the research and development, engineering, and manufacture of flight systems and test equipment for the systems. They currently hold NRC License No. 29-15797-01 which authorizes the possession of a Lixiscope containing iodine-125. They also lease a large number of generally-licensed 3M polonium-210 static eliminators. A license to possess source material was first issued to Eclipse-Pioneer Division of Bendix Aviation Corporation by the Atomic Energy Commission (AEC) in 1958. It authorized possession and use of 4% thorium-magnesium alloy. Subsequent licenses issued to Bendix permitted use of up to 10,000 pounds of 40% thorium magnesium hardener at a site in Teterboro. The most recent source material license expired in 1973, although other records indicate a thorium license may have been active as late as 1975.

In January, 1988, during a survey of the Teterboro, New Jersey area, the Department of Energy (DOE) identified several drums of radioactive material along the outside of the fenceline of property belonging to MetPath, Inc. (MetPath). According to the legal counsel for MetPath, this property was purchased from Bendix. DOE analysis indicated that the drums contain natural thorium. Radioactive material was also identified on an adjacent property now owned by Sumitoma Machinery Corporation (Sumitoma) which had also been purchased from Bendix. The DOE survey reports are included as Attachment 1 to this report.

3. Property History

Personnel interviewed stated that Bendix acquired the the 101-acre Teterboro property in 1937. This original Bendix property is now approximately bounded on the east by Teterboro Airport, on the north by Route 46, on the west by Route 17, and on the south by Malcolm Avenue. When purchased, the land was undeveloped, consisting mainly of marsh and swampland. Approximately three to four feet of fill was added prior to building on the property. Zero to five feet of additional fill was used in the mid-1970's to raise the property level to ten feet above sea level, in accordance with Bergen County flood control specifications.

In 1941, Bendix sold a large portion of this property to the Navy, which built a foundry for the production of magnesium-thorium alloy. The foundry was operated by Bendix under contract to the Navy. The Navy site included a sewage treatment facility, a small incinerator, and sand pits for treatment of magnesium-thorium waste chips from the Bendix machine shops. In 1954, an addition to the foundry was built for the production of aluminum castings. Bendix processed items cast in the foundry in machine shops on their adjacent property. The Navy terminated its use of the foundry in 1961.

Bendix re-purchased the property from the Navy in 1961 and continued to operate the foundry until 1964. Machinery from the foundry was later sold to other foundries which continued to produce the castings needed by Bendix. In 1968, the foundry building was closed and cleaned out. The buildings were converted for use as office space in 1969.

Representatives of Bendix stated that thirty acres of land south of the foundry (adjacent to Malcolm Avenue) were sold, part to MetPath and part to Sumitoma, in the late 1970's. Representatives of MetPath stated they purchased their property on September 29, 1980. Sumitoma purchased the southwest corner of the Bendix property, which contained the sewage facility, incinerator, and sand pits. Representatives of Sumitoma stated that the only structures on this property at the time of purchase were a concrete sewage tank and some small concrete structures that may have been supports or foundations. Soil was removed from the center portion of the property, and replaced with soil from the Franklin Lakes area of New Jersey in order to provide an adequate foundation for subsequent construction of the current building, an office and warehouse of about 75,000 square feet. No other changes were made. According to the Sumitoma representatives, MetPath hired the same contractor who used the same procedures to construct an office and laboratory building on its property.

4. Use of Thorium

Use of thorium at the Teterboro site may have begun in the Navy foundry as early as 1941. Forty percent thorium alloy was received at the foundry in the form of small metal pellets and added to magnesium to produce standard magnesium-thorium alloys, most commonly containing 3.3% thorium. Representatives of Bendix stated that analytical records indicate no thorium use at the foundry after 1951. However, AEC licenses were issued to Bendix Corporation in Teterboro, New Jersey during the period 1958 to 1973 for possession of up to 10,000 pounds of 40% thorium-magnesium hardner for production of up to 4% thorium-magnesium alloy.

According to Bendix representatives, waste scraps of the final alloy from the foundry were recycled. There are no records available pertaining to the disposal of slag or other waste material from the foundry.

The magnesium-thorium alloy from the foundry was machined into final products by Bendix in their facility adjacent to the foundry. Waste chips of the alloy were at one time disposed by incineration in a small (4 feet by 4 feet by 6 feet) brick incinerator primarily used for burning documents. In 1961, the licensee was cited by the AEC for violations related to the incineration of waste. Bendix representatives stated that the waste chips were then placed in sand beds, chemically treated for 20-30 days, then disposed to a landfill. During a 1981 NRC inspection, Bendix representatives stated that waste had been transferred to a firm licensed by the AEC for this material. (See Report No. 99990001/81-15). No records of waste disposal by Bendix during this time are available.

5. Instrumentation Used and Sample Analysis

Radiation levels were measured using a Ludlum Model 12S Micro R Meter, Serial Number NRC 008580, calibrated December 4, 1987. Background levels measured with this instrument are 4-6 microR/hour. Samples of the contents of the drums and of soil taken from areas adjacent to the drums were counted at the Region I Laboratory using an intrinsic germanium detector and a multichannel analyzer. Soil samples were taken from 100 $cm^2$ areas at depths of 5-10 cm. Thorium and radium concentrations in the samples were determined using activities of selected radioactive decay products. A description of the samples is in Attachment 2. The lower limit of detection (LLD) is 0.355 picocuries of thorium per gram of soil and 0.349 picocuries of radium-226 per gram of soil.

6. Inspector Observations

The 55-gallon drums identified by DOE are located on the outside of the west fence of the MetPath property (parallel to Route 17). Although the drums are outside of the enclosure, access to them is most easily attained by crossing the Bendix property, through the security fences. Drums are visible beginning about eighty feet south of the Bendix property, along the bank of a drainage ditch. The drainage ditch feeds into the Berry Creek, which flows into the Hackensack River.

The drainage ditch passes through the western edge of all three properties (Bendix, MetPath, Sumitoma) in Teterboro, parallel to Route 17. The bank is about eight feet wide along the MetPath property where an old, now unused, parking lot is located. Along the Sumitoma property the bank drops sharply to the level of the ditch. The ditch is about six feet below the property level, and about eight feet wide. On the first day of the inspection, the water depth was approximately six inches. The drums identified as containing radioactive material are located along a one hundred foot section of the bank of the drainage ditch on the MetPath property, adjacent to the old parking lot.

Approximately 15-20 drums are visible. These drums have deteriorated, exposing the contents. The contents of some drums appear to be concrete-like. In other drums, the material is wet and crumbly and ranges from white to dark gray in color. Drums appear to be lying on their sides, perpendicular to the fence line. Drums are visible at the top of the bank near the fence as well as at the water line.

7. Radiation Level Surveys

Radiation levels along the inside of the MetPath fenceline were all the same as background. Radiation levels along the outside of the fence at ground level were also background, except near fenceposts 8, 9, and 10 where drums were exposed. Radiation levels near these drums were 40-60 microR/hour.

Radiation levels near the ground at the waterline ranged from 4-12 microR/hour except in areas where drums were exposed. Radiation levels at approximately one meter above the surface of the ground at the water line ranged from 4 to 80 microR/hour. The contents of drums found along the water line had radiation levels ranging from 40 to 800 microR/hour at contact. A complete description of the survey of this section of the ditch is included as Attachment 3. No other portion of the MetPath property was surveyed.

A survey of the Sumitoma property identified a 25-foot-by-30-foot area in the northeast corner with radiation levels generally ranging from 14-100 microR/hour. One spot with a level of 2000 microR/hour was identified in this area. In addition, several discrete spots were noted on the west and south sides of the Sumitoma building with levels of 20-30 microR/hr. One spot less than two inches in diameter had a level of 3000 microR/hour. This was located approximately 15 feet west of the building and 20 feet north of the ornamental garden fence. Surveys along the drainage ditch identified two areas with radiation levels of 20-30 microR/hour where debris and sediment had collected along the bank. All other areas were background.

Surveys were also conducted inside the 75000-square feet office/warehouse building on the Sumitoma property. No radiation levels above background were identified.

8. Contamination Surveys

Samples taken from four drums on the MetPath property were found to contain as much as 480 picocuries of thorium per gram of sample (pCi/g). Soil samples taken from the ditch along the MetPath and Sumitoma properties had thorium levels of 0.7 - 25.4 pCi/g. Normal environmental concentrations of thorium in soil typically fall in the range of 0.2 - 1.3 pCi/g. 10 CFR 40.13(a) exempts from NRC licensing material that is less than 0.05% by weight source material, which is equivalent to 54.5 picocuries per gram of thorium. The data in Attachment 2 indicates that the material in two of the four drums sampled exceed the concentration of thorium which is exempted from licensing.

The two soil samples taken from other areas of the Sumitoma property indicated radium-226 contamination. No thorium was noted in these samples. The sample west of the building containing 315 ±14 pCi/g, and the sample taken from the northeast corner contained 2500± 109 pCi/g. Environmental concentrations of radium-226 in soil typically fall in the range of 0.5 - 2.0 pCi/g. This material is regulated by the State of New Jersey.

The possession of the quantities of thorium determined in samples from the drums without a valid NRC license is an apparent violation of 10 CFR Part 40.

9. Interviews With Personnel

Few records exist of activities on this site during use of the foundry. Most information was received from persons who worked for Bendix during that time. None of the representatives contacted had any knowledge of the drums prior to their discovery by DOE. None of the Bendix representatives could identify the drums, their contents, or the time of their placement along the ditch. It was suggested by Bendix representatives that the barrels may have been used as support for the bank, since the adjacent area had been used as a parking lot for the foundry.

Representatives of MetPath, Inc. had no knowledge of the existence of the drums prior to their discovery by DOE. Representatives of MetPath verified that the ditch is part of their property, although it is outside of the fenceline.

Representatives of Sumitoma had no information on the use of radioactive material on their property prior to 1976. They were unaware of any radioactive contamination of their property until the DOE survey.

10. Exit Interview

The inspectors met with the persons identified in Paragraph 1 to discuss the scope and findings of the inspection.

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
631 PARK AVENUE
KING OF PRUSSIA, PENNSYLVANIA 19406

Docket No. 40-0772

22 OCT 1981

Bendix Corporation
Guidance Systems Division
ATTN: Mr. William Cooper
Manager, Plant Engineering
Teterboro, New Jersey 07608

Gentlemen:

Subject: Inspection 81-15

This refers to the closeout safety inspection conducted by Ms. M. Campbell of this office on August 27, 1981, of activities formerly authorized by NRC License No. STB-424 and to the discussions of our findings held by Ms. Campbell with yourself at the conclusion of the inspection. This closeout inspection was conducted as part of an NRC effort to ensure that facilities where licensed activities were formerly conducted meet current NRC criteria for release for unrestricted use.

Areas examined during this inspection are described in the Office of Inspection and Enforcement Inspection Report which is enclosed with this letter. Within these areas, the inspection consisted of selective examinations of procedures and representative records, interviews with personnel, measurements made by the inspector, and observations by the inspector.

Within the scope of this inspection, no items of noncompliance were observed. In addition, it appears your facility meets current criteria for release for unrestricted use.

In accordance with 10 CFR 2.790 of the Commission's regulations, a copy of this letter and the enclosed inspection report will be placed in the NRC's Public Document Room. If this report contains any information that you (or your contractors) believe to be exempt from disclosure under 10 CFR 9.5(a)(4), it is necessary that you (a) notify this office by telephone within ten (10) days from the date of this letter of your intention to file a request for withholding; and (b) submit within 25 days from the date of this letter a written application to this office to withhold such information. Consistent with section 2.790(b)(1), any such application must be accompanied by an affidavit executed by the owner of the information which identifies the document or part sought to be withheld, and which contains a full statement of the reasons on the basis which it is claimed that the information should be withheld from public disclosure. This section further requires the statement to address with specificity the considerations listed in 10 CFR 2.790(b)(4). The information

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sought to be withheld shall be incorporated as far as possible into a separate part of the affidavit. If we do not hear from you in this regard within the specified periods noted above, the report will be placed in the Public Document Room. The telephone notification of your intent to request withholding, or any request for an extension of the 10 day period which you believe necessary, should be made to the Supervisor, Files, Mail and Records, USNRC Region I, at (215) 337-5223.

No reply to this letter is required; however, should you have any questions concerning this inspection, we will be pleased to discuss them with you.

Sincerely,

John D. Kinneman, Chief, Materials
Radiological Protection Section,
Technical Inspection Branch

Enclosure: Office of Inspection and Enforcement Inspection Report Number 99990001/81-15

cc w/encl:
Public Document Room (PDR)
Nuclear Safety Information Center (NSIC)
State of New Jersey

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF INSPECTION AND ENFORCEMENT

Region I

Report No. 99990001/81-15

Docket No. 40-0772

License No. STB-424 Priority IV Category E

Licensee: Bendix Corporation

Teterboro, New Jersey 07608

Facility Name: Bendix Corporation

Inspection at: Teterboro, New Jersey

Inspection conducted: August 27, 1981

Inspectors: M. Campbell, Radiation Specialist — 10-20-81 date signed

Approved by: John D. Kinneman, Chief, Materials Radiological Protection Section — 10-20-81 date signed

Inspection Summary:
Inspection conducted on August 27, 1981 (Report No. 40-0772/81-15)
Areas Inspected: Special, announced closeout inspection of formerly licensed thorium alloy processor, including interviews with personnel, and independent measurements of contamination and radiation levels. The inspection involved 3 inspector-hours onsite by one regionally-based NRC inspector.
Results: All thorium source material was used in production, prior to expiration of the license. No residual contamination or radiation levels above background were identified in the areas surveyed.

Region I Form 12
(Rev. April 77)

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## DETAILS

1. Individuals Contacted

* Mr. William Hooper, Plant Engineer
  Mr. Dulfer, Safety Engineer
  Mr. R. D'Alfa, Supervisor in Charge of Safety

* indicates presence at exit interview.

2. Background

The Bendix Corporation was licensed to produce magnesium thorium alloys between 1958 and 1975. Thorium alloy containing 40% thorium was added to magnesium castings to produce final castings of alloy containing up to 3% thorium. The purpose of this inspection was to conduct an independent radiation survey of the physical facilities used while the license was in effect.

3. Interviews with Personnel

Company representatives stated that the building which contained the foundry where thorium was used was converted into office space in 1969. Photographs taken during the cleanup of this area demonstrated the thorough and extensive cleaning which was required. This cleaning would have thoroughly decontaminated the foundary had there been any residual thorium contamination.

In 1961, the licensee was cited by the AEC for violations related to incineration of waste from this process in a remote field area. Bendix representatives state that subsequently, waste was transferred to a firm licensed by the AEC for this material. Bendix representatives also stated that in the mid-70's, this remote field area was scraped clean and filled in with up to ten feet of clean fill.

4. Independent Measurements

The inspector surveyed the former furnace area and the area formerly used for storage of thorium alloys, using a Ludlum Model 12S Micro R meter. Average radiation levels were 0.010-0.015 mR/hr which is in the range of natural background. Smear surveys taken in these areas indicated no removable contamination above background.

5. Exit Interview

The inspector met with the Bendix representative denoted in paragraph 1 at the conclusion of the inspection, and summarized the scope and results of the inspection.

## Disposal or Onsite Storage of Thorium or Uranium Wastes From Past Operations

**AGENCY:** Nuclear Regulatory Commission (NRC).

**ACTION:** Discussion of options for NRC approval of applications for disposal or onsite storage of thorium or uranium wastes; interim use and public comment.

**SUMMARY:** This notice discusses five options for NRC approval of disposal or onsite storage of thorium or uranium wastes from past nuclear operations. The options are contained in a Branch Technical Position for administration by the Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards.

**DATES:** Comments on the options for disposal or onsite storage of thorium or uranium are encouraged. Such comments will be considered in any subsequent revision of the Branch Technical Position. Comments are due December 22, 1981.

Note.—Comments received after the expiration date will be considered if it is practical to do so, but assurance of consideration cannot be given except as to comments filed on or before that date.

**FOR FURTHER INFORMATION CONTACT:** Ralph G. Page, Chief, Uranium Fuel Licensing Branch, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, Washington, D.C. 20555, telephone 301-427-4309.

**SUPPLEMENTARY INFORMATION:**

### I. Introduction

Some of the sites formerly used for processing thorium and uranium are known today to be contaminated with residual radioactive materials. Some are currently covered by NRC licenses. Others were once licensed, but the licenses to possess and use material have expired. In many cases, the total amount of contaminated soil is large, but the activity concentrations of radioactive materials are believed sufficiently low to justify their disposal on privately owned lands or storage onsite rather than their transport to a licensed radioactive materials disposal (commercial) site. In many instances packaging and transporting these wastes to a licensed disposal site would be too costly and not justified from the standpoints of risk to the public health or cost-benefit. Furthermore, because of the total volume of these wastes, limited commercial waste disposal capacity, and restrictions placed on receipt of long-lived wastes at commercial sites, it is not presently feasible to dispose of these wastes at commercial low-level waste disposal sites.

Effective January 28, 1981, NRC regulations in 10 CFR 20, "Standards for Protection Against Radiation", were amended (45 FR 71761-71762) to delete § 20.304 which provided general authority for disposal of radioactive materials by burial in soil. Under the amended regulations, licensees must apply for and obtain specific NRC approval to dispose of radioactive materials in this manner under the provisions of 10 CFR 20.302. A case-by-case review was believed needed to assure that burial of radioactive wastes would not present an unreasonable health hazard at some future date.

The deleted provisions of § 20.304 previously permitted burial of up to 100 millicuries of thorium or natural uranium at any one time, with a yearly limitation of 12 burials for each type of material at each site. The only disposal standards specified were (1) burial at a minimum depth of four feet, and (2) successive burials separated by at least six feet. Thus a total of 1.2 curies of these materials were permitted to be disposed of each year by burial in a 12 foot by 18 foot or larger plot of ground.

Under the amended regulations, it is incumbent on an applicant who wants to bury radioactive wastes to demonstrate that local land burial is preferable to other disposal alternatives. The evaluation of the application takes into account the following information:

- Types and quantities of material to be buried
- Packaging of waste
- Burial location
- Characteristics of burial site
- Depth of burial
- Access restrictions to disposal site
- Radiation safety procedures during disposal operations
- Recordkeeping
- Local burial restrictions, if any

For applications involving disposal of soils contaminated with low level concentrations of thorium and uranium (other than concentrations not exceeding EPA cleanup standards), the matters of principal importance are:

- Concentrations of thorium and uranium (either in secular equilibrium with their daughters or without daughters present)
- Volume of contaminated soil
- Costs for offsite and onsite disposal
- Availability of offsite burial space
- Disposal site characteristics
- Depth of burial and accessibility of buried wastes
- State and local government views

### II. Branch Technical Position

There are five acceptable options for disposal or onsite storage of thorium and uranium contaminated wastes. Applications for disposal or storage will be approved if the guidelines discussed under any option are met. Applications for other methods of disposal may be submitted and these will be evaluated on their own merits.

1. Disposal of acceptably low concentrations (which meet EPA cleanup standards) of natural thorium with daughters in secular equilibrium, depleted or enriched uranium, and

uranium ores with daughters in secular equilibrium with no restriction on burial method.

Under this option, the concentrations of natural thorium and depleted or enriched uranium wastes are set sufficiently low that no member of the public is expected to receive a radiation dose commitment from the disposed materials in excess of 1 millirad per year to the lung or 3 millirads per year to the bone from inhalation and ingestion, under any foreseeable use of the material or property. These radiation dose guidelines were recommened by the Environmental Protection Agency (EPA) for protection against transuranium elements present in the environment as a result of unplanned contamination (42 FR 60956–60959). In addition, the concentrations are sufficiently low so that no individual may receive an external dose in excess of 10 microroentgens per hour above background. This is compatible with guidelines EPA proposed as cleanup standards for inactive uranium processing sites (46 FR 2556–2563).

For natural uranium ores having daughters in equilibrium, the concentration limit is equal to that set by the EPA (46 FR 2556–2563) for radium-226 (i.e., 5 pCi/gm, including background) and its decay products.

The concentrations specified below are believed appropriate to apply. It is expected, however, that currently licensed operations will be conducted in such a manner as to minimize the possibility of soil contamination and when such occurs the contamination will be reduced to levels as low as reasonably achievable.

| Kind of material | Concentration (pCi/gm) |
|---|---|
| Natural thorium (Th-232 plus Th-228) if all daughters are present and in equilibrium | 10 |
| Depleted Uranium | 35 |
| Enriched Uranium | 30 |
| Natural Uranium Ores (U-238 plus U-234) if all daughters are present and in equilibrium | 10 |

The analysis upon which the Branch Technical Position is based is available for inspection at the Commission's Public Document Room at 1717 H St., N.W., Washington, D.C.

The concentrations specified under this option may be compared with naturally occurring thorium and uranium ore concentrations of 1.3 pCi/gm in igneous rock and uranium concentrations of 120 pCi/gm in Florida phosphate rock and 50–80 pCi/gm in Tennessee bituminous shale. Concentration limits for natural thorium and natural uranium ore wastes containing daughters not at secular equilibrium can be calculated on a case-by-case basis using the applicable isotopic activities data.

2. Disposal of certain low concentrations of natural thorium with daughters in secular equilibrium and depleted or enriched uranium with no daughters present when buried under prescribed conditions with no subsequent land use restrictions and no continuing NRC licensing of the material.

Under this option the concentrations of natural thorium and uranium are set sufficiently low so that no member of the public will receive a radiation dose exceeding those discussed under option 1 when the wastes are buried in an approved manner absent intrusion into the burial grounds. This option will require establishing prescribed conditions for disposal in the license, such as depth and distribution of material, to minimize the likelihood of intrusion. Burial will be permitted only if it can be demonstrated that the buried materials will be stabilized in place and not be transported away from the site.

Acceptability of the site for disposal will depend on topographical, geological, hydrological and meteorological characteristics of the site. At a minimum, burial depth will be at least four feet below the surface. In the event that there is an intrusion into the burial ground, no member of the public will likely receive a dose in excess fo 170 millirems to a critical organ. An average dose not exceeding 170 millirems to the whole body for all members of a general population is recommended by international and national radiation expert bodies to limit population doses. With respect to limiting doses to individual body organs, the concentrations are sufficiently low that no individual will receive a dose in excess of 170 millirems to any organ from exposure to natural thorium, depleted uranium or enriched uranium.

The average activity concentration of radioactive material that may be buried under this option in the case of natural thorium (Th-232 plus Th-228) is 50 pCi/gm, if all daughters are present and in equilibrium; for enriched uranium it is 100 pCi/gm if the uranium is soluble and 250 pCi/gm if insoluble; for depleted uranium it is 100 pCi/gm if the uranium is soluble and 300 pCi/gm if insoluble. Natural uranium ores containing radium 226 and its daughters are not included under this option, because of possible radon 222 emanations and resultant higher than acceptable exposure of individuals in private residences if houses were built over buried materials.

3. Disposal of low concentrations of natural uranium ores, with all daughters in equilibrium, when buried under prescribed conditions in areas zoned for industrial use and the recorded title documents are amended to state that the specified land contains buried radioactive materials and are conditioned in a manner acceptable under state law to impose a covenant running with the land that the specified land may not be used for residential building. (There is no continuing NRC licensing of the material.)

Disposal will be approved if the burial criteria outlined in option 2 (including burial at a minimum of 4 feet) are met. Depending upon local soil characteristics, burials at depths greater than 4 feet may be required. In order to assure protection against radon 222 releases (daughter in decay chain of uranium 238 and uranium 234), it is necessary that the recorded title documents be amended to state in the permanent land records that no residential building should be permitted over specified areas of land where natural uranium ore residues (U–238 plus U–234) in concentrations exceeding 10 pCi/gm has been buried. Industrial building is acceptable so long as the concentration of buried material does not exceed 40 pCi/gm of uranium (i.e., Ra–226 shall not exceed 20 pCi/gm).

4. Disposal of land-use-limited concentrations of natural thorium or natural uranium with daughters in secular equilibrium and depleted or enriched uranium without daughters present when buried under prescribed conditions in areas zoned for industrial use and the recorded title documents are amended to state that the land contains buried radioactive material and are conditioned in a manner acceptable under state law to impose a covenant running with land that the land (1) may not be excavated below stated depths in specified areas of land unless cleared by appropriate health authorities, (2) may not be used for residential or industrial structures over specified areas where radioactive materials in concentrations higher than specified in options 2 and 3 are buried, and (3) may not be used for agricultural purposes in the specified areas. (There is no continuing NRC licensing of the disposal site.)

Under this option, conditions of burial will be such that no member of the public will receive radiation doses in excess of those discussed under option 1 absent intrusion into the burial ground. Criteria for disposal under these conditions is predicated upon the assumption that intentional intrusion is less likely to occur if a warning is given

in land documents of record not to excavate below burial depths in specified areas of land without clearance by health authorities; not to construct residential or industrial building on the site; and not to use specified areas of land for agricultural purposes. Because of this, we believe it appropriate to apply a maximum critical organ exposure limit of 500 millirems per year to thorium and uranium buried under this restriction instead of 170 millirems as used in options 2 and 3. In addition, any exposure to such materials is likely to be more transient than assumed (essentially continual exposure) under those options. These two factors combine to increase the activity concentration limits calculated under option 2 by about 10. Thus, the average concentration that may be buried under this option for thorium (Th-232 plus Th-228) is 500 pCi/gm if all daughters are present and in equilibrium; for enriched uranium it is 1000 pCi/gm if the uranium is soluble and 2500 pCi/gm if insoluble; and for depleted uranium it is 1000 pCi/gm if the uranium is soluble and 3000 pCi/gm if insoluble.

With respect to natural uranium with daughters present and in equilibrium, the concentration that may be buried under this option is 200 pCi/gm of U-238 plus U-234, i.e., 100 pCi/gm Ra-226. This concentration is based on a limited exposure of 2.4 hours per day to limit the radon dose to less than 0.5 working level month (WLM) which is equivalent to continuous exposure to 0.02 working level (WL). Depending upon local soil characteristics, burials at depths greater than 4 feet may be required.

SUMMARY OF MAXIMUM CONCENTRATIONS PERMITTED UNDER DISPOSAL OPTIONS

| Kind of Material | Disposal Options | | | |
|---|---|---|---|---|
| | 1 [1] | 2 [2] | 3 [3] | 4 [4] |
| Natural Thorium (Th-232 + Th-228) with daughters present and in equilibrium | 10 | 50 | ---- | 500 |
| Natural Uranium (U-238 + U-234) with daughters present and in equilibrium | 10 | ---- | 40 | 200 |
| Depleted Uranium: | | | | |
| *Soluble | 35 | 100 | ---- | 1,000 |
| *Insoluble | 35 | 300 | ---- | 3,000 |
| Enriched Uranium: | | | | |
| *Soluble | 30 | 100 | ---- | 1,000 |
| *Insoluble | 30 | 250 | ---- | 2,500 |

[1] Based on EPA cleanup standards.
[2] Concentrations based on limiting individual doses to 170 mrem/yr.
[3] Concentration based on limiting equivalent exposure to 0.02 working level or less.
[4] Concentrations based on limiting individual doses to 500 mrem/yr and, in case of natural uranium, limiting exposure to 0.02 working level or less.

5. Storage of licensed concentrations of thorium and uranium onsite pending the availability of an appropriate disposal site.

When concentrations exceed those specified in option 4, long term disposal other than at a licensed disposal site will not normally be a viable option under the provisions of 10 CFR 20.302. In such cases, the thorium and uranium may be permitted to be stored onsite under an NRC license until a suitable method of disposal is found. License conditions will require that radiation doses not exceed those specified in 10 CFR Part 20 and be maintained as low as reasonably achievable.

Before approving an application to dispose of thorium or uranium under options 2, 3, or 4, NRC will solicit the view of appropriate State health officials within the State in which the disposal would be made.

Dated at Silver Spring, Maryland this 19th day of October, 1981.

Richard E. Cunningham,

*Director, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards.*

[FR Doc. 81-30808 Filed 10-22-81; 8:45 am]

BILLING CODE 7590-01-M

REPORT NO. 99990001/88-77

ATTACHMENT 1

DOE SURVEY REPORTS

J. Kenneman
NRC

**Department of Energy**
Washington, DC 20545

MAR 1 1988

Mr. William Hooper
Manager of Plant Engineering
Allied Bendix Aerospace Corporation
Route 46 and Industrial Avenue
Teterboro, New Jersey 07608

Dear Mr. Hooper:

As you are aware, the Department of Energy (DOE) is conducting a research and development project to decontaminate the former Maywood Chemical Company site in Maywood, New Jersey, and associated vicinity properties. This effort includes surveys conducted by DOE in order to identify vicinity properties associated with the Maywood site. As a result of a wide-area scan (mobile gamma scan) conducted near your facility, some radiation anomalies were identified on your property in Teterboro and two neighboring properties owned by Sumitomo Machinery Corporation and Metpath Incorporated. Radiological surveys were conducted between November 1986 and January 1988 to identify the source of these anomalies and determine if they were connected with the former Maywood Chemical Company Operations.

The residual radioactivity identified on your property by the survey was primarily due to elevated levels of thorium and radium and their associated decay products in the soil. The information collected as a result of these activities indicates that the residual radioactive material was not derived from the Maywood site. Therefore, your site will not be included in the DOE Maywood project.

It appears the thorium contamination identified on your property may be related to some past activities licensed by the Atomic Energy Commission (as a predecessor to the Nuclear Regulatory Commission), which were conducted for the Navy at a plant operated and later owned by Bendix. The source of the radium contamination is not known; however, it is similar to the type of residues we have seen that are related to radium-coated instruments, such as airplane gauges and watch dials.

As a result of these findings, we are notifying (by copy of this letter) the Nuclear Regulatory Commission, and the State of New Jersey, of our findings, as they have regulatory authority over the thorium and radium, respectively. I am also providing a copy of the letter to the Department of Defense because the thorium contamination may be related to the former Navy plant.

A draft preliminary summary of the survey results is enclosed for your information. A survey report documenting the results of the survey will be provided to you in the next few months. As the results indicate, a portion

of your property may contain residual radioactive material above guidelines used by DOE to determine if a property needs remedial action; however, as noted above, these guidelines do not apply to your property. Based on the measurements taken and the location of the contamination on your property, it does not appear that there is significant potential for workers at your facility to be exposed to radiation levels in excess of dose guidelines.

However, until further evaluation is completed by you or other organizations, as appropriate, we recommend you do not allow individuals to be exposed in these areas over extended periods. Because most of the areas of concern (i.e., two spots in the outfield of your ball park and several around the buildings and parking lot to the southwest of your Main Building) are less than 1 square meter in size, chances of exposures to workers exceeding applicable dose guidelines are small. It is noted that the external gamma rate measurements provided in the summary are at contact with the surface and are significantly lower at the point of exposure (1 meter from the surface). There are also some drums containing thorium-rich compounds near the drainage ditch, near property which you are leasing from Metpath Incorporated. This area is presently fenced; however, the drums are in poor condition and are releasing material to the environment. Concentrations of thorium in the drums exceeded 1000 pCi/gram of thorium. While we have not identified any immediate hazard to the public or your workers associated with these drums, access to the area should be minimized at least until some additional evaluations are completed by the appropriate organizations and/or some interim steps to prevent migration of the material from the site is taken. The Nuclear Regulatory Commission should be contacted with regard to any actions associated with the thorium.

If you have any questions regarding this survey or the information provided, please contact Mr. Andrew Wallo of my staff.

Sincerely,

James J. [illegible]e, Director
Division of Facility and Site
Decommissioning Projects
Office of Nuclear Energy

Enclosure

cc:
[illegible] Engineering, New Jersey Department
[illegible] Environmental Protection
[illegible], NRC (King of Prussia)
[illegible], Army Engineer Div.,
[illegible]ie

DRAFT

## Survey Results

Guidelines applicable to FUSRAP projects are summarized in Table 1 (ref. 3). The normal background radiation levels for the northern New Jersey area are presented in Table 2. These data are provided for comparison with results presented in this section. All direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations measured in environmental samples.

### Surface Gamma Radiation Levels

Gamma radiation levels measured during a gamma scan of the surface of the property at each sample location are shown in Fig. 2. Gamma exposure rates over the vast portion of the property ranged from 7 to 13 μR/h. However, there were two locations in the ball field and 7 to 8 locations near the northern corner of the main parking lot with elevated readings. One of these small areas was outside the security fence in the parking lot, and the others were inside the plant area near the corner of the lot (Fig. 2). Soil samples were taken from these two areas and labeled TJ02B3 and TJ02B4. The two small spots located in the ball field were sampled and labeled TJ02B1 and TJ02B2. All of the elevated "spots" were less than one meter square and had scan ranges from just above background (Table 2) up to 200,000 μR/h.

### Systematic and Biased Soil Samples

Systematic and biased soil samples were taken from various locations on the property for radionuclide analyses. Locations of the systematic (TJ02S) and biased (TJ02B) samples are shown in Fig. 3, with results of laboratory analyses provided in Table 3. Concentrations of radium, thorium, and uranium in these samples ranged from 0.46-2700 pCi/g, 0.34-5.7 pCi/g, and 0.39-2.0 pCi/g, respectively. Samples having the greatest concentrations of radium and thorium were TJ02B1, TJ02B2, TJ02B3, TJ02B4, and TJ02B6, each with values for radium in excess of DOE criteria (Table 1). Samples TJ02B1A&B, TJ02B3C, and TJ02B4B were not processed, because they exceeded the counting capacity of standard environmental analytical equipment and clearly exceeded the DOE guidelines.

Table 1. Applicable guidelines for protection against radiation[a]

| Mode of exposure | Exposure conditions | Guideline value |
|---|---|---|
| Radionuclide concentrations in soil | Maximum permissible concentration of the following radionuclides in soil above background levels averaged over 100 $m^2$ area<br>$^{232}Th$<br>$^{230}Th$<br>$^{228}Ra$<br>$^{226}Ra$ | 5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface |

[a]U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites (Rev. 2, March 1987).

Table 2. Background radiation levels in the northern New Jersey area

| Type of radiation measurement or sample | Radiation level or radionuclide concentration |
|---|---|
| Gamma exposure rate at 1 m above ground surface (μR/h) | 8[a] |
| Concentration of radionuclides in soil (pCi/g) | |
| $^{232}Th$ | 0.9[b] |
| $^{238}U$ | 0.9[b] |
| $^{226}Ra$ | 0.9[b] |

[a]Reference 4.
[b]Reference 5.

Table 3. Concentrations of radionuclides in soil at Allied Bendix Aerospace Corporation, Industrial Avenue, Teterboro, New Jersey

| Sample | Location[a] | Depth (cm) | Radionuclide concentration (pCi/g) | | |
|---|---|---|---|---|---|
| | | | $^{226}Ra$[b] | $^{232}Th$[b] | $^{238}U$[c] |
| | | **Systematic samples**[d] | | | |
| TJ02S1A | 19+80, 730R | 0-15 | 0.74±0.07 | 0.83±0.09 | 0.89 |
| TJ02S1B | 19+80, 730R | 15-30 | 0.78±0.06 | 0.88±0.04 | 0.90 |
| TJ02S1C | 19+80, 730R | 30-45 | 0.80±0.04 | 0.97±0.2 | 0.76 |
| TJ02S1D | 19+80, 730R | 45-60 | 0.76±0.04 | 0.90±0.1 | 0.85 |
| | | **Biased samples**[e] | | | |
| TJ02B2[f] | 0+80, 1050R | 0-15 | 230 ±6 | 0.76±0.3 | <1.7 |
| TJ02B3A[f] | 7+80, 425R | 10-18 | 0.46±0.06 | 0.34±0.1 | 0.39 |
| TJ02B3B | 7+80, 425R | 18-30 | 860 ±20 | 0.59±0.7 | <2 |
| TJ02B4A[f] | 9+20, 445R | 0-15 | 24 ±0.6 | 0.60±0.3 | 0.47 |
| TJ02B4C | 9+20, 445R | 30-45 | 2,700 ±25 | <1.47 | <1.3 |
| TJ02B5A | 15+20, 40R | 0-15 | 1.2 ±0.09 | 0.87±0.2 | 0.83 |
| TJ02B5B | 15+20, 40R | 15-30 | 3.7 ±0.2 | 0.58±0.2 | 0.57 |
| TJ02B6A | 13+80, 275R | 0-15 | 42 ±1 | 0.90±0.2 | 0.85 |
| TJ02B6B | 13+80, 275R | 15-30 | 6.7 ±0.2 | 2.3 ±0.3 | 2.0 |
| TJ02B6C | 13+80, 275R | 30-45 | 2.1 ±0.2 | 1.7 ±0.2 | 1.5 |

[a]Locations of soil samples are shown in Fig. 3.

[b]Indicated counting error is at the 95% confidence level (±2σ).

[c]Total analytical error of measurement results is less than ±5% (95% confidence level).

[d]Systematic samples were taken at grid locations irrespective of gamma exposure.

[e]Biased samples were taken from areas shown to have elevated gamma exposure rates.

[f]Biased samples TJ02B1A&B, TJ2B3C, and TJ02B4B were not processed.

Table 4. Mass Spectroscopy for Elemental Rare Earths at Various Sites in the Teterboro and Maywood, New Jersey, Areas

| Rare Earths | Bendix Site[a] Sample Numbers | | Maywood Chemical Works Site[b] Sample Numbers | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | TJ2 B5A | TJ2 B4A | 354 | 355 | 356 | 357 | 358 | 359 | 360 | 361 | 362 | 363 |
| Ce | <5 | <5 | 1650 | 1600 | >10,000 | >10,000 | 320 | 400 | 140 | 320 | 260 | 275 |
| Dy | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Er | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Eu | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Gd | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Ho | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| La | <5 | <5 | 250 | 250 | 1725 | 1500 | 40 | 60 | 30 | 55 | 75 | 80 |
| Lu | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Nd | <5 | <5 | <5 | 350 | 2400 | 2100 | 30 | 140 | <5 | <5 | 145 | 145 |
| Pr | <5 | <5 | 70 | 80 | 550 | 520 | 20 | 20 | 10 | 20 | 20 | 25 |
| Sm | <5 | <5 | <5 | <5 | 600 | 600 | <5 | <5 | <5 | <5 | <5 | <5 |
| Tb | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Y | <5 | <5 | 10 | 8 | 55 | 30 | 5 | <5 | 10 | 10 | 10 | 10 |
| Yb | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |
| Tm | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 |

[a]Allied Bendix Aerospace Corporation, Industrial Avenue, Teterboro, New Jersey.

[b]Maywood Chemical Works, Maywood, New Jersey (unpublished data).

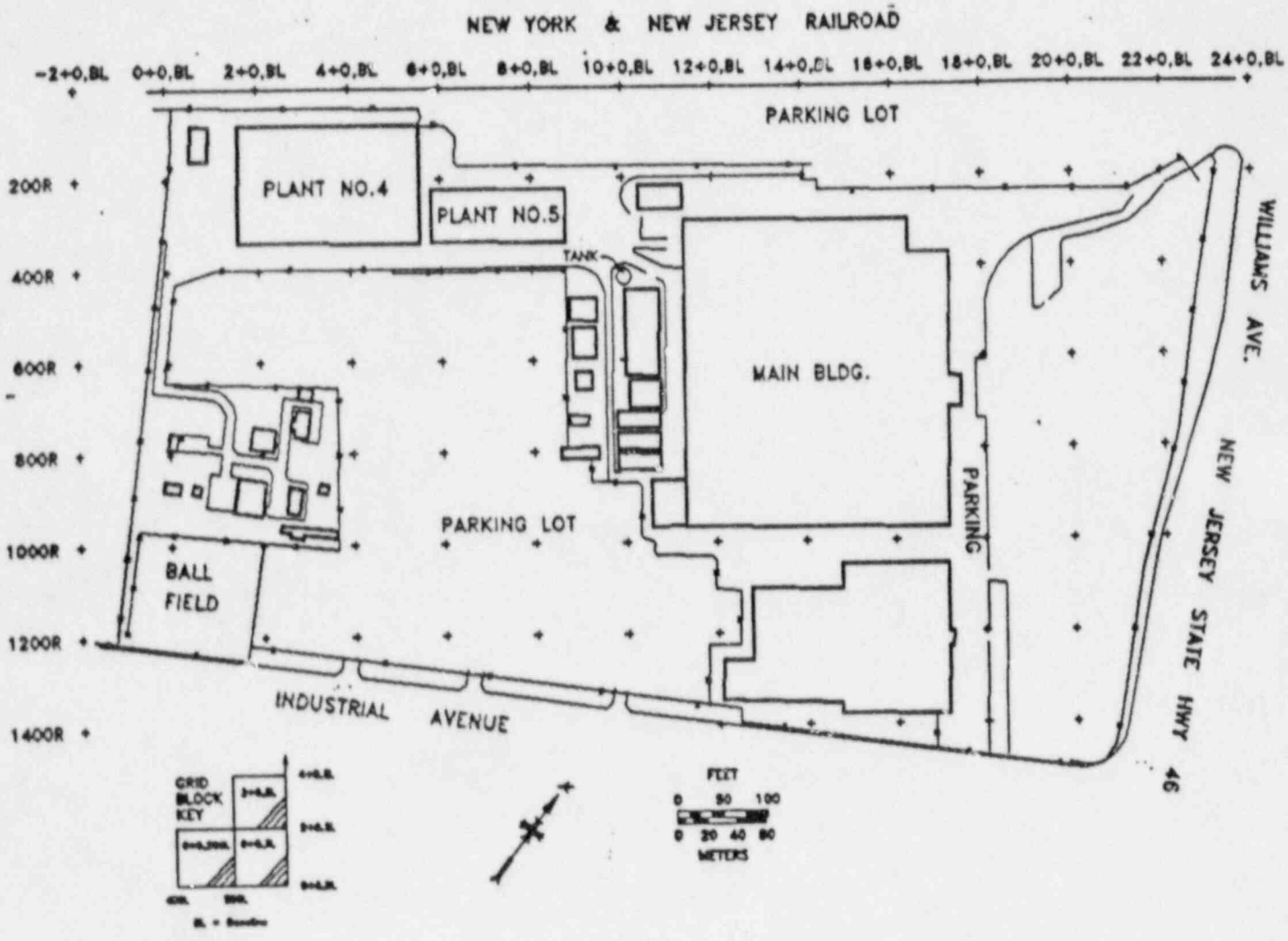



Fig. 1. Diagram showing grid lines for the property at Allied Bendix Aerospace Corporation, Industrial Avenue, Teterboro, New Jersey.

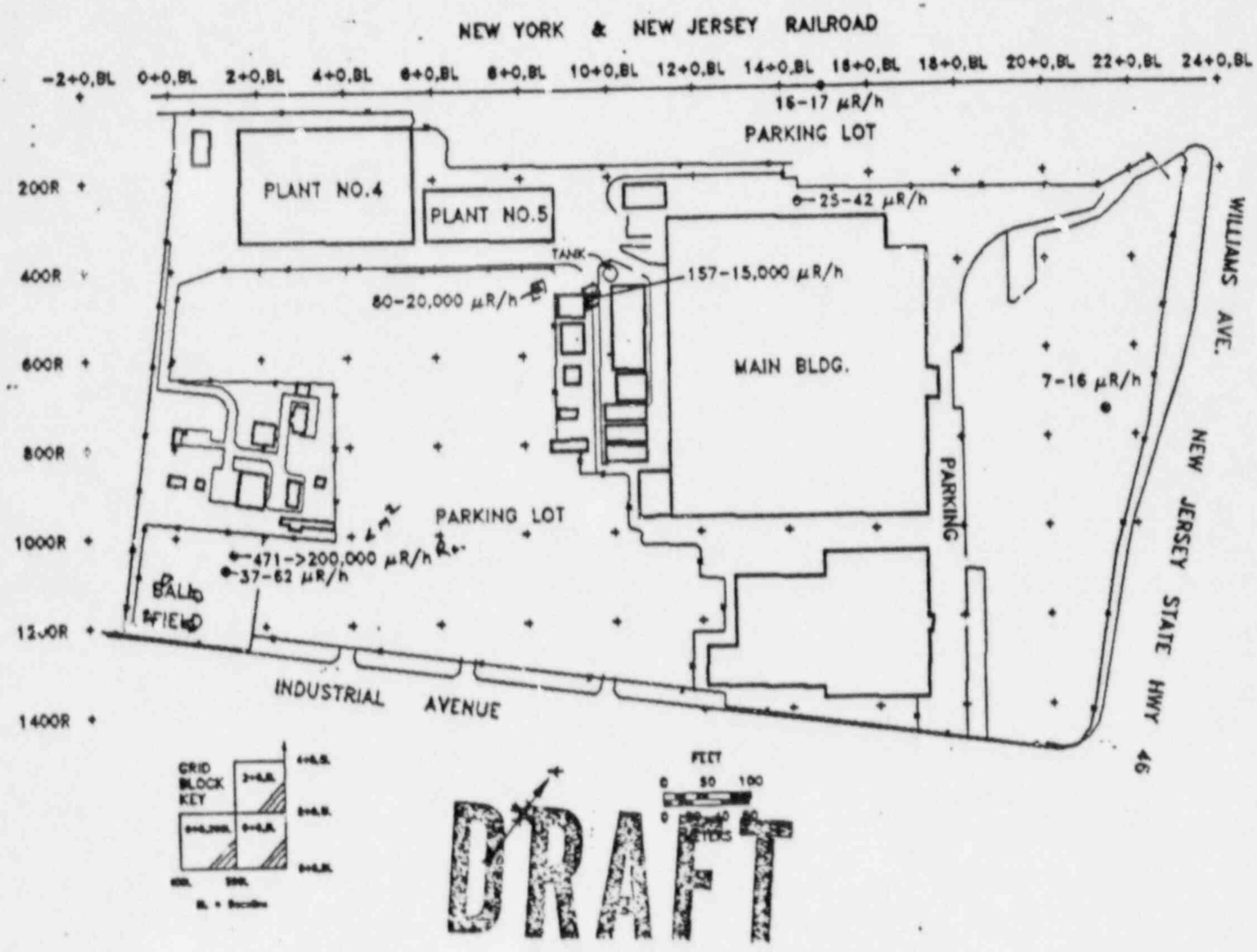



Fig. 2. Gamma radiation levels measured on the surface at Allied Bendix Aerospace Corporation, Industrial Avenue, Teterboro, New Jersey.

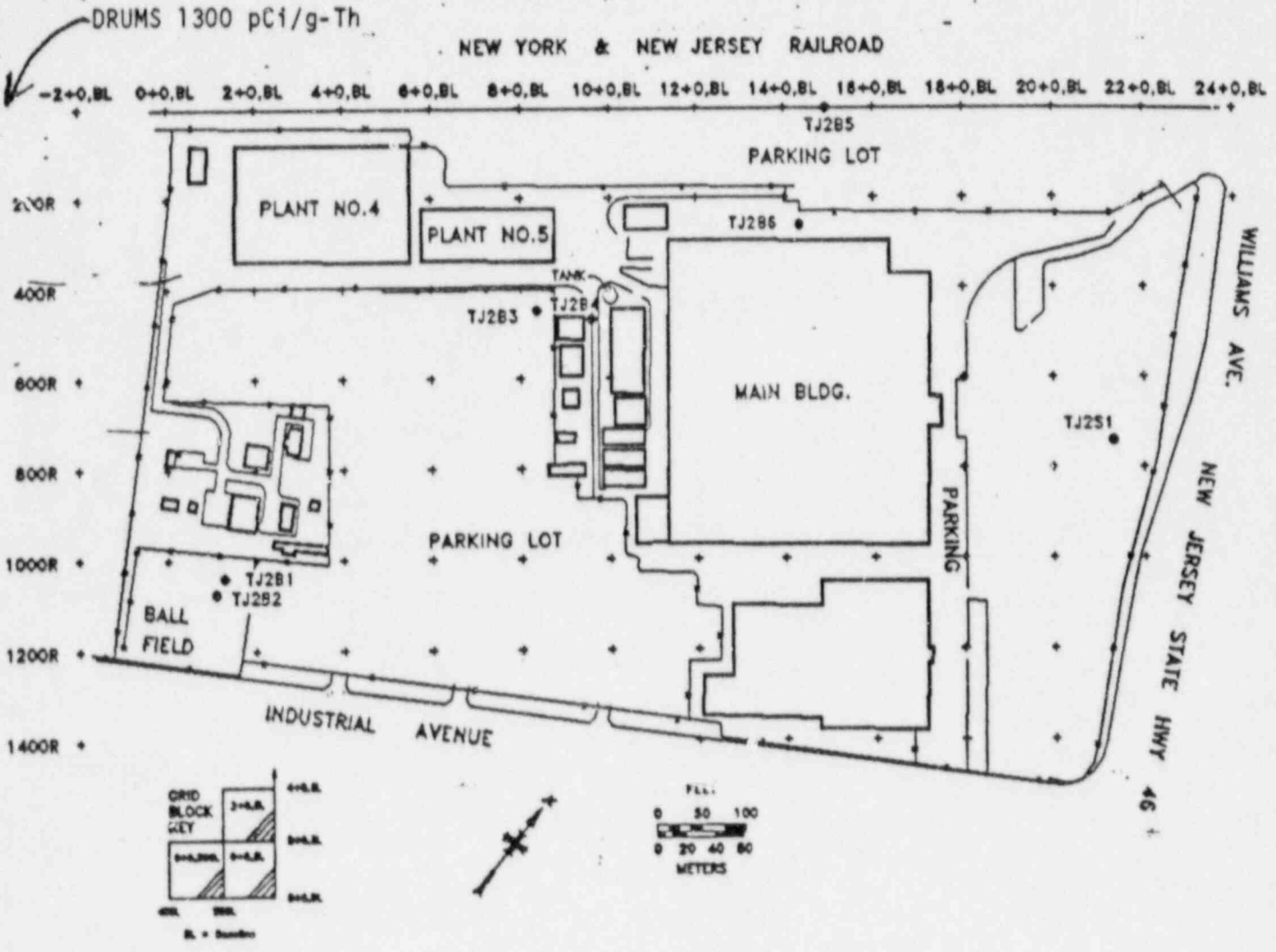



Fig. 3. Diagram showing locations of soil samples taken at Allied Bendix Aerospace Corporation, Industrial Avenue, Teterboro, New Jersey.

J. Kinneman
NRC

**Department of Energy**
Washington, DC 20545

MAR 1 1988

Mr. Lionel Menard
Metpath Inc.
1 Malcolm Avenue
Teterboro, New Jersey 07608

Dear Mr. Menard:

As you are aware, the Department of Energy (DOE) is conducting a research and development project to decontaminate the former Maywood Chemical Company site in Maywood, New Jersey, and associated vicinity properties. This effort includes surveys conducted by DOE in order to identify vicinity properties associated with the Maywood site. As a result of a wide-area scan (mobile gamma scan) conducted near your facility, some radiation anomalies were identified on your property in Teterboro and two neighboring properties owned by Sumitomo Machinery Corporation and Allied Bendix Aerospace Corporation. Radiological surveys were conducted between November 1986 and January 1988 to identify the source of these anomalies and determine if they were connected with the former Maywood Chemical Company Operations.

The residual radioactivity identified on your property by the survey was primarily due to elevated levels of thorium and radium and their associated decay products in the soil. The information collected as a result of these activities indicates that the residual radioactive material was not derived from the Maywood site. Therefore, your site will not be included in the DOE Maywood project.

It appears the thorium contamination identified on your property may be related to some past activities licensed by the Atomic Energy Commission (as a predecessor to the Nuclear Regulatory Commission), which were conducted for the Navy at a plant operated and later owned by Bendix. The source of the radium contamination is not known; however, it is similar to the type of residues we have seen that are related to radium-coated instruments, such as airplane gauges and watch dials.

As a result of these findings, we are notifying (by copy of this letter) the Nuclear Regulatory Commission, and the State of New Jersey of our findings as they have regulatory authority over the thorium and radium, respectively. I am also providing a copy of the letter to the Department of Defense because the thorium contamination may be related to the former Navy plant.

A draft preliminary summary of the survey results is enclosed for your information. Note, the gamma exposure rate measurements provided with this data are contact measurements. Levels at the point of exposure, 1 meter,

will probably be lower. A survey report documenting the results of the survey will be provided to you in the next few months. As the results indicate, a portion of your property may contain residual material above guidelines used by DOE to determine if a property needs remedial action; however, as noted above, these guidelines do not apply to your property. Based on the measurements taken and the location of the contamination on your property, it does not appear that your workers are being exposed to radiation levels in excess of dose guidelines. As a result, the contamination does not appear to represent an immediate hazard to workers.

However, until further evaluation is completed by you or other organizations, as appropriate, we recommend you minimize use of the contaminated areas, particularly the area near the drainage ditch in the northeast corner of your property. This area is presently fenced; however, there are several exposed drums containing thorium rich compounds at this location. The drums are in poor condition and are releasing material to the environment. Concentrations of thorium in the drums exceeded 1000 pCi/gram of thorium. We have completed a spectrochemical analysis of the contents of the drum, which will be provided with the survey report. While we have not identified any immediate hazard to the public or your workers associated with these drums, you may wish to take some interim steps to prevent migration of the material from the site. The Nuclear Regulatory Commission should be contacted with regard to any actions associated with the thorium.

If you have any questions regarding this survey or the information provided, please contact Mr. Andrew Wallo of my staff.

Sincerely,

J. Fiore

James J. Fiore, Director
Division of Facility and Site
Decommissioning Projects
Office of Nuclear Energy

Enclosure

cc:
J. Eng, New Jersey Department
of Environmental Protection
J. Kinneman, NRC (King of Prussia)
R. Nore, U.S. Army Engineer Div.,
Huntsville
D. J. Bardin, Arent Fox

## Survey Results

Guidelines applicable to FUSRAP projects are summarized in Table 1 (ref. 3). The normal background radiation levels for the northern New Jersey area are presented in Table 2. These data are provided for comparison with results presented in this section. All direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations measured in environmental samples.

### Surface Gamma Radiation Levels

Gamma radiation levels measured at each sample location are shown in Fig. 2. Gamma exposure rates over the major portion of the property ranged from 9 to 18 μR/h, with a maximum of 28 μR/h in two areas of less than 0.1 $m^2$ each. The highest measurements were in the northern corner of the property. Most gamma readings were near normal background for the northern New Jersey area (Table 2). Some slightly elevated gamma levels were detected in certain areas of the parking lot. These elevated measurements originated from a particular type of asphalt used in both paving and patching various sections of the parking lot. This type of asphalt has been used in other locations in the Maywood area, where it was also found to have elevated gamma levels. Based on asphalt sampling of a property in one of these other areas, the fill aggregate is thought to contain slightly elevated, naturally occuring radionuclides.

### Systematic Soil Samples

Systematic soil samples were taken from various locations on the property for radionuclide analyses. Locations of these samples (TJ03S) are shown in Fig. 3, with results of laboratory analyses provided in Table 3. Concentrations of radium, thorium, and uranium in these samples ranged from 0.33-77 pCi/g, 0.39-31 pCi/g, and 0.38-1.0 pCi/g, respectively. Areas of greatest concentrations for radium and thorium were in samples TJ03S8 and TJ03S9, with values of 28-77 pCi/g for radium in TJ03S8 and 12-31 pCi/g for thorium in TJ03S9, both in excess of DOE criteria (Table 1). All readings for uranium were near or below natural background levels for the area (Table 2).

Table 1. Applicable guidelines for protection against radiation[a]

| Mode of exposure | Exposure conditions | Guideline value |
|---|---|---|
| Radionuclide concentrations in soil | Maximum permissible concentration of the following radionuclides in soil above background levels averaged over 100 $m^2$ area<br>$^{232}Th$<br>$^{230}Th$<br>$^{228}Ra$<br>$^{226}Ra$ | 5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface |

[a]U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites (Rev. 2, March 1987).

Table 2. Background radiation levels in the northern New Jersey area

| Type of radiation measurement or sample | Radiation level or radionuclide concentration |
|---|---|
| Gamma exposure rate at 1 m above ground surface (μR/h) | 8[a] |
| Concentration of radionuclides in soil (pCi/g) | |
| $^{232}Th$ | 0.9[b] |
| $^{238}U$ | 0.9[b] |
| $^{226}Ra$ | 0.9[b] |

[a]Reference 5.
[b]Reference 6.

Table 3. Concentrations of radionuclides in soil at Metpath Incorporated, 1 Malcolm Avenue, Teterboro, New Jersey

| Sample | Location[a] | Depth (cm) | Radionuclide concentration (pCi/g) | | |
|---|---|---|---|---|---|
| | | | $^{226}Ra$[b] | $^{232}Th$[b] | $^{238}U$[c] |
| | | Systematic samples[d] | | | |
| TJ03S1A | 11+18, 55L | 0-15 | 0.46±0.06 | 2.5 ±0.2 | 0.55 |
| TJ03S1B | 11+18, 55L | 15-30 | 0.53±0.08 | 1.1 ±0.2 | 0.43 |
| TJ03S1C | 11+18, 55L | 30-45 | 0.56±0.06 | 0.95±0.2 | 0.61 |
| TJ03S2A | 11+41, 618L | 0-15 | 0.58±0.07 | 0.65±0.08 | 0.88 |
| TJ03S2B | 11+41, 618L | 15-30 | 0.46±0.05 | 0.50±0.1 | 0.40 |
| TJ03S2C | 11+41, 618L | 30-45 | 0.56±0.09 | 0.55±0.09 | 0.81 |
| TJ03S2D | 11+41, 618L | 45-60 | 0.44±0.04 | 0.49±0.09 | 0.54 |
| TJ03S2E | 11+41, 618L | 60-75 | 0.50±0.08 | 0.60±0.06 | 0.52 |
| TJ03S2F | 11+41, 618L | 75-90 | 0.56±0.02 | 0.64±0.04 | 0.53 |
| TJ03S3A | 5+46, 555L | 0-15 | 0.70±0.07 | 0.75±0.26 | 0.56 |
| TJ03S3B | 5+46, 555L | 15-30 | 0.33±0.2 | 1.9 ±0.3 | 0.46 |
| TJ03S4A | 5+05, 736L | 0-15 | 0.66±0.1 | 0.61±0.2 | 0.75 |
| TJ03S4B | 5+05, 736L | 15-30 | 0.61±0.03 | 0.63±0.1 | 0.48 |
| TJ03S4C | 5+05, 736L | 30-45 | 0.55±0.04 | 0.59±0.08 | 0.41 |
| TJ03S5A | 8+14, 773L | 0-15 | 0.58±0.05 | 0.49±0.1 | 0.55 |
| TJ03S5B | 8+14, 773L | 15-30 | 0.51±0.05 | 0.39±0.07 | 0.39 |
| TJ03S6A | 0+85, 209L | 0-15 | 0.77±0.07 | 0.78±0.09 | 0.86 |
| TJ03S6B | 0+85, 209L | 15-30 | 0.75±0.05 | 0.82±0.2 | 0.84 |
| TJ03S6C | 0+85, 209L | 30-45 | 0.74±0.08 | 0.77±0.1 | 0.83 |
| TJ03S6D | 0+85, 209L | 45-75 | 0.68±0.04 | 0.78±0.08 | 0.72 |
| TJ03S7A | 1+64, 709L | 0-15 | 0.71±0.06 | 0.69±0.1 | 0.93 |
| TJ03S7B | 1+64, 709L | 15-30 | 0.65±0.1 | 0.69±0.2 | 0.99 |
| TJ03S7C | 1+64, 709L | 30-45 | 0.72±0.05 | 0.75±0.1 | 0.88 |
| TJ03S7D | 1+64, 709L | 45-60 | 0.45±0.08 | 0.66±0.2 | 0.47 |
| TJ03S8A | 11+46, 677L | 0-15 | 77 ±3 | 0.42±0.2 | 0.39 |
| TJ03S8B | 11+46, 677L | 15-30 | 28 ±0.9 | 0.52±0.2 | 0.38 |
| TJ03S9A | 10+00, 800L | 0-15 | 1.3 ±0.3 | 31 ±2.4 | 0.83 |
| TJ03S9B | 10+00, 800L | 15-30 | 1.1 ±0.3 | 12 ±1.5 | 1.0 |

[a]Locations of soil samples are shown on Fig. 3.

[b]Indicated counting error is at the 95% confidence level (±2$\sigma$).

[c]Total analytical error of measurement results is less than ±5% (95% confidence level).

[d]Systematic samples were taken at grid locations irrespective of gamma exposure.

TJ01B

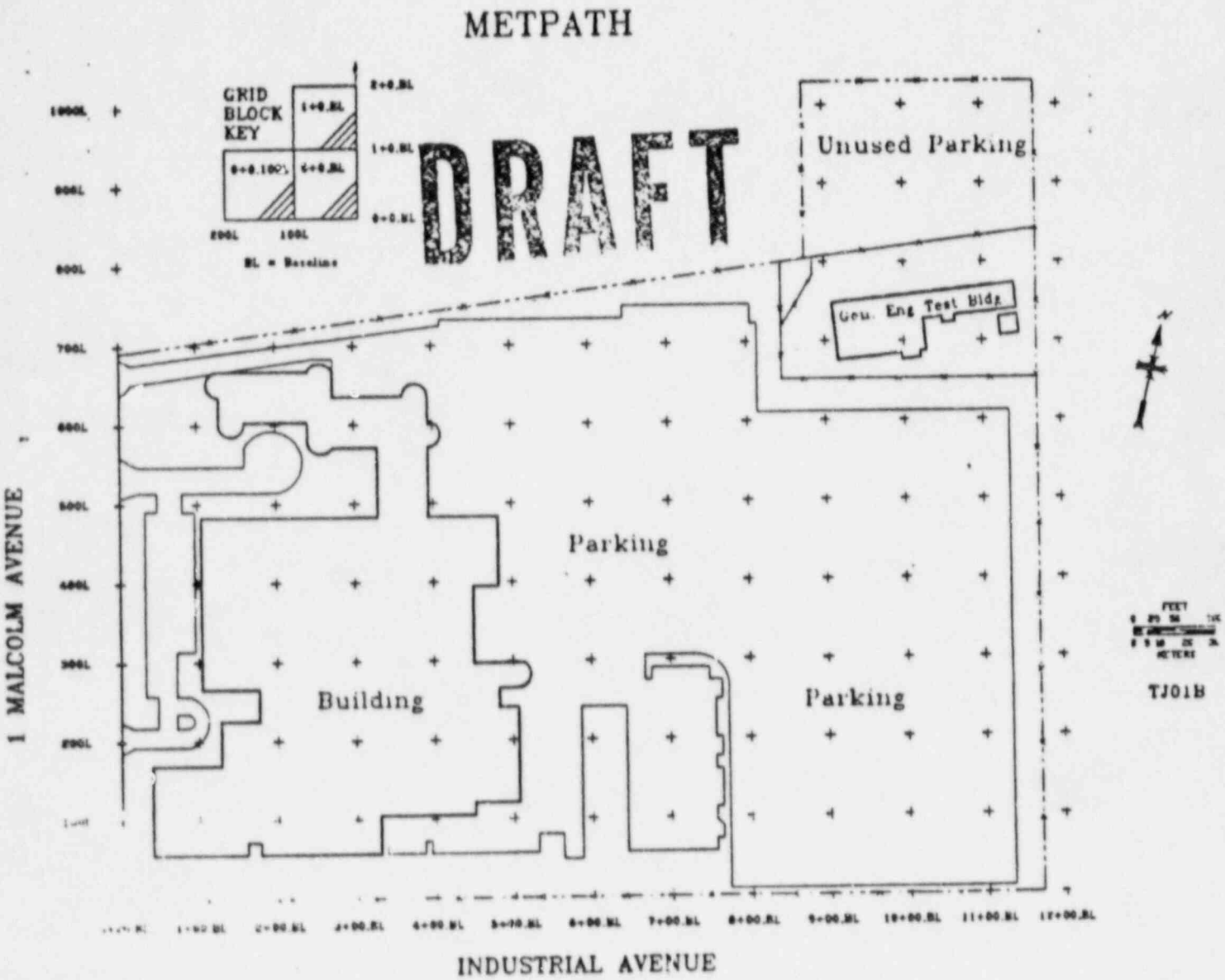



Fig. 1. Diagram showing grid lines for the property at Metpath Incorporated, 1 Malcolm Avenue, Teterboro, New Jersey.

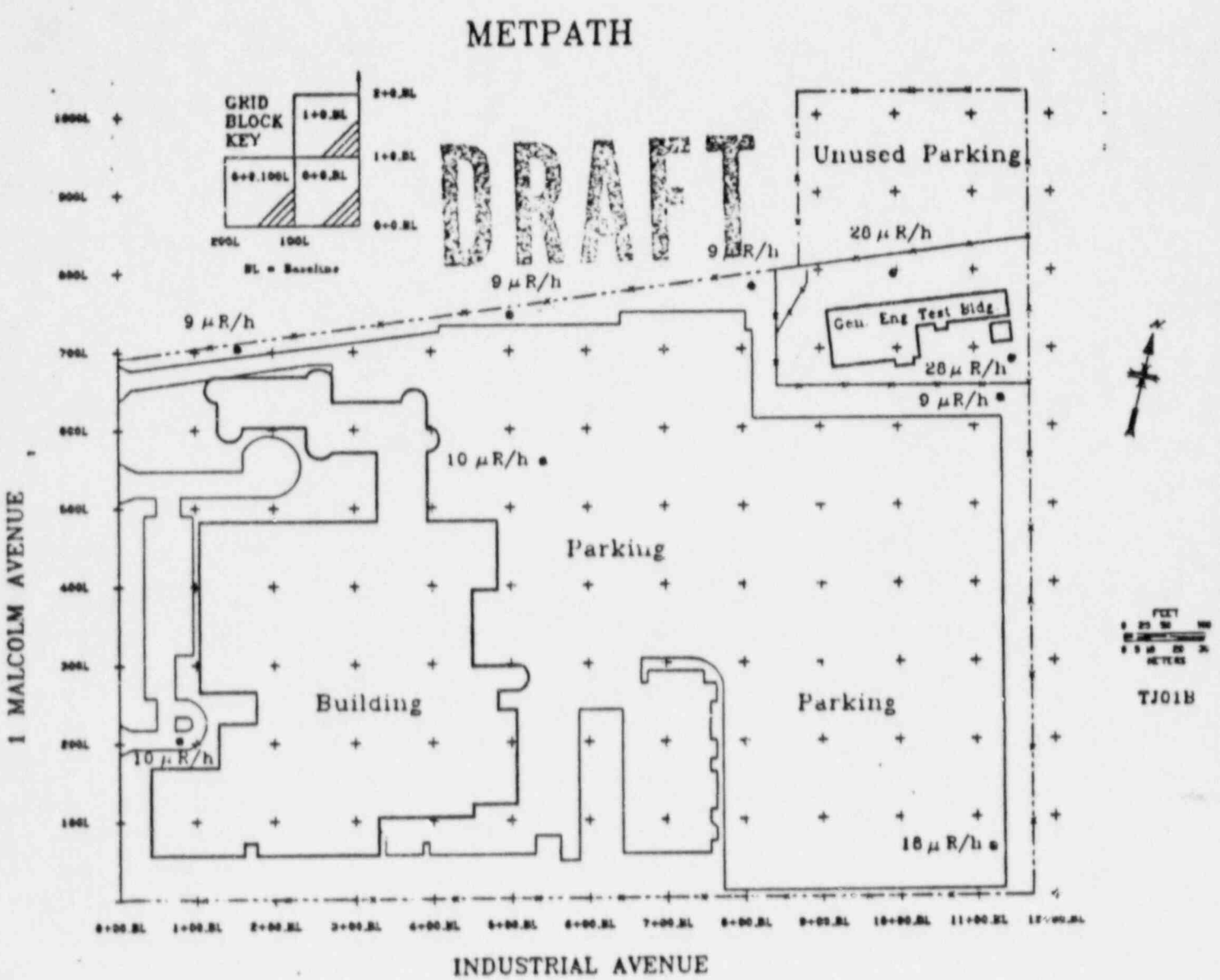



Fig. 2. Gamma radiation levels measured on the surface at Metpath Incorporated, 1 Malcolm Avenue, Teterboro, New Jersey.

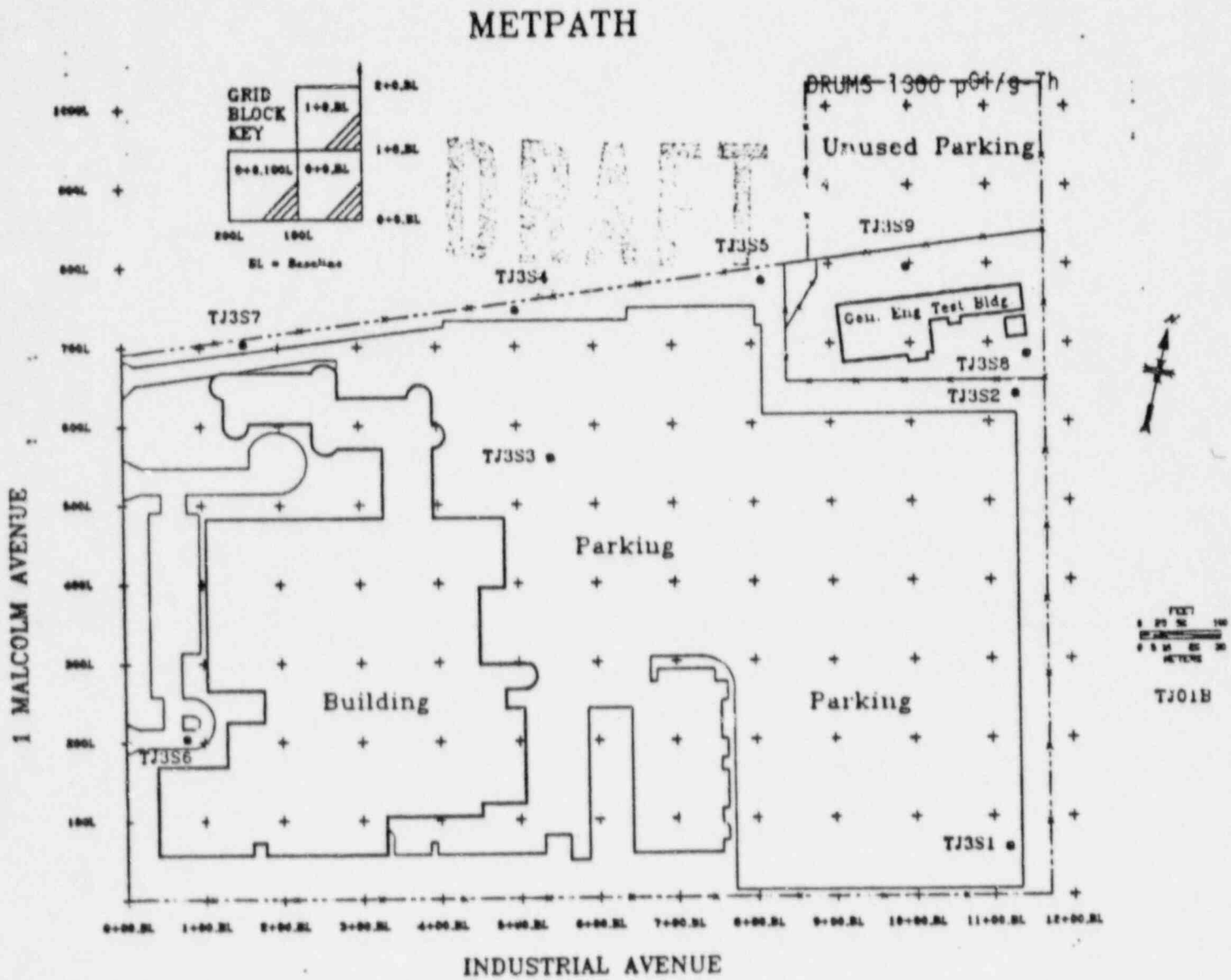



Fig. 3. Diagram showing locations of soil samples taken at Metpath Incorporated, 1 Malcolm Avenue, Teterboro, New Jersey.

J. Kinneman, NRC

**Department of Energy**
Washington, DC 20545

MAR 1 1988

Mr. William M. Lechler
Executive Vice President
Sumitomo Machinery Corporation
7 Malcolm Avenue
Teterboro, New Jersey 07608

Dear Mr. Lechler:

As you are aware, the Department of Energy (DOE) is conducting a research and development program to decontaminate the former Maywood Chemical Company site in Maywood, New Jersey, and associated vicinity properties. This effort includes surveys conducted by DOE in order to identify vicinity properties associated with the Maywood site. As a result of a wide area scan (mobile gamma scan) conducted near your facility, some radiation anomalies were identified on your property in Teterboro and two neighboring properties owned by Metpath Incorporated and Allied Bendix Aerospace Corporation. Radiological surveys were conducted between November 1986 and January 1988 to identify the source of these anomalies and determine if they were connected with the former Maywood Chemical Company Operations.

The residual radioactivity identified on your property by the survey was primarily due to elevated levels of thorium and radium and their associated decay products in the soil. The information collected as a result of these activities indicates that the residual radioactive material was not derived from the Maywood site. Therefore, your site will not be included in the Maywood project.

It appears the thorium contamination identified on your property may be related to some past activities licensed by the Atomic Energy Commission (as a predecessor to the Nuclear Regulatory Commission), which were conducted for the Navy at a plant operated and later owned by Bendix. The source of the radium contamination is not known; however, it is similar to the type of residues we have seen that are related to radium-coated instruments, such as airplane gauges and watch dials.

As a result of these findings, we are notifying (by copy of this letter) the Nuclear Regulatory Commission, and the State of New Jersey of our findings, as each has regulatory authority over the thorium and radium, respectively. I am also providing a copy of the letter to the Department of Defense because the thorium contamination may be related to the former Navy plant.

A draft preliminary summary of the survey results is enclosed for your information. A survey report documenting the results of the survey will be provided to you in the next few months. As the results indicate, a

significant portion of your property may be contaminated above guidelines used by DOE to determine if a property needs remedial action; however, as noted above, these guidelines do not apply to your property. Based on the external gamma measurements taken at one meter from the ground and the location of the contamination on your property, it does not appear that your workers are being exposed to radiation levels in excess of guidelines. As a result, the contamination does not appear to represent an immediate hazard to workers or the public. However, until further evaluation is completed by you or other organizations, as appropriate, we recommend you minimize use of the contaminated areas, particularly the area near the drainage ditch and the southeast corner of your property.

If you have any questions regarding this survey or the information provided, please contact Mr. Andrew Wallo of my staff.

Sincerely,

James O. Fiore, Director
Division of Facility and Site
Decommissioning Projects
Office of Nuclear Energy

Enclosure

cc:
J. Eng, New Jersey Department
of Environmental Protection
J. Kinneman, NRC (King of Prussia)
R. Nure, U.S. Army Engineer Div.,
Huntsville

## Survey Results

Guidelines applicable to FUSRAP projects are summarized in Table 1 (ref. 3). The normal background radiation levels for the northern New Jersey area are presented in Table 2. These data are provided for comparison with results presented in this section. All direct measurement results presented in this report are gross readings; background radiation levels have not been subtracted. Similarly, background concentrations have not been subtracted from radionuclide concentrations measured in environmental samples.

### Surface Gamma Radiation Levels

Gamma exposure rates at about 1 meter from the surface are shown in Table 3A. These rates vary from 6 to 30 uR/h and, over most of the site, were in a range typical of background levels. Gamma radiation levels at the ground surface, measured during a gamma scan of the surface of the property, are shown in Fig. 2 and detailed in Table 3. As with the measurements at 1 meter, gamma exposure rates over the major portion of the property were typical of or near background and ranged from 7 to 12 uR/h. However, gamma levels on significant portions of the property read a few hundred uR/h, with two areas reading upwards of 1260 uR/h. One of these areas covered the eastern corner of the property; the other area was located on the bank of a ditch running along the western side of the building. Both of these areas are indicated by crosshatching in Fig. 2. Other gamma readings along this bank ranged from 10-314 uR/h, with the greatest concentration of elevated readings existing between grid lines 2+00, 200L and 7+00, 300L. The paved sections used for loading docks on the north side of the building had several spots of elevated gamma. The source was either in the asphalt or under it. No samples were taken from this asphalt area.

Systematic and Biased Soil Samples

Systematic and biased soil samples were taken from various locations on the property for radionuclide analyses. Locations of the systematic (TJ01S) and biased (TJ01B) samples are shown in Fig. 3, with results of laboratory analyses provided in Table 4. Concentrations of radium, thorium, and uranium in the systematic samples ranged from 0.66-22 pCi/g, 0.41-5.2 pCi/g, and 0.36-3.6 pCi/g, respectively. Areas of greatest concentrations for radium and thorium in the systematic samples were in locations TJ01S6 and TJ01S21; both were above DOE guidelines (Table 1). Areas with elevated concentrations of radionuclides existed mostly along the banks of the ditch and in the eastern corner of the property. Concentrations of radium, thorium, and uranium in the biased samples ranged from 0.76-1000 pCi/g, 0.68-270 pCi/g, and 0.66-4.6 pCi/g, respectively. Areas of greatest concentrations for radium and thorium in the biased samples were again mostly in locations from along the banks of the ditch (TJ01B1-3,5-7,10 and 11) and in the eastern corner of the property (TJ01B8 and 9), except for TJ01B4 on the southeastern side of the building with a concentration of 42 pCi/g for radium (Fig. 3). Most of the uranium levels were within normal background levels for the northern New Jersey area (Table 2). Concentrations of radium and thorium in the biased samples generally exceed the DOE guidelines for soil (Table 1). Portions of samples TJ01B7 and TJ01B10 were not processed because they exceeded the counting capacity of standard analytical equipment and clearly exceeded the environmental guidelines.

Table 1. Applicable guidelines for protection against radiation[a]

| Mode of exposure | Exposure conditions | Guideline value |
|---|---|---|
| Radionuclide concentrations in soil | Maximum permissible concentration of the following radionuclides in soil above background levels averaged over 100 $m^2$ area<br>$^{232}Th$<br>$^{230}Th$<br>$^{228}Ra$<br>$^{226}Ra$ | 5 pCi/g averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over 15-cm thick soil layers more than 15 cm below the surface |

[a]U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites (Rev. 2, March 1987).

Table 2. Background radiation levels for the northern New Jersey area

| Type of radiation measurement or sample | Radiation level or radionuclide concentration |
|---|---|
| Gamma exposure rate at 1 m above ground surface (μR/h) | 8[a] |
| Concentration of radionuclides in soil (pCi/g) | |
| $^{232}Th$ | 0.9[b] |
| $^{238}U$ | 0.9[b] |
| $^{226}Ra$ | 0.9[b] |

[a]Reference 4.
[b]Reference 5.

| Grid Location | Gamma exposure rate (uR/h) Surface | 1 Meter |
|---|---|---|
| 0+00, 100L | 7 | 8 |
| 1+00, 100L | 7 | 9 |
| 2+00, 100L | 7 | 6 |
| 2+50, 100L | 8 | 8 |
| 3+00, 100L | 10 | 9 |
| 4+00, 60L | 11 | 10 |
| 5+00, 60L | 6 | 6 |
| 6+00, 14L | 6 | 6 |
| 6+00, 100L | 5 | 6 |
| 6+00, 200L | 5 | 8 |
| 6+00, 300L | 7 | 9 |
| 6+00, 350L | 16 | 13 |
| 7+00, 14L | 6 | 6 |
| 7+00, 100L | 7 | 8 |
| 7+00, 200L | 10 | 9 |
| 7+00, 300L | 8 | 10 |
| 7+00, 345L | 9 | 10 |
| 8+00, 14L | 30 | 30 |
| 8+00, 100L | 8 | 8 |
| 8+00, 200L | 8 | 9 |
| 8+00, 300L | 10 | 10 |
| 8+00, 345L | 9 | 9 |
| 8+20, 300L | 10 | 10 |
| 8+20, 345L | 10 | 9 |
| 8+70, 14L | 11 | 11 |
| 8+70, 100L | 9 | 8 |
| 8+70, 150L | 8 | 9 |
| 8+70, 200L | 9 | 6 |
| 8+90, 200L | 8 | 9 |

Surface and 1 meter measurements taken on the Sumitomo property in Teterboro, N.J. November, 1986.

February 26, 1988

TABLE 3a DRAFT

Table 3. Measurement results at Sumitomo Corporation, 7 Malcolm Avenue, Teterboro, New Jersey

| Grid location[a] | Gamma exposure rate at the surface μR/h) | Gamma exposure rate range for scan of grid block[b] (μR/h) |
|---|---|---|
| 0+00, BL | 9 | 5-10 |
| 0+50, 50L | 7 | |
| 0+00, 100L | 7 | 7-37 |
| 0+33, 160L | 37 | |
| 0+50, 150L | 8 | |
| 0+00, 200L | | 10-12 |
| 0+50, 250L | 9 | |
| 0+00, 300L | 11 | 9-11 |
| 0+50, 350L | 9 | |
| 1+00, BL | 7 | 5-10 |
| 1+50, 60L | 7 | |
| 1+00, 100L | 7 | 6-190 |
| 1+00, 170L | 20 | |
| 1+50, 150L | 15 | |
| 1+00, 200L | | 9-12 |
| 1+50, 250L | 9 | |
| 1+00, 300L | 9 | 9-10 |
| 1+50, 350L | 9 | |
| 2+00, BL | 7 | 5-12 |
| 2+39, 52L | 7 | |
| 2+00, 100L | 7 | 7-62 |
| 2+37, 164L | 10 | |
| 2+00, 200L | 9 | 9-125 |
| 2+30, 230L | 126 | |
| 2+40, 275L | 10 | |
| 2+50, 250L | 11 | |
| 2+00, 300L | | 10-12 |
| 2+60, 350L | 11 | |
| 3+00, BL | 7 | 7-22 |
| 3+50, 50L | 11 | |
| 3+94, 57L | 22 | |
| 3+00, 100L | 10 | 7-12 |
| 3+15, 115L | 12 | |
| 3+00, 200L | 12 | 11-314 |
| 3+50, 250L | 12 | |
| 3+56, 225L | 50 | |
| 3+98, 277L | 314 | |
| 3+00, 300L | | 5-11 |
| 3+55, 360L | 10 | |
| 4+00, BL | 7 | 7-11 |
| 4+50, 55L | 10 | |
| 4+00, 200L | 12 | 9-1260 |
| 4+20, 265L | 27 | |
| 4+37, 270L | 15 | |
| 4+00, 300L | | 10-60 |
| 4+50, 360L | 11 | |
| 4+85, 350L | 63 | |

Table 3. (Continued)

| Grid location[a] | Gamma exposure rate at the surface (μR/h) | Gamma exposure rate range for scan of grid block[b] (μR/h) |
|---|---|---|
| 5+00, BL | 7 | 5-10 |
| 5+50, 50L | 6 | |
| 5+00, 100L | | 5-9 |
| 5+50, 150L | 7 | |
| 5+00, 200L | | 5-9 |
| 5+00, 300L | 18 | 7-1260 |
| 5+45, 345L | 11 | |
| 5+99, 351L | 1260 | |
| 6+00, BL | 7 | 5-10 |
| 6+50, 88L | 7 | |
| 6+00, 100L | 5 | 5-12 |
| 6+50, 148L | 8 | |
| 6+00, 200L | 5 | 6-390 |
| 6+00, 300L | 7 | 7-314 |
| 6+10, 327L | 314 | |
| 6+50, 350L | 10 | |
| 7+00, BL | 7 | 5->1260 |
| 7+70, 68L | 9 | |
| 7+88, 10L | 0 | |
| 7+90, 17L | 0 | |
| 7+00, 100L | 7 | 5-63 |
| 7+04, 170L | 63 | |
| 7+50, 150L | 11 | |
| 7+00, 200L | 10 | 7-25 |
| 7+50, 250L | 11 | |
| 7+70, 285L | 25 | |
| 7+00, 300L | 8 | 6-314 |
| 7+10, 304L | 314 | |
| 7+50, 345L | 9 | |
| 8+00, BL | 35 | 6->1260 |
| 8+38, 15L | 55 | |
| 8+52, 33L | >1260 | |
| 8+50, 50L | 11 | |
| 8+00, 100L | 8 | 5-12 |
| 8+50, 150L | 9 | |
| 8+00, 200L | 8 | 7-12 |
| 8+55, 250L | 7 | |
| 8+00, 300L | 10 | 7-24 |
| 8+20, 300L | 25 | |
| 8+50, 350L | 9 | |
| 8+00, 400L | 8 | |



[a]Grid location shown on Fig. 1.

[b]These figures are grid block measurements which are obtained by a gamma scan of the entire block.

Table 4. Concentrations of radionuclides in soil at Sumitomo Corporation, 7 Malcolm Avenue, Teterboro, New Jersey

| Sample | Location[a] | Depth (cm) | Radionuclide concentration (pCi/g) | | |
|---|---|---|---|---|---|
| | | | $^{226}Ra$[b] | $^{232}Th$[b] | $^{238}U$[c] |
| | | Systematic samples[d] | | | |
| TJ01S1 | 0+50, 50L | 0-15 | 0.88±0.02 | 0.85±0.1 | 1.5 |
| TJ01S2 | 0+50, 150L | 0-15 | 0.94±0.04 | 1.1 ±0.09 | 0.98 |
| TJ01S3 | 0+50, 250L | 0-15 | 0.90±0.1 | 0.80±0.02 | 0.84 |
| TJ01S4 | 0+50, 350L | 0-15 | 0.97±0.06 | 0.70±0.03 | 0.98 |
| TJ01S5 | 1+50, 60L | 0-15 | 1.0 ±0.03 | 0.94±0.1 | 0.84 |
| TJ01S6A | 1+50, 150L | 0-15 | 2.8 ±0.07 | 2.5 ±0.03 | 0.78 |
| TJ01S6B | 1+50, 150L | 15-30 | 5.2 ±0.09 | 5.1 ±0.08 | 1.1 |
| TJ01S6C | 1+50, 150L | 30-60 | 11 ±0.4 | 5.1 ±0.6 | 0.64 |
| TJ01S7A | 1+50, 250L | 0-15 | 0.66±0.04 | 0.53±0.02 | 0.72 |
| TJ01S7B | 1+50, 250L | 45-60 | 0.77±0.1 | 0.90±0.02 | 0.84 |
| TJ01S8A | 2+40, 275L | 0-15 | 1.5 ±0.03 | 0.95±0.03 | 0.99 |
| TJ01S8B | 2+40, 275L | 45-60 | 0.94±0.07 | 0.84±0.02 | 1.7 |
| TJ01S9 | 1+50, 350L | 0-15 | 1.3 ±0.04 | 0.87±0.02 | 2.3 |
| TJ01S10A | 2+60, 350L | 0-15 | [illegible] | 0.89±0.1 | 1.5 |
| TJ01S10B | 2+60, 350L | 15-30 | 2.1 ±0.05 | 0.90±0.02 | 1.6 |
| TJ01S10C | 2+60, 350L | 45-60 | 1.4 ±0.03 | 0.90±0.02 | 1.5 |
| TJ01S11 | 3+55, 360L | 0-15 | 0.91±0.1 | 0.84±0.03 | 1.1 |
| TJ01S12A | 4+50, 360L | 0-15 | 2.4 ±0.06 | 0.88±0.03 | 3.6 |
| TJ01S12B | 4+50, 360L | 30-45 | 3.6 ±0.1 | 0.85±0.3 | 3.1 |
| TJ01S13A | 5+45, 345L | 0-15 | 9.2 ±0.2 | 0.86±0.2 | 0.94 |
| TJ01S13B | 5+45, 345L | 15-30 | 3.7 ±0.03 | 0.79±0.3 | 2.5 |
| TJ01S14 | 3+50, 50L | 0-15 | 0.78±0.06 | 0.61±0.6 | 0.62 |
| TJ01S15 | 2+39, 52L | 0-15 | 0.95±0.07 | 0.66±0.09 | 0.79 |
| TJ01S16 | 2+37, 164L | 0-15 | 0.82±0.09 | 0.76±0.2 | 0.95 |
| TJ01S17 | 2+50, 250L | 0-15 | 2.1 ±0.08 | 1.5 ±0.3 | 0.81 |
| TJ01S18A | 4+37, 270L | 0-15 | 4.8 ±0.2 | 0.86±0.3 | 0.76 |
| TJ01S18B | 4+37, 270L | 15-30 | 7.0 ±0.1 | 0.91±0.4 | 0.82 |
| TJ01S19 | 4+50, 55L | 0-15 | 0.73±0.05 | 0.68±0.04 | 0.54 |
| TJ01S20 | 3+15, 115L | 0-15 | 0.73±0.08 | 0.64±0.2 | 0.67 |
| TJ01S21A | 3+50, 250L | 0-15 | 1.5 ±0.03 | 0.83±0.2 | 0.76 |
| TJ01S21B | 3+50, 250L | 15-30 | 7.2 ±0.1 | 2.2 ±0.7 | 0.79 |
| TJ01S21C | 3+50, 250L | 45-60 | 22 ±0.7 | 5.2 ±0.4 | 0.59 |
| TJ01S22 | 5+55, 50L | 0-15 | 0.72±0.09 | 0.68±0.2 | 0.62 |
| TJ01S23 | 5+50, 150L | 0-15 | 0.68±0.09 | 0.59±0.2 | 0.83 |
| TJ01S24 | 7+70, 68L | 0-15 | 2.0 ±0.06 | 0.82±0.1 | 0.76 |
| TJ01S25 | 6+50, 88L | 0-15 | 1.3 ±0.08 | 0.80±0.08 | 0.84 |
| TJ01S26 | 6+50, 148L | 0-15 | 1.3 ±0.1 | 0.81±0.09 | 0.74 |
| TJ01S27 | 6+50, 350L | 0-15 | 2.3 ±0.1 | 0.73±0.2 | 0.92 |
| TJ01S28 | 8+50, 50L | 0-15 | 3.5 ±0.2 | 0.82±0.2 | 0.54 |
| TJ01S29 | 8+50, 150L | 0-15 | 1.3 ±0.06 | 0.54±0.2 | 0.55 |
| TJ01S30 | 8+50, 250L | 0-15 | 0.86±0.07 | 0.41±0.1 | 0.36 |
| TJ01S31 | 8+50, 350L | 0-15 | 0.98±0.05 | 0.41±0.2 | 0.38 |

Table 4. (Continued)

| Sample | Location[a] | Depth (cm) | Radionuclide concentration (pCi/g) $^{226}Ra$[b] | $^{232}Th$[b] | $^{238}U$[c] |
|---|---|---|---|---|---|
| TJ01S32A | 7+50, 150L | 0-15 | 1.5 ±0.03 | 1.1 ±0.09 | 0.93 |
| TJ01S32B | 7+50, 150L | 15-30 | 1.7 ±0.06 | 1.1 ±0.1 | 0.98 |
| TJ01S32C | 7+50, 150L | 30-45 | 1.2 ±0.07 | 0.86±0.1 | 0.70 |
| TJ01S33A | 7+50, 250L | 0-15 | 1.6 ±0.04 | 1.4 ±0.1 | 0.73 |
| TJ01S33B | 7+50, 250L | 15-30 | 1.5 ±0.06 | 1.4 ±0.3 | 0.72 |
| TJ01S33C | 7+50, 250L | 30-45 | 1.7 ±0.03 | 1.4 ±0.1 | 0.76 |
| TJ01S34A | 7+50, 345L | 0-15 | 2.3 ±0.0 | 1.1 ±0.3 | 0.69 |
| TJ01S34B | 7+50, 345L | 15-30 | 0.97±0.07 | 0.60±0.09 | 0.71 |
| | | Biased samples[e] | | | |
| TJ01B1A | 0+--, --L[f] | 0-15 | 2.2 ±0.7 | 99 ±30 | 1.8 |
| TJ01B1B | 0+--, --L | 15-30 | 11 ±2 | 270 ±90 | 4.6 |
| TJ01B2 | 1+00, 170L | 0-15 | 3.0 ±0.9 | 140 ±35 | 2.8 |
| TJ01B3A | 0+33, 160L | 0-15 | 1.3 ±0.2 | 20 ±3.0 | 1.1 |
| TJ01B3B | 0+33, 160L | 15-30 | 0.76±0.09 | 9.6 ±1 | 0.68 |
| TJ01B4 | 3+94, 57L | 0-15 | 42 ±2 | 0.68±0.2 | 0.84 |
| TJ01B5A | 4+20, 265L | 0-15 | 4.0 ±0.1 | 1.0 ±0.1 | 0.83 |
| TJ01B5B | 4+20, 265L | 15-30 | 3.7 ±0.2 | 1.1 ±0.3 | 0.75 |
| TJ01B5C | 4+20, 265L | 30-45 | 2.8 ±0.2 | 1.2 ±0.1 | 0.67 |
| TJ01B5D | 4+20, 265L | 45-60 | 15 ±0.7 | 54 ±5 | 1.7 |
| TJ01B5E | 4+20, 265L | 60-65 | 7.6 ±0.5 | 30 ±2 | 0.98 |
| TJ01B6A | 3+56, 225L | 0-15 | 2.0 ±0.05 | 1.2 ±0.2 | 1.1 |
| TJ01B6B | 3+56, 225L | 15-30 | 1000 ±30 | 1.3 ±2 | 1.4 |
| TJ01B7A[g] | 3+98, 277L | 0-15 | 2.9 ±0.1 | 0.87 | 0.79 |
| TJ01B8A | 7+90, 17L | 0-15 | 26 ±0.7 | 1.1 ±0.4 | 0.67 |
| TJ01B8B | 7+90, 17L | 15-30 | 99 ±5 | 2.1 ±0.6 | 0.76 |
| TJ01B9A | 8+38, 15L | 0-15 | 70 ±2 | 2.2 ±0.9 | 0.96 |
| TJ01B9B | 8+38, 15L | 15-30 | 22 ±0.8 | 1.5 ±0.6 | 0.95 |
| TJ01B9C | 8+38, 15L | 30-45 | 11 ±0.1 | 1.5 ±0.2 | 0.87 |
| TJ01B9D | 8+38, 15L | 45-60 | 4.2 ±0.2 | 1.1 ±0.4 | 0.80 |
| TJ01B10B[g] | 6+10, 327L | 15-25 | 4.2 ±0.3 | 1.6 ±0.4 | 0.87 |
| TJ01B11A | 8+20, 300L | 0-15 | 1.2 ±0.05 | 1.0 ±0.07 | 0.70 |
| TJ01B11B | 8+20, 300L | 15-30 | 21 ±0.5 | 1.1 ±0.2 | 0.66 |
| TJ01B11C | 8+20, 300L | 30-45 | 1.4 ±0.08 | 0.95±0.08 | 0.66 |

[a]Locations of soil samples are shown on Fig. 3.

[b]Indicated counting error is at the 95% confidence level (±2σ).

[c]Total analytical error of measurement results is less than ±5% (95% confidence level).

[d]Systematic samples were taken at grid locations irrespective of gamma exposure.

[e]Biased samples were taken from areas shown to have elevated gamma exposure rates.

[f]Samples were taken from ditch bank near Malcolm Avenue before grid was established.

[g]Biased samples TJ01B7B and TJ01B10A were not processed.

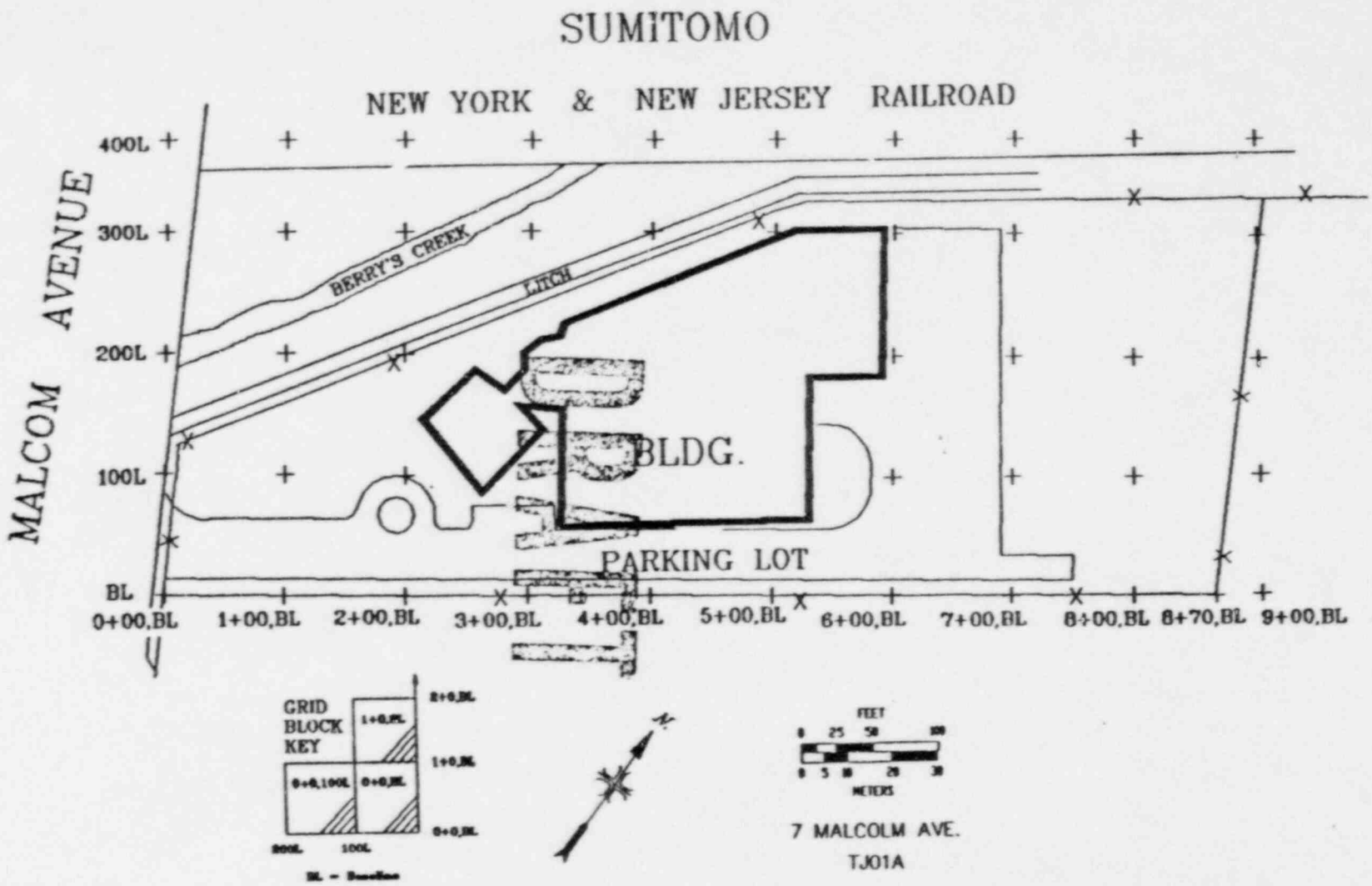



Fig. 1. Diagram showing grid lines for the property at Sumitomo Corporation, 7 Malcolm Avenue, Teterboro, New Jersey.

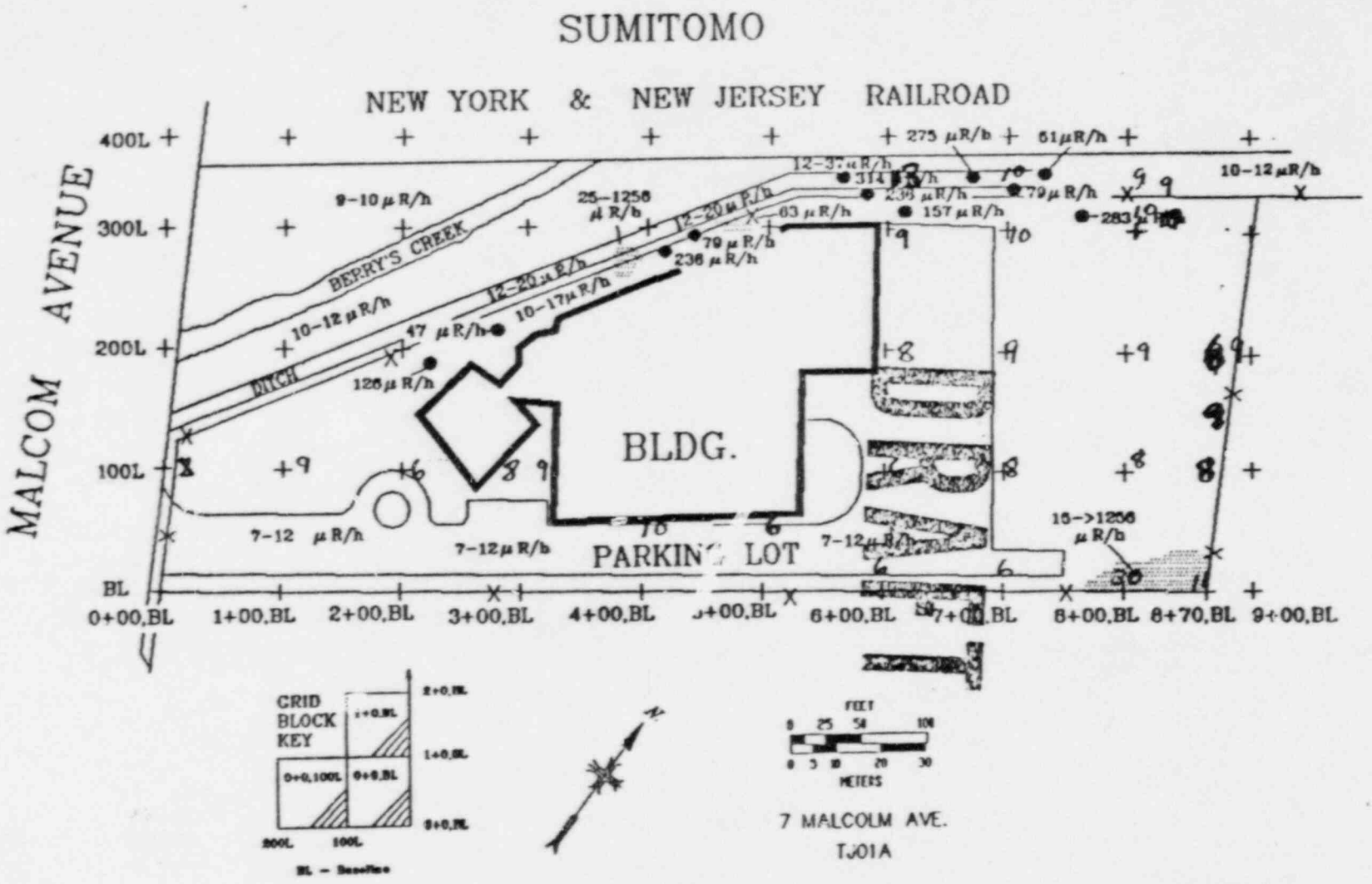



Fig. 2. Gamma radiation levels measured on the surface at Sumitomo Corporation, 7 Malcolm Avenue, Teterboro, New Jersey.

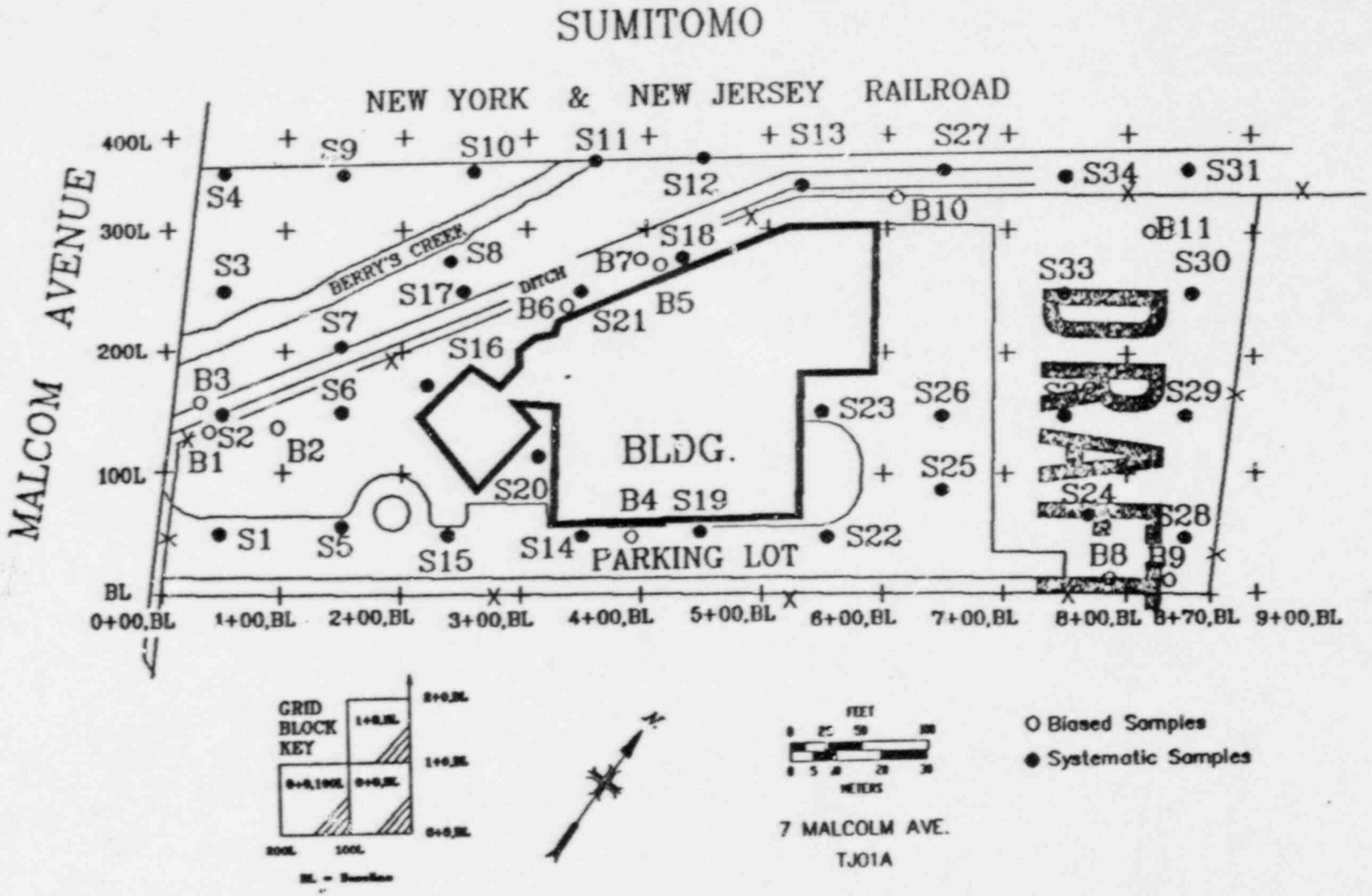



Fig. 3. Diagram showing locations of soil samples taken at Sumitomo Corporation, 7 Malcolm Avenue, Teterboro, New Jersey.

REPORT NO. 99990001/88-77

ATTACHMENT 2

SAMPLE DESCRIPTIONS

Report No. 99990001/88-77
Attachment 2

Sample Descriptions - MetPath

| Sample number | Sample material location | Radiation level (microroentgens per hour) | *Results picocuries per gram | Percent by Weight Thorium |
|---|---|---|---|---|
| 1. | Drum at post 9 | 100 | 36.5 ± 1.2 | 0.03 |
| 2. | Drum at post 11 | 180 | 41.4 ± 1.2 | 0.04 |
| 3. | Soil from bank at post 12 | --- | 2.00 ± 0.20 | 0.002 |
| 4. | Drum at post 12 | 150 | 330 ± 9.5 | 0.30 |
| 5. | Soil from bank at post 22 | 4 | <LLD | |
| 6. | Drum at post 10 | 400-800 | 479 ± 13.6 | 0.44 |

Sample Descriptions - Sumitoma

| Sample number | Sample material location | Radiation level (microroentgens per hour) | *Results (picocuries per gram) |
|---|---|---|---|
| 1. | Soil from ditch bank near iron pipe | 25 | 1.8 ± 0.204 |
| 2. | Soil from ditch bank 150' south of bend | 30 | 0.295 ± 0.189 |
| 3. | Soil from ditch bank | 6 | < LLD |
| 4. | Soil from spot west of building and north of nearby ornamental garden | 3000 | **315 ± 13.8 |
| 5. | Soil from northeast corner | 2000 | **2500 ± 109 |

*Activity of thorium, as determined by results for decay product thallium-208, unless noted otherwise. The LLD (lower limit of detection) for thallium-208 is 0.355 picocuries per gram.

**Activity of radium-226, as determined by results for decay product lead-214. The LLD (lower limit of detection) for lead-214 is 0.349 picocuries per gram.

REPORT NO. 99990001/88-77

ATTACHMENT 3

RADIATION SURVEYS OF DRUMS

Report No. 99990001/88-77

Attachment 3

Radiation Surveys of Drums

For reference purposes, fence posts were counted beginning with the first post south of the Bendix property line fence. Fence posts were approximately ten feet apart. The access to the ditch is through the fence between posts 3 and 4. The background radiation level in this area was between 4 and 6 microroentgens per hour

| | Radiation level (microroentgens per hour) | | | |
|---|---|---|---|---|
| Post | outside fence, ground level | waterline ground level | waterline one meter | Location of drums |
| 1. | background | background | background | none visible |
| 2. | " | " | " | " |
| 3. | " | " | " | " |
| 4. | " | " | " | " |
| 5. | " | " | " | " |
| 6. | " | " | 6-8 | " |
| 7. | " | " | background | " |
| 8. | " | " | 8 | top of bank near fence |
| 9. | 60 | 400 | 15 | top of bank near fence |
| 10. | 40-60 | 600 | --- | open, in water |
| 11. | background | 12 | 18-20 | exposed, in bank |
| 12. | " | 80 | 30-40 | exposed, near waterline |
| 13. | " | 8 | 12 | * |
| 14. | " | 12 | 12 | * |
| 15. | " | background | 70 | exposed, in bank |
| 16. | " | " | background | * |
| 17. | " | " | " | * |
| 18. | " | " | 60 | * |
| 19. | " | " | 30 | * |
| 20. | " | 12 | 80 | exposed, in bank |

21. Beyond this point, the bank height drops. All radiation levels were background for the next 40 feet surveyed.

* Portions of drums were visible throughout this area.

DIRECTIONS FROM PA TURNPIKE

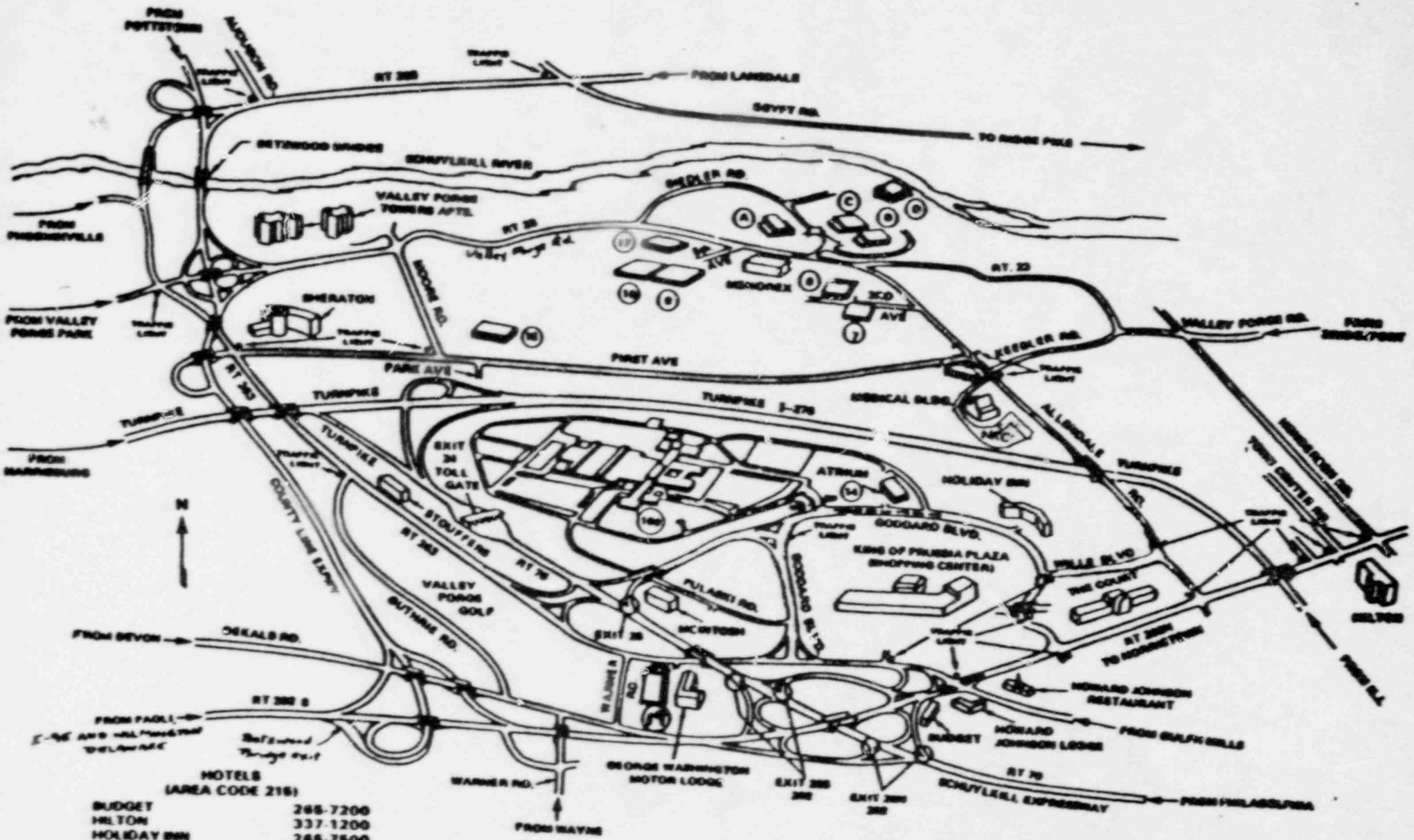
WEST ON PA TURNPIKE TO EXIT 24 (VALLEY FORGE). USE TOLL BOOTH ON RIGHT SIDE.

TAKE FIRST EXIT AFTER TOLL BOOTH (ABOUT 100 YARDS BEYOND TOLL BOOTH).

THE EXIT RAMP DROPS TO GULPH ROAD (RT. 363). CONTINUE TO 2ND TRAFFIC LIGHT, THE INTERSECTION WITH FIRST AVENUE (SHERATON WILL BE ACROSS THE STREET ON YOUR RIGHT).

TURN RIGHT ONTO FIRST AVENUE.

CONTINUE STRAIGHT TO END (WHICH WILL BE ALLENDALE ROAD). TURN RIGHT. GO TO THE FIRST TRAFFIC LIGHT AND TURN RIGHT. FOLLOW THE ACCESS ROAD TO THE BACK OF THE BUILDING. ENTER THE LOBBY AT THE INSIDE CORNER OF THE "L". ENTRANCE TO THE NRC OFFICES IS ON THE RIGHT SIDE OF THE LOBBY.




HOTELS
(AREA CODE 215)

| | |
|---|---|
| BUDGET | 265-7200 |
| HILTON | 337-1200 |
| HOLIDAY INN | 265-7500 |
| HOWARD JOHNSON'S | 265-4500 |
| McINTOSH | 768-9500 |
| SHERATON | 337-2000 |
| STOUFFER'S | 337-1800 |
| GEO. WASHINGTON | 265-6100 |

| | | |
|---|---|---|
| LIBERTY AIRPORT LIMO: | KING OF PRUSSIA: | 688-6666 |
| | PHILA. INT'L AIRPORT: | 365-8416 |
| TAXI SERVICE: | NORRISTOWN RADIO | 539-1700 |
| | NORRISTOWN YELLOW | 277-1234 |
| | RADNOR TAXI | 688-6714 |

# ALLENDALE SQUARE

## OFFICE BUILDINGS & EXECUTIVE SUITES