UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF PUBLIC AFFAIRS, REGION I
631 Park Avenue, King of Prussia, Pa. 19406

No. I-82-38
Contact: Karl Abraham
Gary Sanborn
Tel: 215/337-5330
5000

April 9, 1982

A-158

NOTE TO NEWS AND ASSIGNMENT EDITORS:

The staff of the Nuclear Regulatory Commission and scientists of the Oak Ridge Associated Universities, Oak Ridge, Tennessee, have begun a field investigation into radioactive thorium that over a period of many years may have been deposited along the course of Sheffield Brook in Wayne, New Jersey. Preliminary surveys have shown no immediate health hazard, but more information is needed to properly assess the long-term risks. Approximately 20 owners of private property have been asked by the NRC to permit surveys of portions of their properties as part of the field surveys. Attached are copies of letters recently sent to these property owners and a brief history of an industrial operation formerly carried on at a site on Black Oak Ridge Road in Wayne. After completion of the surveys, a comprehensive report will be prepared by the NRC staff. The report will be made public.

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W. R. Grace and Company
Historical Background

In approximately 1948, Rare Earths, Inc. began processing monazite sand at Pompton Plains, New Jersey, to extract thorium and rare earth elements. The work may have been conducted under contract with the Atomic Energy Commission (AEC). In 1954 the AEC issued a license authorizing the possession, transfer and use of source material (thorium) by Rare Earths, Inc. at this site. In 1957 this activity was taken over by the Davison Chemical Division of W. R. Grace and Company. The processing of monazite sand at this location ceased in 1971. The processing produced large quantities of wastes containing residual thorium. In 1974, W. R. Grace and Company hired a consultant to decontaminate the site to meet AEC criteria for release for unrestricted use. These criteria required that average radiation levels on the ground be less than 0.2 millirem per hour and maximum levels be less than 1 millirem per hour and that removeable alpha contamination in the buildings not exceed 1000 disintegrations per minute (dpm) per 100 square centimeters. The facility was released by the Nuclear Regulatory Commission (NRC, which was established in 1974 to succeed the AEC) for unrestricted use on January 22, 1975, following a confirmatory survey. Documents supplied by W. R. Grace and Company in support of their request for release indicated that 1600 pounds of materials slightly contaminated with thorium were buried on the site in 1974 and that 19,000 pounds of thorium had previously been buried on the site.

In August 1980, the NRC requested that its Regional offices review specified formerly licensed facilities, including the W. R. Grace and Company (Rare Earths) facility in Wayne (Pompton Plains), New Jersey, to determine whether they met current criteria for unrestricted use.

In January 1981, an inspector from the NRC Region I office in King of Prussia, Pennsylvania, accompanied by a representative of the New Jersey Bureau of Radiation Protection, conducted a survey of the Rare Earths property. Based on measurements made at the site and analyses of soil samples in the NRC Region I Laboratory, it was concluded that surface soil contamination levels greater than current (1981) criteria for release for unrestricted use, and elevated radiation levels in excess of current criteria, exist on the site. These contamination and radiation levels do not presently result in a hazard to the health and safety of persons working at or living near the site. Further surveys and evaluations are scheduled for the summer of 1982. On September 10, 1981, an NRC inspector surveyed the interior of all buildings at the site and found that the buildings met current criteria for release for unrestricted use.

On May 25, 1981, an aerial radiological survey of this facility and the surrounding area was conducted by EG&G, Inc., at the request of the State of New Jersey.

The aerial survey identified one offsite area west of the site that exhibited radiation readings higher than normal background radiation levels. On November 23, 1981, a preliminary ground survey was performed by an NRC Region I inspector in this offsite area. The survey found normal background radiation levels in most areas, but radiation levels up to 0.2 millirem per hour were found in one area along Sheffield Brook which runs from the W. R. Grace and Company property towards the Pompton River. Background in this area of New Jersey is affected by the presence of natural uranium deposits, but averages about 0.02 millirem per hour or less. While radiation levels of the magnitude discussed above present no immediate hazard, more extensive surveys in the offsite area will be conducted in the spring of 1982 by Oak Ridge Associated Universities under contract with the NRC's Office of Nuclear Material Safety and Safeguards.

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

Dear

The Nuclear Regulatory Commission (NRC) is reviewing the status of a number of manufacturing facilities around the country which were formerly licensed by the Atomic Energy Commission (AEC). As you may know, a number of the facilities in northern New Jersey which used radioactive material in the 1940's and 1950's were later found to have residual onsite and/or offsite contamination. One of the facilities which was licensed by the AEC was Rare Earths, Incorporated, located at 8-8 Black Oak Ridge Road in Wayne, New Jersey. This company was licensed to extract thorium, a naturally-occurring radioactive material, from monazite sand. In 1957 these activities were taken over by the Davison Chemical Division of W. R. Grace and Company. A summary of the historical background of this facility is enclosed for your information.

To assist with our review of the W. R. Grace and Company facility, the State of New Jersey arranged for an aerial radiological survey of the area surrounding it in May, 1981. The survey was performed by EG&G, Inc. a contractor of the U. S. Department of Energy.

Our review of the results of the aerial survey indicates slightly elevated radiation levels along the Sheffield Brook. However, ground level surveys performed by inspectors from this office have shown no radiation levels above background along Black Oak Ridge Road, Pompton Plains Crossing Road, Farmingdale Road, Deerfield Road or Longport Road. Analysis of water samples from Sheffield Brook has shown no measurable radioactive contamination. The radiation levels measured by the aerial survey appear to be coming primarily from the overgrown area around the Brook. Although these radiation levels do not pose any immediate hazard to the health and safety of individuals living near or frequenting the areas around the stream, additional surveys and evaluations seem appropriate. The results of these surveys will be used to determine if additional actions are required.

We have arranged for an NRC contractor, Oak Ridge Associated Universities (ORAU), to perform these additional surveys. The surveys of the area around the Brook will involve walking across the ground to measure surface radiation levels, and collecting surface and subsurface soil samples. The subsurface soil samples will be collected using a hand carried, motor operated drill which makes a 5" to 7" diameter hole about 2 to 3 feet deep, which afterward will be filled in. The surveys will be performed primarily in the Brook and in the weeded area along the banks of the Brook, although measurements of surface radiation levels will be made in other areas, as well. The NRC contractor will not enter houses or buildings on properties included in this survey. The survey results will be made public.

The Township of Wayne has identified you as an owner of private property along Sheffield Brook. (Block No.). We request your permission to have the contractor, ORAU, perform radiological surveys of the type described in this letter on your property. The surveys will probably be performed during the last two weeks in April, depending on the weather and scheduling of other work. Please sign the enclosed permission form and return it in the enclosed envelope.

A representative of this office will visit you during the week of April 12, 1982, to answer questions you may have about the survey. If you wish to arrange a special time for our representative to visit you or if you have immediate questions, you may call this office collect, and speak to Ms. Myu Campbell (215-337-5246) or Mr. John Kinneman (215-337-5252).

Your cooperation with us is appreciated.

Sincerely,

Original Signed By:

Ronald C. Haynes
Regional Administrator

Enclosures:
1. Permission Form
2. Historical Background
3. Return Envelope

19 APR 1982

A158

Docket No. 40-00086 License No. STA-422

Ruth Baum
125 Pompton Plains Crossing Road
Wayne, New Jersey 07470

Dear Mrs. Baum:

Subject: Radioactive Contamination in Wayne, New Jersey

As you requested, we have reviewed the results of the aerial radiological survey of the W.R. Grace facility performed in May 1981 to determine the radiation levels in the area north of Pompton Plains Crossing Road where you store the soil used in your business. The survey measured only natural background radiation over the entire area where you store the soil. Further, we understand that you do not take soil from the Sheffield Brook or the W.R. Grace property. Since these are the only areas where radioactive contamination was measured by the aerial radiological survey, there is no reason to believe that the soil used by your business is contaminated with radioactive materials.

A copy of the aerial survey, and a copy of a closeup photograph of the area are enclosed. If you have any further questions, please contact us.

Sincerely,

John D. Kinneman

John D. Kinneman, Chief
Materials Radiological Protection
Section

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

bcc: w/enclosures
Region I Docket Room (w/concurrences)
K. Abraham, RI

8204260273
PDR

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OFFICE	DEIP	DEIP					
SURNAME	Campbell	Kinneman					
DATE	4/19/82	4/19/82					

EG&G
ENERGY MEASUREMENTS GROUP

THE
REMOTE
SENSING
LABORATORY
OF THE UNITED STATES
DEPARTMENT OF ENERGY

EG&G SURVEY REPORT
NRC—8113
NOVEMBER 1981

AN AERIAL RADIOLOGICAL SURVEY OF THE

W. R. GRACE PROPERTY

WAYNE TOWNSHIP, NEW JERSEY

DATE OF SURVEY: MAY 1981

EG&G
ENERGY MEASUREMENTS GROUP

EG&G Survey Report
NRC-8113
November 1981

AN AERIAL RADIOLOGICAL SURVEY OF THE

W. R. GRACE PROPERTY

WAYNE TOWNSHIP, NEW JERSEY

DATE OF SURVEY: MAY 1981

T. S. Dahlstrom
Project Scientist

REVIEWED BY

T. P. Stuart, Manager
Nuclear Radiation Department

This Document is UNCLASSIFIED

G. P. Stobie
Classification Officer

This work was performed by EG&G for the Environmental Protection Agency and The United States Nuclear Regulatory Commission through an EAO transfer of funds to Contract Number DE-AC08-76NV01183 with the United States Department of Energy.

ABSTRACT

During the week of 24 May 1981, an aerial radiological survey was performed over the W. R. Grace property in Wayne Township, New Jersey. The facility is occupied by a firm known as Electronucleonics, Inc. An isoradiation map was generated from the aerial data which shows increased levels of ^{208}Tl, a thorium daughter, over the burial grounds and in an area to the west believed to have resulted from subsurface water erosion of material from the burial grounds.

CONTENTS

1.0 SUMMARY

An aerial radiological survey was made during the week of 24 May 1981, of the W.R. Grace property located in Wayne Township, New Jersey. The site is occupied by Electro-nucleonics, Inc. and was formerly used to extract rare earths and thorium from monzanite sands. The property contains a 1.67 acre burial site, where building debris, sludges, and ore tailing had been buried. Average radiation levels of greater than 120 μR/h at one meter over the burial ground were inferred from the aerial data. Ground surveys over the same area indicated radiation levels of some local hot spots of 800 to 1000μR/h. These levels were all due to the thorium daughter, ^{208}Tl.

The aerial survey data also suggests there had been some subsurface contamination to the west along a stream running adjacent to the property. The maximum levels in this area were inferred to be 60 to 120 μR/h at the one meter level. The average background levels were 8 to 12 μR/h including 3.7 μR/h cosmic radiation contribution.

2.0 INTRODUCTION

The United States Department of Energy (DOE) maintains an aerial surveillance operation called the Aerial Measuring System (AMS). AMS is operated for DOE by EG&G. This continuing nationwide program, started in 1958, involves surveys to monitor radiation levels in and around facilities producing, utilizing, or storing radioactive materials. The purpose of the surveys, in general, is to document, at a given point in time, the location of all areas containing gamma-emitting radionuclides (visible at the surface) and to aid in evaluating the magnitude and spatial extent of any radioactive contaminants released into the environment. At the request of federal and state agencies, AMS is deployed for various aerial survey operations.

Aerial radiological detection systems average the radiation levels due to gamma-emitting radionuclides existing over an area of several acres. The systems are capable of detecting anomalous gamma count rates and determining the specific radionuclides causing the anomalies; however, because of averaging, they tend to underestimate the magnitude of localized sources as compared with ground-based readings. As such, the indicated radiation levels in the vicinity of anomalies are not definitive. Ground surveys are required for accurate definition of the extent and intensity of such anomalies.

The results of the survey are reported as radiation exposure rates in microroentgens per hour (μR/h) at 1 meter above the ground surface. Approximate annual absorbed radiation dose levels expressed as millirem per year (mrem/y) are obtained by multiplying μR/h by 8.76. This conversion number applies only to the external radiation dose component.

This report is the result of a survey requested by the Environmental Protection Agency for an area centered on the former W. R. Grace Property in Wayne Township, N.J. The preparation of the report was requested by the Nuclear Regulatory Commission.

3.0 BACKGROUND

Natural background radiation originates from radioactive elements present in the earth and cosmic rays entering the earth's atmosphere from space. The terrestrial gamma rays originate primarily from the uranium decay chain, the thorium decay chain, and radioactive potassium. Local concentrations of these nuclides produce radiation levels at the surface of the earth in the range of 1 to 15 μR/h (9 to 130 mrem/y). Some areas with high uranium and thorium concentrations in surface minerals exhibit even higher radiation levels, especially in the western states. For example, in the Colorado Plateau area the average radiation level is above 200 mrem/y. At some locations in Brazil and India, the natural radiation level is above 1000 mrem/y. One member of each of the uranium and thorium decay chains is an isotope of the noble gas, radon, which can diffuse through soil and be borne by air to other locations. Thus, the level of this airborne radiation depends on the meteorological conditions, the mineral content of the soil, the soil permeability, and other conditions existing at each location at any particular time. The airborne radiation contributes from 1 to 10% of the natural background radiation levels.

Cosmic rays (the space component) interact in a complicated manner with the elements of the earth's atmosphere and the soil. These interactions produce an additional natural source of gamma radiation. Radiation levels due to cosmic rays vary with altitude and geomagnetic

latitude: they range from 3.7 to 23 μR/h (up to 200 mrem/y).[1] The cosmic ray contribution in Wayne Township is estimated to 3.7μR/h.

4.0 DISCUSSION AND RESULTS

The results of the aerial survey are shown in Figure 1 as exposure rate isoradiation contours. These contours are derived from gross gamma count rates at survey altitude. The contours are overlaid on a combination of an aerial photograph and a USGS map (a single photograph of the entire survey area was unavailable). Data analysis details are given in Appendix A.

As shown in Figure 1, the natural background radiation levels generally ranged from 8 to 12 μR/h. Lower radiation levels are evident over large bodies of water where cosmic radiation dominates the background levels.

Radiation levels higher than background were found over the burial ground and over an area west of the property. These contours are shown in blue in Figure 1.

The highest radiation levels inferred from the gross gamma count rates from the aerial survey data were above 120 μR/h. However, these numbers represent levels averaged over the total field-of-view of the detector system and do not reflect small localized hot spots. Measurements taken on the ground with hand-held survey meters gave exposure rates from 800 to 1000μR/h in one area (about two feet in diameter) on the western boundary of the burial ground.

The spread of contamination to the west of the plant is most likely due to subsurface erosion along the outer boundaries of a stream which runs along the eastern and southern boundaries of the property and then flows west on the opposite side of Black Oak Ridge road. The highest levels in this region (inferred from the aerial survey data) were 60 to 120 μR/h.

The blue E level contour surrounding the burial ground and the area to the west does not accurately define the boundaries of the higher radiation levels at ground level. Because the burial ground and stream exhibit relatively high level activity and are concentrated in small areas, the detectors "see" the radiation from these areas, both before the helicopter reaches them and after it has passed them.

There are additional E level contours to the west and south of the contaminated areas. However, these are most likely due to natural radiation anomalies and are not associated with the burial grounds.

A gamma ray energy spectrum was extracted from the aerial data taken over the burial ground (see appendix A). The photopeaks of the ^{208}Tl and other isotopes in the thorium decay chain dominated the spectrum.

The survey data were also processed by another method to identify those areas that contain ^{208}Tl in excess of its natural abundance. The results showed only the area contained within the blue contours. The existence of ^{208}Tl identifies the presence of thorium, which was expected to be present in the residue of monzanite sands used in the production of rare earths and thorium compounds at this facility.

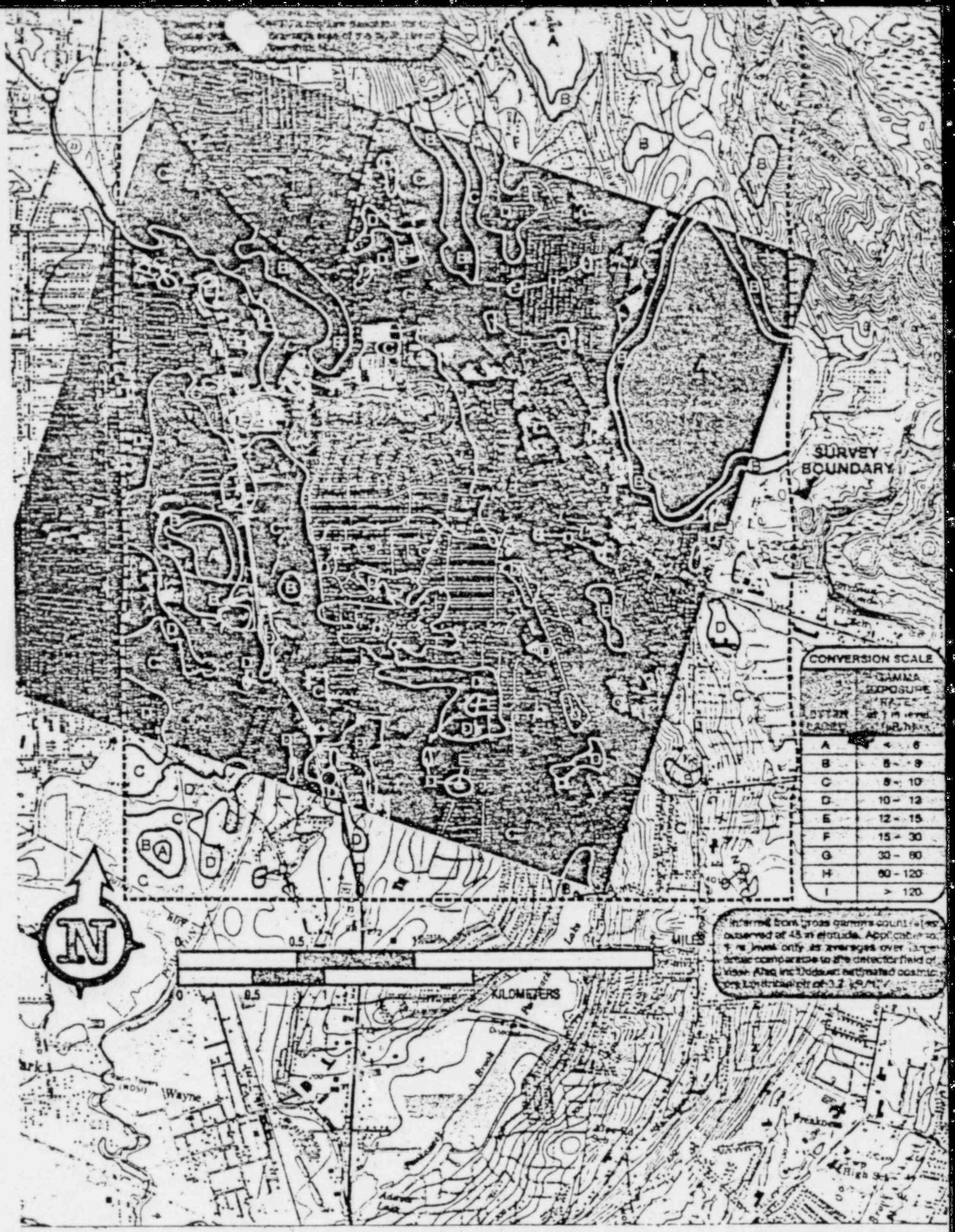

Figure 1. *EXPOSURE RATE ISORADIATION CONTOURS*

APPENDIX A.
SURVEY METHOD, DATA ANALYSIS EQUIPMENT, DATA PROCESSING METHODS AND RESULTS

The data reported here were generated from measurements taken with an airborne system during the week of 24 May 1981. Gamma rays were detected in 12.7-cm diameter by 5.1-cm thick NaI (Tl) crystals arranged in two arrays of ten crystals each. To cover the area of interest the system was flown in a BO-105 helicopter at 45 m altitude along a series of parallel lines. Position information from a microwave ranging system was recorded on magnetic tape along with the radiation data. Correlations between the two and extractions of specific types of nuclides were effected with a computer data processing system. A description of the equipment and operating procedures can be found in References 2 and 3.

Gross Counting Rates

The gamma ray energy spectrum measured during this survey covers the range between 0.05 million electron volts (MeV) and 3 MeV: This spectrum is useful for identifying specific nuclides contributing to the total activity. The most active areas in Figure 1 were singled out for spectral examination. The nuclides responsible for the increased activity were sought by comparing background spectral data with spectral data accumulated while the aircraft was over the anomalous area. The background was taken from data gathered at positions just before or just after the anomaly (Figure 1). A typical background spectrum is shown in Figure A-1. Figure A-2 presents channel-by-channel differences between anomalous and background data. The predominant peaks are due to ^{208}Tl, a daughter of thorium.

The gross count rate isopleths (Figure 1) are based on the sum of all counts in that portion of the gamma ray energy spectrum between 0.05 MeV and 3 MeV. The terrestrial component of gross count rate and the sum of exposure rates due to soil and cosmic ray activity were produced as follows:

1. Overflight of a body of water at the survey altitude to measure the sum of count rates due to aircraft background, cosmic rays, and airborne radon daughter radionuclides.
2. Measurement of count rate over the survey area.
3. Subtraction of Item 1 from Item 2.
4. A predetermined factor obtained over a calibration range near Lake Mead was then applied to convert Item 3 above to exposure rate.

Dependent on (a) the proximity of the survey area to the body of water overflown in Step 2, (b) the differences in topography and meteorological conditions between the areas, and (c) the differences in time between execution of the two flights, the counts resulting from Step 3 and the isopleths shown in Figure 1 may be either rich or poor in airborne radon daughter content. Daily variations in airborne radon daughter concentrations can lead to discontinuities in isopleths across boundaries between areas flown on different days. When necessary, corrections were made for this effect. The correction, based on data from a single cross-track flight, adjusted counting rates to a constant component due to the airborne radon daughter levels. Although not precisely known, this airborne radon daughter component is estimated to contribute an uncertainty of no more than 10% to the exposure rate.

The calibration described in Step 4 was done over an area containing a typical mix of naturally occurring radionuclides. The conversion factor will be in error where the mix is atypical, where man-made nuclides exist, or when airborne radon daughter contributions are not completely subtracted. The conversion factor used was 987 counts per second per μR/h one meter above the ground.

It should be stressed that inherent spatial resolution in any remote sensing survey that uses uncollimated detectors (such as the airborne system) is one to two times the distance between the surveyed surface and the detector. Therefore, ground surveys using detectors at the one meter level will not compare well with an aerial survey over areas that contain sources whose lateral dimensions are small relative to the aircraft altitude. Isopleths constructed from a ground survey over a point source will indicate a source width of one to two meters, whereas aerial survey isopleths over the same source will indictate a source width of at least several tens of meters.

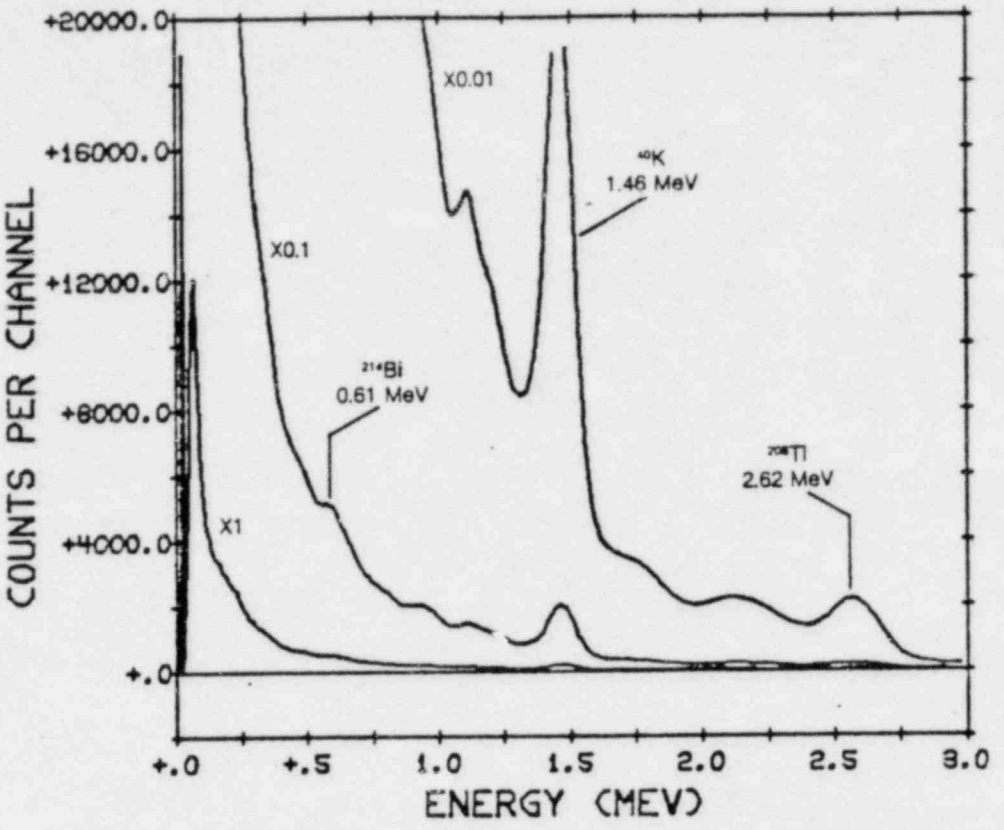

Figure A-1. *GAMMA PULSE-HEIGHT SPECTRUM OF TYPICAL BACKGROUND AREA*

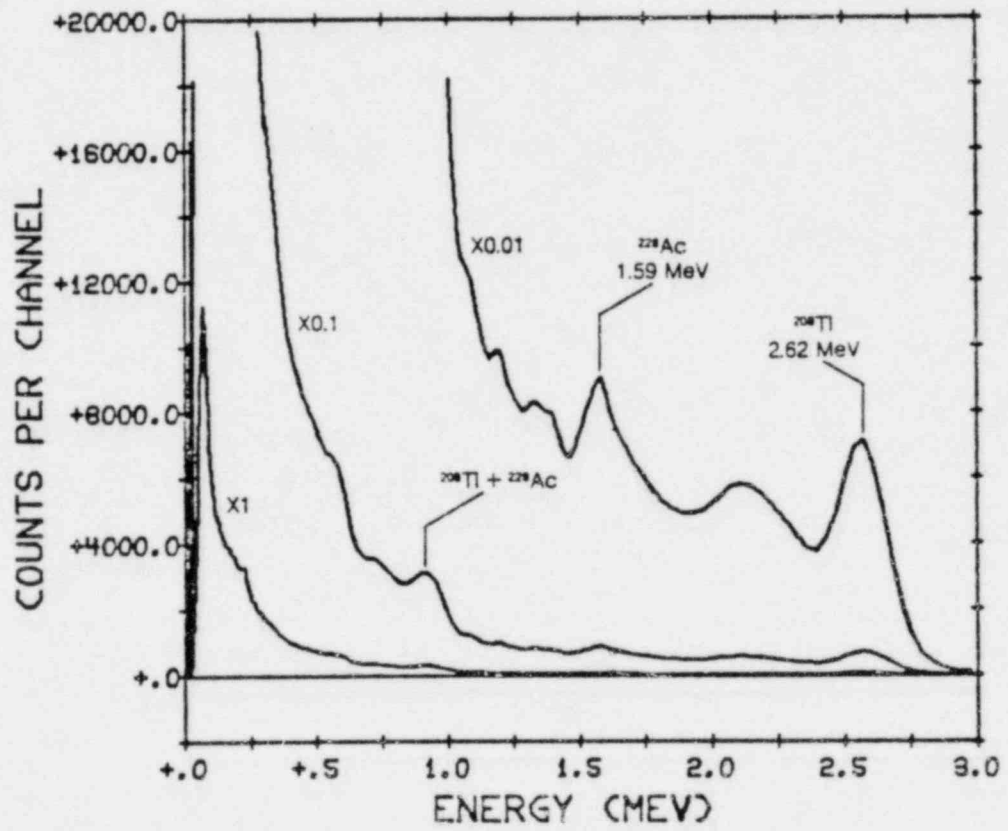

Figure A-2. *NET SPECTRUM OF ELEVATED ACTIVITY OVER THE BURIAL GROUND*

REFERENCES

1. Klement, A. W.; Miller, C. R.; Min, R. P.; Shleren, B. August 1972. *Estimate of Ionizing Radiation Doses in the United States 1960-2000.* U.S. EPA Report ORP/CD72-1. Washington, D.C.: Environmental Protection Agency.

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3. Jobst, J. E. 1979. "The Aerial Radiological Measuring Systems Program." *Nuclear Safety 20: 136-47.*

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W. R. GRACE PROPERTY
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NRC-8113
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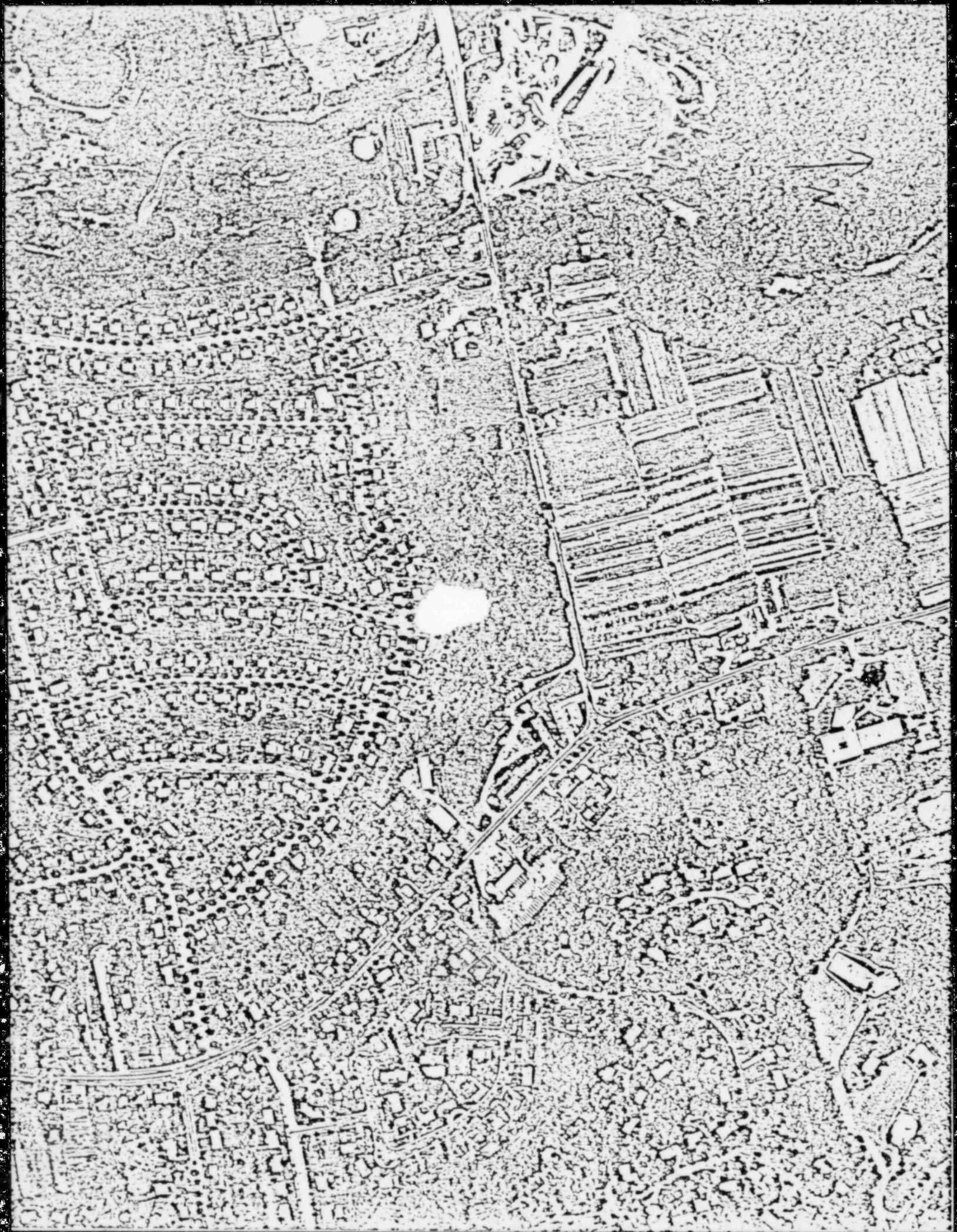
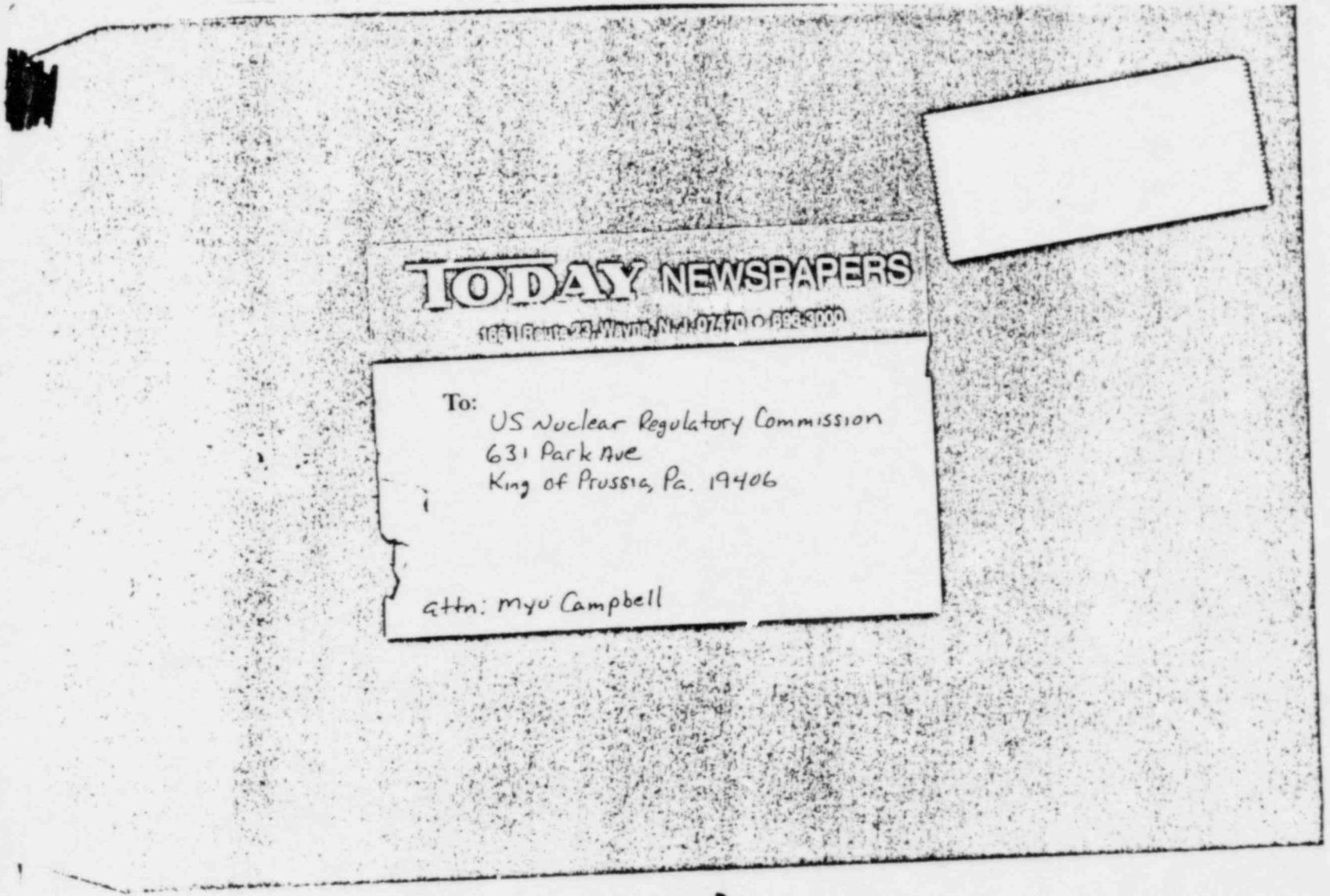
DATE OF REPORT: NOVEMBER 1981

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