ESTIMATE OF RADIUM-226 CONCENTRATIONS IN RUBBLED PCB WAREHOUSE ON VICINITY PROPERTY B ADJACENT TO THE NIAGARA FALLS STORAGE SITE

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1.0 INTRODUCTION

1.1 OBJECTIVE AND SCOPE

This report describes the assumptions and methodology used to estimate radium-226 concentrations in the structural material of a PCB warehouse after rubbling. Estimates were made on the basis of existing radiological data. The PCB warehouse is located on Vicinity Property B at the Niagara Falls Storage Site (NFSS). Conservatism has been applied to reasonably ensure that actual radium-226 concentrations in the rubbled building will not exceed the level identified in this report. The property is to be subjected to PCB decontamination prior to rubbling. Since radiologic and PCB contamination are commingled, the PCB decontamination process will also reduce radiologic contamination and thereby reduce the concentration of radionuclides in the rubbled building. In the interest of conservatism, however, this reduction in radiation contamination levels has not been incorporated into the estimate presented in this report.

1.2 BACKGROUND

The NFSS is a U.S. Department of Energy (DOE) surplus facility located in the Town of Lewiston, Niagara County, New York (Figure A-1). The 77-ha (191-acre) site is a small portion of the original Lake Ontario Ordnance Works (LOOW) and was formerly used for the storage and transshipment and radioactive materials. The site is currently being managed for DOE by Bechtel National, Inc. (BNI), Oak Ridge, Tennessee, as part of the DOE Surplus Facilities Management Program (SFMP) established to plan and manage the ultimate disposition of surplus DOE-owned facilities. Portions of the former LOOW site and other vicinity properties are within the jurisdiction of another DOE remedial action program, the Formerly Utilized Sites Remedial Action Program (FUSRAP). FUSRAP was established to evaluate former

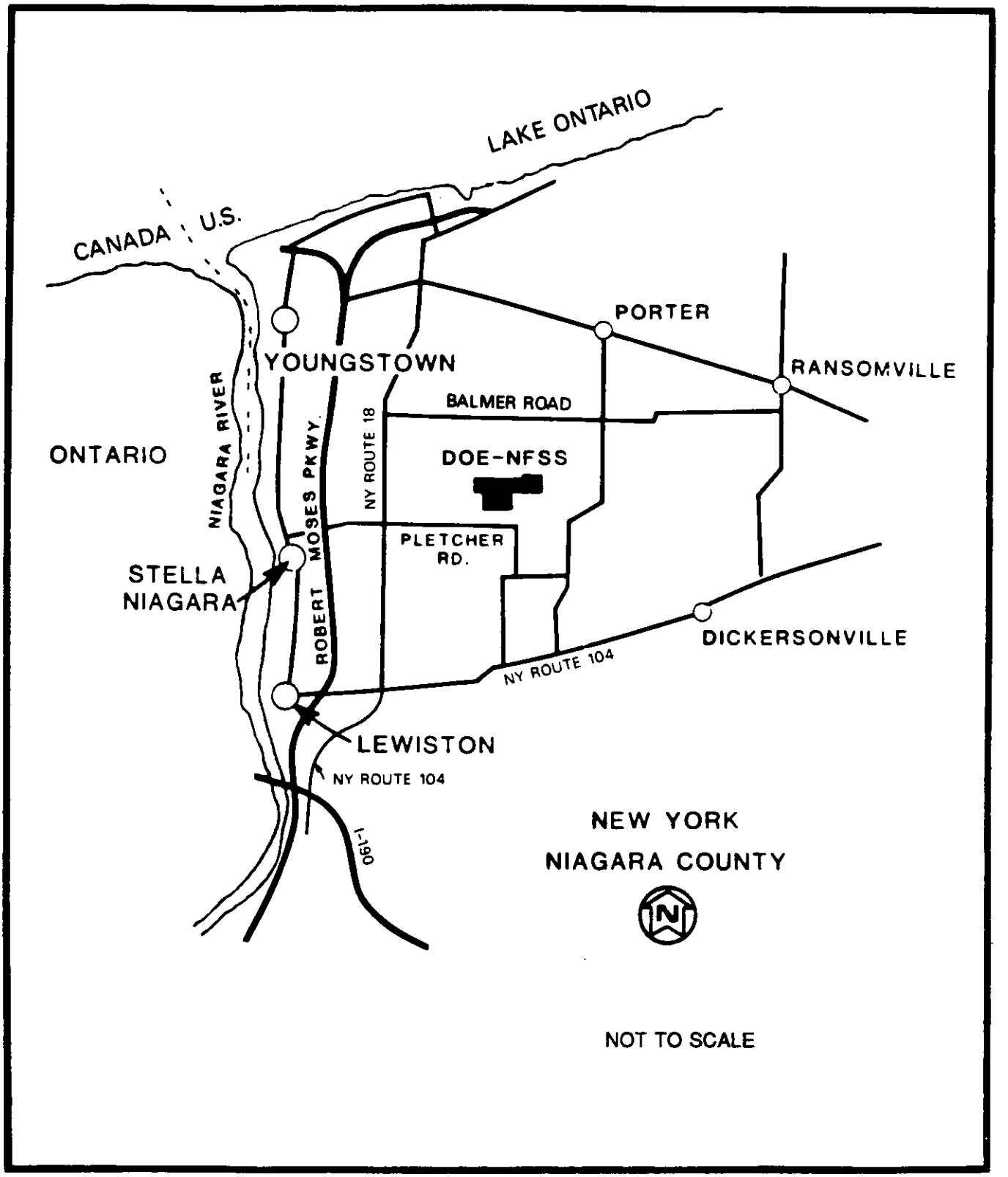

FIGURE A-1 THE REGIONAL SETTING OF THE NFSS

Manhattan Engineer District/Atomic Energy Commission (MED/AEC) sites and to conduct remedial action activities where residual radioactivity exceeds the remedial action guidelines established by DOE.

As a result of MED/AEC activities at the NFSS, some portions of the former LOOW other than the present NFSS were also contaminated. These radioactively contaminated areas located adjacent to or near the NFSS are referred to as vicinity properties and include Property B (Figure A-2).

A warehouse located on Property B is used by the owner to store and repackage PCB-contaminated materials. As a result of these operations, the building has become contaminated with PCBs. The PCB contamination presents an equal or greater hazard to workers and the environment than does the radiological contamination. However, exposure of workers in the building to residual radioactivity on the structure is not a concern under present operating conditions because of the low concentrations of radiological material and because worker occupancy and protection practices provide adequate protection against the radioactivity.

The warehouse is scheduled for PCB decontamination and demolition by the owner following installation of a PCB incinerator at an adjacent location. The wastes generated during PCB decontamination of the warehouse will be adequately controlled through hazardous waste (PCB) control requirements; no specific controls for the radiological materials are required to ensure protection of the workers, public, or environment. Once the PCB contamination has been removed, the building will be demolished and rubbled. As shown in this analysis, the resulting concentration of radium-226 in the soil and rubble will be significantly less than 5 pCi/g on the soil surface and 15 pCi/g beneath the surface layer. All disposal requirements, occupational safety, and public access requirements will be provided under existing site protocol.

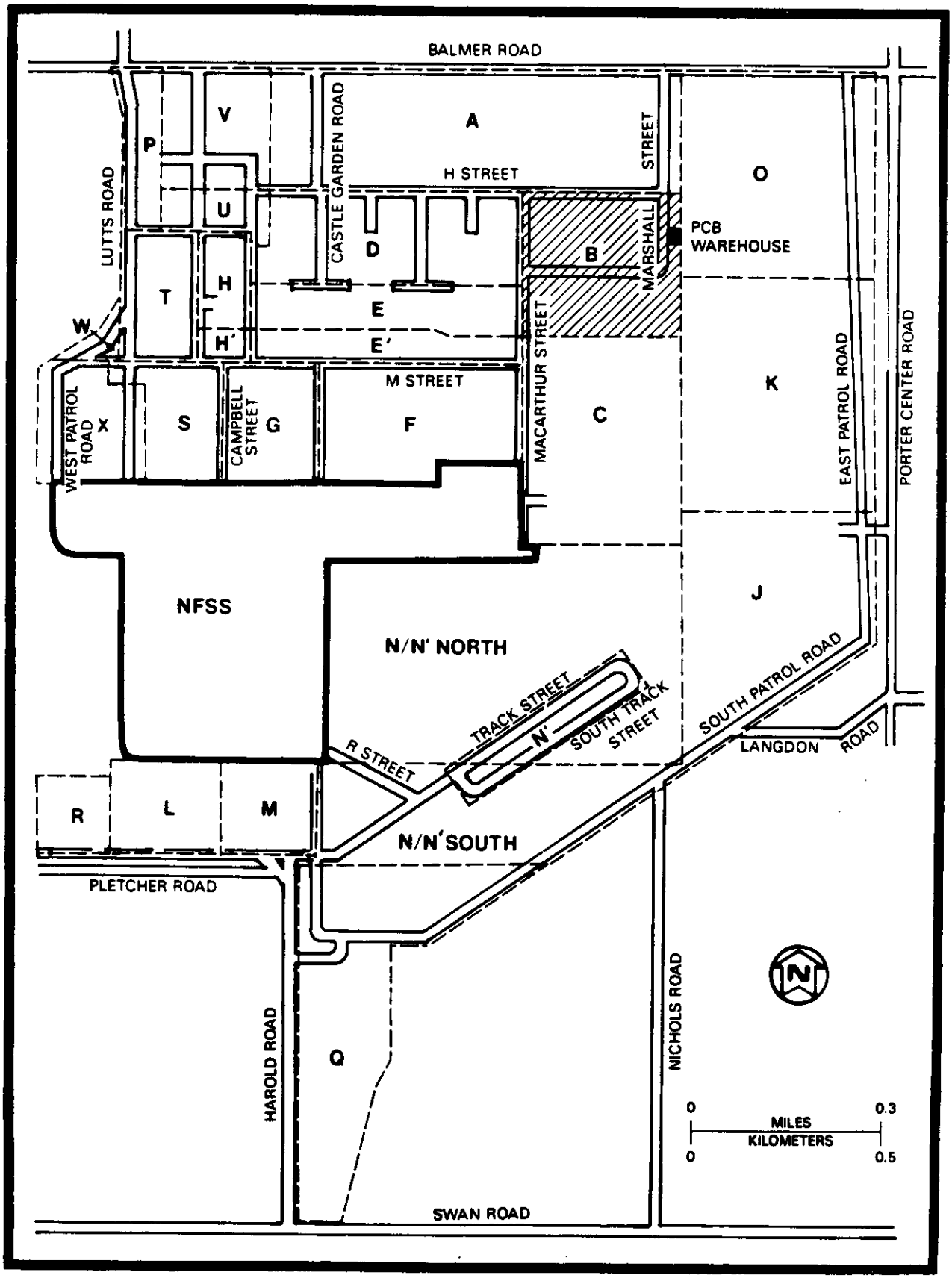

FIGURE A-2 LOCATION OF VICINITY PROPERTY B

2.0 DESCRIPTION AND RADIOLOGICAL STATUS OF THE PCB WAREHOUSE

2.1 DESCRIPTION OF THE PCB WAREHOUSE

The PCB warehouse is located on NFSS Vicinity Property B and is currently owned by Chemical Waste Management, Inc. (CWM). The warehouse is a 45-yr-old single-story building constructed of wood (ceiling and ceiling structures), concrete (floor), and brick and block (interior walls). The warehouse floor area is approximately 1,800 m^2 (19,368 ft^2) elevated about 1.2 m (4 ft) above grade.

2.2 CURRENT RADIOLOGICAL STATUS OF THE PCB WAREHOUSE

In 1984 Oak Ridge Associated Universities surveyed the Property B warehouse to provide a comprehensive assessment of the radiological conditions and associated potential health effects (Ref. 1). A gamma scan of the warehouse identified cracks and expansion joints in the concrete floor with contact radiation levels up to 130 uR/h. The majority of these cracks and joints were located in Rooms 1, 2, and 12 (Figure A-3). Samples of residue from these cracks were analyzed and the contaminant identified as radium-226. Exposure rates at 1 m above the floor throughout the building ranged from 6 to 14 uR/h.

Total alpha contamination averaged 5,580 dpm/100 cm^2 on the floor, 150 dpm/100 cm^2 on lower walls, and 1,850 dpm/100 cm^2 on the upper wall and ceiling surfaces. Beta-gamma contamination levels reached 39,700 dpm/100 cm^2 on the floor, 2,170 dpm/100 cm^2 on lower walls, and 5,930 dpm/100 cm^2 on the upper walls and ceiling. Rooms 1, 2, 3, and 12 have the highest levels of contamination, although all rooms except 10 and 11 contain areas which exceed the residual contamination guidelines (see Figure A-3). Horizontal ceiling surfaces such as beams, HVAC ducts, pipes, and ledges generally have elevated total alpha and beta-gamma contamination levels.

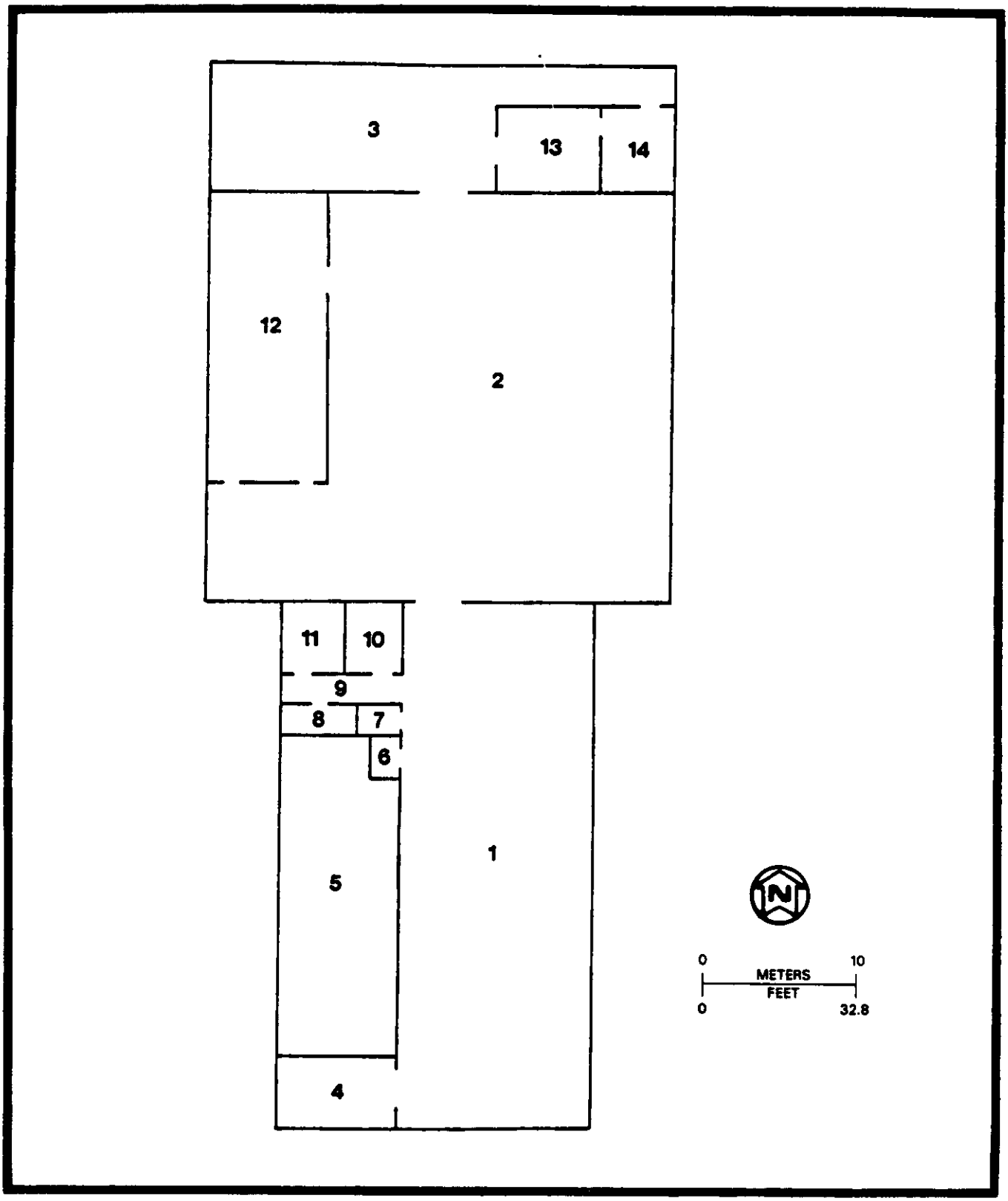

FIGURE A-3 PLAN OF WAREHOUSE INDICATING ROOM DESIGNATIONS FOR SURVEY REFERENCE

Removable (transferable) contamination was below guidelines; the maximum alpha and beta levels measured were 70 dpm/100 cm^2 and 48 dpm/100 cm^2.

3.0 RADIOLOGICAL ASSESSMENT

Estimating radium-226 concentrations in the rubbled warehouse on the basis of limited surface alpha activity data would imply more accuracy than is reasonable. Using the observed alpha activities and conservative assumptions for building material volumes and density, a reasonable estimate of the radium-226 concentrations in the rubbled building was determined.

To perform the alpha survey, the building was divided into four basic areas: (1) floor, (2) upper walls, (3) lower walls, and (4) ceiling structures. The floor is concrete, both upper and lower walls are block/brick, and the ceiling structures are wood. To estimate postrubbling radionuclide concentrations in the spoils on the basis of prerubbling surface alpha radioactivity, the four areas were considered individually.

To estimate the concentration in the floor, it was assumed that the concrete was at least 8 in. thick and that the density of the floor was 2.4 g/cm^3 (150 lb/ft^3). Applying these assumptions to the maximum surface alpha activity and maximum beta-gamma activity resulted in indicated radionuclide concentrations of 0.5 pCi/g and 3.7 pCi/g, respectively.

Radionuclide concentrations in the walls were estimated assuming wall construction was 8-in. by 8-in. by 16-in. concrete blocks with a weight of 22.7 kg (50 lb) per block. The walls were divided into upper and lower sections because of the significant difference in surface contamination. Radium-226 concentrations on the basis of maximum surface alpha activity were estimated to be 0.3 pCi/g in the upper walls and 0.02 pCi/g in the lower walls. Radium-226 concentrations on the basis of maximum beta-gamma activity were estimated to be 1.0 pCi/g in the upper walls and 0.3 pCi/g in the lower walls.

Radionuclide concentrations in the ceiling structures were estimated by assuming 4-in.-thick wood with a density of 0.8 g/cm^3 (50 lb/ft^3). The resultant estimates for radium-226 concentrations in the ceiling structures were 1.0 pCi/g on the basis of maximum alpha activity and 3.3 pCi/g on the basis of maximum beta-gamma activity.

The assumption was made that the rubbled mass of the building would be 40 percent floor, 20 percent upper wall, 20 percent lower wall, and 20 percent ceiling material. Based on these proportions and area concentrations, the weighted average concentration of radium-226 in the rubbled building was estimated to be 0.5 pCi/g on the basis of maximum surface alpha activity over all areas. Similarly, the weighted average concentration on the basis of beta-gamma activity was 2.4 pCi/g.

4.0 DISCUSSION AND CONCLUSIONS

Surface alpha and beta-gamma radiation activity measurements taken on various surfaces inside the PCB warehouse were used to estimate the radium-226 concentrations expected to be present in the rubbled building. Surface areas were divided into four categories: (1) floor, (2) upper walls, (3) lower walls, and (4) ceiling structures. In the interest of conservatism, the maximum activities detected in each area were used in calculating radium concentrations. On the basis of conservative assumptions and maximum surface alpha activity, the estimated upper limit of radium-226 in the rubbled warehouse would be 0.5 pCi/g, therefore allowing it to be released for unrestricted use. Using the same assumptions and the maximum beta-gamma activity, the upper limit would be 2.4 pCi/g, approximately 16 percent of the subsurface radium-226 guideline for soil. Both of these values are below the remedial action guidelines for radium-226 concentrations in soils when covered by more than 15 cm of clean soil. For the purpose of this analysis, it was assumed that all measured activity resulted from radium-226, because this provides the most conservative estimate. Actual radium-226 concentrations when averaged over 10-m by 10-m areas 0.15 m thick would be significantly lower than the calculated values.

The demolition and burial of the PCB warehouse in an unrestricted burial area is a viable alternative from a radiological standpoint. Taken in context with the PCB contamination associated with the structure, the preferred alternative is burial of the rubbled structure with no radiologically governed restriction.

REFERENCES

1. Oak Ridge Associated Universities. Comprehensive Radiological Survey Off-Site Property B Niagara Falls Storage Site, Lewiston, New York, Oak Ridge, TN, May 1984.

Exhibit II

Documents Supporting the Certification of the Remedial Action Activities Performed at Niagara Falls Storage Site Vicinity Properties in Lewiston, New York, from 1983 through 1986

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Exhibit II (1) - Decontamination or Stabilization Criteria

The following documents contain the guidelines that determine the need for remedial action. The subject properties have been decontaminated to comply with these guidelines. The first document listed is included as Appendix A of Exhibit I; the remaining documents are included in this docket by reference.

U.S. Department of Energy. "U.S. Department of Energy Guidelines for Residual Radioactivity at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites," Rev. 1, July 1985.

U.S. Department of Energy. Design Criteria for Formerly Utilized Sites Remedial Action Program (FUSRAP) and Surplus Facilities Management Program (SFMP), 14501-00-DC-01, Rev. 1, Oak Ridge, Tenn., February 1986.

Memorandum, P. J. Gross, Department of Energy, Oak Ridge Operations Office, to J. J. Fiore, Department of Energy Headquarters, Office of Nuclear Energy. "NFSS Residual Radioactive Material Guidelines," BNI CCN 055358, August 30, 1988.

Bechtel National, Inc. Development of A Supplemental Residual Contamination Guideline for the NFSS Central Drainage Ditch, Oak Ridge, Tenn., December 1986.

Exhibit II (2) - Designation or Authorization Documentation

The following documents authorized or designated remedial action to be performed at the subject properties. A copy of each is provided in this exhibit.

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Memorandum, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to L. F. Campbell, Technical Services Division, Oak Ridge Operations Office, Department of Energy. "Designation of NFSS Vicinity Property - Areas Along Pletcher Road," November 2, 1983.	II-7
Memorandum, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to E. L. Keller, Director, Technical Services Division, Oak Ridge Operations Office, Department of Energy. "Designation of Niagara Falls Storage Site Vicinity Properties," June 8, 1984.	II-8
Letter, W. E. Mott, Director, Environmental Control Technology Division, Office of Environment, to R. W. Ramsey. "Remedial Action at the Former Lake Ontario Ordnance Works Site," June 4, 1980.	II-16

Exhibit II (2) - Designation or Authorization Documentation (continued)

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Letter, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to G. H. Spira, Vice President and General Manager, SCA Chemical Services, Inc., April 13, 1984.	II-17
Letter, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to G. H. Spira, Vice President and General Manager, SCA Chemical Services, Inc., September 29, 1983.	II-19
Letter, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to G. H. Spira, Vice President and General Manager, SCA Chemical Services, Inc., June 4, 1984.	II-22
Letter, E. G. DeLaney, Manager, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, Department of Energy Headquarters, to L. F. Campbell, Technical Services Division, Oak Ridge Operations Office. "NFSS Decontamination Criteria," March 16, 1984.	II-24

Exhibit II (2) - Designation or Authorization Documentation (continued)

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Letter, G. P. Turi, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, Department of Energy Headquarters, to G. H. Spira, Vice President and General Manager, SCA Chemical Services, Inc., July 13, 1983.	II-29
Letter, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to S. Washuta, President, Modern Disposal Services, Inc., May 23, 1984.	II-30
Letter G. P. Turi, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, Department of Energy Headquarters, to S. A. Burger, Director, Division of Property and Engineering Management, Employment and Training and Administration, U.S. Department of Labor, July 11, 1983.	II-33
Letter, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to S. Washuta, President, Modern Disposal Services, Inc., June 1, 1984.	II-34
Letter, G. P. Turi, FUSRAP/Surplus Facilities Group, Division of Remedial Action Projects, Department of Energy Headquarters, to E. L. Keller, Director, Technical Services Division, Oak Ridge Office. "Designation of Niagara Falls Storage Site Off-Site Properties H', L, M, Q, and N/N' South," June 29, 1983.	II-36

Exhibit II (2) - Designation or Authorization Documentation (continued)

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Letter, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to C. Shultz, Town of Lewiston, August 23, 1983.	II-37
Letter, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to R. Cleary, Jr., Vice President, Regional Operations, Niagara Mohawk Power Corporation, April 26, 1984.	II-39
Letter, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to J. Sims, Somerset Group, Inc., May 23, 1984.	II-42
Letter, J. E. Baublitz, Director, Division of Remedial Action Projects, Office of Terminal Waste Disposal and Remedial Action, Office of Nuclear Energy, Department of Energy Headquarters, to C. Shultz, Town of Lewiston, May 23, 1984.	II-45

Exhibit II (2) - Designation or Authorization Documentation (continued)

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Letter, W. R. Voigt, Jr., Director, Office of Remedial Action and Waste Technology, Office of Nuclear Energy, Department of Energy Headquarters, to J. La Grone, Manager, Oak Ridge Operations Office. "Designation of Three NFSS Vicinity Properties," December 9, 1985.	II-47