SAFETY EVALUATION REPORT
ON PROPOSED REMEDIATION OF THE CHEMETRON FACILITIES AT THE BERT AVENUE SITE IN NEWBURGH HEIGHTS, OHIO

LICENSE NUMBER SUB-1357
DOCKET NUMBER 040-08724

CHEMETRON CORPORATION

February 12, 1997

Enclosure

FOREWORD

This Safety Evaluation Report (SER) reviews the radiological safety of certain decommissioning actions proposed by Chemetron Corporation at its facilities located on Bert Avenue in Cuyahoga Heights, Ohio. This SER evaluates conformance of the proposed action with U.S. Nuclear Regulatory Commission regulations and regulatory guidance concerning protection against the hazards of radioactive material. It was prepared by staff of NRC's Office of Nuclear Material Safety and Safeguards, in Rockville, Maryland, and NRC's Region III office in Lisle, Illinois.

In connection with the review of the proposed action, staff is also preparing an "Environmental Assessment of Proposed Remediation of the Chemetron Facilities at the Bert Avenue Site in Newburgh Heights, Ohio," which evaluates the environmental impacts of the proposed action. The Environmental Assessment is available for inspection and copying at the NRC Public Document Room, 2120 L Street, N.W., Washington, DC, and at the Local Public Document Room at the Garfield Heights Branch Library, 5409 Turney Road, Garfield Heights, Ohio (Docket Number 040-08724).

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1 INTRODUCTION

This Safety Evaluation Report (SER) was prepared by staff of the U.S. Nuclear Regulatory Commission (hereafter referred to as "the staff"), Office of Nuclear Material Safety and Safeguards, and Region III. This SER concerns a license amendment proposed by Chemetron Corporation (Chemetron) to authorize remediation of radioactive contamination at Chemetron's Harvard Avenue site in Cuyahoga Heights, Ohio; the Bert Avenue site in Newburgh Heights, Ohio; and the McGean-Rohco building complex in Cuyahoga Heights, Ohio. Figure 1.1 shows the general location of the Chemetron facilities. The purpose of the SER is to evaluate the consistency of the licensee's proposal with applicable NRC regulations and regulatory guidance and to recommend appropriate licensing actions. The staff issued license amendments authorizing remediation of the McGean-Rohco complex on August 9, 1994, and authorizing remediation of the Harvard Avenue site on June 7, 1996.

1.1 Background

Chemetron Corporation (Licensee) is the holder of Source Material License No. SUB-1357 (License) originally issued on June 12, 1979, by NRC, pursuant to 10 CFR Part 40, for possession only, of depleted uranium-contaminated waste in a facility located at 2910 Harvard Avenue, Cuyahoga Heights, Ohio (the Harvard Avenue site). On May 7, 1993, Chemetron requested an amendment to its license that would establish October 1, 1993, as the date for the submittal of the Site Remediation Plan for the Harvard Avenue and Bert Avenue Sites. On October 1, 1993, Chemetron submitted its "Site Remediation Plan, Chemetron Remediation Project, Harvard Avenue and Bert Avenue Sites" (Reference 1). However, the submittal did not contain the final radiation survey plan section, the safety analysis section, and the dose assessment section. On October 26, 1993, NRC issued a Confirmatory Order to Chemetron, requiring that the final radiation survey plan section be submitted to NRC by November 1, 1993, and the safety analysis and dose assessment section be submitted to NRC by November 15, 1993. On November 1, 1993, Chemetron submitted the final radiation survey plan section, and on November 11, 1993, Chemetron submitted the safety analysis and the dose assessment sections. Also, on November 1, 1993, Chemetron submitted a remediation plan for the contamination at the McGean-Rohco complex. On March 24, 1994, Chemetron submitted a request to amend its license to authorize remediation in accordance with its "Site Remediation Plan."

On April 4, 1994, Chemetron requested staff to separately review the remediation of the McGean-Rohco buildings so that remediation could begin as quickly as possible. After the review of the portions of the Chemetron Final Remediation Plan for Harvard Avenue and Bert Avenue sites that addressed the McGean-Rohco building remediation, staff published, in the Federal Register, on August 5, 1994, a Finding of No Significant Impact and an Environmental Assessment (EA) for the McGean-Rohco complex remediation (Reference 2). On August 9, 1994, staff issued Amendment 4 to the Chemetron license authorizing Chemetron to conduct the McGean-Rohco building remediation. On August 9, 1994, staff also issued an SER for the proposed remediation of the McGean-Rohco complex.

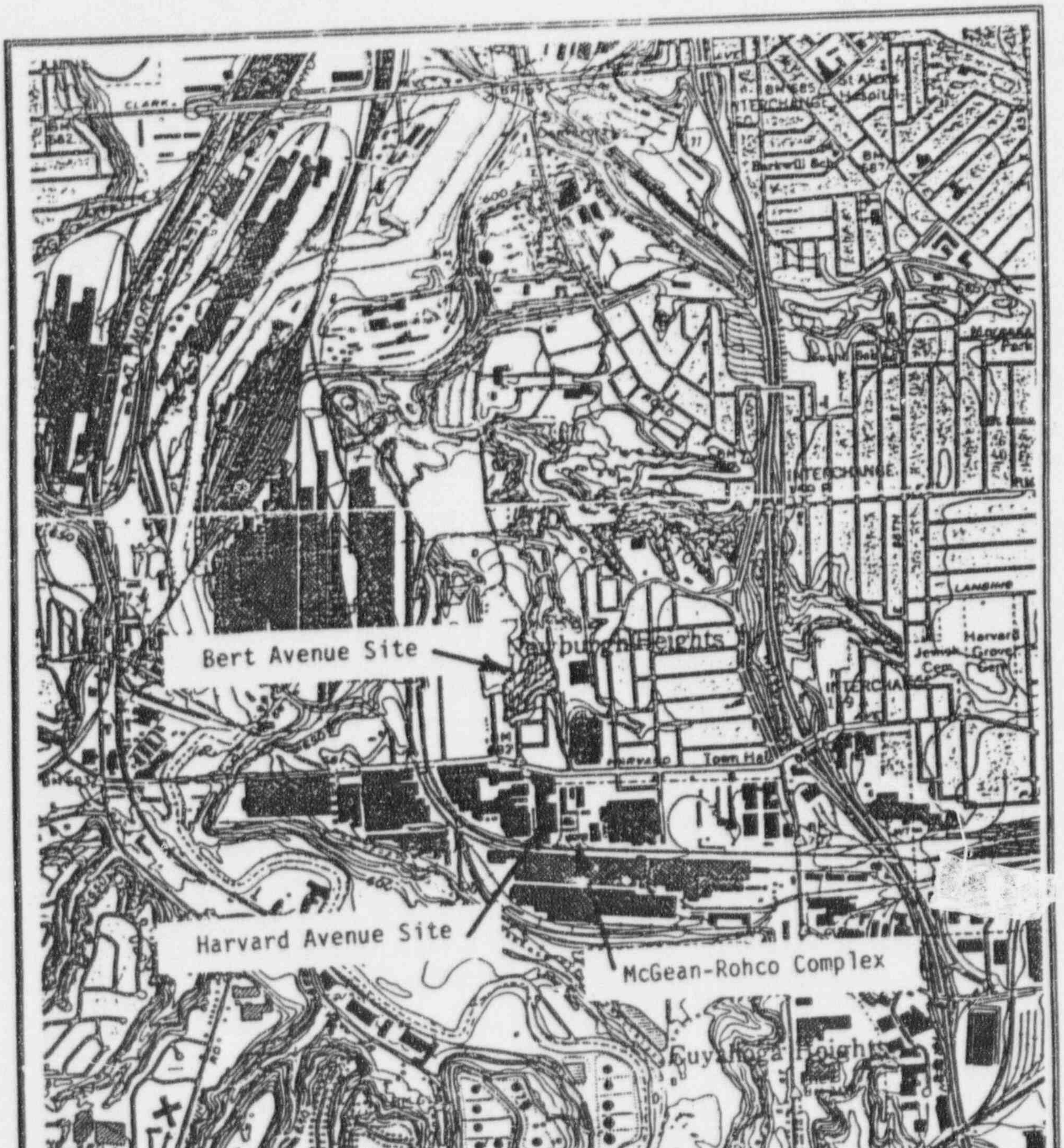

Figure 1.1 Location of Chemetron facilities.

On February 28, 1995, Chemetron submitted Revision 1 to its "Site Remediation Plan" (Reference 3). This revision incorporated modifications to the originally submitted "Site Remediation Plan," based on responses to NRC comments dated February 7, 1994; March 2, 1994; March 9, 1994; April 15, 1994; July 8, 1994; July 22, 1994; December 19, 1994; and December 22, 1994.

On May 18, 1995, Chemetron requested staff to expedite and separately review the remediation of the Harvard Avenue site, so that remediation would not be delayed because of the required Ohio Environmental Protection Agency review of the solid waste issues, at the Bert Avenue site, under its jurisdiction. Staff published, in the Federal Register, on June 6, 1996, a Finding of No Significant Impact and an EA for the Harvard Avenue remediation (Reference 4). On June 7, 1996, staff issued Amendment 5 to the Chemetron license authorizing Chemetron to conduct the Harvard Avenue remediation. On June 7, 1996, staff also issued an SER for the proposed remediation of the Harvard Avenue site.

These documents and a separately prepared and issued staff EA (Reference 5) related to the licensee's proposed remediation plan are the bases of this SER.

1.2 Proposed Action

This SER concerns the proposed final remediation of the Chemetron facilities at Bert Avenue. The purpose of this decommissioning is to remove radioactive contamination to levels such that the site can be released for unrestricted use.

In this action, Chemetron is proposing to use onsite disposal, under 10 CFR 20.2002, at the Bert Avenue facility, for wastes from the remediation of the Bert Avenue site, with concentrations up to the Option 2 limit in NRC's Branch Technical Position on "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations" (1981 BTP) (Reference 6). Wastes that exceed the Option 2 concentration limits in the 1981 BTP will be shipped offsite to a licensed low-level waste disposal site.

2 ADMINISTRATIVE CONTROLS

2.1 Organization and Responsibilities

The licensee's decommissioning project organization is shown in Figure 2.1. The Chemetron decommissioning project organization is headed by the Program Manager, who is responsible for overall project control. The Program Manager is also responsible for meeting environmental, health and safety, quality assurance, and technical requirements. The Project Manager/Radiation Safety Officer (RSO), who is responsible for site safety operations, licensing, and radiation protection. Reporting to the Project Manager is the Quality Assurance Coordinator, Environmental Safety and Health Coordinator, Laboratory Manager, Field Operations Supervisor, Engineering Design Coordinator, and the Excavation and Construction Subcontractors report to the Project Manager. The Quality Assurance Coordinator can report directly to the Program Manager to ensure independence of the Quality Assurance program. The Program Manager and the Project Manager/RSO have sufficient nuclear program management experience and technical qualifications to manage the remediation activities.

Chemetron intends to perform the remediation primarily through the use of contractor personnel. B. Koh & Associates will provide the Program Manager, the Project Manager/RSO, the Quality Assurance Coordinator, and the Environmental Safety and Health Coordinator. Contractor support from Dames & Moore will be responsible for engineering and design. Other contractor support will be provided for laboratory services, excavation and construction, decontamination, and radiation protection.

The staff concludes that the licensee's proposed decommissioning project organization provides sufficient experience and expertise to conduct the remediation in a manner that will protect public and worker health and safety. The organization also provides for an independent Quality Assurance Coordinator.

2.2 Training

Chemetron's worker training program is described in the "Radiation Worker Handbook and Training Manual" (Reference 7). The program includes site orientation training, radiation safety training, and industrial safety training. The training program is consistent with the requirements in 10 CFR Part 19.

Site orientation training is required of all who enter controlled areas, and addresses chemical and radioactive material labeling and posting, the need to limit exposures to workers and the public, and recognition of emergency signals.

Radiation safety training includes basic radiation safety principles and practices, biological effects of radiation, public and worker dose limits, radiological controls, radiation safety responsibilities, emergency procedures, rights of workers, airborne radiation controls, bioassay requirements, prenatal exposures, dosimetry, radiation work permits, waste

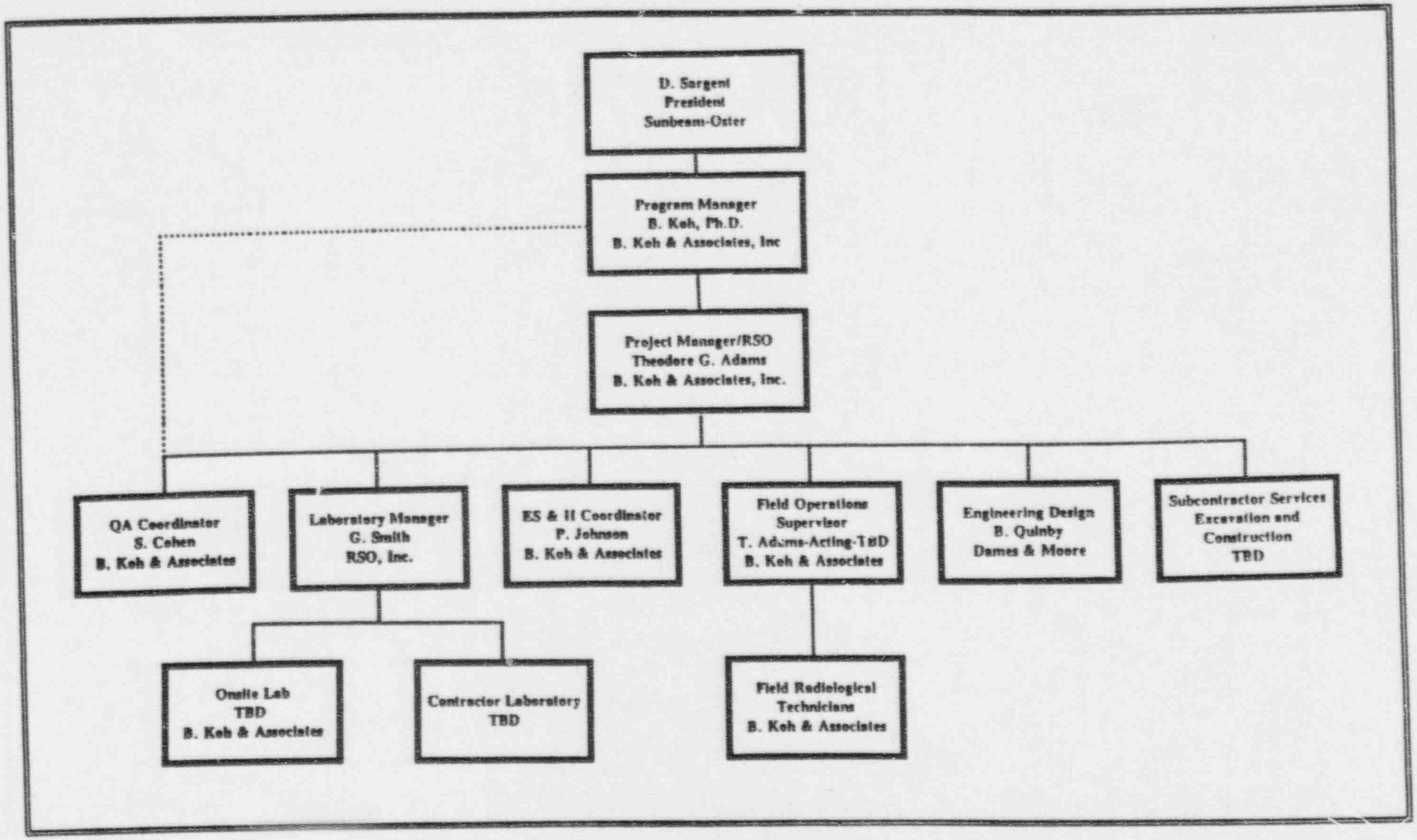

Figure 2.1 Chemetron organization.

minimization, and the as low as is reasonably achievable (ALARA) program. Workers must pass a written examination before being allowed unescorted access to the sites.

Industrial training presents information on industrial hazards that may be encountered during the remediation, proper safety procedures for using specialized equipment (including construction equipment), and emergency procedures.

The staff concludes that the licensee's proposed decommissioning project training program meets the requirements of 10 CFR Part 19, will ensure all Chemetron and contractor staff are knowledgeable of radiation protection requirements and procedures, and will provide the appropriate documentation of personnel training.

2.3 Quality Assurance

The Chemetron quality assurance program is documented in the Chemetron Remediation Project Quality Assurance Program and in the Quality Assurance Project Plan. These documents address management controls and requirements for ensuring quality in remediation activities. The plan requires management audits and radiation protection program controls. The Quality Assurance Coordinator reports directly to the Project Manager/RSO, but can also independently raise quality issues directly with the Program Manager.

The staff concludes that the licensee's Quality Assurance Project Plan is acceptable, provides reasonable assurance that the proposed remediation activities will be conducted in a controlled and acceptable manner, and provides for a Quality Assurance Coordinator who has sufficient independence and authority to correct deficiencies that could affect public and worker health and safety.

2.4 Licensee Flexibility

The licensee has proposed that major changes to the "Site Remediation Plan" will be submitted to NRC for approval. Minor plan revisions or minor field changes that do not affect the quality of the work, objectives, or cause a potential health and safety impact would not require submittal to NRC for approval. Major changes would include revisions that would result in an unreviewed safety question or a change in a license condition. All proposed changes will be reviewed by the Project Manager or his designee, to determine if the change is significant, in accordance with Administrative Procedure AP-06, "Field Changes." All changes will be documented and highlighted by change bars in the margins of the text.

The staff concludes that the proposed program for making changes to the "Site Remediation Plan" and procedures is acceptable. This program will be further documented in a license condition that requires: 1) review of all proposed changes to the "Site Remediation Plan," by the Project Manager or his designee, in accordance with Administrative Procedure AP-06, "Field Changes"; 2) submittal, to NRC, for approval, of changes that would result in an unreviewed safety question, a change in a license condition, or changes

that would have a significant adverse affect on the quality of the work, the remediation objectives, or health and safety; and 3) documentation of the changes made.

3 RADIATION HEALTH AND SAFETY

The staff reviewed the licensee's proposed health physics program, including procedures, equipment, instrumentation, training, and personnel dosimetry. The acceptance criteria are the provisions of 10 CFR Part 20. NRC guidance in Regulatory Guides 8.7, 8.8, 8.9, 8.25, 8.34, 8.36, and 8.37 (References 8 through 14) were also used to evaluate the proposed health physics program.

3.1 Health Physics and Safety Management

The Chemetron decommissioning project organization is headed by the Program Manager, who is responsible for overall project control. The Program Manager is also responsible for meeting environmental, health and safety, quality assurance, and technical requirements. Reporting to the Program Manager is the Project Manager/RSO, who is responsible for site safety operations, licensing, and radiation protection.

The RSO is directly responsible for the development and implementation of the Chemetron Project Health Physics Program, including those actions necessary to maintain exposures ALARA. The RSO has sufficient authority and independence to stop work and correct radiologically unsafe practices. The RSO is responsible for supervising radiation safety operations, ensuring that project personnel receive radiological training, providing technical expertise to radiation safety personnel, conducting audits of the health physics program, reviewing radiation survey reports, and developing and implementing the necessary project radiation safety procedures.

The staff finds that the project health physics management organization is appropriate for the proposed decommissioning effort, and the proposed RSO meets the qualification, experience, and training requirements for an individual responsible for a radiation safety program recommended in Regulatory Guide 10.4 (Reference 15).

3.2 Sources of Radiation

Radiological conditions at the Bert Avenue site have been adequately and appropriately characterized and documented in Chemetron's "Final Site Characterization Report" (Reference 16).

At the Bert Avenue site, Chemetron measured the radioactive concentrations in surface and subsurface soils, groundwater, surface water, and air. Chemetron reported a maximum surface concentration of U-238 of 87 Bq/gm (2341 pCi/gm) or 130 Bq/gm (3510 pCi/gm) total uranium. The most prominent area of surface contamination is Area B, located atop and along the steep slope of the ravine (see Figure 3.1). Portions of Area B have contamination that exceed 37 Bq/gm (1,000 pCi/gm) of U-238 or 56 Bq/gm (1500 pCi/gm) total uranium. Surface contamination is also reported along the natural drainage ditches and groundwater discharge areas (seeps) that discharge into the swampy area at the base of the ravine.

Subsurface soil contamination is reported by Chemetron in two primary areas (Areas A and B) of the Bert Avenue site (see Figure 3.1). The larger of the

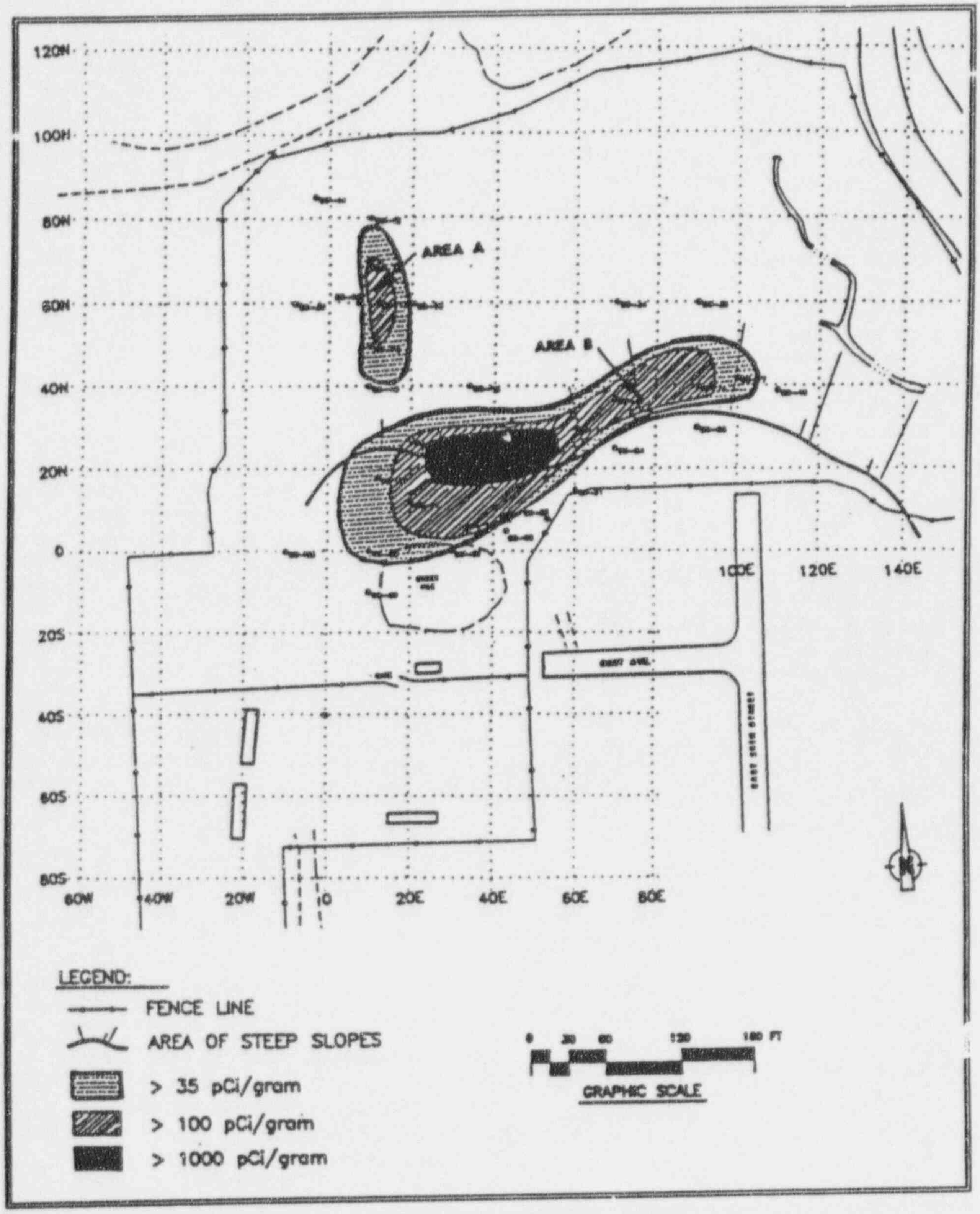

Figure 3.1 Location of highest surface and subsurface activities.

two areas (Area B) is 60-meters (197-ft) long by about 30-m (98-ft) wide, and is located below the surface of the steep slope of the ravine. This area is a subsurface layer of contamination ranging from 1.2 m (4 ft) to 2.4 m (8 ft) in thickness and covered by up to 6.7 m (22 ft) of lower-activity material. This area contains the highest subsurface concentration, 338 Bq (9130 pCi/gm) of U-238 or 507 Bq/gm (13,700 pCi/gm) total uranium, at the Bert Avenue site. A smaller contaminated area of subsurface soil (Area A) is about 35-m (115-ft) long and 10-m (33-ft) wide. This layer is between 0.6-m (2-ft) and 1.8-m (6-ft) thick and is covered by up to 0.6 m (2 ft) of lower-activity material. The maximum activity found in this smaller area was 18.6 Bq/gm (502 pCi/gm) of U-238 or 28 Bq/gm (750 pCi/gm) total uranium.

The average activity at the Bert Avenue site was calculated to be 3.3 Bq/gm (89 pCi/gm) U-238 or 5.0 Bq/gm (134 pCi/gm) total uranium based on all samples having concentrations exceeding 0.74 Bq/gm (20 pCi/gm).

Offsite samples were taken and analyzed for U-238. Chemetron reported one sample having a concentration of 3 Bq/gm (81 pCi/gm). The other samples were less than 1.3 Bq/gm (35 pCi/gm) U-238. Subsequent to the Chemetron sampling, an additional location, near the site gate on Bert Avenue, was found, by a private consultant, to have a U-238 concentration of 47 Bq/gm (1283 pCi/gm). Staff took samples in this location and found a U-238 concentration of 28.4 Bq/gm (767 pCi/gm). Additional sampling of this area in November 1994 showed contamination over the foundation of a demolished house that had been backfilled with Bert Avenue waste materials in the early 1970s. Contamination up to 8.7 Bq/gm (234 pCi/gm) was found and partially excavated in November 1994. The remaining contaminated material will be remediated during the Bert Avenue site remediation.

Th-232 and Ra-226 concentrations in subsurface soils are reported to be below the 1981 BTP limits for thorium contamination (0.37 Bq/gm (10 pCi/gm)) and the U.S. Environmental Protection Agency (EPA) limits for radium contamination of 0.19 Bq/gm (5 pCi/gm) in surface soils and 0.56 Bq/gm (15 pCi/gm) in subsurface soils.

Four piles of excavated soil comprise about 1440 m^3 (51,000 ft^3) and are reported to contain average total uranium concentrations of approximately 1.8 Bq/gm (48 pCi/gm), 1.7 Bq/gm (46 pCi/gm), 0.66 Bq/gm (18 pCi/gm), and 0.89 Bq/gm (24 pCi/gm), respectively.

The volume of contaminated material, at the Bert Avenue site, containing U-238 above 0.56 Bq/gm (15 pCi/gm) is estimated to be over 28,300 m^3 (1,000,000 ft^3). The volume of contaminated material with U-238 in excess of 3.7 Bq/gm (100 pCi/gm) is estimated to be approximately 1960 m^3 (70,000 ft^3). The total volume of radioactive wastes that will require disposal in the cell is estimated to be 13,600 m^3 (482,000 ft^3). Chemetron estimates that 420 m^3 (15,000 ft^3) of wastes will require transport offsite to the Envirocare low-level waste disposal facility in Clive, Utah.

Chemetron analyzed Bert Avenue site groundwater samples from 12 onsite monitoring wells and groundwater seeps. These samples, taken and prepared in accordance with EPA sampling protocols, showed uranium concentrations in the

groundwater were less than the proposed EPA drinking water standard of 1.1 Bq/l (30 pCi/l). Ra-226 was also less than the proposed EPA groundwater standard of 0.74 Bq/l (20 pCi/l). Th-232 concentrations were measured and found to be less than the lower limit of detection. Note that no EPA drinking water limits have been proposed for thorium. Note also that there are no known drinking water wells in the vicinity of the Bert Avenue site, as public drinking water systems are used by local residents. Surface water samples were taken at various locations on the Bert Avenue site, including where surface water exits from the site at the Burke Brook Branch sewer discharge point. The samples taken at the Burke Brook Branch discharge point had uranium concentrations less than the proposed EPA drinking water standard. Other surface water samples had total uranium concentrations up to 1.9 Bq/l (52 pCi/l). These concentrations are well below NRC requirements for effluent release in 10 CFR Part 20, Appendix B (92 Bq/l (300 pCi/l)).

Radiological surveys of ground surfaces performed by staff in 1991 indicate radiation exposure levels of less than 8 nC/Kg/hr (20 uR/hr) in unrestricted areas. Results of environmental radiation monitors (thermoluminescent dosimeters (TLDs) and air samplers) indicate that external and airborne radiation levels are consistent with natural background levels for the suburban Cleveland area.

Chemetron performed chemical analyses on groundwater, surface water, soil, and sediment samples at the Bert Avenue site. Elevated levels of aluminum, antimony, arsenic, and manganese were found in upgradient wells and in downgradient locations. The downgradient locations showed generally lower concentrations of these metals than the upgradient sources. Phthalate compounds and pesticides were also detected in some groundwater samples. The analytical laboratory also detected pesticides in some of the instrument and trip blank samples, causing some of these results to be considered suspect. Methylene chloride was found in 6 of the 14 monitoring wells at concentrations of up to 13 ppb, slightly above the lower limits of detection. In surface water samples, acetone was found at concentrations of up to 41 ppb. Acetone, at a concentration of 32 ppb, was also found at the location where sewerage discharges into the site. No polychlorinated biphenyls were detected in either groundwater or surface water samples.

Sediment samples were analyzed for Toxicity Characteristic Leaching Procedure (TCLP) metals; Target Analyte List (TAL) compounds; and Target Compound List (TCL) compounds. All TCLP metals were below EPA limits for Resource Conservation and Recovery Act (RCRA) hazardous waste classification. Elevated TAL inorganic compound levels were found for aluminum, arsenic, barium, cadmium, lead, and mercury. Acetone was the only TCL compound detected above instrument lower limits of detection.

Soil samples were analyzed for TCLP, TAL, and TCL compounds. TCLP metals were less than the EPA limits for RCRA hazardous waste classification. One TCLP pesticide, heptachlor, was found in one sample in a concentration that exceeds the RCRA hazardous waste classification limit. Methylene chloride, acetone, toluene, and xylene were detected in some of the samples.

3.3 Dose Commitment

3.3.1 Radiation Exposures to the Public

Radiological impacts on members of the public may result from inhalation and ingestion of releases of radioactivity in air and in water during the remediation operations, and direct exposure to radiation from radioactive materials at the site during remediation operations. The public will also be exposed to radiation as a result of the onsite disposals. In addition to impacts from routine operations, the potential radiological consequences of accidents are considered.

The licensee provided an estimate of dose to the public from airborne effluents to be generated during the excavation activities associated with the decommissioning of Bert Avenue site. The estimation was performed using the CAP88PC computer code (Reference 17) (a program developed by EPA to demonstrate compliance with the "National Emission Standards for Hazardous Air Pollutants," 40 CFR Part 61) and predicted a maximum public dose from airborne effluents of 0.04 mSv (4 mrem) for the Bert Avenue site. The licensee assumed that the nearest receptor is 50 m (164 ft) away from the release point.

The staff performed a conservative, independent analysis of the potential for public exposure from airborne effluents. The staff did not use dispersion modeling to estimate the public dose from airborne effluents. Instead, the airborne concentration in the immediate excavation area was estimated and that concentration was used to estimate the maximum public dose, assuming no dispersion between the excavation area and the location of the closest offsite resident. The staff assumed the following:

1. 200 $\mu g/m^3$ (1.23E-8 lb/ft^3) mass loading factor;
2. 4.8 Bq/gm (130 pCi/g) (total depleted uranium);
3. no dispersion from the point of generation to the location of the nearest offsite resident.

The estimated airborne concentration of uranium in the immediate area of the excavation is 9.9E-22 Bq/ml (2.7E-14 μCi/ml), approximately 47 percent of the 10 CFR Part 20, Appendix B, Table 2, Column 1, limit for unrestricted areas. The limit that applies in this case is a weighted average of the limits for U-238 and U-234 assuming that the U-234 activity concentration is 50 percent of the U-238 concentration in the uranium at the Chemetron site; the weighted limit is 2.11E-21 Bq/ml (5.7E-14 μCi/ml). Using the weighted limit, and assuming that continuous exposure at the limit results in 0.5 mSv (50 mrem) (the 10 CFR Part 20 airborne dose limits to members of the public are based on an individual receiving 0.5 mSv (50 mrem) when exposed to a concentration equal to the limit), the estimated dose to the nearest resident during excavation of soil at the Chemetron Bert Avenue site is approximately 0.24 mSv (24 mrem).

Since the estimated maximum dose from potential airborne effluents is a significant fraction of the 10 CFR Part 20 limits, the staff is applying a license condition to require an air sampling program at the site perimeter, and, when airborne concentrations exceed 1.1E-21 Bq/ml (3.0E-14 μCi/ml), to

require that the use of dust suppression measures be considered during the excavation of the contaminated soil at the Bert Avenue site.

The staff performed dose assessments for the Bert Avenue disposal cell using the RESRAD computer code, Version 5.61 (Reference 18). Groundwater doses after 1000 years were analyzed using the NEFTRAN II computer code (Reference 19). The RESRAD code calculates dose impacts assuming a resident-farmer scenario, where an individual would construct a residence, live there, grow food, and consume all drinking water from a conservatively located groundwater well. For the Bert Avenue disposal cell, a waste volume of 15,000 m^3 (530,000 ft^3), at an average concentration of 3.2 Bq/gm (87 pCi/gm) U-238, 0.032 Bq/gm (0.87 pCi/gm) U-235, and 1.71 Bq/gm (42.6 pCi/gm) U-234, was assumed. Calculations were performed using a 2.4-m (8-ft) cover and no cover. The drinking water consumption rate was assumed to be 730 l/yr (193 gal/yr) and the distribution coefficient for uranium in the disposal cell clay liner and natural unsaturated lacustrine clay layer was assumed to be 10 ml/g (280 in^3/lb). Staff also used parameters recommended in staff guidance (Reference 20).

For the RESRAD analysis, the distance from the groundwater well to the ground surface was assumed to be 140 m (460 ft). This well depth was based on the regional geology of the Bert Avenue site. The swampy area at the base of the Bert Avenue site lies just above a lacustrine clay layer that is at least 180-m (600-ft) thick. Overlaying the lacustrine clay layer are fill deposits and an undifferentiated surficial layer that is about 12- to 15-m (40- to 50-ft) thick. The Bert Avenue ravine is cut into the surficial layer. Some groundwater occurs in the surficial deposits. However, groundwater in the surficial deposits is unsuitable for potable water supplies because of industrial development in the area. These groundwater supplies may also be insufficient to provide a reliable source of water for domestic use. Because the lacustrine clays have a relatively low porosity and would not provide sufficient water volumes for domestic use, it was assumed that the groundwater well is drilled into a sand and gravel deposit that is assumed to exist between a depth of 81 m (265 ft) and 155 m (510 ft). This assumption is based on the existence of a groundwater well about 1.6 km (1 mile) from the Bert Avenue site that is drilled to 160 m (523 ft) and boring log information that shows the sand and gravel layer at a depth of 81 m (265 ft) to 155 m (510 ft).

The results of the calculations are shown on Figures 3.2 and 3.3. Over a 1000-year period, the peak dose, assuming a cover and using the RESRAD code, was computed to be 7E-5 mSv/yr (0.007 mrem/yr). These doses include doses from the groundwater dependent pathways, such as direct consumption of groundwater and consumption of food irrigated by groundwater, and groundwater-independent pathways, such as inhalation, ingestion, and direct exposure. The doses are dominated by the radon inhalation pathway. These radon inhalation

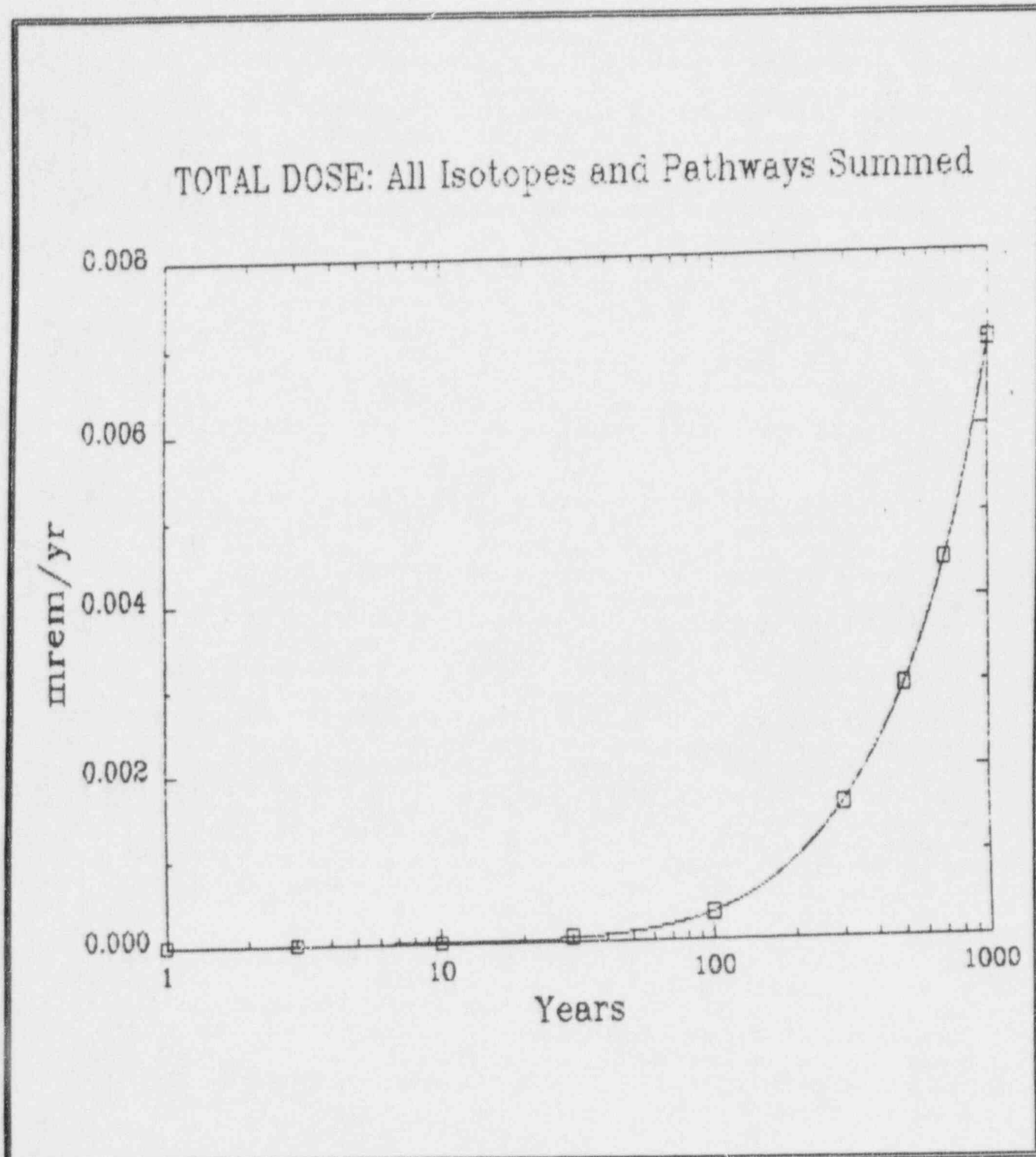

Figure 3.2 Resident-farmer scenario doses for the Bert Avenue disposal cell with cover.

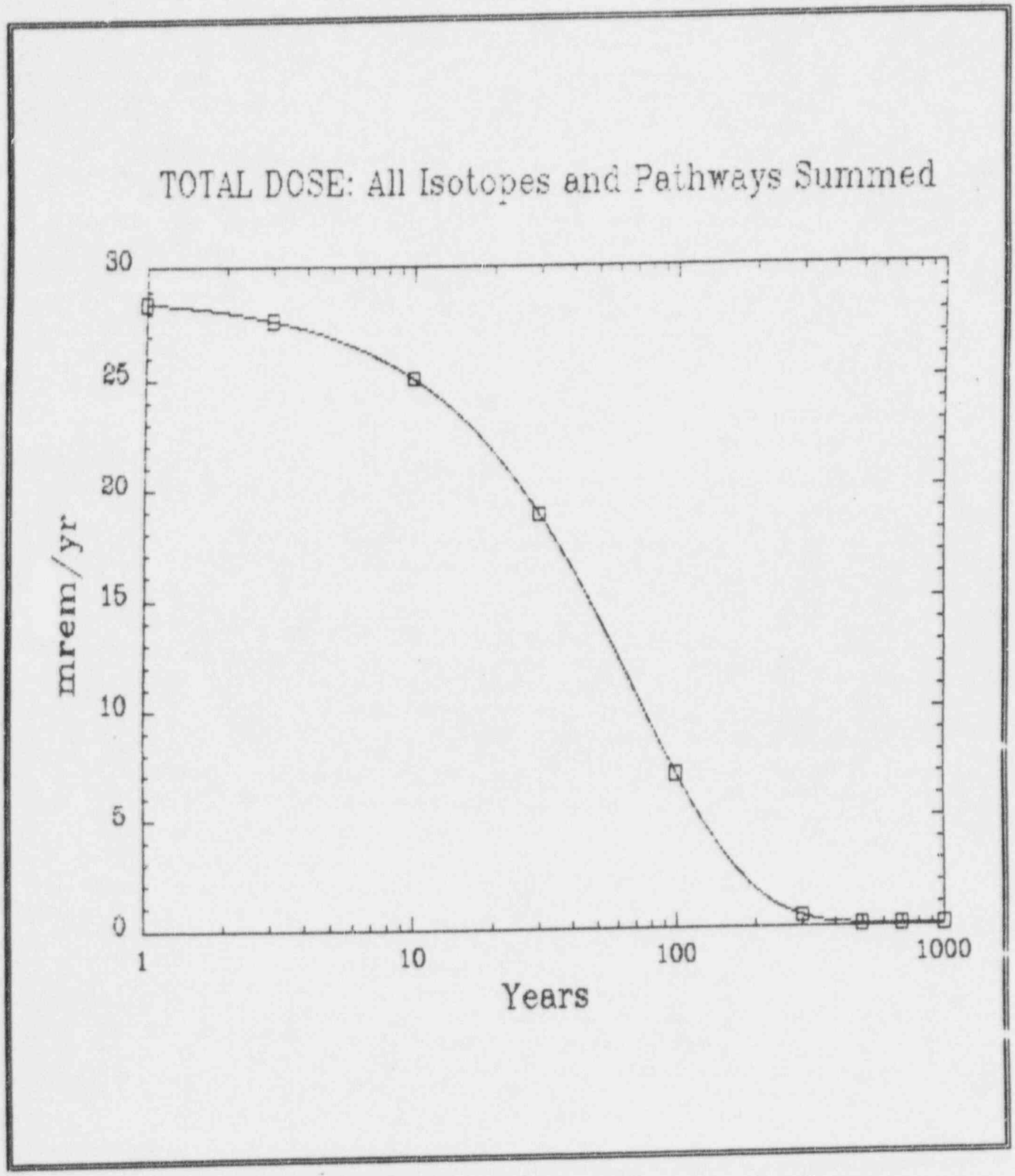

Figure 3.3 Resident-farmer scenario doses for the Bert Avenue disposal cell with no cover.

doses continue to increase from 2.5E-5 mSv/yr (0.0025 mrem/yr) at 1000 years to about 5E-5 mSv/yr (0.005 mrem/yr) at 10,000 years. Assuming no cover, the peak dose over a 1000-year period is 0.28 mSv/yr (28 mrem/yr). In both the cover and no cover cases, doses result from the groundwater independent pathways (inhalation, ingestion, and direct exposure). No groundwater pathway effects were observed in the calculations during the 1000 year time period.

Groundwater pathways after 1000 years were evaluated using the NEFTRAN II code. The NEFTRAN II code was used for this analysis because it can more realistically model the actual dispersion of radionuclides through the lacustrine clay layer than does the RESRAD model. The NEFTRAN II code was used to simulate radionuclide migration in the contaminated soil, clay liner, and lacustrine clay unit. Radionuclide releases from the site were assumed to travel in the lacustrine clay and enter a sand and gravel layer where a withdrawal well was assumed to be located. Key assumptions used in the analysis are as follows:

1. The inventory of U-238 was assumed to be 79.6 GBq (2.15 Ci). The total inventory of U-234 was assumed to be 38.8 GBq (1.05 Ci),

2. Doses are based on release of U-234 and U-238; U-235 was not included because of its negligible dose as compared with the other two nuclides,

3. All releases from the site were assumed to be intercepted by the well (i.e., well production is assumed to be sufficient to justify capture of all releases),

4. Annual well production is 4240 m^3 (150,000 ft^3) based on a reasonable family farm irrigation and consumption rate. Nuclide concentrations at the well are based on 4240 m^3 (150,000 ft^3) of water per year and not the volumetric waste flux out of the disposal unit. This assumes the well will mix fresh and contaminated water at the intake and be sufficient to capture all releases. The model conservatively assumes that there is a sufficient well production volume such that all the contaminants that reach the well depth in a given year are pumped into the well,

5. Two well locations were used -- one at 150 m (500 ft) from the Bert Avenue site and the other at 1500 m (5000 ft) from the Bert Avenue site. Both well locations assume that the vertical migration of nuclides is sufficient to allow interception of the contamination in the sand and gravel layer (see Figure 3.4); for the 1500-m (5000-ft) location currently known to exist (for this case, a vertical migration of about 76 m (250 ft) is necessary for this to occur, which is considered to be a conservative assumption considering the properties of the lacustrine clay layer). For the 150-m (500-ft) location there is additional conservatism by assuming the sand and gravel layer exist at a significantly shallower depth,

6. Disposal cell design properties do not change over the evaluation period,

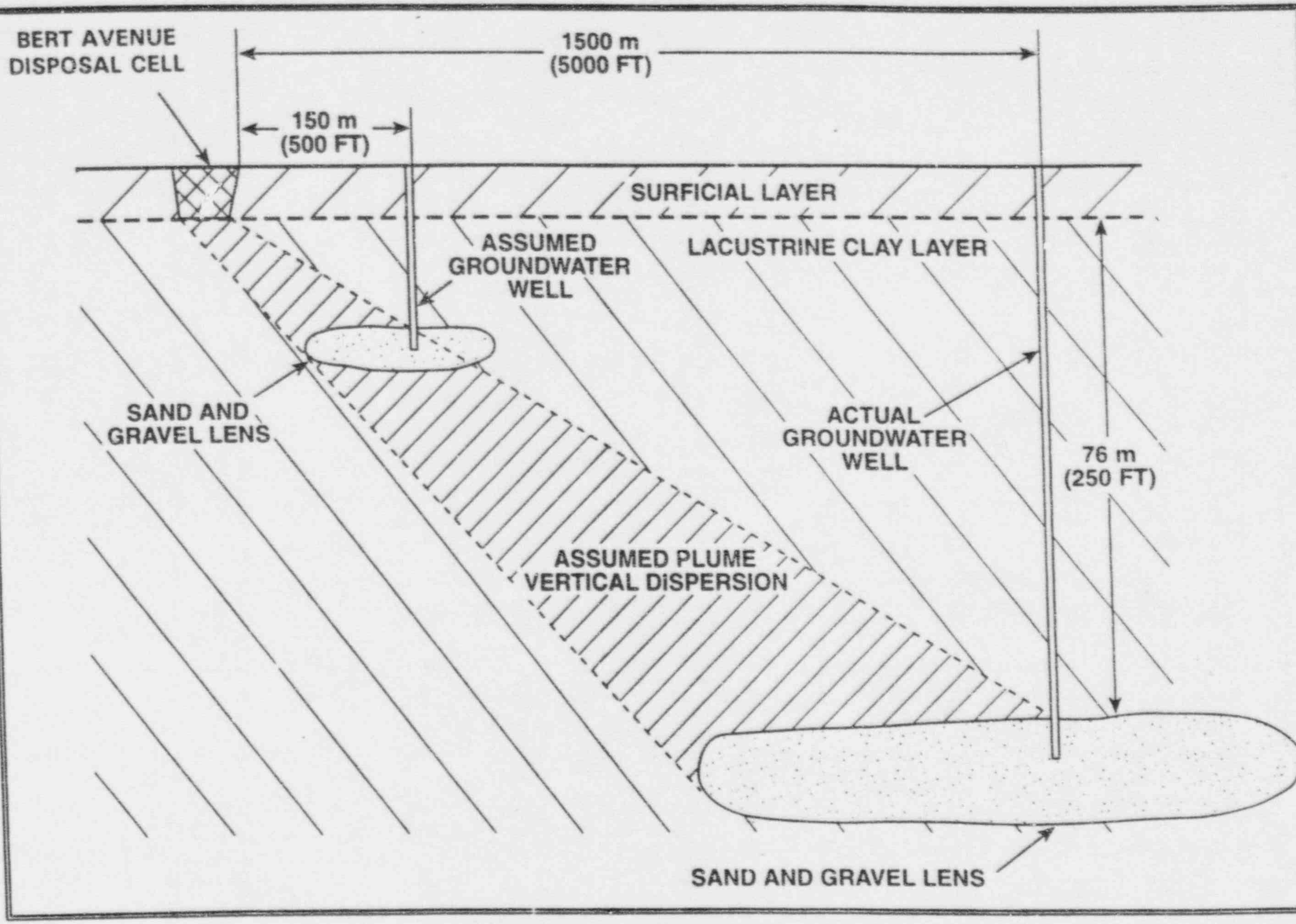

Figure 3.4 Assumed groundwater plume dispersion for NEFTRAN II analysis.

7. The dimensions of the disposal cell are 55 m (180 ft) by 100 m (330 ft) with a thickness of 2.7 m (9 ft),

8. The dimensions of the clay liner surrounding the contaminated soil are 0.9 m (3 ft) on the sides and 1.5 m (5 ft) on the bottom,

9. Hydraulic properties of the contaminated soil are:
porosity of 0.2; bulk density of 1.65 grams/cc (103 lb/ft^3);
conductivity of 20 m/yr (66 ft/yr),

10. Hydraulic properties of the clay liner are:
porosity of 0.4;
bulk density of 1.65 grams/cc (103 lb/ft^3);
conductivity of 0.03 m/yr (0.1 ft/yr),

11. Hydraulic properties of the lacustrine clay are:
porosity of 0.3;
bulk density of 1.65 grams/cc (103 lb/ft^3);
conductivity of 3 m/yr (10 ft/yr);
gradient 10 percent,

12. The solubility of uranium in water is assumed to be 50 mg/l (0.0031 lb/ft^3),

13. The dispersion length is 10 percent of the travel path,

14. The groundwater flux through the disposal unit is determined assuming: (a) a gradient of 1 across the clay liner (bottom) because of perched conditions; (b) the conductivity of the clay liner will limit the flow; and (c) the flow is downward. This results in a volumetric flux of 168 m^3/yr (5940 ft^3/yr) based on an area of 5520 m^2 (59,400 ft^2), conductivity of 0.03 m/yr (0.1 ft/yr), and a gradient of 1,

15. The distribution coefficient (Kd) used for the clay liner and lacustrine clay is 10 ml/g (280 in^3/lb); no retardation is assumed in the contaminated soil,

16. The drinking water pathway dose conversion factor for U-234 is 5.7E-5 mSv/yr per Bq/m^3 (2.1E8 mrem/yr per Ci/m^3) and 5.1E-5 mSv/yr per Bq/m^3 (1.9E8 mrem/yr per Ci/m^3) for U-238.

The results of the NEFTRAN II analysis indicate a peak annual dose of 0.22 mSv (22 mrem) at 8000 years using the well location 150 m (500 ft) from the Bert Avenue site and 0.02 mSv (2 mrem) at approximately 65,000 years at the well location 1500 m (5000 ft) from the Bert Avenue site.

Staff evaluated the groundwater effects if the cell underdrain system ceases to function and the groundwater table rises to the level of the natural topography (see Figure 3.5). Assuming a 10 percent gradient along the longest dimension of the cell, inferred from the cell design slope, and a clay conductivity of 10^{-7} cm/sec (0.1 ft/yr), the water flow rate through the clay liner would be 0.46 m^3/yr (16.2 ft^3/yr). Using the following conservative

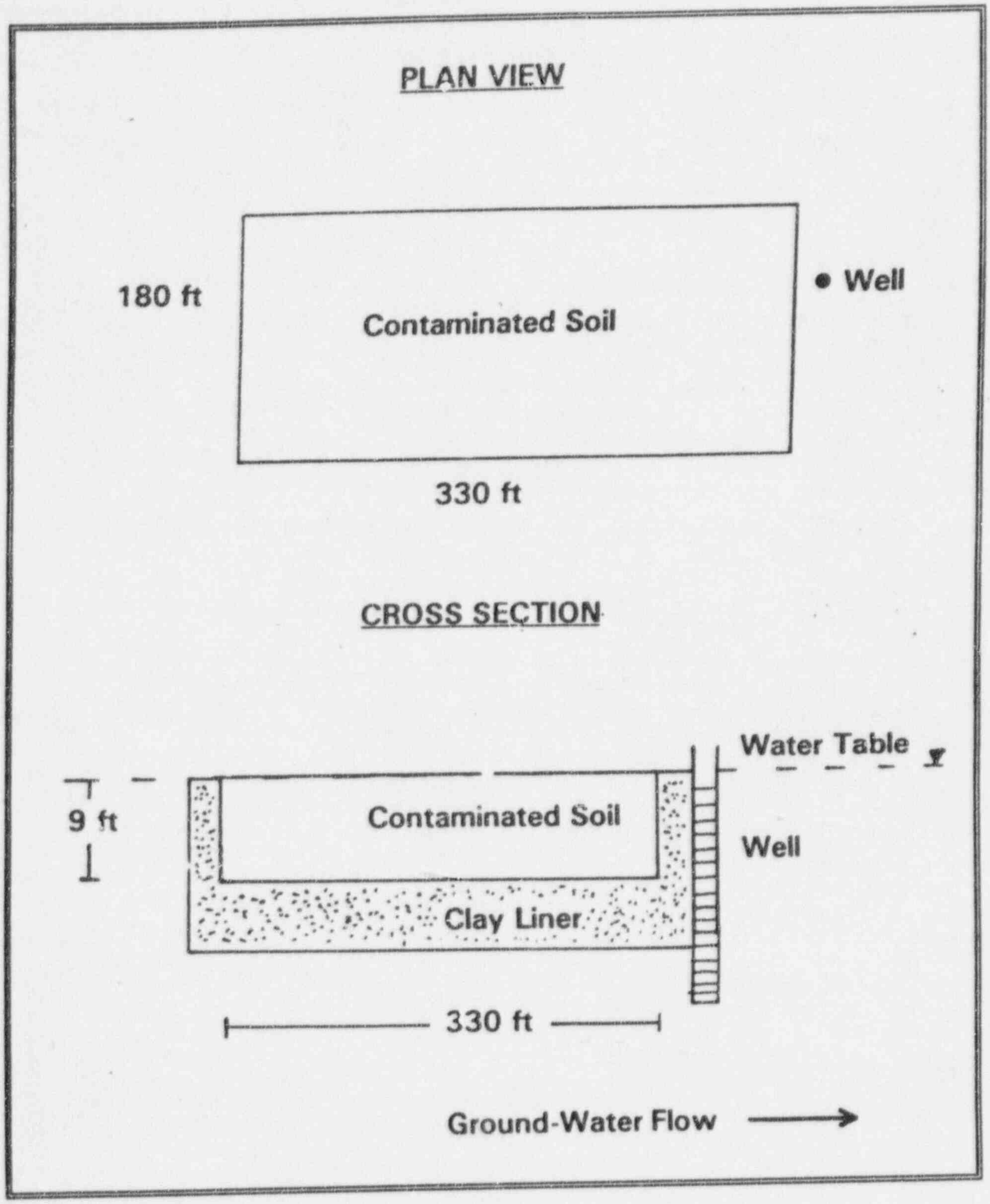

Figure 3.5 Conceptual model for water flow through the Bert Avenue cell assuming a rise in the water table.

geochemical assumptions, the dose from uranium leaving the disposal cell with a sufficient amount of fresh water to meet the annual demand of a resident family of 4240 m^3/yr (150,000 ft^3/yr), was computed:

1. clay distribution coefficient of 10 ml/gm (280 in^3/lb);
2. contaminated soil distribution coefficient of 5 ml/gm (138 in^3/lb);
3. uranium solubility of 5E-5 gm/m^3 (1.8E-6 lb/in^3);
4. all of the water passing through the cell is intercepted by the groundwater well.

The resulting dose was calculated to be 1.0E-5 mSv/yr (0.001 mrem/yr) at 1000 years and 2.0E-4 mSv/yr (0.02 mrem/yr) at 10,000 years.

Staff also analyzed the groundwater effects if the underdrain system continued to function, but the contaminated waste layer became saturated with water forming a perched water zone (see Figure 3.6). This scenario results in a greater head for water movement through the clay liner than the scenario where the groundwater level rises to the level of the natural topography. The water flow direction is downward through the clay liner at a rate of 168 m^3/yr (5940 ft^3/yr). Assuming similar conservative geochemical parameters as above, the dose to an individual member of a resident family using water at a rate of 4240 m^3/yr (150,000 ft^3/yr), would be 0.26 mSv/yr (26 mrem/yr) at 1000 years and the peak dose would be 0.71 mSv (71 mrem) at 1650 years.

The above doses estimated for the public are less than the 1 mSv/yr (100 mrem/yr) limit for exposures to the public in 10 CFR Part 20.

3.3.2 Occupational Exposures

During the remediation of the contaminated materials, workers may receive doses from direct exposure and from the inhalation of dusts containing depleted uranium. From direct exposure, assuming the maximum measured background radiation levels at the Bert Avenue site of 0.1 mSv (10 mrem), over a 3-month period and a 2000-hr exposure, Chemetron computed the direct exposure dose to be 0.14 mSv (14 mrem). Assuming an average total uranium concentration of 4.8 Bq/gm (130 pCi/gm), a dust loading of 200 μg (4.4E-7 lb) of soil per m^3 (35.3 ft^3) of air, a respiratory rate of 1.2 m^3 (42.4 ft^3) of air per hour, a 3000-hr exposure, and dose conversion factors from Federal Guidance Report No. 11 (Reference 21), Chemetron computed the inhalation dose to be 0.12 mSv (12 mrem). The above doses are substantially below the 10 CFR Part 20 limit of 0.05 Sv/yr (5 rem/yr) for routine occupational exposure.

The staff considers that these dose estimates are conservative, but reasonable estimates, and are within NRC requirements.

3.4 Health Physics Program

The licensee's health physics program is described in the "Radiological Control Plan" (Reference 22). This program is intended to ensure that

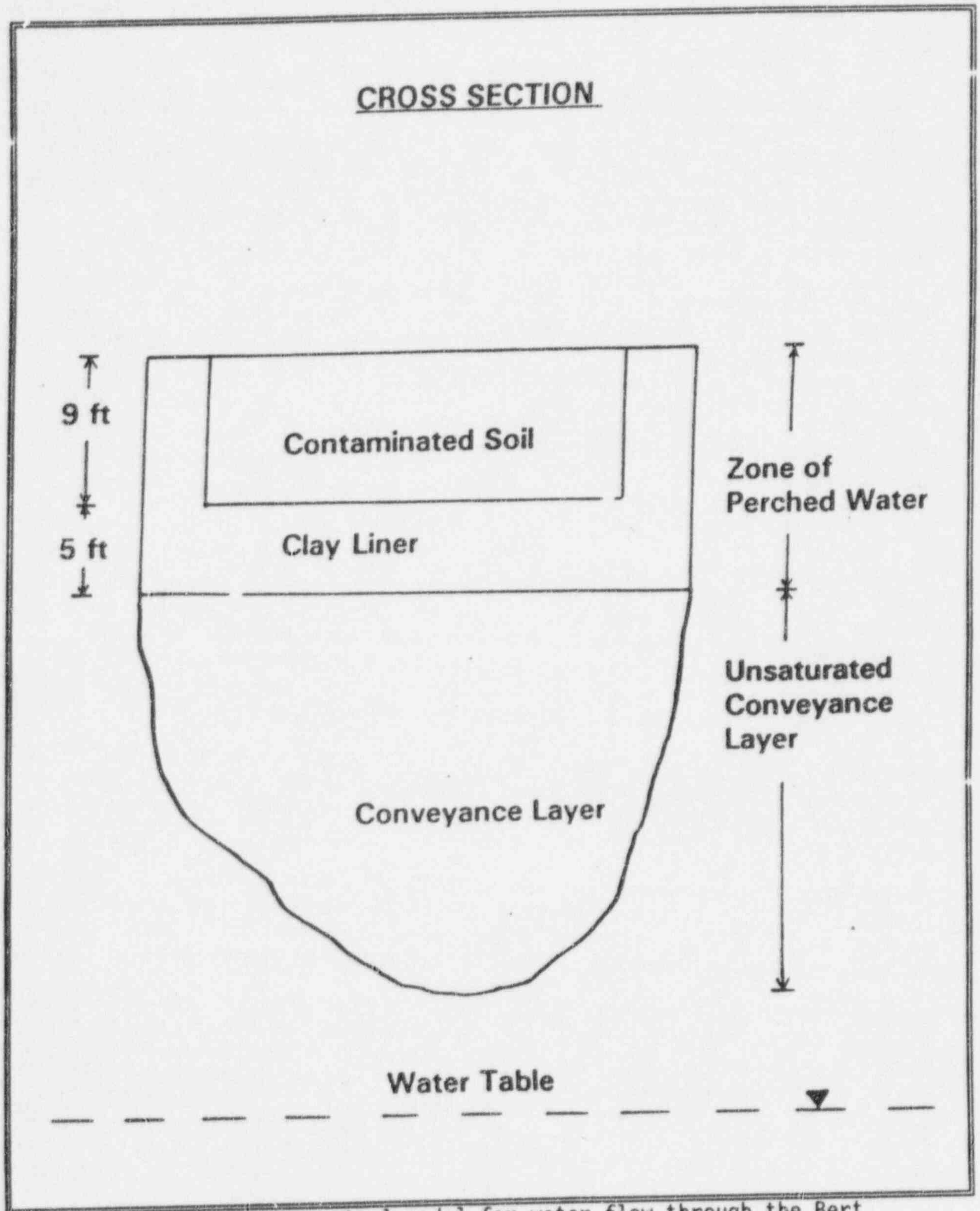

Figure 3.6 Conceptual model for water flow through the Bert Avenue cell assuming local perched water conditions

exposures meet 10 CFR Part 20 requirements and are "ALARA." The "Radiological Control Plan" describes the responsibilities of Chemetron management, the RSO and workers, the ALARA program, radiation safety training requirements, monitoring requirements, a radiation work permit program, internal and external exposure control, contamination control, documentation requirements, and emergency actions.

Chemetron management committed to establishing an ALARA program to reduce individual and collective worker and public exposures to levels that are "ALARA." The RSO is designated as responsible for implementing the ALARA program. The ALARA policy will be incorporated into the development of project procedures and radiation work permits through the reviews by Chemetron management staff and the RSO. The principles of ALARA are covered in the worker training program.

Workers will be trained in accordance with Chemetron's "Radiation Worker Handbook and Training Manual" (Reference 7). The program includes site orientation training, radiation safety training, and industrial safety training. The training program is consistent with the requirements in 10 CFR Part 19.

Site orientation training is required of all who enter controlled areas and addresses chemical and radioactive material labeling and posting, the need to limit exposures to workers and the public, and recognition of emergency signals.

Radiation safety training includes basic radiation safety principles and practices, biological effects of radiation, public and worker dose limits, radiological controls, radiation safety responsibilities, emergency procedures, rights of workers, airborne radiation controls, bioassay requirements, prenatal exposures, dosimetry, radiation work permits, waste minimization, and the ALARA program. Workers must pass a written examination before being allowed unescorted access to the site.

Industrial training presents information on industrial hazards that may be encountered during the remediation, proper safety procedures for using specialized equipment (including construction equipment), and emergency procedures.

Health physics program reviews and audits will be conducted as a part of the Chemetron Quality Assurance Program. Quality assurance provisions will apply to the conduct of surveys, sampling, analyses, use of radiation instrumentation and equipment, and radiation safety procedures and controls.

During the remediation operations, liquid and airborne effluents will be sampled and analyzed to ensure that releases meet the requirements of 10 CFR Part 20, Appendix B. Continuous air sampling will also be performed in work areas and at the site perimeter. Chemetron proposed action levels for airborne releases at 1.1E-21 Bq/ml (3.0E-14 uCi/ml). A license condition will be used to establish an action level when airborne concentrations exceed 1.1E-21 Bq/ml (3.0E-14 uCi/ml) and to require that dust suppression methods be considered for use to limit offsite exposures. Environmental monitoring will also use TLDs to measure direct radiation at the site perimeter.

Contamination controls will be placed on all equipment to be removed from controlled areas. Contamination controls use the limits in "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted

Use or Termination of License for Byproduct, Source or Special Nuclear Material" (Reference 23).

Worker exposure controls include personal dosimetry, a radiation work permit program, personal protective clothing, the establishment of controlled areas, personal surveys when leaving controlled areas, a respiratory protection program, a bioassay program, and documentation of exposures and surveys.

The staff concludes that the proposed health physics program is acceptable, and is capable of effectively measuring worker and public exposures and effluent releases, controlling contamination, training workers, and ensuring that 10 CFR Part 20 requirements will be met.

3.5 Health Physics Instruments, Equipment, and Facilities

Instruments and equipment to be used include portable radiation survey instruments, personnel monitoring equipment, portable area and airborne radioactivity monitors, laboratory equipment, air samplers, respiratory protection equipment, and protective clothing. Onsite and offsite laboratories will be used to provide analytical services. These laboratory services will be used under the Chemetron Quality Assurance Plan and will participate in a laboratory cross-check program. Instruments will be properly stored and maintained, and regularly tested and calibrated with sources traceable to National Institute of Standards and Technology standards.

The staff concludes that appropriate controls will be established to ensure the proper storage, maintenance, and use of health physics instruments, equipment, and facilities.

3.6 Health Physics Procedures

The licensee will control work activities through the use of approved, written, administrative and field procedures. All personnel entering controlled radiation areas will be assigned personnel dosimeters. Workers will be assigned appropriate protective clothing and gear based on work area radiation surveys and the type of work to be performed. All work will be performed in accordance with radiation work permits documenting area radiation hazards and contamination levels and the required radiation exposure protective and monitoring equipment. All radiation exposure information will be obtained, processed, and recorded in accordance with 10 CFR Part 20.

The staff concludes that the proposed program for using procedures to control work activities involving radioactive materials is acceptable.

3.7 Industrial Safety

The proposed decommissioning activities involve the use of construction equipment. Workers will undergo training, in industrial safety, that provides a description of the hazards that will be encountered, warnings and alarms to be used in the event of emergencies, measures to be taken to prevent personal injury, protection of equipment and facilities, first aid, CPR, fire fighting, and use of respirators.

The staff concludes that the proposed industrial safety program will provide an appropriate level of protection to workers.

4 RADIOACTIVE WASTE MANAGEMENT

4.1 Waste Packaging and Shipping

Chemetron indicated that specific waste packaging and transportation methods will be selected during the remediation. These methods will comply with NRC and Department of Transportation (DOT) packaging and shipping requirements. Covered trucks or covered rail hopper cars will be used.

4.2 Offsite Waste Disposal

Remediation activities are expected to generate the following volumes of wastes:

Wastes to be disposed of in the cell	13,600 m^3	(482,000 ft^3)
Wastes to be shipped offsite	420 m^3	(15,000 ft^3)

Wastes can be shipped by either truck or rail. Assuming shipment by 15-m^3 (20-y^3) dump trucks, 28 truckloads would be required to ship the 420 m^3 (15,000 ft^3) of contaminated materials that exceed the Option 2 limits. Assuming covered hopper railcars having a capacity of 59 MT (130 tons), about 62 m^3 (80 y^3) of wastes could be shipped in each railcar. At this capacity, seven railcars would be needed for the shipments.

For truck shipments, it was assumed that the route depicted on Figure 4.1 would be used from Cleveland, Ohio, to Clive, Utah. This route is 2860-km (1775-miles) long and, at an average speed of 80 km/hr (50 mile/hr), the trip duration would be 36 hr. For rail shipments a route length of 2860-km (1775-miles) long was also assumed, and, at an average speed of 64 km/hr (40 mile/hr), the trip duration would be 45 hr.

Staff performed calculations using the MICROSHIELD code (Reference 24) to determine exposure rates at the sides of trucks or railcars having 0.32-cm (0.125-in) steel sides, containing wastes at a concentration of 529 Bq/gm (14,300 pCi/gm) total uranium, the maximum concentration found in Chemetron's waste characterization program. The exposure rate in the truck cab, 61 cm (2 ft) from the end of the truck, would be 1.47E-3 mSv/hr (0.147 mrem/hr) above background. The exposure rate 2.0 m (6.6 ft) from the side of the truck would be 2.1E-4 mSv/hr (0.021 mrem/hr) above background. At these exposure rates the truck driver would receive a dose of less than 0.0588 mSv (5.88 mrem) per trip. The total exposure for the 28 trips would be 1.65 person-mSv (165 person-mrem). The exposures to truck drivers would be substantially less than NRC and DOT limits of 0.02 mSv/hr (2 mrem/hr) in occupiable spaces within the truck cab and 0.1 mSv/hr (10 mrem/hr) at 1.8 m (6 ft) from any side of the truck.

Because of the near-background exposure rates, individuals traveling along the highway adjacent to the trucks or residing near the highway would receive negligible exposures from these shipments. Background exposure rates are generally about 2.6 pC/kg (10 μR/hr) to 3.9 pC/kg (15 μR/hr).

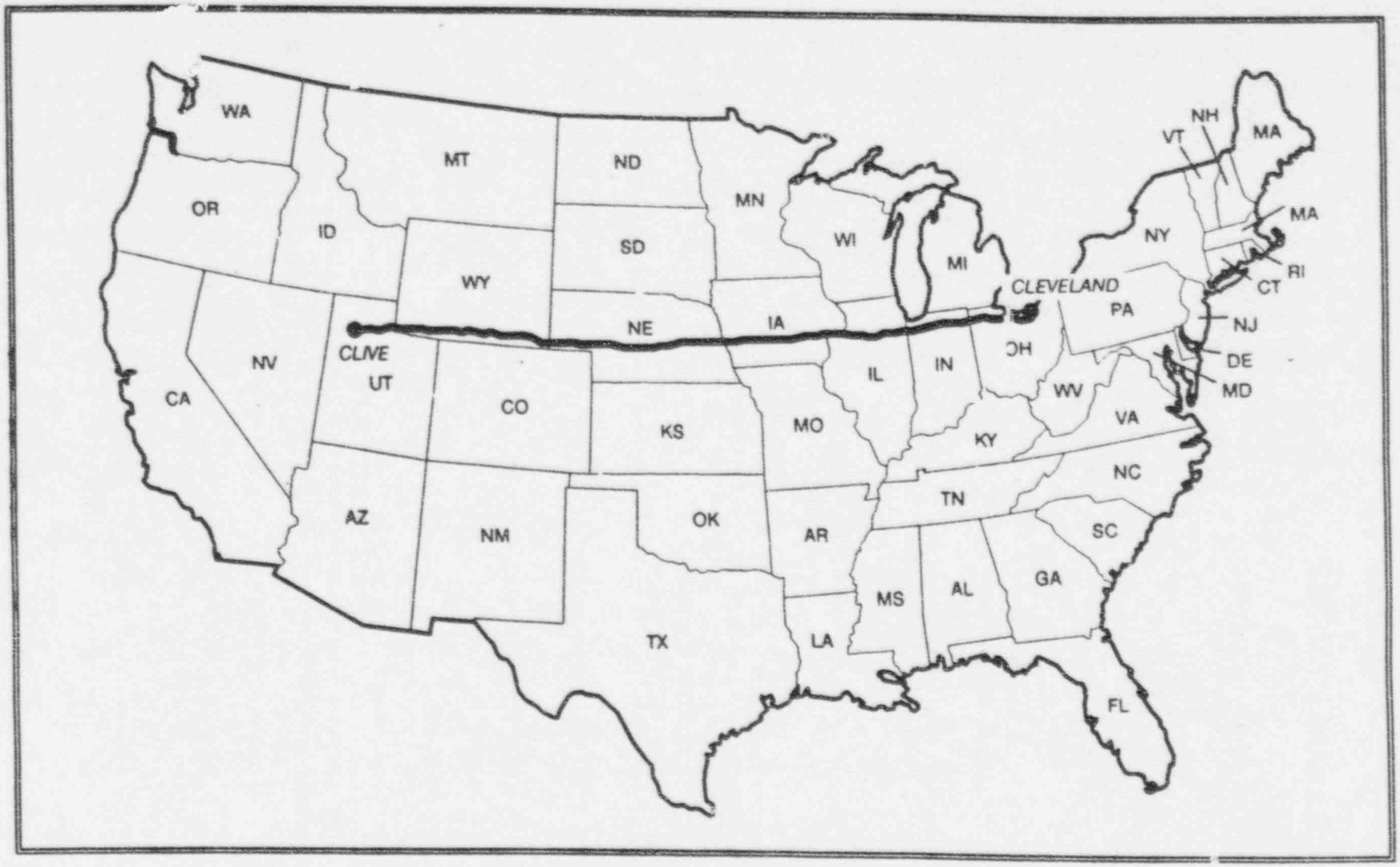

Figure 4.1 Assumed truck shipment route from Cleveland, OH, to Clive, UT.

For rail shipments, exposure rates at 61 cm (2 ft) from the end of the railcar would be 3.88E-3 mSv/hr (0.388 mrem/hr), and at 2.0 m (6.6 ft) from the sides of a railcar having 0.32-cm (0.125-in) steel sides would be 5.08E-4 mSv/hr (0.0508 mrem/hr). Assuming a 2900 km (1800 mile) trip at an average speed of 65 km/hr (40 mile/hr), the trip duration would be 45 hr. Assuming the train operators remained at 0.6 m (2 ft) from the end of the railcar over this duration, the operators would receive 0.233 mSv (23.3 mrem) per trip. Assuming one trip of seven cars is made with four train operators, the total exposure would be 0.932 person-mSv (93.2 person-mrem). Because of the near-background exposure rates, individuals residing or standing near the railroad line would receive negligible exposures from these shipments. These exposures are well within NRC and DOT limits.

Staff concludes that if wastes are shipped offsite, the proposed waste shipment approach is acceptable and in compliance with NRC requirements in 10 CFR Parts 20 and 71, State of Utah requirements, Envirocare site requirements, and DOT requirements.

4.3 Disposal Cell Stability

To ensure that the proposed disposal cell, described in detail in Section 4.1 of the EA, will remain stable (i.e., not subject to subsidence or erosion effects), Chemetron indicated that wastes, the clean fill, and the soil cover placed into the Bert Avenue disposal cell will be placed in no greater than 0.305-m (1-ft) loose lifts and compacted to 95 percent of the maximum dry density, as determined in accordance with ASTM-D698, "Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))" (Reference 25), or 90 percent of the maximum dry density, as determined in accordance with ASTM-D1557, "Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))" (Reference 26). Density testing will be performed over the entire lift thickness, to ensure that the materials are properly compacted. The wastes will be covered with a clean fill and soil cover having a final cover depth of at least 4.9 m (16 ft). Finally, a vegetative cover will be placed over the clean fill and soil cover. To ensure that wastes will not be placed in the local groundwater table, Chemetron committed to ensure that the bottom of the waste layer will be greater than 3.0 m (10 ft) above the highest groundwater elevation.

To ensure the stability of the east-side slope and to ensure long-term erosion will be minimized, Chemetron committed to remove the soft alluvial natural soils beneath the disposal cell and to use a riprap cover. Staff also reviewed the slope stability analyses performed by Chemetron to address the temporary construction slopes for the Bert Avenue cell. Staff concluded that these slopes have an adequate margin of safety to protect workers and nearby residences.

Staff considers the compaction and placement methods proposed by Chemetron to be acceptable for ensuring that the disposal cell will remain stable, and not be subject to significant subsidence or erosion effects. A license condition will be added to ensure that the above compaction and placement procedures will be used.

5 UNRESTRICTED USE REQUIREMENTS

5.1 Unrestricted Use Criteria

Chemetron proposed to use the unrestricted use criteria listed in "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source or Special Nuclear Material" (Reference 23) for surfaces of buildings and equipment, and the Branch Technical Position, "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations" (Reference 6) for soils. Specific values are given below --

Soils:	Depleted uranium on the surface	1.3 Bq/gm (35 pCi/gm) (total uranium)
	Depleted uranium in the disposal cell	5.9 Bq/gm (161 pCi/gm) (total uranium)
	Thorium on the surface	0.37 Bq/gm (10 pCi/gm) (total thorium)
	Radium-226 on the surface	0.18 Bq/gm (5 pCi/gm)
	Radium-226 subsurface	0.56 Bq/gm (15 pCi/gm)

Equipment and building surfaces:

5000 dpm alpha/100 cm^2 (15.5 in^2); averaged over 1 m^2 (10.8 ft^2)
5000 dpm beta-gamma/100 cm^2 (15.5 in^2); averaged over 1 m^2 (10.8 ft^2);
15,000 dpm alpha/100 cm^2 (15.5 in^2); maximum over 1 m^2 (10.8 ft^2);
15,000 dpm beta-gamma/100 cm^2 (15.5 in^2); maximum over 100 cm^2 (10.8 ft^2);
1000 dpm alpha/100 cm^2 (15.5 in^2); removable
1000 dpm beta-gamma/100 cm^2 (15.5 in^2); removable

Exposure rate:

Soils	2.6 pC/kg (10 μR/hr) average above background at 1 m (3.3 ft);
	5.2 pC/kg (20 μR/hr) maximum above background at 1 m (3.3 ft)
Equipment and buildings	1.3 pC/kg (5 μR/hr) above background at 1 m (3.3 ft)

The depleted uranium limits for the disposal cells were determined based on solubility data from uranium solubility tests using the Kalkwarf Method (Reference 27). Uranium solubility tests were performed on waste samples from the Bert Avenue site. The solubility data were used to calculate disposal limits using the following equation:

$$\text{Depleted Uranium Limit (pCi/gm)} = 170/[(F_I)(0.56) + (1 - F_I)(1.9)]$$

where F_I is the insoluble fraction (i.e., the fraction of "Y" classified material if the Kalkwarf method is used).

Based on the average of three samples, the limit for depleted uranium was computed to be 5.98 Bq/gm (161 pCi/gm).

Staff concludes that the above proposed unrestricted use limits are acceptable and consistent with the criteria approved by the Commission in the "Action Plan to Ensure Timely Cleanup of Site Decommissioning Management Plan Sites" (Reference 28).

5.2 Final Radiation Survey Plan

Final radiation surveys will be performed in areas surrounding the disposal cell in accordance with NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination" (Reference 29). The objective of these procedures is to demonstrate, with a 95 percent confidence level, that there are no radioactive hot spots having levels that exceed the averaging criteria in NUREG/CR-5849.

Final radiation surveys will also be performed to ensure that wastes placed in the disposal cell are less than 5.98 Bq/gm (161 pCi/gm) when averaged over a 100-m^2 (1070-ft^2) area and meet the averaging criteria in NUREG/CR-5849. The final surveys will consist of performing radiation scans over 100 percent of each 0.3-m (1-ft) lift and taking one sample for gamma spectroscopic analysis in every 10-m (33-ft) x 10-m (33-ft) area at every 0.3-m (1-ft) lift. If scans or samples indicate activity that exceeds 5.98 Bq/gm (161 pCi/gm), Chemetron will take further samples and determine compliance with the averaging criteria in NUREG/CR-5849. These criteria address averaging concentrations over any 100-m^2 (1070-ft^2) area and using the $(100/A)^{1/2}$ elevated area criteria. Material that exceeds the averaging criteria in NUREG/CR-5849 shall be removed and shipped offsite to a licensed low-level waste disposal site.

NRC will perform confirmatory surveys to ensure that Chemetron's final surveys reflect the actual radiological conditions at the site.

Staff concludes that the final survey plan meets the requirements of 10 CFR 40.42(c)(2)(iii) and the recommendations in NUREG/CR-5849. Therefore, the survey plan is acceptable.

6 EMERGENCY PLANNING

Emergency procedures are provided in the Chemetron Health and Safety Procedures, Emergency Procedures, and the Radiation Control Plan (Reference 22). These procedures address specific actions to be taken by Chemetron staff in case of an emergency. Potential emergencies include accidents, accidental releases, fires, explosions, and natural disasters. Emergency procedure training is addressed in the "Radiation Worker Handbook and Training Manual" (Reference 7).

Offsite assistance can be provided, if necessary, by the police and fire departments in Cuyahoga Heights and Newburgh Heights and by local hospitals. The Program Manager will ensure that local fire, police, and medical emergency units are aware of the decommissioning activities and emergency procedures. A list of personnel to be contacted in case of an emergency will be provided to Chemetron remediation staff and security officers.

Staff concludes that the licensee's proposed emergency plan will adequately provide for the types and magnitudes of emergencies that could potentially occur during the decommissioning operations, and is, therefore, acceptable.

7 PHYSICAL SECURITY

Access to the Bert Avenue site is controlled using "restricted areas," "controlled areas," and "unrestricted areas." Access to "restricted areas" is controlled by Chemetron to limit exposures to radioactive materials. "Controlled areas" are designated by Chemetron to limit access for any reason. Access to "unrestricted areas" is neither limited nor controlled by Chemetron. Figure 7.1 shows the restricted and controlled area designations at the Bert Avenue site. Restricted areas are delineated by fences, barrier tape, or rope, and are posted in accordance with 10 CFR Part 20 requirements and the recommendations in Regulatory Guide 8.1 (Reference 30). The Bert Avenue site is fenced, with access controlled by Chemetron personnel. Entry points into restricted areas will be posted in accordance with 10 CFR 20.1902. All personnel leaving restricted areas are required to perform frisking surveys, to minimize the release of contamination.

Chemetron does not possess any special nuclear material; therefore a materials accountability program is not required.

Staff concludes that the physical security plan proposed by Chemetron meets the requirements of 10 CFR Part 20 and is acceptable.

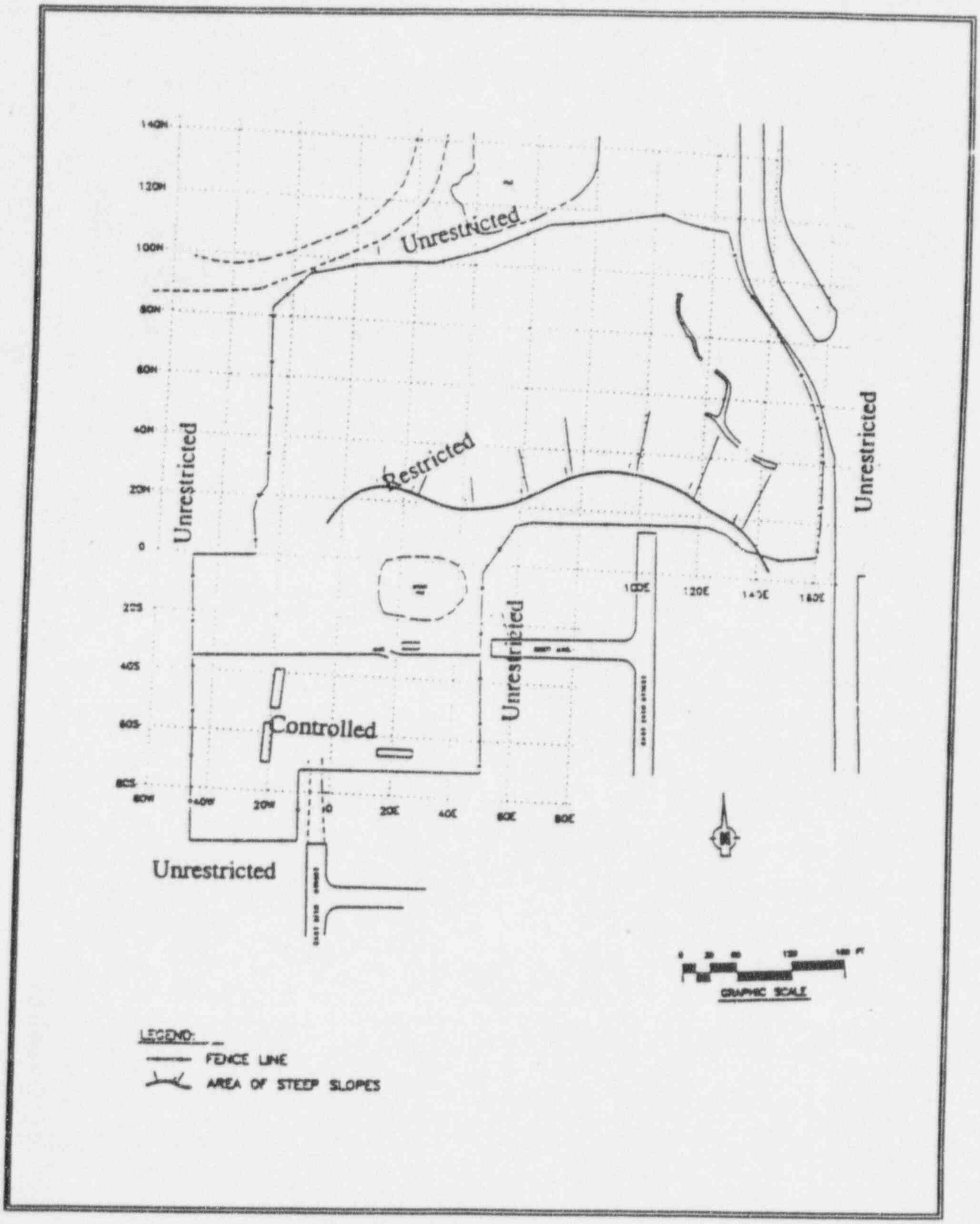

Figure 7.1 Bert Avenue physical security area designations.

8 POSTULATED ACCIDENTS

The staff reviewed the licensee's estimated potential consequences of postulated accidents. The licensee evaluated two worst-case accident scenarios -- a truck tipping over, releasing its contents, and a truck fire causing radioactivity to be dispersed into the air. The scenarios assumed the maximum total uranium concentration of 507 Bq/gm (13,700 pCi/gm) total uranium found at the Bert Avenue site in Chemetron's site characterization. Receptors 10 m (32.8 ft) away would receive a dose of 4.3E-4 mSv (4.3E-2 mrem) from the truck spill accident and 0.04 mSv (4 mrem) from the truck fire accident. These postulated accidents do not have the potential for onsite or offsite radiation doses that exceed the minimum Protective Action Guide level of 0.01 Sv (1 rem), recommended by EPA (Reference 31), or above 10 CFR Part 20 limit of 0.05 Sv (5 rem/yr) for routine occupational exposure, and are, therefore, acceptable.

9 FINANCIAL ASSURANCE

On October 1, 1990, Chemetron provided a decommissioning funding plan to NRC as a part of its license renewal submittal to meet NRC decommissioning financial assurance requirements in 10 CFR 40.36. The decommissioning funding plan consisted of a decommissioning cost estimate, for both the Harvard Avenue and Bert Avenue sites, of $7,465,000 and a parent company guarantee from Sunbeam/Oster Company, Inc., for that amount. Chemetron also provided a standby trust agreement from Chase Manhattan Bank. The parent company guarantee was effective as of November 1, 1990. Staff reviewed both the language in the parent company guarantee and the standby trust agreement to ensure that they were consistent with NRC's guidance for decommissioning financial assurance instruments, in Regulatory Guide 3.66 (Reference 32). NRC concluded that the Chemetron financial assurance instruments meet the requirements in 10 CFR 40.36, that the instruments use language consistent with Regulatory Guide 3.66, and that NRC's rights to draw upon the parent guarantee, if necessary, would not be adversely affected by the instrument language.

In the "Site Remediation Plan," Chemetron provided a revised cost estimate for the decommissioning of the Harvard Avenue and Bert Avenue sites, as required under 10 CFR 40.42(c)(2)(iii)(E). Chemetron's decommissioning cost estimate is $5,345,000 for the Bert Avenue site. Staff reviewed the unit cost factors, the estimated quantities of materials, and the labor costs, using the "Site Remediation Plan" and Means' cost estimating guides (References 33, 34, and 35). Staff concluded that the cost estimates were reasonable for the proposed decommissioning activities, and no changes are necessary in the current parent guarantee.

10 CONCLUSIONS

The staff evaluated the licensee's proposed site remediation plan for the Bert Avenue site for consistency with NRC regulations and regulatory guidance. The staff concludes that the licensee's plan is acceptable with the modifications discussed in this SER. On the basis of the staff's safety evaluation the licensee's plan should be accepted with the following conditions:

1. The licensee is authorized to remediate the Bert Avenue site in accordance with 10 CFR 20.2002 and the licensee's "Site Remediation Plan, Chemetron Remediation Project, Harvard Avenue and Bert Avenue Sites," Revision 1 dated February 28, 1995, including letters dated April 15, 1994, July 27, 1995, October 31, 1995, February 20, 1996, May 17, 1996, June 21, 1996, and September 17, 1996. The licensee shall implement radiological controls in accordance with the "Radiological Control Plan," Revision 2, November 1996, as modified using the procedures in Administrative Procedure AP-06, "Field Changes."

2. The procedure for licensee-initiated and approved changes as described in Revision 1 to the "Site Remediation Plan, Chemetron Remediation Project, Harvard Avenue and Bert Avenue Sites," dated February 28, 1995 may be used provided that:

   i. Review of all proposed changes to the "Site Remediation Plan" by the Project Manager or his designee is in accordance with Administrative Procedure AP-06 "Field Changes;"

   ii. The licensee submits to NRC, for approval, any changes that would result in an unreviewed safety question, a change in a license condition, or changes that would have a significant adverse affect on the quality of the work, the remediation objectives, or health and safety;

   iii. The licensee documents the changes made.

3. Chemetron shall use the unrestricted use criteria listed in "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source or Special Nuclear Material" for surfaces of buildings and equipment, and the Branch Technical Position, "Disposal or Onsite Storage of Thorium or Uranium Wastes from Past Operations," for soils. Specific values are given below --

Soils:	Depleted uranium on the surface:	1.3 Bq/gm (35 pCi/gm) (total uranium)
	Thorium on the surface:	0.37 Bq/gm (10 pCi/gm) (total thorium)
	Radium-226 on the surface:	0.18 Bq/gm (5 pCi/gm)
	Radium-226 subsurface:	0.56 Bq/gm (15 pCi/gm)

Equipment and building surfaces:

5,000 dpm alpha/100 cm^2; average over 1 m^2
5,000 dpm beta-gamma/100 cm^2; average over 1 m^2
15,000 dpm alpha/100 cm^2; maximum over 100 cm^2
15,000 dpm beta-gamma/100 cm^2; maximum over 100 cm^2
1,000 dpm alpha/100 cm^2; removable
1,000 dpm beta-gamma/100 cm^2; removable

Exposure rate:

Soils	2.6 pC/kg (10 μR/hr) average above background at 1 m
	5.2 pC/kg (20 μR/hr) maximum above background at 1 m
Equipment and buildings	1.3 pC/kg (5 μR/hr) above background at 1 m

Chemetron shall use 5.9 Bq/gm (161 pCi/gm) as the Option 2 disposal limit for depleted uranium to be placed in the Bert Avenue disposal cell.

4. Wastes and the clean fill and soil cover placed into the Bert Avenue disposal cell shall be placed in no greater than 0.3-m (1-ft) loose lifts and compacted to 95 percent of the maximum dry density, as determined in accordance with ASTM-D698, "Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3))," or 90 percent of the maximum dry density, as determined in accordance with ASTM-D1557, "Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3))." Density testing should be performed over the entire lift thickness. The wastes shall be covered with a clean fill and soil cover having a final cover depth of at least 4.9 m (16 ft). Deviations in compaction results or final cover depth shall be evaluated in accordance with Administrative Procedure AP-06, "Field Changes." A vegetative cover shall be placed over the clean fill and soil cover. At the time of waste placement, the bottom of the waste layer shall be greater than 3.3 m (10 ft). above the highest groundwater elevation. The east slope of the disposal cell shall be covered with riprap. The soft, alluvial soils located in the vicinity of the open sewer line shall be removed prior to construction of the disposal cell.

5. The licensee shall conduct an air sampling program at the Bert Avenue site work areas and perimeters. If airborne concentrations exceed 1.1E-21 Bq/ml (3.0E-14 uCi/ml) at site perimeter, an investigation shall be conducted to determine if dust suppression measures should be used during the excavation of the contaminated soil to minimize airborne releases. The minimum detectable activity of the air sampler and assay method shall be less than 1.1E-21 Bq/ml (3.0E-14 uCi/ml).

6. During the remediation operations, liquid and airborne effluents will be sampled and analyzed to ensure that releases meet the requirements of 10 CFR Part 20, Appendix B. If liquid waste radioactivity concentrations exceed the requirements in 10 CFR Part 20 and require processing, the licensee shall request NRC approval of the proposed processing system.

7. The licensee shall conduct a final survey and sampling program in areas surrounding the disposal cell in accordance with NUREG/CR-5849, "Manual for Conducting Radiological Surveys in Support of License Termination." Radioactivity levels shall not exceed the averaging criteria in NUREG/CR-5849.

The licensee shall conduct a final survey and sampling program to ensure that wastes placed in the disposal cell are less than 5.98 Bq/gm (161 pCi/gm) when averaged over a 100 m^2 (1070 ft^2) area and meet the averaging criteria in NUREG/CR-5849. The final survey and sampling program shall consist of performing radiation scans over 100 percent of each 0.3 m (1 ft) lift and taking one sample for gamma spectroscopic analysis in every 10 m (33 ft) x 10 m (33 ft) area at every 0.3 m (1 ft) lift. If scans or samples indicate activity that exceeds 5.98 Bq/gm (161 pCi/gm), Chemetron will take further samples and determine compliance with the averaging criteria in NUREG/CR-5849. These criteria address averaging concentrations over any 100 m^2 (1070 ft^2) area and using the $(100/A)^{1/2}$ elevated area criteria. Material that exceeds the averaging criteria in NUREG/CR-5849 shall be removed and shipped off-site to a licensed low-level waste disposal site.

The licensee shall provide hold points in the remediation schedule and provide an opportunity for NRC staff to take samples and perform surveys 1) following removal of contaminated materials in Areas A and B as shown in Figure 3-13 of the site remediation plan; 2) following excavation of contaminated materials and before beginning construction of the disposal cell; and 3) before emplacing non-radioactive solid wastes or cover materials.

Material that exceeds the averaging criteria in NUREG/CR-5849 shall be removed and shipped off-site to a licensed low-level waste disposal site.

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