
Site Characterization Report

For

Former

CLEVITE CORPORATION SITE

East 105 Street, Cleveland, Ohio

Submitted By:

SEVENSON ENVIRONMENTAL SERVICES, INC.

2749 Lockport Road

Niagara Falls, NY 14302

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1 Background/Site Description

The former Clevite Corporation Facility is located at 540 East 105th Street, Cleveland, Ohio. This site is presently owned by Neighborhood Progress, Inc.

Clevite Corporation was a manufacturer of nuclear fuel under an Atomic Energy Commission license, including high-enriched uranium fuel for the U.S. Navy and AEC research reactors, as well as Thorium products. The company ceased fuel manufacturing in the 1960's. A closeout radiation survey by the licensee was accepted by the AEC, and the license was terminated. The 160,000 square foot building was sold in 1991 to Neighborhood Progress, Inc., and has been divided into smaller sections for lease.

On May 27, 1993, a Region III (Chicago) radiation specialist performed a radiation survey at the site which had been identified as a potentially contaminated site in an Oak Ridge National Laboratory review of former AEC and NRC licenses.

The survey identified low-level radioactive contamination in some cracks and crevices in the concrete floor of one portion of the building now occupied by a machine shop.

The machine shop area was surveyed because blueprints in the AEC license file identified it as a fuel manufacturing area. Other areas of the building were surveyed on a sampling basis, and no contamination was identified. Selected areas outside the building were also surveyed, and no contamination was identified.

Based upon its May 27, 1993 survey, the NRC concluded that the first floor machine shop and a few assembly areas were not decontaminated to a residual radiation level consistent with NRC Guidelines. However, the NRC also concluded these radiation levels do not constitute an immediate health and safety problem. Although the NRC believes there is no immediate danger, the NRC believes its measurements exceed NRC limits for unrestricted use.

2 Identity of Potential Contaminants and Release Guidelines

Based on known licensed operations at the site the isotopes have been identified to be:

U-235

U-238

Th-Nat or Th-232

On the basis of lack of knowledge as to where the Th-232 was used and that the Thorium has the most restrictive limits, all radioactive contaminants were assumed to be Th-232. On the basis of this the guidelines were as follows:

Average 1,000 dpm/100 cm squared averaged over 1 m squared

Maximum 3,000 dpm/100 cm squared applied to <100 cm squared
Removable 200 dpm/100 cm squared

Soil Contamination Guideline 30 pCi/g

3 Final/Characterization Survey Procedures

3.1 Survey Objectives

The characterization survey is intended to provide sufficient detail to plan the decontamination effort. Severson used the protocols of a final status survey to perform the characterization survey. The purpose of the final status survey is to demonstrate that the radiological conditions at the former Clevite Site satisfy the NRC guidelines and that the plant site can be released for unrestricted use. Severson will use data obtained during the characterization survey as final survey data in unaffected areas. The specific objectives of the survey are to show that:

A. Surface Activity of Buildings & Structures

1. Average surface contamination levels are within the allowed levels.
2. Small areas of residual activity, known as "hot spots" do not exceed three times the average value. The "hot spot" limit applies to areas up to 100 cm squared. The average activity level within the 1 m squared area containing a "hot spot" must be within the guidelines.
3. Reasonable efforts have been made to clean up removable activity and the removable activity does not exceed 20% of the average surface activity guidelines.
4. Exposure rates in occupiable locations are less than 5 μ R/hr above background. Exposure levels are measured at 1 m from floor and wall surfaces and are averaged over floor areas of 10 m squared.

B. Volume Activity of Soil & Building Materials

1. Average radionuclide concentrations are within the authorized value. Averaging is based on a 100 m squared grid area.
2. Reasonable efforts were made to identify and remove "hot spots" that exceed the average guideline by greater than a factor of the square root of $(100/A)$ where A is the area of the hot spot in m squared.

C. Exposure Rate

1. Exposure rates do not exceed 5 $\mu\text{R/hr}$ above background at one meter from the surface. Exposure rates may be averaged over 100 m squared grid areas. Maximum exposure rates over any discrete area may not exceed 10 $\mu\text{R/hr}$.

The above conditions were demonstrated at a 95% confidence level for each survey unit as a whole. The survey data will be used to calculate the total inventory of isotopes on the site.

3.2. Organization and Responsibilities

The survey was performed by a qualified team of Severson Environmental employees.

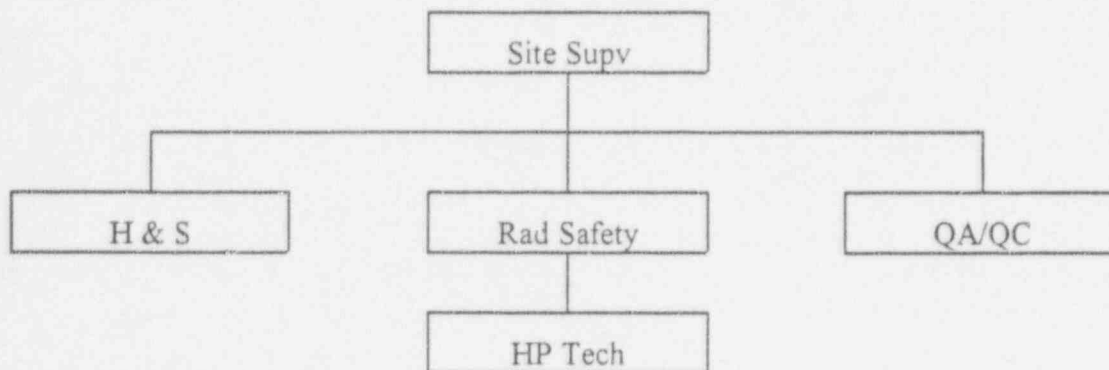
Mr. Anthony Certo-Site Superintendent. His duties are overall responsibility for work operations.

Mr. Rory Grube-Radiological Safety Officer/Health Physicist. His duties are to supervise and perform radiological monitoring and analysis, review and evaluate radiological surveys, prepare reports.

Mr. Scott Wasmer-Health Physics Technician. His duties are to perform radiological monitoring, collect environmental samples, assist in report preparation, enforce site safety and health plan.

Mr. Paul Hitcho-CIH, Health and Safety Officer. His duties are to develop implement and update as appropriate, and enforce the site specific safety health and emergency response plan.

Mr. John Davis-CHP. QA/QC. His duties were to coordinate all interface requirements during the survey process, ensure that all aspects of the QA is adhered to.



3.3 INSTRUMENTATION

Table 1 lists the instrumentation to be used for the survey activities, along with typical parameters and detection sensitivities for the instrumentation and survey technique.

Sensitivities for scanning techniques are based on movement of the detector over the surface at 1 detector width per second and use of audible indicators to sense changes in instrument count rate. Experience demonstrates that qualified surveyors can detect the levels listed in Table 1 with a 90% confidence level. All instruments were calibrated a minimum of once every 6 months, using NIST-traceable standards. Calibration was for the specific uranium radiation energies expected to be present at the site. Operational and background checks were performed at least once each 4 hours on instrument use.

The basic equations for determining field instrument detection limits are:

Surface Activity Measurement for an integrated measurement over a preset time

| | |
|--|--|
| $MDA = \frac{2.71 + 4.65\sqrt{B \cdot t}}{t \cdot E \cdot \left(\frac{A}{100}\right)}$ | <p>MDA = Activity level in dpm/100 cm²</p> <p>B = Background cpm</p> <p>t = count time in minutes</p> <p>A = Active probe area in cm²</p> <p>E = Detector efficiency</p> |
| (1) MDA | |

Surface Activity Measurement of a Ratemeter Instrument

| | |
|---|--|
| $MDA = \frac{4.65 \sqrt{\frac{B}{2t_c}}}{E \cdot \left(\frac{A}{100}\right)}$ | <p>MDA = Activity level in dpm/100 cm²</p> <p>B = Background cpm</p> <p>t_c = meter time constant</p> <p>A = Active probe area in cm²</p> <p>E = Detector efficiency</p> |
| (2) MDA | |

Scanning MDA

| | |
|--|---|
| $MDA = \frac{3 \bullet Br}{E \bullet A/100}$ | <p>MDA = Activity level in dpm/100 cm²</p> <p>Br = Background rate</p> <p>E = Detector efficiency</p> <p>A = Area of probe</p> |
| (3) MDA Scanning | |

Laboratory Analysis of Wipes

| | |
|--|--|
| $MDA = \frac{2.71 + 4.65 \sqrt{B_g \cdot t}}{(t) \cdot (E)}$ | <p>MDA = Activity level in dpm/100 cm²</p> <p>Bg = Background cpm</p> <p>t = count time in minutes</p> <p>E = Detector efficiency</p> |
| (4) MDA | |

Table 2

INSTRUMENTATION FOR RADIOLOGICAL SURVEYS

| Type of Measurement | Detector | Meter | Background | 4 π Eff | Detector Sensitivity |
|--------------------------------------|--|----------------------|---|-----------------------------------|--|
| Surface Activity alpha | Ludlum 43-68 100 cm ² Window Gas Proportional | Ludlum 2221 | 4 - 5 cpm | 20% | 100 dpm |
| Surface Activity Beta | Ludlum 43-68 100 cm ² Window Gas Proportional | Ludlum 2221 | 150 cpm | 48% | Scan 1250 dpm Direct 165 dpm |
| Surface Scan Alpha | Ludlum 43-65 50 cm ² Window Scintillation | Ludlum 3 Ludlum 4 | 1 - 2 cpm | 15% | 80 dpm |
| Surface Scan Beta/Gamma | Ludlum 44-9 15.5 cm ² Window Pancake | Ludlum 3 Ludlum 4 | 20 - 40 cpm | 19% | 2000-4000 dpm |
| Surface Activity Alpha | Ludlum 43-65 50 cm ² Window Scintillation | Ludlum 3 Ludlum 4 | 1 - 2 cpm | 15% | 200 dpm |
| Surface Activity Beta/Gamma | Ludlum 44-9 15.5 cm ² Window Pancake | Ludlum 3 Ludlum 4 | 20 - 40 cpm | 19% | 400-800 dpm |
| Surface Activity Alpha/Beta/Gamma | 43-1-1 | Ludlum 2224-1 | 0.2 - 2 cpm α 140 - 160 cpm $\beta\gamma$ | 27% α 47% $\beta\gamma$ | 14 - 26 dpm α 163 - 175 dpm $\beta\gamma$ |
| Surface Scan Alpha/Beta/Gamma | 43-1-1 | Ludlum 2224-1 | 0.2 - 2 cpm α 140 - 160 cpm $\beta\gamma$ | 27% α 47% $\beta\gamma$ | 2 - 17 dpm α 1191 - 1361 dpm $\beta\gamma$ |
| Surface Scan Gamma | 1 X 1 NaI | Ludlum 3-97 | 7 - 10 μ R | N/A | 4 μ R |

Table 2

INSTRUMENTATION FOR RADIOLOGICAL SURVEYS

| | | | | | |
|----------------|-----------------------|---|---------------|-----|-----------|
| Exposure Rates | 1 X 1 Organic Crystal | W.B. Johnson Model GSM160 μ R Meter | 4 - 5 μ R | N/A | 3 μ R |
|----------------|-----------------------|---|---------------|-----|-----------|

3.4.1 AREA CLASSIFICATION

For purposes of establishing the sampling and measurement frequency and pattern, the site has been divided into affected and unaffected areas. The basis for these classifications are:

Affected Areas: Areas that have potential radioactive contamination (based on plant operating history) or known radioactive contamination (based on past of preliminary radiological surveillance). This includes areas where radioactive materials were used and stored, where records indicate spills or other unusual occurrences that could have resulted in spread of contamination. Areas immediately surrounding or adjacent to locations where radioactive materials were used or stored, or spilled were included in this classification because of the potential for inadvertent spread of contamination. Affected areas include the first floor machine shop and the hallway outside the first floor machine shop and fuel assembly area.

Unaffected Areas: All areas not classified as affected. These areas are not expected to contain residual radioactivity, based on a knowledge of site history and previous survey information. These areas include the remaining first floor, second floor, roof, basement, and remaining site areas.

3.4.2 REFERENCE GRIDS

Grids were established for the purpose of referencing locations of samples and measurements, relative to building and other site features. The gridding intervals are based on the potential for residual contamination in the various plant areas. All affected building area floor and lower wall (up to 2m) surfaces were gridded at 1 m intervals; upper walls and ceilings of affected areas were also gridded at 1m intervals, if residual activity above 25% of the guideline is known or suspected. Building surfaces in unaffected areas or those upper surfaces in affected areas that have not been contaminated as a result of prior activities were not gridded; measurements were referenced to other grid systems or to prominent building feature. Affected outside areas were gridded at 10 m intervals; unaffected areas were not gridded.

The facility was divided into "survey units" having common history, contamination potential, or that are naturally distinguishable from other site areas. The survey units were sized to assure a minimum of 30 measurement locations each for floors and lower walls, other vertical surfaces, and other horizontal surfaces.

Areas identified by scans or direct measurements as exceeding guidelines were reclassified as affected areas and were gridded and resurveyed accordingly. Those areas where the elevated activity was due to fluctuations in background levels were not reclassified. These areas are identified room by room in section 4.1. This decision was based on the type of material and the fact that no alpha contamination existed. It should be noted that both uranium and thorium are alpha emitters.

3.4.3 SURFACE SCANS

Scanning of surfaces to identify locations of residual surface and near-surface activity were performed according to the following schedule:

Affected Areas Surfaces - 100% of surface

Non-contaminated upper surfaces in affected areas - scans in immediate vicinity of measurement

Unaffected Area Surfaces - 10% of lower surface

Building interior surface scans were conducted for alpha, beta, and gamma radiations. Scans of exterior building and paved surfaces were for beta and gamma radiations. Soil surfaces were scanned for gamma radiations only.

Instrumentation for scanning is listed in Table 1. The instruments having the lowest detection sensitivity were used for the scans, wherever physical surface conditions and measurement locations permit.

Scanning speeds were no greater than 1 detector width per second for alpha and beta detection instruments and 0.5 m per second for gamma instruments. Built in unimorph speakers were used to identify locations, having elevated (1.5 to 3 times ambient) levels of direct radiation. All scanning results were noted on standard field record forms; locations of elevated radiation were identified for later investigation.

Reasonable efforts were made to clean surfaces and to remove coverings prior to conducting surveys.

3.4.4 SURFACE ACTIVITY MEASUREMENTS

Direct Measurements

Direct measurements of alpha, beta, and/or beta-gamma surface activity were performed at selected locations using instrumentation described in Table 1. Unless precluded by surface conditions or physical parameters, the most sensitive of the instruments listed for surface measurements (Table 1) were used. Measurements were conducted by integrating counts over a 1 minute period.

Because scanning techniques are not capable of detecting residual thorium activity at <25% of the guideline level, direct surface activity measurements were systematically performed at 1 m intervals on floors and lower walls of affected areas and at the same intervals on upper surfaces that may have residual activities in excess of 25% of the guidelines.

On upper surfaces of affected areas residual activity, measurements were performed at minimum of 30 locations each on vertical and horizontal surfaces. These locations included surfaces where radioactive material would likely settle, and sufficient additional locations to provide coverage at a minimum average of 1 locations per 20 m squared of surface area.

On surfaces of unaffected areas, a minimum of 30 random measurements or an average measurement

of 1 per 50 m squared of building surface area, whichever is greater, were performed for each survey unit. These locations included all building surfaces.

Removable Contamination Measurements

A smear for removable contamination was performed at each measurement location.

3.4.5 EXPOSURE RATE MEASUREMENTS

Gamma exposure rates were measured a 1 m above ground or floor surfaces, using a pressurized ionization chamber or a gamma scintillation instrument, calibrated for Thorium energies. Measurements were uniformly spaced according to the following pattern:

Building Interiors:

Affected Areas: 1 measurement per 4 m squared.

Unaffected Areas: 1 measurement per 200 m squared.

Grounds:

Affected Areas: 5 measurements per 100 m squared grid block.

Unaffected Areas: 50 measurements at randomly selected locations.

3.4.6 SOIL/SEDIMENT SAMPLING

Unaffected land areas surrounding the building had 30 soil samples taken at random locations. Surface measurements were made at 30 random locations on paved areas. 10% of all land and paved areas were scanned for beta/gamma contamination. Areas of concrete in which radiation seems to be entrained were cored and subsoil samples were taken for analysis. Chain of custody procedures were followed for all samples.

3.4.7 SPECIAL MEASUREMENTS AND SAMPLES

Building Interiors:

Remaining ducts, electrical boxes, conduit, or other interior surfaces in affected areas, which may contain residual contamination, were accessed at random and measurements of direct and removable activity performed. Swabs were obtained from insides of wall and floor penetrations, anchor bolt holes, and floor cracks or expansion joints.

Building Exteriors:

Measurements of direct and removable activity were performed on exterior and interior surfaces of air exhaust equipment and at representative locations on roof drains. Samples of roofing material were obtained where direct measurements suggest possible entrained contamination.

Grounds:

Black top in the parking lots varied in thickness from approximately 4" to 16".

3.5 BACKGROUND LEVEL DETERMINATIONS

Initial background exposure rates were determined for the building interior by taking a minimum of 10 measurements at locations of similar construction but without a history of radioactive materials use. Also, a minimum of 10 locations for area background measurement and sampling were selected within a 0.5 to 10 km radius of the site. Exposure rate measurements were performed using a micro R meter. A background soil sample was collected. Results of background exposure rate and thorium soil concentrations were evaluated to assure that the averages determined are representative of the true averages, using procedures described in NUREG/CR-5849. Additional sampling or measurements were performed if necessary to satisfy criteria.

3.6 SAMPLE ANALYSIS

Smears and swabs for removable contamination were analyzed for gross alpha, gross beta activity. Soil, sediment, gravel, roofing material, and other large volume samples were analyzed for Thorium/Uranium by gamma spectrometry; total thorium were calculated on the basis of previously determined (Section 3.2) isotopic activity ratios for this site. Samples of paint, residue, and other samples of small volume were analyzed for Thorium/Uranium by wet chemical separation and alpha spectroscopy.

Laboratory chain-of-custody procedures were observed for all sample analyses.

3.7 DATA INTERPRETATION

Measurement data were converted to units of dpm/100cm² (surface activity), μ R/hr (exposure rates) and pCi/g (soil concentrations) for comparison with guidelines. Values were adjusted for contributions from natural background. Individual measurements and soil levels were compared with "hot-spot" criteria. Average values for survey units were determined and compared with guideline levels. Data for each survey unit were tested against the confidence level objective, using guidance and procedures described in NUREG/CR-5849.

Remediation and/or further sampling and measurements will be performed where guidelines are not met or cannot be demonstrated to the specified level of confidence. Computations and comparisons will be repeated, as necessary.

The unusual alpha to beta ratio can be attributed to the methods used for survey area preparation. Severson removed tile, glue, paint, etc. that was added after the time that the facility was originally surveyed. During the course of removal it is believed that all of the surface contamination was removed leaving only contamination in cracks crevices and depressions in the surface. Because of the increased distance from the probe and any residual material it is not unreasonable to have an abnormal alpha to beta ratio.

All original survey data is being retained at the Clevite site until the completion of the remediation and final status surveys. The original survey data will be forwarded to and archived by Gould Electronics Inc. and will be held until such time as authorized by the NRC for disposal.

4

SURVEY FINDINGS AND RESULTS

Appendix E contains tables of data, affected during the survey. Data are summarized in tables of Appendix F; Appendix F also contains results of data interpretations and comparisons with guidelines and conditions established as survey objectives.

4.1 RESULTS BY ROOM

4.1.1 Basement

4.1.1.1 Boiler Room/Entrance - 32 grids greater than or equal to 25% of the guideline value of which 7 are greater than or equal to 1000 dpm/100cm² (direct). Elevated readings due to naturally occurring radioactive material in structural material. 6 of the seven readings greater than 1000 dpm/100cm² were on brick walls in close areas. These readings are due to the natural fluctuations in background. The seventh reading greater than 1000 dpm/100cm² was on a twelve inch tile drain pipe. Tile drain pipe has naturally occurring radioactive in it as on site sampling has indicated.

4.1.2 South East Wing, 1st Floor

4.1.2.1 Room # 1 - 118 grids greater than or equal to 25% of the guideline value of which 2 are greater than or equal to 1000 dpm/100cm² (direct). 2 grids greater than or equal to 25% of the guideline value of which 1 is greater than or equal to 200 dpm/100cm² (smearable). This room was surveyed as an affected area. This room contained four anchor bolt holes. The contamination was from a single source and in a limited area.

4.1.2.2 Room # 2 - 219 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). 1 grid greater than or equal to 25% of the guideline value of 200 dpm/100cm² (smearable). This room was surveyed as an affected area.

4.1.2.3 Room # 7 - 75 grids greater than or equal to 25% of the guideline value of which 13 are greater than or equal to 1000 dpm/100cm² (direct). 1 grid greater than or equal to 25% of the guideline value of 200 dpm/100cm² (smearable). 3 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area. The contamination was under the wall between room # 7 and room # 18. The contamination was from a single source and in a limited area.

4.1.2.4 Room # 8 - 15 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). This is the room where the Dew Pointer was found, 20 mrem/hr @ contact with source, 2 mrem/hr contact with case. This room was surveyed as an affected area. The elevated activity readings are attributed to naturally occurring radioactive material in the structural material. A clay tile pipe contributed to the elevated activity at the drain.

4.1.2.5 Room # 9 - 41 grids greater than or equal to 25% of the guideline value of which 11 are greater than or equal to 1000 dpm/100cm² (direct). 41 grids greater than or equal to 25% of the guideline value of which 36 are greater than or equal to 200 dpm/100cm² (smearable). 1 grid was greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area. The contamination in this room was a continuation from the hallway.

4.1.2.6 Room # 10 - 7 grids greater than or equal to 25% of the guideline value of which 3 are greater than or equal to 1000 dpm/100cm² (direct). This room was surveyed as an affected area.

4.1.2.7 Room # 11 - 94 grids greater than or equal to 25% of the guideline value of which 3 are greater than or equal to 1000 dpm/100cm² (direct). This room was surveyed as an affected area. The contamination was found under the sliding pocket door from the hallway. The other elevated activity readings are attributed to naturally occurring radioactive material found in the structural material.

4.1.2.8 Room # 12 - 24 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material. This room was surveyed as an affected area.

4.1.2.9 Room # 13 - 47 grids greater than or equal to 25% of the guideline value of which 3 are greater than or equal to 1000 dpm/100cm² (direct). 1 grid was greater than or equal to 3000 dpm/100cm² (direct).

This room was surveyed as an affected area.

- 4.1.2.10 Room # 14 - 69 grids greater than or equal to 25% of the guideline value of which 2 are greater than or equal to 1000 dpm/100cm² (direct). 1 grid was greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.2.11 Room # 15 - 1 grid greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.2.12 Room # 18 - 72 grids greater than or equal to 25% of the guideline value of which 28 are greater than or equal to 1000 dpm/100cm² (direct). 1 grid greater than or equal to 25% of the guideline value of which 1 is greater than or equal to 200 dpm/100cm² (smearable). 7 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area. The contamination in this room was isolated to under the wall adjoining room # 7.
- 4.1.2.13 Sections (A, B, C, etc.) - 60 grids greater than or equal to 25% of the guideline value of which 15 are greater than or equal to 1000 dpm/100cm² (direct). 5 grids greater than or equal to 25% of the guideline value of 200 dpm/100cm² (smearable). 9 grids were greater than or equal to 3000 dpm/100cm² (direct). The hallway, where it joins the west wing, was identified as contaminated above the guideline value and was reclassified as affected. The rest of the areas remained unaffected and the elevated activity is attributed to naturally occurring activity in structural material.
- 4.1.2.14 Test Cell - 26 grids greater than or equal to 25% of the guideline value of which 14 are greater than or equal to 1000 dpm/100cm² (direct). 1 grid greater than or equal to 25% of the guideline value of 200 dpm/100cm² (smearable). 7 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area. This room contained contaminated sand.

4.1.3 South East Wing, 2nd Floor

- 4.1.3.1 Roof - 52 grids greater than or equal to 25% of the guideline value of which 1 is greater than or equal to 1000 dpm/100cm² (direct). All of the roof areas exhibited elevated activity levels. Samples from the roof, counted on site for informational purposes only, indicated no thorium or uranium contamination. A sample sent for uranium and thorium activity determination indicated no uranium and thorium. It is therefore believed that the roof area as a whole is either contaminated with naturally occurring radioactive material or from fall out from nuclear testing and is beyond the scope of the survey guidelines.

4.1.4 West Wing, 1st Floor

- 4.1.4.1 Weld Shop - 117 grids greater than or equal to 25% of the guideline value of which 8 are greater than or equal to 1000 dpm/100cm² (direct). 3 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area. This room is being used for welding with thoriated tungsten rods. This room will be surveyed last after clean-up to minimize the time between remediation and final status survey.
- 4.1.4.2 Elevator Entrance - 29 grids greater than or equal to 25% of the guideline value of which 8 are greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.3 Inside Dock Area - 61 grids greater than or equal to 25% of the guideline value of which 26 are greater than or equal to 1000 dpm/100cm² (direct). 1 grid greater than or equal to 25% of the guideline value of 200 dpm/100cm² (smearable). 21 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.4 Tin Shed (Outside West Wing) - Found a glass jar of thorium oxide. This room was surveyed as an

affected area.

- 4.1.4.5 Hallway - 415 grids greater than or equal to 25% of the guideline value of which 82 are greater than or equal to 1000 dpm/100cm² (direct). 11 grids greater than or equal to 25% of the guideline value of which 4 are greater than or equal to 200 dpm/100cm² (smearable). 45 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.6 Stairwell - 84 grids greater than or equal to 25% of the guideline value of which 9 are greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.7 Room # 1 - 28 grids greater than or equal to 25% of the guideline value of which 8 are greater than or equal to 1000 dpm/100cm² (direct). 6 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.8 Room # 2 - 46 grids greater than or equal to 25% of the guideline value of which 16 are greater than or equal to 1000 dpm/100cm² (direct). 12 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.9 Room # 3 - 175 grids greater than or equal to 25% of the guideline value of which 7 are greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.10 Room # 4 - 65 grids greater than or equal to 25% of the guideline value of which 8 are greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.11 Room # 5 - 30 grids greater than or equal to 25% of the guideline value of which 27 are greater than or equal to 1000 dpm/100cm² (direct). 4 grids greater than or equal to 25% of the guideline value of 200 dpm/100cm² (smearable). 23 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.12 Room # 6 - 124 grids greater than or equal to 25% of the guideline value of which 14 are greater than or equal to 1000 dpm/100cm² (direct). 6 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.13 Room # 7 - 140 grids greater than or equal to 25% of the guideline value of which 25 are greater than or equal to 1000 dpm/100cm² (direct). 3 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.14 Room # 8 - 162 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.15 Room # 9 - 14 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.16 Room # 10 - 39 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.17 Room # 11 - 134 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.18 Room # 12 - 25 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.19 Room # 13 - 43 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm²

(direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.

- 4.1.4.20 Room # 14 - 134 grids greater than or equal to 25% of the guideline value of which 3 are greater than or equal to 1000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.21 Room # 15 - 164 grids greater than or equal to 25% of the guideline value of which 61 are greater than or equal to 1000 dpm/100cm² (direct). 27 grids were greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.22 Room # 16 - 577 grids greater than or equal to 25% of the guideline value of which 182 are greater than or equal to 1000 dpm/100cm² (direct). 28 grids greater than or equal to 25% of the guideline value of which 16 are greater than or equal to 200 dpm/100cm² (smearable). 93 grids were greater than or equal to 3000 dpm/100cm² (direct). Furnace in room was used for smelting depleted uranium. This room was surveyed as an affected area.
- 4.1.4.23 Room # 17 - 61 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.24 Room # 18 - 37 grids greater than or equal to 25% of the guideline value of which 1 is greater than or equal to 1000 dpm/100cm² (direct). 1 grid was greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.
- 4.1.4.25 Room # 19 - 23 grids greater than or equal to 25% of the guideline value of which 2 are greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.
- 4.1.4.26 Room # 20 - 100 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.

4.1.5 West Wing 2nd Floor

- 4.1.5.1 Sections (A, B, C, etc.) - 36 grids greater than or equal to 25% of the guideline value of which 2 are greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.

4.1.6 West Wing 3rd Floor

- 4.1.6.1 Sections (A, B, C, etc.) - 32 grids greater than or equal to 25% of the guideline value of which 3 are greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material. Areas of particular interest were the bathrooms. Drain pipes in the bathrooms are made of tile pipe. The drains are contained in brick walls of which one is covered by glazed tile (glazed tile had the highest background).

4.1.7 West Wing 4th Floor

- 4.1.7.1 Roof - 115 grids greater than or equal to 25% of the guideline value of which 6 are greater than or equal to 1000 dpm/100cm² (direct). 2 grids greater than or equal to 25% of the guideline value of which 1 is greater than or equal to 200 dpm/100cm² (smearable). 2 grids were greater than or equal to 3000 dpm/100cm² (direct). All of the roof areas exhibited elevated activity levels. Samples from the roof, counted on site for informational purposes only, indicated no thorium or uranium contamination. A sample sent for uranium and thorium activity determination indicated no uranium and thorium. It is therefore believed that the roof area as a whole is either contaminated with naturally occurring radioactive material or from fall out from nuclear testing and is beyond the scope of the survey

guidelines. The exhaust duct fan was located on the 4th floor roof and was the source of contamination on the roof. The location where the fan had been was surveyed as affected.

- 4.1.7.2 Sections (A, B, C, etc.) - 15 grids greater than or equal to 25% of the guideline value of which 3 are greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.

4.1.8 North East Wing 1st Floor

- 4.1.8.1 CAMPS Room - 41 grids indicate greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material. It should be noted that the CAMPS area was constructed in the mid sixties. Background fluctuations on construction material were similar to those found throughout the rest of the facility supporting the argument that many of the areas with elevated readings are due to naturally occurring radioactive material found in the structural material.

- 4.1.8.2 Sections (A, B, C, etc.) - 74 grids greater than or equal to 25% of the guideline value of which 5 are greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.

4.1.9 North East Wing 2nd Floor

- 4.1.9.1 Grid Seal storage area. Owner opened a sealed glass case containing uranium powder spilling the contents. He then used a standard vacuum cleaner to cleanup the spilled powder. Severson was requested by the owner to survey the area. 1 grid was greater than or equal to 3000 dpm/100cm² (direct). This room was surveyed as an affected area.

- 4.1.9.2 CAMPS Room - 27 grids greater than or equal to 25% of the guideline value of 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.

- 4.1.9.3 Roof - 62 grids greater than or equal to 25% of the guideline value of which 7 are greater than or equal to 1000 dpm/100cm² (direct). All of the roof areas exhibited elevated activity levels. Samples from the roof, counted on site for informational purposes only, indicated no thorium or uranium contamination. A sample sent for uranium and thorium activity determination indicated no uranium and thorium. It is therefore believed that the roof area as a whole is either contaminated with naturally occurring radioactive material or from fall out from nuclear testing and is beyond the scope of the survey guidelines.

- 4.1.9.4 Sections (A, B, C, etc.) - 66 grids greater than or equal to 25% of the guideline value of which 2 are greater than or equal to 1000 dpm/100cm² (direct). 2 grids greater than or equal to 25% of the guideline value of which 1 is greater than or equal to 200 dpm/100cm² (smearable). These areas were primarily in the grid seal room. The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.

4.1.10 North West Wing 1st Floor

- 4.1.10.1 Corner - 18 grids greater than or equal to 25% of the guideline value of which 1 is greater than or equal to 1000 dpm/100cm² (direct). The elevated activity levels are attributed to naturally occurring radioactive material found in the structural material.

- 4.1.10.2 Roof - 30 grids greater than or equal to 25% of the guideline value of which 5 are greater than or equal to 1000 dpm/100cm² (direct). All of the roof areas exhibited elevated activity levels. Samples from the roof, counted on site for informational purposes only, indicated no thorium or uranium contamination. A sample sent for uranium and thorium activity determination indicated no uranium

and thorium. It is therefore believed that the roof area as a whole is either contaminated with naturally occurring radioactive material or from fall out from nuclear testing and is beyond the scope of the survey guidelines.

4.2 BACKGROUND LEVELS

Background exposure rates for interior and exterior areas vary based on the material being surveyed. The background levels are summarized in Table E-1. These represent average readings for each material. It should be noted that background fluctuated within a given material and higher levels can be obtained. Table E-1 does not reflect the maximum reading for each material. The following table is a quick overview of the ranges of background levels. This further emphasizes the large fluctuations in building material. Small rooms or areas where more than one wall was made of material with elevated background readings in close proximity created many of the false readings in excess of the guideline value.

| Wing | Location | Elev. | Material | cpm |
|-------------------|-----------------------|-------|------------------------|------------|
| West | Bathroom | 4 | Glazed tile over brick | 400 - 1000 |
| North East Corner | Bathroom | 4 | Painted brick | 300 - 725 |
| West | Stairwell | 4 | Painted brick | 350 - 700 |
| West | Sections A, B, C etc. | 3 | Painted brick | 350 - 700 |
| West | Stairwell | 3 | Painted brick | 425 - 800 |
| South East | Floor | 2 | Concrete | 325 - 600 |
| North East | Wall | 1 | Block | 275 - 550 |
| North East | Wall | 1 | Brick | 275 - 650 |

4.3 BUILDING SURVEYS

Scans

Scans of surface (Table E-2) identified multiple locations of residual contamination. Table E-5 represents the unaffected surface activity measurements. Table E-6 represents the unaffected smearable activity measurements.

HP technicians scanned to determine if contamination was in excess of the guideline values. Once the guideline values were exceeded the HP would document the results. The HP technicians did not continue to search for the highest level within the grid. The HP technicians returned to the grid and searched for the highest contamination level and performed a direct reading at the location.

HP technicians performed alpha scans but only annotated readings greater than background. Surveys where alpha scans were performed and no readings logged are less than minimum detectable.

Surface Activity Measurement

Table E-3 presents the results of affected surface activity measurements. Table E-4 presents the results of smearable activity measurements. All individual measurements were within guideline levels, with many of the measurement being below the sensitivity levels of the procedures.

Sampling

Tables E-7 contain results of concrete samples from building interior surface. No evidence of sample activity exceeding guidelines was noted. Gamma scans at outside sampling locations did not indicate potential residual activity.

Exposure Rates

Summary of exposure rates inside structures ranged from 7 to 15 uR/h (Table E-9). These rates were within the guideline levels of 5 uR/h above background.

4.4 GROUND SURVEYS

Scans

Scans identified 72 locations of elevated contact beta radiation. This is attributed to naturally occurring radioactive material in the tar. (Table E-8). The parking lot areas were surveyed as unaffected.

Exposure Rates

Exposure rate measurements are presented in Table E-8. Rates ranged between 7 and 19 uR/h; all locations satisfied the guidelines.

Concentrations In Soil

Table E-8 presents results of soil sampling. No samples contained in excess of the uranium or thorium guideline. The corner where the shed and ducting were found was surveyed as affected.

4.5 DATA EVALUATION

Tables F-1 summarizes the surface activity measurements. F-2 summarizes the isotopic samples results. Results in excess of 25% of the guideline value require further evaluation through surveys or remediation. See Appendix G for the procedures used to ensure the validity of the characterization and final survey data.

SUMMARY

Characterization surveys of the former Clevite site were conducted. Results of the survey indicate that large areas of the southwest and west wings require remediation along with small areas on the second floor and roof. Severson will submit a revised remediation plan to the NRC for approval.

APPENDIX G
QC/QA PROCEDURES

BACKGROUND AND SOURCE CHECKS

1. Initial background levels will be established before work commences per section 5.8 of the manual.
2. A daily background reading should be made. This reading should fall within the limits established for background. If it is higher there is a possibility the detector may be contaminated or meter is not functioning properly.
3. The detection efficiency of the detector should be established initially by taking a series of ten counts and determining the average and the standard deviation at the 95% confidence level.
4. A daily source check should be made of the instrument. The value should fall within the established limits. If it doesn't, check counting gas, high voltage. Compare against similar detector. If comparison fails, send off for repair.

BUILDING SCAN SURVEY

1. Select the proper instrument from those listed in Table 2.
2. Obtain the proper data sheets.
3. Fill in the heading on the data sheet.
4. A. Affected Areas

Scan 100% of the floor and lower walls in affected areas. If it is believed that contamination levels on the upper walls and ceilings are less than 25% of the guideline a minimum of 30 measurement locations on each surface should be selected. If contamination levels are greater than 25% of the guideline value all surfaces shall receive a 100% survey. Record elevated locations of radioactivity.

B. Unaffected Areas

Scan 10% of the floor and lower wall surfaces of unaffected areas using a grid system.

5. Scan speeds will be one detector width per second for beta and alpha particles and 0.5m/sec for gamma radiation. The detector should be no more than 2 cm off the floor for beta detection and no more than 1 cm for alpha detection. The gamma probe will be held at the waist.
6. Locations of elevated radiation will be noted for further investigation.

AVERAGING SURVEY

1. Select the proper instruments from the list in Table 2. Ensure that the background and source checks have been done.
2. Obtain the proper survey sheets.
3. Fill in the data sheet heading.
4. Determine the area of the elevated reading and record the average activity contained in the area. Take five direct readings in the one meter area that contains the elevated reading and record on the form.
5. Repeat for each elevated reading in the survey unit.
6. Turn in the forms to the survey coordinator.

BUILDING DIRECT MEASUREMENT AND REMOVABLE CONTAMINATION SURVEY

1. Select the proper instruments from those listed in table 2. Check to see if backgrounds and source checks have been done.
2. Obtain the proper survey data sheets.
3. Complete the survey information at the top of the form.

4. A. Affected Area

Since the meter used for the beta scanning survey has an MDA greater than 25% of the guide line the survey will be done at one meter intervals on the floor and lower wall surfaces and at all locations determined to have elevated levels of activity from the scan survey. A direct measurement on ceilings and upper wall surfaces should be made for each 20 m² of surface area. A scan of each selected location should be made to identify any locations of elevated activity.

B. Unaffected Area

Thirty or 1 per 50 m² direct measurement points, whichever is greater, should be selected in the unaffected area. All surfaces in the survey unit should be included in the total area.

5. Take a one minute count at each location and record the reading.
6. Take a 100 cm² wipe at each location of the direct survey using moderate pressure. Place the wipe in an envelope labeled with the proper location. If cracks or bolt holes are present use a Q-Tip to obtain a wipe.
7. Insure that the forms have been completed and turn them and the wipes in to the survey coordinator.

DATA EVALUATION, AFFECTED AREAS

For each survey unit file fill out the attached data summary sheet and insert it into the front of the file when it is completed.

CHECK affected Area Surveys for:

1. Completeness of data.
2. Do elevated areas of activity exceed 3 x guideline ? If so tag file with red tag indicating remediations is needed.
3. If elevated areas of activity fall between one and three guideline values tag the file with a blue tag indicating an averaging survey is required.
4. If external gamma readings are greater than b2 x guidelines tag file with red flag for remediation.
5. If removable contamination levels are 0.2 x guideline tag with a red tag for remediation.
6. If all the survey points meet the guideline criteria determine the average activity for the survey unit using eq. 5.11 from the manual.
7. Compare the calculated average value to the guideline using eqs. 5.12 & 5.13.
8. If the value for μ is less than the guideline value the survey unit being tested meets the guideline criteria at a 95% C.L. The file will be tagged with a green flag.
9. If μ is greater than the guideline and the average activity level for the survey unit is greater than the guideline tag the file with a red tag.
10. If the average activity of the survey unit is less than the guideline a larger sample may demonstrate compliance. If a larger sample is required the number of samples to be taken may be determined by eq. 5.14. Tag the file with a yellow flag to indicate additional sampling is required. If after sampling the activity levels cannot meet the guideline criteria tag the file with a red tag for remediation.
12. If the survey unit meets the criteria in step 8 above calculate the radioactive inventory for the survey unit.

DATA EVALUATION, UNAFFECTED AREAS

For each survey unit file fill out the attached data summary sheet and insert it into the front of the file when it is completed.

CHECK unaffected Area Surveys for:

1. Completeness of data.
2. Do elevated area of activity exceed $0.25 \times$ guideline ? If so reclassify unit as affected.
3. If all the survey points meet the guideline criteria determine the average activity for the survey unit using eq.5.11 from the manual.
4. Compare the calculated average value to the guideline using eqs. 5.12 & 5.13.
5. If the value for μ is less than the guideline value the survey unit being tested meets the guideline criteria at a 95% C.L. The file will be tagged with a green flag.
6. If μ is greater than the guideline a larger sample may demonstrate compliance. If a larger sample is needed the number of samples needed can be calculated using eq.5.14. Tag the file with a yellow flag to indicate additional sampling.
7. If upon additional sampling μ is still greater than the guideline reclassify the survey unit as affected.

DATA SUMMARY SHEET

1. DATE _____
2. SURVEY UNIT _____
3. INITIAL CLASSIFICATION _____
4. NUMBER OF SURVEY POINTS > GUIDELINES
 - A. SCANS _____
 - B. DIRECT SURVEYS _____
 - C. EXTERNAL RADIATION _____
 - D. REMOVABLE CONTAMINATION _____
5. NUMBER OF SURVEY POINTS >1 AND <3X GUIDELINES _____
6. ARE ALL DATA POINTS LESS THAN THE GUIDELINE VALUES _____

IF THE ANSWER TO 6 IS YES
7. WHAT IS THE AVERAGE LEVEL OF CONTAMINATION FOR THE SURVEY UNIT _____
8. STANDARD DEVIATION FOR SURVEY UNIT _____
9. μ = _____
10. μ > GUIDELINE _____
11. IS THE AVERAGE VALUE > THAN THE GUIDELINE _____ (REMEDIATE).
12. IS THE AVERAGE VALUE < THAN GUIDELINE _____ (TAKE MORE SAMPLES).
13. HOW MANY MORE SAMPLES MUST BE TAKEN _____