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Formerly Utilized Sites Remedial Action Program (FUSRAP)
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Post-Remedial Action Report for the B & T Metals Site

Columbus, Ohio

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POST-REMEDIAL ACTION REPORT

FOR THE

B&T METALS SITE

COLUMBUS, OHIO

OCTOBER 1996

Prepared for

United States Department of Energy

Oak Ridge Operations Office

Under Contract No. DE-AC05-91OR21949

By

Bechtel National, Inc.

Oak Ridge, Tennessee

Bechtel Job No. 14501

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ACRONYMS

AEC	Atomic Energy Commission
ALARA	as low as reasonably achievable
BNI	Bechtel National, Inc.
DCG	derived concentration guide
DOE	U.S. Department of Energy
FUSRAP	Formerly Utilized Sites Remedial Action Program
IVC	independent verification contractor
LSA	low specific activity
MED	Manhattan Engineer District
ORNL	Oak Ridge National Laboratory
PPE	personal protective equipment
RSS	radiological support subcontractor
SEG	Scientific Ecology Group
TN	Thermo NUtech (formerly ThermoAnalytical, Inc.)

UNITS OF MEASURE

cm	centimeter
cpm	counts per minute
dpm	disintegrations per minute
ft	foot
g	gram
h	hour
in.	inch
lb	pound
L	liter
m	meter
µCi	microcurie
ml	milliliter
µR	microroentgen
mrad	millirad
mrem	millirem
pCi	picocurie
psi	pounds per square inch
yd	yard
yr	year

1.0 INTRODUCTION

1.1 BACKGROUND

This report documents the remedial action conducted at the B&T Metals site in Columbus, Ohio (Figure 1-1) from March to June 1996. Remedial activities at the site were performed as part of the U.S. Department of Energy (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP) following the protocols and procedures established by DOE under the Atomic Energy Act of 1954 and subsequent related legislation. FUSRAP was established to identify and clean up or otherwise control sites where residual radioactive contamination (exceeding current DOE guidelines) remains from the early years of the nation's atomic energy program or from commercial operations causing conditions that Congress has authorized DOE to remedy.

The objectives of FUSRAP as applicable to the B&T Metals site are to

- identify and evaluate all sites used to support former Manhattan Engineer District (MED) and Atomic Energy Commission (AEC) nuclear development activities;
- remove or otherwise control contamination on sites identified as contaminated above current DOE guidelines;
- achieve and maintain compliance with applicable criteria for the protection of human health and the environment;
- certify the site, to the extent practicable, for use without radiological restrictions after remediation; and
- remove hazardous waste that is mixed with radioactively contaminated waste resulting from MED/AEC work in accordance with applicable federal or state laws and regulations.

FUSRAP was established in 1974, and remedial actions began at FUSRAP sites in 1981. Administered by the Former Sites Restoration Division of DOE's Office of Environmental Management, FUSRAP currently includes 46 sites in 14 states. The primary legislation authorizing FUSRAP is the Atomic Energy Act of 1954.

Bechtel National, Inc. (BNI) is the project management contractor for FUSRAP. Oak Ridge National Laboratory (ORNL), the FUSRAP independent verification contractor (IVC) for the B&T Metals site, performed independent designation and verification surveys and will issue a report of post-remedial verification survey results. Health physics and laboratory functions were provided by Thermo NUtech (TN) (formerly ThermoAnalytical, Inc.), the radiological support subcontractor (RSS). Labor support during remediation was provided by SunPro.

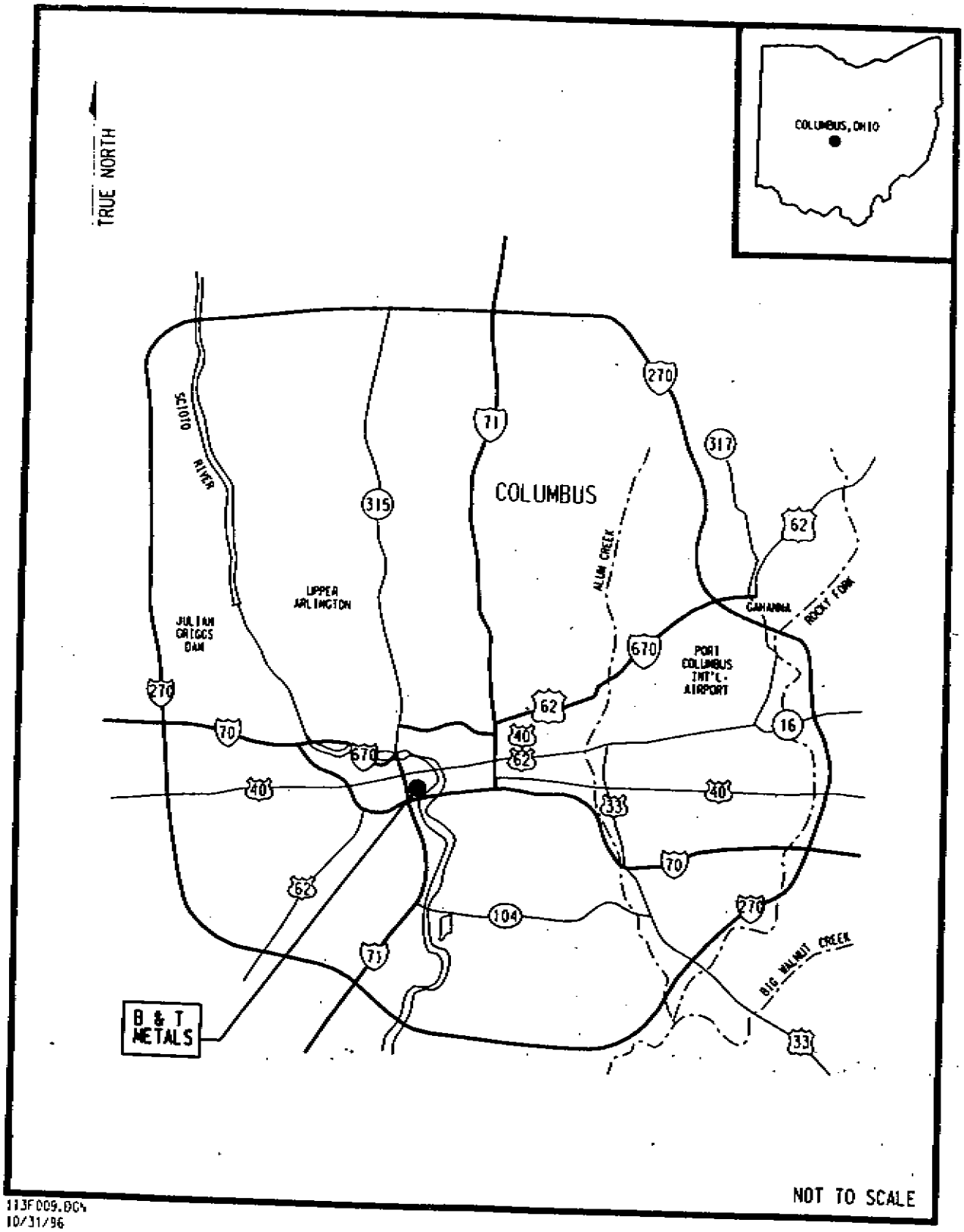

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Figure 1-1
General Site Location

1.2 HISTORY

B&T Metals is located at 425 West Town Street in southwest Columbus, Ohio. The buildings and property cover most of a city block. The site consists of three buildings: the main building, a storage building, and an aluminum extrusion building (Figure 1-2). A review of historic Sanborn insurance maps from 1941 indicate that all three buildings were standing at the time of the MED activities (BNI 1995).

In 1943, the DuPont Company, acting as an agent of MED, contracted with B&T Metals to extrude rods from uranium metal billets. The rods were destined for the Hanford reactor. Production extrusion began in March 1943 and continued until August of that year. It is likely that more than 50 tons of uranium were extruded (Williams 1991). The work performed for MED occurred in the northwest corner of the main building, the largest of the three structures.

Radiological protection during the MED work was provided by Metallurgical Laboratories of the University of Chicago. Measurements taken in March and April 1943 indicated significant amounts of airborne material, and the extrusion process was modified to reduce suspended particulate matter. Upon completion of the project, MED and DuPont representatives visually inspected the site to verify that the facilities and equipment had been cleaned and that all sweepings, turnings, solid scrap, oxides, and wet residue had been shipped offsite (Williams 1991). Although some industrial monitoring was performed during the extrusion operations, there are no records of extensive decontamination or surveys after completion of MED activities.

According to a former employee, process cooling fluids or metal shavings from the extrusion activities may have been poured outside in what is now a parking area, west of the main building, near an electrical substation. Machinery used for processing uranium has been sold or removed, with no records indicating its final disposition.

An initial screening of the B&T Metals property was conducted by members of the ORNL Measurement Applications and Development Group on August 22, 1988. A subsequent visit was made to the site on April 25, 1989, to collect air samples in the main building (ORNL 1990). A radiological assessment of soil and dust samples measured concentrations of radium and thorium at or near the background level, and indoor air samples were below the minimum detectable amounts for gross alpha and beta radiation. However, direct beta/gamma measurements at floor and overhead beam locations exceeded the allowable surface contamination guidelines. Concentrations of uranium ranging from 700 to 1,700 picocuries per gram (pCi/g) were identified inside the main building in several floor, sump, and drain locations and in dust on building support beams. Outdoor soil samples taken at locations with elevated external gamma radiation readings, corresponding to the area where process fluids or shavings from the MED activities reportedly were dumped, showed uranium concentrations ranging from 3.5 to 110 pCi/g (ORNL 1990).

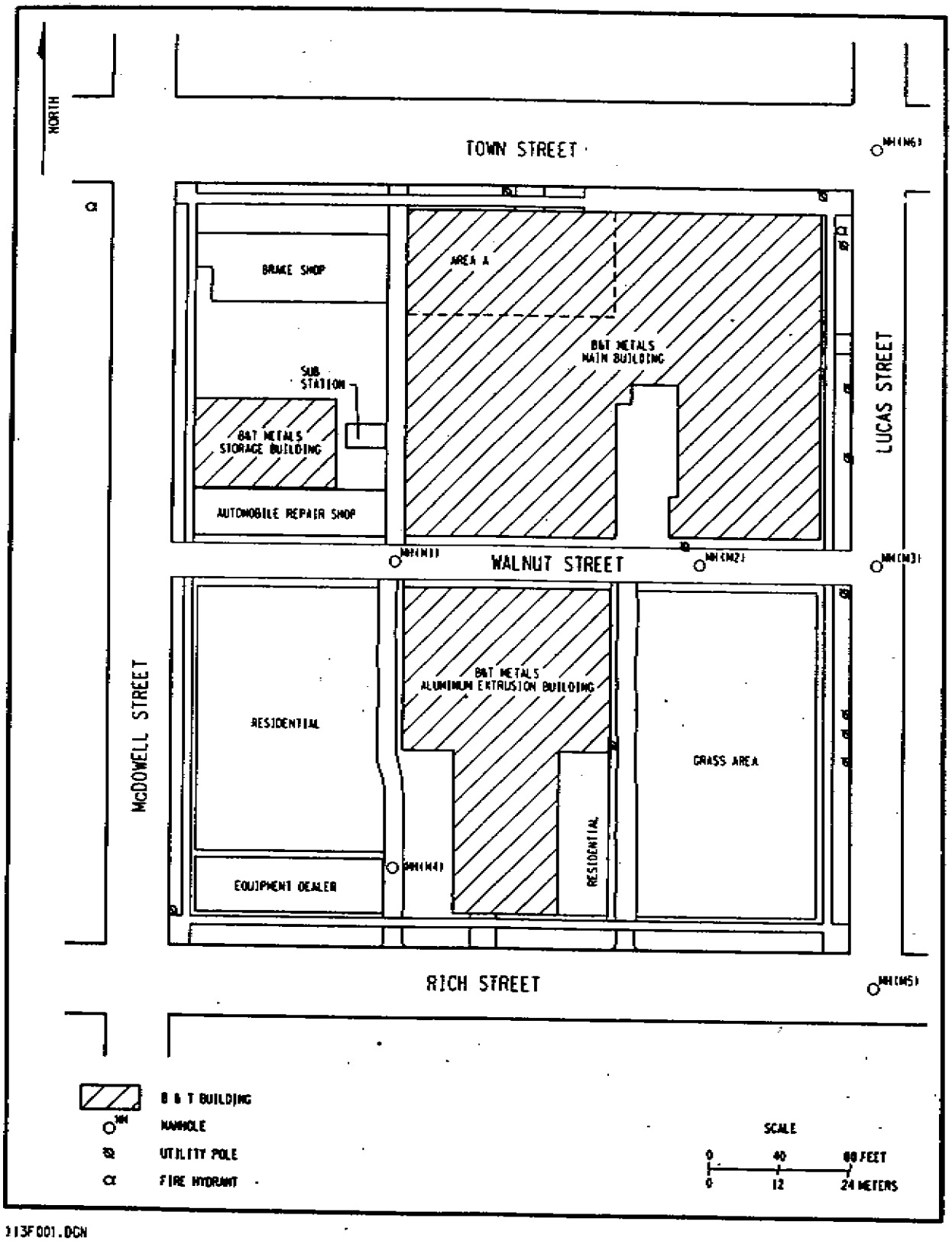

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Figure 1-2
Current Site Plan

2.0 REMEDIAL ACTION GUIDELINES

Radioactive contamination at the site originated from the extrusion of natural (neither depleted nor enriched) uranium rods. Standards and criteria governing the release of properties for future use are included in DOE Order 5400.5, "Radiation Protection of the Public and Environment," and are summarized in Table 2-1. The remedial action guidelines for alpha activity from natural uranium, uranium-235, uranium-238, and associated decay products on indoor and outdoor structure surfaces are 5,000 dpm/100 cm^2 (averaged over 100 cm^2 or less); 15,000 dpm/100 cm^2 (maximum); and 1,000 dpm/100 cm^2 (removable). The site-specific criterion for residual radioactive material in soil is 35 pCi/g for total uranium averaged over 100 m^2 or less (Adler 1994). This guidance was based on DOE's application of the as-low-as-reasonably-achievable (ALARA) principle to the site-specific guidance derived by Argonne National Laboratory based on the most probable future use of the site (ANL 1996). The soil concentration of 35 pCi/g, when applied under extremely conservative exposure scenarios, would result in a dose indistinguishable from background and an insignificant amount when compared to the 100-mrem/yr primary dose limit.

Because only trace concentrations of radium and thorium remain in uranium metal after processing, only extremely low concentrations of these two radionuclides were detected in characterization samples.

3.0 REMEDIAL ACTION

3.1 CLEANUP/DECONTAMINATION ACTIVITIES

Before remedial action began, the site was surveyed to define the boundaries of radioactive contamination, to supplement existing characterization information, and to obtain the radiological and chemical analytical data needed to ascertain the existence of mixed wastes and for classifying the waste to be generated during remediation. This classification was necessary for the waste to be accepted at the low-level radioactive waste disposal facility, Envirocare of Utah in Clive, Utah. As the remedial actions were completed, radiological surveys were performed and samples collected when appropriate to ensure that the residual uranium material had been removed to attain levels below the guidelines established by DOE. Radioactively contaminated lead anchors and sleeves were sent to the Scientific Ecology Group (SEG) facility in Oak Ridge, Tennessee, for decontamination and recycling. No hazardous materials were in the remediation waste stream.

The contaminated portion of the building was prepared for decontamination by relocating uncontaminated machinery and equipment, enclosing the contaminated area with high-density plastic sheeting and establishing a negative-pressure-filtered containment, and establishing an access

Table 2-1

Summary of DOE Guidelines for Residual Radioactive Contamination

Basic Dose Limits

The basic limit for the annual radiation dose (excluding radon) received by an individual member of the general public is 100 mrem/yr above background. In implementing this limit, DOE applies the ALARA principle to set site-specific guidelines.

External Gamma Radiation Limit for Structures

The average external gamma radiation exposure rate inside a building or habitable structure on a site that has no radiological restrictions on its use must not exceed the background level by more than 20 μR/h.

Site-Specific Soil Guidelines

The site-specific criterion for soil is 35 pCi/g above background for total uranium.

Indoor/Outdoor Structure Surface Contamination Applicable to the B&T Metals Site

The residual contamination guidelines for fixed and transferable radioactive contamination (dpm/100 cm^2) (DOE 5400.5):

Radionuclide	Average	Maximum	Removable
Uranium-natural, uranium-235, uranium-238, and associated decay products	5,000 (alpha)	15,000 (alpha)	1,000 (alpha)
Beta/gamma emitters (radionuclides with decay modes other than alpha emissions)	5,000 (beta/gamma)	15,000 (beta/gamma)	1,000 (beta/gamma)

control point. Communication with the property owner was maintained during the entire remediation.

The sequence of decontamination began with the overhead members, proceeded down the walls to the floors, floor cracks, and expansion joints, and then to the soil below the floor slabs, as indicated by direct surveys.

The contaminated steel trusses and other overhead members were vacuumed, cleaned with damp rags, and where required, wiped with soapy rags, degreasing solution, or an approved equivalent. Remaining contaminated areas were decontaminated by wire brushing or grinding down to the bare metal surface with a vacuum attachment on the surface grinder, without gouging or cutting. No lead paint waste was generated during the remediation.

Walls were decontaminated using a wire brush or needle gun where necessary. When these remediation methods failed on clay bricks, and further intrusive methods of remediation threatened the structural integrity of the wall, the contaminated bricks were removed and replaced.

The concrete floors were decontaminated using vacuuming, surface abrasion with a Blastrac™ unit, or grinding and vacuuming. Approximately 0.1 yd^3 (0.08 m^3) of nonradioactively contaminated nonfriable asbestos-containing floor tiles in area A was removed in accordance with OSHA requirements. After all of the floor tiles in area A were removed, the exposed concrete floor was resurveyed and decontaminated in the same manner as the other areas of the floor. The asbestos abatement subcontractor disposed of the nonfriable asbestos-containing floor tiles.

All contaminated lead anchor and sleeve inserts embedded in the floor were removed with a lightweight jackhammer. Approximately 0.04 yd^3 (0.03 m^3) of contaminated lead material was shipped to SEG for recycling. Although the contaminated lead anchor and sleeve inserts exhibited the characteristic of toxicity for lead, the material was not subject to hazardous waste regulations because it was considered scrap metal and was recycled pursuant to Ohio Administrative Code 3745-51-06, "Requirements for Recyclable Materials."

All contaminated floor cracks and joints were decontaminated using a vacuum, jackhammer, or concrete saw, as required, and disposed of as radioactive waste. The surfaces remaining after the concrete was removed were surveyed to ensure that all contamination above the guideline had been removed. All below-grade soil found to be contaminated above the DOE guidelines was removed.

The exterior site area remediated consisted of a 4.1-yd^2 (3.4-m^2) area along the southern side of the substation area west of the main building (Figure 3-1). Except for the recycled lead, all soil and material removed from the building and from the exterior area were disposed of as low-level radioactive waste. The soil was surveyed during excavation and sampled for gamma spectroscopy

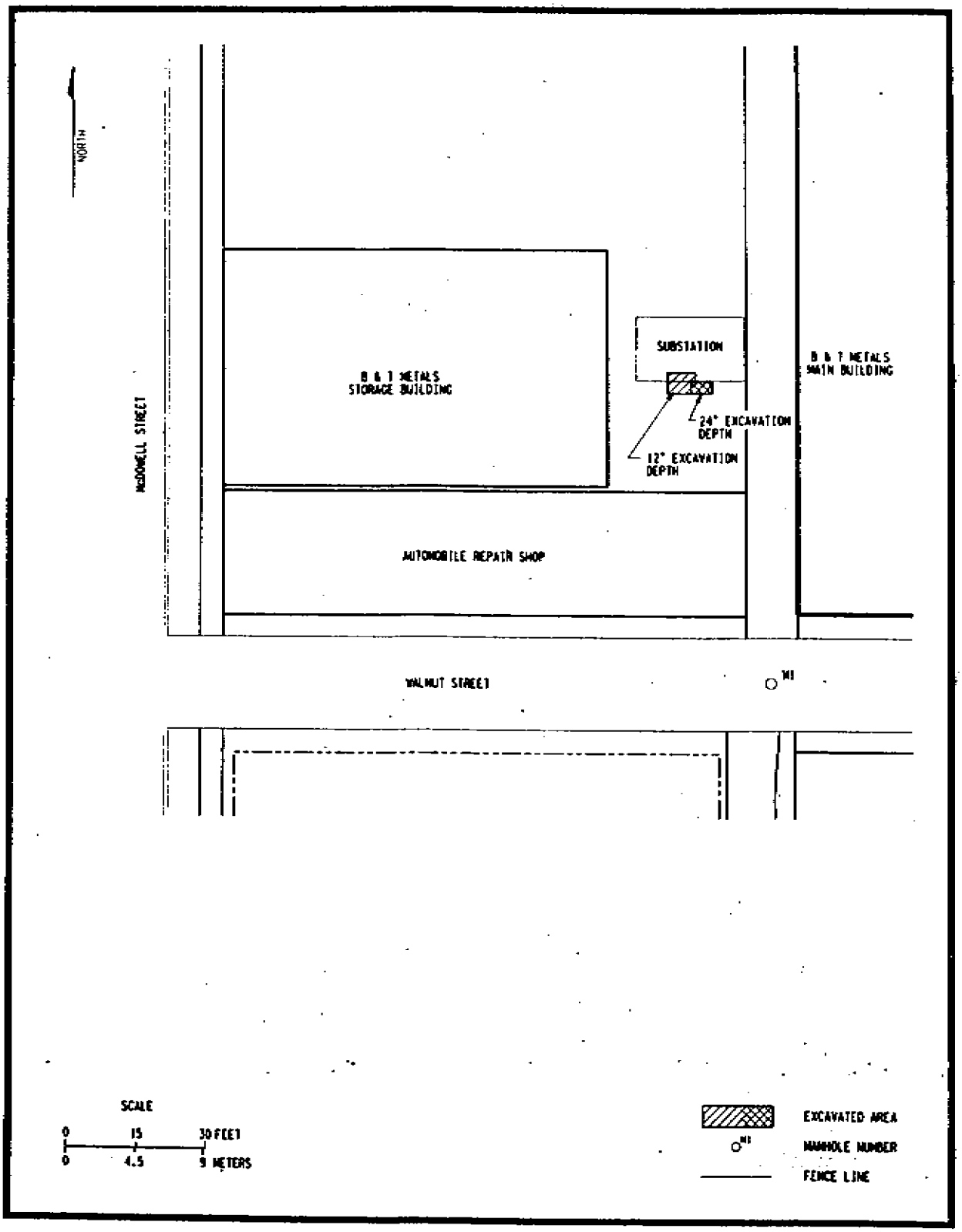

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Figure 3-1
Area of Exterior Excavation

analysis after excavation was completed to ensure that all uranium contamination above the guidelines had been removed.

One subslab drain line and two drain entrances were surveyed and found to contain levels of radioactivity above the guidelines. The drain line was excavated, and the surrounding area wa surveyed to ensure that all contaminated piping, debris, and soil were removed. The resulting trenches were surveyed for any residual radioactive material and excavated further if they did not meet the guidelines established by DOE. The drain line was replaced, and the trenches were backfilled with clean material. The drain entrances were decontaminated using vacuuming and abrasion techniques.

Three manholes (M1, M2, and M6 in Figure 1-2) were surveyed and found to contain levels of radioactivity above the guidelines. The walls of the manholes were remediated by vacuuming, scraping with hand tools, and by using a needle gun.

The three rain gutters on the sawtooth roof of area A were surveyed and found to contain levels of radioactivity above the guidelines. The gutters were remediated by scraping.

After the remedial actions were complete in each area and the IVC had verified the area to be free of any residual radioactive contamination above guidelines, the area was restored to the original or comparable condition agreed to by the property owner. The walls were patched, the concrete floors and trenches were filled, and the concrete was replaced. The exterior area was backfilled with clean fill material and graded.

The contaminated lead material was packaged in a 5-gallon plastic bucket and shipped to SEG for recycling. All other contaminated soil and debris were packaged in low-specific-activity (LSA) containers and shipped to Envirocare of Utah for disposal.

3.2 CONTAMINATION CONTROL DURING REMEDIAL ACTION

During the remedial action, engineering and administrative controls and continuous monitoring were used to protect remediation workers and members of the general public from potential exposure to radiation above applicable standards. These controls are outlined in the site safety and health work instructions.

All personnel working in contaminated areas were required to wear personal protective equipment (PPE), including disposable coveralls, safety glasses, disposable rubber boots, gloves, and hard hats. When conditions warranted, additional protective clothing and equipment such as hoods and respirators were required, as specified in the site safety and health work instructions.

Under the direction of a health physics technician, workers exiting radioactively contaminated work areas were subjected to a whole-body scan (frisked) at the control point with a hand-held radiation detection instrument to ensure that their protective clothing had prevented personal contamination and to prevent the spread of contamination to clean areas. Personnel were resurveyed (boots and hands) after exiting the support area to ensure that no material was transferred to uncontaminated areas. Contaminated PPE was sent to Envirocare for disposal.

The potential primary exposure pathways to radioactive material for members of the general public were inhalation and ingestion of radioactively contaminated airborne dust generated during the remedial action. The potential for contaminant suspension and migration was minimized by

- using wet dust suppression as needed during soil or concrete removal and transport,
- using LSA boxes with secured metal lids to prevent loss of the contaminated contents during shipment,
- enclosing interior work areas with high-density plastic sheeting and establishing a negative-pressure-filtered containment to restrict the movement of airborne materials,
- placing large sheets of plastic on floors in and around contaminated work areas where practical to prevent contaminated materials on the floor from being spread, and
- vacuuming at the point of origin during selected decontamination activities.

Perimeter air particulate sampling was performed adjacent to areas being remediated to ensure that no member of the general public was exposed to radioactivity above the current DOE guidelines (DOE Order 5400.5). The limits expressed in DOE Order 5400.5 are derived concentration guides (DCGs); a DCG is the concentration of a particular radionuclide that would yield a committed effective dose equivalent of 100 mrem/yr (the DOE basic dose limit) to an individual continuously exposed to the radionuclide by one pathway for an entire year. This guideline was established to protect the environment and members of the general public against undue risk from radiation. High-volume air samplers were used to collect air samples to reflect the concentration of airborne radionuclides potentially accumulated in the surrounding area. The filters of the air samplers were accumulated daily and counted after sufficient time was allowed for radon progeny decay. Concentrations of uranium-238 accumulated by area particulate air samplers ranged from 3.9×10^{-15} to 1.2×10^{-13} µCi/ml (0.00012 pCi/L), 16 times less than the DCG of 2.0×10^{-12} µCi/ml (0.002 pCi/L) for uranium-238.

4.0 POST-REMEDIAL ACTION MEASUREMENTS

Radiological surveys and soil analyses were performed at three remote background locations (Figure 4-1). These locations (described in Table 4-1) were selected because they are near the B&T Metals site and can provide radiological data representative of the area but are not influenced by the B&T Metals work. Background measurements and soil samples provide a reference with which results obtained before, during, and after the remedial action may be compared.

To verify that no radioactivity exceeding guidelines remained in the remediated areas, radiological surveys were conducted after remedial actions were completed. These surveys included direct surface measurements on interior surfaces in the northwest corner of the main building (Area A) such as the trusses, walls, concrete, piping, and the trenches that remained after the floor cracks and expansion joints were remediated (Figures 4-2, 4-3, 4-4, and 4-5). Gamma spectroscopy analyses were conducted on soils from excavated areas (Figure 3-1), and external gamma radiation exposure rates were determined using a pressurized ionization chamber.

Direct surface contamination is the total amount of radioactive contamination on a surface; therefore, a survey of direct surface contamination quantifies both removable and fixed contamination. The removable component of surface contamination is transferable and can be picked up on clothing or skin upon contact. To measure transferable contamination, the surface is wiped with a soft absorbent paper. The paper is placed in a portable smear counter, and alpha and beta/gamma radiation are each counted for one minute. These measurements in cpm are then converted to dpm/100 cm^2.

To quantify direct surface contamination, a radiation detection instrument is placed directly over the surface to measure the radioactivity emitted from it. Direct alpha radiation is measured with an alpha scintillation detector connected to a scaler, an instrument that counts the number of radioactive disintegrations detected in a specified amount of time. Direct beta/gamma radiation measurements are obtained with a Geiger-Mueller probe attached to a scaler. The probe is placed over the surface to be surveyed, and pulses are allowed to accumulate for one minute on the scaler, resulting in a measurement of counts per minute (cpm) for the surface area. These measurements are then converted, with appropriate calibration and conversion factors, to dpm/100 cm^2 and compared to the DOE guidelines.

Approximately 2 percent of the direct beta/gamma measurements for individual isolated areas in the overheads were above the average guideline of 5,000 dpm/100 cm^2 but below DOE guidelines when averaged with other measurements over the surrounding 1-m^2 area, as directed in DOE's Verification and Certification Protocol (DOE 1990). All direct beta/gamma results were below the maximum DOE guideline of 15,000 dpm/100 cm^2.

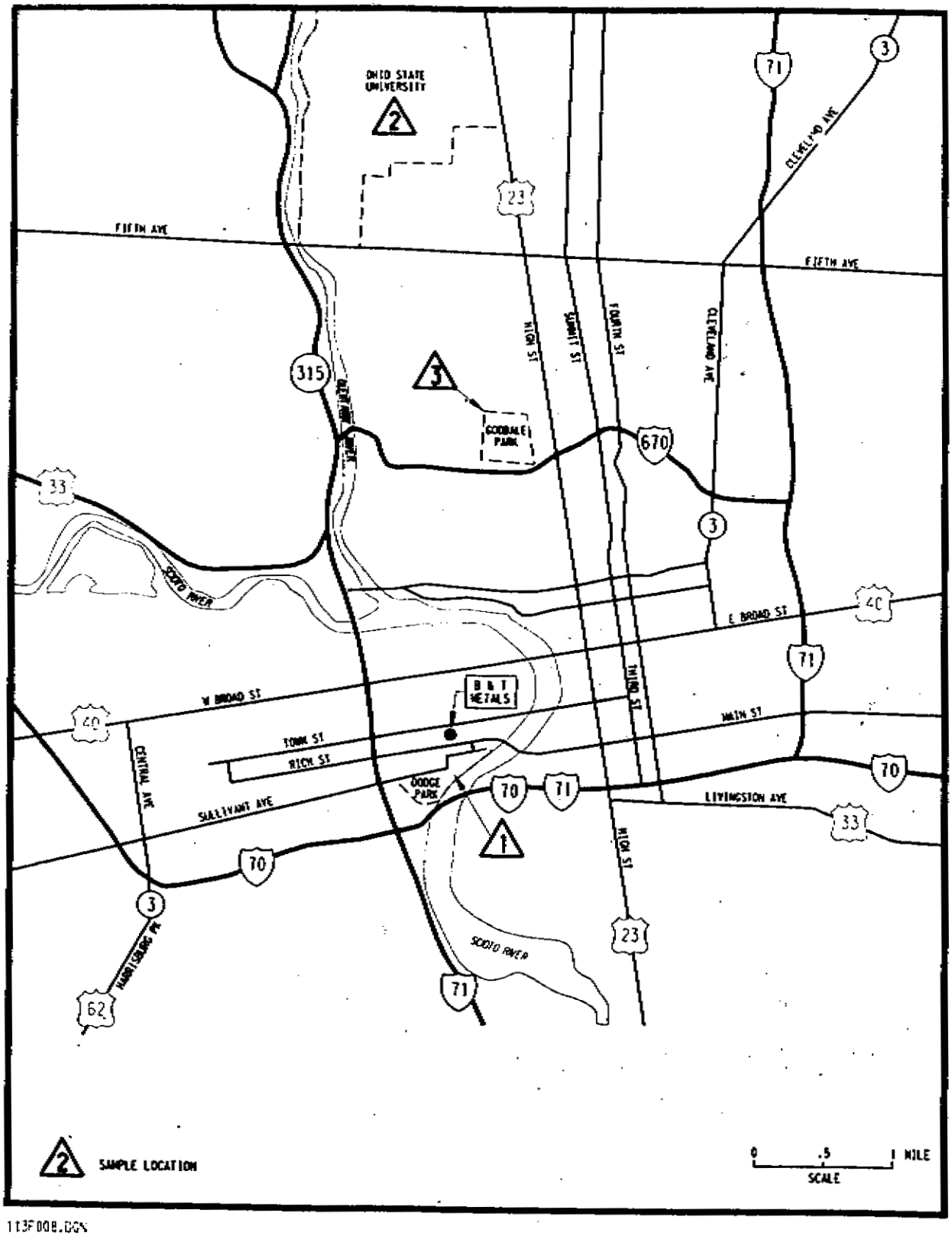

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Figure 4-1
Background Sampling Locations

Table 4-1

Total Uranium Concentrations and External Gamma Radiation Exposure Rates at Background Locations

	Location[a]	External Gamma Radiation Exposure Rate (μR/h)	Total Uranium (pCi/g)
1.	Dodge Park	7.1	4.9
2.	Ohio State University	10.1	5.2
3.	Goodale Park	9.4	6.4
Average background radioactivity		8.9	5.5
Guidelines		-[b]	35

[a]Background sampling locations are shown in Figure 4-1.

[b]Less than 20 μR/h above background in habitable structures, or maximum of 100 mrem/yr for all pathways, excluding radon.

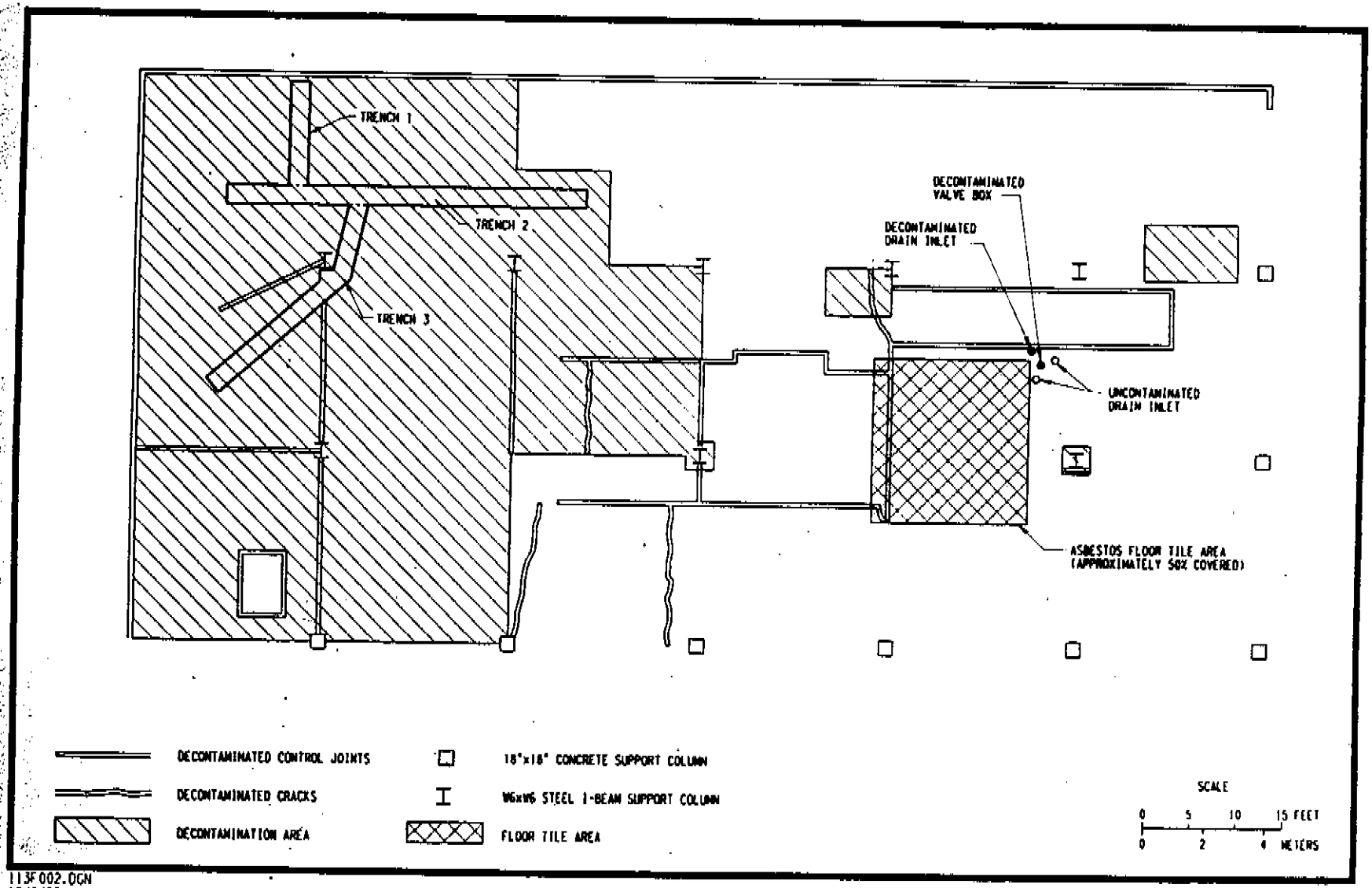

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Figure 4-2
Areas of Remediation on Floor In Area A

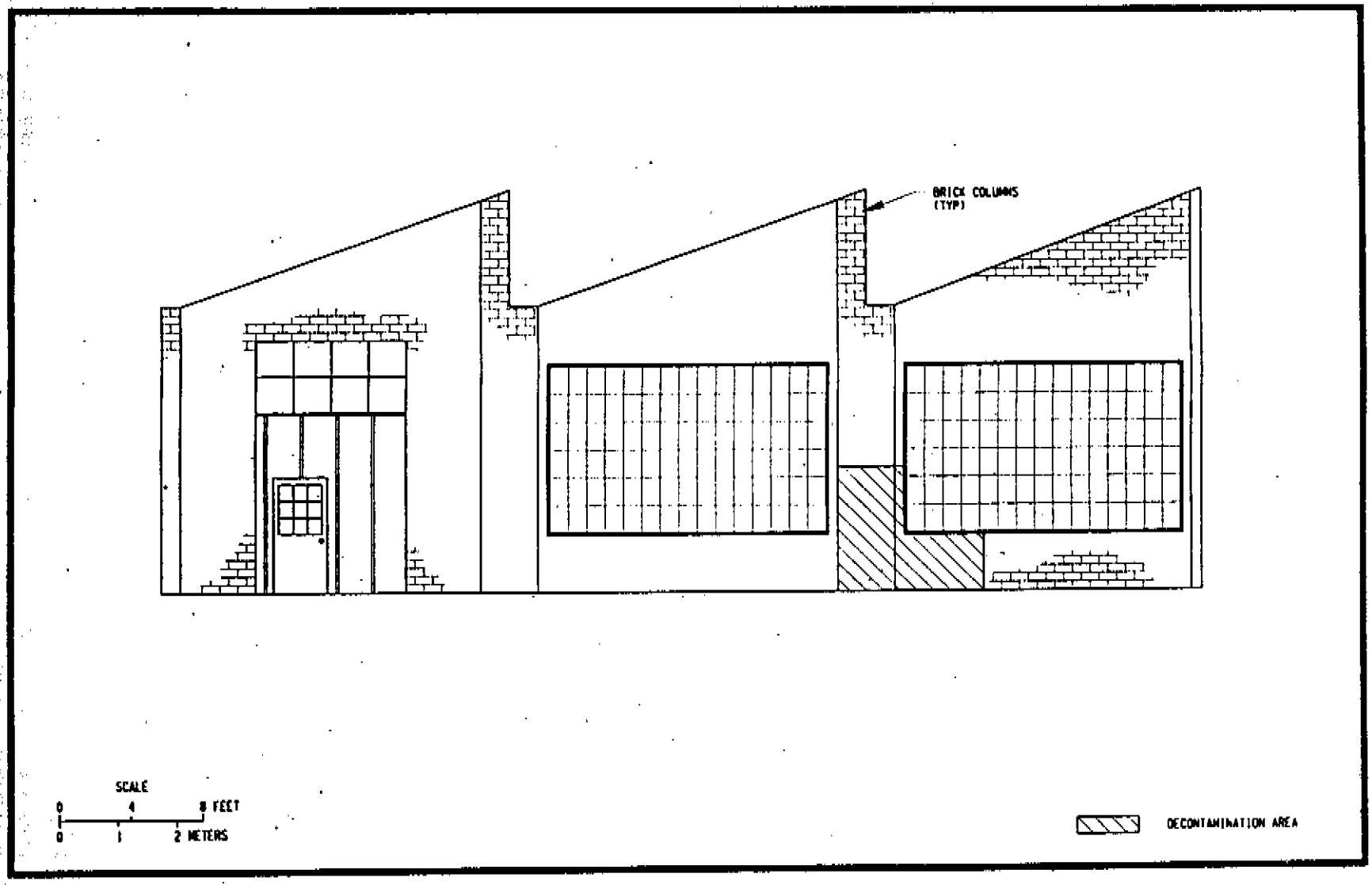

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Figure 4-3
Areas of Remediation on West Wall

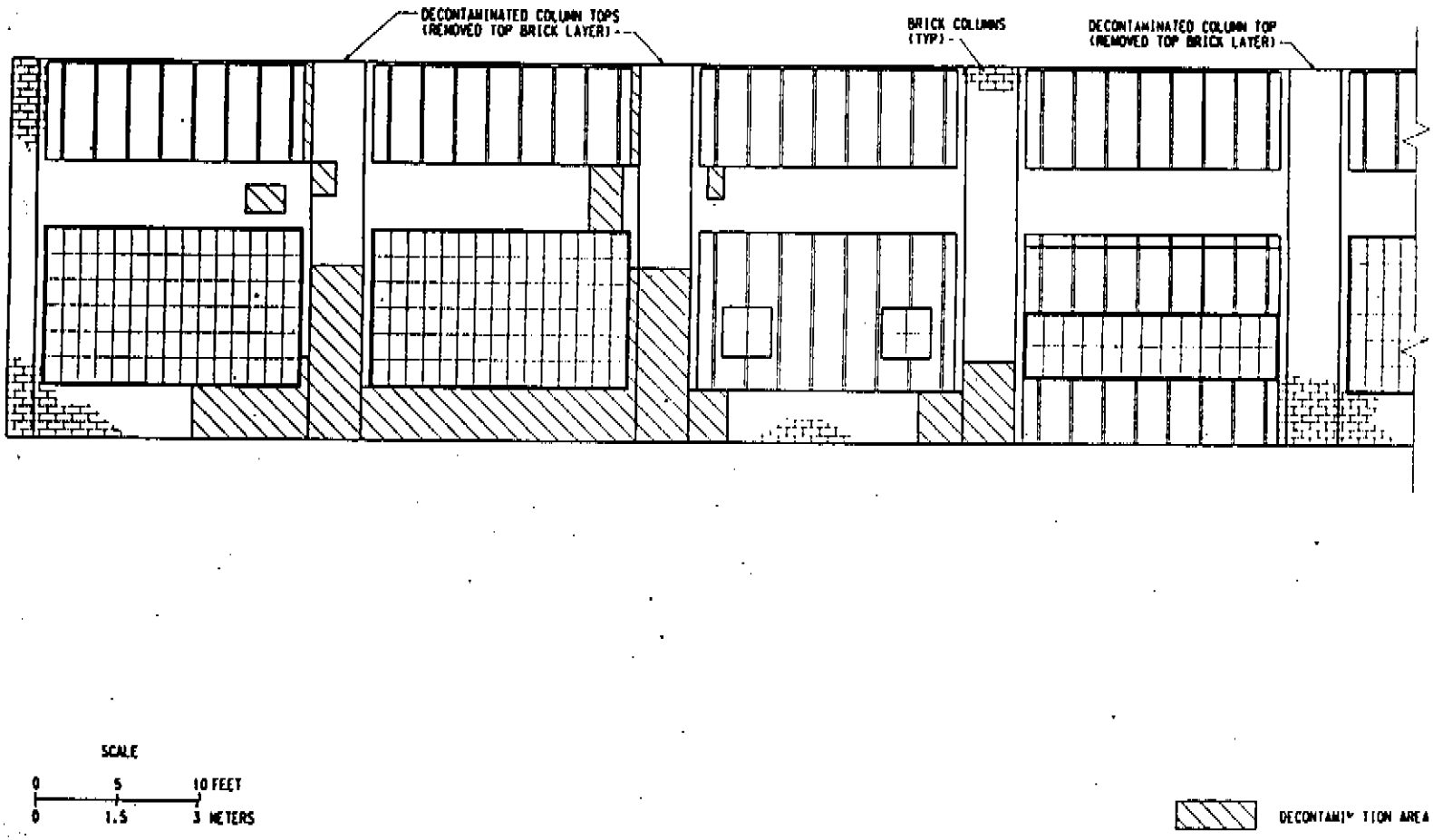

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Figure 4-4
Areas of Remediation on North Wall

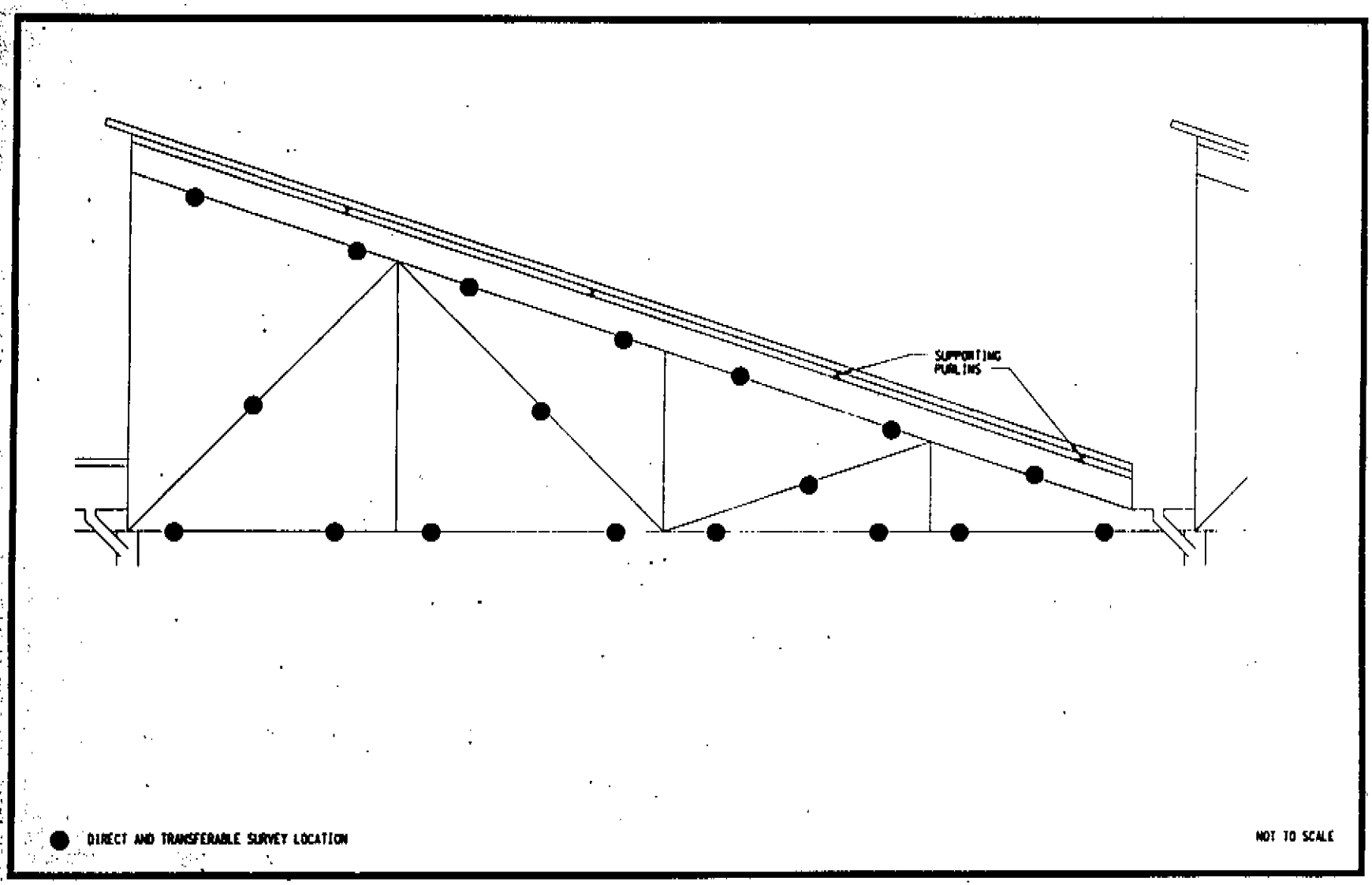

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Figure 4-5
Typical Truss Survey Locations

The external gamma radiation exposure rates were measured with a pressurized ionization chamber at 3 ft (1 m) above the surface. Readings at this elevation provide an estimate of the potential exposure from gamma radiation to the critical body organs near the ground or floor.

One post-remedial action exterior soil sample from the substation area was collected over the 4.1-yd^2 (3.4-m^2) surface area by equally spaced plugs with a depth of 15 cm (6 in.) and diameter of 2.5 cm (1 in.) at a frequency of no less than 25 plugs/100 m^2. Three interior (sub-slab) soil samples, one from each trench shown in Figure 4-2, were also collected from the trenches created by the removal of the contaminated pipeline, floor cracks, and expansion joints at the same frequency. The method used was similar to that for exterior soil sampling. Equally spaced plug soil samples were collected within the trench area and composited for gamma spectroscopy analysis to ensure that the residual uranium contamination was below 35 pCi/g.

Initial post-remediation surveys were conducted by the RSS on behalf of BNI. Survey techniques used during the post-remediation and verification surveys included measurements of direct and transferable surface contamination, walkover gamma scans, external gamma radiation exposure rate measurements, and soil sampling. Methods for the survey techniques are described in the *B&T Metals Site Post-Remedial Action Survey Plan,* which is included as Appendix A. The RSS also provided the laboratory functions for analyzing the collected samples. The IVC performed independent verification surveys of the remediated areas using similar survey techniques. The IVC survey data will be issued as a separate report by ORNL. When remedial action was completed, the property was restored to a condition agreed upon by both DOE and the property owner.

The remediated site components are listed in Table 4-2 along with the number of measurements collected and the results.

Post-remedial action direct surface contamination measurements and soil samples were used to verify the removal of the residual radioactive material, and external gamma exposure rate measurements were taken to ensure that the exposure rate from all pathways, except radon decay, was well below the guideline of 20 μR/h above background for habitable structures.

5.0 POST-REMEDIAL ACTION STATUS

Contaminated lead anchors and sleeves were shipped to SEG for decontamination and recycling. All other residual radioactive materials above the site-specific guidelines were removed from the B&T Metals site and disposed of as low-level radioactive waste at Envirocare of Utah. Waste volumes from the remedial action and their final disposition are listed in Appendix B.

The post-remedial action survey data indicated that all areas of the B&T Metals site determined to be contaminated during characterization surveys are now in compliance with

Table 4-2

Post-Remedial Action Radiological Survey Results

Area	Component	Number of Measurements	Direct Surface Measurements[a] Alpha (dpm/100 cm^2)	Direct Surface Measurements[a] Beta/Gamma (dpm/100 cm^2)	Transferable Surface Measurements[a] Alpha (dpm/100 cm^2)	Transferable Surface Measurements[a] Beta/Gamma (dpm/100 cm^2)	External Gamma Exposure Rate (μR/h)[b]	Total Uranium Concentration (pCi/g)[c]
Main Building	Walls	279	<29 - 879	<522 - 4,990	–[e]	<36 - 70	B - 2.5	–[d]
	Floor trenches	1,334	<24 - 262	<299 - 4,731	–[e]	<33 - 51		Trench 1: 5.0 Trench 2: 12.8 Trench 3: 29.3
	Overheads	1,240	<24 - 2,243	<316 - 11,812[f]	<3 - 194	<35 - 663		–[d]
	Electrical equipment platform	230	<26 - 2,462	<324 - 3,968	<3 - 10	<36 - 166		–[d]
Exterior	Substation	–[g]	–[g]	–[g]	–[g]	–[g]	0.3	25.9
	Manholes/ sewer lines	82	<31 - 333	<377 - 4,347	–[e]	<33 - 114	–	–[d]
	Roof gutters	216	<35 - 202	<274 - 4,527	–[e]	<33 - 38	–	–[d]
DOE guideline			5,000/15,000[h]	5,000/15,000[h]	1,000	1,000	<20[i]	35

[a]< indicates that the measurement was less than the minimum detectable activity (MDA).
[b]Results have background levels for the Columbus area subtracted (8.9 μR/h external gamma exposure rate); B indicates the value is indistinguishable from background.
[c]Results have background concentrations for the Columbus area subtracted (5.5 pCi/g total uranium).
[d]No excavation performed or soil removed.
[e]Transferable measurements required when the criterion for transferable surface contamination (1,000 dpm/100 cm^2) is exceeded in direct measurements.
[f]Individual isolated areas in the overheads that were above the average guideline of 5,000 dpm/100 cm^2 were below DOE guidelines when averaged with other measurements over the surrounding 1-m^2 area.
[g]Soil remediation only.
[h]The residual contamination guidelines for fixed radioactive contamination is 5,000 dpm/100 cm^2 average and 15,000 dpm/100 cm^2 maximum.
[i]Less than 20 μR/h above background in habitable structures, or a maximum of 100 mrem/yr for all pathways, excluding radon.

applicable cleanup guidelines. Considering a review of post-remedial action measurements, survey procedures, and quality assurance data, the IVC confirmed on June 12, 1996, that the site had been decontaminated to the radiological guidelines approved by DOE (ORNL 1996).

After completing verification activities, the IVC notified DOE-Headquarters, Division of Facility and Site Decommissioning, and DOE-Oak Ridge Operations, Former Sites Restoration Division, of its findings and recommendations. DOE reviewed the data to determine whether the remedial action was successful. Based on this review, radiological conditions at the site were determined to be in compliance with DOE decontamination criteria and standards to protect health, safety, and the environment, and DOE certified the site as suitable for appropriate future use without radiological restrictions.

REFERENCES

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GLOSSARY

Alpha-emitting - See **Radiation.**

Ambient Background Radiation - Ambient background radiation refers to naturally occurring radiation emitted from either cosmic (e.g., from the sun) or terrestrial (i.e., from the earth) sources. Exposure to this type of radiation is unavoidable, and its level varies greatly depending on geographic location. For example, New Jersey typically receives 100 millirem per year (mrem/yr). Colorado receives about 115 mrem/yr, and some areas in South America receive up to 7000 mrem/yr. Naturally occurring terrestrial radionuclides include uranium, radium, potassium, and thorium (see **Radionuclide**). The dose levels do not include the concentrations of naturally occurring radon inside buildings.

Beta/gamma-emitting - See **Radiation.**

Centimeter - A centimeter (cm) is a metric unit of measurement for length; 1 inch is equal to 2.54 cm; 1 foot is equal to approximately 30 cm.

Contamination - The term "contamination" is used generally to mean a concentration of one or more radioactive materials that exceeds naturally occurring levels. Contamination may or may not exceed the DOE cleanup guidelines.

Disintegrations per minute - Disintegrations per minute (dpm) is the measurement indicating the amount of radiation being released from a substance per minute.

Dose - As used in this report, dose is actually dose equivalent and is used to relate absorbed dose (mrad) to an effect on the body. Dose is measured in mrem. For comparison, a dose of 500,000 mrem to the whole body within a short time causes death in 50 percent of the people who receive it; a dose of 5,000,000 mrem may be delivered to a cancerous tumor during radiation treatment; normal background radiation at or near sea level results in an annual dose of about 100 mrem; DOE radiation protection standards limit the dose that may be received by members of the general public to 100 mrem/yr above background levels; living in a brick house typically results in a dose of about 75 mrem/yr above the background level.

Exposure Rate - Exposure rate is the rate at which radiation imparts energy to the air. Exposure is typically measured in microroentgens (μR), and exposure rate is typically expressed as μR/h. The dose to the whole body can be approximated by multiplying the exposure rate by the number of hours of exposure. For example, if an individual were exposed to gamma radiation at a rate of 20 μR/h for 168 h/week (continuous exposure) for 52 weeks/yr, the whole-body dose would be approximately 175 mrem/yr.

Gamma Radiation - See **Radiation.**

Meter - A meter (m) is a metric unit of length; 1 m is equal to approximately 39 inches.

Microroentgen - A microroentgen (μR) is a unit used to measure radiation exposure. For further information, see **Exposure Rate.**

Millirem - The millirem (mrem) is the unit used to measure radiation dose to man. The DOE dose limit is 100 mrem above background radiation levels within any one-year period for members of the general public. Naturally occurring radioactive substances in the ground result in a yearly exposure of about 100 mrem to each member of the population. To date, no difference can be detected between the health of population groups exposed to 100 mrem/yr above background and the health of groups who are not exposed.

Natural Background Radiation - Natural background radiation refers to radiation emitted from the naturally occurring radionuclides found in manmade materials. The concentrations of the radionuclide, and thus the radiation, will vary widely because of variations in the composition of the materials. Background locations are selected to provide radiological data representative of the area but not influenced by contamination from the site of interest.

Radiation - There are three primary types of radiation: alpha, beta, and gamma. Alpha radiation travels less than an inch in air before it stops, and it cannot penetrate the outer layers of human skin. Beta radiation can penetrate the outer layers of skin but cannot reach the internal organs. Gamma radiation, the most penetrating type, can usually reach the internal organs.

Radionuclide - Radioactive elements are also referred to as radionuclides. For example, uranium-235 is a radionuclide, uranium-238 is another, thorium-232 is another, and so on.

Remedial Action - Remedial action is a general term used to mean "cleanup of contamination that exceeds DOE guidelines." It refers to any action required so that a property may be certified as being in compliance with guidelines and may therefore be released for future use. Remedial action also includes restoring remediated properties to their original conditions as far as reasonably possible.

Uranium - Uranium is a naturally occurring radioactive element. The principal use of refined uranium is for the production of fuel for nuclear reactors. Uranium in its natural form is not suitable for use as a fuel source.

APPENDIX A

B&T Metals Site
Post-Remedial Action Survey Plan

B&T METALS SITE
POST-REMEDIAL ACTION SURVEY PLAN

PURPOSE

The purpose of this plan is to describe the methodologies that the Formerly Utilized Sites Remedial Action Program (FUSRAP) will use for post-remedial action radiological surveys, sampling, and analysis to document the final condition of the B&T Metals Site as free of residual radioactivity above the release standards of Department of Energy (DOE) Order 5400.5 (Reference 1). Nothing herein is intended to compromise the independence of the Independent Verification Contractor (IVC); the purpose is to document the Project Management Contractor's (PMC's) plans to conduct post-remedial action surveying/sampling and the plans for coordinating effectively with the IVC. The plan addresses the DOE protocol for verification and certification of sites under FUSRAP (Reference 2).

Bechtel National, Inc. (BNI) is the FUSRAP PMC, and the Oak Ridge National Laboratory (ORNL) will act as the IVC.

BACKGROUND

B&T Metals is located at 425 West Town Street in southwest Columbus, Ohio. The buildings and property cover most of a city block. The site consists of three buildings: the main building, a storage building, and an aluminum extrusion building.

In 1943, the DuPont Company, acting as an agent of the Manhattan Engineering District (MED), contracted with B&T Metals to extrude rods from uranium metal billets. The rods were destined for the Hanford reactor. Production extrusion began in March of 1943 and continued until August of that year. The work performed for MED occurred in the northwest corner of the main office building, the largest of the three structures.

Radiological protection was provided by Metallurgical Laboratories of the University of Chicago. Measurements taken in March and April 1943 indicated significant amounts of airborne metals, and the extrusion process was modified to reduce debris. Upon completion of the project, MED and DuPont representatives visually inspected the site to verify that the facilities and equipment had been cleaned and that all sweepings, turnings, solid scrap, oxides and wet residue had been shipped offsite (Reference 3).

RESIDUAL RADIOACTIVITY GUIDELINES

The source of residual radioactivity on the designated property was natural uranium metal milling operations. Residual radioactivity in the building is the result of migration of the uranium metal by such mechanisms as disposal (sweeping or washing), tracking on shoes and clothing, and deposition of smoke from ignition of the pyrophoric metal or fumes generated during machining. The DOE primary standard of 100 mrem/yr above background will be the public dose limit, with remedial action rendering the dose limit as low as reasonably achievable (ALARA). The average level of gamma radiation inside a building or habitable structure on a site to be released without restrictions shall not exceed the background level by more than 20 μR/hr and shall comply with the basic dose limit when an "appropriate-use" scenario is considered (Reference 1).

The residual contamination guidelines for fixed and transferable radioactive contamination (dpm/100 cm^2) (Reference 1):

Radionuclide	Average	Maximum	Removable
U-Natural, U-235, U-238, and associated decay products	5,000 α	15,000 α	1,000 α
Beta-gamma emitters	5,000	15,000	1,000

The *site-specific* contamination guideline for soil is as follows (identified in Reference 8; determined as a conservative fraction of the concentration derived in Reference 9)

Radionuclide	Soil Concentration
Total Uranium	35 pCi/g (above background)

DECONTAMINATION ACTIVITIES

Design drawings for the decontamination activities include 113-DD546-C01 (Vicinity Plan, Site Plan, and Manhole Decontamination Plan) and 113-DD546-C02 (Area A Decontamination Sections and Detail).

A Real Estate Instrument for the affected property shall be in place prior to the initiation of remediation activities.

At a minimum, remediation of the site will consist of decontamination and/or removal of structures exceeding the DOE guidelines for fixed and transferable radioactive contamination as well as excavation and disposal of soil exceeding the 35 pCi/g site-specific guideline for total uranium.

APPENDIX B

Waste Minimization Summary

WASTE MINIMIZATION SUMMARY FOR THE B&T METALS SITE

The decontamination of the B&T Metals site was conducted in a manner that prevented the overexpenditure of funds while expediting the remedial action. Recycling radioactively contaminated lead, refining contamination boundaries, decontaminating walls rather than demolishing them, scraping the rain gutters rather than removing them, using a jackhammer to decontaminate floor cracks and joints where appropriate rather than using a concrete saw, and surveying PPE for disposal as clean trash were a few of the measures used.

The volume and waste streams at the site are listed in Table B-1.

TABLE B-1

REMEDIAL ACTION/WASTE MANAGEMENT SUMMARY

WBS 113

SITE B&T Metals

REMEDIATION AUTHORITY

- [x] NEPA/CERCLA
- [ ] SUPERFUND
- [ ] RCRA

OWNER Mr. David Tolbert
SITE ADDRESS 425 West Town Street
CITY, STATE Columbus, Ohio

ACTION	DATE	RESPONSIBLE ENTITY	DOCUMENT
DESIGNATION	09/25/92	DOE	Authorization for Remedial Action at B&T Metals in Columbus, Ohio
CHARACTERIZATION	10/90	ORNL	Results of the Preliminary Radiological Survey at B&T Metals, Columbus, Ohio
FINAL RA	09/96	DOE/ORNL/BNI	Post-Remedial Action Report for the B&T Metals Site, Columbus, Ohio

TOTAL VOLUME 15 yd^3
To Remain In Situ 0
Volume Recycled[a] 0.04 yd^3
Net Disposal 15 yd^3

Documentation Used: N/A

TYPE OF WASTE FOR NET DISPOSAL:

REGULATORY	VOLUME	DISPOSAL SITE
[x] LLRW	15 yd^3	Clive, Utah
[ ] 11(E)2		
[ ] MIXED		
[ ] CHEMICAL		
PHYSICAL		
[ ] BUILDING RUBBLE		
[ ] SOIL		
[ ] LIQUID		
[ ] OTHER		

TREATMENT TECHNOLOGIES APPLIED AT THE SITE: N/A

[a] Approximately 0.04 yd3 of contaminated lead material was shipped to SEG for recycling.

Consequently, post-remedial action and verification surveys, as well as soil sampling, will focus on confirming that after remedial action, residual radioactivity is not present at concentrations exceeding applicable guidelines. Areas where remediation activities will be conducted will include, but not be limited to, those identified during site characterization activities (Reference 6). To the extent necessary, equipment used during the decontamination activity will be cleaned and surveyed for surficial contamination prior to release.

POST-REMEDIATION SURVEYS AND SAMPLING

The FUSRAP Radiological Support Subcontractor (RSS), is Thermo NuTech (TNu), a division of ThermoAnalytical (TMA). Following remediation, TNu will perform post-remedial action surveys and sampling to determine the completeness of the remedial action and to document that the site now complies with the applicable criteria.

Survey Equipment

The recommended equipment for use by FUSRAP for release of equipment and materials from the site includes, but is not limited to:

- Alpha Scintillation detector (Eberline AC-3 or equivalent; calibration source: Th-230)
- Beta/Gamma Pancake GM detector (7 mg/cm^2 mylar shielded, Eberline HP-210 or equivalent; calibration source: Sr-90, Y-90)
- Alpha Scintillation Counter (Eberline SAC-4 or equivalent; calibration source: Th-230)

The recommended equipment for use by FUSRAP for Post-RA survey and verification includes, but is not limited to:

- Canberra 96-6697 Procount gamma spectroscopy system (calibrated according to instruction in Reference 10)
- Portable Ratemeter/Scaler (Eberline PRS-1 or equivalent)
- Gamma Scintillation Detector (Eberline SPA-3 or equivalent), or low range/high range HP-270 or equivalent (calibration source: Cs-137)
- Reuter-Stokes Pressurized Ion Chamber (PIC) (calibrated by manufacturer)
- Field Instrument for Detection of Low-Energy X-Rays (FIDLER) (calibration source: Am-241)
- HP-260 or equivalent pancake GM detector (calibration source: Sr-90, Y-90)

Similar types of calibration sources (i.e., same radionuclide) and methods for instrument calibration should be used by TNu and ORNL to insure compatibility and reproducibility of survey results.

The Canberra 96-6697 Procount field gamma spectroscopy system may be used to analyze the soil samples and will be operated in accordance with TMA procedure QAP-035 (Reference 10). Of those samples analyzed in the field, a minimum of 5% will then be shipped to the TNu laboratory in Oak Ridge for analysis for list 1 by gamma spectroscopy. Laboratory and field gamma spectroscopy results should agree within 20%. If the field gamma spectroscopy system is not employed, all post-RA soil samples will be analyzed by gamma spectroscopy (list 1) in the Oak Ridge laboratory.

Background Measurements

Prior to performing post-remedial action surveys, TNu will obtain site-specific background measurements. These measurements may be obtained from three remote background locations in the general vicinity of the site (0.5 to 3 miles) according to TNu procedure 3C.2 (Reference 13A). If similar materials (concrete, mortar, brick, etc.) cannot be found within 0.5 to 3 miles of the facility, then interior (non-surface) samples of materials taken from uncontaminated portions of the facility may be used for determining background. To ensure similar background measurements, background locations will be determined by TNu and provided to ORNL. Background measurements will be made at each location.

Post-RA Surveys

After completion of decontamination, TNu shall conduct post-remedial action surveys to document the satisfactory decontamination of the building (Reference 11). The structures left after remediation will be surveyed for alpha and beta/gamma direct and transferable contamination according to TMA procedures 3A.2 and 3A.3 (References 13D and 13E). Gamma exposure rate measurements shall be obtained according to TMA procedure 3B.3 (Reference 13C).

Once remediation of floor and wall areas is complete, if a floor/wall monitor (or equivalent) is available, the entire floor/wall area will be scanned to obtain initial confirmation that no small, isolated areas of contamination were missed during remedial action.

Following methods in reference 11, post-RA direct measurements will be collected, biased within specific 1-m^2 (10.75-ft^2) areas to demonstrate that remediated areas no longer have residual radioactivity above criteria. Direct readings will also be taken in adjacent areas within 0.5 m (1.6 ft) of the formerly contaminated areas to verify that residual radioactivity had not spread to previously clean areas during the removal activities.

Transferable (removable) alpha and beta/gamma measurements will also be taken, at a minimum, at any location that exhibits direct alpha or beta/gamma measurements above the guideline for removable contamination (1,000 dpm/cm^2) (Reference 11).

Post-RA Soil Sampling

Although no soil above guidelines was identified during characterization (Reference 6), this section is included to provide guidance for post-RA soil sampling should any soil above guidelines be identified during remedial action.

Soil samples will be collected from an approximately 100 m^2 grid (10m by 10m where practical) as directed in 191-IG-032 (Reference 12) and TMA procedure 4A.1 (Reference 13F). When deviating from the 10 m by 10 m dimensions (due to irregularities in the area of contamination), total area shall not exceed 100 m^2. For each sample, the approximate depth to the bottom of the excavation for will be recorded in the sampling logbook.

Point sources ("hot spots") will be evaluated using the averaging criteria contained in A Manual for Implementing Residual Radioactive Material Guidelines (Reference 14) and DOE Order 5400.5, Chapter IV, Section 4. Where appropriate, a hybrid grid made up of portions of one or more site grids will be implemented to bound and assign the area (in square meters) to each "hot spot" in question. Composite samples of the soil will be taken from each sample grid. Composite samples will be collected by taking individual samples (25 per 100 m^2) from each sample grid at 0.5' depths and compositing these individual samples into one composite sample for that grid (Reference 12). ORNL may collect samples concurrently.

Samples from each grid shall be collected using properly decontaminated sampling equipment (Reference 15).

TNu samples shall be handled using the same custody and labeling methodology described for sediment samples in the "Instruction Guide for Surface Water and Sediment Sampling Activities" 191-IG-028 (Reference 16) and the sample surveying, packaging, and shipping methodology in PI R4.7 "How to Ship Samples from a FUSRAP Site" (Reference 17).

Safety and Health

Safety and Health risks associated with tasks described herein have been identified and addressed by the **Site Specific Health and Safety Plan for the B&T Metals Site** (Reference 18).

The work will be performed under a Hazardous Work Permit specific to the survey activities, where appropriate.

Quality Assurance/Quality Control

QA/QC field duplicate samples and measurements shall be collected at a frequency of one additional sample/measurement for each 20 collected.

Rinse blanks from decontaminated sampling equipment shall be collected at the rate of one rinse per day of sampling. Rinse blanks shall be collected according to the recommendations in 191-IG-028 (Reference 16).

Data Quality Objectives

The minimum detectable activity (MDA) for analysis of uranium-238 by field gamma spectrometry shall be 5 pCi/g or less. The MDA for laboratory gamma spectrometry shall be less than 3 pCi/g. Quality indicator goals shall be as follows: Precision, ± 2 sigma; completeness, 100%; Accuracy, ± 25%.

BECHTEL/ORNL COORDINATION

Bechtel is the contractor responsible for completing the remedial action and will have the responsibility for decontamination. Upon completion of these decontamination activities and associated post-remedial action surveys and sampling, ORNL will commence verification of the remediation of the B&T Metals site property. ORNL will perform surveys to determine whether there are areas requiring additional remediation. This survey is expected to include all areas previously identified as being contaminated on the B&T Metals site property. Bechtel will assist ORNL in this survey by interfacing with the property owner in advance to secure their approval for property access.

Remediation and verification may be conducted concurrently, to the extent that the two activities do not interfere with each other. Bechtel will provide ORNL access to remediation results and interpretation as they become available. The Bechtel Site Superintendent, or designee, will notify ORNL when remediation of an area is complete, and ORNL will perform final independent verification surveys of the area. Due to the limited size of the areas to be remediated, Bechtel will attempt to provide ORNL with the opportunity for one consolidated verification survey. When applicable, ORNL may collect soil sample splits concurrent with Bechtel sampling efforts. When ORNL has collected all of the samples and instrument readings needed for their independent verification of the site, they will sign the "Findings of Independent Verification Survey" form (Attachment 1).

Remedial action will continue until ORNL agrees decontamination is complete. Final site conditions must meet cleanup objectives. Measurements taken by Bechtel and ORNL at identical locations should agree within the 95 percent confidence interval for the analytical methods used (Reference 2). For consistency and ease of data comparison, Bechtel and ORNL should utilize the same type of calibration techniques, calibration sources, and survey techniques in conducting the surveys. Bechtel and ORNL shall establish a mutually agreeable survey grid across the decontaminated areas and shall conduct their surveys referring to that grid.

Upon agreement by both parties that the site is decontaminated, ORNL will then demobilize, and Bechtel will restore the site to the condition agreed upon by the property owner(s).

Bechtel will provide final validated sample results to ORNL as soon as they are available. Bechtel will prepare a post-remedial action report (PRAR) for DOE review (copy to ORNL) within 3 months following demobilization, and then complete preparation of the Certification Docket. ORNL will issue a preliminary verification letter report to DOE (copy to Bechtel) within 2 weeks following demobilization.

REFERENCES

(1) DOE Order 5400.5, Radiation Protection of the Public and Environment, Washington, DC

(2) DOE, 1990. Verification and Certification Protocol for the Office of Environmental Restoration FUSRAP and D&D Program, Revision 3, November.

(3) Williams, W., 1991, *Authority Determination - B&T Metals in Columbus, Ohio*. DOE correspondence from Office of Environmental Restoration to file, February 21.

(4) ORNL, 1990. Results of the Preliminary Radiological Survey at B&T Metals, 425 West Town Street, Columbus, Ohio (CO001), ORNL/RASA-89/1, Martin Marietta Energy Systems, Inc., Oak Ridge National Laboratory, October.

(5) BNI, 1995. B&T Metals Site Scoping Trip Report, Interoffice Memorandum, J.G. Braun to File, CCN 136878, November 22.

(6) BNI, 1996. Characterization Report for the B&T Metals Site, Columbus, Ohio.

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(10) ThermoAnalytical (TMA), Operation of the Gamma Spectroscopy System, QAP-035.

(11) BNI, 1993. Instruction Guide for Post-Remediation Radiological Survey of Structures, 191-IG-031.

(12) BNI, 1993. Instruction Guide for Post-Remediation Survey of Soil, 191-IG-032.

(13) TMA, Health Physics Operational Procedures Manual
- A) 3C.2 "Determination of Background"
- B) 3B.1 "Delineation of Survey Areas in Open Land"
- C) 3B.3 "Gamma Ray Exposure Rate Surveys at 1-Meter in Open and Enclosed Areas"
- D) 3A.2 "Direct Surface Contamination Survey"
- E) 3A.3 "Transferable Surface Contamination Survey"
- F) 4A.1 "Systematic and Bias Surface Soil Sampling (Radiological)"

(14) DOE/CH/8901. A Manual For Implementing Residual Radioactive Material Guidelines, June 1989.

(15) BNI, 1992. Instruction Guide for Decontamination of Field Sampling Equipment at FUSRAP Sites, 191-IG-011, Revision 5

(16) BNI, 1993. Instruction Guide for Surface Water and Sediment Sampling Activities, 191-IG-028, Revision 0.

(17) BNI, 1994. How to Ship Samples from a FUSRAP Site, PI R4.7, Revision 2.

(18) BNI, 1995. Site Specific Health and Safety Plan for the B&T Metals Site, Toledo, Ohio, 113-HSP, Revision 1.

B&T METALS SITE

FINDINGS OF INDEPENDENT VERIFICATION SURVEY

PROPERTY _____ AREA _____ _____
SURVEY DATE(S) _____
SURVEYOR(S) _____ , _____ , _____

PRELIMINARY FIELD DATA REVIEW:

_____ No Discrepancies _____ Discrepancies Identified

MEASUREMENT PERFORMED:

_____ Beta/Gamma _____ Removable Activity Smear
_____ Other (describe) _____ Direct Measurements

SAMPLES COLLECTED:

_____ Systematic _____ Bias

APPLICABLE GUIDELINES:

Radionuclide	Soil Concentration Above Background
Total Uranium	35 pCi/g, any depth

For fixed and transferable radioactive contamination (U-238)
5000 dpm/100 cm^2, average total
15,000 dpm/100 cm^2, maximum total
1000 dpm/100 cm^2, removable

STATUS (pending final sample results):

_____ Meets Guidelines _____ Does Not Meet Guidelines

Explain Discrepancies: _____

_____

Remarks: _____

_____

I acknowledge that all the samples and instrument readings needed to verify this area as clean have been taken.

Prepared by: _____ Date: _____