CLOSURE PLAN FOR THE

ELKEM METALS BUILDING 78 SDMP SITE

AT

ELKEM METALS COMPANY

MARIETTA, OHIO

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February 26, 1997

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ELKEM METALS BUILDING 78 SDMP SITE
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1.0 Introduction

The purpose of this plan is to provide the framework for final closure of the Elkem Metals Building 78 SDMP Site in Marietta, Ohio. This site has been the focus of decommissioning activities during 1984 and remedial action beginning with discovery of additional contaminants in 1992 and subsequent remediation beginning in 1993 and continuing into 1996. A Final Status Report for the site was submitted in March of 1995 and has been the subject of continuing comments for clarification and revision. This plan discusses the approach which will be taken to assure the approval of the Final Status Report and release of the site. Response to NRC comments from February 22, 1996 accompany this plan and details are addressed within this plan as the issue is discussed. This plan also includes issues from on-site meetings and telephone conversations which have been conducted since the issuance of NRC's February comments. Previous comments and responses which have been resolved will be addressed as necessary in the revisions to the Final Status Report. The report will be generated at the conclusion of the planned efforts. Issues which have been the subject of NRC comment include an explanation of the original project area and additional project areas and the delineation of affected and unaffected areas. Further soil sampling requirements for affected and unaffected soil areas, discussion of affected and unaffected roof areas and surface contamination surveys and sampling of the Building 78 floor area post waste removal.

2.0 Project Areas

The original project for which Project Plans for Remedial Action (Umetco, 1993) were prepared encompassed Building 78 and a soil deposit on the rail siding immediately to the north of the building designated in the Project Plans as Deposit 1. A second soil deposit designated in the Project Plans as Deposit 2 did not exceed NRC's criteria, but was slated for additional investigation as per the project plans. This deposit was located to the north of Building 78 beyond the haul road in what was the tailings pond area which was excavated, removed and backfilled during the 1983 decommissioning.

During remedial actions on site, S. T. Norris (Norris, 1993) conducted further soil characterization work on several areas of the site. Due to the difficulty in determining previously licensed source material from NORM material on the site, a surrogate criteria was developed. The remedial action criteria in the Project Plans were then augmented with the following criteria developed during characterization work.

A sample analyses of NRC licensed UCC source material from the west bag house, in Building 78, indicated a ratio of 0.06% Ta per pCi Th-232. The soil criteria for thorium (Th-228 and Th-232 combined) is 10 pCi/g. Assuming the two isotopes of thorium are in equilibrium, the soil criteria for Th-232, is 5 pCi/g. Multiplying the soil criteria for Th-232 by the ratio of 0.06% Ta/pCi Th-232, results in a value of 0.3% or 3000 ppm (mg/kg) tantalum in soils. The

concentration criteria for tantalum would therefore be proposed at 3000 mg/kg. However, closer examination of the west bag house sample data reveals a ratio of 0.037% Ta/pCi Ra-226. The soil criteria for Ra-226 in surface soils (0 to 15 cm) is 5 pCi/g, resulting in a remediation criteria for Ta of 1850 mg/kg.

This value (1850 mg/kg) was therefore adopted as a surrogate remedial action criteria for tantalum in soils, when found to be associated with radium and/or Th-228/Th-232 concentrations in excess of the established criteria. Soils were considered contaminated with material from UCC's activities only if both tantalum and radium (or thorium) concentrations were above the criteria stated above. In the event soil analyses showed only the radiological portion of the two targets (surrogate and radionuclide) in excess of criteria, the soils represented by the samples were not considered contaminated as a result of UCC's activities. Actual field measurements used in guiding the remedial action caused the removal of any elevated gamma areas, as no real time tantalum analyses were used during the excavation of soils.

Deposit 2 and the tailings pond backfill was investigated during remedial action by IT Corp., in 1993 and determined not to be the result of UCC activities based on the characterization criteria Therefore, remediation of Deposit 2 was not included in the project. The following table presents the soils data from Deposit 2 and across the surface of the backfilled tailings area. No correction for background concentrations has been made in the results shown.

Sample ID #	Ta mg/kg	Ra-226 pCi/g	Th-228 pCi/g	Th-232 pCi/g	U-238 pCi/g
IT-1	<500	1.54	1.9	2.1	1.98
IT-2	<500	9.86	31.8	29.7	14.7
IT-3	<500	9.35	12.4	10.7	4.33
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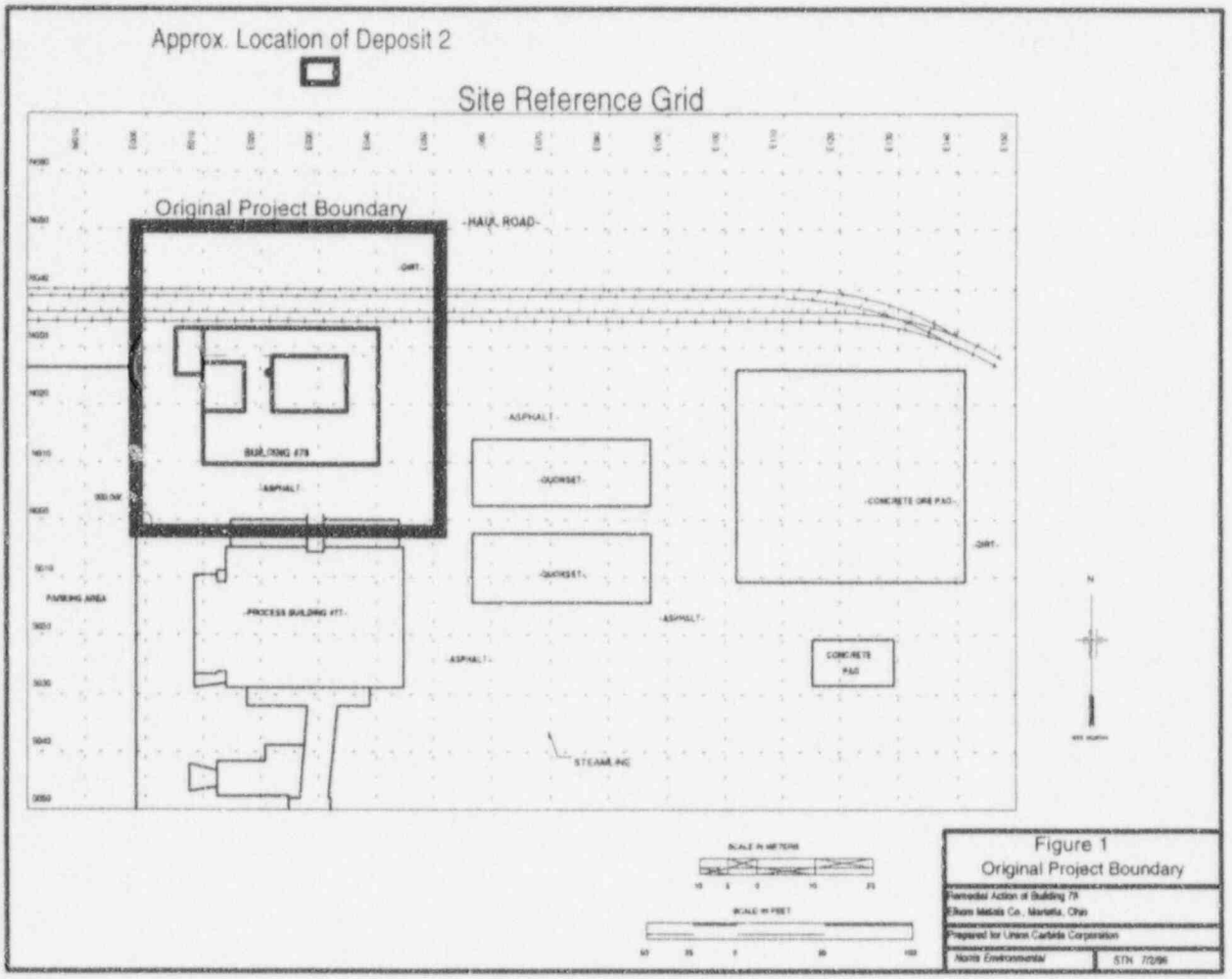
IT-5	<500	2.52	6.44	7.1	4.93
IT-6	<500	5.31	4.2	4.39	5.67

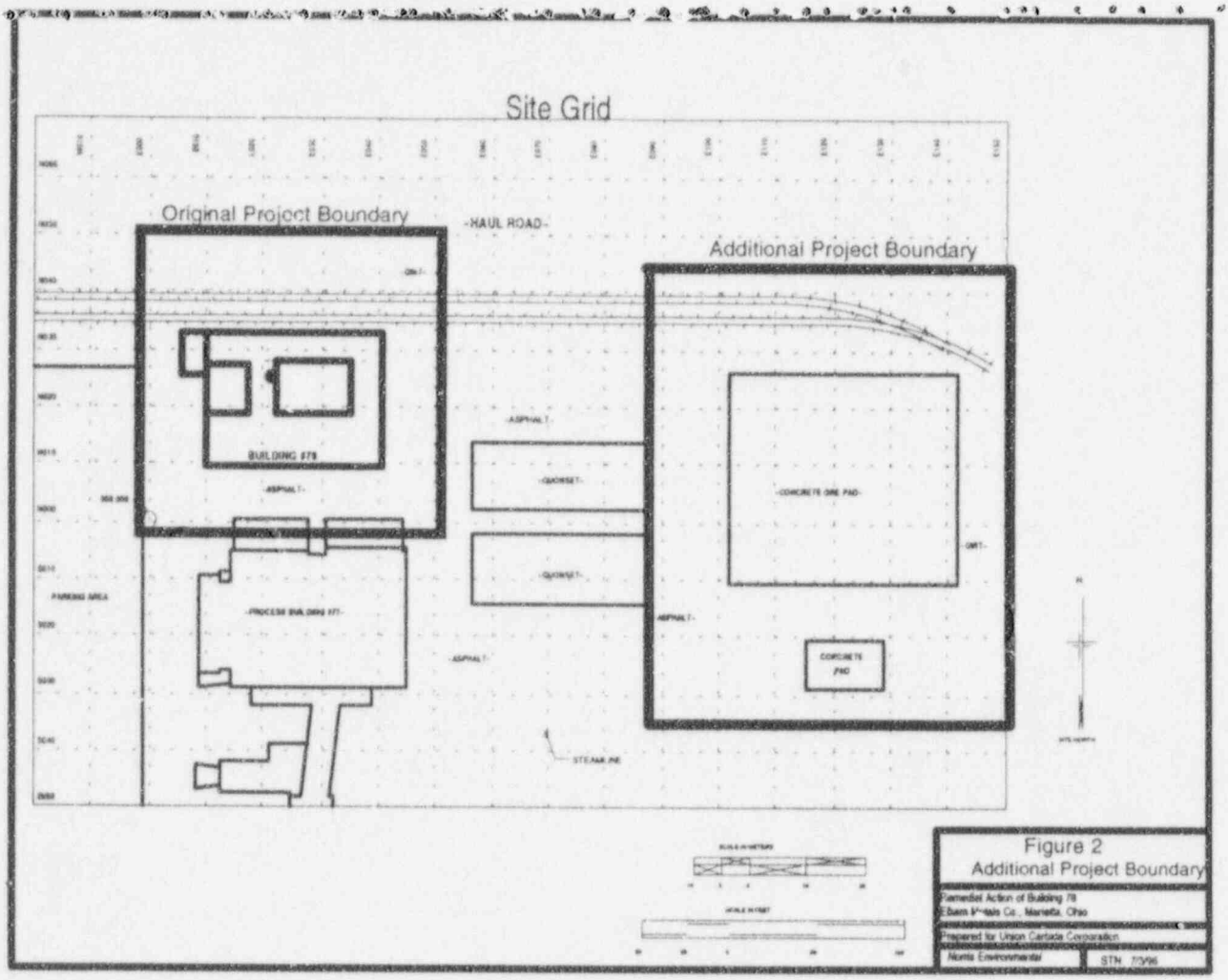
While several of the above samples exhibit concentrations of both radium and thorium above the release criteria for licensed activities, no tantalum was present in any of the samples which indicates the concentrations are the result of deposition of NORM materials not related to UCC's previously licensed activities. These samples were collected from the surface soils (backfill) at Deposit 2 and across the tails area. Figure 1 illustrates the area involved in the original project plans. The approximate location of Deposit 2 is also depicted in Figure 1. The tailings pond area extends from just east of Deposit 2 to the west approximately 130 meters and is 30 to 50 meters wide.

During the process of conducting remedial action on Building 78 and the soil Deposit 1 in 1993, gamma surveys of a soil area surrounding a concrete ore pad to the east were informally conducted as part of an overall site survey of unaffected areas.



Several areas of elevated gamma radiation were discovered and efforts to determine the extent of these anomalies were conducted. The discovery and identification of additional soils around the concrete ore pad was effectively a new project area which was handled by incorporation into the existing project efforts and project plans. Surveys of the surrounding process area revealed several other small anomalies which did not appear to be associated with the primary grinding circuit, and may have been residual materials from the decommissioning activities of

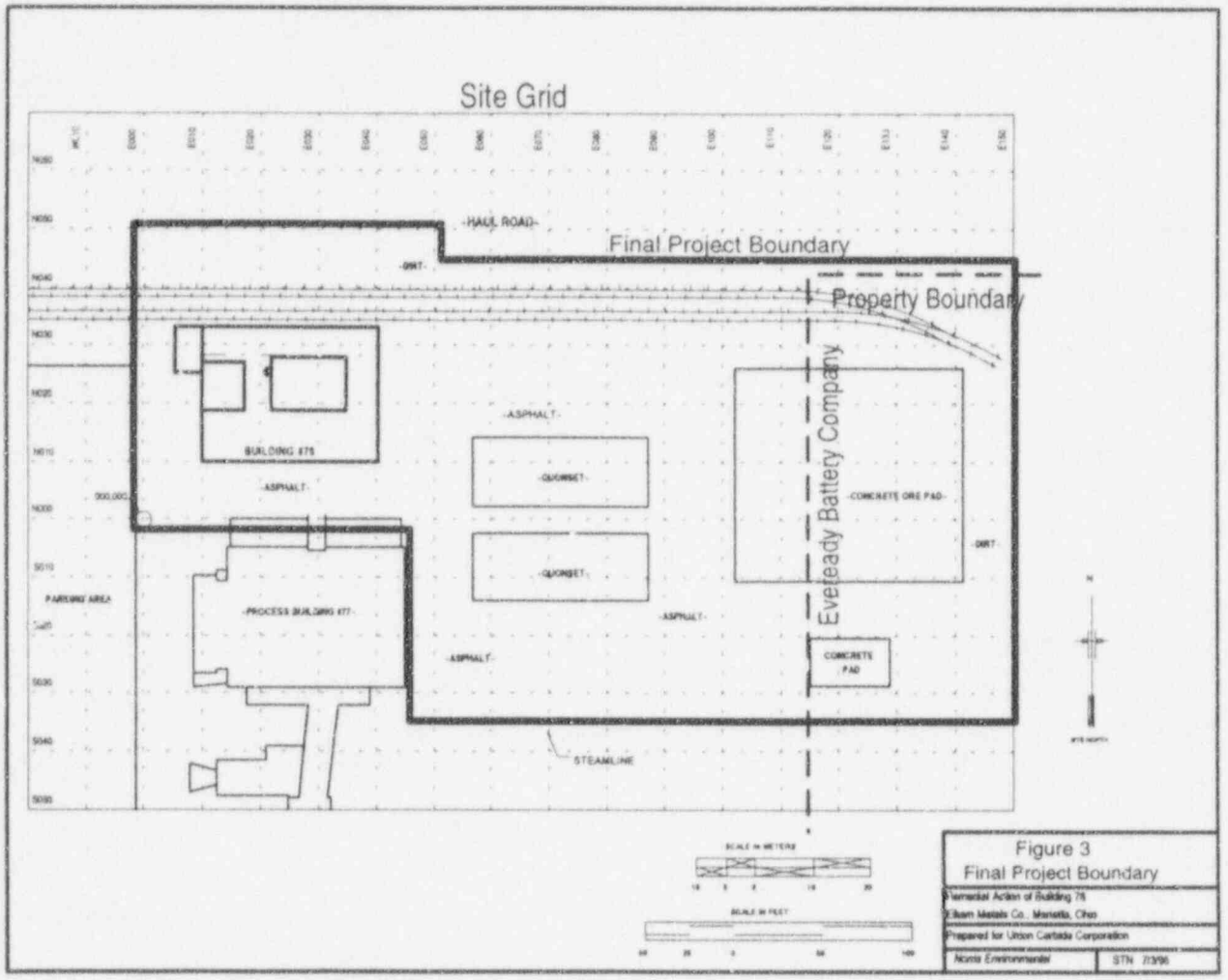
1983. Figure 2 illustrates the location of the additional project area in relation to the original remediation plans.



The two project areas were joined to form the final project area. This project area includes the affected and unaffected areas associated with the primary grinding circuit discussed in Section 3.0. Further, the final project boundary encompasses two quonset buildings which were surveyed for gamma radiation by Chemical Waste Management with no elevated anomalies noted. As no characterization for surface contamination has been conducted, these two quonsets will be characterized as discussed in section 4 below.

Following the completion of the remedial action project, all of the containerized waste was placed on the concrete ore pad for storage until disposal issues could be resolved. In July of 1995, an adjacent property owner, Eveready Battery Company conducted a boundary survey and environmental assessment in conjunction with a pending land sale. The survey revealed

that the final project boundary encroached on Eveready property, and a significant amount of the containerized waste was stored on property belonging to Eveready. Further, a significant volume of the soils remediation completed in 1993 and 1994, involved Eveready property. The Eveready property boundary is depicted in Figure 3 along with the Final Project Boundary.

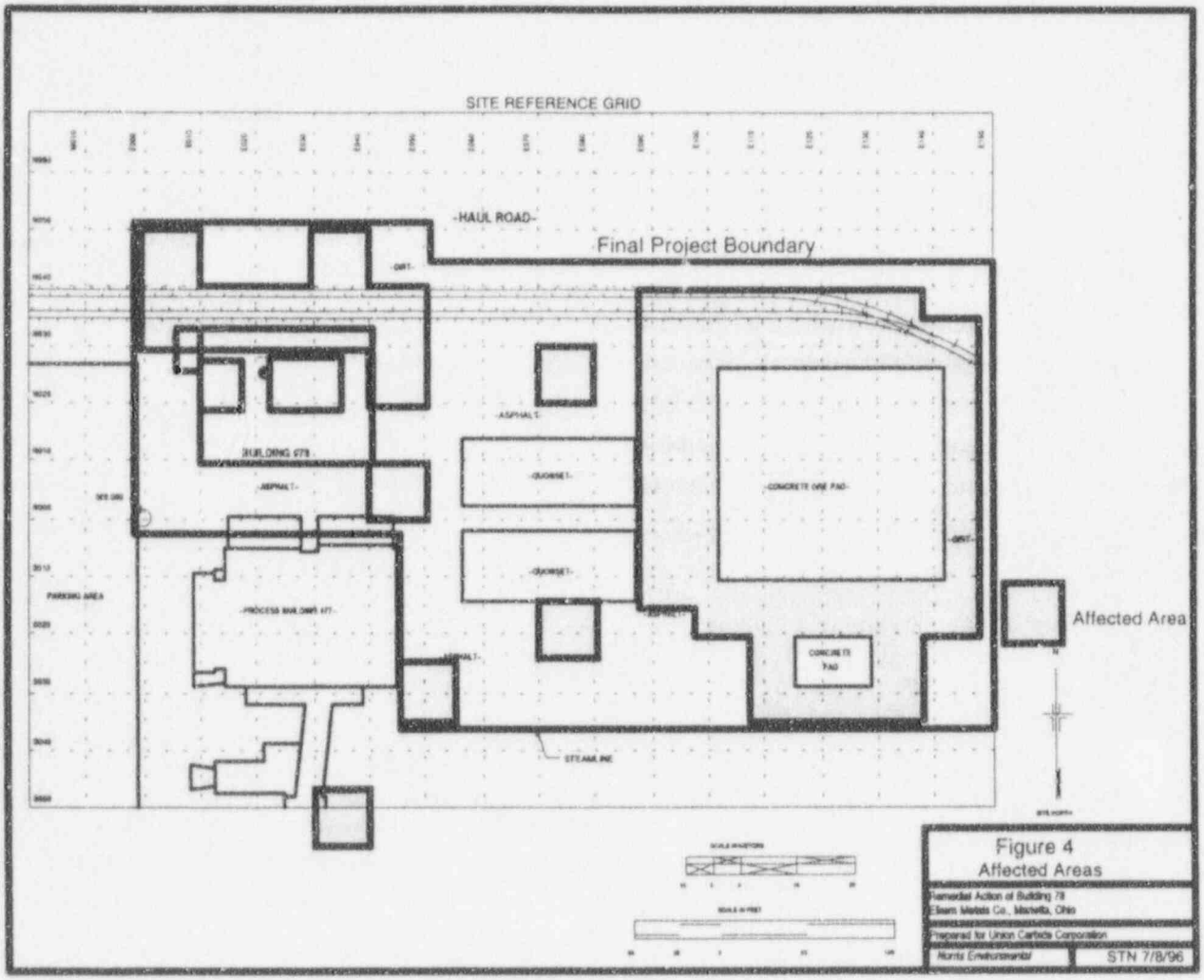


3.0 Delineation of Affected and Unaffected Areas

As discussed in section 2.0, the project areas involve Building 78 and soils along the rail siding immediately to the north, and the concrete ore pad and surrounding soils east of Building 78. The determination of affected areas was made by reviewing of the NRC license and available amendments, records of site process activities with respect to ore handling areas and day to day activities.

3.1 Soils Areas

The designation of affected areas was arrived at by considering where contamination was discovered and evaluating routes of transportation and handling areas which could have been utilized. Areas which had been subject to prior remediation and decommissioned, were not included in the affected areas. Figure 4 depicts the affected areas around Building 78, the concrete ore pad and several small areas which were discovered during site surveys and subsequently remediated.



The affected area in and around Building 78 consists of the building footprint and the area along the rail siding to the north of the building. The original affected area along the rail siding was much smaller prior to remedial action efforts, during which additional contaminants were discovered and as per the guidance in NUREG-5849, the affected area was expanded. The affected area around the concrete ore pad included similar expansions as contaminants

were discovered beyond the margins of the pad and isolated anomalies merged. The affected area around the concrete pad includes the area adjacent to the pad and areas outside the extent of excavation to encompass all of the excavated areas.

3.2 Building 78

The affected areas inside Building 78 were determined by field scoping measurements and minimal characterization by Chemical Waste Management. The majority of the building was called unaffected with the affected area consisting of the primary grinding circuit and immediate floor area. This area was expanded to include most of the interior of the building as surveys conducted concurrent to remedial action indicated contaminants exceeding criteria beyond the original affected limits. The only unaffected area in the building was the floor and process works in the northwest corner of the building known as the west mill area. The remainder of the building floor and walls were considered affected and surveyed as discussed in the Project Plans with survey data presented in the Final Status Report.

Characterization by Chemical Waste Management of the roof areas of the building also indicated no affected areas existed. Surveys during remedial action discovered contaminants above the release criteria around the bucket elevator headworks and bag house vent stacks. Designation of affected areas was based on the characterization data collected subsequent to determining the roof was contaminated. The areas which exhibited contaminants above criteria were delineated as affected and remediated.

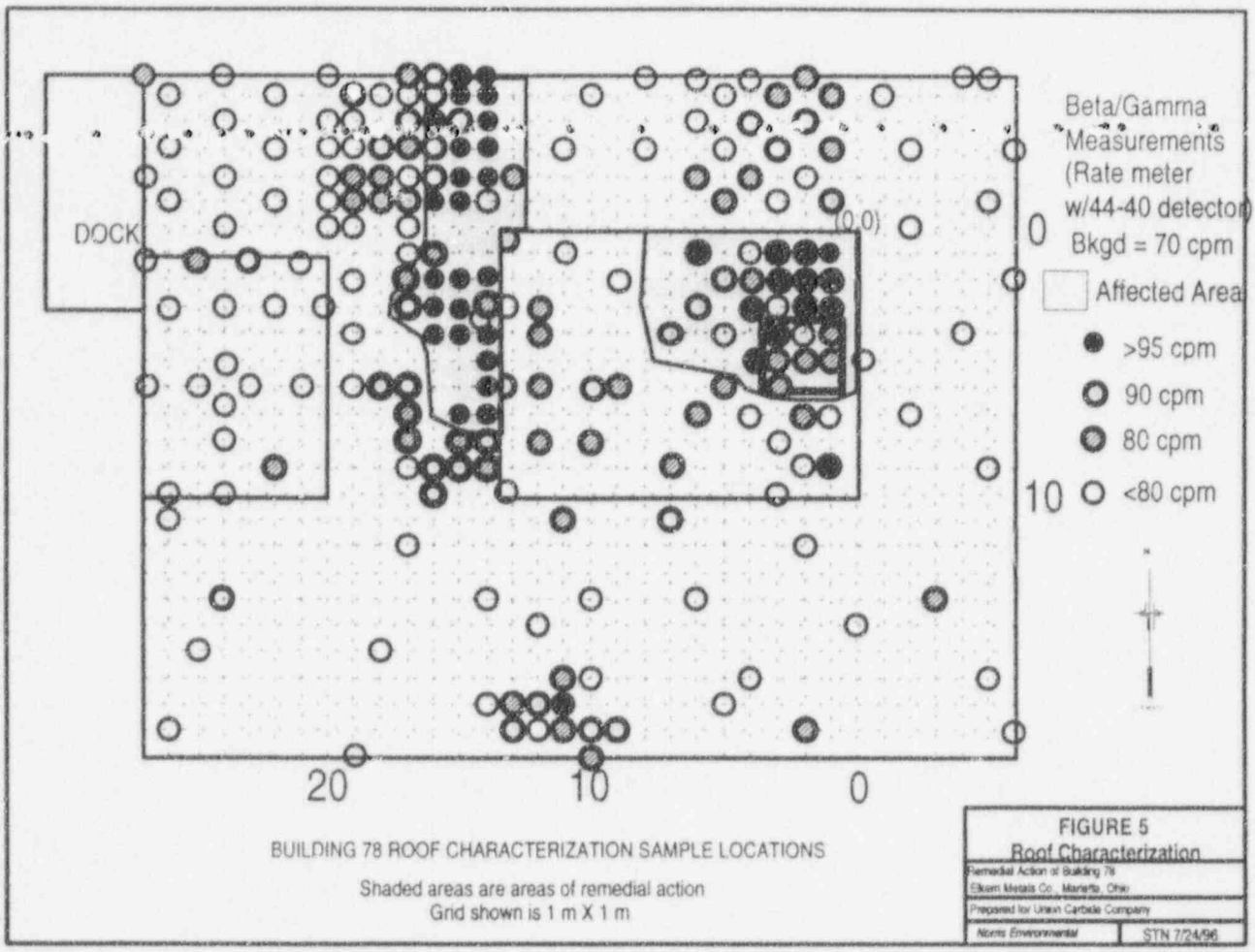


Figure 5 illustrates the location of characterization surface measurements on the roof of Building 78. Measurements were collected using a Ludlum model 44-40 shielded beta/gamma detector with an MDA of 1850 dpm/100 cm^2 (calculated using Tc-99 Eff of 14.1%). The background on the roof was determined to be 70 counts per minute. The average reading on the unaffected portions of the is 70 cpm with a standard deviation of 8.4 cpm. The upper bound of the 95% confidence interval is 98 cpm. While it could be argued that a lower background for the roof might be in order, the range of values across the unaffected roof area confirm an average background of 70 cpm. While the MDA for the characterization instrumentation is higher than the release criteria, the qualitative assessment of the roof with this instrumentation allowed for a definition of affected area boundaries. To designate affected areas on the roof, a value of 25 cpm above background was chosen as the characterization criteria value which equates to 36% above background, or 1200 dpm/100 cm^2. As presented in the Final Status Report, verification data collected after remediation efforts on the roof, was collected with instrumentation which had an MDA less than the release criteria. Resurvey of the primary roof around the west bag house vent stack is discussed in section 4.3 below.

4.0 Remaining Remediation and Verification Issues

There are several areas of concern known to exist on the site at present in addition to questions and comments from NRC. These issues are as follows:

- Statistical evaluation of survey units.
- Building floor above release criteria at grid Q12.
- Survey of the floor of building 78 post waste removal.
- Clarification of surveys and affected area on the primary roof.
- Discussion of remaining source term and associated risk assessment of the drain pipe buried under the building and exposed on the south wall of the process pit.
- Additional soil samples from open land affected areas.
- Unaffected area soil sampling.
- Unaffected Quonset buildings survey.
- Characterization of concrete ore pad for surface contamination.

4.1 Statistical Evaluation of Survey Units

Verification surveys on the building have been completed. Existing data and survey units will be statistically evaluated to determine the upper bound of the 95% confidence interval to assure that the remaining radiological conditions meet the release criteria. A significant portion of the surveys of the soils areas have been completed however to fully address the site as discussed in NUREG-5849, several areas will require additional surveys and soil sampling and that data added to the existing data for statistical evaluation to determine the final radiological condition of the site. These surveys and samples will provide the required data and statistical evaluation to demonstrate that all radiological parameters satisfy the established remedial action criteria.

4.2 Building Floor

The building floor at grid Q12 exhibits a small area less than 1 square meter in total surface, which exceeds the release criteria for total surface contamination. To eliminate this issue, a small containment will be set up and the surface of the concrete floor will be treated to remove the contamination. Verification survey of grid Q12 and a surface wipe sample will be conducted to demonstrate the removal of the contaminants and this data will then be substituted into the Final Status Report verification data for the Q12 grid following statistical evaluation. The 1 m^2 areas surrounding grid Q12 will be scanned to insure no cross contamination occurs due to the remedial activity.

At present, some 300 cubic yards of waste generated during remedial actions on the site is contained in strong light containers and barrels. The waste containers are stored inside the building on an area of approximately 70% of the total floor space. The final disposal of the waste will occur following identification and approval of a disposal facility, and the waste will remain inside the building until a more appropriate storage location is found or disposal issues are resolved and the waste is transported off site.

4.3 Survey of Floor Post Waste Removal

Upon removal of the waste from the building, a surface contamination and exposure rate survey will be conducted. Alpha and beta-gamma scans of the building floor surfaces will be performed using a 100 cm^2 probe. The grid system of 2 m by 2 m blocks will be surveyed at density such that 25% of the floor area will be re-verified to assure that no leakage from waste containers has re-contaminated the floor. If a leak from a container is discovered, the materials will be remediated, the container patched if possible, and the entire area affected by the leak will be subjected to total and removable alpha and beta-gamma measurements performed at 1 m^2 grid intersections. Contact and 1-meter gamma exposure rate measurements will then be made at each 2m X 2m grid block intersection to document the gamma exposure rate in the building. The resurvey of the floor of Building 78 after removal of the waste containers will be performed with a 100 cm^2 probe.

4.4 Primary Roof

The data for the affected area on the primary roof will be reevaluated. Although The existing verification data for the roof was not collected in accordance with the 1 meter by 1 meter grid on the roof, this data will be used for comparison with the release criteria. The release criteria for the roof of Building 78 will be developed using the methodology given in the final report of NUREG-5512, using the beta version of the companion D and D software.

4.5 Drain Pipe in Process Pit

The drain pipe buried beneath the floor and exposed in the south wall of the process pit has been subjected to a second risk assessment using RESRAD5.61 to redefine the dose and source term analyses. The data was based of a sediment sample which was collected from the only pipe which reported to the drain. A NaI gamma meter was used to determine the location of the highest gamma anomaly along the length of the feed from the pit sump pump to the drain pipe. This section of pipe was carefully removed and the sediment was collected from within the pipe. The sediment sample represents the typical concentration of contaminants which

have entered the drain pipe. The drain pipe is primarily empty with a slight amount of sediment in the bottom 1/8 of the drain pipe, which is covered with water. The length of the drain pipe is 54 feet with a diameter of 3 inches. Current depth of burial is 8 feet, consisting of 6 to 7 feet of soil with a 1 to 2 foot concrete cover. The only exposed portion of the pipe is the end protruding from the side wall of process pit inside Building 78. Contamination as determined from the sediment sample discussed above is 9.5 (+/- 0.6) pCi/g Th-232, 3.2 (+/- 0.5) pCi/g Th-230, 8.8 (+/- 0.6) pCi/g Th-228 and 1.9 (+/- 0.3) pCi/g Ra-226 (error terms are 1 sigma). Subtracting the background soil concentrations (Norris, 1994) for the site, the following concentrations were used in the RESRAD5.61 model:

Th-232	7.65	pCi/g	(9.5 pCi/g minus background of 1.85 pCi/g)
Th-230	3.2	pCi/g	(no background data)
Th-228	6.89	pCi/g	(8.8 pCi/g minus background of 1.91 pCi/g)
Ra-226	0.42	pCi/g	(1.9 pCi/g minus background of 1.45 pCi/g)

The total radiation dose summed over multiple pathways including external gamma, inhalation (without radon), soil ingestion and radon. Dose levels associated with these selected pathways are generally dependent upon areal extent of the contaminated zone, radionuclide concentration and volume of cover material if any. As the radionuclide concentrations are constant, the four scenarios developed for analyses represent different size and shape configurations based on possible exposure situations. The scenario models were based on a modified residential exposure time frame.

Scenario 1 is designated as the worst case scenario which has only a remote possibility of occurrence and therefore is used for comparative purposes. This scenario assumes a rectangular area of 16.5 meters (54 feet) in length, 24 centimeters (9.4 inch pipe circumference) wide and 18 centimeters thick, consisting of a homogeneously contaminated soil with the concentrations above.

Scenario 2 assumes the pipe volume, is completely full of contaminants at the above concentrations and is exhumed or exposed at the surface via erosion. This scenario results in a rectangular area of 16.5 meters (54 feet) in length, 8 centimeters (3 inch pipe diameter) wide and 4 centimeters thick, consisting of a homogeneously contaminated soil with the concentrations above.

Scenario 3 assumes the pipe volume, is one-third full of contaminants at the above concentrations and is exhumed or exposed at the surface via erosion. This scenario results in a rectangular area of 16.5 meters (54 feet) in length, 8 centimeters (3 inch pipe diameter) wide and 1.33 centimeters thick, consisting of a homogeneously contaminated soil with the concentrations above.

Scenario 4 demonstrates current conservative conditions on the site. The scenario assumes the pipe volume, is one-third full of contaminants at the above concentrations. This scenario results in a rectangular area of 16.5 meters (54 feet) in length, 8 centimeters (3 inch pipe diameter) wide and 1.33 centimeters thick, consisting of a homogeneously contaminated soil with a soil cover of 2.44 meters (8 feet).

For each scenario, the remaining model variables were held constant using default values of the model. The scenarios are based on a rectangular configuration which required conversion to a circular shape commonly used in the RESRAD model. For comparative purposes, the results of the scenarios of both the rectangular and circular models are presented below.

Scenario	Maximum Total Dose mrem/yr. Circular Zone	Maximum Total Dose mrem/yr. Rectangular Zone
1	16	7
2	2	1
3	0.7	0.3
4	0.002	0.002

The results of the dose model indicate that even at the worst case, a dose of 7 mrem/year would result to an individual exposing the pipe with farm equipment or other such means, and remaining on the approximately 4 m^2 area for extended periods. This is well below the 0.1 rem/year dose limits for individual members of the public as discussed in 10 CFR 20.1301. Furthermore, proposed regulatory changes (Federal Register, August 24, 1994) to 10 CFR 20 discusses acceptable residual radioactivity which results in a TEDE not to exceed 15 mrem/year. This draft limit is exceeded by only one scenario above, which would require a greater concentration than present on site, to be neatly placed in a circular zone as described by the RESRAD model and have the critical group take up residence on a 4 m^2 area. The same worst case scenario in a realistic setting of a rectangular area results in a TEDE of 0.007 rem/year. No further action on the drain pipe is warranted based on the dose assessment model.

4.6 Open Land

The affected area around the concrete ore pad has several areas of soil remediation which have previously been sampled and surveyed for verification. To facilitate a stronger statistical basis for release of the site, the areas around the excavations will be sampled and surveyed for verification. A 10m X 10m grid system will be established across the affected area around the concrete ore pad and surrounding soils as depicted in Figure 5. The grid will be further divided into 5m by 5m quadrant blocks. Quadrant blocks which do not currently exhibit a verification soil sample will be sampled and surveyed. Any quadrant block which has one or more samples already representing the block will not be sampled again. If a quadrant block exhibits two or more samples, those samples will be averaged to represent the soil concentration within the block. A 100 % scan of each affected 100 m^2 grid block will be conducted. Contact and 1-meter gamma radiation measurements will be made at locations equidistant between the center and each of the four corners of each of the remaining 10m X 10m grid blocks resulting in one sample per quadrant. Systematic soil samples will be collected at the same points (four per 10 meter grid block) in the affected area. Soil sample analyses for verification samples will consist of isotopic thorium (Th-228, Th-230, Th-232), radium-226.

The data for each sample will be evaluated along with the existing verification soil samples to determine if the average for each 10m X 10m grid block meets the release criteria. The data will be further evaluated to assure that the upper bound of the 95% confidence interval for each grid meets the release criteria.

Figure 6 illustrates the sample locations for additional soil surveys and sampling and surface contamination surveys and sampling discussed above. The locations were chosen as discussed to assure areas with limited existing data are fully represented.

4.7 Unaffected Outdoor Areas

Sampling and surveys of unaffected areas within the project boundary will be conducted at 30 random locations throughout the project area. These locations are not illustrated in Figure 6, but will be conducted on 10% of the unaffected areas. The unaffected sampling and survey will be conducted in the same manner as for the affected sampling, with a scan of 10% of the area, followed by a surface and 1 meter instrument reading collected prior to sampling of each location.

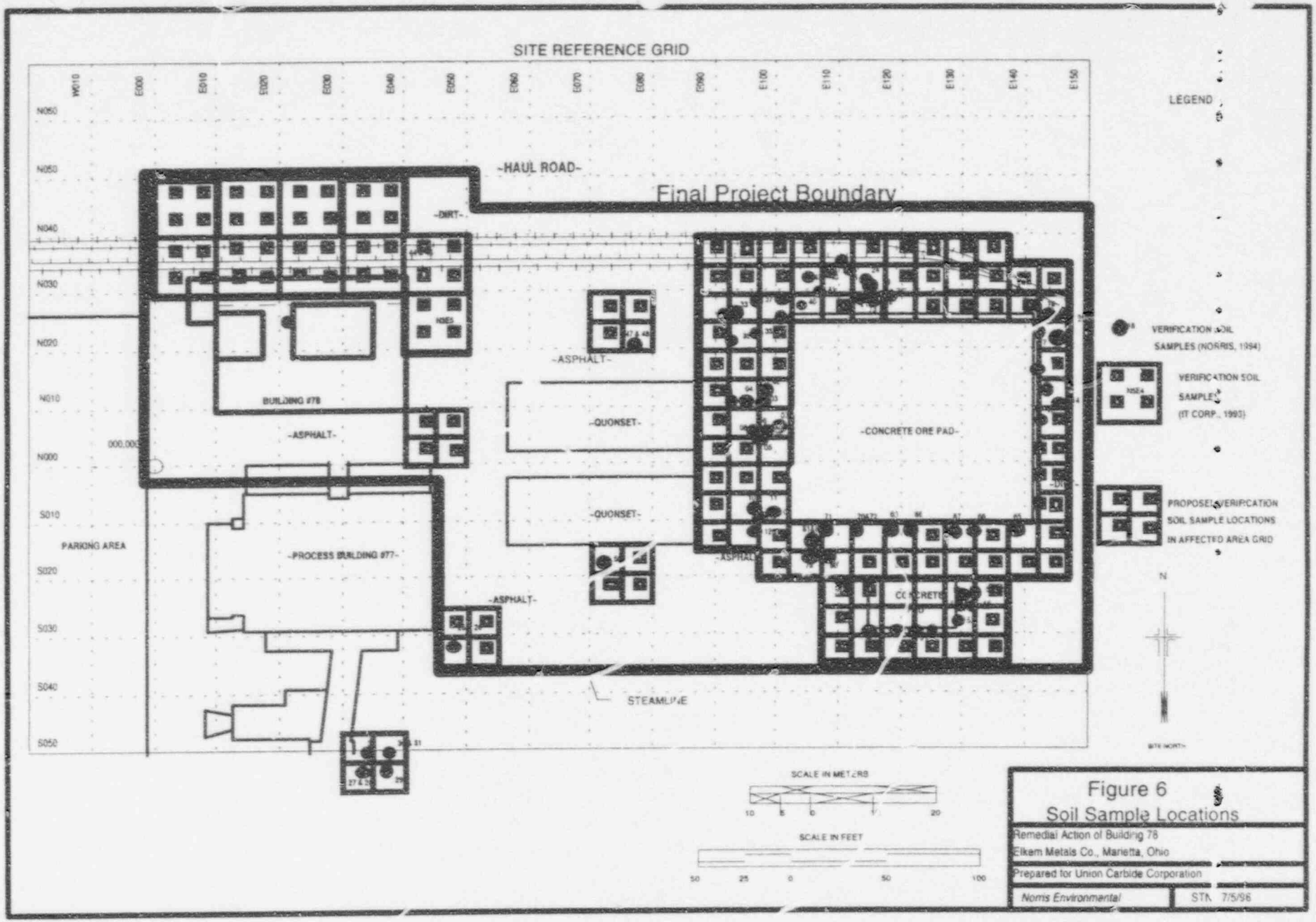


Figure 6
Soil Sample Locations
Remedial Action of Building 78
Elkem Metals Co., Marietta, Ohio
Prepared for Union Carbide Corporation
Norris Environmental | STN 7/5/96

4.8 Quonset Building Sampling

Two quonsets have previously been surveyed for gamma radiation by Chemical Waste Management and Norris Environmental with no anomalous areas discovered. To further characterize these two buildings, a total of 30 surface contamination measurements will be made in the buildings. These measurements will be randomly conducted on concrete floors and wood construction materials inside the buildings such that 10% of the floors and lower 2 meters of the walls of the two buildings will be surveyed. The characterization data will be evaluated to determine if any additional efforts are required in the quonsets.

4.9 Concrete Pad

The concrete ore pad has been subjected to several gamma surveys during past efforts by both Norris Environmental and NRC Region 3. This data will be utilized as part of the characterization of the pad and incorporated into the discussion of the pad in the Final Status Report. However, as the pad is surrounded by affected soils area, surface contamination surveys for total and removable alpha and beta radiation will need to be conducted to characterized the pad. A 10 m X 10 m grid will be established over the surface of the pad and thirty direct and removable surface contamination measurements will be collected across the extent of the pad as shown in Figure 7. Survey and sample locations will be located in each quadrant such that the data can be readily supplemented in an increased density survey in the event that surface contamination is discovered above release criteria requiring additional survey data.

The pad has been used for storage of slag other than UCC licensed material, in addition to the potential use as a source material handling area. As contaminants on a concrete surface would be in the form of a thin lamination, differentiation of the potential contaminants (NORM vs. source) would be very difficult due to the volume of material available for sampling. Characterization data will be evaluated to determine if the pad exhibits surface contamination. In the event the pad exceeds release criteria for surface contamination, an evaluation of the risk/dose assessment of the pad will be conducted. If a dose assessment indicates remediation of the pad is required, further discussion on the nature of the materials will be required along with some determination of disposal issues as the contaminants may be source materials, NORM or a combination of both. Current regulations preclude the disposal of source materials with NORM, or NORM with source materials.

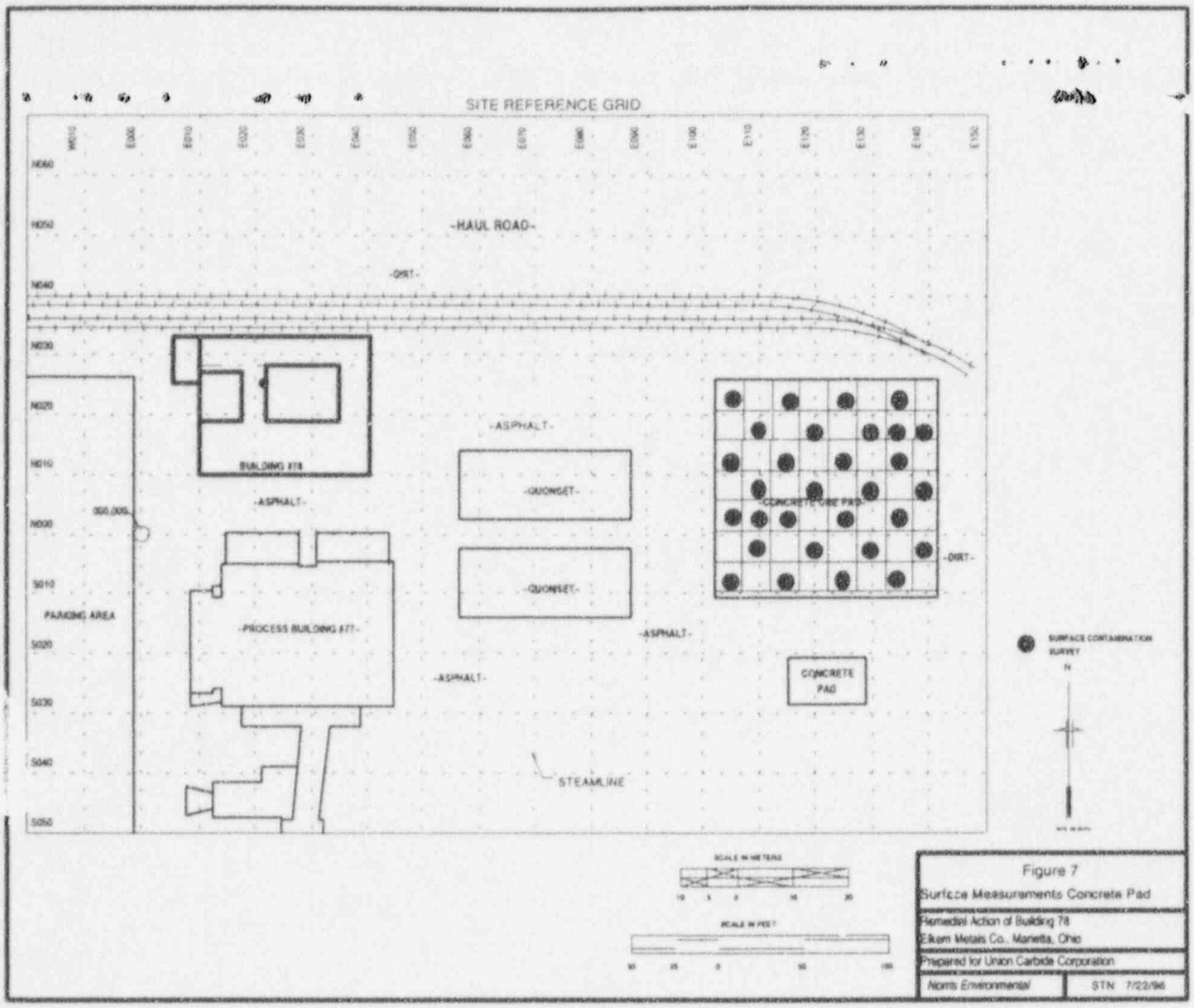


Figure 7
Surface Measurements Concrete Pad
Remedial Action of Building 78
Elkem Metals Co., Marietta, Ohio
Prepared for Union Carbide Corporation
Norris Environmental | STN 7/22/96

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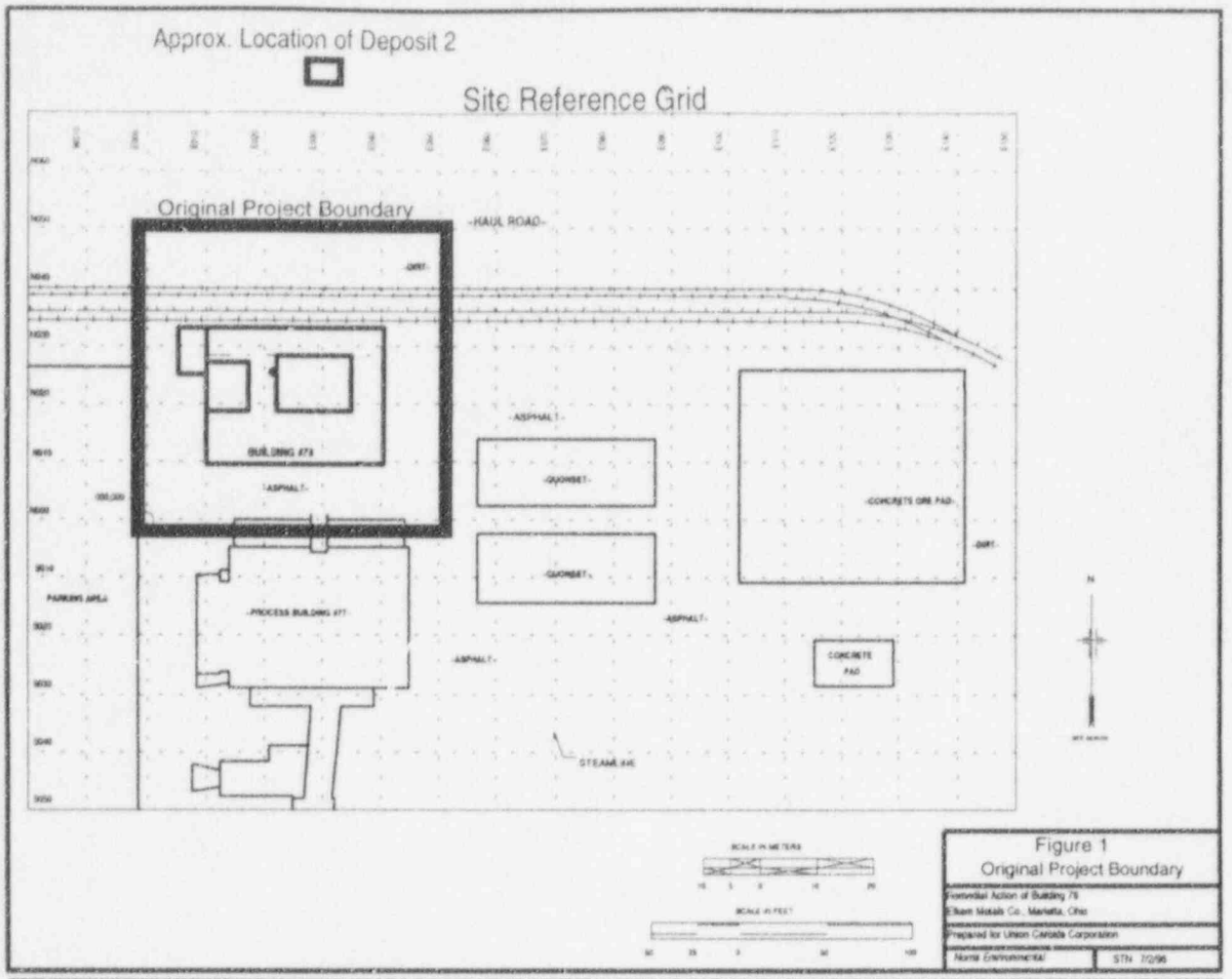
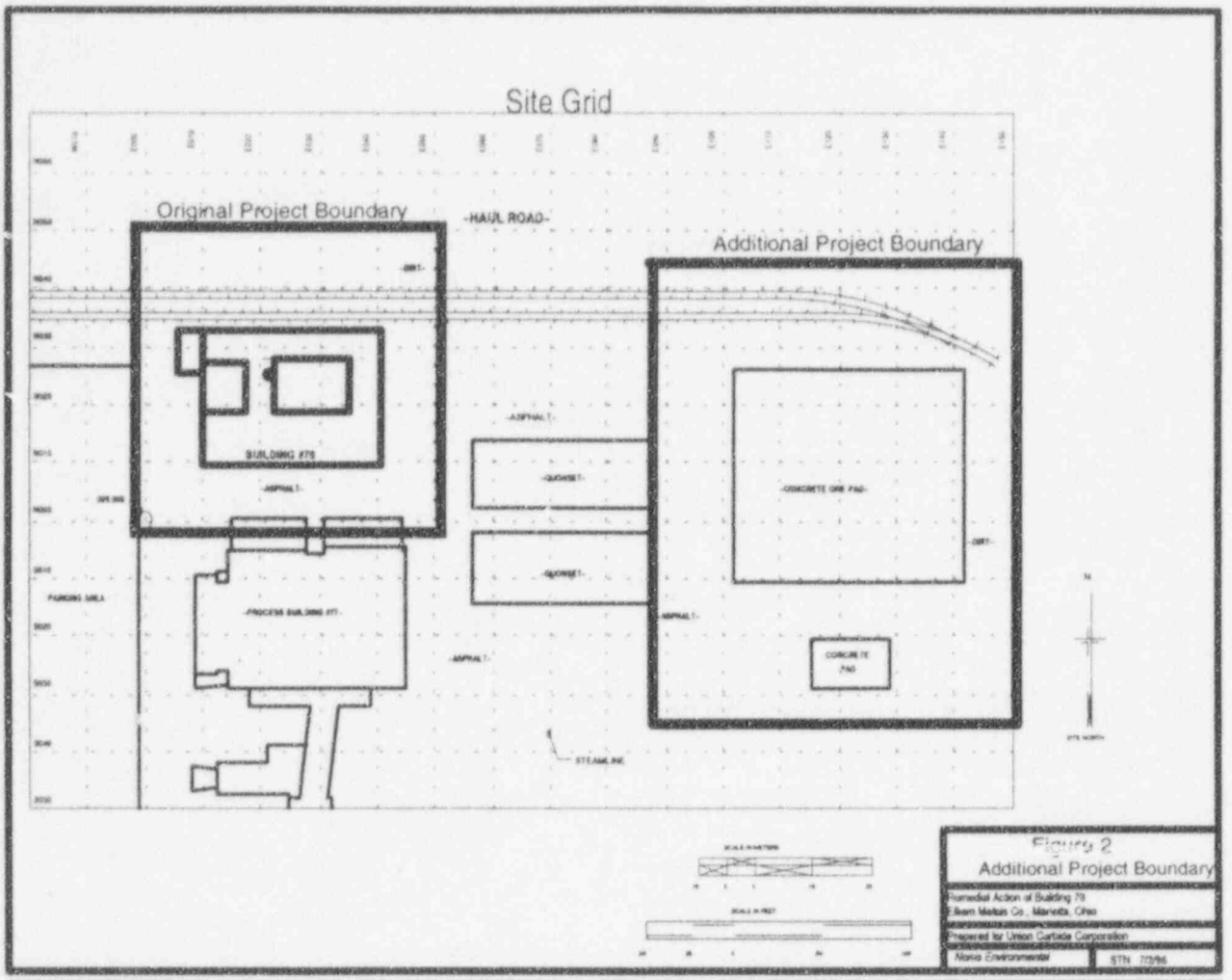
IT-5	<500	2.52	6.44	7.1	4.93
IT-6	<500	5.31	4.2	4.39	5.67

While several of the above samples exhibit concentrations of both radium and thorium above the release criteria for licensed activities, no tantalum was present in any of the samples which indicates the concentrations are the result of deposition of NORM materials not related to UCC's previously licensed activities. These samples were collected from the surface soils (backfill) at Deposit 2 and across the tails area. Figure 1 illustrates the area involved in the original project plans. The approximate location of Deposit 2 is also depicted in Figure 1. The tailings pond area extends from just east of Deposit 2 to the west approximately 130 meters and is 30 to 50 meters wide.

During the process of conducting remedial action on Building 78 and the soil Deposit 1 in 1993, gamma surveys of a soil area surrounding a concrete ore pad to the east were informally conducted as part of an overall site survey of unaffected areas.



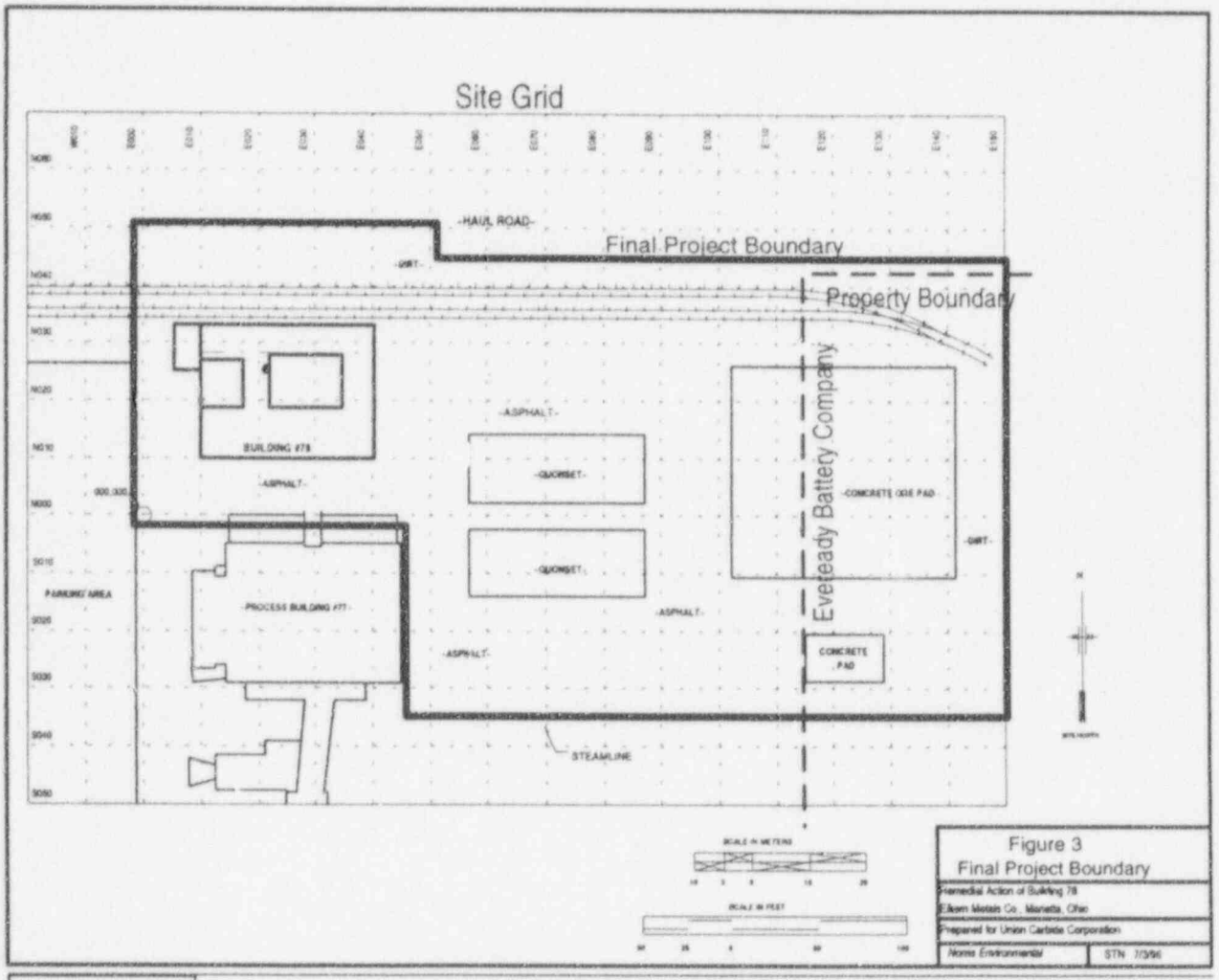
Several areas of elevated gamma radiation were discovered and efforts to determine the extent of these anomalies were conducted. The discovery and identification of additional soils around the concrete ore pad was effectively a new project area which was handled by incorporation into the existing project efforts and project plans. Surveys of the surrounding process area revealed several other small anomalies which did not appear to be associated with the primary grinding circuit, and may have been residual materials from the decommissioning activities of 1983. Figure 2 illustrates the location of the additional project area in relation to the original remediation plans.



The two project areas were joined to form the final project area. This project area includes the affected and unaffected areas associated with the primary grinding circuit discussed in Section 3.0. Further, the final project boundary encompasses two quonset buildings which were surveyed for gamma radiation by Chemical Waste Management with no elevated anomalies noted. As no characterization for surface contaminantion has been conducted, these two quonsets will be characterized as discussed in section 4 below.

Following the completion of the remedial action project, all

of the containerized waste was placed on the concrete ore pad for storage until disposal issues could be resolved. In July of 1995, an adjacent property owner, Eveready Battery Company conducted a boundary survey and environmental assessment in conjunction with a pending land sale. The survey revealed that the final project boundary encroached on Eveready property, and a significant amount of the containerized waste was stored on property belonging to Eveready. Further, a significant volume of the soils remediation completed in 1993 and 1994, involved Eveready property. The Eveready property boundary is depicted in Figure 3 along with the Final Project Boundary.

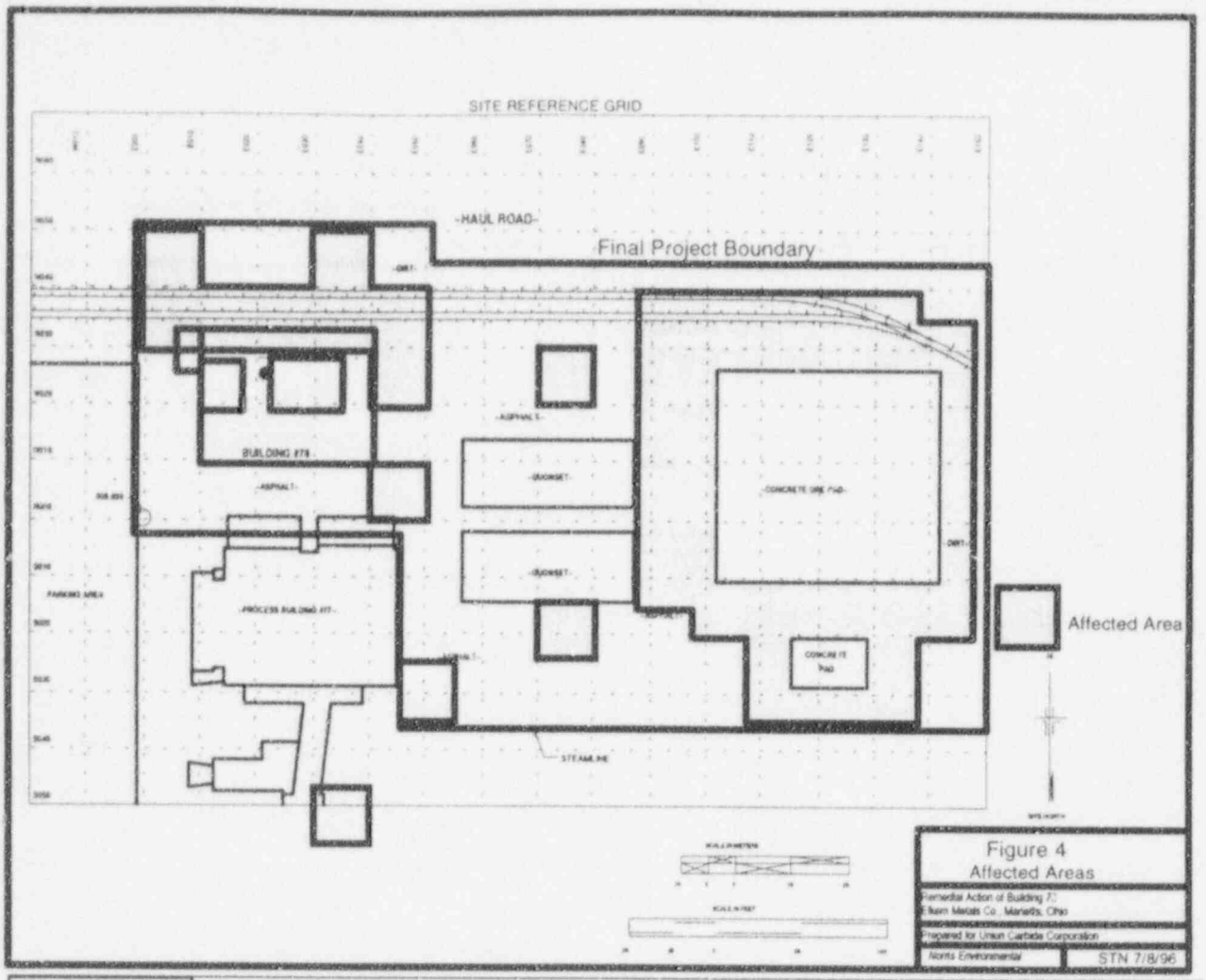


3.0 Delineation of Affected and Unaffected Areas

As discussed in section 2.0, the project areas involve Building 78 and soils along the rail siding immediately to the north, and the concrete ore pad and surrounding soils east of Building 78. The determination of affected areas was made by reviewing of the NRC license and available amendments, records of site process activities with respect to ore handling areas and day to day activities.

3.1 Soils Areas

The designation of affected areas was arrived at by considering where contamination was discovered and evaluating routes of transportation and handling areas which could have been utilized. Areas which had been subject to prior remediation and decommissioned, were not included in the affected areas. Figure 4 depicts the affected areas around Building 78, the concrete ore pad and several small areas which were discovered during site surveys and subsequently remediated.



The affected area in and around Building 78 consists of the building footprint and the area along the rail siding to the north of the building. The original affected area along the rail siding was much smaller prior to remedial action efforts, during which additional contaminants were discovered and as per the guidance in NUREG-5849, the affected area was expanded. The affected area around the concrete ore pad included similar expansions as contaminants were discovered beyond the margins of the pad and isolated anomalies merged. The affected area around the concrete

pad includes the area adjacent to the pad and areas outside the extent of excavation to encompass all of the excavated areas.

3.2 Building 78

The affected areas inside Building 78 were determined by field scoping measurements and minimal characterization by Chemical Waste Management. The majority of the building was called unaffected with the affected area consisting of the primary grinding circuit and immediate floor area. This area was expanded to include most of the interior of the building as surveys conducted concurrent to remedial action indicated contaminants exceeding criteria beyond the original affected limits. The only unaffected area in the building was the floor and process works in the northwest corner of the building known as the west mill area. The remainder of the building floor and walls were considered affected and surveyed as discussed in the Project Plans with survey data presented in the Final Status Report.

Characterization by Chemical Waste Management of the roof areas of the building also indicated no affected areas existed. Surveys during remedial action discovered contaminants above the release criteria around the bucket elevator headworks and bag house vent stacks. Designation of affected areas was based on the characterization data collected subsequent to determining the roof was contaminated. The areas which exhibited contaminants above criteria were delineated as affected and remediated.

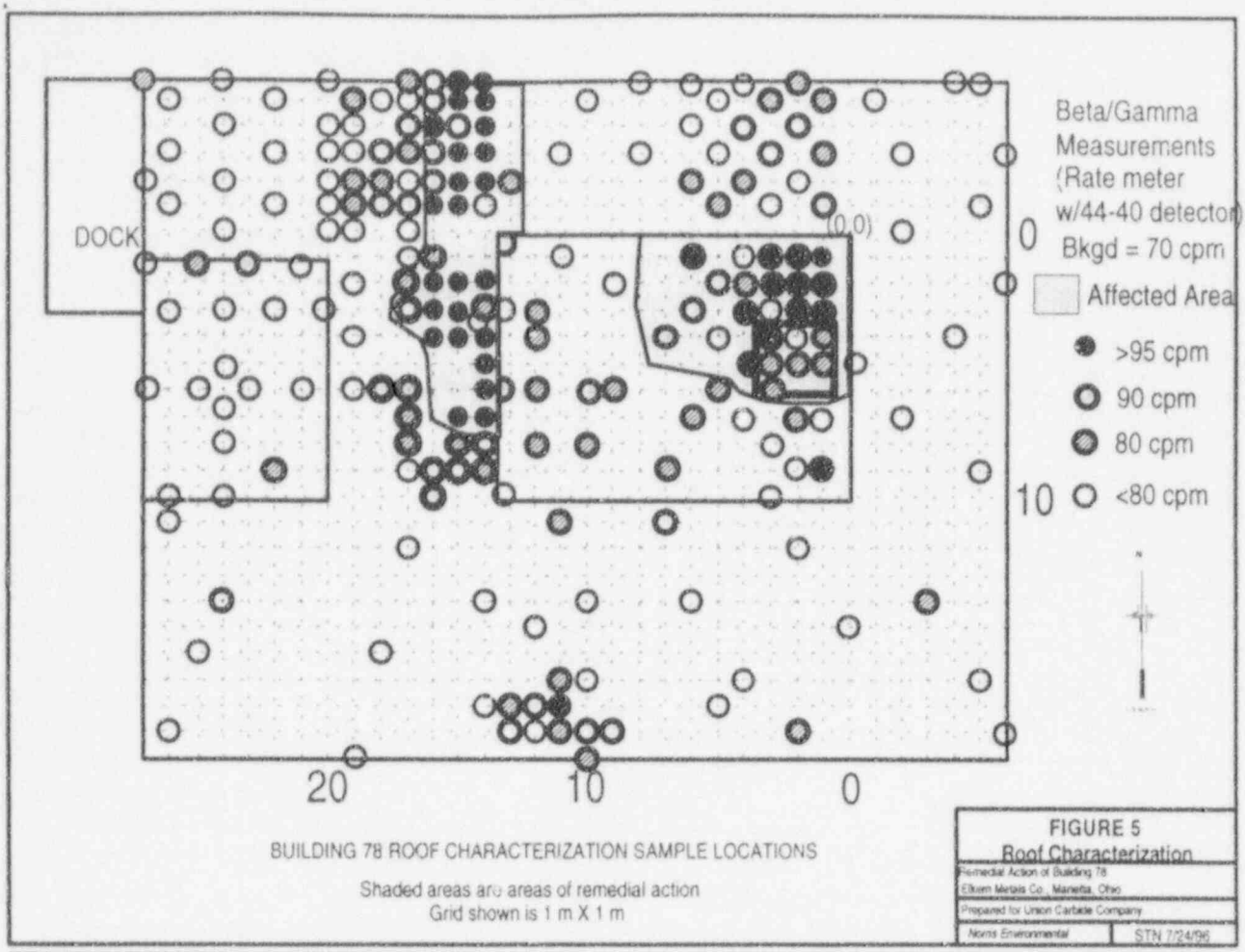


Figure 5 illustrates the location of characterization surface measurements on the roof of Building 78. Measurements were collected using a Ludlum model 44-40 shielded beta/gamma detector with an MDA of 1850 dpm/100 cm^2 (calculated using Tc-99 Eff of 14.1%). The background on the roof was determined to be 70 counts per minute. The average reading on the unaffected portions of the is 70 cpm with a standard deviation of 8.4 cpm. The upper bound of the 95% confidence interval is 98 cpm. While it could be argued that a lower background for the roof might be in order, the range of values across the unaffected roof area confirm an average background of 70 cpm. While the MDA for the characterization instrumentation is higher than the release criteria, the

qualitative assessment of the roof with this instrumentation allowed for a definition of affected area boundaries. To designate affected areas on the roof, a value of 25 cpm above background was chosen as the characterization criteria value which equates to 36% above background, or 1200 dpm/100 cm^2. As presented in the Final Status Report, verification data collected after remediation efforts on the roof, was collected with instrumentation which had an MDA less than the release criteria. Resurvey of the primary roof around the west bag house vent stack is discussed in section 4.3 below.

4.0 Remaining Remediation and Verification Issues

There are several areas of concern known to exist on the site at present in addition to questions and comments from NRC. These issues are as follows:

- Statistical evaluation of survey units.
- Building floor above release criteria at grid Q12.
- Survey of the floor of building 78 post waste removal.
- Clarification of surveys and affected area on the primary roof.
- Discussion of remaining source term and associated risk assessment of the drain pipe buried under the building and exposed on the south wall of the process pit.
- Additional soil samples from open land affected areas.
- Unaffected area soil sampling.
- Unaffected Quonset buildings survey.
- Characterization of concrete ore pad for surface contamination.

4.1 Statistical Evaluation of Survey Units

Verification surveys on the building have been completed. Existing data and survey units will be statistically evaluated to determine the upper bound of the 95% confidence interval to assure that the remaining radiological conditions meet the release criteria. A significant portion of the surveys of the soils areas have been completed however to fully address the site as discussed in NUREG-5849, several areas will require additional surveys and soil sampling and that data added to the existing data for

statistical evaluation to determine the final radiological condition of the site. These surveys and samples will provide the required data and statistical evaluation to demonstrate that all radiological parameters satisfy the established remedial action criteria.

4.2 Building Floor

~~The building floor at grid Q12 exhibits a small area less than 1 square meter in total surface, which exceeds the release criteria for total surface contamination. To eliminate this issue, the surface of the concrete floor will be treated to remove the contamination. Verification survey of grid Q12 and a surface wipe sample will be conducted to demonstrate the removal of the contaminants and this data will then be substituted into the Final Status Report verification data for the Q12 grid following statistical evaluation.~~

The building floor at grid Q12 exhibits a small area less than 1 square meter in total surface, which exceeds the release criteria for total surface contamination. To eliminate this issue, a small containment will be set up and the surface of the concrete floor will be treated to remove the contamination. Verification survey of grid Q12 and a surface wipe sample will be conducted to demonstrate the removal of the contaminants and this data will then be substituted into the Final Status Report verification data for the Q12 grid following statistical evaluation. The 1 m^2 areas surrounding grid Q12 will be scanned to insure no cross contamination occurs due to the remedial activity.

Please take direct measurements w/ appropriate survey instrument and technique

At present, some 300 cubic yards of waste generated during remedial actions on the site is contained in strong tight containers and barrels. The waste containers are stored inside the building on an area of approximately 70% of the total floor space. The final disposal of the waste will occur following identification and approval of a ~~license amendment of a~~ disposal facility, and the waste will remain inside the building until a more appropriate storage location is found or disposal issues are resolved and the waste is transported off site. ~~At present, a facility has been identified at Gas Hills, Wyoming, and an amendment to the site~~

~~license has been submitted to NRC to allow the disposal of the waste. Negotiations with the State of Wyoming with respect to promulgation of regulations governing the waste disposal are in progress.~~

4.3 Survey of Floor Post Waste Removal

Upon removal of the waste from the building, a surface contamination and exposure rate survey will be conducted. Alpha and beta-gamma scans of the building floor surfaces will be performed using a 100 cm^2 probe. The grid system of 2 m by 2 m blocks will be surveyed at density such that 25% of the floor area will be re-verified to assure that no leakage from waste containers has re-contaminated the floor. If a leak from a container is discovered, the materials will be remediated, the container patched if possible, and the entire area affected by the leak will be subjected to total and removable alpha and beta-gamma measurements performed at 1 m^2 grid intersections. Contact and 1-meter gamma exposure rate measurements will then be made at each 2m X 2m grid block intersection to document the gamma exposure rate in the building. The resurvey of the floor of Building 78 after removal fo the waste containers will be performed with a 100 cm^2 probe.

4.4 Primary Roof

The data for the affected area on the primary roof will be reevaluated. Although The existing verification data for the roof was not collected in accordance with the 1 meter by 1 meter grid on the roof, this data will be used for comparison with the release criteria. The release criteria for the roof of Building 78 will be developed using the methodology given in the final report of NUREG-5512, using the beta version of the companion D and D software. ~~The affected area will be revisited and additional surface verification surveys will be conducted on the 1 meter by 1 meter grid system established on the roof. The entire affected area and surrounding 1m X 1m unaffected area on the primary roof will be resurveyed to evaluate the affected roof to assure the roof meets the release criteria. This data will be incorporated into the Final Status Report for the primary roof following statistical evaluation along with the discussion of the primary roof characterization~~

3019

data. If the resurvey indicates surface contamination above the release criteria, a dose (RESRAD5.61) assessment will be used to evaluate the need for further remediation.

The unaffected area of the primary roof will be surveyed at 30 randomly selected measurement locations, as described in NUREG/CR-5849 for unaffected structural areas. A reference grid system (based on 1 m X 1 m roof grid spacing) will be established across the surface of the primary roof to locate unaffected area survey points. Surveys will include scans for total alpha and total beta activity less site background. Removable swipe samples will be collected at each location, and analyzed only if the total alpha surface activity exceeds the removable limits of 200 dpm/100 cm^2.

If the resurvey of the affected area indicates surface contamination above the release criteria, a dose assessment based on NUREG/CR-5512 will be used to evaluate if further remediation is warranted. The assumptions to be used for the dose assessment are based on a Building Occupancy (Surface Activity) Scenario as the residual radioactivity would be associated with a surface or thin-layer surface source. The scenario considers chronic exposure to an individual for 2000 h/yr., in a commercial facility and include external exposure from surface sources, inhalation and ingestion of the removable contamination. Table 3.2, 'Annual Total Effective Dose Equivalent Factors for the Building Occupancy (Surface Activity) Scenario', NUREG/CR-5512, gives a TEDE conversion factor for Th-nat of 3.7E-3 mrem/dpm/100 cm^2. This conversion factor, when multiplied by the surface activity average (Th-nat) dpm/100 cm^2, results in an associated TEDE for the primary roof of Building 78. Upon completion of the resurvey of the affected area on the primary roof, if the data indicates any areas which exceed the release criteria, a dose assessment will be calculated using the following:

$$TEDE, \text{ mrem} = (C, \text{ dpm}/100 \text{ cm}^2)(H_{E,50})$$

where:

TEDE = total effective dose equivalent, mrem

C = average beta (Th nat) dpm/100 cm^2

$H_{E,50}$ = 3.7 x 10^{-3} mrem/dpm/100 cm^2 = total effective dose equivalent conversion factor"

~~This scenario has previously been used for the primary roof affected area as presented on page 6-9 of the Final Status Report for Elkem Metals Building 78 SDMP Site at Elkem Metals Company, Marietta, Ohio (Norris, 1995). The results presented in the report for a dose assessment on the primary roof were based on the highest reported 1 m² average beta concentration of 1361 dpm/100 cm². The assessment was performed for natural thorium and decay products and assumed that the contamination measured (1361 dpm/100 cm²) would be totally removable. The actual concentrations were 1361 dpm/cm² direct, with 0 dpm/100 cm² removable. The associated dose for the primary roof was reported as:~~

$$\text{TEDE, mrem} = (C, \text{dpm/100 cm}^2)(H_{E,50}) = 5.0 \text{ mrem}$$

~~where:~~

~~TEDE = total effective dose equivalent, mrem~~

~~C = 1361 dpm/100 cm² average beta (Th-nat)~~

~~$H_{E,50}$ = 3.7 x 10^{-3} mrem/dpm/100 cm² = total effective dose equivalent conversion factor~~

4.5 Drain Pipe in Process Pit

The drain pipe buried beneath the floor and exposed in the south wall of the process pit has been subjected to a second risk assessment using RESRAD5.61 to redefine the dose and source term analyses. The data was based of a sediment sample which was collected from the only pipe which reported to the drain. A NaI gamma meter was used to determine the location of the highest gamma anomaly along the length of the feed from the pit sump pump to the drain pipe. This section of pipe was carefully removed and the sediment was collected from within the pipe. The sediment sample represents the typical concentration of contaminants which have entered the drain pipe. The drain pipe is primarily empty with a slight amount of sediment in the bottom 1/8 of the drain pipe, which is covered with water. The length of the drain pipe is 54 feet with a diameter of 3 inches. Current depth of burial is 8 feet, consisting of 6 to 7 feet of soil with a 1 to 2 foot concrete cover. The only exposed portion of the pipe is the end protruding from the side wall of process pit inside Building 78. Contamination as determined from the sediment sample discussed above is 9.5 (+/- 0.6) pCi/g Th-232, 3.2 (+/- 0.5) pCi/g Th-230, 8.8 (+/- 0.6) pCi/g Th-228 and 1.9 (+/- 0.3) pCi/g Ra-226 (error terms are 1 sigma).

Subtracting the background soil concentrations (Norris, 1994) for the site, the following concentrations were used in the RESRAD5.61 model:

Th-232	7.65 pCi/g	(9.5 pCi/g minus background of 1.85 pCi/g)
Th-230	3.2 pCi/g	(no background data)
Th-228	6.89 pCi/g	(8.8 pCi/g minus background of 1.91 pCi/g)
Ra-226	0.42 pCi/g	(1.9 pCi/g minus background of 1.45 pCi/g)

The total radiation dose summed over multiple pathways including external gamma, inhalation (without radon), soil ingestion and radon. Dose levels associated with these selected pathways are generally dependent upon areal extent of the contaminated zone, radionuclide concentration and volume of cover material if any. As the radionuclide concentrations are constant, the four scenarios developed for analyses represent different size and shape configurations based on possible exposure situations. The scenario models were based on a modified residential exposure time frame.

Scenario 1 is designated as the worst case scenario which has only a remote possibility of occurrence and therefore is used for comparative purposes. This scenario assumes a rectangular area of 16.5 meters (54 feet) in length, 24 centimeters (9.4 inch pipe circumference) wide and 18 centimeters thick, consisting of a homogeneously contaminated soil with the concentrations above.

Scenario 2 assumes the pipe volume, is completely full of contaminants at the above concentrations and is exhumed or exposed at the surface via erosion. This scenario results in a rectangular area of 16.5 meters (54 feet) in length, 8 centimeters (3 inch pipe diameter) wide and 4 centimeters thick, consisting of a homogeneously contaminated soil with the concentrations above.

Scenario 3 assumes the pipe volume, is one-third full of contaminants at the above concentrations and is exhumed or exposed at the surface via erosion. This scenario results in a rectangular area of 16.5 meters (54 feet) in length, 8 centimeters (3 inch pipe diameter) wide and 1.33 centimeters thick, consisting of a homogeneously contaminated soil with the concentrations above.

Scenario 4 demonstrates current conservative conditions on the site. The scenario assumes the pipe volume, is one-third full of contaminants at the above concentrations. This scenario results in a rectangular area of 16.5 meters (54 feet) in length, 8 centimeters (3 inch pipe diameter) wide and 1.33 centimeters thick, consisting of a homogeneously contaminated soil with a soil cover of 2.44 meters (8 feet).

For each scenario, the remaining model variables were held constant using default values of the model. The scenarios are based on a rectangular configuration which required conversion to a circular shape commonly used in the RESRAD model. For comparative purposes, the results of the scenarios of both the rectangular and circular models are presented below.

Scenario	Maximum Total Dose mrem/yr. Circular Zone	Maximum Total Dose mrem/yr. Rectangular Zone
1	16	7
2	2	1
3	0.7	0.3
4	0.002	0.002

The results of the dose model indicate that even at the worst case, a dose of 7 mrem/year would result to an individual exposing the pipe with farm equipment or other such means, and remaining on the approximately 4 m^2 area for extended periods. This is well below the 0.1 rem/year dose limits for individual members of the public as discussed in 10 CFR 20.1301. Furthermore, proposed regulatory changes (Federal Register, August 24, 1994) to 10 CFR 20 discusses acceptable residual radioactivity which results in a TEDE not to exceed 15 mrem/year. This draft limit is exceeded by only one scenario above, which would require a greater concentration than present on site, to be neatly placed in a circular zone as described by the RESRAD model and have the critical group take up residence on a 4 m^2 area. The same worst case scenario in a realistic setting of a rectangular area results in a TEDE of 0.007 rem/year. No further action on the drain pipe is warranted based on the dose assessment model.

The affected area around the concrete ore pad has several areas of soil remediation which have previously been sampled and surveyed for verification. To facilitate a stronger statistical basis for release of the site, the areas around the excavations will be sampled and surveyed for verification. A 10m X 10m grid system will be established across the affected area around the concrete ore pad and surrounding soils as depicted in Figure 5. The grid will be further divided into 5m by 5m quadrant blocks. Quadrant blocks which do not currently exhibit a verification soil sample will be sampled and surveyed. Any quadrant block which has one or more samples already representing the block will not be sampled again. If a quadrant block exhibits two or more samples, these samples will be averaged to represent the soil concentration within the block. Contact and 1-meter gamma radiation measurements will be made at locations equidistant between the center and each of the four corners of each of the remaining 10m X 10m grid blocks resulting in one sample per quadrant. Systematic soil samples will be collected at the same points (four per 10 meter grid block) in the affected area. The soil samples will then be composited with samples from the other quadrants of the 10m X 10m grid block. Thus, each quadrant will be represented in a composite for the 10m X 10m grid block. In the event a grid block has one or more quadrants already represented, the remaining quadrants will be composited and the data evaluated based on the number of quadrants represented by each composite.

As discussed above, contact and one-meter gamma radiation measurements will be made at each sample location. Up to four soil samples will be collected from within each 100 m^2 grid block, depending of the current representation of the 100 m^2 grid by previous soil samples. Soil sample analyses for verification samples will consist of isotopic thorium (Th-228, Th-230, Th-232), radium-226.

The data for each composite will be evaluated along with the existing verification soil samples to determine if the average for each 10m X 10m grid block meets the release criteria. The data will be further evaluated to assure that the upper bound of the 95%

~~confidence interval for each grid meets the release criteria. The existing soil samples and those to be collected will also be correlated with contact instrument readings to demonstrate the relation between instrument reading estimates of soil concentrations and analytical results of soil samples for actual soil concentrations.~~

The affected area around the concrete ore pad has several areas of soil remediation which have previously been sampled and surveyed for verification. To facilitate a stronger statistical basis for release of the site, the areas around the excavations will be sampled and surveyed for verification. A 10m X 10m grid system will be established across the affected area around the concrete ore pad and surrounding soils as depicted in Figure 5. The grid will be further divided into 5m by 5m quadrant blocks. Quadrant blocks which do not currently exhibit a verification soil sample will be sampled and surveyed. Any quadrant block which has one or more samples already representing the block will not be sampled again. If a quadrant block exhibits two or more samples, those samples will be averaged to represent the soil concentration within the block. A 100 % scan of each affected 100 m^2 grid block will be conducted. Contact and 1-meter gamma radiation measurements will be made at locations equidistant between the center and each of the four corners of each of the remaining 10m X 10m grid blocks resulting in one sample per quadrant. Systematic soil samples will be collected at the same points (four per 10 meter grid block) in the affected area. Soil sample analyses for verification samples will consist of isotopic thorium (Th-228, Th-230, Th-232), radium-226.

The data for each sample will be evaluated along with the existing verification soil samples to determine if the average for each 10m X 10m grid block meets the release criteria. The data will be further evaluated to assure that the upper bound of the 95% confidence interval for each grid meets the release criteria.

Figure 6 illustrates the sample locations for additional soil surveys and sampling and surface contamination surveys and sampling discussed above. The locations were chosen as discussed to assure areas with limited existing data are fully represented.

4.7 Unaffected Outdoor Areas

Sampling and surveys of unaffected areas within the project boundary will be conducted at 30 random locations throughout the project area. These locations are not illustrated in Figure 6, but will be conducted on 10% ~~across~~ of the unaffected areas. The unaffected

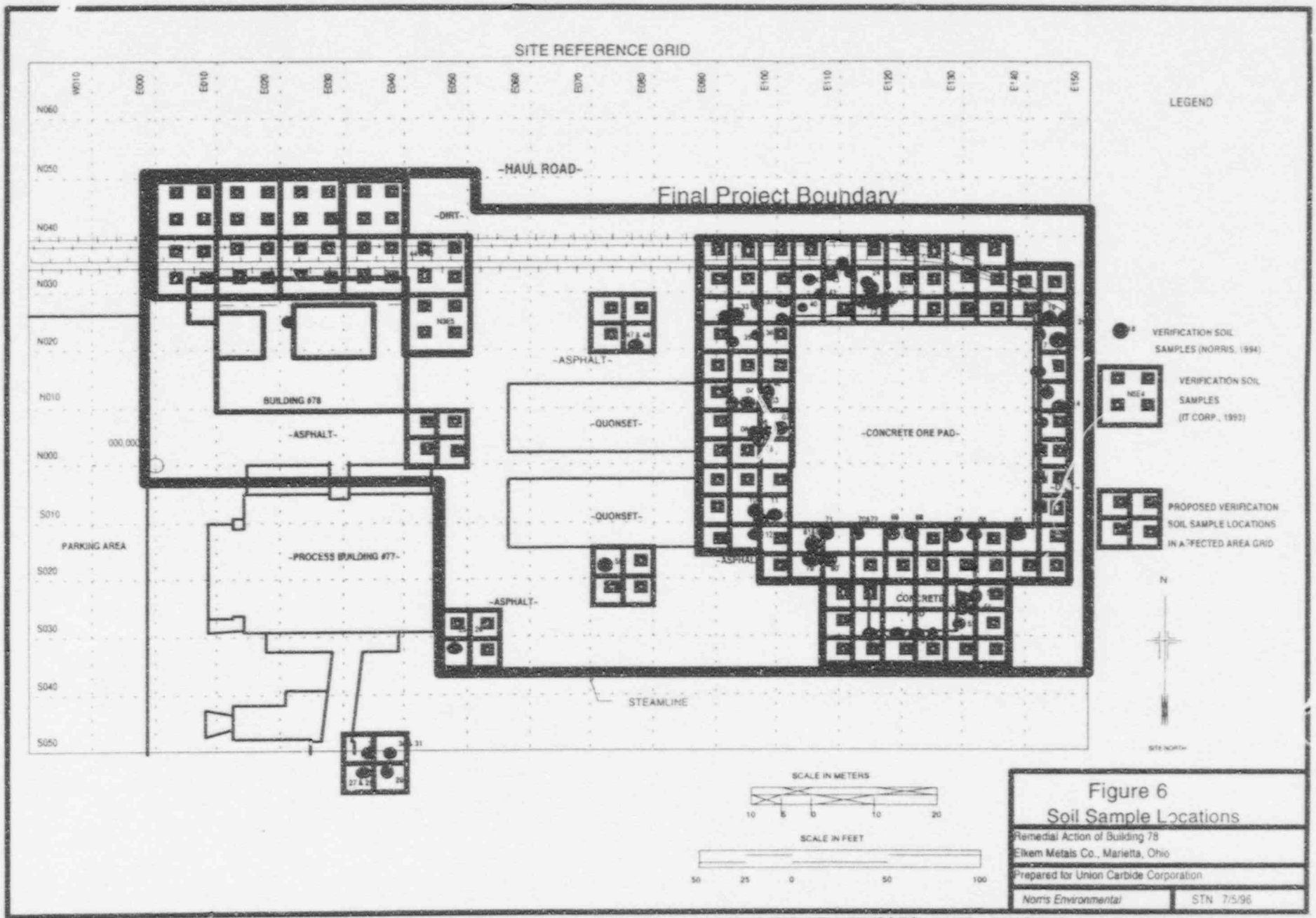


Figure 6
Soil Sample Locations
Remedial Action of Building 78
Elkem Metals Co., Marietta, Ohio
Prepared for Union Carbide Corporation
Norris Environmental | STN 7/5/96

sampling and survey will be conducted in the same manner as for the affected sampling, with a scan of 10% of the area, followed by a surface and 1 meter instrument reading collected prior to sampling of each location.

4.8 Quonset Building Sampling

Two quonsets have previously been surveyed for gamma radiation by Chemical Waste Management and Norris Environmental with no anomalous areas discovered. To further characterize these two buildings, a total of 30 surface contamination measurements will be made in the buildings. These measurements will be randomly conducted on concrete floors and wood construction materials inside the buildings such that 10% of the floors and lower 2 meters of the walls of the two buildings will be surveyed. The characterization data will be evaluated to determine if any additional efforts are required in the quonsets.

4.9 Concrete Pad

The concrete ore pad has been subjected to several gamma surveys during past efforts by both Norris Environmental and NRC Region 3. This data will be utilized as part of the characterization of the pad and incorporated into the discussion of the pad in the Final Status Report. However, as the pad is surrounded by affected soils area, surface contamination surveys for total and removable alpha and beta radiation will need to be conducted to characterized the pad. A 10 m X 10 m grid will be established over the surface of the pad and thirty direct and removable surface contamination measurements will be collected across the extent of the pad as shown in Figure 7. Survey and sample locations will be located in each quadrant such that the data can be readily supplemented in an increased density survey in the event that surface contamination is discovered above release criteria requiring additional survey data.

The pad has been used for storage of slag other than UCC licensed material, in addition to the potential use as a source material handling area. As contaminants on a concrete surface would

be in the form of a thin lamination, differentiation of the potential contaminants (NORM vs. source) would be very difficult due to the volume of material available for sampling. Characterization data will be evaluated to determine if the pad exhibits surface contamination. In the event the pad exceeds release criteria for surface contamination, an evaluation of the risk/dose assessment of the pad will be conducted. If a dose assessment indicates remediation of the pad is required, further discussion on the nature of the materials will be required along with some determination of disposal issues as the contaminants may be source materials, NORM or a combination of both. Current regulations preclude the disposal of source materials with NORM, or NORM with source materials.