PROPOSED CONFIRMATORY SURVEY PLAN FOR THE MAIN PROCESSING BUILDING AND ADJACENT EXTERIOR AREA CABOT CORPORATION READING, PENNSYLVANIA

INTRODUCTION

Kawecki Berylco Industries (KBI), now Cabot Corporation, operated an ore processing plant in Reading, Pennsylvania from April 1967 through May 1968 under Source Material License No. SMB-920 (Docket No. 040-09027) with the Atomic Energy Commission, predecessor to the Nuclear Regulatory Commission (NRC). KBI used an electric arc furnace to increase the percentage of tantalum in low grade tantalum ores from approximately 2% to 15% by weight.

The tantalum ore was shipped by rail to the Reading Facility and stored on-site until used. The ore consisted of glassy flakes which contained 0.11-0.29% thorium as ThO_2 and approximately 0.02% uranium as U_3O_8, which occur naturally in the ores. The ore was crushed and fed into a mix system, where it was mixed with coke and non-magnetic alloys. This mixture was transported to the furnace feed hoppers in which the metal was separated from the ore. In this process, the thorium and uranium became incorporated into the silica slag. The slag was cooled, dumped onto the floor, broken into chunks, and disposed of as waste in the nearby Slag Dump.

Between 1969 and 1983, Applied Health Physics, Inc. performed decontamination of the facility on an intermittent basis. Some building rubble, soil, and miscellaneous low level waste materials removed by the decontamination operations were disposed of in the Slag Dump.

In December 1985, at the request of the NRC, a confirmatory radiological survey was performed by the Radiological Site Assessment Program (currently the Environmental Survey and Site Assessment Program) of Oak Ridge Associated Universities.[1] This survey identified areas of

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Prepared by the Environmental Survey and Site Assessment Program, Energy/Environment Systems Division, Oak Ridge Institute for Science and Education, under interagency agreement (NRC FIN No. A-9076) between the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy.

residual contamination which exceeded the guideline values for natural uranium and thorium. Within the Main Processing Building, areas exceeding the guidelines included floor and upper wall locations, beam supports, overhead cranes, the landing above the tunnel entrance, and the hoppers. This survey did not identify any locations of direct radiation, total surface activity, removable surface activity or contaminated residues and sediments in the tunnel network. Contamination on the upper walls and overhead supports of the Main Processing Building consisted of a loose dust residue; analytical results were compared to soil concentration guidelines. Numerous outdoor soil areas and isolated hot spots in excess of the guideline values were also identified.

As a result of the ORAU findings, Cabot initiated further decontamination operations which were performed by Bullinger's Mills, Inc. during the period between 1988 and 1989. Areas within the Main Processing Building were vacuumed and scrubbed, and contaminated materials which were removed were stored at Cabot's Boyertown site. Outdoor areas, that were identified as exceeding the guideline values by ORAU in 1985, were remediated and filled with stone. Final release surveys were performed by Bullinger's Mills, Inc. The final survey report indicated that removable surface contamination, exposure rate measurements, and radionuclide concentrations in soil were within the NRC guideline values.[2]

During the period of July 26 through August 2, 1991, the Environmental Survey and Site Assessment Program (ESSAP) conducted a confirmatory radiological survey of the Main Processing Building, the site of the former Raw Materials Storage Building, and the surrounding yard and parking lot of the Cabot Corporation Reading Facility.[3] This survey identified numerous areas of residual contamination which exceeded the surface contamination guidelines on the floors, walls, and overhead beams of the Main Processing Building and outdoor measurements identified several locations with soil concentrations exceeding guidelines.

As a result of the latest ESSAP findings, Cabot continued remedial actions at the Reading facility, this time performed by NES, Inc., during the period between late 1994 and early 1995. Areas within the Main Processing Building and outdoor areas, that were identified by ESSAP

as exceeding the guidelines, were remediated. The radiological waste will be transferred to the Boyertown facility for temporary storage.

The NRC Headquarters' Division of Waste Management has requested that the Environmental Survey and Site Assessment Program of the Oak Ridge Institute for Science and Education (ORISE) conduct confirmatory radiological surveys of the floor of the Main Processing Building and exterior areas adjacent to the Main Processing Building.

SITE DESCRIPTION

The Reading Facility site is approximately 2 hectares (5 acres) and is located in Reading, Pennsylvania (Figure 1). The site is bounded by the Reading Railroad on the West, Tulpenhocken Street on the North, and the Slag Dump on the South. The site consists of the Main Processing Building, the site of the former Raw Materials Storage Building (which has since been demolished and removed), the Slag Dump, and the surrounding yard and parking lot (Figure 2). Adjacent to the Main Processing Building are a series of warehouses operated by Hamburg Manufacturers.

The Main Processing Building is a steel/concrete structure, having one main open floor and three small interior rooms. This building contains approximately 10,000 m^2 of floor space; of which, approximately 6,000 m^2 was used for smelting, crushing, chemical extractions, and storage of raw materials. Figure 3 indicates the portion of the facility in which thorium processing was performed by KBI. Mixing, crushing, and smelting were performed in Bay D-E of the building and chemical separations were performed in Pay A-B. Tunnels, used for material storage and transport, run beneath the Processing Building. The ceiling of the Main Processing Building varies in height from 15 to 20 m above the floor and is in extremely poor condition. A major portion of the ceiling and roof is inaccessible due to its deteriorated condition.

The former Raw Materials Storage Building was demolished by the property owner, due to safety concerns over its deteriorated condition. A portion of the yard, west of the Main Processing Building, was backfilled by the owner with part of the debris from the Raw Materials

Storage Building. A portion of the structure was also placed in the Slag Dump. The yard and parking lot areas adjacent to the Main Processing Building are approximately 10,000 m^2; of which, approximately 7,200 m^2 was involved in the handling of the raw materials and ore.

OBJECTIVES

The objectives of the confirmatory survey are to provide independent contractor field data reviews and radiological data for use by the NRC in evaluating the adequacy and accuracy of the licensee's procedures and final status survey results.

RESPONSIBILITY

Work described in this survey plan will be performed under the direction of William L. (Jack) Beck, Program Director and Tim Vitkus, Project Leader with ESSAP. The cognizant site supervisor has the authority to make appropriate changes to the survey procedures as deemed necessary. After consultation with the NRC site representative, the scope of the survey may be altered based on findings as the survey progresses.

DOCUMENT REVIEW

ESSAP has reviewed the licensee's decommissioning plan and radiological survey data.[4] Procedures and methods utilized by the licensee were reviewed for adequacy and appropriateness. The data were reviewed for accuracy, completeness and compliance with guidelines.[5]

PROCEDURES

Survey activities will be conducted in accordance with the ORISE/ESSAP Survey Procedures and Quality Assurance Manuals. Specific survey procedures applicable to this survey are listed on Pages 10 and 11 of this survey plan. Deviations to the survey plan or procedures will be documented in the site log book.

SURVEY PROCEDURES: INTERIOR

The major emphasis of the interior portion of the survey will be on the floor areas identified in the Main Processing Building as exceeding guidelines during the previous ESSAP survey. The extent of survey coverage may vary for each location, depending on survey findings, the licensee's data, and the operational history of the particular area. Overhead and wall surfaces, known to be contaminated, were independently evaluated by the NRC.

Reference Grid

The reference grid systems established by the licensee will be utilized, when appropriate. Measurement and sampling locations on ungridded surfaces will be referenced to prominent building features or the existing grid.

Surface Scans

Surface scans of the floor will be performed using NaI scintillation and large area gas proportional detectors. Scan of areas not accessible with the large area detectors will be performed using GM and/or hand-held gas proportional detectors. A 100% scan of the floor in the affected areas, and a 10 to 25% scan of the floor in unaffected areas, will be performed (to the extent practical considering the condition and accessibility of the floor surfaces). Particular attention will be given to cracks and joints in the floor and walls, ledges, ducts, drains, and other locations where material may have accumulated. All detectors will be coupled to ratemeters or ratemeter-scalers with audible indicators. Locations of elevated direct radiation will be marked for further investigation.

Surface Activity Measurements

Natural uranium and natural thorium emit both alpha and beta radiation at comparable levels; thus, either alpha or beta activity may be measured and compared to the guideline values.

Because rough or dirty surfaces may selectively attenuate alpha radiation, beta measurements will be performed on the surfaces.

Direct measurements for total beta activity will be performed using gas proportional detectors, coupled to portable ratemeter-scalers. The frequency of these direct measurements in the affected areas will be approximately one measurement per 10 m^2 of floor area, and thirty (30) measurements per unaffected survey unit. Additional direct measurements will be performed at locations of elevated direct radiation identified by surface scans.

Smear samples, for determining removable activity levels, will be collected from each direct measurement location.

Miscellaneous Sampling

Miscellaneous samples may be collected from cracks, ledges, piping, ducts, and drains, where material may have accumulated.

SURVEY PROCEDURES: EXTERIOR

The major emphasis of the exterior portion of the survey will be on the outdoor areas, adjacent to the Main Processing Building, identified as exceeding guidelines during the previous ESSAP survey. The extent of survey coverage may vary for each location, depending on survey findings, the licensee's data, and the operational history of the particular area.

Reference Grid

The reference grid system established by the licensee will be utilized. Measurement locations on ungridded surfaces will be referenced to prominent site features or the existing grid.

Surface Scans

Exterior surfaces will be scanned for gamma radiation using NaI scintillation detectors. A 100% scan of the soil in the affected areas, and a 10% scan of the soil in unaffected areas, will be performed. Paved surfaces may also be scanned with a large area gas proportional detector. Locations of elevated direct radiation will be marked for further investigation.

Surface Activity Measurements

Direct measurements for total beta activity will be performed on the paved surfaces using gas proportional detectors, coupled to portable ratemeter-scalers. A minimum of ten direct measurements will be performed. Additional direct measurements will be performed at locations of elevated direct radiation identified by surface scans. Smear samples, for determining removable activity levels, will be collected from each direct measurement location.

Soil Sampling

A minimum of ten soil samples will be collected both from randomly selected outdoor areas, as well as from any exterior locations of elevated direct radiation identified by surface scans.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data will be returned to ORISE's ESSAP laboratory in Oak Ridge, Tennessee for analysis and interpretation. Direct measurements for surface activity will be converted to units of disintegrations per minute per 100 cm^2 (dpm/100 cm^2). Smears will be analyzed for gross alpha and gross beta activity using a low background gas proportional counter, and the results will be converted to units of disintegrations per minute per 100 cm^2 (dpm/100 cm^2). Soil and any miscellaneous samples will be analyzed by gamma spectrometry and/or alpha spectrometry. The radionuclides of interest are Th-232, U-235 and U-238; however, spectra will be reviewed for other identifiable photopeaks. Gamma spectrometry data will be reported in pCi/g. The data

generated will be compared with the licensee's documentation and NRC guidelines established for release to unrestricted use. Results will be presented in a report and provided to the NRC.

GUIDELINES

The primary contaminants of concern for this site are natural thorium and natural uranium. The applicable NRC guidelines for residual thorium and uranium surface activity levels are:[6]

Natural thorium

1,000 dpm/100 cm^2 total, averaged over a 1 m^2 area

3,000 dpm/100 cm^2, total, maximum in a 100 cm^2 area

200 dpm/100 cm^2, removable activity

Natural uranium

5,000 dpm α/100 cm^2 total, averaged over a 1 m^2 area

15,000 dpm α/100 cm^2, total, maximum in a 100 cm^2 area

1,000 dpm α/100 cm^2, removable activity

Soil concentrations for residual uranium and thorium wastes in soil are presented in the NRC's Branch Technical Position on "Disposal or Onsite Storage Thorium and Uranium Wastes from Past Operations." The following guidelines will be used for comparison with the results:[7]

Natural Uranium (U-238 + U-234 + U-235): 10 pCi/g*

Natural Thorium (Th-232 + Th-228): 10 pCi/g*

*With all daughters present and in equilibrium

TENTATIVE SCHEDULE

Measurement and Sampling	January 30 - 31, 1995
Interim Report	February 9, 1995
(surface activity measurements)	
Sample Analysis	February 1995
Draft Report	March 1995

LIST OF CURRENT PROCEDURES

Applicable procedures from the ORISE ESSAP Survey Procedures Manual (Revision 8; December 31, 1993) include:

Section 5.0 Instrument Calibration and Operational Check-Out

- 5.1 General Information
- 5.2 Electronic Calibration of Ratemeters
- 5.3 Gamma Scintillation Detector Check-Out and Cross-Calibration
- 5.5 GM Detector Calibration and Check-Out
- 5.6 Proportional Detector Calibration and Check-Out
- 5.9 Floor Monitor Check-Out
- 5.13 Field Measuring Tape Calibration

Section 6.0 Site Preparation

- 6.2 Reference Grid System

Section 7.0 Scanning and Measurement Techniques

- 7.1 Surface Scanning
- 7.4 Beta Radiation Measurement

Section 8.0	Sampling Procedures	
	8.1	Surface Soil Sampling
	8.2	Subsurface Soil Sampling
	8.7	Determination of Removable Activity
	8.8	Miscellaneous Sampling
	8.9	Sample Identification Labeling
Section 9.0	Integrated Survey Procedures	
	9.1	Background Measurements and Baseline Sampling
	9.2	General Survey Approaches and Strategies
Section 10.0	Health and Safety Control of Cross Contamination	
Section 11.0	Quality Assurance and Quality Control	

Applicable procedures from the ORISE/ESSAP Quality Assurance Manual (Revision 6; July 30, 1993) include:

Section 5	Training and Certification
Section 6	Equipment and Instrumentation
Section 7	Quality Control
Section 8	Sample Chain-of-Custody
Section 9	Data Management
Section 10	Data Review and Validation
Section 11	Records Handling and Storage

REFERENCES

1. "Preliminary Survey Results, Confirmatory Radiological Survey of the KBI Division of Cabot Corporation Reading, Pennsylvania," Oak Ridge Associated Universities, March 1986.

2. "Final Decontamination and Decommissioning Survey, dated 1988-1989," Cabot Corporation, August 1990.

3. "Confirmatory Radiological Survey for Portions of the Cabot Corporation Reading Facility, Reading, Pennsylvania," Environmental Survey and Site Assessment Program, Oak Ridge Institute for Science and Education, June 1993.

4. "Decommissioning Plan for the Main Processing Building and Surrounding Area at the Reading, Pennsylvania Site," NES, Inc., December 1994.

5. Oak Ridge Institute for Science and Education, letter from E. W. Abelquist to R. Hogg, NRC/NMSS, "Document Review - Decommissioning Plan for the Main Processing Building and Surrounding Area at the Reading, Pennsylvania Site," January 23, 1995.

6. U.S. Nuclear Regulatory Commission, Division of Fuel Cycle and Material Safety, Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source or Special Nuclear Material, Washington, D.C., August 1987.

7. U.S. Nuclear Regulatory Commission, Disposal or Onsite Storage Thorium and Uranium Wastes from Past Operations, Washington, D.C., October 23, 1991.

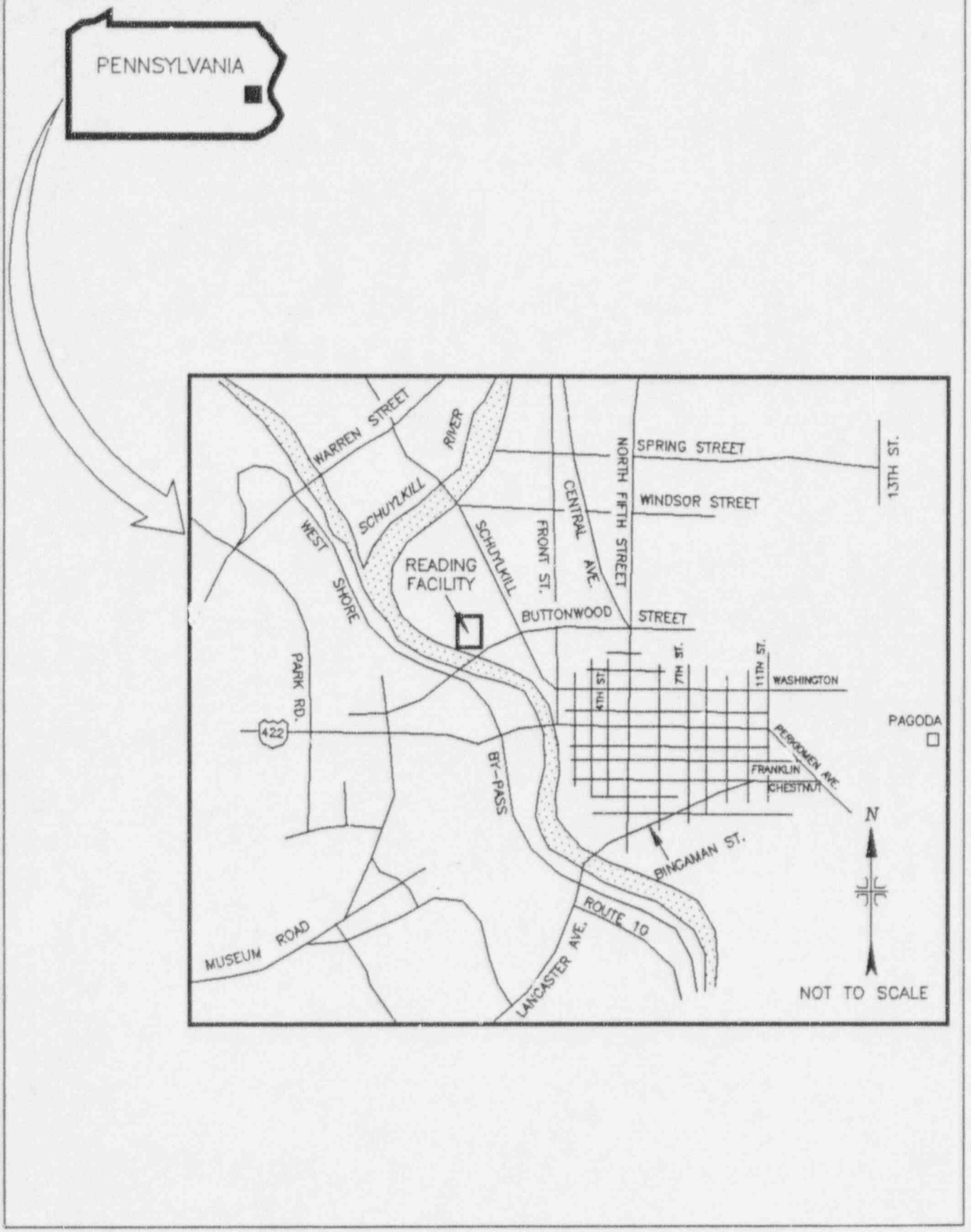

FIGURE 1: Location of the Cabot Corporation, Reading Facility, Reading, Pennsylvania

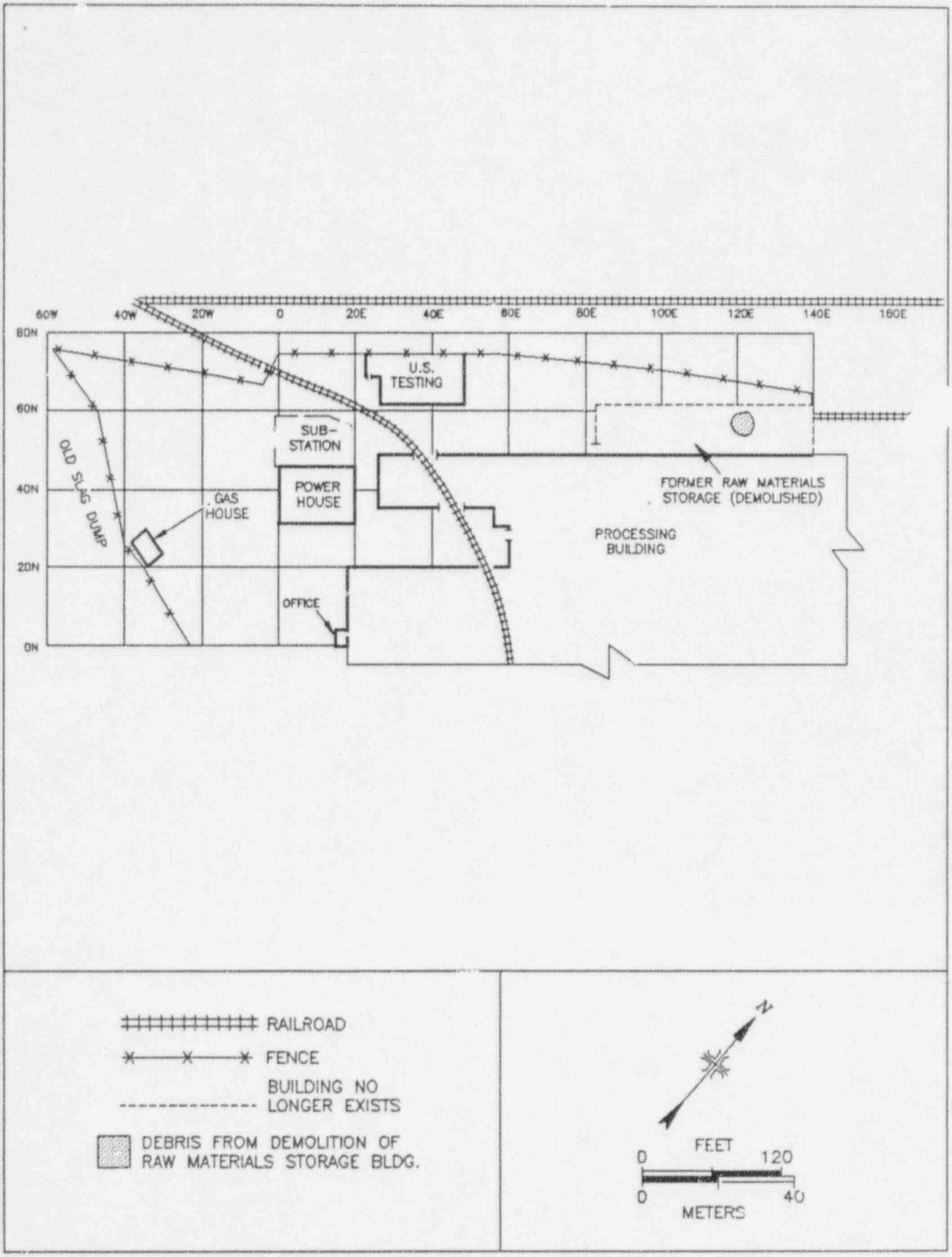

FIGURE 2: Reading Facility – Current Plot Plan with External Survey Reference Grid

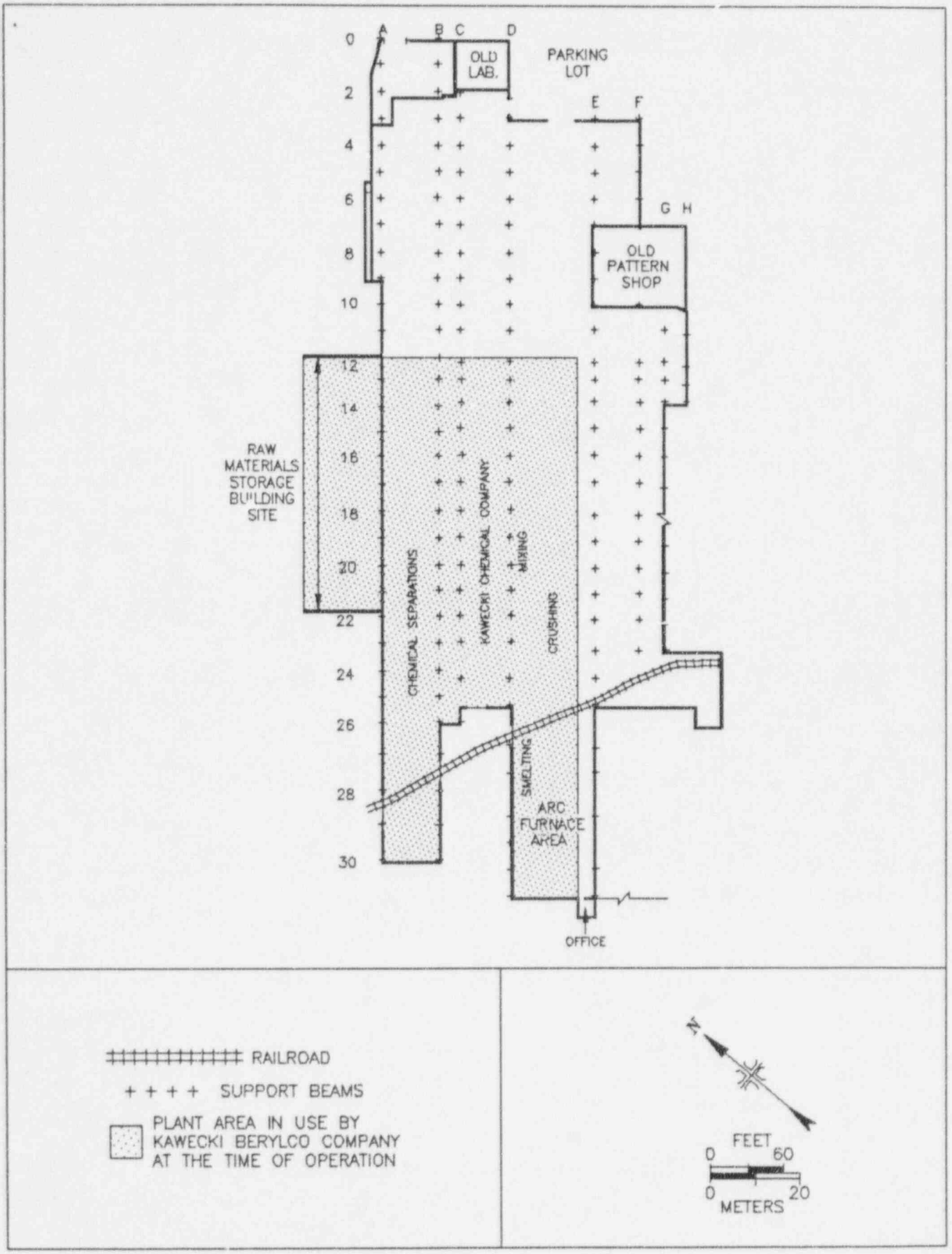

FIGURE 3: Processing Building – Portions Used During Operation

APPENDIX A

SPENDING PLAN	PERFORMANCE PERIOD	
	From	To
Name of Laboratory:	Jan-95	Mar-95
Oak Ridge Institute for Science and Education		
	RFTA	Est. Project Cost
Title of Project: #280	95-08	$52,100.00
Cabot Corporation- Reading		
	NRC Fin Number	ORISE Number
TAC Number:	A9076	1286.02

COST ELEMENTS	**Oct-94**	**Nov-94**	**Dec-94**	**Jan-95**
Direct Costs	$0.00	$0.00	$0.00	$21,175.00
Indirect Costs- (G&A, DOE Factor)	$0.00	$0.00	$0.00	$7,550.00
Total Estimate Costs	$0.00	$0.00	$0.00	$28,725.00
Project Completion	0.00%	0.00%	0.00%	55.13%
COST ELEMENTS	**Feb-95**	Mar-95	Apr-95	May-95
Direct Costs	$15,200.00	$2,050.00	$0.00	$0.00
Indirect Costs- (G&A, DOE Factor)	$5,400.00	$725.00	$0.00	$0.00
Total Estimate Costs	$20,600.00	$2,775.00	$0.00	$0.00
Project Completion	94.67%	100.00%	100.00%	100.00%
COST ELEMENTS	Jun-95	Jul-95	Aug-95	Sep-95
Direct Costs	$0.00	$0.00	$0.00	$0.00
Indirect Costs- (G&A, DOE Factor)	$0.00	$0.00	$0.00	$0.00
Total Estimate Costs	$0.00	$0.00	$0.00	$0.00
Project Completion	100.00%	100.00%	100.00%	100.00%

ACTIVITY INFORMATION	Hours	Estimated Cost
Site Visit	0.0	$0.00
Document Review	0.0	$0.00
Presurvey	26.0	$5,900.00
Travel- Labor	64.0	$14,400.00
Travel- Other Expenses	0.0	$2,600.00
Survey Activities	56.0	$12,700.00
Report Preparation	62.0	$14,400.00
Sample Analysis	0.0	$2,100.00
Other	0.0	$0.00
Total	208.0	$52,100.00