



August 22, 1995

MEMORANDUM TO: Ms. Kimberly J. Hardin
Licensing Branch
Division of Fuel Cycle Safety & Safeguards, NMSS

FROM: Robert J. Bores, Chief *Robert J. Bores 8/22/95*
Facilities, Radiation Protection Section
Division of Radiation Safety and Safeguards

SUBJECT: RESULTS OF THE NRC FINAL WALKOVER SURVEY AT BABCOCK & WILCOX'S APOLLO, PENNSYLVANIA SITE

During the decommissioning of Babcock & Wilcox's (B&W) Apollo, Pennsylvania site, affected areas were divided into five major areas for final remediation and survey; these included the Main Building, South Sewer, North Sewer, South Parking Lot, and the North Parking Lot. Each of these survey areas were previously determined, by NRC confirmatory sampling, to meet guidelines established for unrestricted release. In addition to these confirmatory surveys, the Division of Waste Management, the Division of Fuel Cycle Safety and Safeguards, and the Region I Office, requested a final NRC walkover survey for affected and unaffected areas within the site fenced boundary to provide additional verification that ground level exposure rate measurements met unrestricted release criteria.

The final NRC walkover surveys for the grounds of Babcock & Wilcox's Apollo site were completed during the week of May 22, 1995. The walkover surveys consisted of performing surface scans and exposure rate measurements for approximately 10 percent of the site area. Special emphasis and additional survey time were spent in the areas where radioactive material was known to have been used. This included areas associated with the former Main Building, South Sewer, and laundry. In addition to radiation surveys, the site inspector obtained nine soil samples from two locations on site and six soil samples from two locations off site.

All results met guidelines previously established for unrestricted release, and are presented in the enclosure.

If you have any questions, please contact me at (610) 337-5213 or Randolph Ragland of my staff at (610) 337-5083.

Attachment: NRC Final Walkover Survey, Babcock & Wilcox's Apollo, Pennsylvania site

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NRC Final Walkover Survey
Babcock & Wilcox's Apollo, Pennsylvania Site

1.0 NRC WALKOVER SURVEY OF THE APOLLO SITE GROUNDS

During the decommissioning of Babcock & Wilcox's (B&W) Apollo, Pennsylvania site, affected areas were divided into five major areas for final remediation and survey; these included the Main Building, South Sewer, North Sewer, South Parking Lot, and the North Parking Lot. Each of these survey areas were previously determined, by NRC confirmatory sampling, to meet guidelines established for unrestricted release. In addition to these confirmatory surveys, the Division of Waste Management, the Division of Fuel Cycle Safety and Safeguards, and the Region I Office, requested a final walkover survey for affected and unaffected areas within the site fenced boundary to provide additional verification that ground level exposure rate measurements met unrestricted release criteria.

The final NRC walkover surveys of Babcock & Wilcox's Apollo, Pennsylvania site have been completed. A summary of the NRC walkover survey process, including survey description, instrumentation used, survey methods, results, and comparison with unrestricted release guidelines, and a review of B&W's final walkover survey data, appears below.

1.1 SURVEY DESCRIPTION

The walkover survey consisted of performing surface scans and exposure rate measurements for approximately 10 percent of the area within the fenced boundary. The B&W site contains approximately 1040 25 foot x 25 foot grids, including affected (formerly greater than 30 pCiU/g) and unaffected areas. Of the 1040 grids, 109 grids, or about 10.5 percent of the total number of grids, were selected for surface scans and exposure rate measurements. Survey locations were selected by the inspector by a combination of biased and random selection, to ensure representative surveys from areas that required significant remediation. Special emphasis and additional survey time were spent in areas where radioactive material was known to have been used. This included areas associated with the former Main Building, South Sewer, and laundry. The grid locations that were surveyed are illustrated in Attachment 1, Figure 1, and data for the exposure rate measurements appear in Attachment 2, Table 1.

In addition to the radiation surveys, the site inspector obtained nine soil samples from two locations within the site fenced boundary. Four samples were obtained from an area located immediately north of the former Main Building. This property is not owned by B&W and is considered an offsite, unaffected area. However, this location was chosen for sampling due to its relatively close proximity to the former Main Building. Sampling locations are illustrated in Attachment 1, Figure 1. Also, five soil samples were obtained from an area in the South Parking lot where an 8,000 cubic foot pile of soil, with an

average concentration of 30 pCiU/g, formerly was stored. This area was selected for sampling to verify that surface activity levels were not affected by the former storage of this soil pile. These sampling locations are also illustrated in Attachment 1, Figure 1.

The inspector also obtained six offsite samples at the request of concerned citizens. These included three samples from the driveway of the Stanford Lumber company property, and three samples from soil disturbed during the removal of railroad tracks on Warren Avenue, between North Fourth Street and First Street.

1.2 INSTRUMENTATION

The following radiation detection instruments were used.

Analyzer	Probe/Detector	Calibration/Energy Response Information
Ludlum Analyzer, Model 16 Serial No. 033511	Ludlum Detector Model 44-2, High Energy Gamma Scintillator, Serial No. 1898, & Model 44-3 Low Energy Gamma Scintillator, Serial No. 19623	The instrument/detectors were response checked with a natural uranium source prior to use. The detectors responded satisfactorily to the low energy gammas associated with uranium
Eberline Pulse Rate Meter Model PRM-6 Serial No. 1545 Calibration Due Date: 11/18/95	Victoreen Model 489-55 Sodium Iodide Scintillator Calibration Due Date: 11/18/95	This instrument was calibrated with Cs-137 (0.662 MeV gamma). This instrument over responds to low energy gammas associated with uranium
Ludlum Survey Meter Model 19 MicroRmeter Serial No. 33511 Calibration Due Date: 2/16/96	Internal Probe	This instrument was calibrated with Cs-137 (0.662 MeV gamma). This instrument over responds to low energy gammas associated with uranium

Ludlum Measurements, Inc.
501 Oak Street
Sweetwater Texas, 79556

Eberline Instrument Corporation
Sante Fe, New Mexico, 87501

Victoreen
Cleveland, OH 44104

- Note 1: The use of this instrumentation is not to be construed as an endorsement of the product or its manufacturer.
- Note 2: The instruments used for scanning survey measurements (Ludlum 16 with the Ludlum 44-2/44-3 probes and the Eberline PRM-6 with the Victoreen 489-55 probe) were used solely as a trigger for soil sampling and not to satisfy release criteria.
- Note 3: The Ludlum 19 microRmeter was used to verify that exposure rates met release criteria.

1.3 SURVEY METHODS

1.3.1 Surface Scans

On May 23, 1995 the inspector notified B&W personnel of grid locations selected for surveys. B&W personnel then mowed the grass and surface vegetation to the satisfaction of the inspector. This was necessary in order to perform surface scans.

Surface scans were performed by passing a sodium iodide scintillation detector probe slowly over the surface of the ground. The distance between the probe and the ground surface was maintained at a minimum - nominally about 1 cm. The instrument background count rate was determined by performing a scanning survey of the ground in an unaffected area, immediately adjacent to the site. The midpoint between the upper and lower count rate range was selected as the average background count rate.

The following survey "investigation criteria" were used. Areas with elevated count rates would receive additional survey scans, and areas with count rates exceeding two times the background count rate would be targeted for soil sampling. Identification of elevated count rates was based on visual increases in count rate indications from the count rate meter or audible signals from the associated instrument "speaker".

1.3.2 Exposure Rate Measurements

Measurements of gamma exposure rates were performed at one meter above the ground surface in each selected grid location. The inspector walked slowly over each selected grid holding the instrument at one meter above the ground surface. Instrument readings were allowed to stabilize and measurements were read directly in microRoentgens per hour ($\mu R/h$).

1.3.3 Soil Sampling

Approximately one kilogram of soil was collected at each sampling location. Samples were placed in plastic bags, sealed and labeled. Nine soil samples were obtained within the site fenced boundary, and six samples were obtained from offsite areas. All of the samples were submitted to the Oak Ridge Institute for Science and Education (ORISE) for analysis by gamma spectroscopy.

1.4 RESULTS AND COMPARISONS WITH RELEASE GUIDELINES

1.4.1 Surface Scans

Elevated radiation count rates were identified in various locations across the site. However, these elevated count rates appeared to be associated with miscellaneous rocks and backfill materials obtained from a limestone quarry. No locations were identified with count rates exceeding two times the background count rate. Therefore, no soil

samples were required by the investigation criteria. However, a number of soil samples were collected as described below.

1.4.2 Exposure Rate Measurements

Exposure rate measurements, including background, ranged from 8.5 $\mu\text{R/h}$ to 14.0 $\mu\text{R/h}$, with an average of approximately 11 $\mu\text{R/h}$. ORISE had previously measured background exposure rates for the Apollo, Pennsylvania area to range from 8 - 12 $\mu\text{R/h}$, with an average of approximately 10 $\mu\text{R/h}$. The inspector noted that exposure rate measurements were slightly elevated in two areas; the south side of the Main Building excavation, and the area near the former Laundry. Seventeen measurements from the south side of the Main Building excavation averaged 12.7 $\mu\text{R/h}$ and ranged from 11.5 - 14 $\mu\text{R/h}$. Sixteen measurements from the area near the former laundry averaged 11.7 $\mu\text{R/h}$ and ranged from 10 - 13 $\mu\text{R/h}$. The inspector noted that the slightly elevated radiation levels near the former laundry appeared to originate from rocks and backfill materials that came from a limestone quarry. Survey locations are illustrated in Attachment 1, Figure 1, and survey data are presented in Attachment 2, Table 1.

The site guideline for unrestricted release for exposure rates at one meter above the ground surface is 5 $\mu\text{R/h}$ above background. All exposure rate measurements were within this limit.

1.4.3 Soil Sampling

All soil samples were analyzed by the Oak Ridge Institute for Science and Education (ORISE). Results were submitted to the NRC in a March 2, 1995 letter from W. Adams (ORISE) to R. Ragland (NRC), and in a March 28, 1995 letter from W. Adams (ORISE) to R. Ragland (NRC). These letters appear as Attachment 3 and Attachment 4, respectively. Total uranium activity for the nine samples from within the site fenced boundary ranged from 11.47 - 22.56 pCiU/g, and total thorium activity ranged from 1.63 - 2.40 pCi per gram of soil. The six samples from offsite areas had total uranium activity ranging from less than 4.08 pCiU/g to 8.23 pCiU/g. Thorium concentrations were similar to natural background, and the highest total thorium concentration was 3.25 pCi thorium per gram.

The guidelines for unrestricted release of soil with residual concentrations of enriched uranium and thorium are 30 picocuries of total uranium per gram of soil (pCiU/g) and 10 pCi of total thorium per gram of soil, respectively. All soil concentrations were found to be within these guidelines.¹

1.5 REVIEW OF B&W DATA

B&W submitted results of their final walkover survey of the Apollo site to the NRC in an April 4, 1995 letter from D. Sgarlata (B&W) to K. Hardin (NRC) and an April 13, 1995 letter from D. Sgarlata (B&W) to K. Hardin (NRC). B&W's "Apollo Decommissioning Project Final Walkover

¹ Background concentrations of uranium and thorium were not subtracted.

Survey Report" appears as Attachment 5. B&W performed a 100 percent walkover of accessible grid locations. Some grids were not surveyed because they were located within the river boundary. All exposure rate measurements met previously established unrestricted release criteria. In addition, B&W used a random number generator to select 30 locations across the site for bore hole soil sampling. These samples were analyzed by gamma spectroscopy and total uranium activity was reported. All results met guidelines for unrestricted release.

1.6 ATTACHMENTS

- 1) Figure 1, "Apollo Decommissioning Project Final NRC Walkover Survey"
- 2) Table 1, "Apollo Decommissioning Project Final NRC Walkover Survey - Exposure Rate Measurements"
- 3) March 2, 1995 letter from W. Adams (ORISE) to R. Ragland (NRC)
- 4) March 28, 1995 letter from W. Adams (ORISE) to R. Ragland (NRC)
- 5) April 4, 1995 and April 13, 1995 letters from D. K. Sgarlata (B&W) to K. Hardin (NRC) "Apollo Decommissioning Data Final Walkover Survey Report"