ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

November 5, 2004

Mr. James Kottan
U.S Nuclear Regulatory Commission
Region I
475 Allendale Road
King of Prussia, PA 19406

37-17860-02
030-29288

SUBJECT: CONFIRMATORY SURVEY PLAN FOR THE QUEHANNA DECOMMISSIONING PROJECT KARTHAUS, PENNSYLVANIA [DOCKET NO. 30-29288; RFTA NO. 04-008]

Dear Mr. Kottan:

Enclosed is the confirmatory survey plan for the Quehanna Decommissioning Project for the former PermaGrain facility in Karthaus, Pennsylvania. Confirmatory survey activities are scheduled to begin November 8, 2004. For the schedule to be met, approval of the final survey plan would be needed by November 5, 2004.

If you have any questions, please direct them to me at (865) 576-0065 or Timothy J. Vitkus at (865) 576-5073.

Sincerely,

Wade C. Adams
Health Physicist/Project Leader
Environmental Survey and
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WCA:ar

Enclosure

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CONFIRMATORY SURVEY PLAN
FOR THE QUEHANNA DECOMMISSIONING PROJECT
KARTHAUS, PENNSYLVANIA

INTRODUCTION AND SITE HISTORY

In 1957, the Curtis-Wright Corporation (CWC) finished construction of the research facility at the Quehanna site. Following the construction of the facility, the U.S. Atomic Energy Commission (AEC), a precursor to the U.S. Nuclear Regulatory Commission (NRC), issued a license to CWC in 1958 to operate a swimming pool research reactor. The license also included the use of hot cells, laboratories, and support features (SCIENTECH 2004).

In September 1960, CWC donated the facility and land to Pennsylvania State University (PSU) which subsequently leased the hot cells to Martin Marietta Corporation (MMC). In 1962, MMC used the hot cells to manufacture several prototype thermoelectric generators, known as Systems for Nuclear Auxiliary Power (SNAP) generators, for the AEC. These power sources, which were designed to furnish power for remotely operated, automatically reporting weather stations, navigation buoys, etc., contained very high Sr-90 specific activity in the form of strontium titanate ($SrTiO_3$). MMC's radioactive material license allowed them to maintain megacurie amounts of Sr-90. When MMC terminated its lease in 1967, they partially decontaminated the facility but licensable quantities of Sr-90 remained behind as structural contamination. MMC was the last licensee to use Sr-90 at the Quehanna facility (SCIENTECH 2004).

In 1967, PSU gave up its interest in the Quehanna facility back to the Commonwealth of Pennsylvania which in turn leased the facility to NUMEC, a subsidiary of the Atlantic-Richfield Corporation (ARC). NUMEC used the Reactor Pool to hold a large Co-60 irradiator containing in excess of 1 million curies of Co-60. In 1967, a group of ARC employees bought the wood irradiation process, including the Co-60 irradiator and related equipment at the Quehanna facility. The new company, PermaGrain, was issued NRC Radioactive Materials License Number 37-17860-01 for the irradiator and also assumed "caretaker" responsibilities for the material left behind by previous tenants (SCIENTECH 2004).

Prepared by the Environmental Survey and Site Assessment Program, Radiological Safety, Assessments and Training, Oak Ridge Institute for Science and Education, under interagency agreement (NRC FIN No. J5403) between the U.S. Nuclear Regulatory Commission and the U.S. Department of Energy.

Currently, the Commonwealth of Pennsylvania owns the Quehanna facility and the surrounding real estate and the Department of Conservation and Natural Resources (DCNR) Bureau of Forestry administer the land; the Pennsylvania Department of Environmental Protection (PADEP) assumed the official license since PermaGrain filed for bankruptcy in December 2002. PADEP renewed the license in September 2003 under NRC Radioactive Materials License Number 37-17860-02.

Characterization activities at the facility have identified Sr-90 and Co-60 as the only radionuclides of concern. The scope of the D&D project was expanded in 1998 when high levels of Sr-90 contamination were discovered in Hot Cell 4. PADEP then approved demolition activities that included the removal of the Hot Cell Structure (SCIENTECH 2004). Since the Chapter 7 bankruptcy filing of PermaGrain and their subsequent abandonment of the Quehanna facility in December 2002, the scope of the D&D project was extended to include the former PermaGrain areas, including the Reactor Bay and the irradiator pool (Reactor Pool).

The contaminants of concern are Sr-90 with possible residual Co-60 from the use of and manufacture of cobalt irradiators; however, measurable quantities of Co-60 are not expected since extensive removal remediation has taken place in the localized areas where Co-60 was known to exist. There is also a small potential for activation products from operations of the test reactor (SCIENTECH 2004).

The final status survey plan (FSSP), which supports unrestricted site release, combines surface surveys, concrete core samples and surface and subsurface soil sampling. Site surface waters and groundwater are considered non-impacted and are not part of the final status surveys (FSS) for license termination or any post-closure monitoring program. The FSSP was designed and implemented according to protocols established in the Multi-Agency Radiation Survey and Site Investigation Manual [MARSSIM (NRC 2000)].

Currently, the site decommissioning contractor, SCIENTECH, Inc., is performing FSS of the Quehanna facility based on a FSSP they prepared for PADEP. The objective of the FSSP is to demonstrate that the radiological conditions at the Quehanna facility satisfy the "Decommissioning Plan for the Quehanna, Pennsylvania Site" release criteria and that the site

can be release for unrestricted use. Decommissioning activities have included the removal of the Hot Cell 4 process system by the use of a remotely controlled robot. The Co-60 irradiator sources were removed from the Reactor Pool and hot cells. Areas such as the laboratories, production and storage areas, and offices have been surveyed and decontaminated as necessary. Interior structures north of the Reactor Bay and Cell Face have been surveyed and demolished (e.g. walls, ceiling and floor tiles, etc.) and debris has been disposed of either as clean waste or low-level radioactive waste (LLRW) (SCIENTECH 2004).

Regulators that are involved in the decontamination and decommissioning (D&D) project include the U.S. Nuclear Regulatory Commission (NRC), the DCNR, and PADEP. PADEP took over the license following PermaGrain's Chapter 7 bankruptcy filing in December 2002.

The NRC's Headquarters and Region I Offices have requested that the Environmental Survey and Site Assessment Program (ESSAP) of the Oak Ridge Institute for Science and Education (ORISE) perform confirmatory surveys of the Quehanna facility in Karthaus, Pennsylvania.

SITE DESCRIPTION

The Quehanna facility is located at 115 Reactor Road, Karthaus, Clearfield County, Pennsylvania. The site is approximately 35 kilometers [km (21 miles)] northeast of Clearfield, Pennsylvania and is located in the 20,000-hectare [ha (50,000-acre)] Quehanna Wild Area of the Moshannon State Forest. The area is heavily wooded and sparsely populated. The Quehanna facility has a basement, main and second floor area of approximately 3,700 meters [m (40,000 square feet)].

The Quehanna Site includes or included many affected structures and systems, such as the hot cells complex (Cell Structure), the Waste Water Treatment Building with associated underground tanks and piping, the Reactor Bay, and the hot cell ventilation system. Some of these have been removed as clean debris or partially decontaminated and disposed of as radioactive waste. The facility also includes other laboratories, production areas, storage areas, and offices formerly used by PermaGrain.

OBJECTIVES

The objectives of the confirmatory surveys are to provide independent radiological data for use by the NRC in evaluating the adequacy and accuracy of the licensee's sample plans and release survey results and conclusions.

RESPONSIBILITY

Work described in this survey plan will be performed under the direction of Eric Abelquist, Program Director, Tim Vitkus, Survey Projects Manager, and Wade C. Adams, 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 or if the licensee provides additional information.

DOCUMENT REVIEW

ESSAP has reviewed the licensee's "Quehanna Decommissioning Project, Final Status Survey Plan" for adequacy and appropriateness (SCIENTECH 2004). A comment letter, documenting the review was submitted to the NRC (ORISE 2004a). The final survey data will be reviewed prior to ESSAP's mobilization to the site or while at the site during confirmatory survey activities.

PROCEDURES

Survey activities will be conducted in accordance with the ORISE/ESSAP Survey Procedures and Quality Assurance Manuals (ORISE 2004b and c). Applicable procedures are listed on pages 9 through 11 of this survey plan. Deviations to the survey plan or procedures will be documented in the site logbook.

The following radiological survey procedures will be used by ESSAP to conduct confirmatory surveys of various building surfaces that have been evaluated by SCIENTECH and are to be released for unrestricted use. Specific survey units (SU) will be surveyed based on SCIENTECH's classification of the SUs (Class 1, Class 2, Class 3, non-affected) which generally

follow the MARSSIM definitions. These classifications were based on the potential and extent of the area of origin's radiological hazards based on historical process knowledge and on SCIENTECH's final status survey findings. ESSAP will perform confirmatory surveys in a minimum of 25% of the SUs for which SCIENTECH has provided data—these SUs will be selected based on SCIENTECH's final status data. The percentage of confirmatory surveys conducted for each classification of SU may increase or decrease based on findings as the verification survey activities progress and/or at the discretion of the NRC site representative.

HEALTH AND SAFETY

A walkdown of the project area will be performed in order to evaluate the area for potential health and safety issues. Additionally, the proposed survey and sampling procedures are evaluated to ensure that any hazards inherent to the procedures themselves are addressed in current job hazard analyses (JHAs). The procedures entail minimal potential hazards that are addressed in current ESSAP JHAs. Personnel will also adhere to the SCIENTECH health and safety requirements. Confirmatory activities are expected to be conducted in areas that do not require radiation work permits or special dosimetric considerations.

REFERENCE SYSTEM

Measurements and sampling locations will be referenced to the existing SCIENTECH grid system.

SURFACE SCANS

Interior

Beta and gamma radiation surface scan coverage will be based on the SCIENTECH SU classification. Scan coverage in SUs selected for confirmation will be as follows: up to 50% of the structural surfaces in Class 1 SUs and up to 10% of the structural surfaces in Class 2 SUs. Scanning will be performed on a judgmental basis in Class 3 and Non-Impacted SUs. Additional area scans may be performed, depending on findings as the survey progresses and project time constraints. Particular attention will be given to cracks and joints where material may have

accumulated. Scans will be performed using gas proportional, GM, and NaI scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators. Any locations of elevated direct radiation detected by surface scans will be marked for further investigation—to include additional surface scans, as deemed necessary to delineate contamination boundaries.

Exterior

Exterior areas immediately adjacent to the Quehanna facility buildings and other miscellaneous exterior areas will be beta and gamma scanned as deemed appropriate based on previous survey results and at the discretion of the NRC site representative. Scans will be performed using gas proportional, GM, and NaI scintillation detectors coupled to ratemeters or ratemeter-scalers with audible indicators. Any locations of elevated direct radiation detected by surface scans will be marked for further investigation—to include additional surface scans, as deemed necessary to delineate contamination boundaries.

SURFACE ACTIVITY MEASUREMENTS

Construction material-specific background measurements will be collected as necessary from a non-impacted area of the site for correcting gross activity measurements performed on structural survey units. Initially, direct measurements of surface activity will be performed at any locations of elevated direct radiation identified by surface scans—to include additional direct measurements as deemed necessary to delineate contamination boundaries and for the determination of 1 m^2 average values. The majority of the direct measurements will be performed using gas proportional detectors—GM detectors will be used in areas that are inaccessible to the gas proportional detectors. Additional direct measurements will be performed at co-located measurement locations and at 5 to 10 judgmental locations in each survey unit that receives confirmation surveys; direct measurements on exterior surfaces, e.g., paved areas or concrete pads, may also be performed as deemed appropriate. Detectors will be coupled to ratemeter-scalers. Smear samples, for determining removable gross beta activity levels, will be collected from each direct measurement location.

Areas of residual activity, in excess of the site criteria, will be brought to the immediate attention of the D&D contractor and the NRC site representatives. If additional remediation is performed during the ESSAP survey, follow-up measurements will be performed.

EXPOSURE RATE MEASUREMENTS

Background exposure rates will be determined for the building interior at a minimum of five locations of similar construction but without a history of radioactive materials use; background exterior exposure rates will be determined at a minimum of five locations within a 0.5 to 10 km radius of the site. Exposure rates will be measured at the center of selected SU and at any locations of elevated direct gamma radiation identified by surface scans. Exposure rate measurements will be performed at 1 meter above the surface using a microrem meter.

MISCELLANEOUS MATERIAL SAMPLING

At the discretion of the NRC site representative, samples of miscellaneous material such as concrete, paint, sediment, drain, and dust residues may be collected from judgmental locations that are not accessible for direct survey or from locations of elevated direct gamma radiation detected by surface scans.

SOIL SAMPLING

ESSAP will judgmentally collect surface (0 to 15 cm) soil samples from various locations within each SU that is selected for confirmatory survey activities. Selected sample locations will focus on known areas of radiological releases from the Quehanna facility and major transport and trafficked areas. Additionally, locations exhibiting gamma radiation or surface beta levels distinguishable from background also will be selected for sampling.

Samples would also be collected from these areas below the initial 15 cm depth should field investigations indicate the potential for subsurface contamination. The number of soil samples collected will depend upon findings as the survey progresses and will be based on the results of surface scans. At a minimum, soil samples will be collected from randomly selected from 10% of the SCIENTECH soil sampling locations.

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and data will be returned to ORISE's ESSAP laboratory in Oak Ridge, Tennessee for analysis and interpretation. Samples will be analyzed in accordance with the ESSAP Laboratory Procedures Manual (ORISE 2004d). Smears will be analyzed for gross beta activity using a low background gas proportional counter. Smear data and direct measurements for surface activity will be converted to units of disintegrations per minute per 100 square centimeters (dpm/100 cm^2). Exposure rates will be reported in microroentgens per hour (μR/h). Soil and miscellaneous samples will be analyzed by wet chemistry for strontium and by gamma spectroscopy for gamma-emitting fission and activation products; the results will be reported in units of picocuries per gram (pCi/g). For gamma spectroscopy, the radionuclide of interest is Co-60; however, spectra also will be reviewed for other identifiable total absorption peaks (TAPs).

Results will be presented in a draft report and provided to the NRC for review and comment. Data and samples collected, as part of this survey, will be archived by ESSAP.

GUIDELINES

The primary contaminants of concern for the Quehanna Decommissioning Project are Sr-90 and Co-60 which were identified during characterization as the predominant radionuclides present on surfaces. The applicable NRC guidelines for surface contamination for Sr-90 and Co-60 are (NRC 1987):

	Surface Activity (dpm/100 cm^2)		
Radionuclide Contaminant	Average[a]	Maximum[b]	Removable[c]
Cobalt-60	5,000	15,000	1,000
Strontium-90	1,000	3,000	200

[a]Measurement of average activity should not be averaged over more than 1 m^2.
[b]The maximum contamination level applies to an area not more than 100 cm^2.
[c]The removable contamination level applies to an area not more than 100 cm^2.

ESSAP will use the more restrictive guidelines for strontium contamination for comparing confirmatory survey data.

The soil guidelines are as follows (NRC 1992):

Radionuclide	Soil Concentration Above Background (pCi/g) Average	Maximum
Cobalt-60	8	24
Strontium-90	5	15

The exterior exposure rate guideline is 10 μR/h above background (NRC 1991).

TENTATIVE SCHEDULE

Field Measurements	November 8 through 10, 2004
Sample Analysis	November/December 2004
Draft Reports	January 2005

A final report will be issued within 15 days of the receipt of the NRC comments on the draft report.

LIST OF CURRENT PROCEDURES

Applicable procedures from the ORISE ESSAP Survey Procedures Manual (September 2004) include:

Section 4.0 Quality Assurance and Quality Control

- 4.1 General Information
- 4.2 Training and Certification
- 4.3 Records and Reports
- 4.4 Equipment and Instrumentation
- 4.5 Sample Handling
- 4.6 Job Hazard Analysis – Sample Screening

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 The Bicron Micro-Rem Meter Check-Out
5.11 Floor Monitor Check-Out
5.14 Field Measuring Tape Calibration
5.18 Job Hazard Analysis - Instrumentation Calibration and Setup

Section 6.0 Site Preparation

6.1 Clearing to Provide Access
6.2 Reference Grid System
6.3 Job Hazard Analysis – Site Clearing and Gridding

Section 7.0 Scanning and Measurement Techniques

7.1 Surface Scanning
7.4 Beta Radiation Measurement
7.5 Gamma Radiation (Exposure Rate) Measurement
7.8 Job Hazard Analysis - Surface Scanning and Surface Activity Measurements

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
8.15 Sample Identification and Labeling
8.16 Sample Chain-of-Custody
8.17 Job Hazard Analysis - Sampling

Section 9.0 Integrated Survey Procedures

9.1 Background Measurements and Sampling

9.2 General Survey Approaches and Strategies

Section 10.0 Safety and Contamination Control

Applicable procedures from the ORISE/ESSAP Quality Assurance Manual (August 2004) include:

Section 3	Training and Certification
Section 4	Instrument Quality Control
Section 5	Sample Chain-of-Custody
Section 6	Analytical Quality Control
Section 7	Data Quality Control
Section 11	Critical Record Handling and Storage

REFERENCES

Oak Ridge Institute for Science and Education (ORISE). Document Review—Quehanna Decommissioning Project, Final Status Survey Plan [Docket No. 30-29288; RFTA No. 304-008]. Oak Ridge, Tennessee; August 19, 2004a.

Oak Ridge Institute for Science and Education. Survey Procedures Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; September 2, 2004b.

Oak Ridge Institute for Science and Education. Quality Assurance Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; August 31, 2004c.

Oak Ridge Institute for Science and Education. Laboratory Procedures Manual for the Environmental Survey and Site Assessment Program. Oak Ridge, Tennessee; August 31, 2004d.

SCIENTECH, Incorporated (SCIENTECH). Quehanna Decommissioning Project, Final Status Survey Plan. Revision 0, New Milford, Connecticut; June 22, 2004.

U.S. Nuclear Regulatory Commission (NRC). Current Guidelines on Acceptable Levels of Contamination in Soil and Groundwater in Property to be Released for Unrestricted Use. Washington, DC; January 1992.

U.S. Nuclear Regulatory Commission. Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). NUREG-1575; Revision 1. Washington, DC; August 2000.