Handcrafted American Glass Artistry

J-6

SUB-491
04003149

May 13, 2016

Mr. Dennis Lawyer
Health Physicist
U.S. Nuclear Regulatory Commission
Division of Nuclear Material Safety

RE: Final Status Survey Plan Revisions for Fenton Art Glass, Williamstown, West Virginia

Mr. Lawyer,

Enclosed is a revised Final Status Survey Plan prepared for the Fenton Art Glass facility located in Williamstown, West Virginia. Attachments:

1. **RSP-123 Final Status Survey of the Fenton Glass Facility Revision 1**
2. **Response to Request for Additional Information Concerning Application for a License Amendment, Control 589275**
3. **RSP-008 Instrumentation Uncontrolled**
4. **Floor Plan Fenton Glass Sample Locations**

If there are corrections or additions that are needed, please advise. If the plan is acceptable, Fenton Art Glass is prepared to move forward with the Final Status Survey in accordance with the enclosed plan and will submit the results of the Final Status Survey as soon as it is completed.

If in your review of the enclosed plan you find that you have questions or need additional information, please contact us. Bill Thomas of Plexus is available to discuss the plan.

Respectfully submitted,

George W. Fenton
President

Enclosure

589275

NMSS/RGN1 MATERIALS-002

100 YEARS 1905-2005

The Fenton Art Glass Company 700 Elizabeth Street Williamstown, WV 26187 304/375-6122 Fax 304/375-7533 www.fentonartglass.com

NMSS/RGN1 MATERIALS-002

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1 PURPOSE

This Radiation Safety Procedure (RSP) is intended for use in the final status survey (FSS) and release for unrestricted use at the Fenton Art Glass (Fenton Glass) facility located at 700 Elizabeth Street Williamstown, West Virginia.

2 SCOPE

This RSP is applicable to the acquisition of data by Plexus Scientific Corporation (Plexus) personnel that are necessary for decision-making regarding the release of building surfaces (i.e., walls, structural elements, floor) used or associated with depleted uranium and the production of Vaseline glass at Fenton Glass, hereinafter referred to as the "decommissioning project". Surveys performed for other purposes are exempt from the provisions of this RSP.

Note: Plexus is under contract to Fenton Glass to provide radiological support during the decommissioning project. Plexus' point of contact for this action is Mr. George Fenton (Direct (304) 375-6122 ext 233, Cell (304) 481 7641), e-mail gfenton@fentonartglass.com.

Note: Fenton Glass possesses a radioactive materials license issued by the U.S. Nuclear Regulatory Commission (USNRC) Number SUB-491, Docket Number 04003149. The license expired on November 30, 2015.

3 REFERENCES

3.1 Plexus Scientific Corporation, Radiation Safety Procedure No. RSP-002, "Definitions".

3.2 Plexus Scientific Corporation, Radiation Safety Procedure No. RSP-007, "Training in Radiation Protection".

3.3 Plexus Scientific Corporation, Radiation Safety Procedure No. RSP-008, "Instrumentation".

3.4 Plexus Scientific Corporation, Radiation Safety Procedure No. RSP-009, "Contamination Control".

3.5 Plexus Scientific Corporation, Radiation Safety Procedure No. RSP-018, "Surveillance".

3.6 Plexus Scientific Corporation, Radiation Safety Procedure No. RSP-019, "Smear and Leak Test Swab Counting".

3.7 Plexus Scientific Corporation, Radiation Safety Procedure No. RSP-020, "Tailgate Safety Training".

3.8 Plexus Scientific Corporation, Standard Operating Procedure No. SOP-013, "Field Project Management".

3.9 MARSSIM - U. S. Nuclear Regulatory Commission, NUREG-1575 (Rev. 1), "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)", August, 2000.

3.10 USNRC - U. S. Nuclear Regulatory Commission, USNRC Regulatory Guide No. 1.86, "Termination of Operating Licenses for Nuclear Reactors", June, 1974.

3.11 USNRC - U. S. Nuclear Regulatory Commission, NUREG-5512, "Residual Radioactive Contamination From Decommissioning - Parameter Analysis", Draft, October, 1999.

3.12 USNRC - U. S. Nuclear Regulatory Commission, NUREG-1757, "Consolidated Decommissioning Guidance Decommissioning Process for Materials Licensees", Volume 1, Revision 2, September, 2006.

3.13 USNRC - U. S. Nuclear Regulatory Commission, NUREG-1507, "Minimum Detectable Concentrations With Typical Radiation Survey Instruments For Various Contaminants and Field Conditions", June, 1998.

4 DEFINITIONS

The definition of terms used in this RSP that may not be commonly understood shall be found in RSP-002.

5 PROCEDURE

5.1 Responsibilities

5.1.1 The Vice President shall supply adequate resources to ensure compliance with this RSP.

5.1.2 The Project Manager shall:

5.1.2.1 Ensure current and proper calibration of all radiation detection instruments in the active inventory for this project.

5.1.2.2 Ensure the instrument being used meets the requirements outlined herein.

5.1.2.3 Maintain instrument calibration certificates on file for all radiation detection instruments used to implement this RSP.

5.1.2.4 Assure that all Health Physics Technicians acquiring data in support of restricted area release are properly trained in the provisions of this RSP.

5.1.2.5 Verify compliance with this RSP throughout the decommissioning project.

5.1.2.6 The Field Site Manager and Health Physics Technicians shall:

5.1.2.6.1 Verify that only calibrated radiation detection instruments are used;

5.1.2.6.2 Follow this RSP when acquiring data for use in demonstrating the release status of equipment, components and building surfaces;

5.1.2.6.3 Periodically review this RSP; and.

5.1.2.6.4 Ensure there is a controlled copy of this RSP in the field for the duration of the Decommissioning project.

5.2 Activity Coordination and Scheduling

5.2.1 Characterization, decontamination (as necessary), survey and release of building surfaces.

Note: All Characterization, segregation, decontamination , survey and release of equipment, machines and components in the restricted areas were completed prior to the release surveys of building surfaces that are the subject of this procedure.

5.2.2 Dates for completion of the building surface surveys in the following subsections shall be set by the Field Site Manager.

Note: The date for completion of the Decommissioning project is to be determined but is expected to be before July 31, 2016.

5.3 Release Criteria

5.3.1 The release criteria at the restricted areas shall assume the presence of depleted uranium on surfaces (i.e., Uranium-238, depleted in U235 and U234, and the decay progeny are not in secular equilibrium).

5.3.2 The criteria for release of building surfaces for unrestricted use shall be as shown in the following table (Ref. 3.11, Table 5.19):

Matrix	Radionuclide or Radiation Type	DCGL
Building Surfaces	Total (fixed plus removable) alpha activity	100 dpm/100 cm2
	Removable alpha activity	10 dpm/100 cm2
Direct Exposure Rates in Accessible Areas	Beta/gamma radiation	10 microR/hr above background

5.3.3 Individual measurement detection levels that exceed 50% of the criteria shown in 5.3.2, above shall have an accompanying explanation.

5.3.4 The criteria for release of equipment and construction debris for unrestricted use shall be consistent with the limits established by the USNRC, Reg Guide 1.86 (Ref. 3.10).

5.3.5 The volumetric release criteria for depleted uranium is defined in NUREG 1757, Appendix B, Table (Ref 3.12).

5.4 Instrumentation and Detection Limits

5.4.1 The following instruments (or equivalent) shall be used for general survey or data acquisition purposes:

Probe Model	Meter Model	Detector Area (cm2)	Purpose
Ludlum 44-10 Pancake GM	Ludlum Model 12 (or equivalent)	15	Gross beta/gamma stationary measurements of total beta/gamma activity on surfaces.
Ludlum Model 43-89 Alpha/Beta Phoswich	Ludlum Model 2224 Scaler, Ratemeter (or equivalent)	125	Gross alpha and beta/gamma scans and stationary measurements of total alpha or beta/gamma activity on surfaces.
Ludlum Model 43-93 Alpha/Beta Phoswich	Ludlum Model 2360 Scaler, Ratemeter, Data Logger (or equivalent)	100	Gross alpha and beta/gamma scans and stationary measurements of total alpha or beta/gamma activity on surfaces.

Probe Model	Meter Model	Detector Area (cm2)	Purpose
Ludlum Model 239-1F Alpha/Beta Proportional Detector (floor monitor)	Ludlum Model 2360 Scaler, Ratemeter, Data Logger (or equivalent)	584	Scans for total gross alpha and beta activity
NA	Ludlum Model 19 MicroR Meter (or equivalent)	NA	Exposure rate determinations and gross categorization/segregation of Items for radiological/non-radiological management.
Ludlum Model 43-10-1	Ludlum 2929 Dual Scaler (or equivalent)	NA	Removable contamination surveys (i.e., gross alpha or beta activity on smears).

5.4.2 As applicable, detectors shall be connected to a rate meter capable of providing the necessary voltage to the detector and providing a read-out in "counts per minute".

Note: The detector voltage should be set according to the manufacturer's recommendations and at the voltage used during the most recent calibration.

5.4.3 Detectors and rate meter pairs shall be calibrated daily before each use and as necessary to confirm instrument response as described in Section 5.5, below.

5.4.4 The nominal detection limits for the survey instruments was calculated using the guidance in NUREG 1507 (Ref 3.13) and is as follows:

Probe Model	Background (cpm)		Efficiency (c/d)		Scanning MDA (dpm/100cm2)		Static MDA (dpm/100cm2)	
	α	β	α	β	α	β	α	β
Ludlum 44-10 Pancake GM	NA	40	NA	0.19	NA	NA	NA	1,129
Ludlum Model 43-89 Alpha/Beta Phoswich (125 cm2)	2	134	0.18	0.13	177	1,006	3	7
Ludlum Model 43-93 Alpha/Beta Phoswich (100 cm2)	1	158	0.22	0.19	114	833	3	7
Ludlum Model 239-1F Alpha/Beta Proportional Detector (584 cm2)	4	480	0.13	0.19	56	210	3	4
Ludlum Model 43-10-1	0	48	0.38	0.33	NA	NA	3	4

5.4.5 Scan speed is no faster than 2 cm/sec. See Section 5.9.

5.4.6 Stationary count time is assumed to be no less than two (2) minutes unless modified. See Section 5.10.

5.4.7 Count time for samples of removable activity is at least two (2) minutes. See Section 5.11.

5.5 Daily Instrument Response Checks

5.5.1 Response checks shall be performed and documented daily before use, at the end of the day, and whenever instrument performance is questioned in order to:

5.5.1.1 Assure constancy in instrument response;

5.5.1.2 Verify the detector is operating properly;

5.5.1.3 Determine efficiencies and detection limits, as applicable;

5.5.1.4 Confirm its response is similar to its calibrated response; and

Note: Constancy is determined by comparing the background and source count rates to the 2σ and 3σ values on the applicable 10-point sheet (see RSP-008, Attachment 8.15).

5.5.1.5 Demonstrate that measurement results are not the result of detector contamination or failure.

5.5.2 If an instrument fails a response check or if the response exceeds the 3σ range, it shall not be used until the problem is resolved.

5.5.3 Check Sources

5.5.3.1 All sealed radiation sources used for daily instrument response checks shall be representative of the instrument's response to the identified radionuclides and, as applicable, traceable to NIST.

Note: Photon instrument daily response checks do not require NIST-traceable sources.

5.5.3.2 The following sources shall be made available on-site for the duration of the Decommissioning project:

5.5.3.2.1 NIST-traceableThorium-230 for alpha-sensitive instruments;

5.5.3.2.2 NIST-traceable Technetium-99 for beta-sensitive instruments; and

5.5.3.2.3 Cesium-137 for functionality testing only of photon-sensitive instruments.

5.5.3.3 The Field Site Manager shall control the use and storage of radiation sources throughout the Decommissioning project.

5.5.4 Response Check Procedure

5.5.4.1 The numerical response (or functionality determination) of each instrument shall be entered into a spreadsheet entitled "Daily Instrument Response Checks" (see Attachment 8.1).

5.5.4.2 One spreadsheet shall be maintained for each instrument (detector plus meter) in use.

5.6 Mobilization

5.6.1 See the Field Project Authorization Form (SOP-013) prepared by the Project Manager for the listing of equipment, supplies, licensing and other instructions.

5.6.2 All field personnel shall:

5.6.2.1 Participate in a readiness review lead by the Field Site Manager;

5.6.2.2 Receive training in the requirements of this RSP;

5.6.2.3 Receive radiation safety training as required in RSP-007;

5.6.2.4 Participate in any Fenton Glass mandated safety training the first day on site;

5.6.2.5 Participate in a daily safety briefing as required in RSP-020; and

5.6.2.6 Perform work or collect data as so assigned by the Field Site Manager.

5.7 Coordination of Facility Release Surveys

5.7.1 Release surveys of building surfaces shall be performed in the following specific order within each survey unit:

Note: The specific order is necessary in order to ensure one measurement does not interfere with accurate data acquisition for any follow-up measurements.

5.7.1.1 Marking of survey unit numbers, measurement locations on surfaces and locations with coverings (e.g., chalk, paint).

Caution: Do not mark stationary measurement locations in the exact spot where the measurements are to be performed. Magnets, magnetic tags or chalk outlines using templates that are larger than detector dimensions are preferred in these locations.

5.7.1.2 Surface scans (if required, refer to note in 5.9.1)

5.7.1.3 Stationary measurements.

5.7.1.4 Removable contamination survey measurements (smear collection).

5.7.1.5 Quality control measurements (duplicate or biased smears and stationary measurements).

5.7.1.6 Evaluation of residual radioactivity for painted surfaces as described in 5.13, below.

5.7.1.7 Smear counting.

5.7.2 Each survey unit shall be assigned a unique number by the Project Manager that is recorded on a "Survey Unit Log".

Note: The survey unit number may be assigned at a later date.

5.7.3 Each measurement location (i.e., stationary count and smear) shall be assigned a unique location number as shown on the "Survey Unit Log" (see Attachment 8.2), or equivalent.

5.7.4 Measurement location markings shall be protected to the extent practical from removal or fading until authorized by the USNRC.

5.8 Survey Unit Dimensions and Measurement Locations

5.8.1 The following are the survey unit classifications and survey coverage:

Area Classification	Maximum Dimensions of a Survey Unit (m2)	No. Stationary Measurement and Smears per Survey Unit	Scan Coverage per Survey Unit
1	100	18 + dup	100%
2	1,000	18 + dup	10-30%
3	No limit (surveyor judgement)	18 + dup	Surveyor judgement

5.8.2 Survey unit assignments shall be as shown in Attachment 8.3.

5.8.2.1 Measurement locations shall be marked as follows:

5.8.2.2 18 systematic locations will be selected using a triangular grid pattern within each survey unit.

Note: If area is reclassified Class 1 or Class 2, then the number of measurements (NR) for the survey unit shall be determined using method per NUREG 1575.

5.8.2.3 Systematic spacing on a triangular grid using a grid spacing of less than 2.5 meters shall be used to position measurement locations within each SU.

5.8.2.4 The location of the static measurements will be evenly distributed over the SU on a triangular grid and placed around fixed furniture and structural members.

5.8.2.5 The location of the initial stationary measurement will selected by the surveyor in a random manner. Subsequent locations are selected in a systematic manner. The surveyor will start the measurement for the initial location, near the wall, to the right of the door.

5.8.2.6 Biased measurement locations identified during surface scans may, at the discretion of the surveyor and included in the data set as additional measurements beyond the required minimum number.

5.9 Performing Surface Scans of Building Surfaces

5.9.1 Scan data for alpha activity shall be acquired as instructed in RSP-018.

Note: For purposes of this procedure, the room under the Feldspar Silo, the Color Mixing Room, hallway and travel path to Furnace Tank 8 are currently considered to be Class 1. Surface scans will be performed on 100% of the floor and applicable walls. The adjacent areas, the laboratory, the Batch Mixing room, floor area surrounding Furnace Tank 8 are classified as Class 3. As such, surface scans will only be performed if biased, fixed readings are

found to be above the release criterion in 5.3.2 above. Furthermore, if measurement results are found to be above the 5.3.2 criterion, then this procedure will be revised to reflect the reclassification to a Class 1 or Class 2, as appropriate.

5.9.2 A data logger shall be used to capture scan data.

5.9.3 Scans within a single survey unit shall be completed within one day and with the same detector/rate meter pair.

Note: The data interpretation process becomes significantly more complicated when multiple people/instruments/days acquire data in a single survey unit, thus instrument/day limitations should be enforced except in the case of instrument failure or if there is a need to supplement scan data at later dates.

5.9.4 Scan speeds shall be no faster than two (2) centimeters per second.

5.9.5 Locations exhibiting elevated alpha count rates shall be marked during the performance of the scan, with the maximum measured alpha count rate location clearly identified and marked.

Caution: Surveyors should monitor the audible signal from the alpha channel during scans to ensure no elevated areas are missed. If elevated count rates are noted, confirmation that they are the result of the alpha radiation should be made. If so, the dimensions of the elevated area should be marked, measured, and recorded.

Note: Stationary measurements as directed in Section 5.11 must be performed in all marked locations.

5.9.6 After scanning is complete, or if 400 collection units are reached, data shall be downloaded onto the designated personal computer.

5.9.7 After scans are complete:

Note: To optimize data management, conversion of data as described herein should take place once each day but no less frequent than once every three days.

5.9.7.1 Scan data shall be converted into spreadsheet format as instructed in RSP-039.

Note: The Field Site Manager may elect to e-mail the field data spreadsheets to the Project CHP for entry into the FSS workbooks. The Project CHP, after reviewing those spreadsheets, will contact the Field Site Manager if there are any issues, areas that require additional data acquisition, or other corrective actions, such as decontamination.

5.9.8 One spreadsheet shall be maintained for each survey unit.

5.9.9 If the detection levels calculated in the FSS Workbook for the survey unit in question are not sufficiently low (Attachment 8.5), then area shall be re-surveyed using a slower scan speed.

Note: Contact the Project CHP for assistance in optimizing scan speeds to ensure the detection level requirement in Section 5.3.2 is achieved.

5.10 Performing Stationary Counts on Building Surfaces

5.10.1 Stationary count data for alpha radiation shall be acquired as instructed in RSP-018.

5.10.2 Stationary counts within a single survey unit shall be completed within one day and with the same detector/rate meter pair.

Note: The data interpretation process becomes significantly more complicated when multiple people/instruments/days acquire data in a single survey unit, thus instrument/day limitations should be enforced except in the case of instrument failure or if there is a need to supplement stationary count data at later dates.

5.10.3 The starting point (location) for the first stationary count is selected in a random manner by the surveyor. See Section 5.8.

5.10.4 The following data shall be acquired at each stationary count location:

5.10.4.1 Gross alpha counts with the detector in an open window configuration.

5.10.4.2 Gross alpha counts with the detector in a shielded window configuration.

5.10.4.3 Raw data may be captured by one of the following methodologies:

5.10.4.3.1 In a data logger as instructed in RSP-039; or

5.10.4.3.2 On a "Raw Data Capture Sheet" (see Attachment 8.4) if data loggers are not used.

Note: To minimize data handling time and the potential for transcription errors, the use of data loggers is preferred.

5.10.4.4 Data acquisition times (i.e., integration times or count times) shall be no less than two (2) minutes.

Note: Count times may be adjusted up or down by the Project CHP depending on background count rates and the resulting detection levels. If the detection levels are achievable with lesser count times, they may be so authorized.

5.10.4.5 Duplicate measurements shall be performed at the following minimum frequency:

5.10.4.5.1 Once per survey unit; or

5.10.4.5.2 Once every 18 measurements.

5.10.4.6 After stationary counts are complete, data shall:

5.10.4.7 Be converted into spreadsheet format as instructed in RSP-039 if captured in a data logger; and

5.10.4.8 Entered into a FSS Workbook upon return to the Plexus office (see Attachment 8.5).

5.10.5 If the detection levels calculated in the FSS Workbook greater than the measurement criteria shown in 5.3.2, above, that location shall be re-surveyed with a longer data acquisition time.

Note: Contact the Project CHP for assistance in optimizing count times to ensure the detection level requirement in Section 5.3.2 is achieved.

5.10.6 If any data points are greater than the applicable measurement criterion shown in 5.3.2, above, the dimensions of the elevated area and the survey unit dimensions shall be recorded and an Elevated Measurement Comparison (EMC) evaluation shall be performed.

Note: For stationary measurements, the EMC is equal to 4.0 times the DCGL. However, SU-specific EMCs, using the area factors in Table 5.7 of MARSSIM (Ref 3.9), can be used if so approved by the Project CHP.

5.11 Performing Removable Contamination Surveys (smears)

5.11.1 Removable contamination surveys shall be performed as instructed in RSP-018.

5.11.2 Smears collected within a single survey unit shall be analyzed on the same day and with the same smear counter.

Note: The data interpretation process becomes significantly more complicated when smears are counted with multiple instruments/days, thus instrument/day limitations should be enforced except in the case of instrument failure or if there is a need to supplement smear data at later dates.

5.11.3 Duplicate smears shall be collected immediately adjacent to the previous collection location at the following minimum frequency:

5.11.3.1 Once per survey unit: or

5.11.3.2 Once every 18 smears.

5.11.4 Smears shall be numbered as [SU No.- Location No. - Dup Status]

Note: For example, a smear collected from survey unit 1 at location 14 would be numbered 1-14. A duplicate smear from the same location would be numbered 1-14-d.

5.11.5 Smears shall be analyzed as instructed in RSP-019.

5.11.6 Count times for smears shall be two (2) minutes.

Note: Count times may be adjusted up or down by the Project CHP depending on background count rates and the resulting detection levels. If the detection levels are achievable with lesser count times, they may be so authorized.

5.11.7 Smear data shall be entered into the FSS Workbook for the survey unit in question (see Attachment 8.5).

5.11.8 If the detection levels calculated in the FSS Workbook are greater than the measurement criteria shown in 5.3.2, above, the smear shall be re-counted using a longer count time.

Note: Contact the Project CHP for assistance in optimizing count times to ensure the detection level requirement in Section 5.3.2 is achieved.

5.12 Evaluating Inaccessible Areas

Note: An inaccessible area is one that is too small to permit access by a radiation detector.

5.12.1 An attempt shall be made to collect removable activity from each inaccessible location using a smear.

5.12.2 The location and dimensions of the obstacle or covering shall be documented on the applicable survey map.

5.12.3 The obstacle shall be photographed.

5.13 Evaluating Painted or Covered Surfaces

5.13.1 If painted or covered surfaces are not evaluated, justification for that decision shall be documented for inclusion in the final status survey report.

5.13.2 Small area evaluations:

Note: A small area is one that is less than 100 cm^2 as measured using a pre-prepared template.

5.13.2.1 Perform a stationary measurement in that location.

5.13.2.2 Remove the paint (or other surface covering) before performing a second stationary measurement and smear collection in that location.

5.13.2.3 Document the location on the applicable survey map and describe the nature of the covering.

5.13.2.4 Document the approximate dimensions of the painted surface.

5.13.2.5 Photograph the location.

5.13.3 Large area evaluations:

Note: A large area is one that is greater than 100 cm^2 as measured with a pre-prepared template.

5.13.3.1 Scan the painted area to identify the 100 cm^2 area that exhibits the highest alpha activity.

5.13.3.2 Perform a stationary measurement in that location.

5.13.3.3 Remove the paint (or other covering) using sandpaper, ensuring all of the removed material, including the sandpaper, is placed into a sample collection container.

5.13.3.4 Wipe the cleaned area using a dissolvable filter, placing the filter into the sample collection container.

5.13.3.5 Label the collection container, log the sample into a chain-of-custody form, and forward the sample for analysis if so directed by the Project Manager (see RSP-026).

5.13.3.6 Perform a second stationary measurement over the cleaned location.

5.13.3.7 Perform a contamination survey over the entirety of the cleaned area.

5.13.3.8 Document the location on the applicable survey map, describe the nature of the covering, and record the survey results and sample number.

5.13.3.9 Document the approximate dimensions of the painted surface.

5.13.3.10 Photograph the location.

5.14 Performing Ambient Exposure Rates within Buildings

5.14.1 Ambient exposure rates shall be measured as instructed in RSP-018.

5.14.2 Measurements shall be performed at each stationary count location (see Section 5.11).

5.14.3 Raw data should be captured on a "Raw Data Capture Sheet" (see Attachment 8.4) or a blank spreadsheet extracted from a FSS Workbook (see Attachment 8.5).

5.14.4 Duplicate measurements shall be performed at the following minimum frequency:

5.14.4.1 Once per survey unit; or

5.14.4.2 Once every 18 measurements.

5.14.5 After exposure rates measurements are complete, data shall be entered into the FSS Workbook for the survey unit in question (see Attachment 8.5).

5.14.6 If the detection levels calculated in the FSS Workbook are greater than the measurement criteria shown in 5.3.2, above, that location shall be re-surveyed with either a longer data acquisition time or multiple measurements.

Note: Contact the Project CHP for assistance in optimizing measurement procedures to ensure the detection level requirement in Section 5.3.2 is achieved.

5.15 Evaluating Refractory Brick

5.15.1 Furnace 8 contains refractory brick that contains uranium and thorium as an intrinsic part of the entire refractory brick. In order to demonstrate that Furnace 8 does not contain levels of depleted uranium in excess of the criteria described in Section 5.2, an evaluation must be completed.

5.15.2 Collect at least five (5) wipe samples inside Furnace 8. Evaluate the wipe samples as described in Section 5.11. Confirm that the DCGL for removable activity is satisfied, as described in Section 5.3.

Caution: Do not enter a confined space. Collect the samples near the accessible opening and in an area within arm's reach. Confirm with representative from Fenton Glass that the furnace is de-energized and at ambient temperature.

5.15.3 Evaluate the presence of total uranium on the surface of the refractory brick and compare the results to equivalent measurements on refractory in furnaces that did not process deleted uranium.

5.15.3.1 Collect stationary measurements inside Furnace 8 in accessible areas. Summarize the data as described in Section 5.10.

5.15.3.2 Collect stationary measurements inside two (2) other furnaces. Verify with representatives of Fenton Glass that the furnaces did not process depleted uranium.

5.15.3.3 Compare the results and verify that the results are statically equivalent.

5.16 Photographs

5.16.1 Photographs shall be made to assist in documenting on-site activities and for future reference.

5.16.2 The following photographs shall be taken, at a minimum:

5.16.2.1 One photograph of the general area that holds the survey unit; and

5.16.2.2 One photograph of each survey unit.

5.16.3 The Field Site Manager, or designee, shall maintain a photo log that includes the photograph number, the date of the photo, and a short descriptive phrase that includes the survey unit numbers depicted in the photo, as applicable.

5.17 End of Day Activities

5.17.1 All Mylar windows on survey instruments shall be checked for light leaks, with windows replaced as required.

Note: Window changes can cause elevated phototube response that may take a few hours to clear. Therefore, to ensure instruments are available for use when needed, light leaks should be tested at the end of each work day.

5.17.2 Project team members shall deliver all hard-copy notes, records and log entries made during the day to the Field Site Manager for safe keeping.

Note: The Project Manager will advise the Field Site Manager as to when records should be transferred to the Plexus server for safe keeping.

6 EXEMPTION PROVISIONS

6.1 Changes to this RSP that do not reduce the inherent compliance with the Decommissioning Plan shall be permitted pursuant to the written authorization of the Project Manager and the Project CHP.

7 DOCUMENTATION

7.1.1 Field Logs

7.1.1.1 Project data shall be recorded in a field log (bound and with numbered pages), a Field Activity Daily Log form, or equivalent method of data and information recording.

Note: The contents of the logs maintained by all field personnel shall be subsequently transferred to an electronic format for inclusion in the project records.

7.1.1.2 Field logs shall be reviewed by the Project Manager at least weekly and after any significant event.

7.1.1.3 Each entry into a log shall be legible, factual, detailed, complete and shall be signed and dated by the individual making the entry.

7.1.1.4 If a mistake is made, the error shall have a single line drawn through it, with the initials of the person making the correction written next to the line.

Note: No erasures or "white out" use is permitted.

7.1.1.5 Electronic copies of all field notes and log entries shall be forwarded to the Project Manager as soon as possible after demobilizing from the site.

7.1.2 Survey Packages

7.1.2.1 A survey package shall be prepared for each survey unit.

7.1.2.2 Each survey package should contain or be associated with the following:

7.1.2.2.1 A cover sheet.

7.1.2.2.2 A copy of the applicable calibration certificate for each instrument used to acquire data.

7.1.2.2.3 A copy of the applicable "Daily Instrument Response Check" sheet.

7.1.2.2.4 A copy of the applicable "Survey Unit Scan Results" sheet.

7.1.2.2.5 A copy of the applicable "Survey Unit Stationary Count Results" sheet.

7.1.2.2.6 A copy of the applicable "Removable Contamination Survey Results" sheet.

7.1.2.2.7 A map showing the location of all measurements and issues of interest (i.e., surface coverings).

7.1.2.2.8 Photo documentation showing the location of all measurements and issues of interest, and an indication of where the survey unit sits with respect to the rest of the floor.

7.1.2.3 Each page of the survey package shall be reviewed for completeness and accuracy, and initialed/dated in the bottom right corner by the Project Manager, the Project CHP and the Quality Assurance Officer.

7.1.3 Electronic Records

7.1.3.1 To avoid damage or loss, all electronic data shall be protected.

7.1.3.2 All electronic information acquired for the project shall be downloaded from its collection device (e.g., laptop computers, data loggers, etc.), or scanned if hard copy, on a daily basis and forwarded to the Plexus server.

Note: There are multiple levels of redundant and recoverable storage/backup on the Plexus SharePoint.

8 ATTACHMENTS

8.1 Daily Instrument Response Check

8.2 Survey Unit Log

8.3 Survey Unit Design

8.4 Raw Data Capture Sheet

8.5 Final Status Survey (FSS) Workbook

ATTACHMENT 8.1
DAILY INSTRUMENT RESPONSE CHECK SPREADSHEET

RSP-008, ATTACHMENT 8.17

CONTAMINATION SURVEY INSTRUMENT DATA SHEET

GENERAL INFORMATION		
Project No:		
Meter Model No.:		
Probe Model No.:		
Detector Area (cm1):		
Background Location:		
Count time (min)		
Alpha Check Source No:		
Radionuclide:		
Activity (dpm):		
Beta Check Source No:		
Radionuclide:		
Activity (dpm):		
Analysis Performed By:		

***Area for smear counter is 100*

Date: ______________________ **Signat** ______________________________

Date	Units	Start of Shift Background (alpha)				Start of Shift Background (beta)				End of Shift Background (alpha)				End of Shift Background (beta)				Source Check (alpha)		Source Check (beta)		MDA (dpm)	
		1	2	3	Average (cpm)	1	2	3	Average (cpm)	1	2	3	Average (cpm)	1	2	3	Average (cpm)	Source counts	Eff.	Source counts	Eff.	Alpha	Beta
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***Delete "#DIV/0!" and "#VALUE!" entries in above columns for final statistics to work*				Average	#DIV/0!				#DIV/0!				#DIV/0!				#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!
				Std. Dev	#DIV/0!				#DIV/0!				#DIV/0!				#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!
				Min	#DIV/0!				#DIV/0!				#DIV/0!				#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!
				Max	#DIV/0!				#DIV/0!				#DIV/0!				#DIV/0!		#DIV/0!		#DIV/0!	#DIV/0!	#DIV/0!
				No. Meas	0.00				0.00				0.00				0.00		0.00		0.00	0.00	0.00

ATTACHMENT 8.2
SURVEY UNIT LOG

Survey Unit No.	Descriptor	Location ID/Notes	Area (m2)	No. Meas.	No. Dup.	Scan Coverage	Scan HP	Stationary HP	Smear HP

ATTACHMENT 8.3
SURVEY UNIT DESIGN

Room Name	Survey Class	Floor Dimensions (m2)	Wall Dimensions (m2)	No. Survey Units	Additional Issues to be Addressed
Color Mixing room	1	38	67	1	Storage Containers
Walkway to Furnace 8	1	55	12	1	Interior of Furnace
Laboratory	3	61	67	1	
Floor Area Surrounding Furnace 8	3	Subject to Surveyor Discretion	0	1	Includes the sidewalk leading to the Feldspar Silo
Room under the Feldspar Silo	1	17	27	1	
Batch Mixing Room	3	76	140	1	

ATTACHMENT 8.4

RAW DATA CAPTURE SHEET

Survey No.:		Surveyor:			
Area Description:		Survey Unit No.:		Date of Survey:	
Meter SN:		Probe SN:		Cal Due:	
Count Time (min):		Alpha Eff (c/d):		Beta Eff (c/d):	
Action Levels (DCGL × Eff × Count Time):		*Alpha (counts):*		*Beta (counts):*	
Location ID	Measurement No.	Shielded		Unshielded	
		Alpha	*Beta*	*Alpha*	*Beta*

ATTACHMENT 8.5
FSS Workbook
(Spreadsheet version located on SharePoint)

Plexus Scientific Corporation
Nuclear Solutions Division
7130 Minstrel Way, Suite 215
Columbia, Maryland 21045
(443) 319-8055
www.plexsci.com

May 13, 2016

George Fenton
Fenton Art Glass Company
700 Elizabeth Street
Williamstown, WV 26187

Re: Response to Request for Additional Information Concerning Application for a License Amendment, Control 589275

Dear Mr. Fenton:

As we discussed, the Nuclear Regulatory Commission requested additional information regarding the final status survey at your facility in Williamstown, West Virginia. Attached are the responses that I recommend you provide to the NRC, describing the details of the final status survey plan.

Please let me know if you have any questions.

Sincerely,

Bill Thomas

Bill Thomas, CHP
Vice President, Nuclear Solutions Division

Attachment

Attachment 1

Response to Comments

Fenton Art Glass, Control 589275

The NRC reviewed the final status survey plan, RSP-123, Rev 0, dated May 3, 2016, and provided the following comments. A response is provided for each comment. And the survey plan was revised as described in the Response.

	Comment	Response
1	There is no discussion of site characterization, work history, site description within this survey plan. You may refer to your earlier description in the March 8, 2016, letter but since you are using a new consultant, this should be addressed. Without a site characterization, work history, and site description, survey design and locations cannot be determined to be satisfactory. Please provide site characterization, work history, and site description.	The previous site characterization, work history and site description was provided by MSES in their report, "*Final Status Survey Plan For Termination of License for Fenton Art Glass Williamstown, West Virginia*", dated March 8, 2016, previously reviewed by the NRC. The information provided in the MSES report was used to develop the procedure to complete the final status survey, RSP-123. The report, describing the final status survey, will be referenced in the Final Status Survey report and summarize the site description.
2	Step 5.3.4 states that the release of equipment and construction debris for unrestricted release shall be consistent with the limits established by Regulatory Guide 1.86. This is the guide for release of equipment and items but is not allowed for volumetrically contaminated material. If release criteria is needed for volumetrically contaminated debris material, the criteria will need to be submitted and reviewed.	The text was revised. Based on the site characterization, the potential impacts are on the surface only. It is assumed that there is no volumetric impacts. However, if the release of equipment and construction debris identifies potential impacts, discrete samples will be collected and analyzed by a qualified radiochemistry laboratory. The results will be compared to the screening criteria provided in NUREG 1757, Volume 1, Appendix B. Specifically, construction debris will be released for unrestricted use if the concentrations of uranium 238 are less than 14 picocuries per gram (pCi/g).
3	Step 5.4.5 states to use 2 cm/sec scan rates on all instruments. Then it states that the Project CHP can vary scan rates. With this process we cannot verify that you are using appropriate calculations methods for MDC scan rates and the factors being used in this calculation. It also does not provide what level of MDC scan rate is the minimum criteria in your survey. This also does not provide use of source efficiency. Please	The text has been revised. The scan rate is set at 2 cm/sec. The instrument MDC was calculated using the guidance in NUREG 1507 and the results are provided in Section 5.4.4. For your information, the following parameters were used • surface efficiency = 0.25 (alpha) • surveyor efficiency = 0.5 • Type I error = 0.95 • Type II error = 0.05 • d' = 3.28

	Comment	Response
	provide MDC scan rates, the variables used in the calculation, and the minimum sensitivity that will be achieved.	
4	Please provide a copy of RSP-008, "Instrumentation."	An uncontrolled copy of this standard operating procedure is provided with the transmittal to the NRC.
5	Step 5.8.2 states that the survey units are as assigned in Attachment 8.3. Please provide a graphical presentation of the survey grids and their points. Additionally, provide justification that these contain areas of licensed activities.	A survey map is provided for the rooms and areas to be surveyed, including the Batch Mixing Room and the room under the Feldspar Silo, is provided in this transmittal. The justification for the areas to survey was provided in the report by MSES, dated March 8, 2016. See response to Question 1.
6	Based on licensing history, it was stated that a drum was stored in a field spar storage silo which contained radioactive material. Please state why this area is not included in the survey.	Table 8,3 was updated. This area is classified as a MARSSIM Class 1.
7	Based on licensing information submitted on March 6, 1978, the processing of material was once added in a batch mixing room. This room does not appear to be included in your survey units. Please perform a survey in this location.	Table 8,3 was updated. This area is classified as a MARSSIM Class 3.
8	Step 5.8.2.2 states that 18 systematic triangular grids will be used in a survey class one areas. The procedure does not justify the considerations that went into determining the number of grid locations.	The number of static measurements collected in each Class 1 survey unit was calculated using the guidance from NUREG 1575. Specifically, the relative shift was assumed to be 1.7 and a Type I error of 0.05 and a Type II error of 0.05. Given that uranium is present in the background, the Wilcoxon Rank Sum (WRS) test is used to evaluate the survey data. The minimum number of samples required is described in Table 5.3 of the MARSSIM Manual and the number (N/2) of samples is 15 static locations. Consistent with MARSSIM guidance, the number of samples was increased by 20% in order to account for a reasonable amount of uncertainty in the input parameters and allow some flexibility to account for lost or unusable data.

	Comment	Response
9	Step 5.8.2.3 states that there is a systematic spacing on a square grid. This appears contrary to the triangular grids stated in Step 5.8.2.2. Please confirm the method of grids being used.	The text was revised. A triangular grid, consistent with the guidance in NUREG 1575, will be used for each survey unit.
10	Step 5.8.2.6 states that the surveyor starts the initial stationary measurement in a random manner. What guidance is given to the surveyor to pick a random spot?	The text was revised. The surveyor enters the room and identifies an accessible area near the wall, right of the door. The surveyor selects the first survey location at a distance approximately equal to the equal distance grid dimension, away from the wall. The remaining of the survey locations are selected in a systematic manner and using a triangular grid, with the equal distance between each survey location.
11	Step 5.8.2.6.2 states that a biased measurement may take the place of a systematic measurement. What is the basis of doing this? Where is this located in guidance?	The text was revised. All static measurements will be systematic. Biased measurements will be collected in the event of elevated count rates during the scan.
12	Step 5.9.5 states that the surveyor must listen to alpha and beta counts. As the DCGL is in terms of alpha, the scan surveys sensitivity is normally done by section 6.7.2.2 of NUREG-1575. If the beta counts are on, please describe full detail on how scans are performed and how it can meet sensitivity criteria. Please describe or provide procedure when the surveyor obtains an alpha count.	The text was revised. During the scan, the alpha counts will be used to alert the surveyor about a potential area where elevated counts exist.
13	Step 5.9.9 states to re-perform scan if the detection rates are not sufficiently low. Please present the minimum criteria for scan MDC rates.	The nominal MDC for each instrument is provided in Section 5.4.4. Also see the response to Question 3.
14	Step 5.15 gives the survey steps for evaluating the refractory brick. The bricks' uranium content will be variable. Please describe the statistical tests what will be used to evaluate the results.	Static measurements will be collected inside Furnace 8 and at least 2 other accessible furnaces that have not processed uranium. The results from the two non impacted furnaces will be summarized, as an average, standard deviation and a 95% UCL will be calculated. The data from Furnace 8 will be summarized and compared to the non impacted furnaces.

	Comment	Response
15	The survey plan does not specify how the results of the other surveys will be evaluated to state if the facility meets the release criteria or not.	The survey results from each survey unit will be evaluated in a manner that is consistent with MARSSIM, NUREG 1575. The WRS test will be used to compare the results with the DCGL. If necessary, the Elevated Measurement Comparison (EMC) will be used to evaluate elevated results in small localized areas. A conclusion will be established for each survey unit, stating the survey unit can released for unrestricted use. When all survey units are released, a statement will be provided in the final report that states that the facility can be released for unrestricted use and the radioactive materials license can be terminated.

TABLE OF CONTENTS

1 PURPOSE

This Radiation Safety Procedure (RSP) describes the requirements for calibration and use of radiation survey instruments and for performing radiological surveillance by Plexus Scientific Corporation (Plexus) employees and project personnel.

2 SCOPE

This RSP applies to all radiological instrumentation used by Plexus employees or project personnel for radiation protection purposes. Instruments that are not used for radiation protection purposes are exempt from the requirements of this procedure.

3 REFERENCES

3.1 American National Standards Institute, "Radiation Protection Instrumentation Test and Calibration," N323-1997, 1997.

3.2 MARSSIM - U. S. Nuclear Regulatory Commission, NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual", December, 1997.

3.3 NUREG-1507, "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions", December, 1997.

3.4 Instrument instruction manuals published by the instrument manufacturers.

3.5 Plexus Radiation Safety Procedure No. RSP-004, "Radiation Protection Records".

3.6 Plexus Quality Policy Statement No. QPS-005, "Corrective Actions".

4 DEFINITIONS

The definition of terms used in this RSP that may not be commonly understood shall be found in RSP-002, "Definitions".

5 PROCEDURE

5.1 Responsibilities

5.1.1 The Vice President, Nuclear Solutions Division (Vice President) shall supply adequate resources to ensure compliance with this procedure.

5.1.2 The Radiation Safety Officer (RSO) shall:

5.1.2.1 Assure the adequacy of the radiation survey instrumentation program.

5.1.2.2 Ensure current and proper calibration of all radiation detection instruments in the active inventory.

5.1.2.3 Maintain instrument calibration certificates on file for all radiation detection instruments in the active inventory.

5.1.2.4 Assure that all Health Physics Technicians are properly trained in the provisions of this procedure.

5.1.2.5 Verify compliance with this procedure during planned and periodic audits of the radiation protection program.

5.1.3 Health Physics Technicians shall:

5.1.3.1 Verify that only calibrated radiation detection instruments are used.

5.1.3.2 Follow this procedure when performing radiological surveillance activities.

5.1.3.3 Update the Instrument Tracking Spreadsheet (see 5.3, below) for all instruments in their custody.

5.1.3.4 Periodically review this procedure.

5.1.4 The Instrument Program Manager shall:

5.1.4.1 Maintain all Certificates of Calibration on the Plexus Server.

5.1.4.2 Monitor the calibration status of all instruments in the Plexus inventory and notify responsible Health Physics Technicians when calibration is pending.

5.2 Radiation Survey Instruments

5.2.1 Instrumentation used by Health Physics Technicians shall:

5.2.1.1 Be of sufficient sensitivity and accuracy to assess the radiation exposure rates from radioactive materials which may be found at the project location;

5.2.1.2 Detect the presence of radioactivity on tools, equipment, clothing, materials, and personnel at all levels which may be found at a client site;

5.2.1.3 Have been calibrated within the past year;

5.2.1.4 Be in good working condition; and

5.2.1.5 Be of sufficient quantity to support on-going or planned operations.

Note: MARSSIM and NUREG-1507 describe the different methods for determining instrument sensitivity.

5.2.2 The basis for selection of instruments for use by Plexus shall include:

5.2.2.1 Type of radiation to be measured.

5.2.2.2 Sensitivity required.

5.2.2.3 Purpose of the survey.

5.2.3 Instruments maintained in the active inventory should be evaluated, tested, and documentation obtained, as appropriate, for the following:

5.2.3.1 Physical construction

5.2.3.2 Effect of shock, sound, vibration, electric transients, RF energy, magnetic fields and high humidity

5.2.3.3 Extent of switching transients, capacitance effects, geotropism and static charge effects

5.2.3.4 Power supply, including stability and battery life

5.2.3.5 Range, sensitivity, linearity, detection limit, and response to overload conditions

5.2.3.6 Accuracy and reproducibility precision

5.2.3.7 Energy dependence

5.2.3.8 Angular dependence

5.2.3.9 Response to ionizing radiation other than those being measured

5.2.3.10 Temperature and pressure dependence on measurements

Note: These tests are normally performed by the manufacturer and credit may be taken for the manufacturer's evaluation and testing. If credit is taken for the manufacturer's testing, a copy of the test results, in the form of instrumentation manuals or specification sheets, should be maintained along with instrument records. These results should be requested in the purchase order for each new instrument.

5.3 Instrument Tracking

5.3.1 All instruments in the Plexus inventory shall be entered into the Instrument Tracking Spreadsheet.

Note: The Instrument Tracking Spreadsheet is located on the Plexus server (Public Folder/Plexus Instrumentation Program/Instrument Tracking Spreadsheet).

5.3.2 One spreadsheet page shall be assigned to each instrument that captures the following:

5.3.2.1 Instrument name, make, model and serial number;

5.3.2.2 As applicable, the probe name, make, model and serial number;

5.3.2.3 Date of last entry into the spreadsheet;

5.3.2.4 Date of last calibration;

5.3.2.5 Current location of the instrument; and

Note: Location designators are 1 = Ohio(Cleveland) office, 2 = Maryland office; 3 = Ohio(Findlay) office; 4 = Out for Rental; 5 = Out for Calibration and 6 = Job Site.

5.3.2.6 Notes or items of interest to others.

5.3.3 The health physics technician with current custody of an instrument is responsible for updating the spreadsheet whenever action is taken (e.g., instrument sent for calibration, instrument sent to another Plexus office, instrument taken out of service, instrument returned from calibration with new due date, etc.)

5.3.4 The original copy of each calibration certificate shall be forwarded to the Instrument Program Manager after the date of calibration has been updated in the instrument Tracking Spreadsheet.

5.3.5 The Instrument Program Manager shall scan each calibration certificate and store same on the Plexus server (active file).

5.4 Instrument Calibration

5.4.1 Instruments shall be calibrated as noted in the Attachment 8.1 through Attachment 8.15 and following significant repairs to the rate meter and/or detector.

Note: Cable of equal length, battery, and mylar window changes may not necessitate re-calibration, depending upon whether such action induces response changes. A note of the change(s) made should be included on the applicable daily check sheet (Attachment 8.18 through 8.21).

5.4.2 Instruments not listed in Attachment 8.1 through Attachment 8.15 should be calibrated as recommended by the vendor until such time as an instrument-specific attachment is prepared for this RSP.

5.4.3 Each rate meter should be calibrated with a specific detector, designated by the detector serial number.

Note: The use of a ratemeter with a different detector may constitute the use of an un-calibrated meter.

5.4.4 A contractor shall provide calibration services using radiation sources which are traceable to the National Institute of Standards and Technology (NIST).

5.4.5 Instruments shall be calibrated according to the guidelines of ANSI-N323-1997, "Radiation Protection Instrumentation Test and Calibration".

5.4.6 A Request for Instrument Calibration Sheet (see Attachment 8.16) should accompany each instrument sent for calibration.

5.4.7 The Certificate of Calibration shall cite the applicable standard used, certify that radiation sources are traceable to NIST, and provide both pre- and post-calibration responses.

5.4.8 The contractor shall be the manufacturer of the instrument or an individual/firm that has been pre-qualified by the RSO.

5.4.9 Calibration schedules should be staggered to maintain at least one calibrated contamination survey meter, one calibrated ambient exposure rate instrument, one calibrated high-range exposure rate instrument, and one calibrated stationary smear counter available at all times.

5.4.10 If the Certificate of Calibration indicates an out-of-tolerance condition for a pre-calibration response, the following shall be performed:

5.4.10.1 A memo justifying the acceptability of the out-of-tolerance condition shall be written and attached to the Certificate; or

5.4.10.2 The use records for that instrument over the previous calibration period shall be evaluated for continued acceptability and corrections made pursuant to QPS-005, as necessary.

5.5 Instrument Efficiency

Instrument efficiencies used to interpret contamination survey data for the applicable radiation type (i.e., Tc-99 betas; Th-230 alphas) using hand-held instruments shall be taken from the current calibration certificate.

5.6 Source-to-Detector Correction

5.6.1 Contamination survey instruments shall be calibrated with the NIST-traceable source on contact with the detector face.

5.6.2 In the field, the instrument efficiency as determined in Section 5.5, above, shall be corrected for the actual source-to-detector (i.e., E_D) distance.

5.6.3 The following are the E_D values for beta-emitting radionuclides:

Distance From Detector Face to Surface (cm)	Source-to-Detector Correction (E_D)					
	Ni-63 (Disc)	C-14 (Disc)	Tc-99 (Disc)	Tc-99 (Distributed)	Tl-204 (Disc)	Sr/Y-90 (Disc)
Contact	1	1	1	1	1	1
0.5	0.381	0.786	0.864	0.803	0.910	0.9189
1	0.196	0.648	0.7779	0.701	0.836	0.8534
2	0.038	0.431	0.5920	0.503	0.645	0.6995

5.6.4 The following are the E_D values for alpha-emitting radionuclides:

Distance From Detector Face to Surface (cm)	Source-to-Detector Correction (E_D)		
	Pu-239 (Disc)	Th-230 (Disc)	Th-230 (Distributed)
Contact	1	1	1
0.5	0.808	0.812	0.761
1	0.656	0.606	0.579
2	0.1974	0.0423	0.0990

Note: Unless otherwise specified in the work plan, the Tc-99 (Distributed) and Th-230 (Distributed) values, on contact with the surface should be used for stationary measurements.

Note: Unless otherwise specified in the work plan, the Tc-99 (Distributed) and Th-230 (Distributed) values, at 0.5 cm from the surface, should be used for stationary measurements.

5.7 Reference Source Response

Note: Upon receipt from calibration, reference source responses shall be performed with all applicable check sources/source sets available at the specific Plexus office.

5.7.1 The response of each instrument to all applicable reference sources placed in a repeatable position shall be determined before the instrument is placed into active use and after each calibration.

Note: For contamination survey instruments, all sources should include Sr-90, Tc-99, C-14 and Th-230.

5.7.2 With the instrument switch position noted, the reference source and detector shall be placed in the reference position and the instrument shall be allowed to stabilize.

5.7.3 A minimum of ten (10) data points shall be acquired and documented on an "Instrument Response Record (10-Point Check)" form (Attachment 8.17).

Note: For instruments with both a scaler and rate meter mode, data shall be acquired for both modes.

5.7.3.1 For most detectors, the first reference position shall be at the center of the detector face and at the specified distance from the face.

5.7.3.2 The following nine data points shall be acquired after lifting and repositioning the detector over the reference source each time.

5.7.3.3 For large area detectors (i.e., Ludlum Model 43-37 floor monitor), the reference position shall be moved for each of the 10 measurements such that the entire surface of the detector is covered.

5.7.3.4 For exposure rate meters (i.e., Ludlum Model 19 microR meter), the reference position shall be moved for each of the 10 measurements such that all three of the "dimples" in the detector case are covered.

5.7.4 Control levels shall be determined as follows:

5.7.4.1 The arithmetic mean, the standard deviation, and the 2σ and the 3σ values from the 10 data points shall be determined.

5.7.4.2 The mean measurement ± the 2σ value, and the mean measurement ± the 3σ value should be recorded on a label affixed to the instrument, if space is available, and transferred to the applicable daily instrument check sheet (Attachment 8.18 through Attachment 8.21).

5.7.5 The 10-point check results, on Attachment 8.17 or equivalent, shall be placed onto the Plexus server with the calibration certificate.

Note: For some instruments, recording the acceptable ranges on the calibration label may be helpful during field use.

5.8 Reference Background Response

5.8.1 The response of each instrument in a reference background location shall be determined before the instrument is placed into active use and after each calibration.

Note: Material-specific backgrounds may differ significantly from the reference background response, depending upon the location or surface used for the reference background response. In that case, the Project CHP should be contacted for assistance in preparing a site-specific background.

5.8.2 With the instrument switch position noted, the detector shall be placed in the reference position and the instrument shall be allowed to stabilize.

5.8.3 A minimum of ten (10) data points shall be acquired and documented on an " Instrument Response Record (10-Point Check)" form (Attachment 8.17).

Note: For instruments with both a scaler and rate meter mode, data shall be acquired for both modes.

5.8.4 Control levels shall be determined as follows:

5.8.4.1 The arithmetic mean, the standard deviation, and the 2σ and the 3σ values from the 10 data points shall be determined.

5.8.4.2 The mean measurement ± the 2σ value, and the mean measurement ± the 3σ value should be recorded on a label affixed to the instrument, if space is available, and transferred to the applicable daily instrument check sheet (Attachment 8.18 through Attachment 8.21).

5.8.5 The 10-point check results, on Attachment 8.17 or equivalent, shall be placed onto the Plexus server with the calibration certificate.

Note: For some instruments, recording the acceptable ranges on the calibration label may be helpful during field use.

5.9 Pre-operational, End of Shift, and Post-repair Checks

5.9.1 Each instrument shall be labeled with a unique identifier (e.g., serial number of detector and rate meter) to enable traceability to surveys and records.

5.9.2 Prior to each use, daily when kept in use, at the end of each work shift, or after a minor repair (i.e., window change), each instrument shall be checked for the following, as applicable:

5.9.2.1 Battery function.

5.9.2.2 High voltage.

5.9.2.3 Response to a reference source.

5.9.2.3.1 If any response exceeds the mean measurement $\pm$ the 3σ value, that instrument shall be removed from service.

Note: The Project CHP should determine what actions should be taken in order to assess the validity of data acquired over the day.

5.9.2.3.2 If any two consecutive daily responses exceed the mean measurement $\pm$ the 2σ value, the instrument may be removed from service pending an evaluation of its operational status.

5.9.2.4 Reset Button function.

5.9.2.5 Audible response function.

5.9.2.6 Physical damage.

5.9.2.7 Current calibration sticker.

5.9.2.8 Response to background radiation.

5.9.2.8.1 Response to background radiation should be determined at a reproducible location that is in the vicinity of but not near known radiation sources or radiation-producing machines.

5.9.2.8.2 Three readings should be obtained at the start and end of each work shift, and after minor repairs (i.e., window change).

5.9.3 The results of the daily check should be recorded on the "Photon Instrument Daily (QC) Check Sheet" (Attachment 8.18 or 8.19) or the "Contamination Instrument Daily (QC) Check Sheet" (Attachment 8.20 or 8.21).

Note: Users may select from sheets that accommodate start- and end-of-shift readings, or start-of-shift readings only. The selection of the correct sheet should be specified in the work plan.

5.9.4 Instruments failing any pre-operational, end-of-shift or post-repair check shall be taken out of service, segregated from other instruments, tagged as "out of service", and repaired and calibrated, if required, prior to use.

6 EXEMPTION PROVISIONS

Variances and exceptions to the requirements of this RSP shall be permitted pursuant to the written authorization of the RSO and the Vice President.

7 DOCUMENTATION

7.1 All records pertinent to this procedure shall be maintained pursuant to RSP-004.

7.2 The following records shall be maintained:

7.2.1 Instrument calibration and maintenance records.

7.2.2 Manufacturer instruction manuals for each type of rate meter and detector.

7.3 All forms associated with the implementation of this procedure shall be completed in their entirety (i.e., all boxes and fields shall have an entry of data, the initials "NA" for "not applicable", or an indicator of "no further entries).

8 ATTACHMENTS

8.1 Ludlum Model 44-9 Alpha, Beta, Gamma Detector

8.2 Ludlum Model 12 Count Ratemeter

8.3 Ludlum Model 2241 Scaler/Ratemeter & Model 44-10 High Energy Gamma Detector

8.4 Ludlum Model 2929 Dual Channel Scaler & Model M43-10-1 Alpha/Beta Sample Counter

8.5 Ludlum Model 2224 Scaler/Ratemeter & Models 43-89 and 43-93 Alpha/Beta Scintillators

8.6 Bicron Micro Rem Survey Meter

8.7 Mini-Buck Gas Flow Calibrator Model M-30

8.8 F&J Specialty Products, Inc. Model LV-1, Regulated Low Volume Air Sampler

8.9 MSA ESCORT™ Pump

8.10 Ludlum Model 44-110 Tritium Detector

8.11 Ludlum Model 19 MicroR Meter

8.12 Ludlum Model 2224 Scaler/Ratemeter & Model 239-1F Floor Monitor

8.13 Ludlum Model 9 Ion Chamber and Ludlum Model 9DP Pressurized Ion Chamber

8.14 Ludlum Model 2224 Scaler/Ratemeter & Model 43-68 Gas Proportional Detector

8.15 Ludlum Model 12-4 Ratemeter & Model 42-31H Neutron Detector

8.16 Request for Instrument Calibration Sheet

8.17 Instrument Response Record (10-Point Check)

8.18 Photon Instrument Once Daily (QC) Check Sheet

8.19 Photon Instrument Twice Daily (QC) Check Sheet

8.20 Contamination Instrument Once Daily (QC) Check Sheet

8.21 Contamination Instrument Twice Daily (QC) Check Sheet

ATTACHMENT 8.1

Instrument Name:
Ludlum Model 44-9 Alpha, Beta, Gamma Detector

General Description:
The Model 44-9 GM (Pancake) Detector detects Alpha, Beta, and Gamma emitting radiation. Its size and shape provide easy handling for surveying or personnel monitoring. The detector is energy dependent, over responding by a factor of six in the 60 keV - 100 keV range when normalized to Cs-137.

The thin mica window is protected by a 79% open stainless steel screen. The GM tube can easily be removed for replacement if necessary.

The GM detector operates between 850 - 1000 volts. The tube manufacture recommends operation at approximately 900V. The recommended instrument input sensitivity is approximately 30 mV or higher to prevent the detector from double pulsing.

The Model 44-9 should operate with any Ludlum instruments or equivalent instruments that provide 900 VDC and input sensitivity of approximately 30 mV or higher.

Typical Uses:
Alpha, Beta, Gamma contamination surveys, Personnel frisking.

Required Maintenance:
Consult Model 44-9 Alpha, Beta, Gamma Detector Instruction Manual.

Operation Procedure:
Consult Model 44-9 Alpha, Beta, Gamma Detector Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

ATTACHMENT 8.2

Instrument Name:
Ludlum Model 12 Count Ratemeter

General Description:
The Ludlum Model 12 Count Ratemeter provides the required electronic circuitry for radiation monitoring with proportional, scintillation and GM detectors.

Typical Uses:
Contamination and radiation surveys.

Required Maintenance:
Consult Model 12 Count Ratemeter Instruction Manual.

Operation Procedure:
Consult Model 12 Count Ratemeter Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
Dependent on probe being used with instrument.

*

ATTACHMENT 8.3

Instrument Name:
Ludlum Model 2241 Scaler/Ratemeter & Model 44-10 High Energy Gamma Detector

General Description:
The Model 2241 is a portable microprocessor-based digital scaler/ratemeter designed for use with scintillation, GM, and proportional type detectors for measurement of ionizing radiation. The data is presented on a four digit (six digit in the scaler mode) Liquid Crystal Display (LCD) with a moving decimal point. A three-position switch labeled OFF/RATEMETER/SCALER selects the desired operating mode for the instrument. Programmable display units (ratemeter mode only) are represented in R/hr, Sv/hr, cpm, or cps with multipliers of micro (μ) or milli (m) for R/hr and Sv/hr and kilo (k) for cpm or cps. The display units are auto-ranging enabling the readout to display a broad range of radiation activity.

> *Note: When in the scaler mode, the display is limited to an upper value of 9999. Readings exceeding this value are denoted by a two digit number in the bottom right of the display. These numbers are in units of tens of thousands and precede the number displayed (i.e. a reading of 6777 with a 12 in the bottom right corner is read as 126,777).*

The Ludlum Model 44-10 utilizes a two-inch by two-inch NaI(Tl) crystal for high energy gamma detection (approximately 60 keV to 2 MeV range). The detector also provides high sensitivity for surveying and pulse height discrimination for single channel or multichannel applications.

Typical Uses:
Gamma Surveys where a detachable probe is required. Gamma surveys when time integration is required. Surveys where radionuclide identification is desirable.

Required Maintenance:
Consult Model 2241 Scaler/Ratemeter Instruction Manual.
Consult Model 44-10 High Energy Gamma Detector Instruction Manual.

Operation Procedure:
Consult Model 2241 Scaler/Ratemeter Instruction Manual.
Consult Model 44-10 High Energy Gamma Detector Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
Cs-137 Button Source[1]

[1]Another source (e.g., Am-241, Co-60) may be selected if it is more consistent with the radiations to be detected.

ATTACHMENT 8.4

Instrument Name:
Ludlum Model 2929 Dual Channel Scaler & Model M43-10-1 Alpha/Beta Sample Counter

General Description:
The Model 2929 is a Dual Channel Scaler designed for use with "Phoswich" and/or proportional detectors. A pulse height analyzer is employed to provide information to the two independent counters. The Model 2929 has adjustable count time periods ranging from 0.1 to 990 minutes and has a click per event audio for each of the two channels. The unit may also be operated with two printing calculators (Ludlum Model 264) via data connectors located on the rear chassis.

The Model 43-10-1 is a Alpha/Beta Sample Counter capable of holding up to a two inch diameter filter or planchet. The sample drawer, when fully closed strikes a micro switch to allow HV to be applied to the photo multiplier tube (PMT). The sample drawer is locked in the closed position by rotation of the side lever mounted on the side of the instrument towards the rear. To discriminate alpha and beta radiations simultaneously requires the counting instrument to have separate power supplies or threshold controls for each channel. The Ludlum Model 2929, Model 2223, or Model 2224 instruments provide the necessary circuitry for simultaneous alpha/beta discrimination.

Typical Uses:
Counting air samples, contamination swabs and smears.

Required Maintenance:
Consult Model 2929 Dual Channel Scaler Instruction Manual.
Consult Model M43-10-1 Alpha/Beta Sample Counter Instruction Manual.

Operational Procedure:
Consult Model 2929 Dual Channel Scaler Instruction Manual.
Consult Model M43-10-1 Alpha/Beta Sample Counter Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
Th-230 for Alpha, Sr-90 or Tc-99 for Beta.

ATTACHMENT 8.5

Instrument Name:
Ludlum Model 2224 Scaler/Ratemeter & Models 43-89 and 43-93 Alpha/Beta Scintillators

General Description:
The Model 2224 is a portable microprocessor based radiation survey instrument used to measure and discriminate low level alpha/beta radiation when used with an alpha/beta scintillation or proportional detector. The data is displayed by an analog ratemeter and six-digit LCD counter. The ratemeter dial indicates 0 - 500 cpm with four linear multipliers of X1 - X1000 producing an overall range of 0 - 500K cpm. The LCD is used to display the counts accumulated during the preset count time. There are four count times available via internal switches. These count times are 6 seconds, 30 seconds, 60 seconds, and 120 seconds. The ratemeter and LCD can display alpha only, beta only or alpha and beta by selecting the corresponding toggle switch selection.

The Models 43-89 and 43-93 detectors have active areas of 125 and 100 cm^2, respectively. They are used for detecting alpha and/or beta radiation. To discriminate alpha and beta radiations simultaneously requires the counting instrument to have either separate power supplies or window/threshold controls for each channel. The Model 2224 instrument provides the necessary circuitry for simultaneous alpha/beta discrimination, and a Model 2360 does the same but with datalogging capability.

Typical Uses:
Contamination surveys, building/area release surveys, and personnel frisking.

Required Maintenance:
Consult Model 2224 Scaler/Ratemeter Instruction Manual.
Consult Model 43-89 Alpha/Beta Scintillator Instruction Manual.
Consult Model 43-93 Alpha/Beta Scintillator Instruction Manual.

Operation Procedure:
Consult Model 2224 Scaler/Ratemeter or 2360 Scaler/Ratemeter/Datalogger Instruction Manual.
Consult Model 43-89 Alpha/Beta Scintillator Instruction Manual.
Consult Model 43-93 Alpha/Beta Scintillator Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
Th-230 for Alpha, Sr-90 or Tc-99 for Beta

ATTACHMENT 8.6

Instrument Name:
Bicron Micro Rem Survey Meter

General Description:
The Bicron Micro Rem model is a lightweight, portable survey meter for applications where accurate dose rate measurements of low gamma radiation levels are required. The Bicron Micro Rem model reads dose rate directly, eliminating the need for conversation from mR/hr.

Typical Uses:
Area radiation surveys, and radiation release surveys.

Required Maintenance:
Consult Bicron Micro Rem Survey Meter Instruction Manual.

Operation Procedure:
Consult Bicron Micro Rem Survey Meter Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
Cs-137 button source.

ATTACHMENT 8.7

Instrument Name:
Mini-Buck Gas Flow Calibrator Model M-30

General Description:
The Mini-Buck Calibrator® utilizes the principle of measuring the flow rate of gases over a fixed volume per unit of time. The Mini-Buck Calibrator® Model M-30 has a flow rate range of 100 cc/min to 30.00 liters/min.

Typical Uses:
Flow calibration of air sampling pumps.

Required Maintenance:
Consult the Mini-Buck Gas Flow Calibrator Model M-30 Instruction Manual.

Operation Procedure:
Consult the Mini-Buck Gas Flow Calibrator Model M-30 Instruction Manual.

Calibration:
Annually by the manufacturer

ATTACHMENT 8.8

Instrument Name:
F & J Speciality Products, Inc. Model LV-1, Regulated Low Volume Air Sampler

General Description:
The Model LV-1 is a 100 to 120V AC low volume air sampler consisting of an oil-less, carbon vane vacuum pump with a combination filter holder, flow meter, a vacuum gauge, a constant air flow regulator for use where a nearly consistent air flow is desirable.

Typical Uses:
Area air sampling.

Required Maintenance:
Consult the F & J Speciality Products, Inc. Model LV-1, Regulated Low Volume Air Sampler Instruction Manual.

Operation Procedure:
Consult the F & J Speciality Products, Inc. Model LV-1, Regulated Low Volume Air Sampler Instruction Manual.

Calibration:
Annually by the manufacturer.

ATTACHMENT 8.9

Instrument Name:
MSA ESCORT™ Pump

General Description:
The ESCORT™ Pump contains a diaphragm pump mechanism driven by an acentric on a motor shaft. A rechargeable battery pack powers the motor. The motor speed is varied by turning the flow control. The pump flow ranges from 0.5 to 3.4 LPM on a integral flowmeter, that is graduated in 0.2 LPM divisions. The elapsed time readout utilizes a quartz controlled timer with a capacity to read out to 9999 minutes in one-minute step increments. The ESCORT pump has an operation time of a minimum of eight-hours at 2.5 LPM with a 15-inch water column pressure drop depending on the sample device loading.

Typical Uses:

Required Maintenance:
Consult the MSA ESCORT™ Pump Instruction Manual.

Operation Procedure:
Consult the MSA ESCORT™ Pump Instruction Manual.

Calibration:
Prior to each use with a mini-Buck Flow Calibrator.

ATTACHMENT 8.10

Instrument Name:
Ludlum Model 44-110 Tritium Detector

General Description:
The Model 11-110 is a windowless, gas flow proportional detector. The Model 44-110 is used with a count-rate instrument such as a Ludlum Model 12. The Model 44-110 works using a count gas referred to as P-10, which is a gas combination of 90% Argon and 10% Methane.

Typical Uses:
Tritium surface contamination surveys.

Required Maintenance:
Consult the Ludlum Model 44-110 Tritium Detector Instruction Manual.

Operation Procedure:
Consult the Ludlum Model 44-110 Tritium Detector Instruction Manual.

Calibration:
Annually by the manufacturer

Check Source:
Not used.

ATTACHMENT 8.11

Instrument Name:
Ludlum Model 19 MicroR Survey Meter

General Description:
The Ludlum MicroR Meter is a lightweight, portable survey meter for applications where accurate exposure rate measurements of low gamma radiation levels are required. The Ludlum MicroR Meter reads exposure rate.

Typical Uses:
Area radiation surveys, and radiation release surveys.

Required Maintenance:
Consult Ludlum MicroR Survey Meter Instruction Manual.

Operation Procedure:
Consult Ludlum MicroR Survey Meter Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
Cs-137 button source.

ATTACHMENT 8.12

Instrument Name:
Ludlum Model 2224 Scaler/Ratemeter & Model 239-1F Floor Monitor

General Description:
The Model 2224 is a portable microprocessor based radiation survey instrument used to measure and discriminate low level alpha/beta radiation when used with an alpha/beta scintillation or proportional detector. The data is displayed by an analog ratemeter and six-digit LCD counter. The ratemeter dial indicates 0 - 500 cpm with four linear multipliers of X1 - X1000 producing an overall range of 0 - 500K cpm. The LCD is used to display the counts accumulated during the preset count time. There are four count times available via internal switches. These count times are 6 seconds, 30 seconds, 60 seconds, and 120 seconds. The ratemeter and LCD can display alpha only, beta only or alpha and beta by selecting the corresponding toggle switch selection.

The Model 239-1F Floor Monitor is a gas proportional floor monitor detector mounted on a roll-around cart. The detector has an active area of 582 cm^2. The instrument features a flow system, quick disconnects, a gas bottle mount, and a means to adjust the height of the detector from the floor for optimum performance. A P-10 gas bottle and regulator are required for operation of the floor monitor.

Typical Uses:
Building/area release surveys

Required Maintenance:
Consult Model 2224 Scaler/Ratemeter Instruction Manual.
Consult Model 239-1F Floor Monitor Instruction Manual.

Operation Procedure:
Consult Model 2224 Scaler/Ratemeter Instruction Manual.
Consult Model 239-1F Floor Monitor Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
Th-230 for Alpha, Sr-90 or Tc-99 for Beta

ATTACHMENT 8.13

Instrument Name:
Ludlum Model 9 Ion Chamber Survey Meter and Ludlum Model 9DP Pressurized Ion Chamber

General Description:
The Ludlum Model 9 Ion Chamber is a self-contained, portable instrument used in the detection of beta-gamma radiation. The unit is provided with a sliding window for beta-gamma discrimination. The data is displayed by an analog meter. The dial indicates 0 - 5 mR/hr with four linear multipliers of X1 - X 1000 producing an overall range of 0 - 5,000 mR/hr. With the sliding window open, beta-gamma radiation is measured. With the sliding window closed, gamma radiation is measured.

The Ludlum Model 9DP is a modern, digital, hand-held pressurized ion chamber designed to detect gamma and X-ray energies above 25 keV. It will also see beta energies above 1 MeV. The instrument can be configured to read in either in units of Sv, R, or Gy and is readily changed by an administrator without requiring a new calibration. The instrument is auto-ranging with a rate measurement range of 0-50 mSv/h (0-5 R/hr, 0-50 mGy/h).

Typical Uses:
General purpose beta-gamma radiation survey.

Required Maintenance:
Consult Model 9 Ion Chamber Instruction Manual.

Operation Procedure:
Consult Model 9 Ion Chamber Instruction Manual.
Consult Model 9DP Ion Chamber Instruction Manual

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
Cs-137

ATTACHMENT 8.14

Instrument Name:
Ludlum Model 2224 Scaler/Ratemeter & Model 43-68 Alpha/Beta Gas Proportional Detector

General Description:
The Model 2224 is a portable microprocessor based radiation survey instrument used to measure and discriminate low level alpha/beta radiation when used with an alpha/beta scintillation or proportional detector. The data is displayed by an analog ratemeter and six-digit LCD counter. The ratemeter dial indicates 0 - 500 cpm with four linear multipliers of X1 - X1000 producing an overall range of 0 - 500K cpm. The LCD is used to display the counts accumulated during the preset count time. There are four count times available via internal switches. These count times are 6 seconds, 30 seconds, 60 seconds, and 120 seconds. The ratemeter and LCD can display alpha only, beta only or alpha and beta by selecting the corresponding toggle switch selection.

The Models 43-68 detector has an active area of 100 cm^2. It is used for detecting alpha and/or beta radiation. To discriminate alpha and beta radiations simultaneously requires the counting instrument to have either separate power supplies or window/threshold controls for each channel. The Model 2224 instrument provides the necessary circuitry for simultaneous alpha/beta discrimination, and a Model 2360 does the same but with datalogging capability.

Typical Uses:
Contamination surveys, building/area release surveys, and personnel frisking.

Required Maintenance:
Consult Model 2224 Scaler/Ratemeter Instruction Manual.
Consult Model 43-68 Alpha/Beta Gas Proportional Instruction Manual.

Operation Procedure:
Consult Model 2224 Scaler/Ratemeter or 2360 Scaler/Ratemeter/Datalogger Instruction Manual.
Consult Model 43-68 Alpha/Beta Gas Proportional Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
Th-230 for Alpha, Sr-90 or Tc-99 for Beta

ATTACHMENT 8.15

Instrument Name:
Ludlum Model 12-4 Ratemeter & Model 42-31H Neutron Detector

General Description:
The Model 12-4 is a Survey Meter coupled to a Model 42-31H Neutron Detector; providing the required electronic circuitry and detector for measuring and monitoring of neutron radiation. The instrument provides four linear ranges used in combination with an exposure rate or CPM (counts per minute) meter dial. The instrument features a regulated HV (high-voltage) power supply, unimorph speaker with audio ON-OFF capability, fast-slow meter response, meter reset button and a six-position switch for selecting battery check or range multiples of ×1, ×10, ×100, and ×1000. Each range multiplier has its own calibration potentiometer. The unit body and meter housing are made of cast aluminum and the can is 0.23 cm (0.090 in.) thick aluminum.

Typical Uses:
General purpose neutron radiation survey.

Required Maintenance:
Consult Model 12-4 Ratemeter Instruction Manual.
Consult Model 42-31H Neutron Detector Instruction Manual.

Operation Procedure:
Consult Model 12-4 Ratemeter Instruction Manual.
Consult Model 42-31H Neutron Detector Instruction Manual.

Calibration:
Annually or as otherwise recommended by manufacturer.

Check Source:
None

ATTACHMENT 8.16
REQUEST FOR INSTRUMENT CALIBRATION SHEET
(*Available in word processing form on the server*)

ATTACHMENT 8.17
INSTRUMENT RESPONSE RECORD (10-POINT CHECK)
(*Available in spreadsheet form on the server*)

ATTACHMENT 8.18
PHOTON INSTRUMENT ONCE DAILY (QC) CHECK SHEET
(*Available in spreadsheet form on the server*)

ATTACHMENT 8.19
PHOTON INSTRUMENT TWICE DAILY (QC) CHECK SHEET
(*Available in spreadsheet form on the server*)

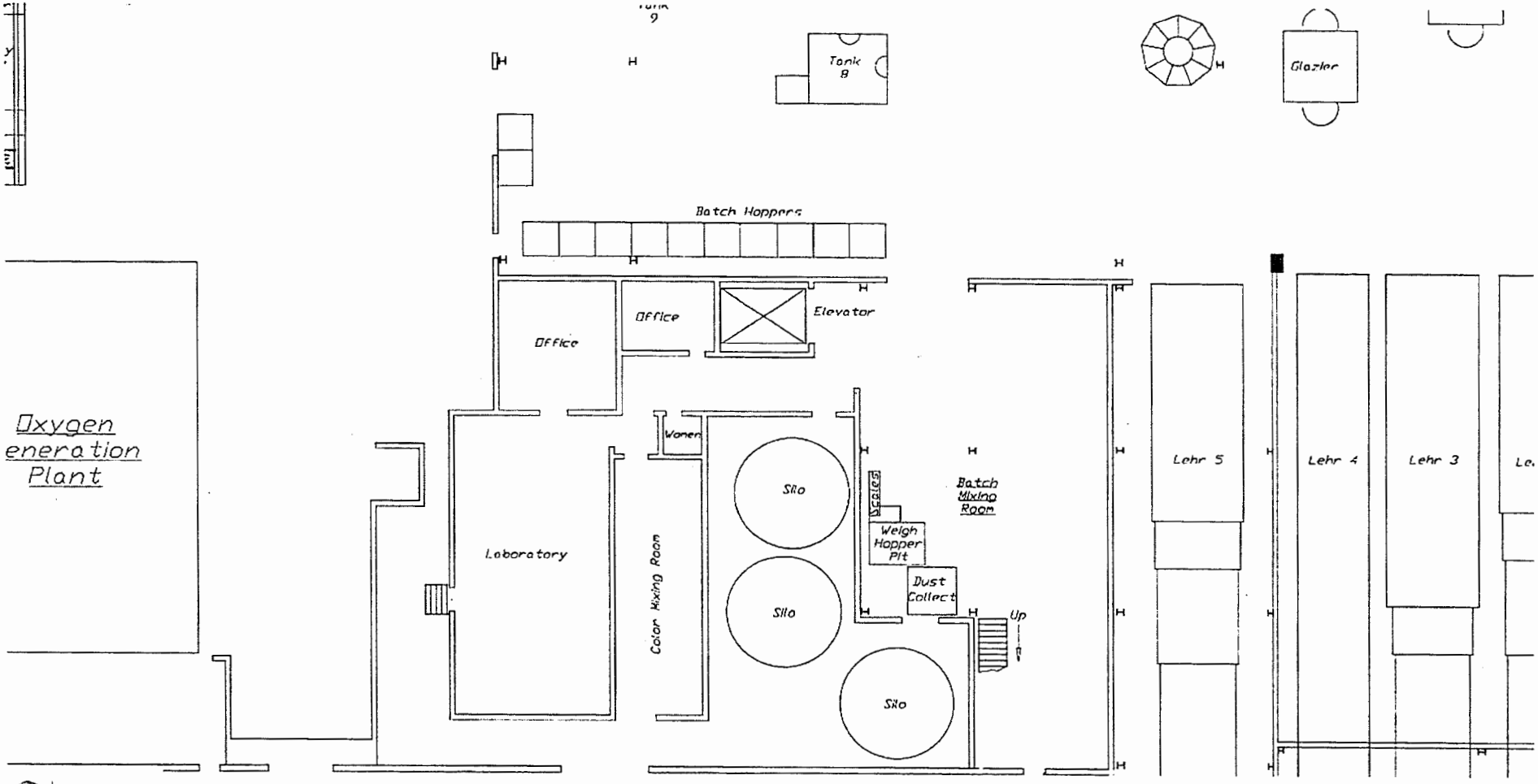
ATTACHMENT 8.20
CONTAMINATION INSTRUMENT ONCE DAILY (QC) CHECK SHEET
(*Available in spreadsheet form on the server*)

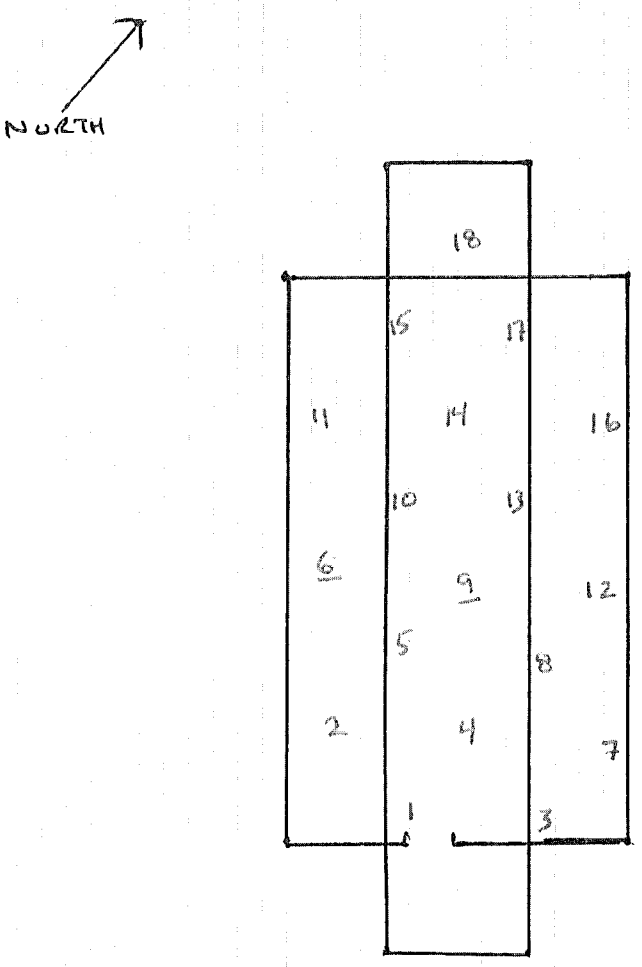
ATTACHMENT 8.21
CONTAMINATION INSTRUMENT TWICE DAILY (QC) CHECK SHEET
(*Available in spreadsheet form on the server*)

9 CHANGE HISTORY

Date	Rev. Number	Author/Submitted By	Change Reference	Approval
3/14/16	10	CDBerger	Company name change	

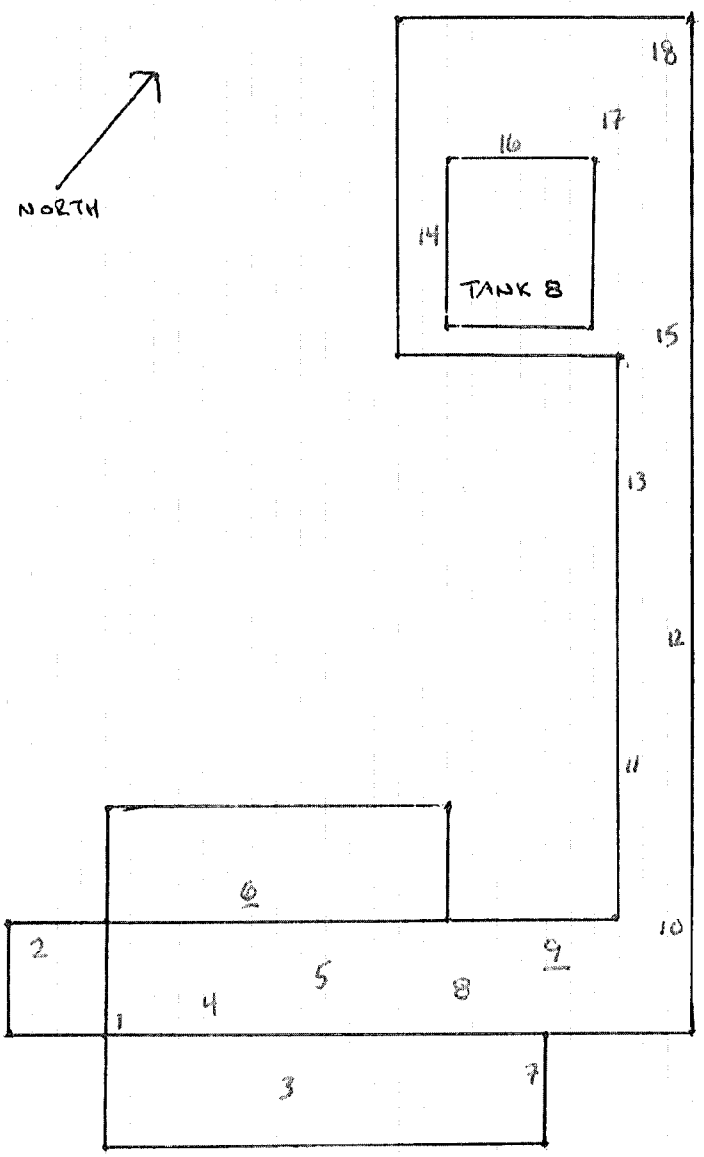
Fenton Art Glass Plant Layout.dwg





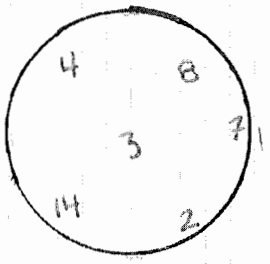
COLOR MIXING ROOM

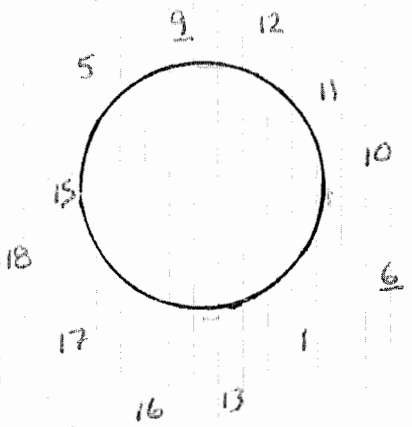
□ = 0.5 M x 0.5 M



HALLWAY FROM COLOR MIXING ROOM TO TANK B

□ = 0.5 M x 0.5 M





SILO FLOOR

SILO INSIDE WALL

□ = 0.5M x 0.5M

WALL SURVEY LOCATION	ELEVATION ABOVE FLOOR
1	1 M
5	1.5 M
6	1.5 M
9	0.5 M
10	2 M
11	1.5 M
12	0.5 M
13	1 M
15	0.5 M
16	1.5 M
17	2 M
18	1 M