FENTON

*Handcrafted American Glass Artistry*

March 8, 2016

SOB491
04003149

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

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

Mr. Lawyer,

Enclosed is an updated Final Status Survey Plan prepared for the Fenton Art Glass facility located in Williamstown, West Virginia. Thank you for your review of the previously submitted plan.

Additions and corrections have been included per your email of February 17, 2016. If there are corrections or additions that are still 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.

Respectfully submitted,

George W Fenton

George W. Fenton
President

Enclosure

589275

100 YEARS 1905 • 2005

*The Fenton Art Glass Company 700 Elizabeth Street Williamstown, WV 26187 304/375-6122 Fax 304/375-7833 www.fentonartglass.com*

REC'D IN LAT 03/09/2016

Project 14-511
March 8, 2016

# Final Status Survey Plan For Termination of License for Fenton Art Glass Williamstown, West Virginia

Prepared for:

**Fenton Art Glass**
**700 Elizabeth Street**
**Williamstown, West Virginia**
**26187**

Prepared by:


*MSES consultants, inc.*

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FINAL STATUS SURVEY PLAN
FOR
RADIOACTIVE MATERIAL STORAGE AREA
AND SITE SURVEY OF THE FENTON ART GLASS FACILITY
WILLIAMSTOWN, WEST VIRGINIA

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FINAL STATUS SURVEY PLAN
FOR
RADIOACTIVE MATERIAL STORAGE AREA
AND SITE SURVEY OF THE FENTON ART GLASS FACILITY
WILLIAMSTOWN, WEST VIRGINIA

## 1.0 INTRODUCTION

Fenton Art Glass (Fenton) manufactured many types of glass for sale to the public over many years. Fenton used depleted Uranium Oxide in the manufacture of certain colored glass articles, commonly called "Vaseline glass". The manufacturing process was continuous for many decades, beginning in the early 1900's. Due to economic and market conditions, Fenton considerably curtailed manufacture in the period between 2007 and 2011. In November 2011 Fenton ceased production of glass which contained the depleted Uranium Oxide.

## 2.0 SITE DESCRIPTION

At the time of this Final Status Survey, the Site is composed of a two-story structure with a sub-surface story (basement), with limited area being used for painting small glass pieces to produce jewelry type products. No glass is being produced at the site. The top floor of the structure is ≈85,800 $ft^2$ and was historically used as office space and merchandise staging for packaging and shipping. The ground floor consists of ≈85,800 $ft^2$ used for finishing, storage and office space as well as ≈67,200 $ft^2$ used as factory floor where the raw materials for glass production were delivered to tanks (furnaces where the materials were melted to make glass) and the glass products were formed. The basement is composed of two sections; one section is ≈45,600 $ft^2$ and was used primarily for storage of refractory brick, tank parts, glass moulds, and other manufacturing equipment not in use; the other section is ≈19,550 $ft^2$ and housed hoppers for raw material (sand, soda ash, etc.) and physical plant equipment (water pumps, etc.). Figure 1 shows the footprint of the first floor layout which held the gift shop, reception, glass finishing, storage, shipping and the main manufacturing floor, and does not show the basement or the second story.

Fenton relegated the storage, transport and use of the Uranium Oxide material to a relatively small area of ≈1000 $ft^2$. The square footage included in this estimation includes the entire floor area of the passages used to carry the Uranium Oxide material from the locked storage cabinet to the tank (tank #8[furnace]) used to produce the desired glass products. Figure 2 is an expanded excerpt of the outlined area from Figure 1 and shows the area where Uranium Oxide was stored, transported and used. The area outlined in red at the bottom left of the figure is the proposed final status survey, Class 1 area. The area outlined in red encompasses the secure storage area for U238 material, transport path and tank #8 (furnace) where the U238 was added to the mixture to produce the desired product.

Over the last few decades, Fenton had employed a number of recommendations from the Nuclear Regulatory Commission (NRC) and Applied Health Physics concerning storage and handling of the material. When manufacture using the depleted Uranium Oxide ceased, the material was being stored inside a locked cabinet, inside a restricted access room. The material was delivered to the Fenton facility in small plastic bags of specific weight. The small bags of material were packaged in a larger 'drum' which was placed inside the locked cabinet, inside the restricted room. When a batch of glass was to be produced using the depleted Uranium Oxide, a trained employee would enter the restricted access room, unlock the storage cabinet, place the desired number of bags of material needed for the batch into a rubber pail. The rubber pail was designated for this specific purpose. Once the material was placed in the rubber pail, the employee would, lock the cabinet, leave the restricted access room and travel a specific route to the factory floor where a screw charger was positioned to deliver all of the ingredients for the batch to the furnace where the ingredients would be melted to produce the glass. The small bags of depleted Uranium Oxide would then be placed in the hopper of the screw charger and then delivered into the furnace in the same manner as the remaining ingredients.

Fenton produced "Vaseline glass" or "uranium glass" for just over 100 years. In recent decades, (since about 1958) Fenton used depleted Uranium Oxide (U238) material in order to produce the desired merchandise. The U238 material was stored in a restricted access room inside a locked cabinet. The U238 material was carried by trained employees along a specified route and placed in a hopper, attached to a screw charger, at the furnace (also referred to as a tank) where ingredients were melted to produce the molten glass needed to manufacture merchandise for sale to the public. The process of introducing the U238 material was as follows: sand and other ingredients were added to the hopper of the screw charger; after an amount of the sand and other ingredients were moved by the screw charger into the furnace, the U238 material, bag and all, was placed in the screw charger; the remaining sand and other ingredients were added to the hopper and used to insure the U238 material was completely transferred to the furnace. The only merchandise Fenton produced using the U238 material was the "Vaseline glass". The "Vaseline glass" only comprised a portion of the merchandise produced by Fenton.

## 3.0 SUMMARY OF INVESTIGATIONS

In October 2014, MSES conducted a screening survey of the facility to identify whether there were areas in the factory which exhibited elevated levels of radioactivity. Survey readings obtained during the October 2014 screening survey indicated there were some locations in the factory where radioactivity, above background, was detected. The screening survey was conducted by simply measuring radiation levels at the surface of machinery, implements, and various other surfaces within the factory. No wipe tests were conducted. No material samples were sent to off-site laboratories for analysis.

Also on October 13, 2014, Ms. Annette K. Reynolds, Nuclear Fuel Services, Inc. (NFS) packaged and prepared for shipment the last remnants of the depleted Uranium Oxide on the property. This remnant was simply feed material that had been purchased, but had not been used in the manufacture of glass products. Fenton has not used, purchased or stored any U238 material at the site since October 2014. Copies of a "Uranium Running Log" are included as Attachment A. A copy of the Nuclear Material Transaction Report sent to Fenton Art Glass Company from Nuclear Fuel Services, Inc. is included as Attachment B. The 10.9 kilograms (23.98 pounds) of material shipped to Nuclear Fuel Services, Inc. comprised the last amount of material present at the site.

Subsequent to the October 2014 screening survey, housekeeping commensurate with decreasing manufacturing and production was conducted. Normal activities such as sweeping, consolidating and refurbishing equipment were conducted.

In December 2015 MSES conducted a screening wipe test survey of the Fenton facility. A 100 $cm^2$ template was used to acquire wipe samples which were analyzed using a Ludlum Model 3 and Ludlum Model 44-9 detector. This report was forwarded by Fenton Art Glass.

## 4.0 OBJECTIVES

The objective of this final status survey plan is to provide information about survey approaches and methodologies derived from NUREG-1575 Rev.1, MARSSIM, and planned for use during the final status survey to demonstrate residual radioactivity levels at the Fenton site meet criteria for termination of Fenton's site license.

## 5.0 DERIVED CONCENTRATION GUIDELINE LEVELS (DCGLs)

The derived concentration guideline level (DCGL) for the site/area is established at 1.01E+2 dpm/100 $cm^2$ for alpha contamination due to U238. For this site/area, an ALARA limit of 100 dpm/100 $cm^2$ would not appear to be unreasonable.

The DCGL values were read from Table 5.19 Concentration (dpm/100 $cm^2$) equivalent to 25 mrem/y for the specified value of $P_{crit}$, published in NUREG/CR-5512, Vol. 3, page 4-45.

## 6.0 DATA QUALITY OBJECTIVES

For the purpose of establishing DQOs, the null hypothesis ($H_0$), that residual contamination exceeds release criteria, and the alternate hypothesis ($H_a$), that residual contamination meets the release criteria will be tested.

Due to the nature of the operations conducted at the facility and the procedures followed in the past decade or so, the presence of alpha emitting contamination due to the presence of U238 in the background is highly unlikely. The presence of activity (non-specific emitters) detected in and

around areas of the facility where refractory materials were used, is not anticipated to be caused by alpha emitting materials. However, refractory materials will be assessed in order determine whether detected activity is from alpha emitters. This assessment will be used to establish a baseline activity for refractory materials in order to evaluate any activity detected around tank 8, the tank where the "Vaseline Glass" was produced. Given the above, the Sign test is used to determine the number of data points needed for acceptable use of statistical tests. During the DQO process, acceptable decision error rates were determined. Type I decision error ($\alpha$) and Type II decision error ($\beta$) were set at 0.05. The shift, $\Delta$, also referred to as the lower bound of the gray region (LBGR), was set at 50% of the DCGL.

The square root of the DCGL was taken as the standard deviation value used to determine the number of sample point measurements to be taken.

***Table 1. U238 DCGL and related data.***

| | NRC DCGL (dpm/100cm$^2$) | $\Delta$ (dpm/100cm$^2$) | $\sigma$ (dpm/100cm$^2$) | $\Delta/\sigma$ | Number of Samples required per survey unit as per Sign Test |
|---|---|---|---|---|---|
| Direct | 101 | 50.5 | 10 | 5 | 14 |

## 7.0 PROCEDURE OVERVIEW

### 7.1 Class 1 Area

The area of the facility which has a reasonable potential to exhibit residual radioactivity due to the use of U238, and area ≈93 m$^2$, was designated as MARSSIM Class 1 area, based on historical and operational information provided by facility records. Since the maximum square footage for a Class 1 survey unit is 100 m$^2$, the area of interest comprises the survey unit and is shown on Figure 2 outlined in red. Based on the DQO process, the minimum number of sample points to be assessed is 14. No less than 14 sample point locations will be assessed. Due to the irregular shape of the Class 1 area, it would be reasonable to expect more than 14 sample point locations.

Again, due to the irregular shape of the Class 1 area, determining sample point locations is challenging. If the area were a simple square, a simple grid pattern with ≈3.2 foot spacing between grids, would yield ≈81 grid intersections. However, the area presented in this case is not a neat square, since it is comprised of storage, transport and incorporation areas. Therefore, a grid pattern with 4 foot spacing was applied to a scale drawing of the area. Based on MARSSIM formula 5-8 (below), the distance between sample locations should be ≈8.46 feet.

$$L = \sqrt{\frac{A}{n}}$$

Where A is the area of the survey unit and $n$ is the number of samples determined to be needed.

In order to take a conservative approach, sample locations will be spaced approximately 8 feet apart as indicated on the attached Figure 4. Also, due to the shape of the area (long and narrow), sample locations are positioned near the middle of the narrow sections in order to accomplish the most conservative approach, since transport of the material would have been along the center path of the area.

Direct measurements of other areas of the main manufacturing floor surrounding the identified Class 1 area will be conducted to demonstrate whether DCGL is exceeded in the surrounding areas. The surface materials in the Class 1 area are not dissimilar compared to other surface materials in the rest of the main manufacturing floor.

### 7.1.1 Class 1 scan survey

According to MARISSM (August 2000) page 5-36, the required Scan MDC may be calculated by equation 5-3.

$$Scan\ MDC\ (required) = (DCGL_W)\ X\ (Area\ Factor)$$

Given equation 5-3 with a $DCGL_W$ of 100 dpm/100cm$^2$ and an Area Factor equal to 6.7, from MARISSM Table 5.6 for an area 100m$^2$ and U-238; the required Scan MDC for this survey would be 670 dpm/100cm$^2$.

The equipment used to conduct scan surveys will be the Ludlum Model 3 scaler meter and Ludlum Model 43-92 alpha Scintillator. A scan rate of approximately 3 cm/s is projected. A scan survey of the Class 1 area will be conducted. A four (4) square foot area around each of the discrete sample locations will be scanned.

Utilizing Equation (6-12) from MARSSIM (August 2000) page 6-48, assuming the manufacturer's reported equipment 4π efficiency (26.3%) from the calibration conducted January 21, 2016, the probability of detecting a single count while passing over the contaminated area would be 73.5%. If one assumes an equipment efficiency of 15%, then the probability of detecting a single count while passing over the contaminated area would be 52.8%.

$$P(n \geq 1) = 1 - e^{\frac{-GEd}{60v}}$$

Where

| | | |
|---|---|---|
| P(N≥1) | = | probability of observing a single count |
| G | = | contamination activity (dpm) {using the DCGL of 100 dpm/100cm$^2$} |
| E | = | detector efficiency (4π) {26.3% actual} |
| D | = | width of detector in direction of scan (cm) {9.1 cm for the 43-92} |

Referencing NUREG/CR5512, page 6.4, ceilings and walls could be expected to have contamination levels at 50% and 10%, respectively, compared to the floor surfaces. However, in the structure under consideration, the ceilings are quite high and one would

not expect the contamination level to approach the 50% range. Ceilings and walls will not be surveyed if the floor surfaces do not exhibit contamination above the DCGL.

### 7.2 Class 2 Area

No Class 2 areas were identified for the planning purposes for the final status survey.

### 7.3 Class 3 Area

No Class 3 areas were identified for the planning purposes for the final status survey.

### 7.4 Wipe tests

Wipe tests will be performed at each of the survey sample locations indicated and discussed in section 7.1 above. The Ludlum Model 2350-1 ratemeter/scaler/data logger with Ludlum Model 43-92 alpha Scintillator described in Section 8.0 will be used to examine the wipe tests.

### 7.4 Reference Area

Background (reference) measurements are to be taken outside of the Class 1 area. Fourteen (14) measurements will be made on surfaces in the reference area, very similar, if not identical to those inside the survey unit. The background measurements will be taken in areas that were not, according to historical and operational information, subject to exposure from licensed radioactive materials.

In addition to the measurements planned and described above, the entire second floor (outside of the described Class 1 area) will be randomly surveyed to determine whether any residual contamination is present outside of the Class 1 area. During previous surveys, elevated readings were noted on refractory material which had never been used in conjunction with production of the "Vaseline glass". Readings of these materials will be conducted with the alpha specific probe in order to establish a background contamination level associated with refractory material in general. The background contamination level associated with refractory material will be used for comparing readings to areas and materials known to have been associated with activities involving the subject licensed material. The background readings will be used to determine whether any contamination in Tank 8 is exceeds the DCGL above the levels.

Fenton plans to sell left over and repurposed refractory materials to other entities for use in industrial and manufacturing settings.

## 8.0 INSTRUMENTATION

The instrument to be used for the final status survey is a Ludlum Model 2350-1 ratemeter/scaler/data logger with a Ludlum Model 43-92 alpha Scintillator. The 43-92 has a published background of 3 cpm or less. MDA calculation is shown below. The planned background and sample read time is three (3) minutes.

***Table 2. Instrumentation for Survey***

| Type of Measurement | Instrumentation | | Background[a] | 4π Eff. (%) | Detection Sensitivity |
|---|---|---|---|---|---|
| | Detector | Meter | | | |
| Activity | Ludlum Model 43-92 (100cm$^2$) Alpha Scintillator | Ludlum Model 2350-1 ratemeter/scaler/ data logger | 3 cpm or less | 26.3 (Pu239) | 36.49 dpm/100cm$^2$ |

[a] Nominal value from manufacturer

RadCalc printout for MDA determination

DETECTION LIMITS--SURFACE CONTAMINATION

INPUT DATA:
Background Count = 2 cpm
Background Counting Time = 3 minutes
Sample Counting Time = 3 minutes
Detector Area = 100 cm²
Detector Efficiency = 26.3 % *(Pu239; Ludlum reports the value would be the same for U238)*
In or to compensate for an appropriate source efficiency of 0.25, in accordance with MARSSIM (page 6-25), the detector efficiency was entered as 13.15%.

RESULTS:
Critical Level (Lc) = 1.899 cpm above bkgd.
Detection Limit (Ld) = 4.799 cpm above bkgd.
Minimum Detectable Activity (MDA) = 36.49 dpm/detector
Minimum Detectable Activity (MDA) = 36.49 dpm/100 cm²
Minimum Detectable Activity (MDA) = 1.644E-5 µCi/detector
Minimum Detectable Activity (MDA) = 1.644E-7 µCi/100 cm²

All values calculated to the 95% confidence level

Caclulated by RadCalc Ludlum Edition version 1.0 on 2/25/2016 at 9:59:34 AM.

Instrument Specifications from the manufacturer are included in Attachment C. Calibration certificates and related documents are Attached.

# CERTIFICATE OF CALIBRATION

Ludlum Measurements, Inc.

Designer and Manufacturer of Scientific and Industrial Instruments

# CERTIFICATE OF CALIBRATION

**LUDLUM MEASUREMENTS, INC.**
501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.

☐ 10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

CUSTOMER MSES CONSULTANTS ORDER NO. 20282370 20282614/430856

Mfg. Ludlum Measurements, Inc. Model 2350-1 Serial No. 313167

Cal. Date 21-Jan-16 Cal Due Date 21-Jan-17 Cal. Interval 1 Year Meterface N/A

Check mark ☑ applies to applicable instr. and/or detector IAW mfg. spec. T. 73 °F RH 24 % Alt 705.8 mm Hg

☑ New Instrument Instrument Received ☐ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

☑ Mechanical check ☑ Input Sens. Linearity

☑ F/S Resp. check ☑ Reset check ☑ Window Operation

☑ Audio check ☑ Alarm Setting check ☑ Battery check (Min. Volt) 4.4 VDC

☑ Ratemeter Linearity check ☑ Integrated Dose check ☑ Recycle Mode check

☑ Data Log check ☑ Overload check ☑ Scaler Readout check Threshold Dial Ratio 100 = 10 mV

☑ Calibrated in accordance with LMI SOP 14.8 ☑ Calibrated in accordance with LMI SOP 14.9

☑ HV Readout (2 points) Ref./Inst. 500 / 499 V Ref./Inst. 2000 / 1992 V

**COMMENTS:** *Firmware: 37122N32*

Gamma Calibration: GM detectors positioned perpendicular to source except for M 44-9 in which the front of probe faces source.

| | Probe Model | Serial # | High Voltage | Threshold | Units/ Time Base | Dead Time Correction Factor | Calibration Constant | Linearity ±10%* |
|---|---|---|---|---|---|---|---|---|
| Detector # 0 | LMI43-92 | PR355568 | 650 | 400 | 7 / 1 | 0.000000E+00 | 1.000000E+00 | |
| Detector # 1 | LMI44-2 | PR335157 | 850 | 350 | 4 / 2 | 1.485046E-05 | 1.104544E+10 | ✓ |
| Detector # 2 | LMI44-2 | PR335157 | 850 | 350 | 7 / 1 | 1.485046E-05 | 1.104544E+10 | ✓ |
| Detector # 3 | LMI44-9 | PR333692 | 900 | 800 | 4 / 2 | 8.201140E-05 | 1.966474E+08 | ✓ |
| Detector # 4 | LMI44-9 | PR333692 | 900 | 800 | 7 / 1 | 8.201140E-05 | 1.966474E+08 | ✓ |
| Detector # | | | | | | | | |
| Detector # | | | | | | | | |
| Detector # | | | | | | | | |
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| Detector # | | | | | | | | |
| Detector # | | | | | | | | |
| Detector # | | | | | | | | |

**Units:** 0 – rad, 1 – Gray, 2 – rem, 3 – Sv, 4 – R, 5 – C/Kg, 6 – Disintegrations, 7 – Counts, 8 – Ci/cm sq., 9 – Bq/cm sq.
**Time Base:** 0 – Seconds, 1 – Minutes, 2 – Hours

* See attached detector documentation, if applicable.

| Digital Readout | REFERENCE CAL. POINT | INSTRUMENT RECEIVED | INSTRUMENT METER READING* | REFERENCE CAL. POINT | INSTRUMENT RECEIVED | INSTRUMENT METER READING* |
|---|---|---|---|---|---|---|
| | 400kcpm | | 400 kcpm | 400cpm | | 400 cpm |
| | 40kcpm | | 40.0 kcpm | 40cpm | | 40.0 cpm |
| | 4kcpm | | 3.99 kcpm | | | |

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978. State of Texas Calibration License No. LO-1963

**Reference Instruments and/or Sources:** Cs-137 S/N: ☐ 039 ☐ 2171CP ☑ 2261CP ☐ 720 ☐ 734 ☐ 731 ☐ 1131 ☐ 1616 ☐ 1696 ☐ 1909 ☐ 1916CP ☐ 5105 ☐ 5717CO ☐ 5719CO ☑ 60646 ☐ 70897 ☐ 73410 ☑ E552 ☐ G112 ☐ M565 ☐ S-394 ☐ S-1054 ☐ T10081 ☐ T10082 Neutron Am-241 Be S/N: ☐ T-304 Ra-226 S/N: ☐ Y982

☑ Alpha S/N Pu239 L537C ☐ Beta S/N ☑ Other Am241 ~0.66 µCi

☑ m 500 S/N 214069 ☐ Ra-226 S/N Y982 ☑ Multimeter S/N 89630683

Calibrated By: [signature] Date 21-Jan-16

Reviewed By: [signature] Date 22 Jun 16

Designer and Manufacturer
of
Scientific and Industrial
Instruments

**LUDLUM MEASUREMENTS, INC.**
501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.

☐ 10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

# *Bench Test Data For Alpha Detector*

Detector 43-92 Serial No. PR355568

Customer MSES CONSULTANTS

Order #. 20282370 (20282614/430856)

Counter 2350-1 Serial No. 313167

Counter Input Sensitivity 40.00 mV

Count Time 60 seconds

Distance Source to Detector Surface

Isotope Pu 239, 26500 dpm

Other Cal Constant = 1.000000E+00 Dead Time = 0.000000E+00

43-4/43-44 HV Adjust for Altitude

| Altitude | High Voltage |
|---|---|
| Sea Level | 2050 V |
| 1000 foot | 2025 V |
| 2000 foot | 2000 V |
| 3000 foot | 1975 V |
| 4000 foot | 1950 V |
| 5000 foot | 1925 V |
| 6000 foot | 1900 V |
| 7000 foot | 1875 V |

Alpha Scintillation Detector

| HV Plateau | Background | Source Count |
|---|---|---|
| 500 | 0 | 4470 |
| 550 | 0 | 6250 |
| 600 | 0 | 6620 |
| 650 | 1 | 6890 |
| 700 | 1 | 6730 |
| 750 | 2 | 7090 |
| 800 | 4 | 6780 |
| | | |
| | | |

Operating Voltage Set at 650.00 V

| Air Proportional | 43-5 | 43-65 | 43-90 | Background | Meter Reading | Range/Scale |
|---|---|---|---|---|---|---|
| Toe | Toe | L/S* | Toe | 1 | 6660 | cpm |
| Center | Center | Center | Center | 1 | 6890 | cpm |
| Heel | Heel | Other** | Heel | 1 | 6610 | cpm |

☑ Uniformity (± 10%)

Average Efficiency - 26.3 % 4 π

* Least Sensitive Position (Heel of Detector)
** Opposite Least Sensitive Position (Top of Detector)

Signature [signature]

Date 21-Jan-16

Designer and Manufacturer
of
Scientific and Industrial
Instruments

**LUDLUM MEASUREMENTS, INC.**
501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.

☐ 10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

# *Model 2350 Bench Test Data*

20282614/430856

Customer MSES CONSULTANTS Date 21-Jan-16 Order #. 20282370

Model 2350-1 Serial No. 313167 Detector 44-2 Serial No. PR335157

Source Cs 137 21 mCi, 3 mCi

High Voltage 850 V As Found _____ V. Input ~~0.00~~ 35 AMM mV As Found _____ mV.

Cal. Constant 1.104544E+10 as found _____

Dead Time 1.485046E-05 as found _____

Alarm Setting: Ratemeter 1000000000.000000 as found _____

Scaler 1000000.000000 as found _____

Integrated dose 1000000000.0000 as found _____

Overload ☐ On ☑ Off as found ☐ On ☐ Off Window OFF ~~100~~ as found _____

Detector Received: ☑ Within Toler. +-10% ☐ 10-20% ☐ Out of Tol. ☐ Requiring Repair ☐ Other-See comments

| Reference Point | "As Found" Readings: Meter Reading | After Adjustment Readings: Meter Reading |
|---|---|---|
| 20 mR/hr | | 19.1 mR/hr |
| 15 | | 14.9 |
| 10 | | 10.2 |
| 4 | | 4.10 |
| 2 | | 2.40 |
| 1 | | 1.00 |
| 500 µR/hr | | 485 µR/hr |
| 200 | | 187 |
| 100 | | 95.3 |

Other _____

Signature [signature] Date 21-Jan-16

Designer and Manufacturer
of
Scientific and Industrial
Instruments

**LUDLUM MEASUREMENTS, INC.**
501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.

☐ 10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

# Bench Test Data

20282614/430856

Detector 44-2 Serial No. PR335157 Order #. 20282370

Customer MSES CONSULTANTS

Counter 2350-1 Serial No. 313167 Counter Input Sensitivity ~~8.00~~ 35 AMM mV

Count Time 6 seconds Distance Source to Detector Surface

Other Cal Constant = 1.104544E+10 Dead Time = 1.485046E-05

| High Voltage | Background | Isotope Am241 Size ~0.66 µCi | Isotope ____ Size ____ | Isotope ____ Size ____ | Isotope ____ Size ____ |
|---|---|---|---|---|---|
| 650 | 560 | 860 | | | |
| 700 | 1000 | 3310 | | | |
| 750 | 1050 | 6890 | | | |
| 800 | 1040 | 7680 | | | |
| → 850 | 1360 | 6800 | | | |
| 900 | 1240 | 7790 | | | |
| 950 | 1380 | 7030 | | | |
| 1000 | 1460 | 7570 | | | |

☐ Gas proportional detector count rate decreased ≤ 10% after 15 hour static test using 39" cable.

Signature [signature] Date 21-Jan-16

Ludlum Measurements, Inc. certifies that the above instrument has been calibrated by standards traceable to the National Institute of Standards and Technology, or to the calibration facilities of other International Standards Organization members, or have been derived from accepted values of natural physical constants or have been derived by the ratio type of calibration techniques. The calibration system conforms to the requirements of ANSI/NCSL Z540-1-1994 and ANSI N323-1978. State of Texas Calibration License No. LO-1963

Designer and Manufacturer
of
Scientific and Industrial
Instruments

**LUDLUM MEASUREMENTS, INC.**
501 Oak Street
325-235-5494
Sweetwater, TX 79556, U.S.A.

☐ 10744 Dutchtown Road
865-392-4601
Knoxville, TN 37932, U.S.A.

# CONVERSION CHART

20282614/430856

Customer MSES CONSULTANTS Date 21-Jan-16 Order #. 20282370

Model 2350-1 Serial No. 313167 Detector Model 44-9 Serial No. PR333692

Source Cs137 204 mCi, 21 mCi High Voltage 900.00 V

Count time 6 seconds Input Sensitivity 80.00 mV

| Reference Point | "As Found" Readings (CPM): with Deadtime | "As Found" Readings (CPM): w/o Deadtime | After Adjustment Readings (CPM): with Deadtime | After Adjustment Readings (CPM): w/o Deadtime |
|---|---|---|---|---|
| 150 mR/hr | | | 476 kcpm | NA |
| 50 mR/hr | | | 163 kcpm | |
| 15 mR/hr | | | 50.9 kcpm | |
| 5 mR/hr | | | 16.9 kcpm | |
| 1.5 mR/hr | | | 4.50 kcpm | |
| 1.0 mR/hr | | | 3.39 kcpm | |
| | | | | |
| | | | | |
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| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Signature: [illegible] Date 21-Jan-16

Designer and Manufacturer
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865-392-4601
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# CONVERSION CHART

20282614/430856

Customer MSES CONSULTANTS Date 21-Jan-16 Order #. 20282370

Model 2350-1 Serial No. 313167 Detector Model 44-9 Serial No. PR333692

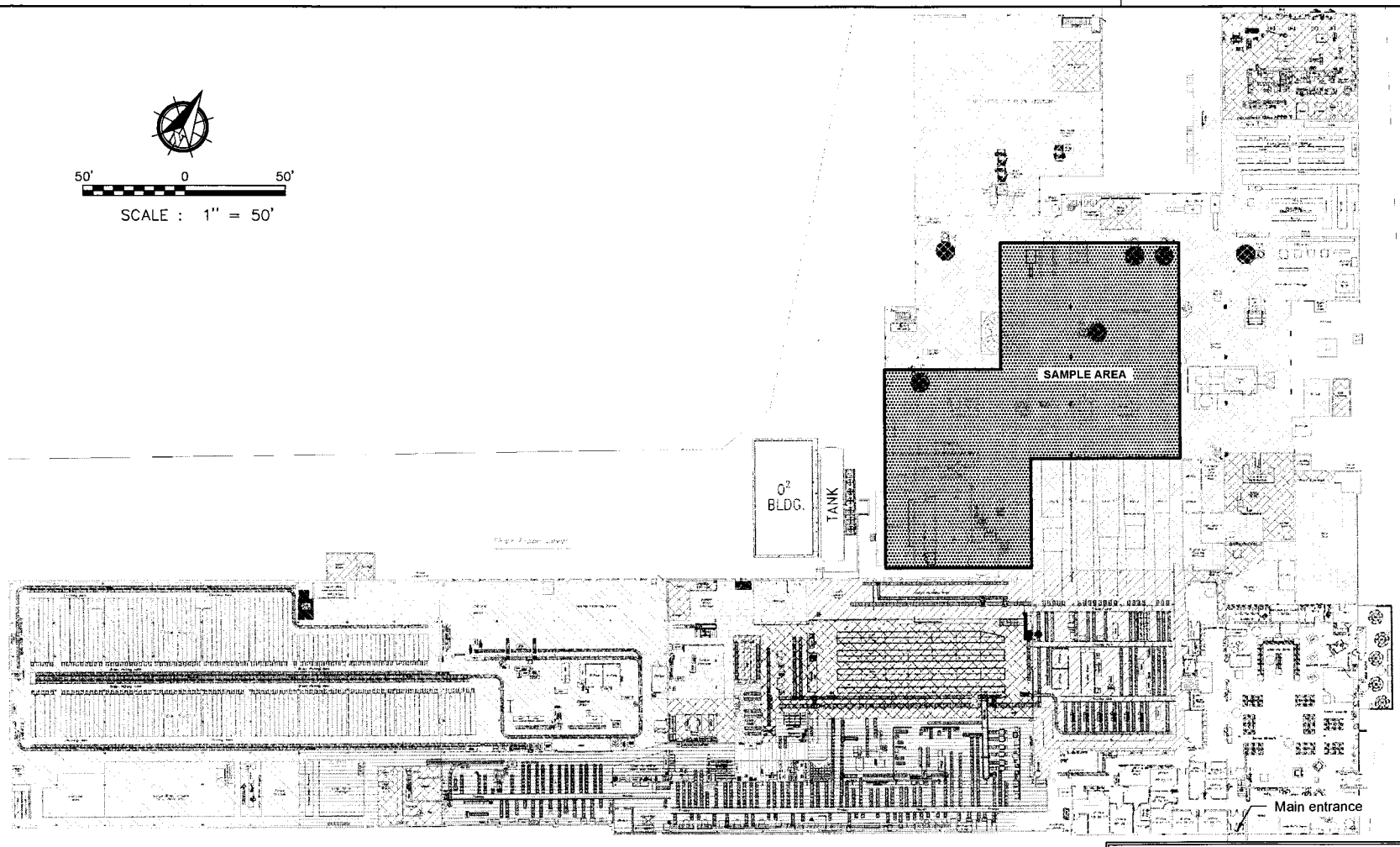
Source Cs 137 204 mCi, 21 mCi High Voltage 900.00 V

Count time 6 seconds Input Sensitivity 80.00 mV

| Reference Point | "As Found" Readings: with Deadtime | "As Found" Readings: w/o Deadtime | After Adjustment Readings: with Deadtime | After Adjustment Readings: w/o Deadtime |
|---|---|---|---|---|
| 300 mR/hr | | | 309 mR/hr | NA |
| 200 | | | 199 | |
| 80 | | | 79.1 | |
| 20 | | | 19.6 | |
| 8 | | | 8.0 | |
| 6 | | | 6.18 | |
| 2 | | | 2.06 | |

Signature: [illegible] Date 21-Jan-16

# FIGURES

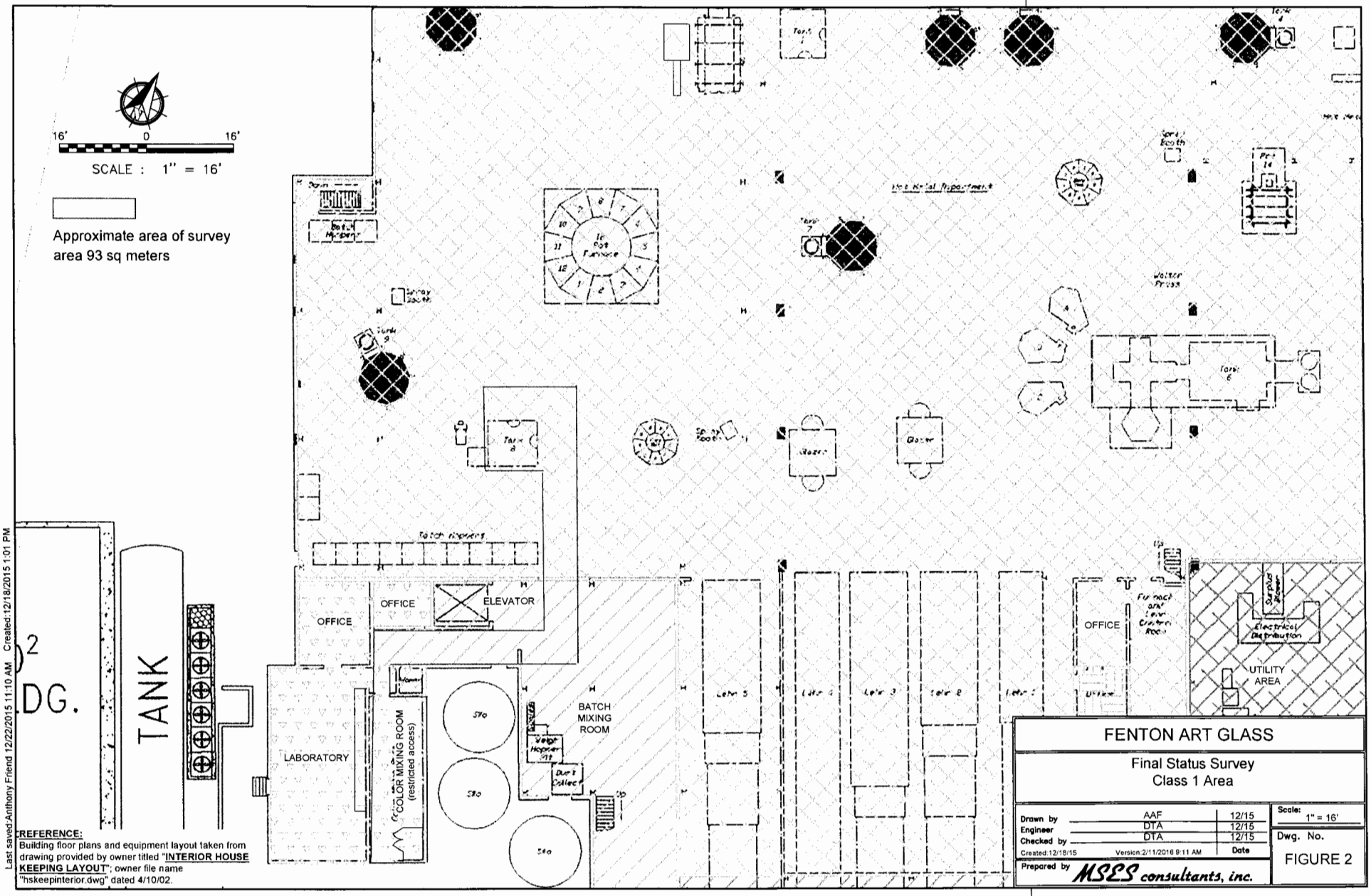



**REFERENCE:**
Building floor plans and equipment layout taken from drawing provided by owner titled "**INTERIOR HOUSE KEEPING LAYOUT**"; owner file name "hskeepinterior.dwg" dated 4/10/02.

| | | | |
|---|---|---|---|
| FENTON ART GLASS | | | |
| SCREENING SURVEY<br>AREA OF SURVEY | | | |
| Drawn by | AAF | 12/15 | Scale: 1" = 50' |
| Engineer | DTA | 12/15 | |
| Checked by | DTA | 12/15 | Dwg. No. |
| Created:12/18/15 | Version:2/15/2016 8:43 AM | Date | FIGURE 1 |
| Prepared by MSES consultants, inc. | | | |

Last saved:Anthony Friend 2/15/2016 8:41 AM Created:12/18/2015 1:01 PM

F:\On-going\Projects\14-511 Fenton Radiological Survey\engineering\drafting\14-511-1.dwg, figure 1, 2/15/2016 8:43:27 AM, Anthony Friend, DWG To PDF.pc3, ANSI full bleed B (17.00 x 11.00 Inches)




**REFERENCE:**
Building floor plans and equipment layout taken from drawing provided by owner titled "**INTERIOR HOUSE KEEPING LAYOUT**"; owner file name "hskeepinterior.dwg" dated 4/10/02.

Last saved:Anthony Friend 12/22/2015 11:10 AM Created:12/18/2015 1:01 PM

F:\On-goingProjects\14-511 Fenton Radiological Survey\engineering\drafting\14-511-1.dwg, figure 2, 2/11/2016 9:11:32 AM, Anthony Friend, DWG To PDF.pc3, ANSI full bleed B (17.00 x 11.00 Inches)

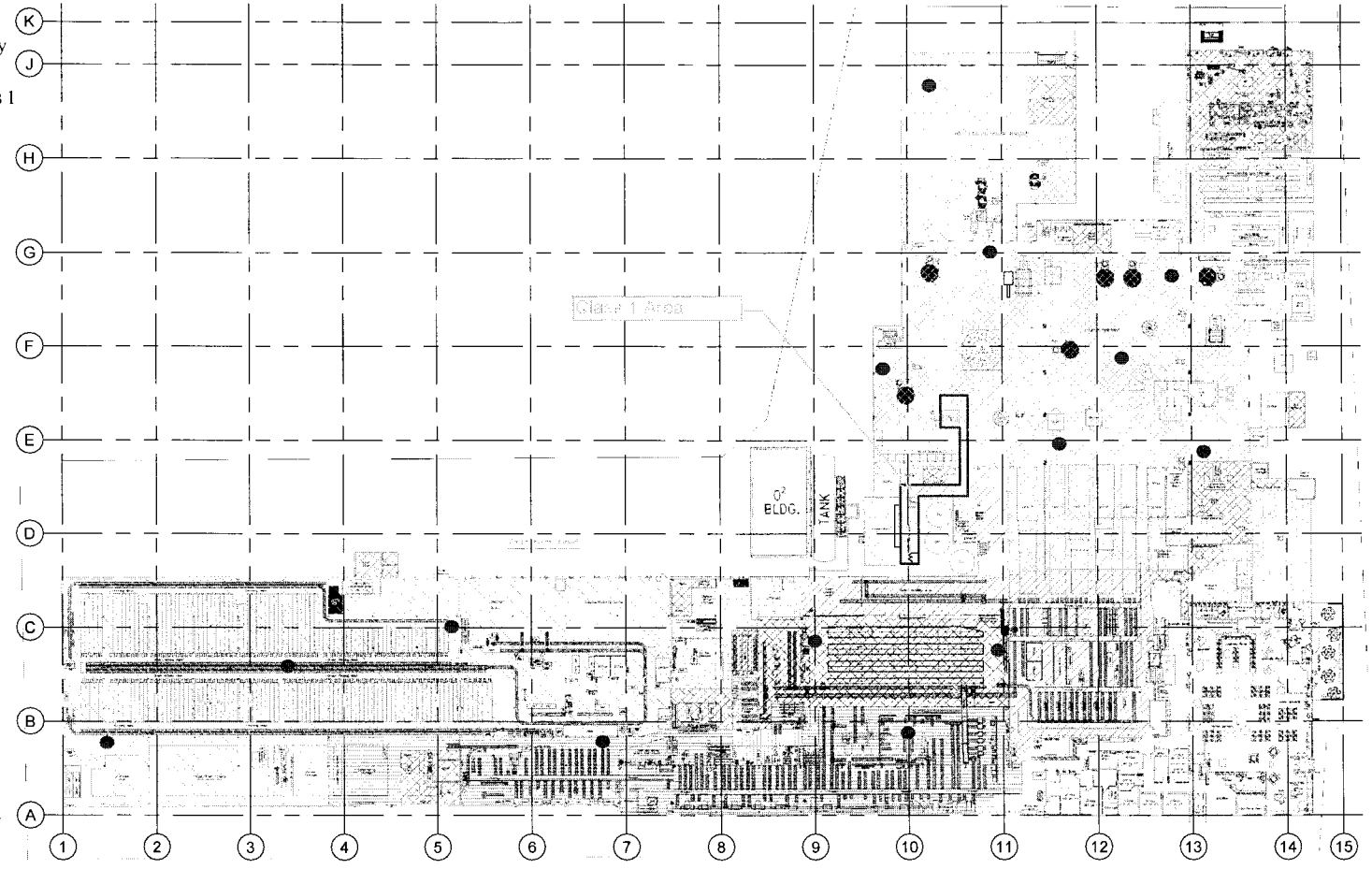
# FENTON ART GLASS

## Final Status Survey
## Class 1 Area

| | | | |
|---|---|---|---|
| Drawn by | AAF | 12/15 | Scale: 1" = 16' |
| Engineer | DTA | 12/15 | |
| Checked by | DTA | 12/15 | Dwg. No. |
| Created:12/18/15 | Version:2/11/2016 9:11 AM | Date | FIGURE 2 |

Prepared by MSES consultants, inc.

● Proposed survey scan locations outside of Class 1 area.




60 0 60'

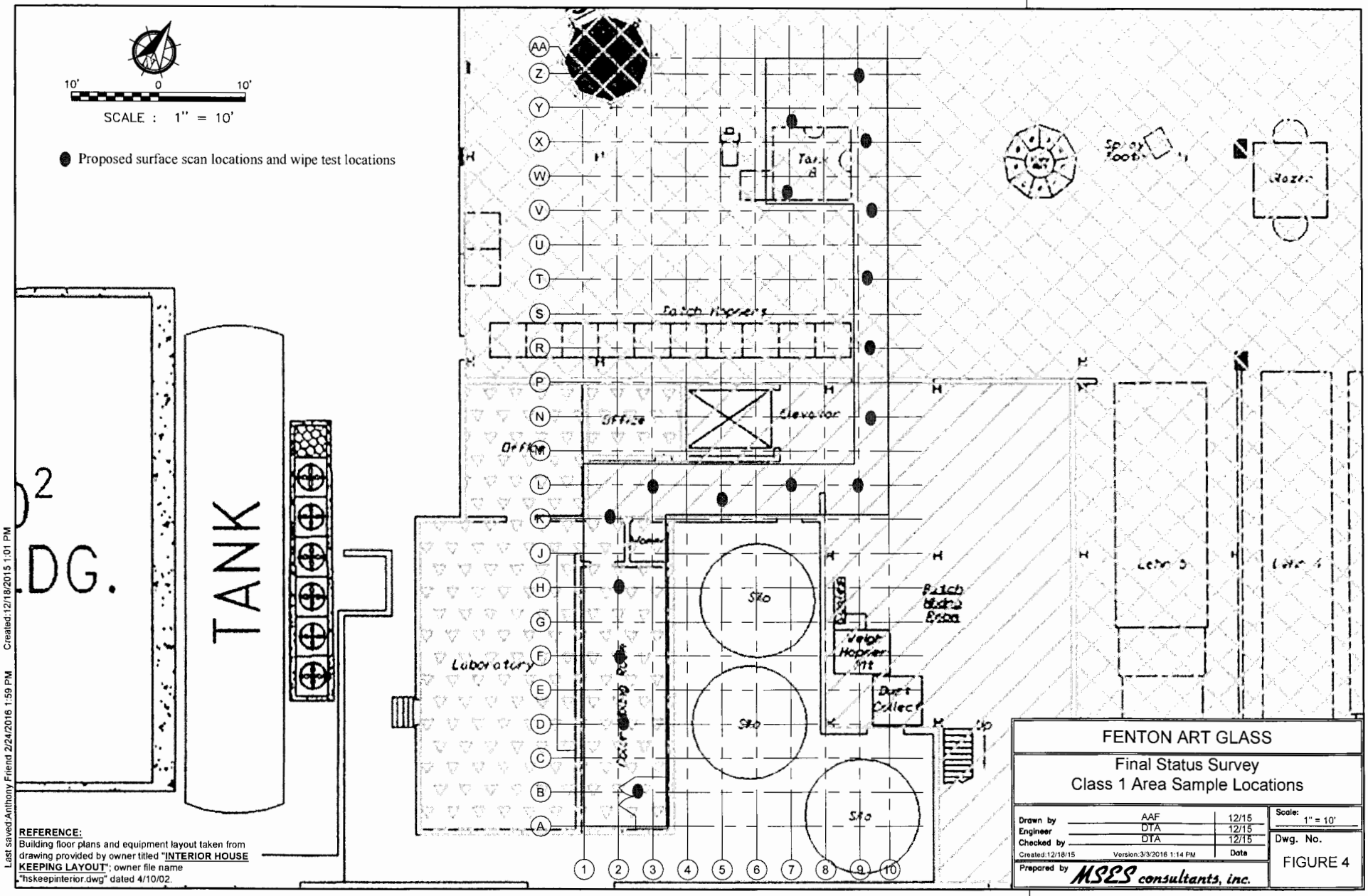
SCALE : 1" = 60'

**REFERENCE:**
Building floor plans and equipment layout taken from drawing provided by owner titled "**INTERIOR HOUSE KEEPING LAYOUT**"; owner file name "hskeepinterior.dwg" dated 4/10/02.

| FENTON ART GLASS | | | |
|---|---|---|---|
| Final Status Survey<br>Background/Reference Sample Locations | | | |
| Drawn by | AAF | 12/15 | Scale: 1" = 50' |
| Engineer | DTA | 12/15 | |
| Checked by | DTA | 12/15 | Dwg. No. |
| Created:12/18/15 | Version:3/3/2016 1:14 PM | Date | FIGURE 3 |
| Prepared by MSES consultants, inc. | | | |

Last saved:Anthony Friend 2/24/2016 1:59 PM Created:12/18/2015 1:01 PM

F:\Ongoing\Projects\14-511 Fenton Radiological Survey\engineering\drafting\14-511-1.dwg, figure 3, 3/3/2016 1:14:33 PM, Anthony Friend, DWG To PDF.pc3, ANSI full sheet B (17.00 x 11.00 inches)




Last saved:Anthony Friend 2/24/2016 1:59 PM Created:12/18/2015 1:01 PM

F:\OngoingProjects\14-511 Fenton Radiological Survey\engineering\drafting\14-511-1.dwg, figure 4, 3/3/2016 1:14:35 PM, Anthony Friend, DWG To PDF.pc3, ANSI full bleed B (17.00 x 11.00 Inches)

# ATTACHMENT A

2009

# URANIUM RUNNING LOG

| DATE | LBS. USED | ACCUM. 31-0 | | DATE | LBS. USED | ACCUM. |
|---|---|---|---|---|---|---|
| 2-4-09 | 9 | 25-0 | | 5-13-09 | 5.0 | 29-0 |
| 2-9-09 | Recd 25.0 | 50-00 | | 5-18-09 | 4.0 | 26-0 INV. |
| 2-10-09 | 4.0 | 46-0 | | 5-21-09 | Recd 25-0 | 51-0 |
| 2-12-09 | 4.0 | 42-0 | | 5-22-09 | 5-0 | 46-0 |
| 2-18-09 | 8-0 | 34-0 | | 6-2-09 | 9-0 | 37-0 |
| 2-20-09 | 2-0 | 32-0 | | 6-3-09 | 10-0 | 20-0 |
| 2-23-09 | 5.0 | 27-0 | | 6-4-09 | 11-0 | 11-0 |
| 2-26 | 5-0 | 22-0 | | 6-7-09 | 10-0 | 1-0 |
| 2-27 | 25-0 Recd | 47-0 | | 6-10-09 | Recd 50-0 | 51-0 |
| 3-5-09 | 5.0 | 42-0 | | 6-13-09 | 5.0 | 46-0 |
| 3-9-09 | 5-0 | 37-0 | | 6-16-09 | 5.0 | 41.0 |
| 3-12-09 | 5.0 | 32-0 | | 6-17-09 | 5.0 | 36.0 |
| 3-16-09 | +25 Recd | 57-0 | | 6-20-09 | 6.0 | 31.0 |
| 3-16-09 | 5-0 | 52.0 | | 6-23-09 | 10.0 | 20.0 |
| 3-17-09 | 11.0 | 39.0 | | 7-1-09 | Recd 25.0 | 45.0 |
| 3-18 | 8 | 31.0 | | 7-17-09 | 3-0 | 42.00 |
| 3-19 | 7 | 24.0 | | 7-22-09 | 3.0 | 34.00 INV. |
| 3-20-09 | 12 | 14-0 | | 7-24-09 | 9.0 | 25.00 |
| 3-23-09 | 8 | 6 | | 7-27-09 | 11.00 | 14.00 |
| 3-23-09 | +25 | 31 | | 7-28 | 9.0 | 5-00 |
| 3-24-09 | 6.0 | 25.0 | | 7-29 | 5.0 | 0.0 |
| 3-25-09 | 17-0 | 8-0 | | 7-31 | Recd 25.0 | 25.0 |
| 3-26-09 | 7-0 | 1.0 | | 8-2 | 6.0 | 19.0 |
| 3-30-09 | 25-0 | 26-0 | | 8-4 | 8.0 | 11.0 |
| 3-30-09 | 5.0 | 21-0 | | 8-7 | 7.0 | 4.0 |
| 4-13-09 | Recd 25-0 | 46-0 | | 8-10 | Recd 50.0 | 54.0 |
| 5-6-09 | 6.0 | 40.0 | | 8-22-09 | 9.0 | 45.0 |
| 5-11-09 | 6.0 | 34.0 | | 8-24-09 | 8.0 | 37.0 |

URANIUM RUNNING LOG

| DATE | LBS. USED | ACCUM. | | DATE | LBS. USED | ACCUM. | |
|---|---|---|---|---|---|---|---|
| 8-25-09 | 8.0 | 29.0 | | 12-24-09 | 7.0 | 46-0 | |
| 9-9-09 | 7.0 | 22-0 | | 12-31-09 | 5.0 | 41-0 | |
| 9-14-09 | Recd 25.00 | 47.0 | | 1-5-10 | 7.0 | 34-0 | |
| 9-17-09 | 2.0 | 45.0 | | 1-6-10 | 8.0 | 26-0 | |
| 9-22-09 | 7.0 | 38.0 | | 1-7-10 | 4.0 | 22-0 | |
| 9-25-09 | 5.0 | 33.0 | | 1-7-10 | +25 Recd | 48-0 | Phy Inventory |
| 9-29-09 | 5.0 | 28.0 | | 1-10-10 | 8.0 | 40.0 | |
| 10-1-09 | 5.0 | 23.0 | | 1-11-10 | 8.0 | 32.0 | |
| 10-8-09 | 12.0 | 11.0 | | 1-13-10 | 4.0 | 27.00 | |
| 10-8-09 | Recd 25.00 | 34.00 INV. | | 1-18-10 | +25 Recd | 53.00 | |
| 10-13-09 | 11.0 | 23.00 | | 1-19-10 | 4.0 | 49.00 | |
| 10-14-09 | 6.0 | 17.00 | | 2-8-10 | 3.0 | 46.0 | |
| 10-15-09 | 8.0 | 9.00 | | 2-10-10 | 3.0 | 43.0 | |
| 10-18-09 | 9.0 | 0.0 | | 2-16-10 | 7.0 | 36.0 | |
| 10-21-09 | Recd | 50.00 | | 2-23-10 | 3.0 | 33.0 | |
| 10-21-09 | 17.0 | 33.00 | | 2-26-10 | 5.0 | 28.0 | |
| 10-25-09 | 8.0 | 25.00 | | 2-26-10 | Recd 25.0 | 53.0 | |
| 10-27-09 | 5.0 | 20.00 | | 3-2-10 | 3.0 | 50.0 | |
| 11-6-09 | 4.0 | 16.00 | | 3-3-10 | 12.0 | 37.00 | |
| 11-10-09 | Recd 25.0 | 41.00 | | 3-4-10 | 14.0 | 25.00 | Phy INV. |
| 11-12-09 | 4.0 | 37.00 | | 3-14-10 | 7.0 | 18.00 | |
| 11-25-09 | 4.0 | 33.0 | | 3-15-10 | 14.00 | 4.0 | |
| 11-30-09 | Recd 25 lbs | 58.00 | | 3-15-10 | +50.0 Recd | 54.00 | |
| 12-2-09 | 7.0 | 51.00 | | 3-18-10 | 7.0 | 47.00 | |
| 12-6-09 | 10.00 | 41.00 | | 3-21-10 | 7.0 | 40.0 | |
| 12-7-09 | 9.00 | 32.00 | | 3-22-10 | → | 30 | Phy INV. |
| 12-8-09 | 11.00 | 21.00 | | 3-22-10 | 7.0 | 23-0 | |
| 12-9-09 | 7.0 | 14.00 | | 3-23-10 | 7.0 | 16-0 | |
| 12-10-09 | 7.0 | 7.00 | | 3-24-10 | 3.0 | 13-0 | |
| Recd → 12-14-09 | *50.00 | 57.00 | | 3-25-10 | 8.0 | 5-0 | |
| 12-18-09 | 4.0 | 53.00 | | 3-25-10 | Recd 50 lbs | 55-0 | |

URANIUM RUNNING LOG

| DATE | LBS. USED | ACCUM. | | DATE | LBS. USED | ACCUM. |
|---|---|---|---|---|---|---|
| 3-28-10 | 14-0 | 41-0 | | 6-24-10 | 5-0 | 78-0 |
| 3-30-10 | 6-0 | 35-0 | | 6-30-10 | 6-0 | 72-0 → Phy INV. |
| 3-31-10 | 12-0 | 23-0 | | 7-6-10 | 5-0 | 67-0 |
| 3-31-10 | 25# Recd | 48-0 | | 7-9-10 | 5-0 | 62-0 |
| 4-5-10 | 20.00 | 28-0 | | 7-15-10 | 5-0 | 57-0 |
| 4-7-10 | 10-0 | 18-0 | | 7-19-10 | 5.0 | 52-0 |
| 4-8-10 | 10-0 | 8-0 | | 7-26-10 | 4.0 | 48-0 |
| 4-14-10 | Recd 25 lbs | 33-0 | | 8-1-10 | 8-0 | 40-0 |
| 4-15-10 | 25.0 Recd lbs | 58-0 | | 8-4-10 | 5-0 | 35-0 |
| 4-29-10 | 8.0 | 50.0 | | 8-11-10 | 13 | 22-0 |
| 5-3-10 | 5.0 | 45.0 | | 9-24-10 | 3-0 | 19-0 |
| 5-4-10 | 6.0 | 39.0 | | 9-30-10 | 25 Recd | 44-0 |
| 5-7-10 | 9-0 | 30.0 | | 10-10-10 | 14-0 | 30-0 |
| 5-11-10 | 6.0 | 24.0 | | 10-11-10 | 14-0 | 16-0 |
| 5-12-10 | 5.0 | 19-0 | | 10-12-10 | 25 Recd | 41-0 |
| 5-12-10 | Recd 25# | 44.0 | | 10-13-10 | 12-0 | 29-0 |
| 5-14-10 | 11-0 | 33-0 | | 10-14-10 | 25 Recd | 54-0 |
| 5-14-10 | 3:00 PM | 28# [illegible] | | 10-17-10 | 12-0 | 42-0 |
| 5-19-10 | 22.0 BE | 6-0 | | 10-18-10 | 12-0 | 30-0 |
| 5-18-10 | 5.0 | 1-0 | | 10-19-10 | 10 | 20-0 |
| 5-18-10 | Recd 25#0 | 26-0 | | 10-21-10 | 12 | 8-0 |
| 5-19-10 | 4-0 | 22-0 | | 10-25-10 | Recd 25 10-25-10 | 33-0 |
| 5-20-10 | 11-0 | 11-0 | | 10-29-10 | Recd 25.00 | 58-0 |
| 5-[illegible] | 11-[illegible] | 0-[illegible] | | 11-5-10 | 18-0 | 40-0 |
| 5-21-10 | Recd 50.0# | 50-0 | | 11-8-10 | 10-0 | 30-0 |
| 6-1-10 | Recd 25#0 | 75-0 | | 11-9-10 | 11-0 | 19-0 |
| 6-1-10 | 5-0 | 70-0 | | 11-10-10 | 3-0 | 16-0 |
| 6-3-10 | Recd 25# | 95-0 | | 11-11-10 | Recd 25.0 | 41-0 |
| 6-9-10 | 3.0 | 92-0 | | 11-15-10 | 3-0 | 38-0 |
| 6-10 | 5-0 | 87-0 | | 11-16-10 | 6-0 | 32-0 |
| 6-18 | 4-0 | 83-0 | | 11-24-10 | 3-0 | 29-0 |

11-24-10 URANIUM RUNNING LOG
27-0

| DATE | LBS. USED | ACCUM. | | DATE | LBS. USED | ACCUM. |
|---|---|---|---|---|---|---|
| 12-1-10 | 3-0 | 26-0 | | | | |
| 12-2-10 | Recd. 25-0 | 51-0 | | | | |
| 12-7-10 | 1-0 | 50-0 | | | | |
| 12-8-10 | 4-0 | 46-0 | | | | |
| 12-13-10 | 9-0 | 37-0 | | | | |
| 12-14-10 | Recd 25-0 | 62-0 | | | | |
| 12-15-10 | 10-0 | 52-0 | | | | |
| 1-6-11 | 4-0 | 48-0 | | | | |
| 1-18-11 | 4-0 | 44-0 | | | | |
| 1-21-11 | 4-0 | 40-0 | | | | |
| 1-25-11 | 4-0 | 36-0 | | | | |
| 1-29-11 | 4-0 | 32-0 | | | | |
| 2-4-11 | 4-0 | 28-0 | | | | |
| 2-8-11 | Phy. Inv. | 32-0 | | | | |
| 2-9-11 | 3-0 | 29-0 | | | | |
| 3-25-11 | Recd 25.. | 54-0 | | | | |
| 3-30-11 | 5-0 | 49-0 | | | | |
| 4-4-11 | 3-0 | 46-0 | | | | |
| 4-6-11 | 4-0 | 42-0 | | | | |
| 4-12-11 | 13-0 | 29-0? | | | | |
| 4-26-11 | Recd 25 | 54 | | | | |
| 5-6-11 | 4-0 | 50-0 | | | | |
| 5-8-11 | 9-0 | 41-0 | | | | |
| 5-9-11 | 8-0 | 33-0 | | | | |
| 5-10-11 | 7 | 26 | | | | |
| 5-16-11 | — PI | 18 PI | | | | |
| 5-18-11 | 6 | 12 | | | | |
| 5-23-11 | 5 | 7 | | | | |
| 5-25-11 | Recd 25.0 | 32.0 | | | | |
| | | | | | | |
| | | | | | | |

# ATTACHMENT B

30G-14-0352

DOE/NRC F 741
(6-2002) Previous editions are obsolete
MANDATORY DATA COLLECTION
AUTHORIZED BY 10 CFR 30, 40, 50, 70, 72, 74
75, 150. Public Law 93-703, 95-471, 95-91

U.S. DEPARTMENT OF ENERGY AND U.S. NUCLEAR REGULATORY COMMISSION

# NUCLEAR MATERIAL TRANSACTION REPORT

Approved By OMB: No. 3150-0003

SNM-03-01

Estimated burden per response to comply with this mandatory collection request: 45 minutes. This information is required for NRC licensing reports that show changes in inventory of nuclear materials. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington DC 20555-0001 or by internet e-mail infocollects@nrc.gov, and to the Desk Officer of Information and Regulatory Affairs (3150-0003), Office of Management and Budget, Washington DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to the information collection.

| 1. Shipper's RIS | 2. Receiver's RIS | 3. Transaction No | 4. Correction No | 5. Processing Code | 6. Action Code | 7. Documentation (Only if document is classified SECRET) |
|---|---|---|---|---|---|---|
| XJL | ZQN | 2 | | A Shipper A / B Receiver A | A Shipper A / B Receiver B | Copy of Copies Series |

8. A. Name and Address of Shipper
Fenton Art Glass Company
420 Caroline Avenue
Williamstown, WV 26187
C. Attention Mike Fenton
D. Telephone 304-375-6122

9. A. Name and Address of Receiver
Nuclear Fuel Services, Inc.
P.O. BOX 337 MS 123
Erwin, TN 37650
C. Attention Clayton Brown
D. Telephone 423-735-5535

10. Number of Data Lines: 1

11. Nature of Transaction

12. A. Shipped For Acct Of / B. RIS

13. A. Shipped To Acct Of / B. RIS

| No. | Distribution of Copies |
|---|---|
| 1 | XJL |
| 2 | ZQN |
| 3 | ZQN-XJL |
| 4 | |
| 5 | |
| 6 | |
| 7 | |

14. Transfer Authority Contract, Mil Draft, or Order Number

15. Export or Import Transfers a Licence No

16. Material Type and Description
Depleted Uranium Powder

| 17. Line Number | 18. Country of Origination | 19. Material Type | 20. Obligated Element Weight | 21. Obligated Isotope Weight |
|---|---|---|---|---|
| | | | | |

| 22. Action Date | Month | Day | Yrs |
|---|---|---|---|
| A. Shipment | 10 | 13 | 2014 |
| B. Shipper's Corr | | | |
| C. Receipt | 10 | 16 | 2014 |
| D. Receiver's Meas. | | | |
| E. Receiver's Corr. | | | |

23. A. Miscellaneous
Sales Order 1586Y
Bill of Lading P27962
Tranfer # 41319

B. Condse Note Attached: Yes / Yes / No

24. Total Gross Weight: 10.9

25. Total Volume (Waste Transfers Only)

| | Back Reference Number A | Line No. B | Type of Inv Chang C | Identification (Item/Batch Name) D | No. of Items E | Project Number F | Material Type G | Comp. Facility Code H | Owner Code I | Key Meas. Point J | Meas. Ident K 1 Basis | 2 CMP | 3 Method | Gross Weight L | Net Weight M | Element Weight N | Element Limit of Error O | Weight % Isotope P | Isotope Weight Q | Isotope Limit of Error R |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26. Shipper's Data | | 1 | | | 1 | | 10 | 455 | J | | | | | | | 7 | | 0.22 | | |

26. Shipper's Data — T. Signature of Authorized Official and Date Signed

27. Receiver's Data — T. Signature of Authorized Official and Date Signed: Clayton Brown 10-20-14

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27. Receiver's Data | | 1 | | | 1 | | 10 | 455 | J | | | | | | | 7 | | 0.22 | | |

Warning: False statements in this certificate may be subject to civil and/or criminal penalties. NRC regulations require that submissions to the NRC be complete and accurate in all material respects. 318 U.S.C. Section 1001 makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

# ATTACHMENT C

# Model 2350-1
## General Purpose Ratemeter/Scaler/Data Logger

*Radiation Detection for a Safer World*

Ludlum Measurements, Inc.

### Features

- Large Digital Display
- Auto-ranging
- Stores 1000 Data Points
- Overload Protection
- Wide Range High Voltage
- Stores 16 Detector Parameter Setups
- Separate Alarms for Ratemeter, Scaler, & Integrated Dose

Part Number: 48-2751

### Specifications

**INDICATED USE:** field analysis and data logging
**SUGGESTED DETECTORS:** Geiger-Mueller (GM), proportional, and/or scintillation; will store up to 16 detector setups
**DISPLAY:** 8-line LCD display with 15 characters per line
**BACKLIGHT:** 2-position toggle switch to turn backlight ON or OFF
**SCALER:** 6-digit display
**RATEMETER:** digital ratemeter, corrected for dead time and calibration constant
**TIMER:** used in conjunction with scaler. Count time can be set from 1 to 65,535 seconds in 1-second intervals.
**TREND INDICATOR:** 5-decade logarithmic bar graph
**SCALE:** can display in rem/hr, Sv/h, R/hr, cpm, cps, dpm, dps, rad(r), Gray(G), C/kg, Ci/cm$^2$, or Bq/cm$^2$
**INTEGRATED DOSE:** counter provided total accumulated dose for up to 45 days (will display in same units as ratemeter)
**AUDIO:** built-in unimorph speaker with volume control (greater than 60 dB at 0.61 m {2 ft}, full volume)
**AUDIO DIVIDE:** operator-selected divisions of 1, 10, or 100 events per click
**ALARM:** separate alarms for digital ratemeter, scaler, and integrated dose can be set at any point (audible and visual indicators)
**ACK/SCROLL:** pushbutton to silence audio after alarm has been indicated and/or scroll through the various displays
**DATA LOGGER:** capable of logging up to 1000 individual data points with the following identifiers for each point: eight Location codes (5 character); time of day; month, day, and year; detector number, count rate/scaler count/integrated dose; count time; logging mode; sample number
**DETECTOR PARAMETERS:** capable of storing the following parameters for 16 different detectors: model number; serial number; calibration constant; dead time correction; high voltage; threshold; window; display range multiplier; display time base; display units; overload current; ratemeter alarm setting; scaler alarm setting; scaler count time, integrated dose alarm setting
**RS-232 PORT:** full duplex communication port that allows for instrument setup by optional keypad or PC, also allows for data to be transferred to a PC file
**BAR CODE READER (optional):** allows for setup of instrument by computer generated bar codes
**HIGH VOLTAGE:** adjustable from 400 to 2500 volts
**THRESHOLD:** adjustable from -100 to -1000
**WINDOW:** adjustable from 0 to 1000 above threshold
**GAIN:** adjustable from 2 to 350 mV at threshold setting of 100
**DEAD TIME:** adjustable to compensate for dead time of detector and electronics
**RESPONSE:**
FIXED: adjustable from 1 to 127 seconds in 1-second intervals
VARIABLE: varies according to number of counts, typical times FAST: 4-25 seconds, SLOW: 4 to 60 seconds from 10% to 90% of final reading
**TEMPERATURE RANGE:** 0 to 50 °C (32 to 122 °F ) (LCD display limits temperature range)
**POWER:** 4 "D" cell batteries (housed in a sealed compartment that is accessible from back of instrument)
**BATTERY LIFE:** greater than 75 hours (low battery condition is automatically indicated)
**SIZE:** 14.2 x 11 x 22 cm (5.6 x 4.3 x 8.8 in.) (H x W x L) without handle, 20.9 cm (8.2 in.) (H) with handle
**WEIGHT:** 2.4 kg (5.2 lb), including batteries

P.O. Box 810, Sweetwater, Texas 79556 / http://www.ludlums.com
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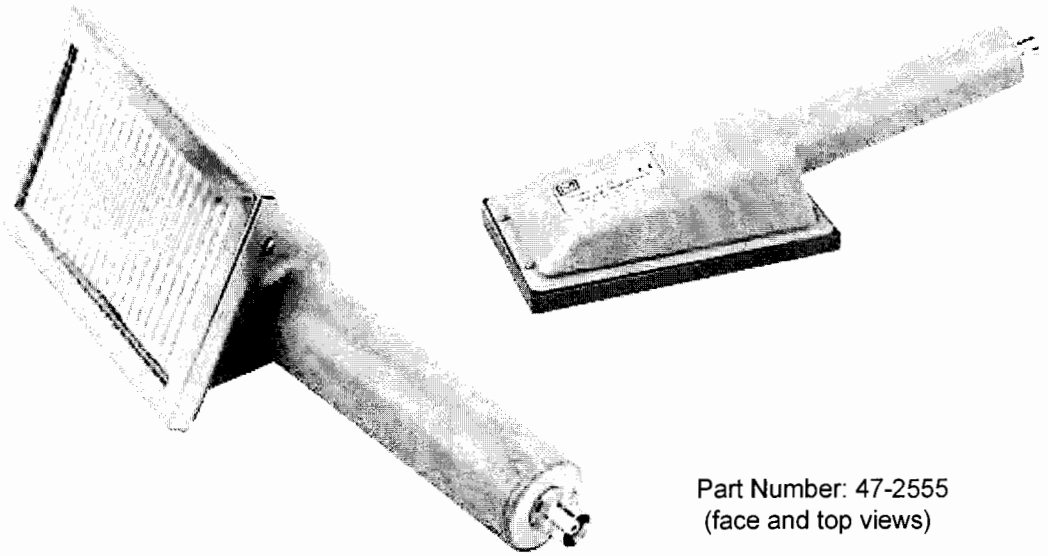
Apr 2013

# Model 43-92
## Alpha Scintillator

*Radiation Detection for a Safer World*

Ludlum Measurements, Inc.



Part Number: 47-2555
(face and top views)

### Specifications

**INDICATED USE**: alpha contamination survey
**SCINTILLATOR**: ZnS(Ag)
**EFFICIENCY (4π)**: typically 20%–$^{239}$Pu
**WINDOW**: 0.8 mg/cm² aluminized Mylar (1.2 mg/cm² recommended for outdoor use)
**REMOVABLE PROTECTIVE SCREEN**: 0.79 mm (0.03 in.) thick, 6.5 mm (0.25 in.) square openings, 88% open (*see below for optional protective screens*)
**SCREEN OUTER DIMENSIONS**: 167.6 x 91.4 mm (6.6 x 3.6 in.) (L x W)
**WINDOW AREA**:
Active: 100 cm² (15.5 in²)
Open: 88 cm² (13.6 in²)
**RESPONSE NON-UNIFORMITY**: less than 10% from average reading
**BACKGROUND**: 3 cpm or less
**PHOTOMULTIPLIER TUBE**: 2.9 cm (1.13 in.) diameter
**OPERATING VOLTAGE**: typically 500–1200 volts (1500 volts maximum)
**CONSTRUCTION**: aluminum with beige powder coating
**TEMPERATURE RANGE**: -20 to 50 °C (-4 to 122 °F)
**CONNECTOR**: series "C", unless specified otherwise
**SIZE**: 6.4 x 9.5 x 31.2 cm (2.5 x 3.8 x 12.3 in. (H x W x L)
**WEIGHT**: 0.5 kg (1.0 lb)

### Optional Protective Screens

**Model L-7393-209**: 0.79 mm (0.031 in.) thick, 4 mm (0.16 in.) square openings, 81% open
**Model L-7393-208**: 0.79 mm (0.031 in.) thick, 4.8 mm (0.19 in.) hex openings, 83.5% open
**Model L-7393-138**: 0.51 mm (0.020 in.) thick, 6.5 mm (0.25 in.) square openings, 88% open

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March 2015