Phase 4 - Soil Sampling and Analysis Plan

Sigma-Aldrich Fort Mims Site

Maryland Heights, Missouri

U.S. Nuclear Regulatory Commission
Radioactive Materials License No. 24-16276-01

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1.0 Introduction

The Fort Mims Site occupies approximately one-acre open land area with no structures. This site was once occupied by Sigma-Aldrich's radiochemistry facility that was previously decommissioned and demolished in compliance with in NUREG 1757 Volume 2, Consolidated NMSS Decommissioning Guidance and NUREG 1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The document describes the approach, methods and techniques for the design and performance of characterization and final status surveys. This parcel of land is located in a commercial/light industrial park in Maryland Height, Missouri. The Fort Mims facility currently operates under U.S. Nuclear Regulatory Commission (NRC) Radioactive Materials License Number 24-16273-01.

This soil-sampling plan is designed to define the lateral and vertical extent of carbon-14 (^{14}C) and tritium (^{3}H) contamination in soils at the site by using the United States Environmental Protection Agency (EPA) Triad approach for site assessment and cleanup. The original approved soil sampling plan was designed to evaluate the upper six inches of surface soil following the guidance of MARSSIM. The soil sample results indicate detectible concentrations of contaminants present well below the surface (>6 inches).

As such, the Phase 4 soil sampling approach uses the previous soil sampling data to identify areas of concern which require further characterization to define the vertical and horizontal extent of contamination. The goal of this sampling event is to define the extent of contamination at the site so that site-specific Derived Concentration Guidance Levels (DCGLs) can be developed and groundwater monitoring locations can be selected. All soil sampling activities shall be carried out in accordance with the Sigma Aldrich Fort Mims Decommissioning Health and Safety Plan.

1.1 Background

There have been three phases of soil sampling that have occurred to date. A total of two hundred fourteen (214) discrete soil samples have been obtained from the site from three previous soil sampling events. The first two soil sampling events were performed in compliance with the approved Open Land Soil Sampling Plan dated October 20th, 2008. The third round of soil sampling used biased sampling to evaluate the former building footprint and former septic system at the site. The soil sampling results from each round of sampling indicated contamination exceeded the approved default screening value of 12 picoCuries/Gram (pCi/g) for ^{14}C in both surface and subsurface soils.

Past site characterization events have failed to bound the extent of horizontal and vertical contamination in soils at the site.

1.2 Contaminants of Concern

Through interviews, characterization and historical site data it has been determined that the Nuclides of Concern (NOC) for this facility decommissioning are Carbon-14 (^{14}C) and Tritium (^{3}H). Through the first three phases of soil sampling only one soil sampling location near the former septic tank location exceeded the approved default screening value for tritium (^{3}H) of 110 pCi/g.

1.3 Data Quality Objectives

1.3.1 Statement of the Problem

A number of soil contamination data gaps exist from the three previous soil sampling events. The Fort Mims facility requires further soils characterization in order to bound the vertical and horizontal extent of contamination. This data is necessary to help in the development of site-specific DCGLs.

1.3.2 Sample Design Summary

The sample design and DQOs were based on the USEPA *Soil Screening Guidance* (EPA/540/R-96/018), the USEPA *Guidance for the Data Quality Objectives Process* and the USEPA *Using the Triad Approach to Streamline Brownfields Site Assessment and Cleanup*.

1.4 Characterization Design for Soil Areas

A Conceptual Site Model (CSM) was developed based on review of the existing data obtained during prior sampling events combined with the historic operations onsite. The existing soils data and survey maps were combined into a single CSM using Geographic Information System (GIS) to provide location and depth of sampling. This data was imported into Spatial Analysis Decision Assistance (SADA) 5.0.7800.0 software to create a 3D model of existing contamination levels at the site.

Review of this data and operational history indicate there are two potential sources of soils contamination onsite:

- Soil deposition from exhaust stack emissions to the west of the former building
- Deposition from exhaust stack emissions on the roof in which rain runoff drained to the south and southwest corner of the former building
- Septic disposal of contaminants under the former foundation of the building

While the potential contaminant source for two of these areas may be linked to exhaust stack emissions, the mechanisms for fate and transport are very different. The current soil data for the open land area west of the former building indicate surficial deposition over a wide area

has occurred with little vertical movement of contaminants in soil. The data from the runoff area south and southwest of the former building indicate that contaminants may have been transported deeper in soils by runoff. This will require sampling at greater depths to define the vertical extent of contamination.

The former septic system has the highest potential for migration of contaminants due to the volume of water passing though this contaminated area. Soil samples will be required at the greatest depth in this location and down gradient of the water pathway.

It will also be necessary to expand the survey units to include additional areas south of the property boundary of the site. This will encompass the parcel of land to the south and east of the former building location. The highest contamination levels were located between the former building and south property boundary, thus resulting in further investigation. Therefore, samples will be heavily focused on the areas where contamination is likely to be present in order to quantify the boundaries of contamination. This will be done to verify and help bound the known areas of contamination.

This sampling design covers both the data gaps identified from the previous sampling events as well as extend sampling to new areas of concern. Samples will be obtained from previous sample coordinates where contamination levels exceed 50 pCi/g for ^{14}C at the deepest interval sampled. In these locations, one additional sample will be collected from 1 meter below the last recorded sample depth. Table 1.4-1 lists the locations and depths where the data gap samples will be obtained. Attachment A – Data Gap Samples depicts the locations of each proposed data gap sample.

Table 1.4-1
Data Gap Sample Locations

Location	Depth (Meters)
29-015	3
29-018	1
29-019	1
29-045	1, 2, 3
29-049	3
29-051	3
29-061	3

In addition to the data gap sample locations described above, Additional samples shall be obtained from Survey Unit 29 in order to properly characterize the former exhaust stack and steric systems areas. Survey Unit 30 will evaluate the open land area to the south and east of

the former building footprint. This land area slopes towards the south and surface contamination may have migrated following the surface water runoff pathway. These sample locations are depicted in Attachment A.

The Phase 4 sample locations were based off the previously established triangular sampling grids to evaluate adjacent areas where sampling results exceeded 50 pCi/g. For the purpose of this investigation, the lateral spacing between these additional locations will match the Phase 3 sampling event which was approximately 9.1 meters. A field technician will verify the location of each sample using a Trimble GPS tracker unit. At each of the new locations, one surface sample will be collected from 0 - 6 inches below the ground surface. Additional samples shall be collected at these locations at 1 meter, 2 meter and 3 meter depths. These sample locations are depicted in Attachment A.

1.4.1 Site Screening Levels

Site screening levels (SSL) have been set at 50 pCi/g for ^{14}C and 220 pCi/g for ^{3}H based off the previous soil sampling results. The SSL's do not correspond to a specific annual dose limit but are to be used as a decision point to determine when additional data should be obtained.

Site-specific DCGLs for subsurface soils will be developed once the horizontal and vertical extent of contamination has been determined.

2.0 Quality Assurance Project Plan

2.1 Project Management

2.1.1 Project/Task Organization

The project organization described in this section shall be responsible for achieving quality on this project. Verification personnel, whether in line or organizationally independent, have sufficient freedom, authority, access, and responsibility to:

- Identify quality problems, deficiencies in hardware and documentation, and noncompliance with performance objectives.
- Initiate, recommend, or provide solutions through designated channels
- Verify implementation of the solutions
- Assure that deficient work is stopped or is proceeding under controlled conditions until proper disposition of the unsatisfactory condition is accomplished.

The quality related responsibilities for the management positions of the Sigma-Aldrich Fort Mims Decommissioning are provided in Table 2-1. Where titles are used to designate responsibility the named position has the authority to designate another qualified position within the organization to perform an assigned task. The incumbent, however, retains the responsibility for implementing the requirements. Project organizations operate directly in accordance with this QAPP.

- The Project Manager (PM) is responsible for the overall safe, timely and cost effective completion of the project. The individual is responsible for all project activities and directly supervises the Sr. Health Physics Technicians and subcontractors; approve all project expenditures; provide interface between the client and company resources; and maintain project budget and schedules. In addition, the PM is responsible for ensuring the elements of this QAPP are successfully implemented.
- The Quality Assurance Representative is responsible for the development and issuance of this QAPP and reviewing and concurring with project plans and procedures affecting quality. The Quality Assurance Representative is also responsible for the following:
    - Advising management of quality achievement and recommending means of improving quality performance.
    - Establishing generic project management/quality assurance procedures and instructions. Verifying the quality of work by audit or surveillance.
    - Investigating quality issues.
    - Furnishing quality assurance expertise to support project assessments.

- The Senior Health Physics Manger is responsible for survey planning, implementation and documentation. This individual is responsible for implementation of the D&D Plan and meeting all data quality objectives.
- The Health and Safety Officer is responsible for implementing project health and safety and the DDES Health and Safety Program. The Health and Safety Officer reports directly to the Corporate Safety and Health Manager.
- The Senior Health Physics Technician is responsible for implementing all aspects of radiation safety and data collection.

All personnel have the responsibility for executing their work and ensuring that quality-affecting activities within their purview are performed in conformance with this QAPP and the applicable approved plans and procedures.

All project personnel have the authority and responsibility to stop their own work when continuation will produce or conceal results that are not in accordance with prescribed requirements of this QAPP, and the responsibility to report such conditions to line management.

2.1.2 Special Training Requirements/Certification

Project personnel shall be indoctrinated and trained in accordance with this QAPP, project specific documents, applicable DDES corporate procedures and applicable Sigma Aldrich procedures.

- Indoctrination to the project scope of work shall be provided to all project personnel
- Project Personnel shall be provided sufficient training prior to commencement of the individuals assigned task(s). The extent of training shall be determined by the Project Manager. The extent of training shall be based on scope, complexity, and nature of the assigned task(s), education, experience, previous training, and proficiency of the individual.
- The training method employed may be one or all of the following:
    - Classroom instruction;
    - Reading assignments;
    - On-the-job;
    - Practical demonstration
- Education and experience qualifications shall be documented by resume with relevant formal educational training certificates enclosed with the resume.
- All forms of personnel indoctrination and training shall be documented and maintained.

All employees exposed to hazardous substances, safety hazards or health hazards shall be thoroughly trained as prescribed by 29 CFR 1910.120. Training of project employees shall include:

- Safety, Health and other site hazards
- Proper use of PPE
- Work practices that can minimize risks from hazards
- Engineering controls
- Equipment use
- Medical surveillance requirements

At a minimum all project employees shall be required to be trained in a 40 hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course. This training requires an initial 40-hour session of off-site instruction and three days of field experience. There are additional requirements for occasional site workers, managers and supervisors. 29 CFR 1910.120(e)(8) addresses refresher training for 40-hour site worker certified employees; this refresher training is eight hours in length.

2.1.3 Documentation and Records

Project documents and records that shall be considered Quality Assurance Records include but are not limited to the following:

- Decommissioning Plan
- Health and Safety Plan
- Soil Sampling Plan
- Project-Specific Procedures
- Supporting Quality Assurance Procedures

Project documents shall be reviewed for adequacy and approved by authorized personnel. Document control shall insure that only the most current documents are in use during the performance of project activities. Project-specific and supporting quality assurance procedures, work instructions, quality plans and other documents which specify quality requirements or prescribe activities affecting quality shall define the required documents or data to be maintained as Quality Assurance Records. Additional documents such as quality-related procurements for items and sub-contracted services, personnel training records and qualification documentation shall also be maintained as Quality Assurance Records. Records shall be protected against damage, deterioration or loss.

2.1.4 Nonconformance Control and Corrective Action

All project personnel shall be responsible for notifying their supervisor, the Project Manager, or the Quality Assurance Manager of conditions or items that do not meet specified requirements. All project personnel are encouraged to identify any activity, process, or procedure that could lead to a potential nonconformance or a condition adverse to quality. All nonconformance's, corrective actions, and preventative actions shall be documented and maintained.

2.2 Measurement/Data Acquisition

2.2.1 Sampling Process Design

This soil sampling procedure is designed to describe the use of equipment and the handling and processing of the sample after the retrieval of material. The collection of samples may be done using hand augers, a Geoprobe or similar drilling rig.

2.2.2 Analytical Methods Requirements

Test America in Earth City, Missouri will be used for radiochemical analysis of the soil samples. All samples shall be analyzed for ^{3}H and ^{14}C. Both ^{3}H and ^{14}C analysis will be performed by oxidation of the sample to vaporize and capture volatile ^{3}H and ^{14}C. Both the volatile and non-volatile samples will be analyzed using a liquid scintillation counter. The Test America analytical methods are LCS and EERF C-01-1, respectively.

2.2.3 Instrument/Equipment Testing, Inspection, Maintenance

Instrumentation and Equipment shall be used in accordance with DDES procedures and policies. All instrumentation shall be calibrated in accordance with manufacturer's instruction or by a subcontracted laboratory calibration procedure.

2.2.4 Instrument Calibration Frequency

Calibration checks of laboratory counting equipment and field instruments shall be performed per manufacturers or NIST specifications and periodicities. Some field instruments do not require periodic calibration; these will be marked as such. NIST traceable sources shall be used where applicable. Data sheets of calibration checks of fixed laboratory counting equipment will be maintained for both source and background during the course of the project to evaluate trends in counting data.

When field instruments are in use, daily response checks using radioactive sources with similar energies shall be used to verify the functionality of field instruments. Background readings will be taken as part of the daily response check.

When instruments and equipment are found out of calibration or not functioning as expected, evaluations shall be made to assess the validity of the data obtained since the

last performance test. This evaluation shall be documented and if required, processed as a nonconforming condition.

The following documentation shall be maintained:

- Calibration Procedures
- Calibration Certificates
- Instrument and Equipment Inventory
- Nonconformance and Corrective Action Reports

2.2.5 Data Acquisition Requirements (Non-Direct Measurements)

The data collection process will be defined, controlled, verified, and documented. The following activities shall be addressed in the applicable final status survey procedures:

- Scanning and direct measurements
- Field sampling methods
- Sample handling and custody
- Analytical operations for bench top laboratory equipment

Procedures shall be reviewed and approved. Procedures shall include, but are not limited to the following:

- A design which assures data is traceable to the survey and analytical procedures, performance standards, data collectors, analysts and measuring and test equipment.
- Noting deviations from planned data-collection operations on the survey forms or in field logbooks.

2.3 Data Validation and Usability

2.3.1 Data Review, Validation, and Verification Requirements

Laboratory analysis shall be evaluated as follows:

- External analytical laboratories will be required to provide their own data validation package for review. As appropriate, this package may include gamma spectrum identification information such as calibration and peak identification measurements, isotopic quantification calculations and, if radiochemical analysis is used, percent sample recovery.

- The Project Manager will review the sample data to ensure chain of custody has been preserved, all samples taken having corresponding sample results provided, limits of detection are at or below criteria specified in the D&D Plan,

peak identification is correct (i.e. the radionuclide identified is associated with the energy line in the spectrum), and calculations for peak quantification are accurate.

Field data shall be reviewed to ensure that:

- All DQOs are met as defined in the D&D Plan and Soil Sampling Plan
- Forms are accurate and complete and the type of survey has correctly been assigned to the survey unit.
- The Minimum Detectable Concentration (MDC) for measurements meets the criteria specified in the D&D Plan and Soil Sampling Plan
- Instrumentation calibrations and functional checks have been performed accurately and at the specified frequency.

2.3.2 Data Analysis

The statistical guidance contained in the Soil Sampling Plan will be used to determine if additional surveys or sample measurements are needed.

Quality Control (QC) measurements, samples, and direct measurements are technical activities performed to measure the residual radioactive contamination from licensed activities. The measurement results will be compared to the criteria listed in the Soil Sampling Plan.

3.0 Field Sampling Plan

3.1 Sampling Objectives

This soil sampling plan has been designed to both complete the site soils characterization. During the characterization phase of the sampling the goal is to fill in the existing data gaps and bound the areas of contamination. The data will be imported into GIS based mapping software to allow for easy identification during remediation or future sampling campaigns.

3.2 Sampling and On-Site Environmental Measurement Procedures

Subsurface and surface soil sampling shall be conducted using hand augers, a Geoprobe or equivalent drilling equipment. Surface soil samples may be collected by using manual or hand operated devices when access to sampling locations with a Geoprobe may be impeded due to overgrowth of vegetation.

3.2.1 Surface Soil Sampling

Surface soils are classified as soils between ground surface and 6 inches below ground surface. As these samples are obtained, they will be homogenized in stainless steel mixing bowls.

3.2.2 Subsurface Soil Sampling

Subsurface samples are classified as those samples that are below six inches of ground surface. These samples shall be obtained using a Geoprobe or similar using push tubes, split spoons, etc. Subsurface soil samples will be collected from 6 inches below ground surface to 1 meter. Sample intervals will continue in 1 meter intervals based on the designated boring depth defined in the soil sampling plan. Each sampling interval will be homogenized in stainless steel mixing bowls.

3.2.3 Soil Sampling Procedure

The soil sampling will be performed as follows:

- Sampling personnel will don a new pair of disposable gloves immediately before collecting soil samples at each location;
- A hand-auger or push probe will be used to collect soil at accessible locations from 0” to 6” below ground surface;
- If the hand auger or push probe is unable to access the sampling location a Geoprobe will be used to collect soil samples;
- A minimum of 500 grams of material will be collected from each sampling location before homogenization. In the case of deep sample locations, multiple

samples will be collected in proximity to each other to obtain the necessary sample volume;

- Homogenized soil will be placed into sample containers;
- A completed sample label will be affixed to each sample container and clear packing tape used to secure the sample label to the container. Note: It may be practical to write the applicable information directly on the containers;
- A custody seal will be affixed over the lid of the sample container;
- The sample number, date, time and description of the sample will be recorded on the chain-of-custody (COC) record and in the field logbook. All entries will be written in permanent black ink;
- Each sample will be numbered, labeled and packaged in accordance with the Sample Number and Sampling Packaging & Shipment sections;
- Field documentation, including field logbooks and COC records, will be filled out in accordance to the Field Records, Sample and Document Control;
- The hand auger, push probe and Geoprobe shall be decontaminated in accordance to the decontamination procedure.

3.3.4 Sample Identification

Each sample will be identified as follows:

WW: Up to 2-character designation of the survey unit (for example, “29”)

YYY: 3-character designation of the sample number (for example, “002”)

ZZZZ: 1-character designation of the sample depth (for example, “3”)

For example, in the sample identification number 29-002-3, “29” represents the survey unit, sample, “002” represents the sample collected at location 002, “3” represents the depth in meters of which the sample was obtained. The sample number will be recorded in the field logbook, on the labels or containers and chain-of-custody record at the time of sample collection. A complete description of the sample and sampling conditions will be recorded in the field logbook and referenced using the unique sample identification number.

3.2.4 Sample Labeling

Sample labels are necessary to prevent misidentification of samples. Sample labels will be filled out in permanent ink and affixed to sample containers at the time of sample collection. Each sample container will be labeled with the following, at a minimum.

- Sample identification number

- Sample collection date (month/day/year)
- Time of collection (24-hour clock)
- Samplers initials

3.2.5 Sample Packaging and Shipment

Sample packaging and shipment procedures for this project will be in accordance with Department of Transportation (DOT) and International Air Transportation Association (IATA) procedures as applicable for packaging and shipping of samples. Samples for radiological will be packaged in an insulated cooler with sufficient packing material if samples are transported by a commercial carrier.

3.2.6 Sample Handling and Mixing

Precautions will be taken to prevent sample contamination. Clean gloves, sampling and mixing equipment will be used for each sample taken and will be decontaminated prior to subsequent use. One member of the sampling team will be responsible for taking field notes, filling out labels, COC's, etc., while other members of the team shall obtain soil samples. Collection activities will take place from the least suspect contamination locations to the most suspect contamination locations to prevent cross contamination between sampling locations. A minimum of 500 grams of soil shall be collected at each sampling location.

After collection, all soil samples shall be mixed thoroughly to ensure sample uniformity. As the required volume of soil is collected it will be transferred into stainless steel mixing bowls to be homogenized using stainless steel mixing spoons. Once the soil has been properly mixed, samples will be removed and placed into the sample containers for analysis. Mixing in the bowls will consist of breaking down any clumps of material with stainless steel spoons and stirring in a circular fashion, reversing direction and occasionally turning the material over from the bottom of the bowl to the top to prevent settling of the finer materials. Any rocks or debris will be removed from the sample. After mixing is complete, the soil will be divided into two sample sets and placed into sample containers.

3.2.7 Decontamination Procedure

Decontamination of non-disposable sampling equipment will be performed to prevent introduction of extraneous material into samples and to prevent cross contamination between samples. This cleaning process will be done in a series of wash bins to assure that contamination is not spread and enhance the probability of being able to release the equipment from the site.

The following steps will be utilized for general decontamination of non-disposable sampling equipment:

- Clean with appropriate non-phosphorus decontamination solution to remove gross contamination from the equipment within a wash bin.
- Rinse and perform a 2nd cleaning in the 2nd wash bin.
- Rinse and wipe equipment using a water from a clean water wash bin.
- Final wipe and cleaning with a dry clean cloth to remove remaining solution and contamination from the equipment.
- Radiological screening of equipment to verify effectiveness of the decontamination for equipment that is to be taken off site at the completion of work activities. This process will be completed using hand held survey meters and wipes that will be analyzed using a liquid scintillation counter.

3.3 Field Records, Sample and Document Control

In order to maintain the integrity and traceability of samples, all information pertinent to field sampling will be recorded in a field logbook. All samples will be properly labeled and custody sealed prior to being transported to the laboratory. All samples will be accompanied by a completed COC. All documentation will be recorded in a bound field logbook with permanent ink.

3.4 Chain of Custody

To establish the documentation necessary to trace sample possession from the time of collection through analysis and disposal, a COC record will be completely filled out and will accompany every sample obtained. Samples will be delivered to the laboratory as soon as practical. At a minimum, the following items will be on the COC record:

- Project name
- Sample ID
- Sampler Name
- Sampler Signature
- Date of sample collection
- Sample matrix
- Sample location codes
- Number of sample containers
- Comments
- Relinquish signature
- Laboratory representative signature
- Date of custody transfer

3.5 Custody Seals

Sample custody seals are used to detect unauthorized tampering of samples from the time of sample collection to the time of analysis. The applicable seals will be signed or initialed and dated by the sampler. The seals will be placed on the sample containers and shipping containers in such a way that they must be broken in order to open the containers. Seals will be affixed to containers before the samples leave the custody of the sampling personnel.

3.6 Field Logbook

A permanently bound field logbook with consecutively numbered pages, used for sampling activity only, will be assigned to this project. All entries will be recorded in permanent ink. At the end of each work day, the logbook pages will be signed by the responsible party and any unused portion of the page will be crossed out, signed and dated. If it is necessary to transfer the logbook to another person, the person relinquishing the logbook shall sign and date the last page used, and the person receiving the logbook shall sign and date the next page to be used.

At a minimum, the logbook will contain the following information:

- Project name and site location
- Date and Time
- Personnel in attendance
- General weather information
- Work performed
- Field observations
- Sampling performed, including specifics such as location, type of sample, type of analyses, and sample identification numbers
- Problems encountered and corrective action taken
- Verbal or written instructions
- Any other events that may affect the samples

3.7 Document Corrections

Changes or corrections on any project document will be made by crossing out the erroneous item with a single line and initialing (by the person performing the correction) and dating the correction. The original item, although erroneous, must remain legible beneath the cross-out line. The new information should be written clearly above the crossed-out item.

3.8 Management of Investigation-Derived Waste

It is anticipated that Investigation-Derived Waste (IDW) will be generated during the characterization and final status survey soil sampling events. Anticipated waste materials that will be generated as part of the soil sampling scopes include:

- Well development and purge water
- Waste soil, sediment and water
- Used personal protective equipment
- Decontamination liquids
- Used sampling equipment
- Paper towels
- Sampling bottles

All wash water from the cleaning of soil samples shall be collected into 55-gallon polyethylene drums and held on site. 55-gallon steel drums shall be used to collect any dry wastes associated with this scope of work. Once the sampling event is complete, the drum(s) will be analyzed for radiological contamination and waste profiling. IDW does not include wastes that are generated from the displacement or removal of environmental media as a result of remediation activities.

4.0 Conclusions

The Phase 4 Soil Sampling Plan has been designed to fill the existing data gaps in the soils data previously obtained and evaluate the area of concern south of the former building footprint. The results of the Phase 4 sampling will be used to help calculate site-specific DCGLs and help in the development of a ground water monitoring strategy.

5.0 References

USEPA Soil Screening Guidance User's Guide, Second Edition 9355.4-23 (July 1996).

USEPA Using the Triad Apporach to Streamline Brownfields Site Cleanup (June 2003).

USEPA *Guidance for the Data Quality Objectives Process EPA/240/B-06/001* (February 1996).

NUREG 1505 A Nonparametric Statistical Methodolgy for the Analysis of Final Status Decommissioning Surveys. (1995).

NUREG 1506, Measurement Methods for Radiological Surveys in Support of New Decommissioning Criteria. (1995).

NUREG 1507, Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions. (1997).

NUREG 1575, Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM), Revision 2. (2001).

NUREG 1727, NMSS Decommissioning Standard Review Plan, Final. (2000).

NUREG 1757, Vol. 2. Consolidated NMSS Decommissioning Guidance, Final Report. (2003).

Attachment A:
Soil Sampling Maps

Note:
- All Sample Units are in pCi/g

Legend

Soil Sample Location

FMF-28

FMF-29

Sigman Aldrich Soil Results
C-14
Sigman Aldrich Fort Mims Facility
11542 Fort Mims drive
Maryland Heights, Missouri

REQUESTED BY: M. Norton

DRAWN BY: M. Senne

DATE: 3/12/2015

PROJECT NO: MA-15-028-02

Decontamination Decommissioning & Environmental Services, LLC
"Preserving Our Clients Best Interest"
DDES

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Googe Earth Pro Imagery: 10/21/2014

Sigman Aldrich Soil Results
H-3
Sigman Aldrich Fort Mims Facility
11542 Fort Mims drive
Maryland Heights, Missouri

REQUESTED BY: M. Norton

DRAWN BY: M. Senne

DATE: 3/12/2015

PROJECT NO: MA-15-028-02

Decontamination Decommissioning & Environmental Services, LLC
"Preserving Our Clients Best Interest"
DDES

Googe Earth Pro Imagery: 10/21/2014

Legend

- Existing Soil Sample Location
- Proposed Soil Sample Location
- FMF-28
- FMF-29

Phase 4 Soil Sampling Locations
Sigman Aldrich Fort Mims Facility
11542 Fort Mims drive
Maryland Heights, Missouri

REQUESTED BY: M. Norton	
DRAWN BY: M. Senne	
DATE: 3/12/2015	
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Decontamination Decommissioning & Environmental Services, LLC
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Googe Earth Pro Imagery: 10/21/2014

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