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DEPARTMENT OF NATURAL RESOURCES
ENVIRONMENTAL PROTECTION DIVISION

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Guidance for Demonstrating Completion of Soil Removal Actions at Corrective Action Sites in Georgia

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Acknowledgements

The following Environmental Protection Division (EPD) staff members participated in the development of this guidance document:

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Additional EPD staff and management participated in the technical review of this document.

Applicability

This guidance document is applicable for use at corrective action sites regulated under the programs of the Land Protection Branch (LPB)[1] at which soil removal actions are being performed as corrective actions in accordance with the following statutes and the corresponding rules:

- Federal Resource Conservation and Recovery Act (RCRA)
- Federal Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- Georgia Hazardous Waste Management Act, O.C.G.A. 12-8-60 *et seq.*
- Georgia Hazardous Site Response Act (HSRA), O.C.G.A. 12-8-90 *et seq.*
- Georgia Voluntary Remediation Program Act (VRPA), O.C.G.A. 12-8-100 *et seq.*
- Georgia Brownfield Act, O.C.G.A. 12-8-200 *et seq.*
- Georgia Solid Waste Management Act, O.C.G.A. 12-8-20 *et seq.*

The above-referenced statutes are administered by the LPB programs listed below:

- Hazardous Waste Corrective Action Program
- Hazardous Waste Management Program
- Response & Remediation Program
- Solid Waste Management Program
- Risk Assessment Program

[1] This guidance document is not applicable for use at sites regulated under the Georgia Underground Storage Tank (UST) Program. For information regarding verification sampling for soil removal actions performed at UST sites, please reference the UST Closure Report Guidance, which can be accessed at the following web address:

https://epd.georgia.gov/sites/epd.georgia.gov/files/related_files/site_page/clsrptguid.doc

I) Introduction and Purpose

This guidance document was designed for sites at which soil removal actions are being performed in accordance with an existing corrective action approach. Therefore, it is anticipated that, at a minimum, the initial location(s) and dimensions of the area(s) to be excavated have been determined, based on site data and soil cleanup criteria, commensurate with the requirements of the regulatory program under which the site is managed.

1. The excavation and removal of contaminated soils to achieve compliance with concentration-based cleanup goals is a commonly-selected corrective action for environmental sites in Georgia. As with other forms of corrective action, the success of a soil removal action in meeting site cleanup criteria must be demonstrated in order for the removal action to be considered complete. The adequate demonstration of corrective action completion for a soil removal action should include the following key components:

    1. The development and implementation of a post-excavation verification soil sampling strategy,

    2. The use of appropriate data evaluation methods to determine/demonstrate compliance with site cleanup goals, and

    3. The submittal of a report to EPD that documents the relevant project information and supports the determination of corrective action completion.

The LPB has developed this guidance document to clarify the Branch's requirements, recommendations, and general expectations regarding the above-identified components of the demonstration process. The recommendations included in this guidance are consistent with current and historic EPD practice, in addition to available EPA guidance and published guidance from several states. Supporting reference documentation may be found in Appendix A. It is recommended that facilities performing soil removal actions under the programs of the LPB review this guidance document prior to commencing project activities to ensure a clear understanding of the critical elements needed to demonstrate compliance with site cleanup criteria. ***Any deviations from the recommendations included in this guidance document should be presented to EPD for review and approval prior to implementation.***

II) Document Organization

The layout of this guidance document mirrors the natural progression of the demonstration process described above, as follows:

- Section III – Sampling: This section provides guidance regarding the recommended Standard Operating Procedures (SOPs) and analytical methods to be used when implementing a post-excavation verification sampling plan. It includes default sampling criteria to assist with determining the number and placement of verification samples, based on the dimensions of the excavation footprint. Additionally, a discussion regarding the use of models to design post-excavation verification sampling plans is provided.

- Section IV – Data Evaluation: This section offers a discussion of the expected methods for comparing site data to the established cleanup goals for the purpose of determining and/or demonstrating corrective action completion.

- Section V – Reporting: This section summarizes the project reporting requirements and recommendations.

III) Sampling

An integral part of demonstrating the completion of a soil removal action is the design and implementation of a post-excavation sampling plan. The collection of a sufficient number of samples from spatially representative locations within the footprint of the excavation is critical to accurately assessing contaminant concentrations in residual soils for decision-making purposes (i.e. determining whether the removal action meets cleanup goals, or whether further excavation is necessary). This section supports the development and implementation of a post-excavation verification sampling plan by identifying the field sampling SOPs and analytical methods that should be used during field activities. It also provides default sampling criteria for determining the number and distribution of samples needed to assess corrective action completion, including guidance regarding scenarios when the use of a model for developing a sampling plan may be appropriate.

Although several key factors can influence the final post-excavation verification sampling plan design, the default sampling criteria provided in this section may be used as a first approximation of sample data needs. However, when a site's Conceptual Site Model (CSM) offers a refined spatial understanding of contaminant distribution (i.e. allows for the identification of "hot spots") and/or identifies other site conditions that may influence contaminant fate and transport, professional judgment should be used to adjust the sample locations for the initial sampling plan, as necessary, to intercept the portions of the excavation footprint most likely to show residual impacts following excavation. Additionally, because field conditions may differ from those expected when the initial sampling plan is designed, further changes to the number and/or locations of the samples based on field observations may be necessary. Therefore, the post-excavation verification sampling plan may be modified, in consultation with EPD, over the life of the project. All field activities and any required changes to the sampling plan should be performed under the oversight of a Georgia registered Professional Engineer (P.E.) or a Professional Geologist (P.G.) and should be justified and clearly documented in project field notes and reports.

Sampling and Analytical Methods

Soil sampling and field documentation for the purposes of post-excavation cleanup verification should be conducted in accordance with the most current versions of the Standard Operating Procedures (SOPs) found in the United States Environmental Protection Agency (USEPA) Quality System and Technical Procedures, which may be accessed at the following website:

https://www.epa.gov/quality/quality-system-and-technical-procedures-sesd-field-branches

Particular attention should be paid to ensuring that the appropriate soil sampling method for each type of contaminant is used. For example, soils potentially impacted with Volatile Organic Compounds

(VOCs) should not be homogenized during sample collection, since it may result in the release of volatiles from the sample matrix. Instead, samples to be analyzed for VOCs should be collected using a sampling device designed to minimize the loss of volatiles (e.g. EnCore®, TerraCore™, etc.).

All soil samples should be analyzed using US EPA Solid Waste (SW)-846 methods, or other pre-approved methods. Approval for the use of alternative analytical methods should be obtained during the development of the corrective action plan. However, if the use of an alternative method is deemed necessary during the development of the post-excavation verification sampling plan, site managers should contact the regulatory compliance officer for the site to obtain approval for the use of the proposed method prior to implementing the sampling plan. In order to maintain the comparability of existing site data with verification data, it is recommended that the Data Quality Objectives (DQOs) and analytical methods used to obtain verification samples be consistent with those applied to existing site data.

Number of Samples

Determining the number of verification samples needed to assess contaminant concentrations in residual soils following a soil removal action should begin with the understanding that, in most cases, [with the exception of those in which the full plane of a sidewall or floor area terminates against a non-soil horizon (e.g. bedrock, building foundation, water table, etc.) or regulatory boundary (e.g. limited responsibility for contamination beyond a site boundary)[2]] no fewer than five (5) verification samples will be required: one sample per sidewall (total of 4 samples) and one sample per floor area. This minimum sampling frequency should be supplemented with additional samples based on the following guidelines:

- One sample should be collected every twenty-five (25) linear feet along the perimeter of the sidewalls of the excavation, for every five (5) feet of depth within the zone of contamination.
- One sample should be collected for every 625 ft^2 of floor area[3].
- For excavations with sidewall perimeters that are not multiples of 25 ft, floor areas that are not multiples of 625 ft^2, and/or depths that are not multiples of 5 ft, the sidewall, floor, and depth dimensions should be rounded up to the next greatest multiple to determine the number of samples needed.

Sample Distribution

In general, the sample location layout for the initial sampling plan may be based on an evenly-spaced pattern that conforms to the sampling criteria presented above. However, as previously noted, when a site's CSM offers a refined spatial understanding of contaminant distribution (i.e. allows for the identification of "hot spots") and/or identifies other site conditions that may influence contaminant fate and transport, professional judgment should be used to adjust sample locations, as necessary, to intercept the portions of the excavation footprint most likely to show residual impacts following excavation.

[2] For cases in which the full plane of a sidewall or floor area terminates against a non-soil horizon or regulatory boundary, verification samples will not be required for that particular plane.

[3] For floor areas having dimensions that approach a linear shape, such as those that may be associated with pipeline releases, floor samples should be collected at the same frequency identified above for sidewall samples.

Regardless of the level of information available within a site's CSM, sample locations should be adjusted in the field, as needed, to account for: subsurface heterogeneity, preferential pathways, exposure, toxicity, and/or visual signs of contamination (e.g. free product, soil staining), etc. It should also be noted that when a model is used to develop a sampling strategy, the placement of the samples may be dictated by the model. Any deviations from the original post-excavation verification sampling plan, along with the rationale for those deviations, should be documented and discussed with the regulatory compliance officer.

Statistical Models

For excavations exceeding 18,000 ft^2, the above criteria may yield a sampling plan that is resource-intensive. In such cases, the use of a statistical model to develop a verification sampling strategy may be more efficient by reducing the number of samples needed to demonstrate compliance with site cleanup goals, while still maintaining the level of confidence needed to support the demonstration. In particular, modeling based on the USEPA's DQOs (USEPA 2000a) and systematic planning process is considered a feasible approach to designing a defensible sampling strategy that satisfies the requirements of this guidance document.

EPD will consider the use of models developed/sponsored by the USEPA, the U.S. Geological Survey, the U.S. Department of Defense, or the U.S. Department of Energy. EPD may also consider models developed by other entities. However, any modeling software not previously approved for use by EPD must be shown to be well-documented, verified, and peer-reviewed. Additionally, if any modeling software is used that cannot be obtained without a cost, a copy of that software, and a user license, must be provided to EPD. Finally, while EPD will consider the application of such models, it should be noted that the use of models currently approved by EPD, as indicated above, is preferred.

IV) Evaluation of Data

Typically, the Corrective Action Plan (CAP) or other analogous document for a removal action will include pre-determined soil cleanup criteria, or target levels, that will be applied to post-excavation site data. Depending upon the requirements of the regulatory program under which a site is managed, compliance with the soil cleanup goals can be evaluated using either Not-to-Exceed (NTE) values or Site Specific Target (SST) values. For program-specific information regarding the applicability of each approach, please consult the EPD program with regulatory oversight.

Not to Exceed (NTE) Cleanup Criteria

When using the NTE approach to verify site cleanup, the site's pre-determined cleanup goals act as "not-to-exceed" values and are compared, on a point-by-point basis, to each discrete verification sample result. Any sample results that exceed an NTE threshold indicate that further soil removal is warranted to address soil contamination. Successive iterations of excavation, followed by verification sampling in accordance with Section III of this guidance, should be conducted until no further verification samples exceed the NTE threshold.

Specific examples in which the NTE soil removal approach may be applicable include, but are not limited to, the following:

- 391-3-19-.04(2)(a) removals to below a Notification Concentration,
- To meet the regulatory requirements for Type 1-4 cleanups under 391-3-19-.07(6)-(9),
- Soil concentrations protective of groundwater,
- Soil concentrations protective for vapor intrusion,
- Acute hazard levels for emergency response,
- Removal to Background levels.

Site Specific Target (SST) Cleanup Criteria

The SST approach to site cleanups primarily utilizes an "area averaging" approach to evaluate the post-excavation verification sampling data. The SST approach to site cleanup can be defined as treating or removing soils with the highest contaminant concentrations such that the average (usually the 95% upper confidence limit (UCL) of the average utilizing ProUCL software) concentration remaining onsite after remediation is at or below the cleanup level (U. S. EPA, 2005[4]).

However, the following limitations must be taken into account, with the SST approach:

- The minimum sampling criteria determined for an excavation may not provide a data set that is sufficiently robust to support the calculation of a site average using a statistical approach. Site managers should ensure that the number of samples collected is adequate to fulfill the sample size requirements of the statistical method used.

- The potential for soil leaching may be a concern at HSRA/RCRA facilities that have groundwater compliance driven remedial action objectives.

- Sites with source material or "hot spots" may be unsuitable, depending on the requirements of the regulatory program.

- Because soils with concentrations exceeding the cleanup level will be left onsite, it is necessary to demonstrate that those concentrations do not represent acute and sub-chronic health risks.

- Community involvement concerns and instances where the responsible party does not own the property and does not have express permission from the property owner to leave contaminant concentrations above default regulatory levels in place.

For more information regarding the use of site-averaging to demonstrate compliance with cleanup goals, please refer to: [Place holder for area averaging guidance reference]

[4] U.S. EPA, 2005. *Peer Review Draft Guidance on Surface Soil Cleanup at Hazardous Waste Sites: Implementing Cleanup Levels*, Office of Emergency and Redial Response, April. Available online: http://www.epa.gov/sites/production/files/documents/guidance-cleanup-April-05.pdf

IV) Reporting

The final component of demonstrating the successful completion of a removal action is to present documentation of the project activities, relevant information, and project results in a manner that clearly supports corrective action completion. All basic site information and corrective action details should already have been established within a pre-existing CAP, or other analogous document. Therefore, the final compliance reporting focuses on the pertinent and applicable information necessary to support the site's compliance with, and certification to, the applicable regulatory standard(s). At a minimum, EPD recommends that the following components and associated information be provided in the final report:

- Indication of the DQOs and how they were met, (i.e. the target levels for the removal, as well as how the particular data evaluation approach was used to demonstrate compliance with those target levels).

- Copies of any laboratory certifications required by the applicable statutes and associated rules of the regulatory program with oversight.

- Copies of all laboratory reports and any associated data validation documentation.

- Tables and Figures showing all sample results along with the (associated) cleanup criteria[5].

- Description and documentation of any deviations from the proposed sampling plan.

- The signature and certification of the Georgia registered P.E. or P.G. overseeing the project, in addition to any certifications required by the regulatory program with oversight.

In addition, EPD recommends that the following items be verified in the report:

- DQOs for verification samples were consistent with those of the delineation samples, as well as with the requirements of the regulatory program under which the site is managed (i.e. the verification data are comparable with existing site data).

- The pre-approved analytical methods (SW-846, or other EPD-approved methods) were used to analyze verification samples. The laboratory reports requested above should provide supporting evidence that the pre-approved methods were used.

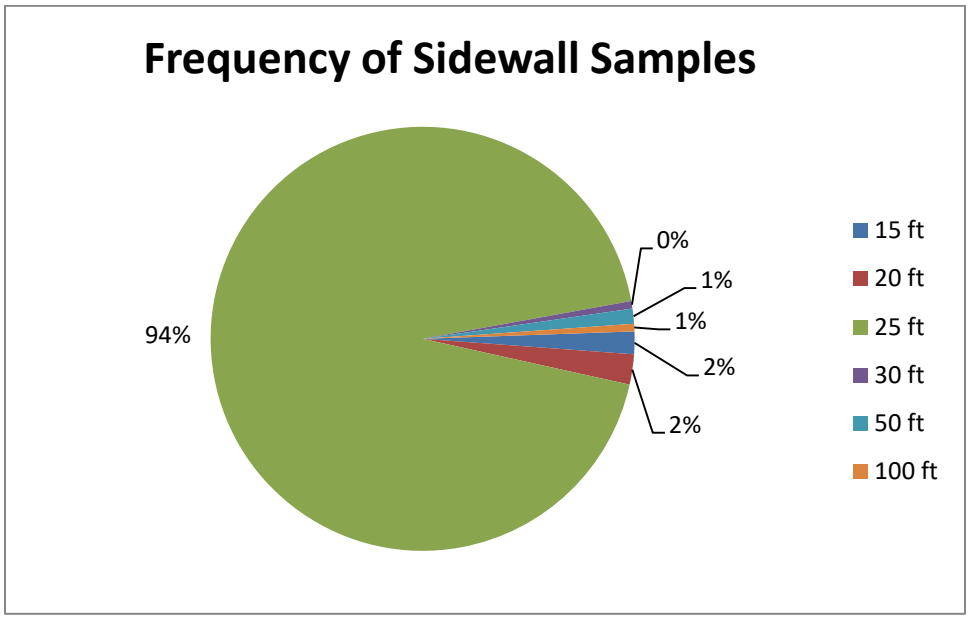
- Documentation that the pre-approved SOPs (current USEPA SOPs, or other pre-approved SOPs) for fieldwork were followed.

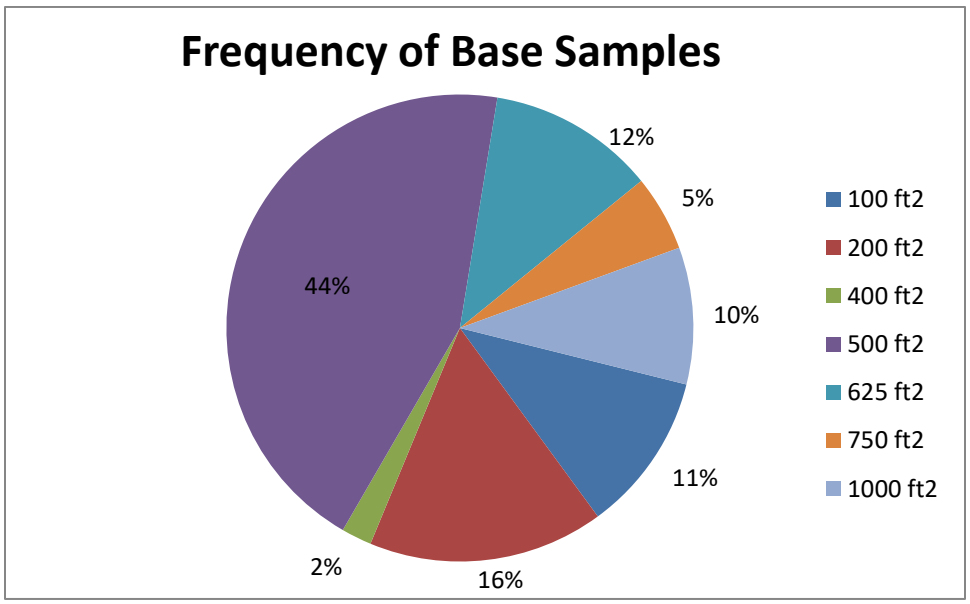
[5] Non-detect results should be shown as being less than (<) the associated detection limit and clean-up criteria (e.g. <0.018 mg/kg).

Appendix A

State of Practice Summary

GAEPD Hazardous Waste Remediation Sites





EPA References

- U.S. Environmental Protection Agency. 1989a. *Methods for Evaluating the Attainment of Cleanup Standards – Volume 1: Soil and Soil Matrix*. EPA/230/02-89-042. Office of Policy, Planning, and Evaluation, Washington, DC.
- U.S. Environmental Protection Agency. 1989b. *Methods for Evaluating the Attainment of Cleanup Standards – Volume 3:Referenced-Based Standards for Soils and Solid Media*. EPA/230/R-94/004. Office of Policy, Planning, and Evaluation, Washington, DC.
- U.S. Environmental Protection Agency. 1996. *Soil Screening Guidance: User's Guide*. Publication 9355.4-23. Office of Solid Waste and Emergency Response, Washington, DC.
- U.S. Environmental Protection Agency. 2000a. *Guidance for the Data Quality Objectives Process (QA/G-4)*. EPA/600/R-96/055. Office of Environmental Information, Washington, DC.
- U.S. Environmental Protection Agency. 2000b. *Data Quality Objectives Process for Hazardous Waste Site Investigations (QA/G-4HW)*. EPA/600/R-00/007. Office of Environmental Information, Washington, DC.
- U.S. Environmental Protection Agency. 2002a. *Guidance on Choosing a Sampling Design for Environmental Data Collection (QA/G-5S)*. EPA/240/R-02/005. Office of Environmental Information, Washington, DC.
- U.S. Environmental Protection Agency. 2002b. *Calculating the Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites*. OSWER 9285.6-10. Office of Emergency and Remedial Response, Washington, DC.
- U.S. Environmental Protection Agency. 2005. *Guidance on Surface Soil Cleanup at Hazardous Waste Sites: Implementing Cleanup Levels*. EPA 93550.0-91. Peer Review Draft. Office of Emergency and Remedial Response, Washington, DC. Available online: https://www.epa.gov/sites/production/files/documents/guidance-cleanup-April-05.pdf
- U.S. Environmental Protection Agency. 2015. *ProUCL Version 5.1 – User Guide*. EPA/600/R-07/041. Office of Research and Development, Washington, DC.

Guidance researched from other states:

- Alabama: ADEM's *UST Closure Site Assessments, Guidance Manual-Section III*, dated Sept 2007 (pgs 7-8 of PDF) http://www.adem.state.al.us/programs/water/waterforms/USTClosureSiteAssessment.pdf
- Florida: *Standard Operating Procedures PCS-004*, dated Oct 1, 2001 http://www.dep.state.fl.us/waste/quick_topics/publications/pss/pcp/a-soil-MEMO.pdf
- Florida: *Preapproval Program Guidance for Technical and Cost Justification for Contaminated Soil Source Removal*, dated Feb 2007 http://www.dep.state.fl.us/waste/quick_topics/publications/pss/pcp/March12007Guidance/SRGuidance-021507.pdf

- Kentucky: *Closure Outline for UST*, dated July 2011 (pgs 5-6 of PDF) http://waste.ky.gov/PPA/Docs_Inc_Ref/Closure%20Outline.pdf
- Indiana: From *UST Closure Assessment* webpage http://www.in.gov/idem/landquality/2385.htm
- Michigan: *Guidance Document, Verification of Soil Remediation*, dated April 1994 (pgs 8-9 of PDF) http://www.michigan.gov/documents/deq/deq-whm-hwp-verification-soil-remediation_248125_7.pdf
- Minnesota: *Excavation of Petroleum Contaminated Soil and Tank Removal Sampling* (pgs 3-4 of PDF), dated Sept 2008 https://www.pca.state.mn.us/sites/default/files/c-prp3-01.pdf
- Arkansas: *Closure Guide* for UST (pg 10 of PDF); At least one soil sample per tank https://www.adeq.state.ar.us/rst/programs/pdfs/closure_guide.pdf
- Louisiana: *UST Closure Guidance Document*, dated May 2010 (pgs 19-25 in PDF); Any areas of obvious contamination must be sampled; must take 1 sample from backfill http://www.deq.louisiana.gov/portal/Portals/0/UndergroundStorageTank/UST%20Closure%20Guidance%20Document%20-%20Effective%20Date%205-01-10.pdf
- New Mexico: *UST Soil/Water Sampling and Disposal Guidelines* website, dated April 1995; Must sample where there is evidence of a release https://www.env.nm.gov/ust/soilsamp.html
- Connecticut: *Draft RCRA Closure Plan Guidance for Treatment, Storage and Container Storage Areas and Tank Systems (Draft document, No issue date)* http://www.ct.gov/deep/lib/deep/waste_management_and_disposal/remediation_waste/rcra_closure_plan_guidance.pdf
- New Jersey: *Technical Guidance for Site Investigation for Soil, Remedial Investigation for Soil, and Remedial Action Verification Sampling for Soil*, dated March 2015. http://www.nj.gov/dep/srp/guidance/srra/soil_inv_si_ri_ra.pdf
- California Environmental Protection Agency. 2001. *Information Advisory Clean Imported Fill Material.* Department of Toxic Substances Control.

Miscellaneous

- Pacific Northwest National Laboratory. 2014. *Visual Sample Plan – Version 7.0 User's Guide*. PNNL-23211.
- The Interstate Technology & Regulatory Council. 2012. *Technical and Regulatory Guidance - Incremental Sampling Methodology*.