RESIDENTIAL PROPERTY SAMPLING WORK PLAN—Revision 2

Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri
RCRA Permit Number MOD007129406

Submitted by:

GREENFIELD
ENVIRONMENTAL TRUST GROUP

Greenfield Environmental Multistate Trust LLC,
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Revision 2 – October 23, 2018
(Revision 1 – December 21, 2017)
(Revision 0 – August 7, 2017)

REVISION HISTORY

Residential Property Sampling Work Plan
Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri

The following table documents the revisions made to the Residential Property Sampling Work Plan for the former Tronox/Kerr-McGee Facility at 2800 West High Street, Springfield, Missouri, by version.

Version Number	Date	Revision Initiated By	Description of Revision	Author
0.0	8/7/2017	Not Applicable	Baseline Version – No Changes	Environmental Works, Inc. (EWI)
1.0	12/21/2017	MoDNR	Appendix A – Added example of draft webpage version of Odor Reporting Form	EWI
2.0	10/4/2018	Greenfield Environmental Multistate Trust, LLC	Title Page, Header, Section 1.0 – Changed "Former Tronox Facility" to "Former Tronox/Kerr-McGee Facility" to provide additional description of the Facility. Table of Contents – Updated titles of Figure 1.0 and Table 1.0 to match current versions. Section 1.0 – Added a footnote of historical names used for the Facility, along with the street address, to provide supplemental means of identifying the site. Added descriptive text on the scope and triggers for sampling described in this Work Plan. Added text to provide examples of scenarios in which the Multistate Trust may request access for residential property sampling. Added text to indicate how data collected as part of this Work Plan will be used to supplement outdoor air evaluations described in the Final Additional Outdoor Air Sampling and Indoor Air Confirmation Sampling Work Plan (including Addendum). Section 2.1 – Revised text to reflect up-to-date procedures and to describe the availability of a MoDNR webpage (launched in May 2018) for residents to report odor concerns.	Integral Integral Integral EWI

Version Number	Date	Revision Initiated By	Description of Revision	Author
			Section 2.3 – Changed polycyclic aromatic hydrocarbons (PAHs) to semi-volatile organic compounds (SVOCs) and added version letters to analytical methods (e.g., EPA Methods 8260B and 8270D) in this and subsequent sections. Added text to clarify that handheld global positioning system (GPS) unit will be used to record sample location coordinates.	Integral
			Sections 2.3.3 – Clarified that that the target sample depth for soil is 0 to 1 foot below ground surface.	Integral
			Section 2.3.4 – Added section to describe additional soil or seep sampling that may be implemented to further evaluate conditions based on observations by the field team.	Integral
			Section 3.0 – Added additional description of the data evaluation and reporting procedures that will be applied to data collected under this Work Plan.	Integral
			Section 4.0 – Added references cited in text additions described above.	Integral
			Figure 2.0 – Removed notes (1) and (2). Added complete or potentially complete migration pathways from shallow groundwater to soil and from soil to homegrown produce.	Integral
			Table 1.0 – Updated screening levels to match current (May 2018) default Regional Screening Levels (RSLs), which included eliminating two SVOCs (acenaphthylene and phenanthrene) that do not have RSLs. Revised screening levels for seep water to match the ingestion pathway for tap water. Added screening levels for air samples. Revised headings and footnotes for clarity.	Integral
			Table 2.0 – New table listing data quality objectives.	Integral

Version Number	Date	Revision Initiated By	Description of Revision	Author
			Appendix A – Updated to include current version of MoDNR odor reporting form. Additional edits: *Part 3:* Corrected numbering and added prompt to include GPS coordinates when located samples. *Outdoor grid plot:* Changed name to Odor Observation and Sample Locations, made minor revision to instructions, and added request to include distances to permanent structures. *Neighborhood Location Map*: Updated to base map with better resolution. Appendix B – *Part 2*: Added prompt to include GPS coordinates when located samples. *Outdoor grid plot:* Changed name to Sample Locations, revised instructions to remove outdoor air sampling references, and added request to include distances to permanent structures. *Neighborhood Location Map:* Updated to base map with better resolution. Appendix D – Added vapor sampling log sheet.	Integral, EWI EWI EWI

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Appendix E Seep Water Sampling Log

Appendix F Soil Sampling Protocol and Soil Sampling Log

LIST OF ACRONYMS

BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes, and Naphthalene
COCs	Contaminants of Concern
CSEM	Conceptual Site Exposure Model
EPA	United States Environmental Protection Agency
EWI	Environmental Works, Inc.
GPS	Global Positioning System
MDL	Method Detection Limit
MoDNR	Missouri Department of Natural Resources
QAPP	Quality Assurance Project Plan
RCRA	Resource Conservation and Recovery Act
RAO	Remedial Action Optimization
RL	Reporting Limit
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SIM	Selective Ion Monitoring
SOP	Standard Operating Procedure
SVOC	Semivolatile Organic Compound
VOC	Volatile Organic Compound

1.0 INTRODUCTION, PURPOSE, AND SCOPE

This Residential Property Sampling Work Plan (Work Plan) was prepared by Environmental Works, Inc. (EWI) on behalf of the Greenfield Environmental Multistate Trust LLC, not individually, but solely in its representative capacity as Trustee for the Multistate Environmental Response Trust (Multistate Trust) for the Former Tronox/Kerr-McGee Facility[1] located at 2800 West High Street in Springfield, Missouri (Facility or Site), Resource Conservation and Recovery Act (RCRA) Post-Closure Care Permit Number MOD007129406. A Facility location map is included as Figure 1.0. This Work Plan supports the Environmental Actions performed by the Multistate Trust as approved by and under the oversight of the Missouri Department of Natural Resources (MoDNR) as Lead Agency for the Site.

Residents of the neighborhood northeast of the Facility have reported odors in outdoor air and have questioned whether the odors could be coming from the Facility. Previous accounts of outdoor odors indicate that the odors are ephemeral. In addition, residents have reported seeps and expressed concern about potentially contacting or gardening in seep water and soil that could be contaminated with Facility-related contaminants of concern (COCs; see **Table 1.0** for a list of Facility-related COCs). This Work Plan provides a sampling and analysis approach to quickly mobilize a team to perform the following activities to help address the topics described above:

- Observe odor or seeps and document whether conditions exist that suggest surface/near surface contamination (e.g., odors or wet soil with a sheen)
- Depending on the observed conditions, collect air, seep water, and/or soil samples for laboratory analysis of Facility-related COCs to quantitatively assess possible source(s) of odors, and support an initial, screening-level evaluation of potential risks to residents.

In addition, this Work Plan describes the approach for comparing sample results with applicable United States Environmental Protection Agency (EPA) Regional Screening Levels (RSLs) to assess whether further evaluation of potential human health risks is warranted. The data quality objectives for sampling seep water, soil, or air at residential properties are described in **Table 2.0**.

The scope of this Work Plan is limited to investigating odors and seeps at properties in the neighborhood northeast of the Facility. The primary trigger for initiating work described in this Work Plan is a request from a resident. Alternatively, the Multistate Trust could trigger this Work Plan by approaching a property owner with a request to investigate odors or seeps using the procedures in this Work Plan. Examples of the circumstances that could lead the Multistate Trust to request property access include further evaluation of an odor or seep source reported by a resident of an adjacent property, or observation of odors or seeps by field personnel while working in public right-of-ways (e.g., within the Clifton Drainage; walking along public sidewalks or streets). Regardless of the triggering event, investigative activities would proceed only if the resident[2] agrees to and signs the access agreement.

[1] The Site is referred to as the Former Tronox Facility, Former Tronox/Kerr-McGee Facility, Former Kerr-McGee Facility, Former Tronox/Kerr-McGee Wood Treatment Facility, and/or the Kerr-McGee Chemical Corporation (KMCC) Forest Products Division (FPD), Springfield, Missouri Facility.

[2] If the resident is not the owner, an access agreement signed by the owner will be required prior to entering upon and having access to the property.

Although the procedures described in this Work Plan include collection of local weather data from an on-Facility weather station to help ascertain the direction of possible odor sources, the scope of this Work Plan is not intended or designed to provide a comprehensive evaluation of odor sources that are distant from residential properties. Rather, data collected under this Work Plan will be used to supplement evaluations of benzene, toluene, ethylbenzene, xylenes, and naphthalene (BTEXN) concentrations that have been detected in outdoor air in the northeast residential neighborhood, at the Facility, and in the surrounding area using the procedures described in in the Indoor Air Work Plan (EWI 2017), Additional Outdoor Air Sampling and Indoor Air Confirmatory Sampling Work Plan (CH2M 2017), and Addendum to Additional Outdoor Air Sampling and Indoor Air Confirmatory Sampling Work Plan (Jacobs 2018). If the findings from data collected under those work plans indicate that BTEXN in neighborhood outdoor air is due to a source other than the Facility, collection and evaluation of additional air samples under the procedures of this Work Plan would not be necessary. Similarly, the comprehensive data collection and evaluation activities described in the Remedial Action Optimization Work Plan Addendum 3 (Integral, in prep.), which includes a comprehensive human health risk assessment for residents, may supplant the need to collect air, seep water, or soil samples using the triggers and procedures described in this Work Plan.

2.0 METHODS

The following section describes the methodology for (1) completing an odor or seep observation form, (2) collecting pre-sampling data, (3) conducting interviews with residents, (4) collecting ambient air samples, seep water samples, and soil samples (as appropriate), and (5) evaluating and reporting the sample results.

2.1 Record of Observations and Implementation Plan

Residents have several options for reporting odors or requesting sampling. Previously, residents in the neighborhood were given information to contact the Multistate Trust by phone. To obtain timely responses to odor complaints, residents were also given a 24-hour response line for the Multistate Trust's local contractor, Environmental Works, Inc. (EWI, the contractor). In May 2018, MoDNR launched a webpage for residents to report odor concerns. Odor reports that are submitted on MoDNR's webpage are forwarded to the Multistate Trust and EWI. For complaints reported through MoDNR's webpage or for calls received by EWI's 24-hour response line, EWI will contact the resident to initiate the response activities. EWI will confer with the Multistate Trust, who will notify MoDNR of any odor complaints and the results of any field verification activities.

Appendix A contains a "Residential Odor Observation Form" formatted for a phased approach to implement the investigation of the odor observations. During the initial call(s) with the resident, the Multistate Trust or EWI will obtain as much detail concerning the resident's observations as can be gleaned during the call. If this information is obtained by the Multistate Trust, the information will be relayed to EWI to be included in Part 1 of the Residential Odor Observation Form. EWI's two-person sampling team will then mobilize to the area to perform field verification prior to interviewing the resident or sampling outdoor air. Observations made will be detailed in Part 2 of the form in **Appendix A**.

Appendix B contains a "Residential Media Sampling Form" for use in investigating seep water or soil concerns expressed by residents or noticed during EWI field verification. Part 1 of the form provides

descriptions of the location, information on the type of media to be sampled, and potential related information on things such as odors, septic line damage or repairs, and chemical use in the yard. Part 2 of the form provides information on the type of sampling performed.

Upon arriving at the property, Multistate Trust and EWI representatives will ask the resident to sign an access agreement (**Appendix C**) allowing them to access the resident's property for observation and sampling. To ensure that laboratory-provided sampling supplies are readily available during seasons when historical odors have been noted, the Multistate Trust's contracted laboratory will provide certified equipment to EWI. Air sampling canisters will be replaced monthly throughout the duration of this investigation; soil and water sampling containers will be replaced as needed.

2.2 Pre-sampling Data Collection

EWI personnel will mobilize to the on-Facility weather station to collect current readings. Wind direction and speed will be recorded on the Residential Odor Observation Form. On the way to the residential location(s), EWI personnel will drive on roads at least one street away both upwind and downwind from the reported odor location to note if odors are present within this range. At the reported odor location, EWI personnel will individually, and independent of resident observations, note observations and odors. This information, including wind direction and estimated speed from the on-Facility weather station, will be recorded on Part 2 of the Residential Odor Observation Form. Ground conditions in the general area will be assessed for the following: wetness and sheen, odor, staining, and evidence of other surface or near surface contamination.

Upon arrival at a specific residential location, EWI will interview the available resident(s) about their observations. EWI will review the access agreement with the resident. If the resident has questions regarding the access agreement, EWI will direct the resident to the Multistate Trust for further information.

Using Part 3 of the Residential Odor Observation Form, the resident will be asked several questions about the initial odor or seep observations, time of onset, description, similarity to previous occurrences, and other observations deemed pertinent by the resident(s).

If the resident signs the access agreement, EWI personnel will walk the area to observe the ground conditions, assessing for the following: wetness and sheen, odor, staining, and evidence of other surface or near-surface contamination. A field sketch map will be completed with pertinent items noted, and photographs collected of the observation area and any specific applicable observations. In the case of odor observations, the location of the odor and wind direction will be evaluated to determine where the ambient air sampling apparatus will be set up. The locations of garages or sheds that could be the source of chemical odors will be noted. Soil and seep water samples, as practical, will be collected in cases where a seep or other evidence of contamination is observed, as described in Section 2.3.

2.3 Sampling and Analysis Plan

Sampling and analysis after a reported odor, seep, or soil observation will involve collection of one or more of these specific media: ambient air, seep water, and soil. Each medium and collection method are described in the following subsections. This sampling plan has been adapted from the Sampling and Analysis Plan (SAP) (EWI 2016a), the Quality Assurance Project Plan (QAPP) (EWI 2016b), and the Indoor

Air Work Plan (EWI 2017). Air samples will be analyzed for BTEXN using EPA Method TO-15 Selective Ion Monitoring (SIM). Soil and seep water samples will be analyzed for BTEXN using EPA Method 8260B and for the semivolatile organic compounds (SVOCs) listed in Table 1.0 using EPA Method 8270D[3].

Following collection of samples, Part 4 of the Residential Odor Observation Form (Appendix A) will be completed, and a post-sampling evaluation will be completed to ascertain if any recent or ongoing neighborhood activities may have influenced the sampling event results (i.e., lawns being mowed, people painting, trash burning).

2.3.1 Ambient Air Sampling Procedure

Ambient air sampling as part of a residential odor observations event will be performed in accordance with pertinent sections of EWI Standard Operating Procedure (SOP) # 21 (**Appendix D**) and involve the following:

1. If a sustained odor is present, select a downwind sampling location at or very close to the location of the odor observation. Select a second location within the neighborhood, upwind from the subject residence, to collect a background sample. Use the prevailing wind direction to plan locations. A handheld global positioning system (GPS) unit will be used to identify the coordinates of the air sample collection locations, as well as manual distance measurements from identifiable points of reference.
2. Place 6-liter Summa® canisters, with flow controllers preset at the laboratory for a 1-hour collection time, away from busy roads to the extent practicable. Set the canister at a height of 3 to 5 feet above ground surface. Secure the canisters to immovable objects if possible for security. Place a sign stating "DO NOT DISTURB – AIR SAMPLING IN PROGRESS" on or near the canister during the 1-hour sample collection period.
3. If so decided with the Multistate Trust manager during initial conversations about the particular odor complaint, collect a duplicate air sample.
4. Following collection of samples, label the canisters and ship them under chain-of-custody per the Facility's QAPP to Eurofins laboratory for analysis by EPA Method TO-15 SIM for BTEXN with 5-day turn-around time. Although there may be SVOCs that could contribute to odors, the duration of the sampling event and volume of air collected using Summa® canisters do not facilitate analysis for SVOCs at a sufficiently low method detection limit to feasibly detect low concentrations of SVOCs. Therefore, SVOC analysis will not be performed.

2.3.2 Seep Water Sampling Procedure

A seep sample will be collected if a seep with the potential for Facility-related COCs is reported or is present in the vicinity of a reported odor with sufficient water for sampling. If the seep water is

[3] SVOC concentrations in samples collected under this Work Plan will be analyzed using EPA Method 8270D, which is the most up-to-date version of this EPA-approved method. In summary, EPA Method 8270D improves quality control in the laboratory, relative to EPA Method 8270C, but does not change the underlying technology, method detection limits (MDLs), or reporting limits (RLs). Because the underlying technology, MDLs, and RLs remain the same between these two versions of EPA Method 8270, historical SVOC concentrations measured using EPA Method 8270C can be directly compared with future concentrations measured using EPA Method 8270D.

sufficiently deep with low suspended solids, a sample will be collected with a clean sampling container and transferred into laboratory provided sample containers. Special care will be taken to ensure sediment is not transferred to the sample containers. The sample will be labeled and placed in an iced cooler for overnight shipment under established chain-of-custody procedures to Eurofins Laboratory for analysis of BTEXN by EPA Method 8260B and SVOCs by EPA Method 8270D. Prior to collecting the sample, the location will be described on the Seep Water Sampling Form (**Appendix E**). A handheld GPS unit will be used to identify the coordinates of the seep sample collection location, as well as manual distance measurements from identifiable references. The description will include observations regarding time, flow conditions, color, odor, temperature, pH, dissolved oxygen percent, and conductivity. These parameters will be measured directly in the seep water if possible. If the seep water is not deep enough or of sufficient volume, seep water will be collected using an additional wide mouth jar, and field parameters will be measured from the jar.

2.3.3 Surface Soil Sampling Procedure

A surface soil grab sample will be collected if soil with the potential for Facility-related COCs is reported or is present in the vicinity of a reported seep or odor observation. Samples will be collected according to procedures stated in Section 4.0 (Surface and Near-Surface Soil Sampling Protocol) of the Facility SAP; this section is included in **Appendix F**. The sampling protocol from referenced Section 4.0 includes the following:

- Soil sampling locations shall be marked in the field and referenced on a soil sampling description log (see Appendix F). A handheld GPS unit will be used to identify the coordinates of the soil sample collection locations, as well as manual distance measurements from identifiable references.
- Soil samples will be collected using various methods (soil punches, scoops, shovels), although samples for volatile organic compound (VOC) analysis will be collected using EnCore-type samplers.

The targeted sample depth will be from approximately 0 to 1 foot below ground surface. Collected samples will be labeled, immediately placed in an iced cooler, and shipped overnight to Eurofins Laboratory using chain-of-custody protocols. Samples will be analyzed for BTEXN by EPA Method 8260B and SVOCs by EPA Method 8270D.

2.3.4 Additional Soil or Seep Sampling

Additional sampling and/or analysis of soil or seep water may be completed on the property during the field team's visit depending on conditions observed. The purpose of this additional work will be to better delineate the nature, extent, and source of observed contamination and, if implemented, provide information to evaluate exposure potential and the need for a remedial action. The need for additional information will be determined by the field team leader, in consultation with the Multistate Trust. This work may include:

- Conducting additional analytical testing on the collected samples to better understand the nature of the observed contamination (fingerprinting using total petroleum hydrocarbon analysis by EPA Method 8015, the full standard analyte list of VOCs by EPA Method 8260B, or

advanced fingerprinting analysis). If the potential for additional contaminant sources is identified, additional chemical analyses may be performed to further distinguish Facility from non-Facility impacts. To accommodate this contingency, sufficient sample volume will be collected to allow the analytical laboratory to extract and hold a representative aliquot for advanced fingerprinting analysis following review of VOC and SVOC concentration results obtained using conventional analytical methods. The specific analysis methods implemented will depend on the potential additional contaminant source. MoDNR and the resident will be informed of any planned additional analyses.

- Making visual observations and conducting soil sampling to evaluate whether potential source(s) on the residential property may be contributing contaminants to soil and groundwater (e.g., fuel tank, chemical/waste oil storage area). Pending results of these observations, the field team, in discussion with the Multistate Trust, may elect to perform analyses other than BTEXN and SVOCs (e.g., total petroleum hydrocarbon analysis by EPA Method 8015, the full VOC list by EPA Method 8260B, or metals) to help identify non-Facility sources.
- Collecting additional soil or seep samples from up to six locations for analysis of BTEXN by EPA Method 8260B and SVOCs by EPA Method 8270D to further constrain the extent of observed contamination. These additional locations may include points that are relatively distant to the initial location for the purpose of assessing background conditions and informing the extent of appropriate decision units should additional investigation of risk be necessary. If contamination is observed at the bottom of the 1-foot target depth, additional soil samples may be collected below this depth to evaluate variation in concentrations vertically. If possible (i.e., resident grants permission and area is physically accessible), a track-mounted drill rig will be used to advance borings. However, if samples can only be collected with hand tools (e.g., hand auger, shovel), the depth of vertical soil sampling will effectively be limited to approximately three feet below ground surface.

Although the additional sampling described above is not intended to fully delineate the extent of observed contamination, providing the field team with the flexibility to collect supplemental samples from other locations on the property will facilitate a more robust understanding of potential Facility-related impacts than would be achieved with a single sample.

Prior to sample collection, the field team leader will mark each location and confirm with the resident that permission is granted to proceed with sample collection activities. Documentation of sample locations and sample collection procedures will be consistent with the protocols described in Sections 2.3.2 and 2.3.3.

3.0 DATA EVALUATION AND REPORTING

Upon receipt, analytical results will undergo data validation per procedures specified in the QAPP, which are equivalent to the EPA Stage 2A validation level described in EPA (2009). Validated data will be compared to background concentrations and risk-based screening levels that are described below. The risk-based screening levels are listed in Table 1.0.

BTEXN concentrations in the air sample from the property being evaluated will be compared with both the concurrent upwind sample and the range of ambient concentrations measured during more comprehensive outdoor air sampling (CH2M 2017) as part of the process for determining if additional sampling or a more detailed risk evaluation is warranted. As an initial evaluation, the indoor air action levels identified in the Indoor Air Work Plan (EWI 2017), and listed in Table 1.0, will serve as screening levels for samples of outdoor air.

For soil and seep water samples, the conservative screening levels listed in Table 1.0 were compiled using EPA RSLs for a target hazard quotient of 1.0 and excess lifetime cancer risk of 10^{-6}. The screening levels for soil listed in Table 1.0 are the generic RSLs for residential soil, which assume daily exposures via soil ingestion and dermal contact. EPA has not published screening levels specific to ephemeral seep water. Therefore, the assumptions for each exposure pathway considered in EPA's development of the tap water RSL (i.e., ingestion, direct contact, inhalation) were evaluated relative to the site-specific exposures identified in the conceptual site exposure model (CSEM) presented as Figure 2.0 to determine the most appropriate surrogate screening level. The outcome of this evaluation was the identification of the default screening levels for the water ingestion pathway as the most appropriate surrogate for initial evaluation of ephemeral seep water.

Concentrations of BTEXN and SVOCs in soil and seep water samples collected from a residential property will be compared both individually and cumulatively to their respective screening levels in Table 1.0. For properties where multiple seep or soil samples are collected, the additional data will be included in the screening process and evaluated to assess the nature and extent of contamination.

A summary report will be prepared and provided to MoDNR and the resident, which will include a copy of the Residential Odor Observation Form (Appendix A) and/or Residential Media Sampling Form (as appropriate; Appendix B), tabulated analytical results from the all samples collected during the sampling event, comparison with background results in the case of air samples, and results of a comparison with the screening levels listed in Table 1.0. Given the conservative assumptions[4] that underlie the screening levels listed in Table 1.0, it is important to note that detection of a concentration greater than a screening level listed in Table 1.0 does not necessarily indicate that there is an immediate health concern or that an exposure pathway is complete. Rather, this finding would indicate that a more detailed human health risk evaluation using existing data and, in some cases, collection of additional samples may be necessary to assess the potential for long-term, chronic exposures to Facility-related COCs. The process for implementing a more detailed human health risk assessment will be described in the Remedial Action Optimization Work Plan Addendum 3 (Integral, in prep.). If unacceptable human health exposures related to the Facility are identified, the Multistate Trust will coordinate with MoDNR to develop and implement appropriate actions to reduce exposures to acceptable levels.

4.0 REFERENCES

CH2M, 2017. Additional Outdoor Air Sampling and Indoor Confirmatory Sampling Work Plan, Former Tronox Facility, Springfield, Missouri. CH2M HILL Engineers, Inc., December 11, 2017.

[4] EPA residential RSLs assume exposures occur daily for 350 days per year over 26 years, whereas the CSEM assumes that the ephemeral conditions that could lead to potential exposure to Facility-related COCs occur for relatively short periods of time that are substantially less than 350 days per year.

EPA, 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. EPA 540-R-08-005. United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, DC. January 13.

EWI, 2016a. Sampling and Analysis Plan, Former Tronox Facility, 2800 West High Street, Springfield, Missouri, RCRA Permit Number M0D007129406, Environmental Works Inc., August 18, 2016.

EWI, 2016b. Quality Assurance Project Plan, Remedial Action Optimization, Former Tronox Facility, 2800 West High Street, Springfield, Missouri, RCRA Permit Number M0D007129406, Environmental Works Inc., August 18, 2016.

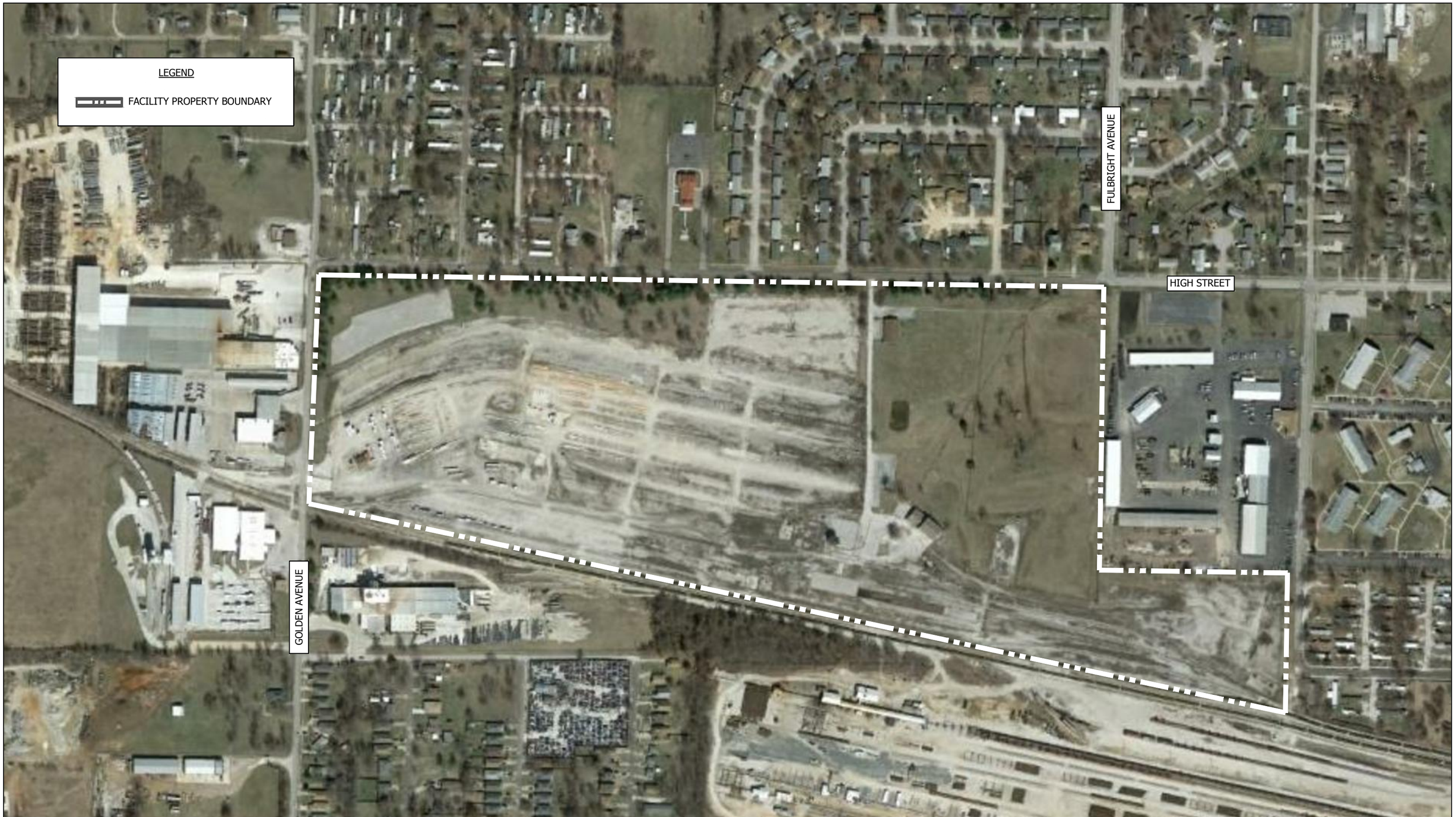
EWI, 2017. Indoor Air Work Plan, Former Tronox Facility, 2800 West High Street, Springfield, Missouri, RCRA Permit Number M0D007129406, Environmental Works Inc., May 4, 2017.

Integral, in prep. Remedial Action Optimization Work Plan Addendum 3. Integral Consulting Inc.

Jacobs, 2018. Addendum to Additional Outdoor Air Sampling and Indoor Air Confirmatory Sampling Work Plan, Former Tronox Facility, Springfield, Missouri; RCRA Permit No. MOD007129406, Jacobs Engineering Group, Inc., August 17, 2018.

FIGURES AND TABLES

RESIDENTIAL PROPERTY SAMPLING WORK PLAN
Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri
RCRA Permit Number MOD007129406



NORTH

CHECKED BY: B. LANNING

E.W.I. # 150683
DRAWN BY: CRR
Apr. 12, 2017

SCALE IN FEET
0 150 300
APPROXIMATE

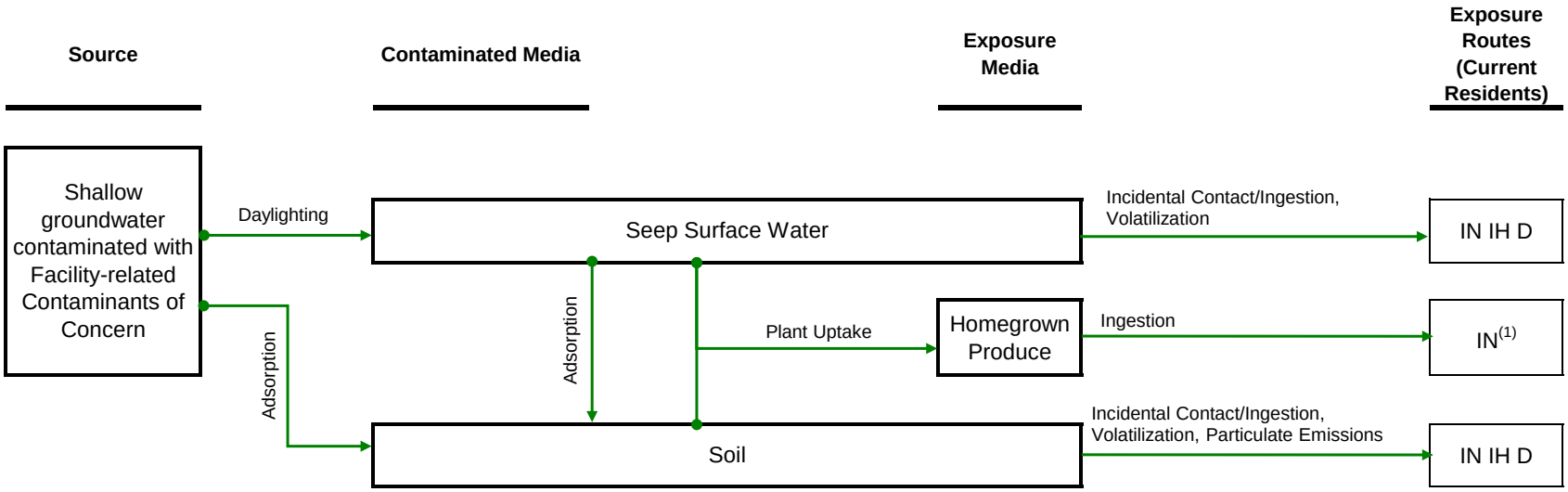
PREPARED FOR:
Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust

PREPARED BY:
ENVIRONMENTAL WORKS

FACILITY LOCATION MAP

FORMER TRONOX/KERR-MCGEE FACILITY
2800 WEST HIGH ST.
SPRINGFIELD, GREENE COUNTY, MISSOURI

FIGURE
1.0



LEGEND

Complete or Potentially Complete Pathway

"IN"	Ingestion
"IH"	Inhalation
"D"	Dermal

NOTES

(1) Applicable only in cases where a garden is present in a seep area

FIGURE 2.0. CONCEPTUAL SITE EXPOSURE MODEL
Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri

TABLE 1.0
SCREENING LEVELS FOR CONTAMINANTS OF CONCERN
Former Tronox/Kerr-McGee Facility, Springfield, Missouri

Category **Parameter**[a]		Screening Level: Resident Outdoor Air [b] ($\mu g/m^3$)	Risk basis [c]	Resident Seep Water [d] ($\mu g/L$)	Risk basis [c]	Resident Soil [e] (mg/kg)	Risk basis [c]
Volatile Organic Compounds (VOCs)							
Benzene	71-43-2	3.6	c	1.4	c	1.2	c
Toluene	108-88-3	5200	n	1,600	n	4,900	n
Ethylbenzene	100-41-4	11	c	7.1	c	5.8	c
Xylenes	1330-20-7	100	n	4,000	n	580	n
Semivolatile Organic Compounds (SVOCs)							
Acenaphthene	83-32-9	--		1,200	n	3,600	n
Anthracene	120-12-7	--		6,000	n	18,000	n
Benz[a]anthracene	56-55-3	--		0.25	c	1.1	c
Benzo[a]pyrene	50-32-8	--		0.1 [f]	c	0.11	c
Benzo[b]fluoranthene	205-99-2	--		0.25	c	1.1	c
Benzo[k]fluoranthene	207-08-9	--		2.5	c	11	c
2-Chlorophenol	95-57-8	--		100	n	390	n
Chrysene	218-01-9	--		25	c	110	c
Dibenz[a,h]anthracene	53-70-3	--		0.1 [f]	c	0.11	c
Dibenzofuran	132-64-9	--		20.0	n	73	n
2,4-Dimethylphenol	105-67-9	--		400	n	1,300	n
2,4-Dinitrophenol	51-28-5	--		40	n	130	n
Fluoranthene	206-44-0	--		800	n	2,400	n
Fluorene	86-73-7	--		800	n	2,400	n
Indeno[1,2,3-cd]pyrene	193-39-5	--		0.25	c	1.1	c
2-Methylnaphthalene	91-57-6	--		80	n	240	n
Naphthalene	91-20-3	0.83	c	400	n	3.8	c
Phenol	108-95-2	--		6,000	n	19,000	n
Pyrene	129-00-0	--		600	n	1,800	n

Notes

-- indicates that EPA has not published an RSL for this parameter.

[a] EPA Regional Screening Levels (RSLs) have not been published for the Facility-related contaminants of concern acenaphthylene or phenanthrene.

[b] The screening level for outdoor air samples is conservatively based on the indoor air action level identified in the Indoor Air Work Plan (EWI 2017). Indoor air action levels were developed based on exposure for 350 days per year over 26 years using a target risk of 1E-05 and hazard quotient of 1.0.

[c] Risk basis notation: c = cancer endpoint drives RSL; n = non-cancer endpoint drives RSL

[d] RSLs have not been published for evaluating potential residential exposure to seep water. The default RSL for ingestion of tapwater was deemed an appropriately conservative surrogate standard for screening potentia exposure of residents to seep water. The RSL for ingestion of tapwater assumes daily residential consumptic of 2.5 liters of drinking water 350 days per year over 26 years using a target risk of 1E-06 and hazar quotient of 1.0.

[e] RSL for residential soil includes daily exposures (i.e., 350 days per year) via incidental ingestion and dermal contact over 26 years, assuming a target risk of 1E-06 and hazard quotient of 1.0

[f] The current laboratory minimum detection limit (MDL) of 0.1 µg/L is assigned as the screening level for benzo[a]pyrene and dibenz[a,h]anthracene because the current RSL of 0.025 g/L is less than the MDL

Source: EPA Regional Screening Levles (RSLs) - Generic Tables. Tables as of: May 2018
(https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables

TABLE 2.0
DATA QUALITY OBJECTIVES
Former Tronox/Kerr-McGee Facility, Springfield, Missouri

Issue Statement	Objective	Investigation Approach	Decision Factors or Criteria
Residents of the neighborhood northeast of the Facility have reported odors in outdoor air and have questioned whether they could be coming from the Facility or Facility-related COCs, and whether the source of the odors may present a health risk.	Identify location of odor complaint and investigate potential sources. Collect samples based on field conditions to screen whether Facility-related COC are present at concentrations that warrant further evaluation of human health risk.	1. Contact resident/owner and record pertinent information on the odor complaint. 2. Mobilize a field team and assess wind direction and current conditions at the resident's property and the surrounding area. 3. If a sustained odor is present and access is granted, collect air samples as close to the potential source as practicable for analysis of BTEXN. If soil or seep may be the source of odor, collect soil and/or seep sample for analysis of BTEXN and SVOCs. 4. If an air sample is collected, determine predominant wind direction and collect a synoptic upwind air sample for evaluation of background conditions 5. If odor is not sustained, an air sample will not be collected unless directed by the Multistate Trust. The field team will evaluate if there are seeps or soil that could be the source of the observed odor and if identified and access granted, collect soil and/or seep sample for analysis of BETXN and SVOCs. 6. Use field observations to determine if collection of additional soil samples is warranted for the purpose of constraining the extent of observed contamination, evaluating potential on-property sources of contamination, or evaluating background conditions.	• A signed access agreement is required to conduct any sampling. • A sustained odor must be present to trigger sample collection, unless directed by the Multistate Trust. • Wind direction data will be needed to identify the appropriate direction for collection of upwind air samples. • If the source of the odor concern is suspected to be on an adjacent property and has not been previously investigated, contact the Multistate Trust. If approved, approach the property owner with request to sample, obtain signed access agreement, and collect sample(s) following the investigative approach. • The presence of other on-property potential sources of contaminants (e.g., fuel tanks, chemical/waste storage areas) or the need to further delineate soil impact will determine the location and number of supplemental soil samples, if any, and the need for additional analytes (e.g., such as total petroleum hydrocarbons, and the full standard list of VOCs). • Compare the validated sampling results to screening levels in Table 1.0. If sample results exceed screening levels and the chemical signature shows a Facility-related source, implement a more detailed human health risk evaluation using existing data and, if necessary, data from additional samples to assess the potential for chronic exposures. If concentrations are less than screening levels or show a non-Facility source, no additional risk assessment or sampling is necessary to evaluate the triggering event.

TABLE 2.0
DATA QUALITY OBJECTIVES
Former Tronox/Kerr-McGee Facility, Springfield, Missouri

Issue Statement	Objective	Investigation Approach	Decision Factors or Criteria
Residents of the neighborhood northeast of the Facility have reported seeps and expressed concern about potential for Facility-related COC in soil or seep water.	Collect seep water (if present) and soil samples on the subject residential property to screen whether Facility-related COC are present at concentrations that warrant further evaluation of human health risk.	1. Contact resident and record pertinent information on the area of seep or soil that is of concern. 2. Mobilize a field team and, if access is granted, assess property conditions and collect seep (if present) and soil samples for analysis of BTEXN and SVOCs from area(s) indicated as a concern by the resident. 3. Use field observations to determine if collection of additional soil samples is warranted for the purpose of constraining the extent of observed contamination, evaluating potential on-property sources of contamination, or evaluating background conditions.	• If the seep water volume is insufficient or has high suspended solids, collect a surface soil grab sample at the seep in lieu of a water sample. • If the source of the seep or soil concern is suspected to be on an adjacent property and has not been previously investigated, contact the Multistate Trust. If approved, approach property owner with request to sample, obtain signed access agreement, and collect sample(s) following the investigative approach described in this Work Plan. • The presence of other on-property potential sources of contaminants (e.g., fuel tanks, chemical/waste storage areas) or the need to further delineate soil impact will determine the location and number of supplemental soil samples, if any, and the need for additional analytes (e.g., such as total petroleum hydrocarbons, and the full standard list of VOCs). • Compare the validated sampling results to screening levels in Table 1.0. If sample results exceed screening levels and the chemical signature shows a Facility-related source, implement a more detailed human health risk evaluation using existing data and, if necessary, data from additional samples to assess the potential for chronic exposures. If concentrations are less than screening levels or show a non-Facility source, no additional risk assessment or sampling is necessary to evaluate the triggering event.

Notes
BTEXN = benzene, toluene, ethylbenzene, xylenes, and naphthalene; air samples will be analyzed for BTEXN using EPA Method TO-15 Selective Ion Monitoring. Soil and seep water samples will be analyzed for BTEXN using EPA Method 8260B.
COCs = contaminants of concern
EPA = U.S. Environmental Protection Agency
Facility = former Tronox/Kerr-McGee Facility, 2800 West High Street, Springfield, Missouri
VOC = volatile organic compound
SVOC = semivolatile organic compound; soil and seep water samples will be analyzed for the SVOCs listed in Table 1.0 using EPA Method 8270D.

APPENDIX A

RESIDENTIAL ODOR OBSERVATION FORM

RESIDENTIAL PROPERTY SAMPLING WORK PLAN
Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri
RCRA Permit Number MOD007129406

GREENFIELD
ENVIRONMENTAL TRUST GROUP

Attachment
Residential Odor Observation Form

Preparer's name:		Date/Time prepared:		
Affiliation:		Phone number:		
Email:				

Part 1: Initial Residential Complaint (Information obtained during initial contact)

1. Resident Filing Complaint (Check if same as location of odor: ☐) (Are you filing Complaint for someone else: ☐ Yes ☐ No)

	Occupant name(s):		Interviewed:	☐ Yes ☐ No
	Address:			
	City:	State:	Zip code:	
	Home phone:	Cell phone:		

2. Location of Odor

	Address or Nearest Cross Road(s):		Location on attached map? ☐ Yes ☐ No
	Date of Odor on-set:	Time of Odor on-set:	
	Direction Odor is coming from: From ☐ Front or ☐ Back of Home		
	Is the odor in one area or multiple?	Is this a reoccurring odor? ☐ Yes ☐ No	
	Additional Information: _____ _____ _____ _____ _____ _____ _____		

Part 2: Field Verification Form (to be filled out by Contractor onsite prior to interviewing resident)

Verifiers Name:		Date Time on-site:	
Affiliation:		Phone number:	

***Locate nuisance odor location on Beacon or residential site map and survey ambient air starting at least one street away, working your way towards odor location complaint point/area. Make sure to survey potential odors in each cardinal direction (north, south, east, west). Locate driving route on attached map. See example for reference.*

1. Location of Odors

Is the Odor Described by Resident also Present Away from the Point of Complaint? If so, indicate direction

☐ North ☐ South ☐ East ☐ West

Other (multiple directions, inconsistent odor, ect.):_____

Any other Notes:_____

_____

_____

2. Describe Current Area Conditions

On-Facility Weather Station Data:

Wind Direction:_____ Wind Speed: _____

Temperature:_____

Recent Precipitation? ☐ Yes ☐ No Date/Storm Duration (in hours): _____ Amount (inches):_____

Ground conditions away from complaint area in direction odor coming from (check all that apply):

☐ Wet ☐ Sheen ☐ Odor ☐ Staining ☐ Evidence of other surface or near surface contamination

Describe:_____

3. Describe the Odor (Check appropriate response)

☐ Earthy/Musty/Moldy ☐ Chlorine/Bleachy ☐ Rotten Eggs/cabbage/garlic ☐ Rancid/sweaty/sour milk ☐ Ammonia/fishy

☐ Manure/Sewage ☐ Glue/Gasoline/mothballs ☐ Other:

4. Describe the Intensity? (Check appropriate response)

☐ Trace ☐ Noticeable ☐ Moderate ☐ Strong ☐ Very Strong

If Variable, what is Range of Intensity?

5. Describe the Offensiveness? (Check appropriate response)

☐ Not Unpleasant ☐ Unpleasant ☐ Offensive ☐ Highly Offensive

Part 3: Field Verification Form (to be filled out by Contractor during onsite resident interview)

Interview with On-Site Resident

1. Access Agreement (attached to this form)

	Person(s) Signing Agreement:		Same as Complainant:	☐ Yes ☐ No
	Contractor Verifying Access Agreement Signed:		Signature:	

2. Describe the Odor (Check appropriate response)

☐ Earthy/Musty/Moldy ☐ Chlorine/Bleachy ☐ Rotten Eggs/cabbage/garlic ☐ Rancid/sweaty/sour milk ☐ Ammonia/fishy

☐ Manure/Sewage ☐ Glue/Gasoline/mothballs ☐ Other:

3. Describe the Intensity? (Check appropriate response)

☐ Trace ☐ Noticeable ☐ Moderate ☐ Strong ☐ Very Strong

If Variable, what is Range of Intensity?

4. Describe the Offensiveness? (Check appropriate response)

☐ Not Unpleasant ☐ Unpleasant ☐ Offensive ☐ Highly Offensive

5. Additional Descriptions of Odor

	Is odor still present as described via telephone complaint? ☐ Yes ☐ No	If no, explain:
	Does the odor occur at a usual time?	Time of Odor on-set:
	Does the odor occur after certain rain events? ☐ Yes ☐ No	Is this a reoccurring odor? ☐ Yes ☐ No
	Could a specific location be drawn on the Attached Diagram? ☐ Yes ☐ No	

Ground Conditions at area of complaint (check all that apply):

☐ Wet ☐ Sheen ☐ Odor ☐ Staining ☐ Evidence of other surface or near surface contamination

Describe:_____

6. Locations of Ambient Air Sampling

	Is a near residence ambient air sample able to be collected? ☐ Yes ☐ No	If yes, Note Sample ID:
	Location of near residence ambient air sample (describe location and include coordinates from a hand-held GPS unit):	
	Was a background ambient air sample able to be collected? ☐ Yes ☐ No	If yes, Note Sample ID:
	Location of background ambient air sample (describe location and include coordinates from a hand-held GPS unit):	
	Were ambient air sampling forms filled out? ☐ Yes ☐ No	

7. Additional Information/Actions Regarding Odors and Ambient Air Sampling

In addition to the above survey and comments below, if location(s) of odor is/are within 25 feet of a building, complete potential air quality factors form in **Part 5*

	Provide additional clarification for answers in Part 3, sections 2 or 3 above: _____ _____ _____ _____ _____ _____ _____

Part 4: Field Verification Form – Post Sampling (to be filled out by Contractor after samples are collected)

Verifiers Name:		Date Time on-site:	
Affiliation:		Phone number:	

1. Did you notice any of the following activities?

	Did someone mow their lawn ☐ Yes ☐ No	If yes, Note Time:
	Was anyone painting or using solvents? ☐ Yes ☐ No	If yes, Note Time:
	Was anyone burning yard waste or any fire? ☐ Yes ☐ No	If yes, Note Time:
	Did anyone apply fertilizer? ☐ Yes ☐ No	If yes, Note Time:
	Was anyone working on their car nearby? ☐ Yes ☐ No	If yes, Note Time:
	Did anyone use ink, glue or sealants? ☐ Yes ☐ No	If yes, Note Time:
	Did anyone use insect repellant, have extermination services or use mothballs? ☐ Yes ☐ No	If yes, Note Time:

Part 5: Other Potential Near-Building Air Quality Factors

Complete if location of odor is Less than 25 feet from a building.

Factors that may influence ambient air quality:

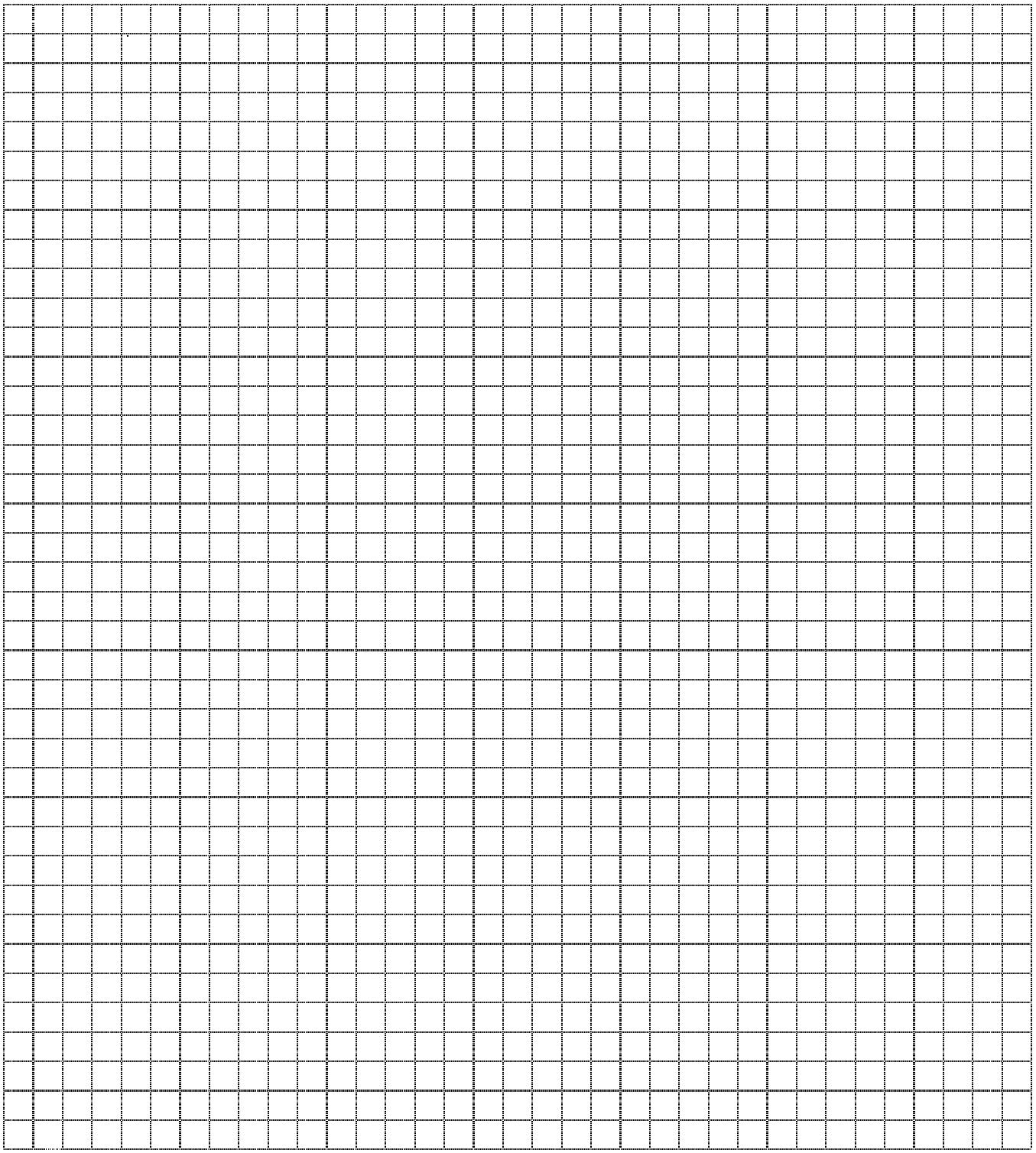
Is there an attached garage:	☐ Yes ☐ No		
Are petroleum-powered machines or vehicles stored in the garage (e.g., lawn mower, ATV, car):	☐ Yes ☐ No	Please specify:	
Has the building ever had a fire:	☐ Yes ☐ No	When:	
Is a kerosene or unvented gas space heater present:	☐ Yes ☐ No	Where & type:	
Is there a wood stove in the building:	☐ Yes ☐ No	How frequently:	
Have cleaning products been used recently:	☐ Yes ☐ No	When & type:	
Has painting/staining been done in the last 6 months:	☐ Yes ☐ No	Where & when:	
Has any remodeling or construction occurred in the last 6 months:	☐ Yes ☐ No	Where & when:	

Is there a clothes dryer:	☐ Yes ☐ No	If yes, is it vented outside:	
Does resident state that there are there odors in the building:	☐ Yes ☐ No	If yes, please describe:	

Do any of the building occupants use solvents at work:	☐ Yes ☐ No
If yes, what types of solvents are used:	
Do any of the building occupants regularly use or work at a dry-cleaning service:	☐ Yes ☐ No
If yes, indicate approximately how frequent:	

Odor Observations and Sample Locations

Insert sketch (or attach separate document) of the area outside the building and location of outdoor air samples. Provide distances to to permanent structures. If applicable, provide information on spill locations, potential air contamination sources, locations of wells, septic system, etc., and PID meter readings. Indicate wind direction and speed during sampling.



Scale: _____ **North (indicate direction):** _____

Neighborhood Location Map

Note: This is an online form from MoDNR for residents, included here for your information

Tronox Odor Reporting Form

The department has recently become aware that citizens have been noticing offensive odors near the former Tronox wood-treating facility, located at 2800 W. High St. in Springfield, Missouri. The department is encouraging everyone who notices the odors to report it so the department and Greenfield Environmental Multistate Trust can try to locate and reduce or eliminate the odor source(s).

You may report your odor concerns online, using the odor reporting form below, or by calling Greenfield Environmental, at 417-942-0190. If someone does not answer your call, please feel free to leave a voicemail message describing the odor and when and where you noticed it. Please also leave a phone number where you can be contacted for more information.

Section I - Odor Information

Please provide as much information as possible about the odor.

*(Items marked * are required)*

***Date odor noticed :**

***Time odor noticed (approx) :**

*** Street Address (or nearest intersection):**

*** City:** Springfield

*** State:** Missouri

*** Zip Code:** 65803

Current Weather Conditions

Wind: SW 7 mph

Temperature (°F): 72

***Odor strength :**

--Please select a value--

(1=mild, 5=moderate, 10=intense)

Air Information
Broadcast Email Lists
Commissions and Boards
Commission Meetings and Events
Contact Us
Grants and Loans
Land and Geology Information
News and Multimedia
Organizational Chart
Public Meetings and Notices
Report an Environmental Problem
Rules in Development
Site Directory
Waste and Recycling
Water Information

Contact Information

Department of Natural Resources
P.O. Box 176
Jefferson City, MO 65102
800-361-4827
573-751-3443
Contact Us

Report an Environmental Concern

Note: This is an online form from MoDNR for residents, included here for your information

***Where was the odor noticed?**

Check all that apply:

☐ Outside
☐ Inside a building/home

NOTE: If the odor is only inside and smells like rotten eggs or sulfur, you may have a natural gas leak. Please contact your local utility or other appropriate local authorities to investigate.

Duration

How long did the odor last?

0 days | 0 hours | 10 minutes

Is this a recurring odor?

○ Yes ○ No

***Please describe the odor to the best of your ability:**

Section II - Contact Information

Enter your contact information.

Name:

Name

Phone Number:

Phone Number

Email:

Email

Section III - Agreement & Submit

By clicking the "Agree" checkbox below, you acknowledge the information you are submitting is correct and accurate to the best of your knowledge. This information will also be sent to Greenfield Environmental. All submissions are subject to the Missouri Sunshine Law.

☐ *** Agree**

Note: One must agree to be able to submit the form.

Submit | Reset Form

Note: This is an online form from MoDNR for residents, included here for your information

The following text will appear after the user clicks the "submit" button.

Hazardous Waste Program

Tronox Wood Treatment Facility Odor Concern

Thank you for your concern

Thank you for reporting your odor concern. If you included your contact information on the form, a representative of Greenfield Environmental will contact you to confirm they received your form, and may ask you for more information.

If you notice the same odor in the same location, please call Greenfield Environmental at 417-942-0190, so the air can be sampled as soon as possible.

APPENDIX B

RESIDENTIAL MEDIA SAMPLING FORM

RESIDENTIAL PROPERTY SAMPLING WORK PLAN
Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri
RCRA Permit Number MOD007129406

GREENFIELD
ENVIRONMENTAL TRUST GROUP

Attachment
Residential Media Sampling Form

Contractor's Name:		Date/Time prepared:		
Affiliation:		Phone number:		
Email:				

Part 1: Residential Location and Type of Media Impact Information

1. Resident Location for Sampling (Check if same as location of odor: ☐)

	Occupant name(s):		Odor Complaint Also?	☐ Yes ☐ No
	Address:			
	City:	State:	Zip code:	
	Home phone:	Cell phone:		

2. Information on Potentially Impacted Media (note location on attached map)

	Type of Media	WATER ☐ SOIL ☐
	Description of Location	☐ Front Yard ☐ Side Yard (direction:) ☐ Back Yard ☐ Inside Home
	If Inside Home	☐ Unoccupied Basement ☐ Lowest Occupied Level - Room Use: ☐ Collection Sump ☐ Floor cracks ☐ Wall/Floor Juncture
	Size of Area of Impact: Length: _____(ft) Width: _____ (ft) Depth (water): _____ (ft) Is impact in one area or multiple? _____ Is this a recurring impact? ☐ Yes ☐ No	
	Odor Present: ☐ None ☐ Earthy/Musty/Moldy ☐ Chlorine/Bleachy ☐ Rotten Eggs/cabbage/garlic ☐ Rancid/sweaty/sour milk ☐ Ammonia/fishy ☐ Manure/Sewage ☐ Glue/Gasoline/mothballs ☐ Other:	
	Additional Information: _____ _____ _____ _____ _____ _____ _____	

3. Verification of Potentially Related Activities

	Was there a recent rain event? ☐ Yes ☐ No	If yes – Date/Time/amount:
	Was the lawn recently mowed ☐ Yes ☐ No	If yes – Date/Time:
	Was anyone painting or using solvents? ☐ Yes ☐ No	If yes – Date/Time:
	Was anyone burning yard waste or any fire? ☐ Yes ☐ No	If yes – Date/Time:
	Has any plumbing or septic line work been done? ☐ Yes ☐ No	If yes – Date/Time:
	Was anyone working on their car? ☐ Yes ☐ No	If yes – Date/Time:
	Did anyone use ink, glue or sealants? ☐ Yes ☐ No	If yes – Date/Time:
	Has fertilizer been applied to the yard? ☐ Yes ☐ No	If yes – Date/Time:
	Was herbicide applied to the yard area? ☐ Yes ☐ No	If yes – Date/Time:
	Have extermination services been used? ☐ Yes ☐ No	If yes – Date/Time:

Part 2: Media Sampling Performed

1. Verify Access Agreement Completed

	Owner that Signed Agreement:		Date Signed:	
	Contractor Verifying Signed Agreement:		Signature:	

2A. Water Sampling, If Performed (see Water Sample Field Sheet)

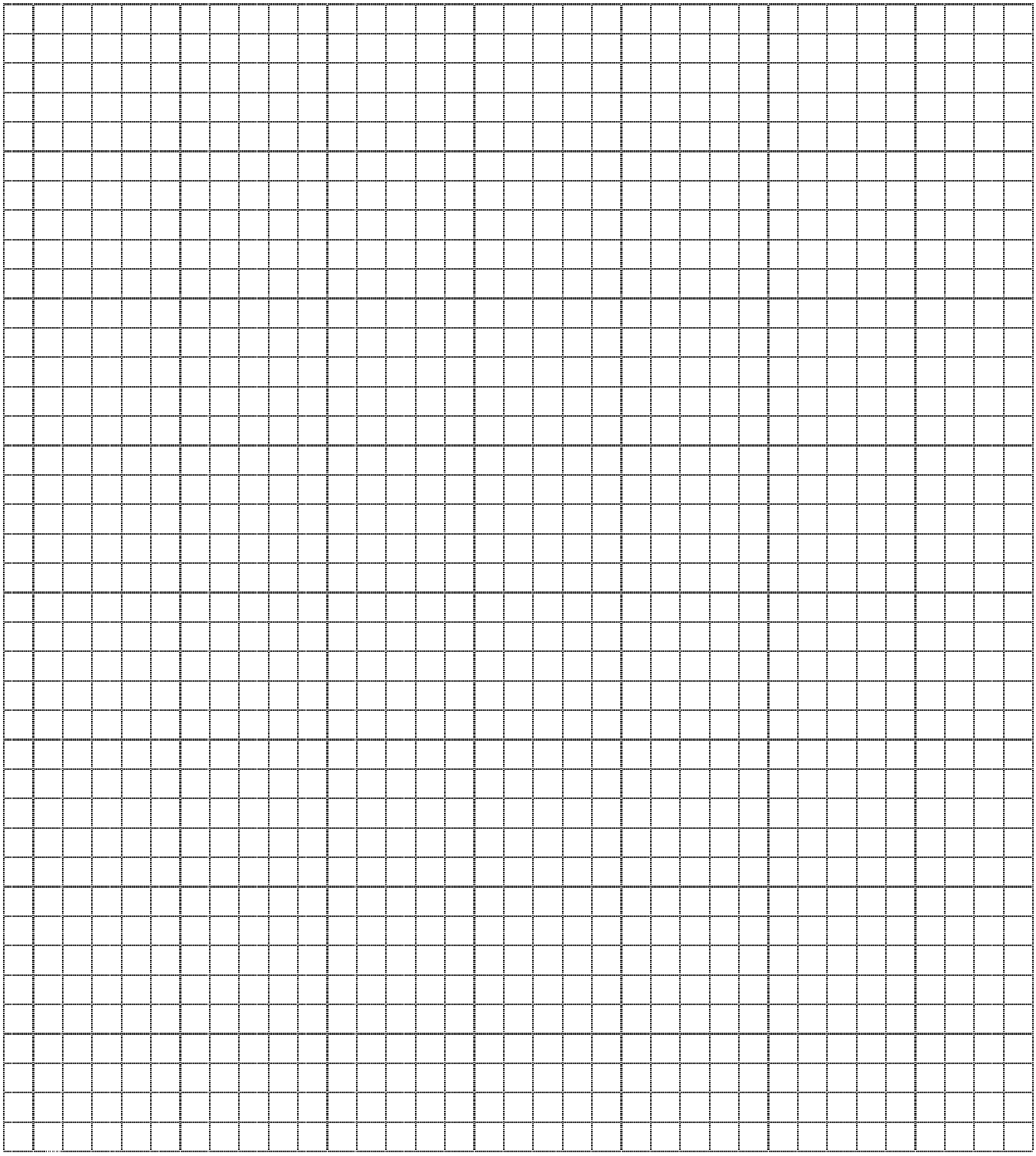
	Date of Water Sampling:	Number of Water Samples Collected:
	Location of Sample – same as location of impact noted above? ☐ Yes ☐ No ☐ Front Yard ☐ Side Yard ☐ Back Yard ☐ Unoccupied Basement ☐ Lowest Occupied Room ☐ Collection Sump ☐ Pool at floor cracks ☐ Pool at Wall/Floor Juncture	
	Additional Information (including coordinates from a hand-held GPS unit): _____ _____ _____ _____	

2B. Soil Sampling, If Performed (see Soil Sample Field Sheet)

	Date of Soil Sampling:	Number of Soil Samples Collected:
	Location of Sample – same as location of impact noted above? ☐ Yes ☐ No ☐ Front Yard ☐ Side Yard ☐ Back Yard ☐ Other:	
	Additional Information (including coordinates from a hand-held GPS unit): _____ _____ _____ _____	

Sample Locations

Insert sketch (or attach separate document) of the area outside the building and location of sample locations. Include distances to permanent structures. If applicable, provide information on spill locations, potential air contamination sources, locations of wells, septic system, etc., and PID meter readings. Indicate wind direction and speed during sampling.



Scale: _____ **North (indicate direction):** _____

Neighborhood Location Map

APPENDIX C

RESIDENTIAL PROPERTY SAMPLING ACCESS AGREEMENT

RESIDENTIAL PROPERTY SAMPLING WORK PLAN
Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri
RCRA Permit Number MOD007129406

RESIDENTIAL PROPERTY SAMPLING ACCESS AGREEMENT

I [PRINT NAME] _____ hereby give permission to the Greenfield Environmental Multistate Trust LLC, Trustee of the Multistate Environmental Response Trust, and its employees, agents and contractors (collectively, the Trust), to enter upon and have access at reasonable times to the home/business located at [PRINT ADDRESS] _____, Springfield, MO (the Property). The Property is owned by [PRINT OWNER'S NAME] _____, who, if not me, can be reached at [INSERT PHONE NUMBER AND ADDRESS] _____ _____.

The Trust is granted permission to enter the Property from time to time for the following purposes and activities, all at no cost to me:

(1) Survey and inspect the construction and contents of the Property.
(2) Install equipment to collect ambient (outdoor) air samples on the Property.
(3) Collect groundwater or soil samples on the Property
(4) Send the collected samples to a specialized laboratory for analysis.
(5) If necessary and approved by the Missouri Department of Natural Resources (MDNR), install a vapor mitigation system.

The permission that is granted shall remain in effect until the activities are completed to the satisfaction of MDNR. I understand that the Trust will provide a summary of the final sampling results for the Property to me.

I agree to not damage or interfere with the installed sampling instruments and equipment to help ensure the accuracy and effectiveness of their purpose and results.

This permission is given by me voluntarily, on behalf of myself and all other co-owners of the Property, with knowledge of my right to refuse and without threats or promises of any kind.

Signed By: _____ Date: _____
Name: _____
Phone: _____
Email: _____

Please mail or email the signed agreement to:

Greenfield Environmental Multistate Trust LLC, Trustee
Attn: Craig Kaufman
1506 D Street SE
Washington, DC 20003
ck@g-etg.com

Please call Craig at 215.837.3702 with questions.

APPENDIX D

SOP No. 21: INTEGRATED AMBIENT INDOOR AND OUTDOOR AIR SAMPLING METHOD FOR TRACE VOCs USING SUMMA CANISTERS

RESIDENTIAL PROPERTY SAMPLING WORK PLAN
Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri
RCRA Permit Number MOD007129406

Skills Required:

1) 40-hour HAZWOPER training (if working on hazardous waste sites)
2) Understanding of, and ability to make decisions regarding, site-specific objectives
3) Training in assembly and proper use of sampling equipment
4) Knowledge of Environmental Works, Inc. (EWI) and the state of Missouri and EPA quality control standards
5) Knowledge of corporate safety requirements and health and safety plan

1. Scope and Application

This sampling method describes the procedure for collecting ambient air samples for targeted volatile organic compounds (VOCs). Reporting limits for these samples are usually very low and extremely prone to positive bias from interfering VOC sources. The method is based on clean sampling techniques. The requirements of clean sampling dictate that sampling and sample handling are done by trained personnel. A building survey must be performed before sample collection. It is the responsibility of the project team to make sure this procedure meets all applicable regulatory standards and receives approval/concurrence from the leading regulatory agency for the project. Vapor intrusion (VI) subject-matter experts (SMEs) should be consulted as needed to address technical, regulatory or field implementation issues associated with the use of this standard operating procedure (SOP).

2. Summary of Method

A sample of air is withdrawn, using clean technique, into a certified clean and evacuated SUMMA canister using a certified, clean flow controller. Sample collection can be integrated over time by adjusting the flow controller. Eight-hour samples will be collected during a period of time when the building is in operational mode and workers are inside the building to mimic the exposure to a worker during one shift. Six-liter canisters will be used for ambient air sampling (see Table 1).

Table 1 – Common Sampling Rates for Ambient Air Sampling

Can Size	Length of sampling time	Sampling Flow Rate (ml/min)
6-Liter	1 hour	90
6-Liter	8 hours	11.25
6-Liter	24 hours	3.75
1-Liter	5 minutes	180
1-Liter	1 hour	15
850-ml	5 minutes	150
850-ml	1 hour	12

3. Project Specific Considerations

3.1. Selection of sample locations—Indoor and outdoor sample locations should be selected during the building survey and in consultation with the building owner/occupant. The sample locations should be selected to meet the project-specific data quality objectives. Procedures for performing a building survey are described in the SOP—Building Surveys for Vapor Intrusion Evaluation.

3.1.1. Guidelines for selecting indoor air sample locations

3.1.1.1. Typically, indoor air samples should be collected from each compartment or heating, air-conditioning, and ventilation (HVAC) zone within a building.

3.1.1.2. Typically, indoor air samples should be collected on the lowest floor of the building at breathing zone height (approximately 3 to 5 feet) toward the center of the building away from windows.

3.1.1.3. Consideration should be given on a case-specific basis to those situations (such as a daycare facility) where a different sampling height may also be appropriate to evaluate a unique setting or population.

3.1.1.4. Indoor air samples should be located in the areas of the building that are occupied most frequently and by the most amount of people.

3.1.1.5. Indoor air samples can be collected from more than one floor within a structure to address varying risk exposures and as part of the process to distinguish contaminants related to vapor intrusion from background sources. Thus, the location and position of the sample container will vary depending on which floor the sampling event takes place.

3.1.1.6. Crawlspace samples are collected in a similar manner to indoor air. The canister is placed in the space and opened. If sections of the crawlspace are divided, more than one sample may be collected in each area.

3.1.1.7. Sewer headspace samples are collected in the same manner to indoor air. The canister is placed in the manhole and opened. The manhole cover should be sealed once the canister is opened.

3.1.1.8. The basement sample(s) are primarily designed to investigate worst-case situations within a structure. Therefore, basement samples are positioned as close as possible to the source area (e.g., sumps or major cracks in the foundation).

3.1.2. Guidelines for selecting outdoor air sample locations

3.1.2.1. Typically, outdoor air samples are collected upwind and/or downwind of the building or site being investigated.

3.1.2.2. Avoid biasing the sample results by placing the canister near potential outdoor VOC sources such as busy roads or gas stations.

3.1.2.3. Outdoor air samples are typically located at least 10 feet away from buildings. However, the outdoor air canister may be placed near the outdoor air intake for the HVAC system for the building.

3.1.2.4. Outdoor air sample canisters should be secured to an immovable structure to ensure security for sampling in public areas. A bicycle lock or piece of chain and padlock can be used. NOTE: Do not secure the canister to or close to a living tree, however, because the tree's evapotranspiration process may release VOCs from groundwater into the vicinity.

It may be a good idea to attach a label to the canister explaining that it is an environmental sample and should not be tampered with. The label can also include contact information.

3.1.2.5. Typically, outdoor air samples should be collected at breathing zone height (approximately 3 to 5 feet).

3.2. Selection of sampling schedule—Sample collection should ideally occur during typical operating conditions (i.e., if workers occupy the building from 8 a.m. to 4 p.m., the sample collection would also take place from 8 a.m. to 4 p.m.). However, building owners/occupants may request that sampling take place when the building is not in use. In this case, make sure the HVAC system is set to typical operating conditions. Also, consider when the sample pressure will need to be checked (e.g., it's not a good idea to start 24-hour samples at 8 a.m. because they will need to be checked around 4 a.m. the next day).

4. Health and Safety

There are several health and safety topics to consider when performing air sampling.

4.1. Field teams should work in pairs at residential buildings or at industrial/commercial buildings where a relationship with the building occupant has not yet been established. A field team member should never enter a building alone for the first time. The mental stability of a building occupant should not be taken for granted. Building surveys at abandoned buildings should also be performed in pairs; if one team member is injured, the other will be able to seek help.

4.2. Beware of animals and insects. This applies to abandoned buildings and residences.

4.3. Be careful of overhead hazards in basements.

4.4. Beware of pinch points and use the correct hand tools to avoid hand injuries.

5. Canister Security

5.1. Field teams should assure that sampling canisters are not disturbed by building occupants.

5.2. If there is a community outreach program associated with the VI sampling event, then information should be made available to building occupants prior to the sampling event that informs occupants about the sampling activities and sampling equipment.

5.3. Each sampling canister should be clearly marked with a sign that includes contact information for a point of contact. An example of a sign that can be attached to each sampling canister is provided in the attachment to this SOP. This sign can be edited with project-specific information, laminated and attached to each sampling canister using cable ties (do not attach the signs using adhesive tape).

6. Apparatus and Materials

6.1. Laboratory supplied 6-liter canister, SUMMA polished, certified clean and evacuated.

6.2. Laboratory supplied flow controller, certified clean and set at desired sampling rate.

6.3. Shipping container suitable for protection of canister during shipping. The canisters should be shipped back to the laboratory in the same shipping container in which they were received.

6.4. Wrenches and screw driver (clean and free of contaminants), various sizes as needed for connecting fittings and making adjustment to the flow controller. A 9/16-inch wrench fits the ¼-inch Swagelok® fittings, which most canisters and flow controllers have.

6.5. Laboratory supplied negative pressure gauge, oil-free and clean, to check canister pressure. The laboratory may either provide one pressure gauge to be used with all of the canisters, or a pressure gauge for each canister to be left on during sample collection. Sometimes the canisters are fitted with built-in pressure gauges that are not removable. These gauges are for field use only, and are an approximate measure of the actual vacuum. Regularly calibrated—and less rugged—vacuum gauges are used at the laboratory to measure vacuum before shipment and again after sample receipt.

6.6. Sampling cane or similar device for outdoor air sampling to prevent water from entering canister during sampling.

7. Sample Collection

7.1. Clean sampling protocols must be followed when handling and collecting samples, which requires care in the shipping, storage, and use of sampling equipment. Cleanliness of personnel who come in contact with the sampling equipment is also important: no smoking, no eating, no drinking, no perfumes,

no deodorants, no dry cleaned clothing, etc. Canisters should not be transported in vehicles with gas-powered equipment or gasoline cans. Sharpie markers should not be used for labeling or note- taking during sampling.

7.2. The field team should order some additional canisters in case these are needed to replace visibly damaged canisters or canisters that have leaked during initial leak testing.

7.3. The SUMMA canisters are certified clean and evacuated by the laboratory to negative 30 inches mercury (inches Hg). Care should be used at all times to prevent inadvertent loss of canister vacuum. ***Never open the canister's valve unless the intent is to collect a sample or check the canister pressure with an attached gauge.***

7.4. Prior to taking air samples, be sure to complete a building survey for vapor intrusion evaluations (see SOP—*Building Surveys for Vapor Intrusion Evaluation*). Note any changes in building conditions (especially potential VOC sources) since the building survey was performed.

7.5. When taking outdoor samples, sewer headspace samples, or crawl space samples, be sure to note on the field log any items that might bias analytical results (such as gasoline cans, garbage, fresh paint, etc.)

7.6. Inspect the canister for damage and do not use a canister that has visible damage.

7.7. Verify that the canister has sufficient initial vacuum for sampling. Initial canister vacuums that are less than certified by the laboratory (~29 to 30 inches Hg) are a potential indication of leakage which could affect the accuracy of analytical results. Measure the initial canister vacuum using an external vacuum gauge, as described below.

7.7.1. Remove the protective cap from the valve on the canister; make sure the canister valve is closed before doing this.

7.7.2. Attach an external vacuum gauge to the canister and open the valve. If the vacuum gauge has two openings, make sure that the other opening is closed; the canister cap can be used for this. After taking the reading, record the initial vacuum, close the canister valve and remove the gauge.

7.7.3. Measure the initial canister pressure using a digital vacuum gauge with 0.25% accuracy at the -30 to 0 inches Hg range and NIST-traceable calibration for vacuum measurements. See the *Technical Bulletin: Use of External Vacuum Gauges with Canisters* for a recommended model of vacuum gauge1 for use with Summa canisters used for vapor intrusion sampling.

7.7.4. Do not sample using a canister without sufficient initial vacuum. Be advised that sampling data may be flagged or rejected from canisters with low initial vacuum (less than 28 inches Hg). Low initial vacuum could create a low bias in analytical results due to air leakage. While there is also a smaller risk that air leakage could introduce contaminants into the

canister, the primary concern is the low bias to analytical results; this bias is within the range of analytical variability allowed with the EPA Method TO-15 (±30%) for initial vacuums >24 inches Hg. The table presented in Paragraph 6.5.5 identifies the field team's response based on the initial vacuum reading for a canister. In addition, this table also identifies the potential bias to results at different initial canister vacuums.

7.7.5. Use the following table to determine when to use canisters based on initial vacuum readings:

Table 2 - Initial Vacuum Readings, Potential Errors, and Field Team Response Actions

Initial Vacuum Reading	Potential Error in Analytical Results Due to Leakage	Field Team Response
>30 to 28 inches Hg	Up to -10% error	Use canister for sampling – no limitations on use.
>26 to 28 inches Hg	Up to -21% error	Use canister for sampling if necessary; replace canister with a spare if spares are available.
>24 to 26 inches Hg	Up to -30% error	Sampling with canister is not advisable. Contact project manager and obtain direction before sampling with this canister. Be advised that qualifiers may be applied to analytical results sampled with canisters with vacuums less than 26 inches Hg.
<24 inches Hg	>-30% error	Do not use this canister for sampling. Analytical results will be rejected.

1 A PG5 Digital Pressure Gauge from Automation Products Group (APG), Inc.(http://www.apgsensors.com/products/pressure-sensors/digital- pressure-gauges/pg5) with National Institute of Standards and Technology (NIST)-traceable calibration certificate, or equivalent, is recommended for making vacuum measurements.

7.8. Flow controllers should come pre-set by the laboratory to sample at a pre-determined rate based on specific project requirements (see Table 1 for the most common options). In some cases [that is, project-specific quality assurance (QA)], the flow rate will need to be verified in the field prior to use. This is accomplished with a bubble meter, vacuum source, and instructions supplied by the laboratory.

7.9. In the field log record the canister identification (ID), flow controller ID, initial vacuum, desired flow rate, sample location information, and all other information pertinent to the sampling effort. The indoor and outdoor temperature and barometric pressure should be recorded when sampling is begun and completed.

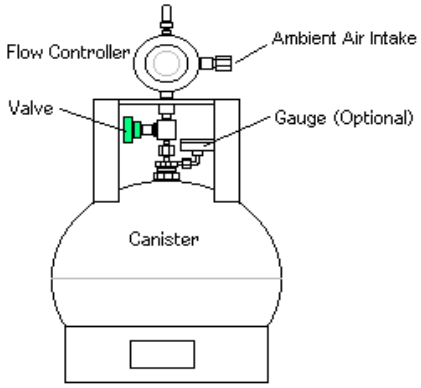
7.10. Connect the flow controller to the canister (Figure 1).

7.10.1. The flow controller fitting denoted "LP" or "OUT" is connected to the canister. Tighten the fitting to be leak free but do not over-tighten (a ¼ -turn past snug is usually enough). When tightening the fitting, be sure that the valve assembly does not rotate by using your other hand to hold the valve steady.

7.10.2. If an assigned pressure gauge is used for each canister, the pressure gauge should be attached to the canister first and then the flow controller should be attached to the pressure gauge.

7.10.3. When the flow controller and vacuum gauge are attached correctly they will not move separately from the canister (they will not spin around)

FIGURE 1
Assembled Canister Sampler for Integrated Sample Collection



7.11. For outdoor samples or sewer headspace samples, be sure that the inlet to the flow controller is protected from precipitation. Either place the canister and flow controller under a shelter/enclosure, use a sampling cane provided by the laboratory, or use a clean piece of aluminum foil to build a tent over the flow controller inlet.

7.12. Remove all work articles from the sampling area.

7.13. To begin sampling, slowly open the canister valve one full turn.

7.14. For canisters with built-in or assigned vacuum gauges, monitor the vacuum change several times during the course of the selected sample period to ensure the canister is filling at the desired rate.

7.15. At the end of the sample period, close the canister valve finger tight.

7.16. Remove the flow controller (and assigned pressure gauge) and replace the protective cap on the canister valve fitting.

7.17. Measure the final canister vacuum with the digital vacuum gauge. Attach the digital vacuum gauge, open the canister valve, and record the final vacuum. Close the valve, remove the gauge, and replace and tighten the cap on the canister.

7.18. Ideal final vacuum in the canister is between 2 and 10 inches Hg. More than 10 inches Hg means that a smaller than expected sample volume has been collected, which can increase reporting limits. A small amount of vacuum should be left in the canister to assess the potential for leakage during transport to the laboratory.

7.19. Consult with the project manager before submitting the sample to the laboratory if a final vacuum greater than 10 inches Hg, or less than 2 inches Hg are encountered. Use the following table for guidance to determine how to address final vacuum measurements:

Table 3 – Final Vacuum Readings and Field Team Response Actions

Final Vacuum Reading	Field Team Response
< 2 inches Hg	Contact Project Manager before submitting sample. Notify analytical laboratory to report their laboratory-measured pressure and to get direction from the Project Manager before analyzing sample.
> 2 inches Hg and <10 inches Hg	Submit sample for analysis - no limitations on data use
>10 inches Hg	Contact Project Manager before submitting sample. Verify final vacuum with the analytical laboratory before analysis.

7.20. Canisters with no vacuum left (i.e., 0 inches Hg) should not be analyzed. Contact the Project Manager before submitting a sample with a final vacuum of 0 inches Hg to determine the appropriate course of action. One option is to verify the final vacuum with the analytical laboratory. If there is vacuum remaining in the canister according to the laboratory vacuum gauge, the Project Manager may direct the analytical laboratory to analyze the sample.

7.21. The analytical laboratory should be directed to not analyze a sample showing a final vacuum of 0 inches Hg (as measured by the laboratory), and to notify the Project Manager and obtain further guidance regarding that sample.

7.22. If the flow controller is going to be used for more than one sample collection, be sure to purge it between uses. To do this, attach the flow controller to a vacuum source and draw clean air or gas (ultra-high purity) through it for several minutes before attaching it to the canister.

8. Altitude Correction

8.1. Air pressure decreases with elevation. Therefore, a canister evacuated at a laboratory located at sea level will show a lower vacuum measurement at a higher altitude. Generally, a 1,000-foot rise in elevation corresponds to a 1-inch Hg drop in pressure OR a 1 inch Hg decrease in measured vacuum. For example, a canister evacuated to 30 inches at sea level and used at 3,000 feet would show an initial vacuum of 27 inches Hg.

8.2. If you plan to sample at altitude, be sure to inform the laboratory ahead of time so they adjust the flow controllers accordingly

8.3. If sampling is being conducted at higher elevations, verify the elevation difference between the analytical laboratory and field location and determine the associated decrease in measured vacuum.

8.3.1. Calculate the pressure difference between the laboratory and field location as follows: Difference from Sea Level (field)—Difference from Sea Level (laboratory). Use the Altitude Correction Table attached to this SOP.

8.3.2. Subtract the pressure difference determined in Section 8.3.1 from allowable initial vacuum levels (Section 7.7) and final vacuum levels (Section 7.18) to determine appropriate initial and final vacuum levels.

9. Sample Handling and Shipping

9.1. Fill out all appropriate documentation (chain of custody, sample tags) and return canisters and equipment to the laboratory.

9.2. The canisters should be shipped back to the laboratory in the same shipping container in which they were received. The samples do not need to be cooled during shipment.

DO NOT put ice in the shipping container.

9.3. When packing the canisters for shipment, verify that the valve (just past finger tight) and valve caps are snug (1/4-turn past finger tight), and use sufficient clean packing to prevent the valves from rubbing against any hard surfaces. Never pack the cans with other objects or materials that could cause them to be punctured or damaged.

9.4. **Do not place sticky labels or tape on any surface of the canister!**

9.5. Place a custody seal over the openings to the shipping container.

9.6. Make sure to insure the package for the value of the sample containers and flow controllers only if corporate card policy does not cover this.

9.7. Ship canisters for overnight delivery. NOTE: If sampling on a Friday, ensure the laboratory accepts samples on Saturdays (you do not want the canisters sitting on a loading dock [or worse] for 3 days).

10. Quality Control

10.1. Canisters supplied by the laboratory must follow the performance criteria and quality assurance prescribed in U.S. Environmental Protection Agency (EPA) Method TO-14/15 for canister cleaning, certification of cleanliness, and leak checking. SOPs are required.

10.2. Flow controllers supplied by the laboratory must follow the performance criteria and QA prescribed in EPA Method TO-14/15 for flow controller cleaning and adjustment. SOPs are required.

Vapor Sampling - Summa Canisters
Sampling Log

Field ID	Location Description (include property address and coordinates from hand-held GPS)	Canister ID	Pressure Gauge ID	Flow Controller ID	Flow Controller Rate	Sample Start Date	Sample Start Time	Initial Canister Pressure (in Hg)	Final Canister Pressure (in Hg)	Time Check	Pressure Check (in Hg)

APPENDIX E

SEEP WATER SAMPLING LOG

RESIDENTIAL PROPERTY SAMPLING WORK PLAN
Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri
RCRA Permit Number MOD007129406

GREENFIELD
ENVIRONMENTAL TRUST GROUP

SEEP WATER SAMPLING LOG

PROJECT NAME: _____

PROJECT / NO: _____ **EVENT:** _____

DATE: _____ **TIME:** _____ **PERSONNEL:** _____

SEEP LOCATION: _____ **SAMPLE ID:** _____

PARAMETER MEASUREMENTS

TIME	FLOW	COLOR	ODOR	TEMP	pH	DO%	COND

SAMPLING DATA

(fill in blanks or circle as appropriate)

SAMPLING METHOD: _____ **DATE:** _____ **TIME:** _____

ANALYTES: VOC PAH TPH-DRO TPH-GRO TPH-ORO Oxygenates METALS Other _____

CONTAINER: 40 ml VOA (#____) 1 L Amber Glass (#____) 250 ml Poly (#____) 500 ml Poly (#____)

PRESERV. None Hydrocloric Acid Sulfuric Acid Nitric Acid Na Thiosulfate

DUPLICATE COLLECTED? _____ **SPLIT SAMPLE?** _____ **FOR WHO?** _____

SEEP LOCATION: _____ **SAMPLE ID:** _____

PARAMETER MEASUREMENTS

TIME	FLOW	COLOR	ODOR	TEMP	pH	DO%	COND

SAMPLING DATA

(fill in blanks or circle as appropriate)

SAMPLING METHOD: _____ **DATE:** _____ **TIME:** _____

ANALYTES: VOC PAH TPH-DRO TPH-GRO TPH-ORO Oxygenates METALS Other _____

CONTAINER: 40 ml VOA (#____) 1 L Amber Glass (#____) 250 ml Poly (#____) 500 ml Poly (#____)

PRESERV. None Hydrocloric Acid Sulfuric Acid Nitric Acid Na Thiosulfate

DUPLICATE COLLECTED? _____ **SPLIT SAMPLE?** _____ **FOR WHO?** _____

SAMPLING NOTES:

APPENDIX F

SOIL SAMPLING PROTOCOL AND SOIL SAMPLING LOG

RESIDENTIAL PROPERTY SAMPLING WORK PLAN
Former Tronox/Kerr-McGee Facility
2800 West High Street, Springfield, Missouri
RCRA Permit Number MOD007129406

4.0 SURFACE AND NEAR-SURFACE SOIL SAMPLING PROTOCOL

Surface and near-surface soil samples (depth of 2 ft) are collected following procedures described in *Preparation of Soil Sampling Protocols: Sampling Techniques and Strategies*, a USEPA document prepared by Benjamin J. Mason (July 1992). Section 5 of this USEPA document is provided as Appendix E. Generally, the procedures allow for the use of soil punches, scoops and shovels, soil probes and hand augers, and power augers.

4.1 STEPS TAKEN PRIOR TO SAMPLING

4.1.1 Initial Observations

Soil sampling locations shall be marked in the field and referenced on a Soil/Core Description Log (Appendix D), so as to enable resampling of that exact location at a later date, if necessary. Weather conditions on the sampling date shall be described, as well as any unusual weather events (for example, drought or rainstorms) prior to the sampling event. Other appropriate notes are made as deemed necessary.

4.2 OBTAINING SOIL SAMPLES

Depending upon the required laboratory analyses, soil samples shall be collected using various methods. Surface and near-surface samples that require chemical testing shall be collected with soil punches, scoops, shovels, probes, or augers, and stored in appropriate glass sample containers supplied by the laboratory. Samples to be tested for physical parameters (for example, permeability, Atterberg Limits, etc.) shall be collected using dedicated Shelby (thin-walled) tubes advanced by a Geoprobe® or drill rig. Both ends of the Shelby tube shall be capped and secured upon retrieval from the bore, so as to ensure no disturbance to the sample.

Soil samples collected with scoops, shovels, probes, and augers shall be described according to American Society for Testing and Materials (ASTM) Method D2488-09a, Description and Identification of Soils (Visual Manual Procedures), incorporated in soil sampling SOPs in the Facility QAPP.

4.2.1 Field Compositing

Where composite samples must be taken, compositing shall be performed with large dedicated plastic sheets (one-time use only) or with stainless steel mixing bowls, pending the volume of sample to be composited. In each case, clods of soil shall be broken up with hand tools before being mixed. Following mixing, the soil shall be placed in a pile, sectioned into four quarters, and small samples from each quarter shall be taken and mixed together to form the composite. The composite shall then be placed in a glass jar and shipped with remaining samples to the laboratory. The excess soil shall be discarded by returning the soil to the bore hole or excavation from where it originated. An effort shall be made to retain the vertical sequence with the deepest zones being returned first, and so on. Where excess soil is deemed too voluminous to return to an excavation or borehole, the soil shall be containerized at the Facility for profiling and disposal in accordance with applicable local, state, and federal regulations.

4.2.2 Sample Preservation

Soil samples collected in jars for chemical analyses shall be stored at 4°C until shipping. For shipping, samples shall be placed in a cooler with bagged ice and appropriate cushioning material (e.g. bubble-wrap), and shipped to the laboratory via overnight express delivery. Other than capping both ends of a Shelby tube, no special preservation procedures are required for geotechnical (non-chemical analysis) types of samples.

4.2.3 Decontamination Procedures

All sampling tools shall be decontaminated between use with a steam cleaner or in a non-phosphate detergent solution (i.e., Alconox or similar), followed by a rinse with clean water.

4.3 FIELD CHAIN-OF-CUSTODY

Laboratory-supplied chain-of-custody forms shall be utilized during sample collection, management, and shipping. Chain-of-custody forms shall accompany all soil samples collected and shipped for analyses, with appropriate annotations and signatures for each change of personnel assuming custody.

4.4 LABORATORY SAMPLE CUSTODY LOG

Once the sample coolers arrive at the laboratory, the coolers shall be checked for damage or tampering, and stored in a secure area prior to analysis. The sample custodian shall record the condition of each sample on a sample custody log along with the appropriate testing procedure. The record shows for each link in the process the person with custody and the date each person accepted or relinquished custody.

4.5 DATA REPORTING

All analytical laboratory data collected from surface and near-surface soil samples shall be included in the CAE Report covering the period of their collection. Data reporting shall include copies of the laboratory reports and field sampling forms. During the sampling event, any deviations from the prescribed methodology in this SAP shall be noted and presented as part of the CAE Report or other required MDNR reporting.

Environmental Works, Inc.
1455 E. Chestnut Expressway
Springfield, Missouri 65802
Office: 417-890-9500
FAX: 417-823-9659

SHALLOW SOIL SAMPLING LOG

PROJ. NAME/NO.: ____________________

LOGGER: ____________ DATE: ____________

LOCATION: ____________________

HOW SAMPLED: ____________________ TIMES: __________

SIZE/DEPTH	SOIL AND IMPACT DESCRIPTION	SAT'N	PID/ODOR	SAMPLE ID / DEPTH

LOCATION: ____________________

HOW SAMPLED: ____________________ TIMES: __________

SIZE/DEPTH	SOIL AND IMPACT DESCRIPTION	SAT'N	PID/ODOR	SAMPLE ID / DEPTH

LOCATION: ____________________

HOW SAMPLED: ____________________ TIMES: __________

SIZE/DEPTH	SOIL AND IMPACT DESCRIPTION	SAT'N	PID/ODOR	SAMPLE ID / DEPTH