RESIDENTIAL PROPERTY SAMPLING WORK PLAN

Former Tronox Facility
2800 West High Street, Springfield, Missouri RCRA
Permit Number MOD007129406

Submitted by:

Greenfield Environmental Multistate Trust LLC,
Trustee of the Multistate Environmental Response Trust

Prepared by:

For Submittal to:

Missouri Department of Natural Resources
P.O. Box 176
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August 7, 2017

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LIST OF ACRONYMS

BTEXN	Benzene, Toluene, Ethylbenzene, Xylenes, Naphthalene
COCs	Contaminants of Concern
CSEM	Conceptual Site Exposure Model
EPA	United States Environmental Protection Agency
EWI	Environmental Works, Inc.
MDL	Method Detection Limit
MoDNR	Missouri Department of Natural Resources
PAH	Polycyclic Aromatic Hydrocarbon
QAPP	Quality Assurance Project Plan
RCRA	Resource and Conservation Recovery Act
RAO	Remedial Action Optimization
RSL	Regional Screening Level
SAP	Sampling and Analysis Plan
SIM	Selective Ion Monitoring
SOP	Standard Operating Procedure
TAT	Turnaround Time
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 Facility, Springfield, Missouri (Facility), Resource Conservation and Recovery Act (RCRA) Post Closure Care Permit #MOD007129406. A Facility Location map is included as Figure 1.0

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. 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). 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 exists suggesting surface/near surface contamination (e.g., odors or wet soil with a sheen)
- Depending on the observed conditions, collect air, seep water or soil samples for laboratory analysis of Facility COCs

This Work Plan also describes additional evaluations in support of this analysis including:

- Collection of local weather data from an on-Facility weather station at times when odors are noted to help ascertain the direction of possible odor sources
- Evaluation of other nearby or distant sources of odors away from the residence area being evaluated
- Comparison of analytical results to applicable United States Environmental Protection Agency (EPA) Regional Screening Levels (RSLs) to (1) assess whether further evaluation of potential human health risks is warranted and (2) support the assessment of whether actions are required to reduce human exposures to acceptable levels.

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 of the sample results.

2.1 Record of Observations and Implementation Plan

Information for residents to contact the Multistate Trust was previously provided to the neighborhood. Residents observing odors or seeps will normally telephone the Multistate Trust. If the Multistate Trust's local contractor, Environmental Works, Inc., (EWI), is contacted directly by a resident, the resident will be referred to the Multistate Trust. The Multistate Trust will obtain the resident's contact information, and as much detail concerning their observations as can be gleaned during the call. The Multistate Trust

will relay this information to EWI, verify EWI's availability, and instruct EWI to mobilize to the resident's property. The Multistate Trust will also notify MoDNR regarding the upcoming activities.

Appendix A contains a "Residential Odor Observation Form" formatted for a phased approach to implement the investigation of the odor observations. Part 1 of the form will be filled out by EWI with the information provided by the Multistate Trust. EWI will procure the necessary sampling equipment, including lab-supplied equipment (see Section 2.3), and will mobilize a two-person field team to the area to complete field verification Parts 2 and 3 of the Residential Odor Observation Form as described below. For on-residence visits, the residents will be asked to sign an access agreement (**Appendix C**) allowing Multistate Trust and EWI representatives to access their property for observation and sampling.

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

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 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 the residents, note observations and odors. This information, including wind direction and estimated speed, 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, or evidence of other surface or near surface contamination.

Upon arrival to specific residential location, the resident(s) will be interviewed 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 the resident(s) reports as potentially pertinent.

EWI personnel will walk the area to observe the ground conditions, assessing for the following: wetness and sheen, odor, staining, or 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

Sampling and analysis after a reported odor or seep observation will involve collection of one or more of these specific media: ambient air, seep water, and soil. Each media and collection method is 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, Remedial Action Optimization (QAPP)(EWI, 2016b), and the Indoor Air Work Plan (EWI, 2017. Each sampled media will be analyzed for benzene, toluene, ethylbenzene, xylenes, and naphthalene (BTEXN). Soil and seep water samples will be analyzed for BTEXN and the polycyclic aromatic hydrocarbons (PAHs) identified as Facility COCs.

Following collection of samples, **Part 4** of the Residential Observation Form 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, etc.).

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 (see **Appendix D**) and involve the following:

1. Select a sampling location at or very close downwind to the location of the odor observation, and select a second location within the neighborhood, upwind and distant from the subject residence, to collect a background sample. Use prevailing wind direction to plan locations.
2. Six-liter Summa® canisters with flow controllers pre-set at the laboratory for a one-hour collection time will be placed away from busy roads to the extent practicable, and set at a height of three to five feet above ground surface. The canisters will be secured to immovable objects if possible for security. A sign stating “DO NOT DISTURB – AIR SAMPLING IN PROGRESS” will be placed on or near the canister during the one-hour sample collection period.
3. Decision to collect a duplicate air sample will be discussed with the Multistate Trust manager during initial conversations about the particular odor complaint.
4. Following collection of samples, the canisters will be labeled and shipped under chain-of-custody per the Facility’s QAPP to Eurofins laboratory for analysis by Method TO-15 Selective Ion Monitoring (SIM) for the Facility-related volatile organic compounds (VOCs) list (BTEXN) with 5-day turn-around time (TAT). Although there may be PAHs that could contribute to odors, the duration of the sampling event and volume of air collected using Summa® canisters do not facilitate analysis for PAHs at a sufficiently low method detection limit (MDL) to feasibly detect low concentrations of PAHs. Therefore, PAH analysis will not be performed.

2.3.2 Seep Water Sampling Procedure

If sufficient seep water is present in cases where a seep is observed, a seep sample will be collected. If the seep water is 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 (EPA Method 8260) and the specific PAHs (Method 8270) identified as Facility COCs (see **Table 1.0**). Prior to collecting the sample, the location will be described on the attached Seep Water Sampling Form (**Appendix E**). 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

Surface soil grab samples will be collected in the area of seeps where observations suggest possible soil contamination. 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).
- Soil samples will be collected using various methods (soil punches, scoops, shovels), although samples for VOC analysis will be collected using EnCore-type samplers.

Collected samples will be labeled, immediately placed in an iced cooler, and shipped overnight to Eurofins Laboratory using QAPP chain-of-custody protocols. Samples will be analyzed for BTEXN (EPA Method 8260) and the specific PAHs (Method 8270) identified as Facility COCs (see **Table 1.0**).

3.0 DATA EVALUATION AND REPORTING

Upon receipt, analytical results will undergo data validation per procedures specified in the QAPP. Ambient air results from the residential and background canisters will be compared, and ambient air results will be compared analytical data from any seep water and/or soil samples that are collected during the event.

Analytical results will be compared to EPA RSLs for target hazard quotient of one (1) and excess lifetime cancer risk of 10^{-6} to (1) assess whether further evaluation of potential human health risks is warranted and (2) support the assessment of whether actions are required to reduce human exposures to acceptable levels. Figure 2.0 presents a conceptual site exposure model (CSEM) for potential seep-related exposures on residential properties. This CSEM will guide further evaluations of human health risks in cases where analytical results exceed the RSLs. The scope of such an assessment, if needed, will be developed in coordination with MoDNR following the initial data evaluation.

A summary report will be prepared and provided to the Missouri Department of Natural Resources (MoDNR) and the resident (with MoDNR approval), which will include a copy of the Residential Observation Form and/or Residential Media Sampling Form (as appropriate), tabulated analytical results from the sampling event, comparison with upwind results in the case of air samples, and results of the screening-level comparison.

If unacceptable Facility-related human exposures are identified, the Multistate Trust will coordinate with MoDNR to develop and implement appropriate actions to reduce exposures to acceptable levels.

4.0 REFERENCES

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

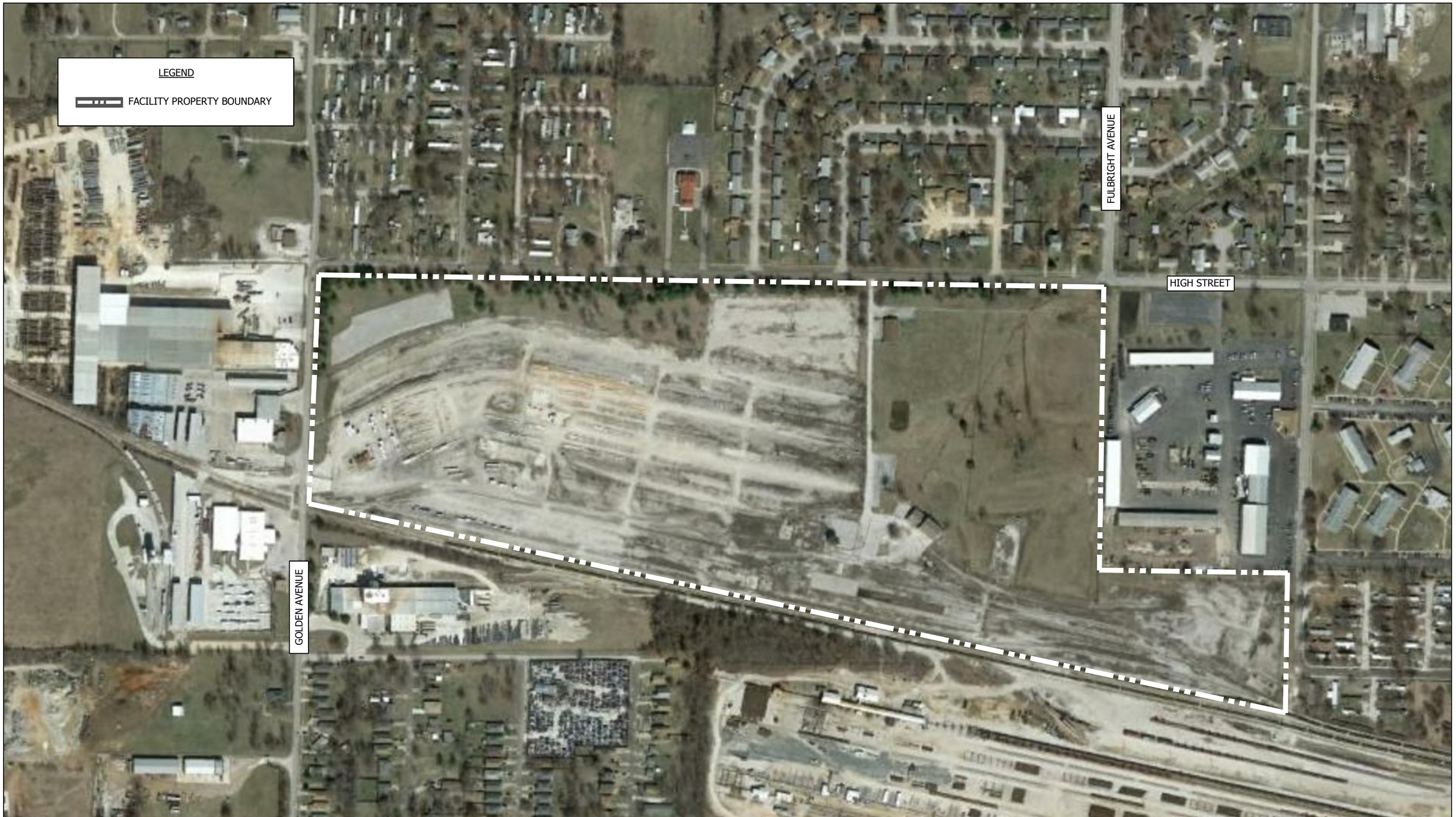
EWI, 2016b. Quality Assurance Project Plan, Remedial Action Optimization, Former Tronox Facility, 2800 West High Street, Springfield, Missouri, RCRA Permit Number M0D007129406, Environmental Works Inc., August 18, 2016

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

FIGURES AND TABLE

RESIDENTIAL PROPERTY SAMPLING WORK PLAN

Former Tronox 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

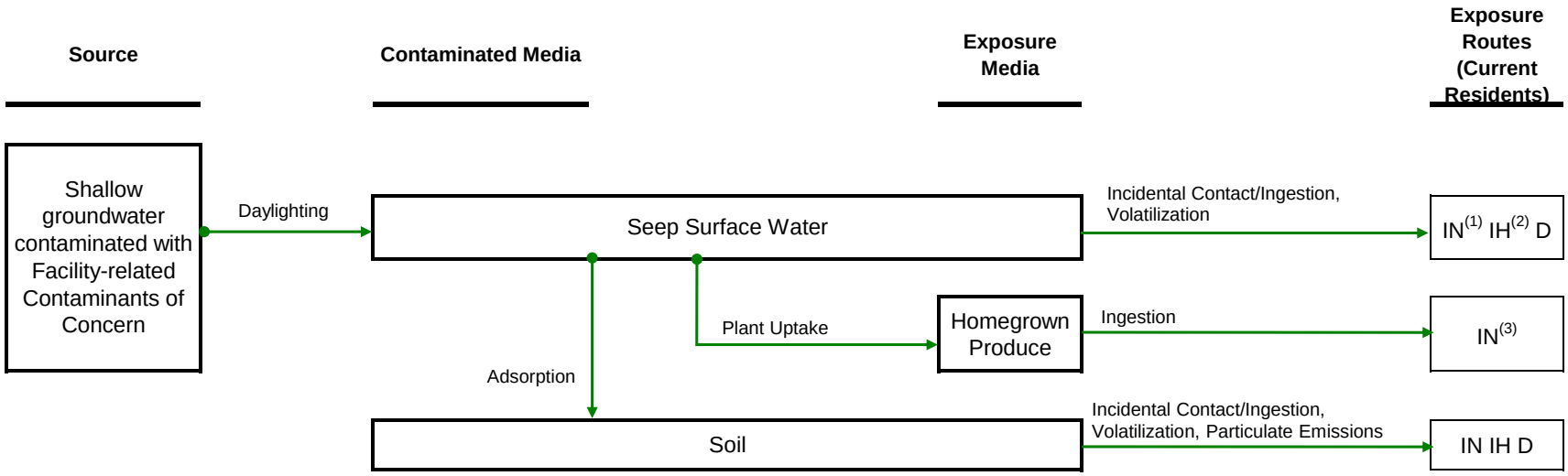
PREPARED FOR:
Greenfield Environmental Multistate Trust, LLC, Trustee of the Multistate Environmental Response Trust

PREPARED BY:
ENVIRONMENTAL WORKS

FACILITY LOCATION MAP

FORMER TRONOX 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) Pathway potentially complete but insignificant

(2) Water and soil contaminant concentrations are assumed to be in equilibrium and volatilization is accounted for under soil

(3) Only applicable in cases where a garden is present in a seep area

FIGURE 2.0 - CONCEPTUAL SITE EXPOSURE MODEL
Former Tronox Facility
2800 West High Street
Springfield, Greene County, Missouri

TABLE 1.0
CONTAMINANTS OF CONCERN
Former Tronox Facility, Springfield, Missouri

Parameter	Water Screening Level Region 3 RSL - Tapwater		Soil Screening Level Region 3 RSL-Residential Soil	
	(ug/L)	MDL	(mg/Kg)	MDL
Acenaphthene	530	0.1	3,600	0.003
Acenaphthylene	c	0.1	c	0.003
Anthracene	1,800	0.1	18,000	0.003
Benzene	0.46	0.2	1.2	0.002
Benz(a)anthracene	b	0.1	0.16	0.003
Benzo(a)pyrene	b	0.1	0.016	0.003
Benzo(b)fluoranthene	b	0.1	0.16	0.003
Benzo(k)fluoranthene	0.34	0.1	1.6	0.003
2-Chlorophenol	0.5	0.5	390	0.017
Chrysene	3.4	0.1	16	0.003
2,4 dinitrophenol	39	10	130	0.3
2,4 dimethylphenol	360	0.5	1,300	0.017
Dibenzofuran	7.9	0.5	73	0.017
Dibenzo(a,h)anthracene	b	0.1	0.016	0.003
Ethylbenzene	1.5	0.2	5.8	0.002
Fluoranthene	800	0.1	2,400	0.003
Fluorene	290	0.1	2,400	0.003
Indeno(1,2,3-CD)pyrene	b	0.1	0.16	0.003
2-Methylnaphthalene	36	0.1	240	0.003
Naphthalene	0.17	0.1	3.8	0.003
Phenanthrene	c	0.1	c	0.003
Phenol	5,800	0.5	19,000	0.017
Pyrene	120	0.1	1,800	0.003
Toluene	1,100	0.2	4,900	0.002
Xylene	190	0.2	580	0.005

NOTES:

a - Screening levels derived from USEPA Region 3 Regional Screening Levels (June 2016)

b - Region 3 screening level is lower than ability of current analytical technology to routinely attain detection limits at or below such levels. The current laboratory minimum detection level (MDL) is assigned as the screening level

c - Compound is not listed in the RSL database. Analytical MDL is assigned as the screening level

APPENDIX A

RESIDENTIAL ODOR OBSERVATION FORM

RESIDENTIAL PROPERTY SAMPLING WORK PLAN

Former Tronox 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 from Multistate Trust Manager 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	How long has odor been occurring?
	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

Check the reported odor against "What is that Odor" and "Search Odors" databases within this online CDC reference website: https://www.atsdr.cdc.gov/odors/index.html

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:_____

5. Locations of Ambient Air Sampling

	Is a near residence ambient air sample able to be collected? ☐ Yes ☐ No	If yes, Note Sample ID:
	Describe location of near residence ambient air sample:	
	Was a background ambient air sample able to be collected? ☐ Yes ☐ No	If yes, Note Sample ID:
	Describe location of background ambient air sample:	
	Were ambient air sampling forms filled out? ☐ Yes ☐ No	

6. 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:

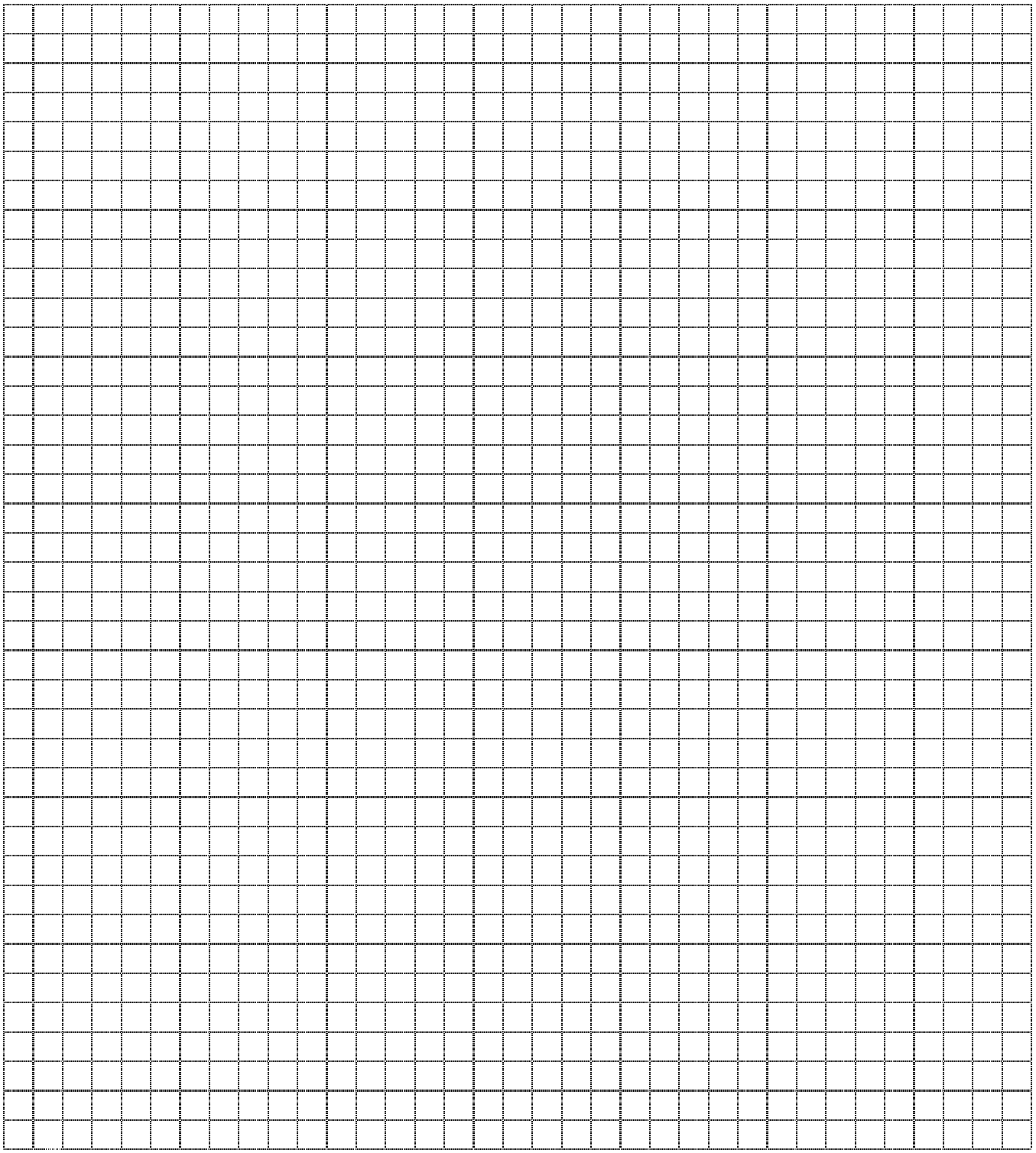
Is there an attached garage:	☐ Yes ☐ No		
Are petroleum-powered machines or vehicles stored in the garage (e.g., lawn mower, ATV, car):	☐ Yes ☐ No	Please specify:	
Has the building ever had a fire:	☐ Yes ☐ No	When:	
Is a kerosene or unvented gas space heater present:	☐ Yes ☐ No	Where & type:	
Is there 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:	

Outdoor grid plot (Include if outdoor ambient air samples collected):

Insert sketch (or attach separate document) of the area outside the building and locate outdoor air sample locations.
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 B

RESIDENTIAL MEDIA SAMPLING FORM

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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)

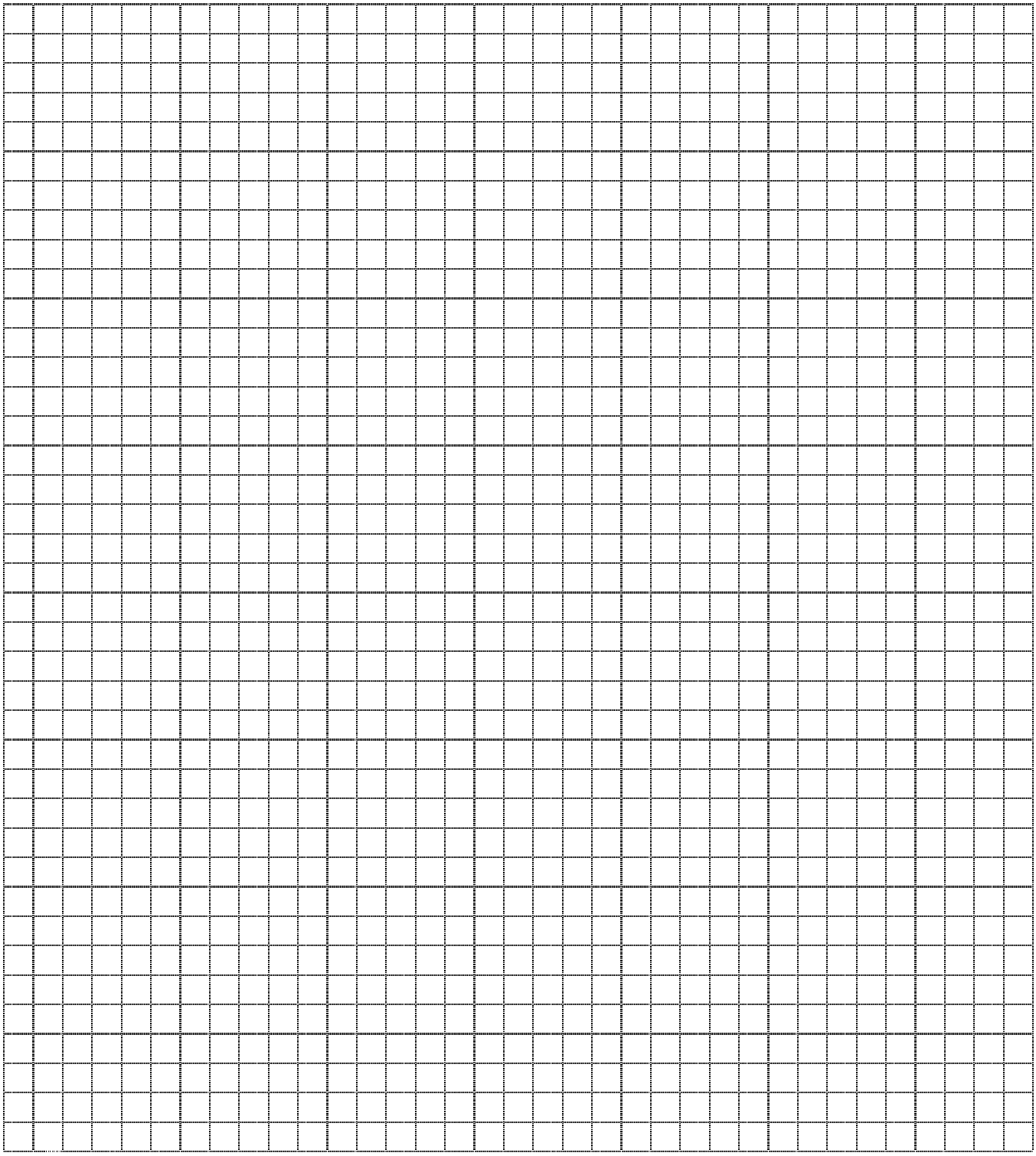
	Date of Water Sampling:	Number of Water Samples Collected:
	Location of Sample – same as location of impact noted above? ☐ Yes ☐ No ☐ Front Yard ☐ Side Yard ☐ Back Yard ☐ Unoccupied Basement ☐ Lowest Occupied Room ☐ Collection Sump ☐ Pool at floor cracks ☐ Pool at Wall/Floor Juncture	
	Additional Information: _____ _____ _____ _____	

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: _____ _____ _____ _____	

Outdoor grid plot (Include if outdoor ambient air samples collected):

Insert sketch (or attach separate document) of the area outside the building and locate outdoor air sample locations.
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 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 #21
INTEGRATED AMBIENT INDOOR AND OUTDOOR AIR SAMPLING METHOD FOR TRACE VOCs USING SUMMA CANISTERS

RESIDENTIAL PROPERTY SAMPLING WORK PLAN
Former Tronox 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.

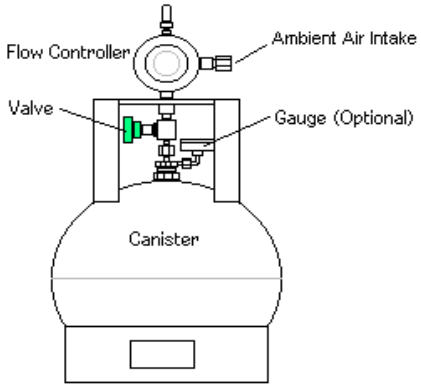
7.10. Connect the flow controller to the canister (Figure 1).

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.

APPENDIX E

SEEP WATER SAMPLING LOG

RESIDENTIAL PROPERTY SAMPLING WORK PLAN

Former Tronox 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 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