

Agricultural Plant Tissue Sampling Results

East Palestine, Ohio

Columbiana County

Ohio Department of

Agriculture

The Ohio State University

May 16, 2023

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Introduction, Purpose, and Scope

The Ohio Department of Agriculture (ODA) and The Ohio State University (OSU) established a procedure to sample and analyze plant tissue materials in Columbiana County to address concerns of the local agricultural community following the Norfolk Southern Railroad train derailment in East Palestine, Ohio. Local agricultural producers have expressed the desire for the testing of plant tissue to understand the full impact of the derailment on their agricultural products. A list of plant tissue sample matrices is presented in EXHIBIT A.

In response, ODA and OSU conducted voluntary vegetation (winter crops, pasture species, etc.) sampling to determine if levels of semi-volatile organic compounds (SVOCs) are present on farms in the East Palestine area and if they warrant further investigation. The sites were selected in consultation with the Columbiana Soil and Water Conservation District, Columbiana County Farm Bureau, OSU Extension and Ohio EPA.

The data generated by this effort is intended to support the immediate needs of the local agricultural community and supplement results from the USEPA soil sampling plan that is underway via unified command. The voluntary sampling was conducted by ODA plant health inspectors who are trained in environmental sampling and hold EPA credentials related to pesticide regulatory investigation. Samples were analyzed by The Ohio State University using USEPA Method 8270 with modified extraction protocols to accommodate plant tissue matrices. Extraction protocols were adapted from approved Association of Official Analytical Collaboration International (AOAC) methods established for pesticides.

Inspections and Sampling Locations

OSU, in coordination with local partners, identified proposed sampling locations within a five-mile radius of the train derailment site. Special consideration was given to sites particularly affected by the plume, observations made during the vent and burn event, and existing soil sampling locations performed by USEPA and Norfolk Southern Railroad as identified in the Preliminary Residential/Commercial/Agricultural Soil Sampling Work Plan. A grid of sample locations can be found on EXHIBIT B.

Samples represented plant tissue from growing crops, including winter wheat, barley, alfalfa and grass pastures, hay fields, and grassed waterways. In-field sampling locations were determined through consultation with the landowner to identify suspected areas of impact. If suspected impact areas were not identified, samples were then collected based off broader grid sampling to allow for full-field representation.

Sampling Procedures

Procedures for the collection, delivery, and identification of samples were detailed in the East Palestine Plant Tissue Sampling Work Plan. The following is a summary of the Work Plan.

Sample Collection

All samples were collected in new laboratory-provided 50mL amber glass jars with Teflon-lined lids in concurrence with USEPA Method 8270E. In-field sample locations were selected based on consultation with the landowner(s), when available, to identify areas most likely to have been impacted. The following collection method was used for each sample:

Prior to sample collection, the location of the property, including GPS location, was recorded. Collection personnel washed and dried hands prior to putting on a new pair of gloves, and decontaminated sampling equipment by wiping down the equipment and rinsing with acetone between each sample.

Samples of plant tissue were harvested at the growing point, or crown, of the plant, and included only foliage of similar type to ensure a consistent sample. Samples were collected from locations identified by the landowner as an impacted area, if identified by the landowner.

Samples were placed in the laboratory-provided jar, which was then sealed and bagged following the bagging and tagging protocol found in EXHIBIT C. Decontamination measures were then completed as stated above, the sample area was photographed, and additional QA/QC field sample collections were completed following Quality Assurance procedures.

Bagging and Tagging Protocol

All samples were identified for delivery utilizing the protocol found in EXHIBIT C. Samples were each labeled and assigned an ID based on date, inspector credentials, sample sequence, and inspector initials. Sealed sample jars were placed inside an inverted polybag, which was then tied, sealed, and officially labeled in accordance with the protocol.

Once properly bagged and labeled, samples were immediately placed in chilled, insulated coolers. Delivery of samples from the field to the lab's custody was completed no later than the next business day. Standard chain of custody procedures were followed to ensure proper handling of samples.

Quality Assurance

At a minimum of 10% of sampling sites, a field replicate sample was collected to measure sample representativeness and natural variability of the matrix sampled. Decontamination procedures were not necessary between replicate collections, replicate sites represented a variety of crops and included sites from the background and inner radii. A minimum of 5% field blanks (minimum two field blanks, included on two separate sampling days) were also collected. Field blanks were 50mL amber glass jars that are taken to the field site, where the lid was removed allowing air to fill as "field blank" jar from one site. The jar was dated, labeled as "field blank" then resealed and placed into coolers with all other samples.

Laboratory Analysis

All samples were couriered to OSU, College of Food, Agricultural, and Environmental Sciences, under standard chain-of-custody procedures and stored at -40 °C until time of analysis. During this phase samples were analyzed for the focused SVOC listed in EXHIBIT E.

Frozen plant tissue samples were homogenized in a stainless-steel Waring blender with liquid nitrogen to fracture tissues prior to SVOC extraction using AOAC method 2007.01. Extracts were returned to cold-storage prior to analysis using USEPA SW-846 method 8270e. All samples were analyzed in duplicate with spike-recovery and surrogates samples included to ensure analytical quantification and accuracy.

Reporting of Results and Data Evaluation

A total of 31 plant tissue samples were collected and analyzed for the focused list of SVOCs in Exhibit E. National regulatory levels for SVOCs in plant material have not been established by the EPA or the FDA, therefore plant tissue data within the inner-radius (n=13) were compared to data from background-radius locations (n=18) to evaluate for potential contamination due to the derailment event. The close geographical proximity between the background-radius and inner-radius locations allowed for a comparison within the same weather pattern and growing year.

To determine potential impact from the event, each SVOC from the inner-radius was compared to the background-radius if values were reportable. Of the 26 selected SVOCs, none were

detected above reportable limits in the inner-radius. In the background-radius, only one compound (Benzo[b]fluoranthene) was above reportable limits (see Table) in 2 of the 18 background samples. As this detection was only found in the background-radius there is no reason to suggest that this detection is a result of the train derailment. Since there were no reportable SVOCs within the inner-radius, the implication is that plant materials are not contaminated with SVOCs.

Scientific research has found the primary mode of SVOC ingestion from plant materials by animals or humans is a result of the SVOCs or SVOC contaminated soil being deposited on the exterior of the plant tissue. The findings from these data indicate that plant tissue is an unlikely source of SVOC exposure in the impacted zone from the Norfolk Southern train derailment. A holistic evaluation of these data to in relation to results from soil, air and water data collected under USEPA supervision within the background- and inner-radii would further clarify that plant materials are not likely a primary SVOC exposure pathway for animals or humans.

Table: Plant tissue analysis for selected semi-volatile organic compounds (SVOCs) from actively growing plants in agricultural fields of Columbiana County following the Norfolk Southern train derailment. Samples were collected between April 10 – 12, 2023.				
Analyte	CAS No. ⁽¹⁾	Reporting Level (ppm) ⁽²⁾	Inner-Radius Range ⁽³⁾ (ppm)	Background-Radius ⁽⁴⁾ Range (ppm)
2,4,5-Trichlorophenol ⁽⁵⁾	95-95-4	0.42	<0.42	<0.42
2,4,6-Trichlorophenol ⁽⁵⁾	88-06-2	0.40	<0.40	<0.40
2,4-Dichlorophenol	120-83-2	0.43	<0.43	<0.43
2-Chlorophenol	95-57-8	0.31	<0.31	<0.31
2-Methylnaphthalene	91-57-6	0.66	<0.66	<0.66
4-Chloro-3-methylphenol	59-50-7	0.59	<0.59	<0.59
4-Chlorophenyl phenyl ether ⁽⁵⁾	7005-72-3	0.48	<0.48	<0.48
Acenaphthene ⁽⁵⁾	83-32-9	0.21	<0.21	<0.21
Acenaphthylene ⁽⁵⁾	208-96-8	0.69	<0.69	<0.69
Anthracene	120-12-7	0.36	<0.36	<0.36
Benzo[a]anthracene	56-55-3	0.29	<0.29	<0.29
Benzo[a]pyrene	50-32-8	0.15	<0.15	<0.15
Benzo[b]fluoranthene	205-99-2	0.28	<0.28	<0.28 - 0.37 ⁽⁶⁾
Benzo[g,h,i]perylene	191-24-2	0.20	<0.20	<0.20
Benzo[k]fluoranthene	207-08-9	0.26	<0.26	<0.26
Chrysene	218-01-9	0.25	<0.25	<0.25
Dibenz(a,h)anthracene	53-70-3	0.41	<0.41	<0.41
Fluoranthene	206-44-0	0.36	<0.36	<0.36
Fluorene ⁽⁵⁾	86-73-7	0.79	<0.79	<0.79
Hexachlorobenzene	118-74-1	0.28	<0.28	<0.28
Indeno[1,2,3-cd]pyrene	193-39-5	0.41	<0.41	<0.41
Naphthalene	91-20-3	0.70	<0.70	<0.70
Pentachlorophenol	87-86-5	0.74	<0.74	<0.74
Phenanthrene	85-01-8	0.24	<0.24	<0.24
Phenol	108-95-2	0.34	<0.34	<0.34
Pyrene	129-00-0	0.32	<0.32	<0.32
(1) A unique number assigned by the Chemical Abstracts Service, a division of the American Chemical Society to identify a specific compound.				
(2) ppm = µg/g				
(3) 13 Inner-radius Samples				
(4) 18 Background-radius Samples				
(5) Only spike-recovery used				
(6) 2 of 18 background-radius samples were above the reporting limit. Detection is not believed to be associated with train derailment.				

Exhibits

Exhibit A – Plant Material List

Exhibit B – Sampling Locations

Exhibit C – Bagging and Tagging Protocol

Exhibit D – Sample Collection Form

Exhibit E – Focused SVOC List

EXHIBIT A

Plant Material List

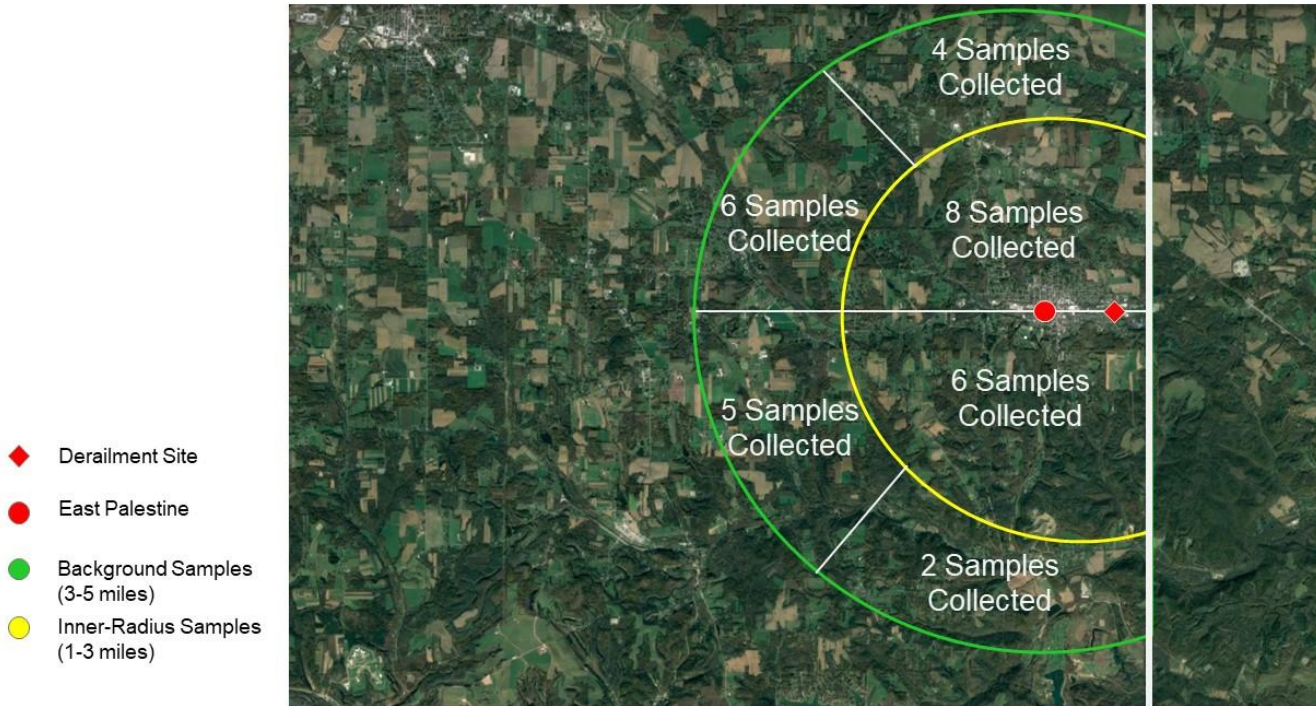
The following are plant materials identified as potential plant materials in the area of interest.

Growing Crops –

- Malting Barley
- Winter Wheat
- Pasture (Alfalfa or Grass Mix)
- Hay Field (Alfalfa or Grass Mix)
- Forage Cover (Grassed Waterways) - plant tissue will be pulled from grassed waterways adjacent to fields of growing crops if determined to be down-field and a more likely point of deposition.

EXHIBIT B

Sampling Locations



This map is a representation of the plant tissue sampling locations. The green radius represents locations selected for background sampling purposes, and the yellow radius represents locations selected for inner radius sampling purposes.

Samples IDENTIFICATION

Every sample requires an identifying number.

An example of a sample number consists of:

- (1) the date (YYMMDD)
- (2) the inspector's credential number
- (3) an inspection sample sequence number
- (4) the inspector's initials.

For example: 170209-01-01 TH

02/09/2017 = Date

01 = Inspector's Assigned Ohio

Number 01 = Sample Sequence
Number

TH = Inspector's Initials

**The use of a pre-printed label with the same information on it is acceptable.

BAGGING

1. Invert the polybag (turning inside out) to have the sealed seam inside the polybag.
2. Using a magic marker, write your sample number and initials on the inverted bag.
3. Place the identified sample(s) in the polybag.
4. Twist the top of the polybag and tie a knot in the bag. Note: leave enough room at the top of the bag to fold down over the knot.
5. Fold the top of the polybag down over the knot and re-twist the bag.
6. Apply monofilament, masking or other type tape around the polybag, at the area just below the knot.
7. Complete the ODA Official Sample Seal (Pre- printed labels are acceptable to use) and peel away the backing of the Seal.
8. Apply the seal around the taped area of the bag by bringing the two ends of the seal together, and then press the seal together until it reaches the bag area.

SEALS

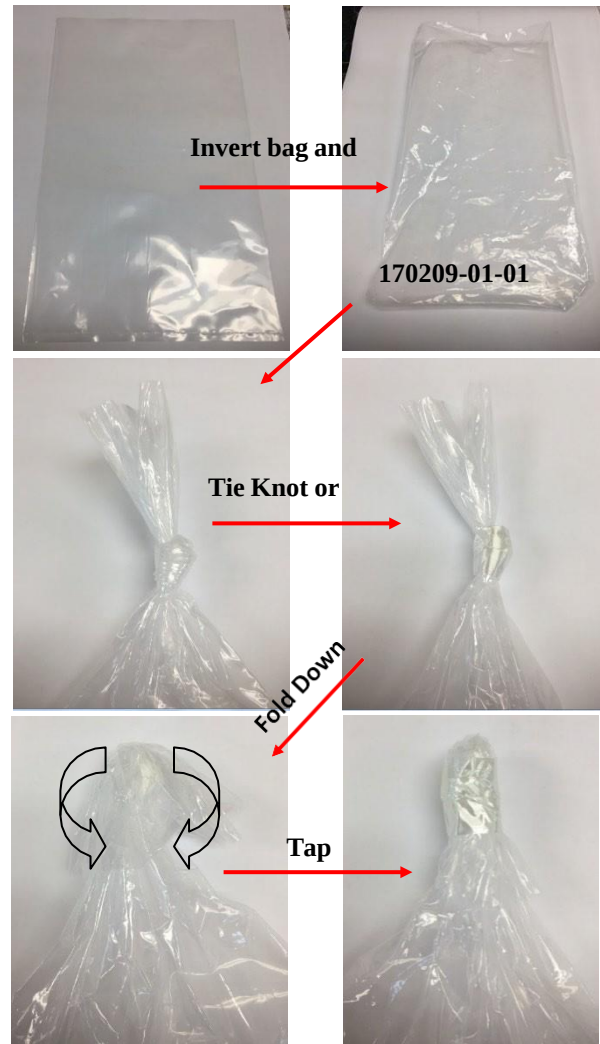
- All physical samples are to be officially sealed by using a completed ODA Official Sample Seal.

The use of a pre-printed label with the same information on it is acceptable.

OFFICIAL SAMPLE SEAL
INSPECTOR: TIM HOFFMAN

SAMPLE PRESERVATION and DELIVERY

- Secure the sample(s) assuring chain-of-custody procedures until the sample(s) are sent or delivered to the laboratory. Place the samples on ice for transportation to the laboratory.



OHIO DEPARTMENT OF AGRICULTURE OFFICIAL SAMPLE				SAMPLE NO. _____ SAMPLE OF _____ INSPECTOR _____		SAMPLER: _____ -01-_____ OFFICIAL SAMPLE SEAL INSPECTOR: TIM HOFFMAN	
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SAMPLE COLLECTION REPORT

THE FOLLOWING SAMPLE WAS COLLECTED PURSUANT TO SECTION 9(a) OF THE FEDERAL INSECTICIDE, FUNGICIDE, AND RODENTICIDE ACT, AS AMENDED (7 U.S.C. 136 g) OR SECTION 921.18 OF THE OHIO PESTICIDE LAW, OR CHAPTER 905 OF THE OHIO FERTILIZER, LIME, AND AGRICULTURAL ADDITIVES LAW.

FIRM NAME		DATE	CASE NO.
NAME			
ADDRESS		NAME OF COLLECTOR (Print)	
SAMPLE NUMBER	DESCRIPTION OF SAMPLE		
DATE SHIPPED		CHAIN OF CUSTODY	SHIPPED VIA
RECEIVED BY		TIME & DATE	
RECEIVED BY		TIME & DATE	
RECEIVED BY		TIME & DATE	
RECEIVED BY		TIME & DATE	
THE ABOVE DOCUMENTARY AND/OR ENVIRONMENTAL SAMPLES WERE COLLECTED BY THE O.D.A. IN CONNECTION WITH THE ADMINISTRATION AND ENFORCEMENT OF THE F.I.F.R.A. AND/OR THE OHIO PESTICIDE LAW AND RECEIPT IS HEREBY ACKNOWLEDGED.			
SIGNATURE		PRINT NAME	
X		X	
Rev 3/17	ORIGINAL - Office	SECOND COPY - Inspector	THIRD COPY - Collection Site

EXHIBIT E

Focused List of Semi-volatile Organic Compounds EPA Method 8270E

Analyte	CAS No.
2,4,5-Trichlorophenol	95-95-4
2,4,6-Trichlorophenol	88-06-2
2,4-Dichlorophenol	120-83-2
2-Chlorophenol	95-57-8
2-Methylnaphthalene	91-57-6
4-Chloro-3-methylphenol	59-50-7
4-Chlorophenyl phenyl ether	7005-72-3
Acenaphthene	83-32-9
Acenaphthylene	208-96-8
Anthracene	120-12-7
Benzo[a]anthracene	56-55-3
Benzo[a]pyrene	50-32-8
Benzo[b]fluoranthene	205-99-2
Benzo[g,h,i]perylene	191-24-2
Benzo[k]fluoranthene	207-08-9
Chrysene	218-01-9
Dibenz(a,h)anthracene	53-70-3
Fluoranthene	206-44-0
Fluorene	86-73-7
Hexachlorobenzene	118-74-1
Indeno[1,2,3-cd]pyrene	193-39-5
Naphthalene	91-20-3
Pentachlorophenol	87-86-5
Phenanthrene	85-01-8
Phenol	108-95-2
Pyrene	129-00-0