EPA United States Environmental Protection Agency

CESER QUALITY ASSURANCE PROJECT PLAN

Office of Research and Development

Land Remediation & Technology Division

Environmental Decision Analytics Branch (EDAB)

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Extramural

QA Category B

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Prepared By

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K-LRTD-0032360-QP-1-1

A.1 Approval Page

QA Project Plan Title:		Strategies for Characterization of Food Waste: Sampling & Analysis	
QA Activity Number:		1	
If Intramural or Extramural, EPA Project Approvals			
Name:	Jill Hoelle	Signature/Date:	Hoelle, Jill Digitally signed by Hoelle, Jill Date: 2020.06.11 14:48:43 -04'00'
Name:	Michael Gonzalez	Signature/Date:	MICHAEL GONZALEZ Digitally signed by MICHAEL GONZALEZ Date: 2020.06.11 10:00:49 -04'00'
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Name:		Signature/Date:	
If Extramural, Contractor Project Approvals			
Name:	TBD	Signature/Date:	
Name:		Signature/Date:	

A.2 Table of Contents

Revision History

Table 1 QAPP Revision History

Revision Number	Date Approved	Revision
1	6/11/2020	Initial QAPP for Phase 2 of the project, see K-LRTD-0032360-QM-1-0.

Section A - Executive Summary

A.3 Distribution List

Quality Assurance Project Plans and Standard Operating Procedures shall be controlled through documented approvals as required by Section 5.3 of the Office of Research and Development Quality Management Plan. The project lead will be responsible for distribution of the current signed approved version of the QA Project Plan to project participants shown in Section A.4. Signed approved versions of SOPs will be available to project staff through the ORD@Work SOP intranet site. Signature approved electronic copies of this QA Project Plan, SOPs, and any associated QA assessment reports, will be maintained in ORD QA Track. The project lead will be responsible for timely communications with all involved participants and will retain copies of all management reports, memoranda, and correspondence between research task personnel.

A.4 Project Task Organization

- Dr. Daniel Young, EPA ORD, Project Lead/WACOR, Scientific leadership for the research effort.
- Dr. David Meyer, EPA ORD, Output Lead/Alt WACOR, Scientific leadership for the research effort.
- Dr. Michael Gonzalez, EPA ORD, Manager, Management Oversight.
- Mrs. Jill Hoelle, EPA ORD, QA Manager, Oversight of QA program implementation.
- Ruth Corn, EPA COR, Project officer for Contract Officer Representative.
- Contractor Project Officer, TBD.
- Contractor QA Officer, TBD.

A.5 Problem Definition Background

The U.S. is committed to reducing food waste by 50% by 2030. To divert food waste from landfills, OLEM promotes anaerobic digestion and composting of food waste; however, contamination of food waste with packaging (including film plastics) may complicate composting and anaerobic digestion operations and decrease the market desirability and safety of land application of the compost and digestate made from food waste. De-packaging technologies (beyond screens and filters) are increasingly being used by large food waste generators and treatment facilities as primary means of removing plastics.

A.6 Project Description

This product will test the performance of de-packaging equipment available on the market in real-world settings. The research will characterize the plastics, including quantity and particle size, in food waste streams before and after the use of de-packaging technologies. The results from this study will be useful to OLEM, restaurant and commercial kitchen operators, food retailers, composters, and wastewater treatment facility staff across the U.S. as they seek to exclude plastics (including microplastics) from the food waste stream. Key Words: Food waste, landfill diversion, waste management, sustainable materials management, plastics, food de-packaging, secondary data, existing data, EPA QA R/5, flowsa, SciFinder. This work is related to additional food waste research under SHC RA7, including life-cycle analyses of various approaches to managing food waste.

A.7 Quality Objectives and Criteria

Research activities must be documented according to the requirements of ORD QA Policies titled Scientific Recordkeeping: Paper, Scientific Recordkeeping Electronic, and Quality Assurance Quality Control Practices for ORD Laboratory and Field-Based Research, as well as requirements defined in this QA Project Plan. The ORD QA Policies require the use of research notebooks and the management of research records, both paper and electronic, such that project research data generation may continue even if a researcher or an analyst participating in the project leaves the project staff. Electronic project records can be maintained by the project lead on using this EXISTING DATA SEARCH TOOL or can be stored on the ORD network drive, List file path where files are stored. Electronic Records shall be maintained in a manner that maximizes the confidentiality, accessibility, and integrity of the data. ORD PPM Section 13.6 provides guidance on the maintenance of electronic records for ORD. Records retention: Records that are generated under this research effort will be retained in accordance with EPA Records Schedule 1035, and as required by Section 5.1 of the ORD Quality Management Plan for QA Category A Projects.

A.8 Special Training Certification

Project personnel working in the sampling and/or analysis phase of this work are required to complete required lab and/or field safety training as appropriate. Project staff working on sample analysis are expected to have an Initial Demonstration of Analyst Proficiency (IDAP) on record prior to samples analysis.

A.9 Documents and Records

Research activities must be documented according to the requirements of ORD QA Policies titled Scientific Recordkeeping: Paper, Scientific Recordkeeping Electronic, and Quality Assurance Quality Control Practices for ORD Laboratory and Field-Based Research, as well as requirements defined in this QA Project Plan. The ORD QA Policies require the use of research notebooks and the management of research records, both paper and electronic, such that project research data generation may continue even if a researcher or an analyst participating in the project leaves the project staff. Electronic project records can be maintained by the project lead on using this EXISTING DATA SEARCH TOOL or can be stored on the ORD network drive, List file path where files are stored. Electronic Records shall be maintained in a manner that maximizes the confidentiality, accessibility, and integrity of the data. ORD PPM Section 13.6 provides guidance on the maintenance of electronic records for ORD.

 Records retention: Records that are generated under this research effort will be retained in accordance with EPA Records Schedule 1035, and as required by Section 5.1 of the ORD Quality Management Plan for QA Category A Projects.

Section B

B.1 EXPERIMENTAL DESIGN

B.1.1 Analyte(s) of Interest & Matrix/Matrices'

Microplastics are plastic particles less than 5 mm in one dimension that pollute the environment such as rivers, lakes, and oceans. The plastics are organic chemicals that are composed of polymers that contain various carbon base units (e.g., ethylene, propylene, styrene), functional groups and sizes. Microplastics are classified into two segments, primary and secondary types. Primary microplastics include fragmented fibers and particles generated in the washing drainage of food waste of the particle materials. Secondary microplastic is formed in the process of being gradually broken down into small fragments by the force of waves, wind, and ultraviolet rays from the sun over a longer period of time. Microplastics can be analyzed using bulk analytical techniques such as elemental analysis, pyrolysis gas chromatography/mass spectrometry (GC/MS) or total organic carbon (TOC), or they can be analyzed at the microscopic level using stereomicroscopy such as digital microscopes, scanning electron microscope (SEM) or transmission electron microscope (TEM), or using Raman and infrared microscopy. While microscopes are typically used for initial characterization or for a qualitative assessment of microplastics in the environment, quantitative analysis of microplastics is currently mainly performed using Fourier transformation infrared spectroscopy/microscopy (FTIR/μFTIR).

B.1.2 Sampling and/or Experimental Design

The focus of this research is plastic waste generated from food packaging, which typically winds up as road litter or it is found in wastebaskets, streams, rivers, wastewater treatment plants (typically in biosolids) or in landfills. In this study, plastics and microplastics will be collected from wastebaskets at domestic locations or at various restaurants and businesses serving food. Food waste from houses, restaurants, and groceries will be collected in Ziploc bags and transported back to EPA's AWBERC Facility for analysis. At each location, approximately 100g of material is expected to be collected. Ziploc bags containing Ottawa sand or similar material will be used as a control and trip blank. The samples will be stored in a freezer at -20C until they are processed for analysis.

B.1.3 Sampling Locations & Frequency

Sampling will be conducted at various restaurants and businesses serving food. A sampling of food waste will be conducted after written approval by the appropriate owner/manager. Approximately 100g of material will be collected in Ziploc bags at each domestic or commercial location.

B.2 SAMPLING PROCEDURES

B.2.1 Non-Synthetic (real-world sample) Samples

Once the sampling locations are identified and appropriate permissions are obtained, from the owners, a section of the sampling container (waste bins or dumpsters) will be randomly chosen and the contents of the section mixed with a stirring rod. From this section, approximately 100g of material will be collected into Ziploc bags and transported to AWBERC for storage until they are ready for analysis.

B.2.2 Synthetic (lab-prepared) Samples

Ottawa sand that has been muffled in an oven at 600C will be used as a control for this study. For a trip blank, 100g of the muffled sand will be placed in a Ziploc bag and transported to the sampling sites and back to AWBERC. These samples will be processed using the same procedure as for the field samples. In addition, a fresh batch of muffled sand will be used as a laboratory control at the time of sample processing and analysis.

B.2.3 Decontamination Procedures

Spatulas or tongs will be used to collect samples from waste bins or dumpsters. These will be washed with SuperQ water that will be brought to the field and wiped with antimicrobial wipes before use at the next sampling location. The outsides of the Ziploc bags will be sprayed with 70% ethanol prior to placing them in coolers for transport back to AWBERC.

B.2.4 Sample Containers & Quantities

Ziploc bags are expected to be used to collect all samples in the field. Approximately 100g of waste material will be collected at each sampling location. A Ziploc bag filled with Ottawa sand muffled at 600C will be used as a trip blank on field sampling days.

B.2.5 Labeling

Samples will be labelled using the name of the concern, sampling location and a date. For example, Kroger-Everton-05252020 will imply the samples was collected at a Kroger grocery store in Everton on May 25, 2020.

B.2.6 Sample Preservation

Samples from the field will be stored in a freezer at -20C until they are ready to be processed. Since microplastics are not known to degrade in the environment, there is no hold time for sample processing.

B.2.7 Calibration Procedures

Samples will be collected in Ziploc bags, disinfected and stored in a cooler for transportation back to the EPA. Each Ziploc bag containing the sample will be labelled at the time of collection using a sharpie, and a chain of custody will be updated with the new sample at the place of collection. Upon transport back to AWBERC, the samples will be transferred to a -20C freezer and the chain of custody signed by the sample custodian.

B.3 MEASUREMENT PROCEDURES

B.3.1 Field Analyses

No field analysis is anticipated for samples collected from the field in this study.

B.3.2 Lab Analyses

Prior to analyzing the waste material collected in Ziploc bags, the samples will be dried in an oven at 105C to remove moisture, and once dry, the samples will be sieved through a sieve shaker to obtain a material with different sizes. Samples contained in each mesh will initially be qualitatively analyzed using a microscope to determine the presence of plastics. Once identified, these plastic particles will be isolated and quantitatively analyzed using SOP K-LRTD-SOP-1203-0 entitled Fourier Transformation Infrared (FTIR) Spectroscopic Analysis. Identification by Spectral Libraries. Shimadzu “LabSolutions” software for FTIR includes approximately 12,000 spectra in a proprietary spectral library. Furthermore, a "Thermally degraded plastic library" is available as an optional software package, which

contains a total of 111 spectra of unheated and heat-degraded at 200°C to 400°C for 13 types of plastics. Chemical degradation of plastics is almost always considered as oxidative degradation.

B.3.3 Specific Calibration Procedures

The calibration procedures described in the SOP K-LRTD-SOP-1203-0 entitled Fourier Transformation Infrared (FTIR) Spectroscopic Analysis will be followed under this QAPP.

B.4 METHOD PERFORMANCE METRICS

B.4.1 Method QC check

A 4-point calibration will be performed using a known standard at the beginning of the analysis. The coefficient of regression should be > 0.99. The calibration should be run again if these criteria are not met. All samples and controls will be measured in triplicate using the FTIR. The RSD should be < 10%. Occasional data outside the acceptance limits will be flagged. If more than 30% of the samples fail these criteria, the problem will be investigated and the analysis repeated. The spectra from each sample should have a match quality > 500. If these criteria are not met, the problem should be investigated and the sample reanalyzed.

Section C

C.1 Assessments and Response Actions

For QA Category A projects, at least one QA audit is required per ORD QA Policy titled Use of the Graded Approach for Quality Assurance of Research. A technical systems audit TSA will be completed within one year of the initial QA Project Plan approval date for this research effort. The TSA will be conducted in accordance with ORD QA Policy titled Audits of Technical and Quality Systems. Draft publications resulting from this project will undergo ORD clearance in STICS prior to dissemination as required by ORD Policy titled ORD Clearance Policy and Procedures and CESER SOP titled Standard Operating Procedure for Product Clearance.

C.2 Reports to Management

Results of QA audits will be reported in accordance with ORD QA Policy titled Audits of Technical and Quality Systems. Implementation of corrective actions for audit findings will be verified by the QA Manager, and status of implementation tracked through closure. Required approvals for draft publications undergoing ORD clearance is documented in STICS.

Section D

D.1 Data Review, Verification, and Validation

Data packages will be prepared by the primary analyst and will include raw data from the instrument, spectra (if any), processed data and final results. This data package will be reviewed by a secondary analyst or QA Manager. During this review, at least 10% of the data will be checked for transcription and calculation errors. The QA/QC acceptance criteria and flagging will be checked.

D.2 Verification and Validation Methods

Data packages prepared by the primary analyst will be reviewed by a secondary analyst or QA Manager. During this review, at least 10% of the data will be checked for transcription and calculation errors. The QA/QC acceptance criteria and flagging will be checked. the review will be documented by a review form, through notations in lab notebooks or through emails. Additional QA/QC review may be conducted upon request of the CESER QA Manager. The results generated from this study may be disseminated through presentations, posters, reports, journal articles or standard operating procedures. For each of these, the products may undergo additional peer-review according to established ORD procedures.

D.3 Reconciliation with User Requirements

The data generated under this research is considered exploratory, i.e., determining the amount of microplastics in food-waste. As such, the results are expected to be reported as a value along with RSD from triplicate measurements. If additional study is warranted (e.g., comparing microplastic concentrations among different sources, locations, seasons, etc.), the QAPP will be modified to include these additional research objectives.

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