BACKGROUND RADIATION SURVEY & DOSE MODELING WORK PLAN

Old Chemical Waste Landfill
Kansas State University
Manhattan, Kansas

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Prepared For

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3.0 INVESTIGATION PROGRAM

3.1 LIST OF ACTIVITIES

The fieldwork anticipated under this work plan includes:

1. Collect, screen, and analyze surface soil samples (upper 6-inches) at locations shown in Table 3-1 and Figures 2 and 3.
2. Collect, screen, and analyze subsurface soil samples (on nominal 2-ft centers until groundwater intercept), at locations shown in Table 3-1 and Figures 2 and 3.
3. Collect and analyze groundwater samples at locations shown in Table 3-1 and Figures 2 and 3.
4. Perform a gamma radiation survey along transects spanning the OCWLF control area and a background location as shown in Figures 2 and 4 Appendix B.
5. Perform dose assessment using RESRAD and RESRAD-OFFSITE computer models.

TABLE 3-1
SAMPLE COLLECTION AND ANALYSIS REQUIREMENTS

Sample Point ID	Location Influence (Note 2)	Media Collected	Aliquot Frequency	Number of Aliquots	Screen In Field	Lab Analyses (Note 3)
SP-A	LF – Down	Soil & GW	See Note 1	8 Soil / 1 GW	Yes	3 Soil / **1S /** 1 GW
SP-B	LF – Side	Soil & GW	See Note 1	8 Soil / 1 GW	Yes	3 Soil / 1 GW
SP-C	LF – Side	Soil & GW	See Note 1	8 Soil / 1 GW	Yes	3 Soil / 1 GW
SP-D	LF – Up	Soil & GW	See Note 1	8 Soil / 1 GW	Yes	3 Soil / **1S /** 1 GW
SP-E	LF – Up	Soil & GW	See Note 1	8 Soil / 1 GW	Yes	3 Soil / 1 GW
SP-F	Lateral BG	Soil	See Note 1	8	Yes	3 Soil
SP-G	BG	Soil	See Note 1	8	Yes	3 Soil
SP-H	BG	Soil	See Note 1	8	Yes	3 Soil
SP-I	BG	Soil	See Note 1	8	Yes	3 Soil / **1S**
SP-J	LF – Up	Soil	See Note 1	8	Yes	3 Soil
SP-K	LF – Side	Soil	See Note 1	8	Yes	3 Soil
SP-L	LF – Side	Soil	See Note 1	8	Yes	3 Soil
GP-A	BG	Soil & GW	See Note 1	8 Soil / 1 GW	Soil only	3 Soil 1 GW
GP-B	BG	Soil &GW	See Note 1	8 Soil / 1 GW	Soil only	3 Soil 1 GW
GP-C	Lateral BG	Soil & GW	See Note 1	8 Soil / 1 GW	Soil only	3 Soil / **1S /** 1 GW
GP-D	BG / RZ	Soil & GW	See Note 1	8 Soil / 1 GW	Soil only	3 Soil / 1 GW
GP-E	BG	Soil & GW	See Note 1	8 Soil / 1 GW	Soil only	3 Soil / 1 GW
Well E	BG	GW	NA	1	No	1
Well F	BG	GW	NA	2	No	2
Well D	BG	GW	NA	1	No	1
SW	BG	Water	NA	1 if available	No	1
Duplicate Soil	Field Selected	Soil	Field Selected	5	Yes	5
Duplicate GW	Field Selected	GW	NA	2	No	2

Note 1 = Collect soil at 6 inches below ground surface and again on 2-ft centers (i.e. at 2, 4, 6, 8…etc) to a 16-ft maximum or until the water table is encountered.
Note 2 = Sample is located in BG – Background Reference Point; LF – Landfill influence possible; Lateral to LF; Up – hydraulically upgradient; Down – hydraulically downgradient; Side – side gradient; RZ – reverse zone of GW flow.
Note 3 = Up to 3 soil aliquots and 1 groundwater (GW) aliquot will be submitted to lab. The 3 soil samples will be field selected based on lithology, staining, or instruments response unless "**1S**" is indicated including the surface soil aliquot as one of the samples from that point for analysis. Submit one GW sample from Well F and one GW sample from GP-D for VOC analysis through Accutest Labs.

event that deflections occur, the operator will sweep the suspect area again and hold the instrument over any spot exhibiting elevated readings for a period of 1 minute and record the median measurement of analogue instruments or integrated measurement for digital instruments. The record may be entered directly into the Trimble Geo XH GPS/Datalogger at the GPS coordinates, but must be entered in the field notes with a reference notation to correlate to the GPS data. Any location subject to 1-minute readings will also be screened for 1 minute with an ion chamber instrument and the related reading recorded in the field notes. Field personnel will walk and carry the needed equipment by hand or in backpacks with the detector mounted to a wheeled cart or stand. The detector may be placed on a wand to accommodate using the instrument for this survey configuration.

4.2.2 Static Survey Method

The field crew will use the static survey method if the radiation instrumentation can not be connected to a GPS unit, or automated data recording can not be performed for any reason, or if the kinetic survey trail proves inefficient in collecting the necessary data. The static method requires the field crew to stop along each transect line at either 25 or 50-foot intervals and measure gamma radiation for a minimum of 1-minute intervals with both the NaI detector and the ion chamber instruments. Each detector will be held within 3 inches of the ground surface, either by hand or using stands. Concurrently, the GPS unit will determine the latitude and longitude of the location to sub-meter accuracy. The field crew will record the three data points (counts per minute, uR/hr, and geographic coordinates) in the field notes before proceeding to the next point along the transect line. The field crew will proceed to the next transect line as directed above and repeat the procedures until completing a transect area.

4.2.3 Calibration

The meter and detector will be supplied by a rental company that will calibrate the device according to the manufacturer's requirements. A certificate of calibration will be requested with the rental shipment and inspected for completeness and timeliness of calibration. In the event discrepancies are observed in the calibration certificate, the vendor will be contacted for replacement.

4.2.4 Operation

The meter and detector each have daily operational checks that must be performed. The field crew will review the manuals at the start of each work period and perform the operational checks recommended by the manufacturer's manuals. Record the time and outcome of these checks in the field notes. The field crew will repeat the daily check procedure between transect areas. Check sources will be required from the rental company to perform the operational checks.

4.3 SAMPLE POINT SURVEY

Field personnel will use a hand-held GPS device with sub-meter horizontal accuracy to determine soil-sampling point locations. The field crew will hold the GPS device at each location for a sufficient period of time to accurately measure the position from the available constellation of GPS satellites. Native latitude and longitude GPS measurements are acceptable, so long as a conversion exists for plotting on a map based on the K-State University grid system and the Kansas State Plane coordinate system.

In the event that the GPS device can not function as intended (due to canopy density, inclimate weather or distortion from buildings), horizontal locations may be measured as off-sets from quasi-permanent objects, such as fence posts, building corners, curbs, etc. so long as the quasi-permanent feature is shown accurately on the base map being used for this project.