Standard Operating Procedure for Preparation of Samples for Gamma Spectroscopy and Gross Beta Analysis

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1.0 Identification of Test Method

The procedures described in this SOP have been developed by the LDEQ Environmental Radiation Laboratory in accordance with the requirements of the Louisiana Department of Environmental Quality.

2.0 Applicable Matrices

This SOP covers the following matrices: Air (Charcoal Cartridges, Air Particulate Filters); Fish; Milk (Whole Milk, Iodine Resin); NORM samples; Sediment; Vegetation; and Water.

3.0 Detection and Quantitation Limits

Not applicable. Refer to SOP 1259 for Detection Limits for Gross Beta. Refer to SOP 1557 for Detection Limits for Gamma Spectroscopy. Refer to SOP 1310 for Detection Limits for Tritium Analysis by Liquid Scintillation.

4.0 Scope and Application

This SOP describes in detail the procedures used by the LDEQ Environmental Radiation Laboratory to prepare samples for gamma analysis using the Canberra Genie 2000 Gamma Spectroscopy system, and for gross beta analysis

5.0 Summary of Method

Samples are collected and processed to ensure uniform conditions for analysis.

6.0 Definition of Terms

6.1 Air Particulate Filter (APF) – A paper fiber pre-filter used for collection of air particulates, placed in front of the Charcoal Cartridge.

6.2 Charcoal Cartridge (CC) – An air sampling cartridge designed for collection of RadioIodine.

6.3 Duplicate Measurement – A second measurement made on the same (or identical) sample of material to assist in the evaluation of measurement variance.

6.4 ERL – Environmental Radiation Laboratory

6.5 Exposure Rate—the exposure per unit of time, such as milliroentgen per hour (mR/hr) and microroentgen per hour (μR/hr).

6.6 Minimum Detectable Activity (MDA) – The minimum level of activity that can be measured (counted) with a defined level of confidence that the

measurement is not the result of random fluctuations in the background count (i.e. “noise”).

6.6.1 The DEQ Environmental Radiation Laboratory defines the level of confidence for the MDA at 95%. This means that for an observed sample count that appears to indicate that the sample activity is equal to the MDA, there is only a 5% probability that the sample might actually be free of activity.

6.6.2 The MDA is also referred to as the **detection limit** or **lower limit of detection**. The counting rate from a sample at the MDA is called the **determination level.**

6.7 NORM – is an acronym for Naturally Occurring Radioactive Materials. It is associated with oil and gas exploration and refining processes.

6.8 See QA Manual, Appendix B for additional definitions.

7.0 Interferences and Pretreatments

7.1 See Section 11.

8.0 Safety

8.1 Always wear a lab coat, radiation dosimeter badge, and safety glasses, goggles or lab face shield when working in the lab. Dosimeter badges are collected and replaced monthly.

8.2 Use extra care when working with a knife or other sharp instrument. For safety reasons, avoid working alone with a sharp knife in the lab.

8.3 Material safety data sheets (MSDS) of all chemicals used in the DEQ Environmental Radiation Laboratory are kept in a yellow binder in Room R-02. Additionally, MSDS are available at a web site maintained by Cornell University. The link is: http://hazard.com/msds/index.php. NOTE: Radioactive materials are not included in the notification requirements of the OSHA Hazard Communication Standard (29CFR1910.1200).

8.4 The following chemicals have the potential to be highly toxic or hazardous:

8.4.1 Sodium Iodide is an irritant. Avoid contact with the skin and eyes. .

8.4.2 Nitric Acid - Use neoprene or nitrile gloves, chemical resistant apron, and safety glasses, goggles or lab face shield when handling nitric acid. Nitric acid is toxic and corrosive. Avoid contact with skin or eyes and avoid breathing fumes. If acid should come in contact with skin, remove all contaminated clothing and wash the affected area with soap and water immediately. If acid comes in contact with the eyes, flush with water for 15 minutes. In either case seek medical attention.

9.0 Equipment and Supplies

9.1 Air:

Charcoal Cartridges	Air Particulate Filters
Ziplock Bags	Glassine Envelopes
Tweezers	Markers
RADeCO Model No. HD-28A Air Samplers	Labels

9.2 Fish:

Ohaus TP4KS balance	Cutting board
Sharp knife	Electric knife (Optional)
1 liter Marinelli Beaker	Poly Jar

9.3 Milk

9.3.1 Whole Milk:

Scissors	4-Liter Marinelli Beaker
4-Liter Beaker	2-Liter Graduated Cylinder
	Stirrer/Magnet

9.3.2 Iodine Resin:

Ohaus TP4KS balance	Dremel Drill w/ small drill bit
Wood	Latex Gloves
2-ml Pipet	250-mL Tripour Beaker
4-Liter Beaker	50-ml Tripour Beaker
Poly Jar	Ziplock Bag
Scissors	Filter Paper
Tweezers	DI Water
Stirrer/Magnet	

9.4 NORM samples:

Ohaus TP4KS balance	Zip-Lock Bags
Wypall wipes	Stainless steel trays
White absorbent paper	

9.5 Sediment:

Stainless steel trays	Aluminum foil
Spatula	Thelco drying oven
Stoneware mortar and pestle	Tyler Sieve Shaker
Ohaus TP4KS balance	0.5-liter Marinelli beaker

9.6 Vegetation:

White absorbent paper	Ohaus TP4KS balance
4-Liter Marinelli beaker	

9.7 Water:

Vacuum Flasks	Filter Holders
Graduated Cylinders	142 mm Filters
Tubing	Qorpak Bottles
2- or 4-Liter Filter Flasks	Tweezers
Yellow grease pencil	4-Liter Marinelli Beakers

10.0 Reagents and Standards

10.1 Milk-Iodine Resin Preparation (Section 14.4)

10.1.1 Dowex 1-X8 Ion Exchange Resin: Supplied by BIO-RAD Laboratories of Hercules, CA.

10.1.2 NaI Carrier Solution (10mg/ml I):

10.1.2.1 Prepared by dissolving 2.95 gram of reagent grade NaI in reagent water and diluting to mark in a 250 mL volumetric flask.

10.1.2.2 Expiration Date is five (5) years from the date of preparation.

10.2 Water Sample Preparation (Section 14.8).

10.2.1 Concentrated nitric acid.

11.0 Sample Collection, Preservation, Shipment, Storage, and Sample Rejection Policy

11.1 Except as noted in Section 11.1.1, all radiological samples shall be screened upon arrival at the laboratory in order to ensure that the activity of the sample is within acceptable limits. The screening procedure is described In Appendix C, "Sample Screening Procedure using the Ludlum Model 19 Radiation Survey Meter." Screening of radiological samples shall be documented by noting on the chain-of-custody form the radiation level (in µR/h), identification of the survey meter used, the date of the screening, and the initials of the person performing the screening.

11.1.1 Screening is not required for scheduled samples as listed in Appendix E.

11.1.2 Samples that show a radiation level greater than 1000 µR/hr shall not be accepted. Unacceptable samples shall be returned to sender, or if the sample cannot be returned, shall be held in the hazardous waste storage area until instructions for disposal can be obtained from the Surveillance Division of DEQ.

11.2 Most of the samples received by the ERL are scheduled samples collected from predetermined sample locations. The sample location for scheduled samples are identified by Location Code on the Chain-of-Custody form. Current Location Codes are listed in Appendix E, "Location Codes for Sample Collection."

11.3 **Air Samples** are collected at the River Bend Station (METOW) and Zachary Entergy Facility (ZACRY) on the first working day of every week. Air samples for Waterford-3 and the Grand Gulf Nuclear Station are delivered by mail. The samples consist of a charcoal cartridge (CC) and an air particulate filter (APF) for each monitoring station. The procedure for collecting air samples is as follows:

11.3.1 Before going out to the sampler, be sure that you have a pre-prepared air filter head assembly for each monitoring station to replace the filter head assemblies that you will be picking up. The assemblies are prepared as described in Section 11.1.10 below.

11.3.2 Label ziplock bags for the CC's and glassine envelopes for the APF's with the beginning and ending dates and location for each sample.

11.3.3 Once at the air sampler site, open front door of RADeCO air sampler weather house.

11.3.4 On the air sampler data log sheet, record the location, date and time at which air filter head was changed, the total elapsed time from the air sampler timer, and the air flow rate at the end of the sampling period.

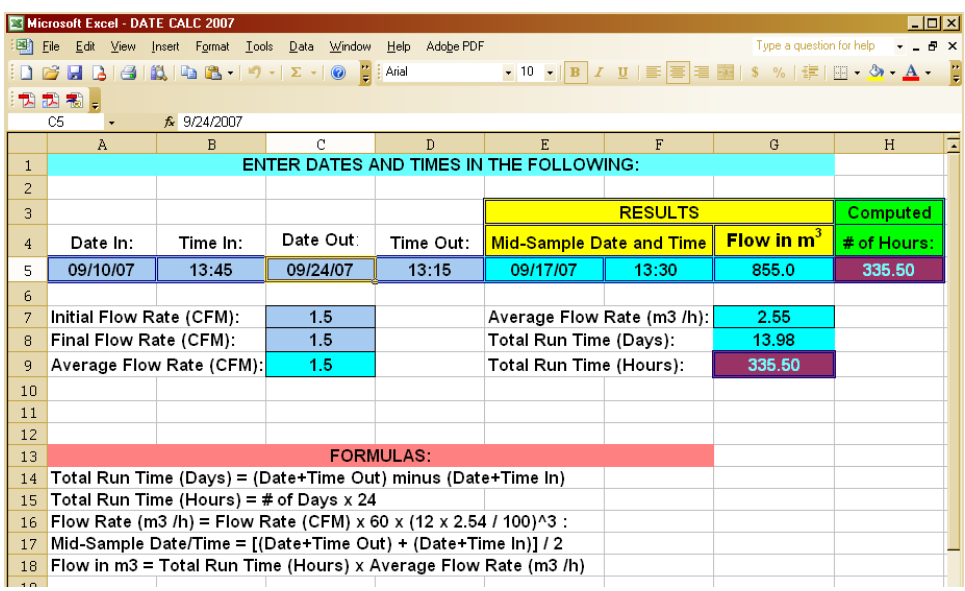
11.3.5 Remove the quick-disconnect air sampler filter head (this unit works in the same manner as an air hose quick disconnect by pulling back on the spring-loaded connector).

11.3.6 Replace the filter head with the previously prepared filter head in the tool kit.

11.3.7 Using a new air sampler data log sheet, record the location, date/time and then reset the air sampler timer.

11.3.8 Record the beginning air flow rate after changing air filter head. The RADeCO Model No. HD-28A air sampler is designed to maintain a constant flow rate, and is calibrated to run at 1.5 CFM (Cubic Feet per Minute). If the flow rate indicator is not at 1.5 CFM, adjust the flow rate to 1.5 CFM and make a note in the comment section on the air sampler data log sheet. If the unit can not maintain a constant flow rate, it must be recalibrated.

11.3.9 After returning to the lab, calculate the midpoint of the sampling period and the air flow in cubic meters, using the Spreadsheet **Date Calc 2008.xls.** This spreadsheet is protected so that entries can only be made in the appropriate fields. Enter the Date In, Time In, Date Out and Time Out in the fields as labeled. Times will be displayed in the military time format. The flow rate should remain at 1.5 CFM, but if it was observed that the final flow rate had changed, enter the final flow rate as observed. (See Figure 1).



Microsoft Excel - DATE CALC 2007

	A	B	C	D	E	F	G	H
1	ENTER DATES AND TIMES IN THE FOLLOWING:							
2								
3					RESULTS			Computed
4	Date In:	Time In:	Date Out:	Time Out:	Mid-Sample Date and Time		Flow in m^3	# of Hours:
5	09/10/07	13:45	09/24/07	13:15	09/17/07	13:30	855.0	335.50
6								
7	Initial Flow Rate (CFM):		1.5		Average Flow Rate (m3 /h):		2.55	
8	Final Flow Rate (CFM):		1.5		Total Run Time (Days):		13.98	
9	Average Flow Rate (CFM):		1.5		Total Run Time (Hours):		335.50	
10								
11								
12								
13	FORMULAS:							
14	Total Run Time (Days) = (Date+Time Out) minus (Date+Time In)							
15	Total Run Time (Hours) = # of Days x 24							
16	Flow Rate (m3 /h) = Flow Rate (CFM) x 60 x (12 x 2.54 / 100)^3 :							
17	Mid-Sample Date/Time = [(Date+Time Out) + (Date+Time In)] / 2							
18	Flow in m3 = Total Run Time (Hours) x Average Flow Rate (m3 /h)							

Figure 1

11.3.10 Record the Mid-Sample date and time on the air sampler data log sheets.

11.3.11 Record the same information on the charcoal cartridge zip-lock bag labels.

11.3.12 Using a Sharpie (permanent marker) pen, record the air flow in cubic meters on the APF glassine envelopes.

NOTE: Be careful not to write on top of the APF, since this may loosen some of the particulate matter and could result in loss of undetermined amount of the sample.

11.3.13 File the air sampler data sheet in the appropriate binder.

11.3.14 As you remove the used cartridges and filters, you will exchange them with new cartridges and filters in the air filter head assembly.

11.3.14.1 Unscrew the charcoal cartridge portion of the filter assembly and place the charcoal cartridge into a labeled zip-lock bag, with the arrow pointing towards the label.

11.3.14.2 Carefully unscrew the front face of the air filter head.

11.3.14.3 Using tweezers, grasp the air particulate paper by the edge. Touch only the white part of the filter at the edge – do not allow the tweezers to touch the gray particulate layer. Carefully remove the air particulate paper filter and place into the pre-labeled glassine envelope for that air sampler location.

11.3.14.4 Using tweezers, place a new, clean air particulate paper filter, with the rough surface side facing out, into the air sampler filter head and screw the front face back onto the assembly.

11.3.14.5 Place a new charcoal cartridge into the air filter head assembly being certain the **ARROW POINTS TOWARD THE SMALL END CONNECTOR** (air intake end) of the filter assembly.

NOTE: The arrow is located on the side of the charcoal cartridge and **MUST** point in the direction of the air flow.

11.3.14.6 Screw the charcoal cartridge portion of the air filter head assembly back together.

11.3.14.7 Place prepared assembly in the tool kit for future use.

11.4 **Fish samples** are collected annually from the Waterford-3 and River Bend Station locations. Some fish will come in frozen fillet form. In this case, fish must be stored in the freezer until ready for analysis. Other times fish will come in dried flake form. In this case, keep the sample in the refrigerator until ready for analysis. For fish samples supplied as dry flakes, the wet/dry weight ratio must be included on the chain of custody. If the wet/dry ratio cannot be obtained, the result will be recorded based on the dry weight, and noted as such in the LIMS.

11.5 **Milk samples** are collected quarterly from Zeringué Dairy (Indicator location) near Waterford-3 and from Ernst & Sons Dairy at 18636 Sisters Road in Ponchatoula, Louisiana (Control location). Samples are collected in 4L collapsible plastic containers. Four 4-liter samples are collected at each sampling location, two for Waterford-3 and two for the LDEQ Environmental Radiation Laboratory. Milk samples are transported to the laboratory inside an ice chest with ice or ice packs to prevent spoilage. Store the milk samples in the refrigerator until they are ready to be prepared for counting. There are no dairies or milk cows in the vicinity of River Bend Station or on the Louisiana side of the Mississippi River near the Grand Gulf Nuclear Station.

11.6 **NORM samples** are collected by DEQ inspectors during the course of inspections in which NORM may be a potential problem. Samples are collected in 120-mL Poly-Jars which are delivered inside individual plastic zip-lock bags.

11.7 **Sediment samples** are collected annually from Waterford-3 and River Bend Station.

11.8 **Vegetation samples** are collected quarterly at River Bend Station and Waterford-3. Vegetation samples are collected and delivered in large plastic bags. No vegetation samples are collected from Grand Gulf Nuclear Station. Vegetation samples are kept in the freezer until the samples can be analyzed.

11.9 **Water samples** are collected monthly from sites near the River Bend, Grand Gulf, and Waterford-3 nuclear power plants. Waterford-3 personnel provide monthly samples from three drinking water stations and one surface water location near Waterford-3. River Bend personnel provides quarterly surface water samples collected from upstream and downstream of the River Bend Station. Four liters of water are collected at each sampling point. Samples are collected in 4L collapsible plastic containers, which are labeled with the collection date and time, and site information. River Bend also provides quarterly 1-L ground water samples collected from monitoring well sites. Grand Gulf water samples are collected by DEQ personnel by the following procedure: A waterproof permanent marker is used to label two 4-L collapsible plastic containers with the designated sample points (GUPSTR and GDNSTR). Water is collected at the designated sampling points by dipping a large beaker or pitcher into the river. The water is poured into a collapsible 4-Liter plastic container, using a funnel to prevent spillage, until the container is full. The collection date and time is noted, and is written on the sample container with a waterproof permanent marker. Information on the samples collected is then entered on the appropriate chain-of custody form. Water samples are stored in the refrigerator until ready for analysis.

11.10 Samples received by the Environmental Quality Laboratory must be entered into LIMS. Information to be included is: Sample Location,

Sample Number, Sample Date, Sample Time, Sample Collector, Arrival Date, and Arrival Time. After samples have been properly logged in, they must be stored in the designated location. See Appendix A2.

11.11 Criteria for sample receipt and storage are listed in the table below. (See Table 1). Samples collected in the wrong container (i.e., NORM samples) or inadequate sample size (less than half the normal volume) are causes for sample rejection. A wide variance in sample geometry will not produce scientifically defensible results.

Table 1

Sample Type	Container	Minimum Sample Quantity	Storage Conditions	Hold Time
Charcoal Cartridge:	Zip-Lock bag	One Cartridge per site	Store at room temperature	8 days
Air Particulate Filter	Glassine Envelope	One filter per site	Store at room temperature	28 days
Water	Cubitainer	0.5 L	Refrigerate at 0.5-6.0°C (32.9-42.8°F)	28 days
Milk	Cubitainer	0.5 L	Refrigerate at 0.5-6.0°C (32.9-42.8°F)	28 days
Vegetation	plastic bag	> 400 g	Store in Freezer; temperature not critical	28 days
Fish	Foil or plastic wrap	> 400 g	Store in Freezer; temperature not critical	28 days
Sediment	None specified	> 400 g	Store at room temperature	28 days
NORM	120-mL jar in plastic bag	> 50g	Store at room temperature	6 months

12.0 Quality Control

12.1 Ohaus TP4KS balance: a calibration check shall be performed prior to use on every day that the balance is used. The calibration check shall be performed using certified weights that bracket the intended range of use, and shall be recorded in the balance log (Logbook RAD-012). The calibration check shall be considered acceptable if the weight measurements fall within ±0.1% of the certified value. If the calibration check fails, the balance shall be recalibrated, using to the procedure described in Appendix B. If this procedure does not correct the problem, the balance shall be serviced by a qualified technician.

12.2 Refer to SOP 1259 for Quality Control requirements for Gross Beta. Refer to SOP 1557 for Quality Control requirements for Gamma Spectroscopy.

Refer to SOP 1310 for Quality Control requirements for Tritium Analysis by Liquid Scintillation.

13.0 Calibration

13.1 The RADeCO Model No. HD-28A air samplers are calibrated annually by manufacturer and labeled with the date of calibration and the expiration date. Samplers are rotated in service to ensure that the calibration is current for all air samplers in the field.

13.2 The Ohaus TP4KS balance shall be calibrated and serviced annually by a qualified technician. Daily calibration checks shall be performed on each day that the balance is used.

14.0 Procedure

14.1 **Air**

14.1.1 Charcoal cartridges shall be analyzed as soon as practicable after they arrive at the laboratory.

14.1.2 Air Particulate Filters (APF) must be analyzed for Gross Beta before quarterly Gamma analysis is performed. APF must be set aside for at least 4 days or more after collection to allow for decay of Radon daughters before Gross Beta is performed. Attach all the APF glassine envelopes from one week together, again being sure the binder clamp is not touching the APF's, and store them in the designated place until they can be tested for Gross Beta activity. Refer to SOP #1259.

14.1.3 Gamma analysis of air particulate filters is done quarterly. The air particulate filters are composited by site and location. At the beginning of every quarter, a pre-labeled plastic ziplock bag is prepared for each of the six air sample locations. After Gross Beta analysis has been completed, transfer each APF to the designated ziplock bag and save for quarterly gamma analysis. At the end of a calendar quarter, the composite APF samples are analyzed by Gamma Spectroscopy. Refer to the procedure for Gamma Spectroscopy Spectrum Analysis (SOP #1557).

14.1.4 A record shall be kept of the individual Air Particulate Filters used in each quarterly composite. Enter the LIMS Sample ID and Sample Volume for each APF in the appropriate place on the Air Particulate Filter Quarterly Composite spreadsheet, which is shown in Appendix F of this SOP. The initial date and time for each composite is the start time for the first sample filter in the composite. The final date and time for each composite is the collection time for the last sample included in the composite. The spreadsheet automatically calculates the mid-point date and time,

and the total sample volume. Formulas are locked down in the spreadsheet to prevent unauthorized entry.

14.1.5 At the end of the quarter, when all of the composites for a quarter have been collected and entered in the spreadsheet, log the composite samples into the LIMS, with the Analysis Code $GAIRP. Enter the LIMS Sample ID for the composites in the space provided on the spreadsheet. Print a copy of the completed spreadsheet page, initial and date it, and place the copy in the designated binder for APF composites.

14.2 **Fish**

14.2.1 Frozen fish preparation

14.2.1.1 Wear laboratory apron and latex gloves.

14.2.1.2 Cover the bench top with absorbent paper.

14.2.1.3 Remove fish sample from freezer.

14.2.1.4 Let the fish sample warm up three to four hours. It is usually easier to cut the fish when they are still slightly frozen.

14.2.1.5 Choose either one Liter or one-half Liter Marinelli beaker, depending on the amount of fish sample.

14.2.1.6 Make a label, with the LIMS number for the sample. Tape the label to the lid of the Marinelli beaker.

14.2.1.7 Perform a calibration check on the Ohaus TP4KS balance.

14.2.1.8 Tare the labeled Marinelli beaker and lid.

14.2.1.9 Cut the fish into small pieces using a cutting board and a sharp knife. An electric knife may be used.

14.2.1.10 Fish samples typically have been filleted. If the samples have not been filleted, cut pieces only from the edible portions of the whole fish.

14.2.1.11 Place the cut up fish into the Marinelli beaker so that it is moderately well packed with no obvious void spaces.

14.2.1.12 After filling the Marinelli beaker, cover the lid, measure the weight and record the weight.

14.2.1.13 Place any unused fish in a plastic bag and dispose of in accordance with Section 21.0 of this SOP.

14.2.2 Dried flakes of fish (as provided to laboratory)

14.2.2.1 Cover the bench top with white absorbent paper.

14.2.2.2 Get the fish sample out of the refrigerator.

14.2.2.3 Choose either a 65 ml Poly Jar or a 0.5 Liter Marinelli beaker depending on the size of sample.

14.2.2.4 Make a label, with the LIMS number for the sample. Tape the label to the lid of the Poly Jar or Marinelli beaker.

14.2.2.5 Perform a calibration check on the Ohaus TP4KS balance.

14.2.2.6 Tare the labeled Marinelli beaker or Poly Jar and lid.

14.2.2.7 Place sample into either Marinelli beaker or Poly Jar up to the colored line.

14.2.2.8 Place the Marinelli beaker or Poly Jar containing fish sample with lid on the balance. Record the weight and convert into wet weight. Wet weight can be obtained by the formula below.

$$Wet\,SampleWeight(kg) = Ratio\left(\frac{wet}{dry}\right) \times Dry\,SampleWeight(kg)$$

Where $Ratio\left(\frac{wet}{dry}\right)$ is given with the sample.

14.2.3 Analyze the sample immediately after preparation. The analysis procedure is described in the SOP for Sample Analysis Using the Canberra Genie 2000 Gamma Spectroscopy System (SOP #1557).

14.3 **Milk – Whole Milk**

14.3.1 Milk samples must be kept refrigerated until ready to be analyzed. Preparation of milk samples must be done immediately before analysis to minimize the potential for spoilage...

14.3.2 Make a label with the LIMS number for the sample. Tape the label to the lid of a 4-Liter Marinelli beaker.

14.3.3 Using a graduated cylinder, measure and pour 4 liters of fresh, whole milk into a 4-L Marinelli beaker. Record the volume if the amount of milk is less than 4 liters. Put the labeled lid on the Marinelli beaker and move it to the counting room.

14.3.4 Dispose of any leftover milk in accordance with Section 21.0 of this SOP.

14.3.5 Analyze the sample immediately after preparation. The analysis procedure is described in the SOP for Sample Analysis Using the Canberra Genie 2000 Gamma Spectroscopy System (SOP #1557).

14.4 **Milk – Iodine Resin**

14.4.1 Make a label with the LIMS number for the sample. Tape the label to a 4-L plastic beaker equipped with a handle and pouring spout.

14.4.2 Using a graduated cylinder, measure and pour 4 liters of fresh, whole milk into the beaker. Drain any leftover milk into a sink with running water. Record the volume if milk is less than 4 liters.

14.4.3 Dispose of any leftover milk in accordance with Section 21.0 of this SOP.

14.4.4 Add a stirring magnet and stir the sample on a magnetic stirrer on medium setting. Do not use heat.

14.4.5 Shake the NaI carrier solution (in a marked volumetric flask on the lab benchtop) before using it.

14.4.6 Using the a Class A 2-mL pipette or a calibrated autopipette, add 2 mL of NaI carrier solution to the milk; continue to stir.

14.4.7 Prepare a poly-jar using the Dremel drill to cut holes in the bottom using a block of wood and then insert a 47-mm diameter 0.45 µm filter paper to fit inside the bottom.

14.4.8 Perform a calibration check on the Ohaus TP4KS balance.

14.4.9 Weigh out 45.0±1.0 grams ion-exchange resin (DOWEX 1-X8, 20-50 mesh, Chloride form) onto a tared weighing paper or dish.

14.4.10 Transfer the measured ion-exchange resin to the beaker of milk; continue to stir on a medium/high setting for a minimum of 2 hours.

14.4.11 When time is completed, stop stirring and let the resin settle to the bottom of the beaker.

14.4.12 Place a large magnet on the outside bottom of the four Liter beaker to attach to the magnet inside the beaker. Rinse the inside stirring magnet with DI water to remove any resin. Carefully remove the stirring magnet from inside the beaker and set aside for washing.

14.4.13 Slowly and carefully drain the milk into the double black lab sink in R01, taking care not to lose any of the ion-exchange resin.

14.4.14 Rinse the ion-exchange resin with DI water (deionized water) 3-4 times, or until the decanted water is clear.

14.4.15 Using an indelible marker, write the LIMS number for the sample on the poly-jar.

14.4.16 Place the prepared poly-jar on a waste water collector. This is a set of tripour disposable beakers; a 50-mL tripour inside of a 250-mL tripour, held upright using a lead donut.

14.4.17 Transfer the resin from the 4-Liter beaker into the prepared labeled poly-jar container, using a DI water wash bottle, as needed, to aid in the transfer.

14.4.18 After the transfer is complete, remove the excess water by vacuum suction. This can be accomplished by placing the poly-jar on the lower part of a two-part suction funnel fitted to a vacuum flask.

14.4.18.1 If a suction funnel is not available, the sample can be dried by leaving the poly-jar to sit overnight on the waste water collector (See 14.4.16), with the cap resting lightly on top to allow the water to drain. Leave a small air gap so that a vacuum will not develop.

14.4.19 After the excess water has drained, screw on the cap and place poly-jar into a labeled ziplock bag for counting.

14.4.20 Analyze the sample within 48 hours after preparation. The analysis procedure is described in the SOP for Sample Analysis Using the Canberra Genie 2000 Gamma Spectroscopy System (SOP #1557).

14.5 **NORM Samples**

14.5.1 NORM samples are prepared in the field during collection, and are delivered in 120-mL Poly-Jars inside ziplock bags. Once delivered to the laboratory, samples are transferred to a clean labeled ziplock bag, weighed, and then are ready for gamma spectroscopy analysis.

14.5.2 Cover a stainless steel tray with white absorbent paper, and then cover this with two unfolded Wypall wipes.

14.5.3 Label new ziplock bags with sample number and sample date.

14.5.4 Wear latex gloves.

14.5.5 Place NORM samples on covered stainless steel tray inside laboratory fume hood, and remove NORM samples from the sample ziplock bag

NOTE: Working in the fume hood with samples on a covered stainless steel tray will minimize potential laboratory contamination while handling NORM samples.

14.5.6 Place the NORM sample inside the clean labeled ziplock bag.

14.5.7 As each NORM sample is put into a clean ziplock bag, put the sample aside on a clean tray in the hood. **Do not put the clean sample back onto the original sample covered tray.**

14.5.8 Once NORM sample(s) have been transferred into clean, labeled ziplock bags, remove laboratory wipes and discard. Place samples on a clean, white absorbent paper covered stainless steel tray.

14.5.9 Perform a calibration check on the Ohaus TP4KS balance.

14.5.10 Tare a labeled NORM empty sample container and ziplock bag.

14.5.11 Weigh the NORM sample(s). Record the sample weight on the ziplock bag and on the NORM Sample Analysis Worksheet.

14.5.12 Move the tray with NORM samples to counting room.

14.5.13 Place the original NORM sample ziplock bags and wipes in a plastic bag until after analysis. Discard in accordance with Section 21.0, "Waste Management."

14.5.14 Analyze the sample within the hold time specified in Section 11.11, Table 1. The analysis procedure is described in the SOP for Sample Analysis Using the Canberra Genie 2000 Gamma Spectroscopy System (SOP #1557).

14.6 **Sediment**

14.6.1 Wear apron and latex gloves.

14.6.2 Press the ON/OFF switch of the drying oven for power to the ON position, so the oven can heat up to temperature prior to the sample drying.

14.6.3 Make sure the timer knob of the oven is in the Hold position.

14.6.4 Cover working counter top space with white absorbent paper.

14.6.5 Cover a stainless steel tray with heavy duty aluminum foil.

NOTE: Before covering with foil, make sure the tray fits inside the oven since there are different size trays and not all of them will fit inside the oven.

14.6.6 Using a Sharpie pen, label the stainless steel tray with the sample name, writing on the side of the tray on the aluminum foil.

14.6.7 Transfer the sediment from the sample container onto the labeled stainless steel tray. Use a spatula to spread the sample out in an even thin layer.

14.6.8 Discard the sample container.

14.6.9 Wash or clean the spatula between samples thoroughly to avoid cross contamination.

14.6.10 Place the stainless steel tray with sediment in the Thelco Drying Oven. If there are more than two samples to prepare at a time, record which sample goes to the top shelf and which goes on the bottom shelf on the log book.

14.6.11 Record the oven temperature in the log book. If sample is being dried more than one day, everyday that the oven is on, temperature of the oven shall be recorded on the log book.

14.6.12 Dry the sediment sample in the oven, which is set at 100˚ Celsius for at least twelve hours, or until the sample is completely dry.

14.6.13 When sample drying is finished, turn the power to the oven off by pressing the ON/OFF switch to OFF position.

14.6.14 When the sediment sample is dry and cool, remove the stainless steel tray from the oven.

14.6.15 Place the stoneware mortar and pestle next to the tray.

14.6.16 Lift the hammer of the Tyler Sieve Shaker. Take the sieve shaker pan out. Lower the hammer back.

14.6.17 Assemble the sieve shaker bottom pan and the sieve together and set the lid aside. This bottom pan will catch the finely ground sediment.

14.6.18 Scoop a small amount of sediment from the stainless steel tray with a spatula, spoon, or scraper and place it in the large stoneware mortar.

14.6.19 Using mortar and pestle, grind sediment until it is in reasonably small pieces – about pea-sized or smaller. Remove stones, seashells and stems from samples.

14.6.20 Continue grinding until the sediment is fine.

14.6.21 Transfer the finely ground sediment into the assembled sieve shaker. The sieve used is a U.S.A. Standard Testing Sieve, No. 40, Tyler Equivalent 35 mesh.

14.6.22 Repeat grinding until all the sample is ground and put into the assembled sieve shaker.

14.6.23 Place the lid of the sieve shaker. Lift the hammer of Tyler Sieve Shaker. Put sieve shaker assembly including lid into the Tyler Sieve Shaker and put the cork installed sieve cover on top.

14.6.24 Lower the hammer part.

14.6.25 Set the run time about 2 minutes by turning the thumb wheel + (plus) or – (minus) to the desired time in the digital window.

14.6.26 Push the start bar to start shaker. An audible tone will be heard at the end of shaking.

14.6.27 Once shaking is complete, remove the sieve assembly from the shaker.

14.6.28 Carefully remove the catch pan from the bottom of the sieve assembly. After shaking in the shaker the catch pan and sieve are held tightly together. Put a spatula in between edge of the catch pan and the sieve and twist the spatula. This will loosen the assembly.

14.6.29 Place the lid under the sieve part to catch any debris that might fall.

NOTE: The sediment in the catch pan will be very fine; handle gently to avoid airborne dust particulates in the laboratory.

14.6.30 Select one of the 0.5-L Marinelli beakers with a blue line. The blue line has been marked at a volume of 435 cm^3, which indicates the amount of sample to add. Make a label with the LIMS number for the sample. Tape the label to the lid of the Marinelli beaker.

14.6.31 Perform a calibration check on the Ohaus TP4KS balance.

14.6.32 Tare the beaker making sure the tare weight includes the weight of both the beaker and its lid with the label attached.

14.6.33 Scoop out the dried sediment and place it into the tared 0.5-liter Marinelli beaker up to the marked line. Place the leftover sediment, stones and debris in a plastic bag for disposal.

14.6.34 After filling the 0.5-liter Marinelli beaker, weigh the sediment and record its weight.

14.6.35 Carefully clean and dry the sieve assembly, stainless steel tray, spatula, mortar and pestle.

14.6.36 Analyze the sample within the hold time specified in Section 11.11, Table 1. The analysis procedure is described in the SOP for Sample Analysis Using the Canberra Genie 2000 Gamma Spectroscopy System (SOP #1557).

14.7 **Vegetation**

14.7.1 Remove vegetation sample from the freezer.

14.7.2 Cover the counter top surface with the absorbent paper.

14.7.3 Wear latex gloves and plastic apron.

14.7.4 Make a label with the LIMS number for the sample. Tape the label to the lid of a 4-L Marinelli beaker.

14.7.5 Perform a calibration check on the Ohaus TP4KS balance.

14.7.6 Tare the Marinelli beaker with the label attached lid by pressing **ON/TARE** button. Remove the beaker from the balance.

14.7.7 Tear the vegetation sample into small pieces. A knife and a cutting board can be used if needed.

14.7.8 Discard any big stems or dead leaves.

14.7.9 Place the cut up vegetation sample into the beaker so that it is moderately well packed with no obvious void spaces.

14.7.10 After filling the four Liter Marinelli beaker, place it back on the balance and record the net weight of the vegetation. The weight will be approximately 500 g. Discard any remaining sample in a plastic bag.

14.7.11 Analyze the sample within the hold time specified in Section 11.11, Table 1. The analysis procedure is described in the SOP for Sample Analysis Using the Canberra Genie 2000 Gamma Spectroscopy System (SOP #1557).

14.8 **Water**

14.8.1 Setup Filter Holders

14.8.1.1 Filter holders are custom made for DEQ by Geotech Environmental Equipment, Inc. Refer to Picture 1 in Section 23.1.

14.8.1.2 Place the dispersement disc into the filter holder plate.

14.8.1.3 Insert the O-ring into the groove on the filter holder plate.

14.8.1.4 Put one 0.45 micron, 142 mm diameter membrane filter on top of disc and O-ring.

14.8.1.5 Place the barrel onto the filter holder plate and tighten with 3 swing-a-way bolts. Note: The six “L” shaped retaining pins are not needed, as the bolts will stay in place without them once they have been tightened.

14.8.1.6 Screw the three legs into the filter holder plate.

14.8.1.7 Place the assembled filter holder over the 2-liter filtering flask. Since the legs are shorter than the flasks, use foam blocks to make the holder the same height as the flasks.

14.8.2 Check Vacuuming System

14.8.2.1 Check all the tubing on the vacuum system for any cracks or loose connections. Make sure that there are enough supplies before beginning the procedure.

14.8.2.2 The Drierite® in the vacuum flasks connected to the vacuum line must be blue-colored (dry). If not, carefully remove the stopper from flask and disconnect the tubing from the flask. Place the entire flask with the Drierite® crystals in the drying oven and heat at approximately 100ºC until the color is a deep blue. After cooling, reconnect the flask to the vacuum system.

14.8.2.3 All tubing must be connected to the filtering flask and the vacuum line. All stopcocks and valve must be in the closed position.

14.8.2.4 Be sure that all tubing between filtering flask and vacuum line has a tight fit to minimize any leakage in the system.

14.8.3 Water Filtration

14.8.3.1 Remove sample from the refrigerator.

14.8.3.2 Shake sample vigorously to ensure a homogenous mixture.

14.8.3.3 Begin by carefully pouring a small amount of water (just enough to cover the filter) into the barrel to check for leaks. Once seals are known to be tight, start pouring water into the barrel about one fourth of the way. Every time the filter is changed, start with a small amount of water first to check for leaks.

14.8.3.4 Turn on the vacuum valve and open all the stopcocks to the filtering flask.

14.8.3.5 Slowly and cautiously, keep pouring water into the barrel until the filtering flask underneath is full, using care not to overfill the flask. Near the top of the filtering flask, water will fill up rapidly since the diameter of the barrel is a lot larger than the diameter of the filtering flask at the top.

14.8.3.6 Because of the varying silt concentrations in the river water, more or less volume of water may be filtered before a change in filter is required. Observation of the time to filter a portion of sample is needed to make this determination.

14.8.3.7 After filling both 2-liter filtering flasks, discard any unfiltered sample.

14.8.3.8 Once the water sample is completely filtered, remove filter from filter holder and discard.

14.8.3.9 Collect subsamples for tritium analysis, as follows:

14.8.3.9.1 For the quarterly River Bend and Grand Gulf samples, fill a 60-mL glass container with filtered water, then cap the jar. Label the jar to identify the quarter, year, collection site, and LIMS Sample ID. Set aside for Tritium Analysis.

14.8.3.9.2 For the monthly samples from Waterford-3, 60-mL quarterly composite samples are made using 20-mL aliquots from three successive months in each quarter of the calendar year. At the beginning of each quarter, take a 60-mL container for each collection site and label the container to identify the quarter, year, and collection site. After each water sample has been filtered, transfer 20 mL of the filtered water into the appropriately labeled glass container for the collection site, using a class A

pipette or autopipette. Set the container aside in the sample drawer. Enter the LIMS sample ID, collection date and time, initials of sample collector, and volume in the “Tritium Sample (composite)” Log Book (RAD-002). As water samples are collected in succeeding months, repeat the procedure. When each 60-mL container contains three 20-mL aliquots from three successive months, the quarterly composites will be complete. Log the quarterly composites into LIMS as new samples (Test Code LSCINT), and enter the LIMS sample number for each composite sample in the Tritium Samples log book. Set the composite samples aside for tritium analysis.

14.8.3.10 Return the remainder of the filtered water sample to its original sample container. Mark the cap or cubitainer using the yellow grease pencil with “F” to denote sample has been filtered.

14.8.3.11 Place the filtered water sample container inside the fume hood.

14.8.3.12 Using a small tripour beaker carefully add 15 mL of concentrated nitric acid to the container of filtered water.

14.8.3.13 Screw cap tightly onto the sample container then shake sample vigorously to assure a homogeneous mixture.

14.8.3.14 Mark the sample cap or cubitainer using the yellow grease pencil with a capital “A” to denote sample has been acidified.

14.8.3.15 Make a label with the LIMS number for the sample. Tape the label to the lid of a 4-L Marinelli beaker.

14.8.3.16 Using a two liter graduated cylinder, measure two liters of filtered water. Pour the measured water sample into a four liter Marinelli beaker. Measure a second two liters of filtered water and pour into the Marinelli beaker. If sample is less than four liters, record actual volume of sample for the analysis on the chain-of custody form. Discard any unused filtered sample.

14.8.3.17 Wash all the filtering equipment and glassware thoroughly and double rinse with DI water then place on the drying rack next to the double stainless steel sink in R01.

14.8.3.18 Replace soiled or wet bench top absorbent paper with a clean piece of absorbent paper.

14.8.3.19 Refer to the procedure for Gamma Spectrum Analysis (SOP #1557).

15.0 Evaluation of Data, Reporting Results and Calculations

15.1 Not Applicable.

16.0 Method Performance

16.1 Not Applicable

17.0 Pollution Prevention

17.1 Cover any surface that may come in contact with samples with white absorbent paper.

17.2 Change the absorbent paper whenever it becomes soiled or wet from the sample preparation.

17.3 Pollution prevention encompasses any technique that reduces or eliminates the quantity or toxicity of waste at the point of generation.

17.4 The quantity of chemicals purchased should be based on expected usage during its shelf life and disposal cost of unused material. Actual reagent preparation volumes should reflect anticipated usage and reagent stability.

18.0 Data Assessment and Acceptance Criteria

18.1 Refer to the SOP for Sample Analysis Using the Canberra Genie 2000 Gamma Spectroscopy System (SOP #1557).

19.0 Corrective Action for Out of Control Data

19.1 A corrective action form must be generated if any of the following occur:

19.1.1 If the preparation is performed using the incorrect parameters for the requested sample.

20.0 Contingencies for Handling Unacceptable Data

20.1 Not Applicable.

21.0 Waste Management

21.1 Samples with an exposure rate less than or equal to 200 µR/h, or that upon analysis are shown to have activity equivalent to background or control samples can be disposed of in the same manner as ordinary waste. After a sample has been analyzed, if it is determined that the total sample activity is lower than 200 pCi, the sample+ can be handled and disposed of as non-radioactive material.

21.1.1 Solid samples and leftovers are put into a trash can that has been lined with a plastic bag. If necessary, put the sample in a plastic bag and then secure the bag before discarding.

21.1.2 Liquid samples must be drained into the double black sink in R01 with plenty of running water.

21.2 Samples that are determined to have radioactive levels unsuitable for regular disposal will be disposed in a safe way and by an NRC approved method.

22.0 Data and Records Management

22.1 Procedures for data and records management must adhere to the Quality Manual and subordinate documents covering record keeping and the document control plan. Records documenting all laboratory activities shall be retained permanently. All records shall be stored in such a way as to be secure and accessible.

22.2 Electronic records are kept stored on the computer hard drive and are backed up on compact disks.

22.3 Chain of Custody and other paper documents shall be kept in the designated binders.

22.4 Older documents shall be moved to storage folders, and kept in document storage boxes by year. Boxed documents shall be placed in the data storage room.

23.0 Tables, Diagrams, Flowcharts, and Validation Data

23.1 Picture 1: Water Filtering System

24.0 References

24.1 Department of Health, Education and Welfare, Public Health Service: Radioassay Procedures for Environmental Samples. National Center for Radiological Health (1967) Sec. 1, pp. 36-115.

24.2 Atomic Energy Commission: Regulatory Guide 4.3 (September, 1973).

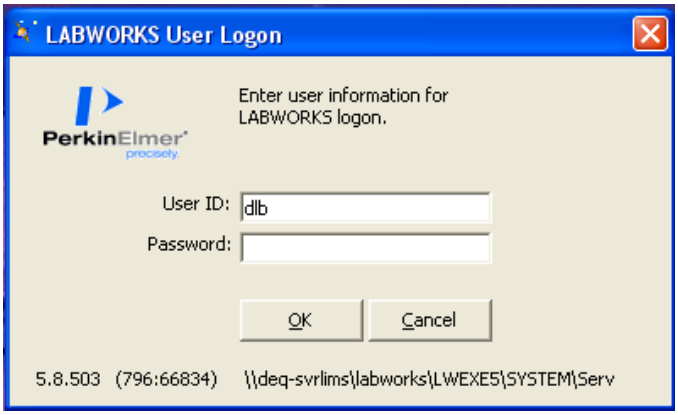
24.3 Environmental Measurements Laboratory (EML): EML Procedures Manual (26th Ed., 1983). EML, 376 Hudson Street, New York, N.Y. 10014 (Formerly the Health and Safety Laboratory – HASL).

24.4 National Environmental Research Center, Environmental Protection Agency (EPA): Handbook of Radiochemical Analytical Methods. Program Element 1 HA 325. Office of Research and Development, Las Vegas, Nevada 89114 (February, 1975).

Appendix A. Logging Samples into LIMS and Entering Data.

A1.0 Logging on to the System

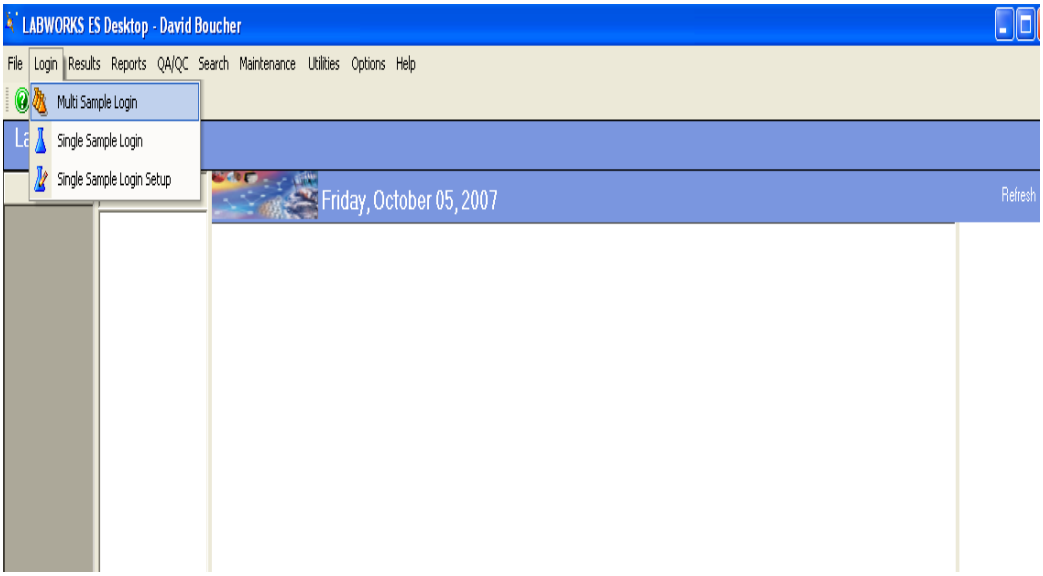
A1.1 Click on the **Labworks** icon on the desktop, enter your username and password in the designated fields, and click the "OK" button.



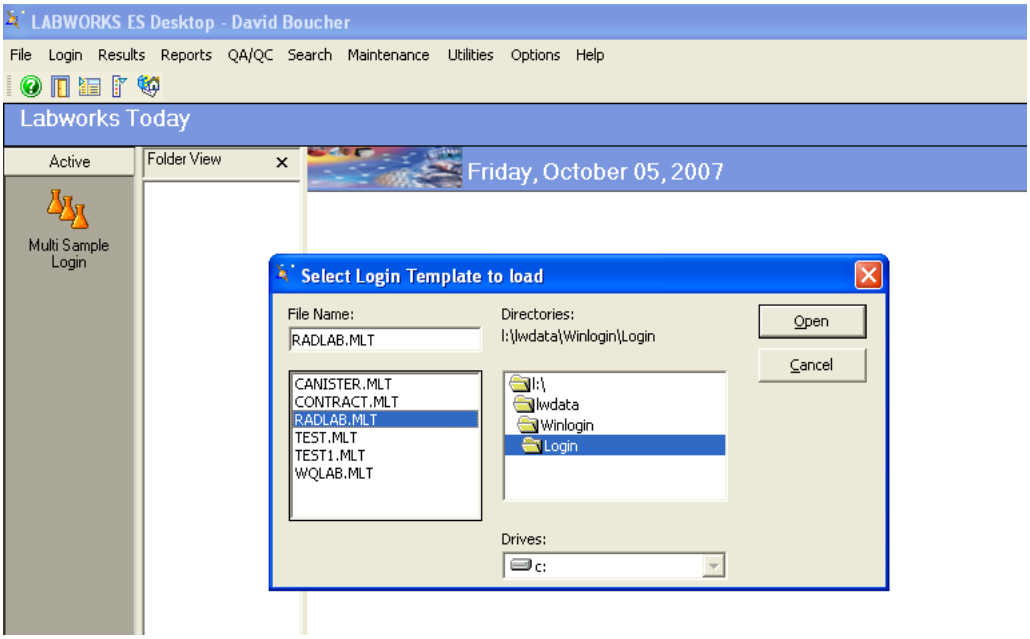
A1.2 Enter user name and password.

A2.0 Sample Login

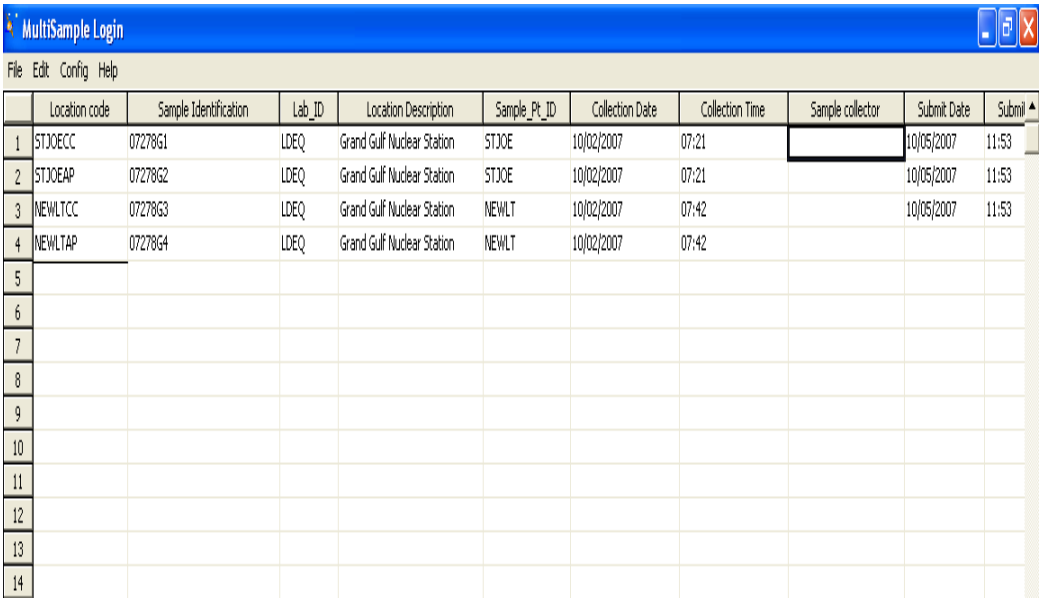
A2.1 Select "Multi Sample Login" on the Login pull-down menu.



A2.2 On the “Select Login Template” pop-up menu, select “RADLAB.MLT”, and click “Open”. The login spreadsheet will appear.



A2.3 In the first column, fill in the location code for each sample. Location codes are printed on the chain of custody form.



	Location code	Sample Identification	Lab_ID	Location Description	Sample_Pt_ID	Collection Date	Collection Time	Sample collector	Submit Date	Submit
1	STJOECC	07278G1	LDEQ	Grand Gulf Nuclear Station	STJOE	10/02/2007	07:21		10/05/2007	11:53
2	STJOEAP	07278G2	LDEQ	Grand Gulf Nuclear Station	STJOE	10/02/2007	07:21		10/05/2007	11:53
3	NEWLTCC	07278G3	LDEQ	Grand Gulf Nuclear Station	NEWLT	10/02/2007	07:42		10/05/2007	11:53
4	NEWLTAP	07278G4	LDEQ	Grand Gulf Nuclear Station	NEWLT	10/02/2007	07:42			
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										

A2.4 When you enter the location codes, some of the data fields will be automatically filled in, but others will be filled in by you. The second column is for the **Sample Identification** code, which is also referred to as the "**DEQ ID**." The format for the Sample Identification code is five numbers, followed by a letter, then another number, as follows:

A2.4.1 The first two digits of the DEQ ID represent the year; for example, a sample identification that begins with "07" indicates that the sample was entered in 2007.

A2.4.2 The next three digits of the DEQ ID are a number between 001 and 366, representing the date as the number of days that have passed since the beginning of the year. For example, January 1 would be represented as "001" because it is the first day of the year. December 31 would be represented as "365", because it is the 365th day. The day number can be found on the desk calendar.

A2.4.3 The next part of the DEQ ID is a letter representing the site. Grand Gulf is designated as "G," River Bend is "R", and Waterford-3 is "W."

A2.4.4 The last part of the DEQ ID is a consecutive number for each sample received from the site on that day.

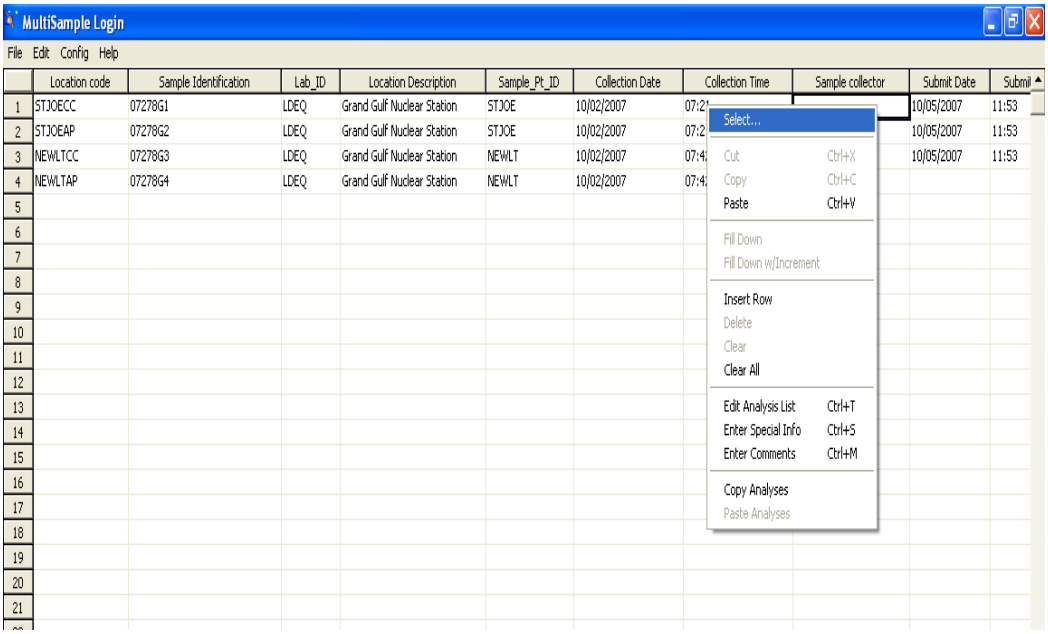
A2.4.5 For example, the third of four samples received from Grand Gulf on October 11, 2007 would have a DEQ ID of **07284G3.**

A2.5 You will also need to fill in the Collection Date and Collection Time, and the Submit Date and Submit Time. The submit date and time are the date and time that the sample was received by the laboratory. Enter times in military time format.

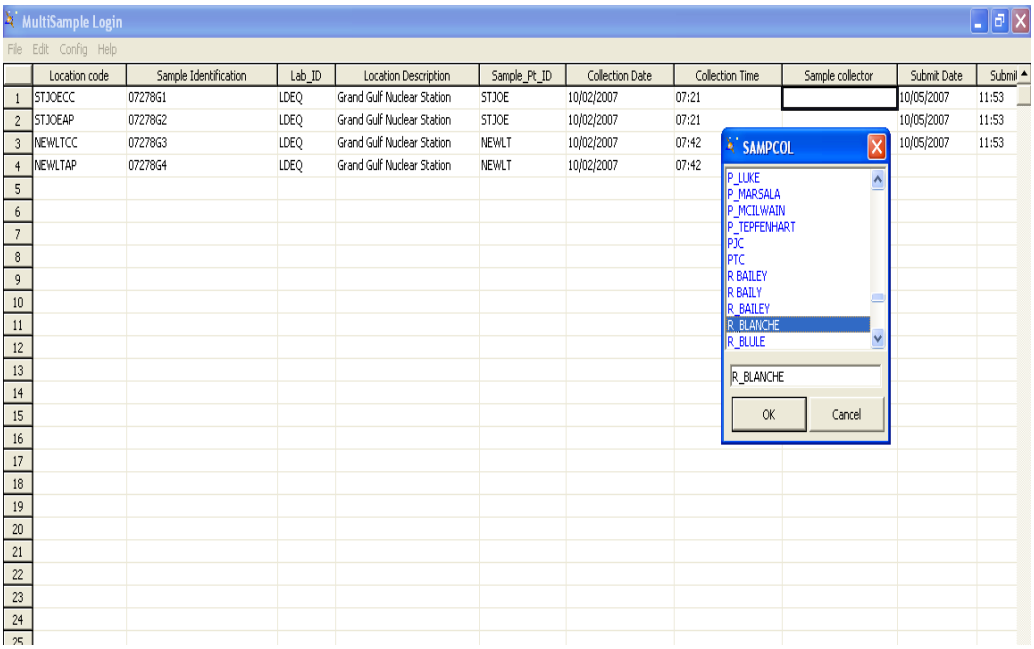
A2.6 The Sample Collector is entered as first initial, underscore, and the last name. For example, John Smith would be entered as **J_SMITH**.

A2.7 If you are not sure how to fill out a specific field, you can select from a list of previous entries by right-clicking in the field. An example is shown below.

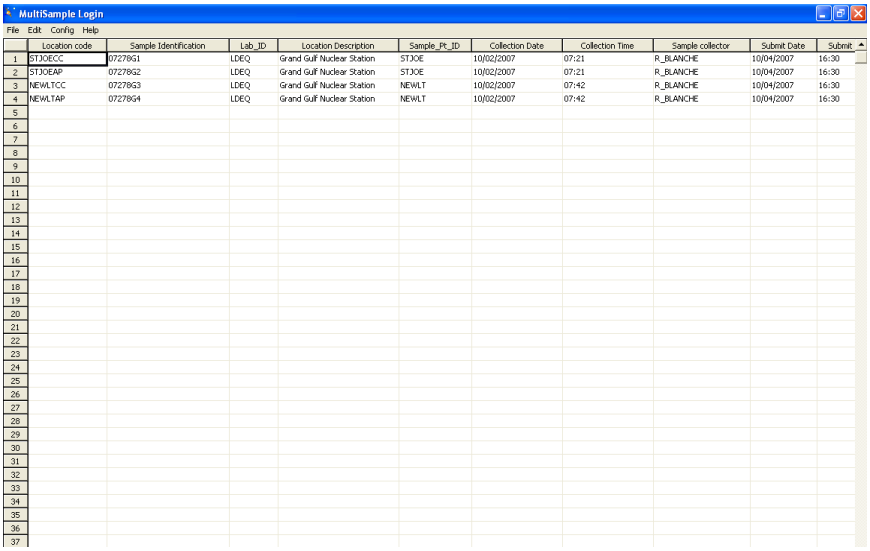
A2.8 For example, to select the name of the sample collector from a list, right click the field under “Sample Collector”, then click on “Select” on the pop-up menu.



A2.9 After you click “Select”, a list appears. Highlight the name you want, and click “OK” to select a name from the list.

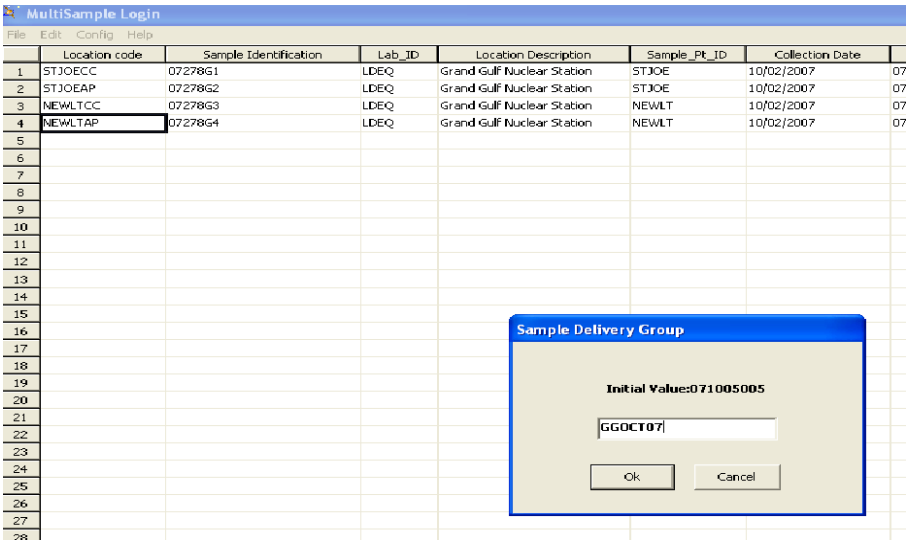


A2.10 After all of the information has been filled in, check to see that everything is correct. Click on a cell in each row and look in the field at the bottom of the screen to confirm that the correct analysis code appears. (A table of Analysis Codes is found in Appendix D of this SOP). If everything is correct, click the "Login" button in the lower right hand corner of the screen.



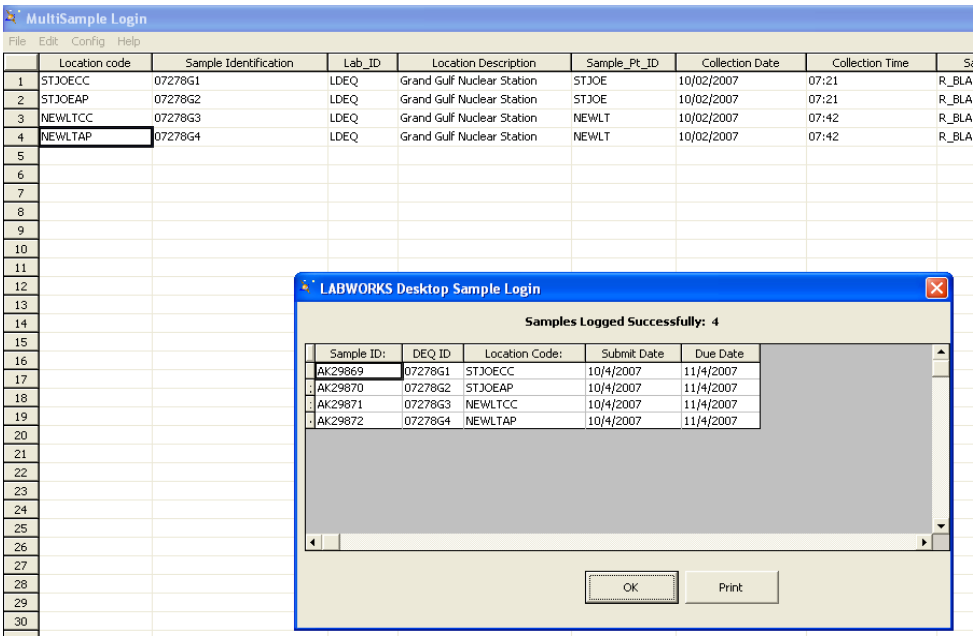
	Location code	Sample Identification	Lab_ID	Location Description	Sample_Pt_ID	Collection Date	Collection Time	Sample collector	Submit Date	Submit
1	STJOECC	07278G1	LDEQ	Grand Gulf Nuclear Station	STJOE	10/02/2007	07:21	R_BLANCHE	10/04/2007	16:30
2	STJOEAP	07278G2	LDEQ	Grand Gulf Nuclear Station	STJOE	10/02/2007	07:21	R_BLANCHE	10/04/2007	16:30
3	NEWLTCC	07278G3	LDEQ	Grand Gulf Nuclear Station	NEWLT	10/02/2007	07:42	R_BLANCHE	10/04/2007	16:30
4	NEWLTAP	07278G4	LDEQ	Grand Gulf Nuclear Station	NEWLT	10/02/2007	07:42	R_BLANCHE	10/04/2007	16:30

A2.11 After you click "Login", you will be prompted to enter the name of a Sample Delivery Group. The Sample Delivery Group is designated by Location, Month and Year. Grand Gulf is designated as "GG", River Bend as "RBS", and Waterford-3 as "W3". For example, a sample from Grand Gulf entered in August of 2006 would be in Sample Delivery Group "**GGAUG06**". A sample from River Bend entered in March of 2007 would be in Sample Group "**RBSMAR07**".



	Location code	Sample Identification	Lab_ID	Location Description	Sample_Pt_ID	Collection Date
1	STJOECC	07278G1	LDEQ	Grand Gulf Nuclear Station	STJOE	10/02/2007
2	STJOEAP	07278G2	LDEQ	Grand Gulf Nuclear Station	STJOE	10/02/2007
3	NEWLTCC	07278G3	LDEQ	Grand Gulf Nuclear Station	NEWLT	10/02/2007
4	NEWLTAP	07278G4	LDEQ	Grand Gulf Nuclear Station	NEWLT	10/02/2007

A2.12 After you have entered the Sample Delivery Group, a table of the samples you logged in will appear on a pop-up window. The first column of the table will list the Sample IDs that LIMS has assigned to each sample. Click "**Print.**" After the window has printed successfully, click "**OK**".



A2.13 Copy the LIMS Sample ID for each sample in the designated field on the chain-of-custody form or the air sampler data log sheet.

A2.14 Copy the LIMS Sample ID for each sample onto the label of the sample container, or write it on the sample container with indelible marker.

A2.15 For Air Particulate Filters, enter the LIMS Sample ID and the Sample Volume for each APF in the appropriate place on the Air Particulate Filter Quarterly Composite spreadsheet. See Section 14.1 for more information.

A3.0 Entering Data into LIMS

A3.1 The procedures for entering sample results into LIMS are different for each type of analysis. Specific descriptions of the procedures for data entry are found in the current SOPs for Gamma Analysis, Gross Beta Analysis, and Tritium Analysis.

Appendix B. Calibration of Ohaus TP4KS balance

B1.0 Calibration of Ohaus TP4KS balance must be performed whenever the daily calibration check does not fall within acceptable limits (±0.1%).

B1.1 Press and hold **ON/TARE** until **CAL** is displayed.

B1.2 When **ON/TARE** is released, **SPAN** will be displayed.

B1.3 Press **MODE** to change the selection to linearity calibration, **Lin** will be displayed.

B1.4 Press **ON/TARE** to accept the display selection.

B1.5 When **ON/TARE** is released "C 0 g" will be displayed indicating that no weight should be on the pan.

B1.6 With no weight on the pan, press **ON/TARE**.

B1.7 The display will show "C" followed by the value of the weight which must be placed on the pan.

NOTE: Use white gloves provided with the weights. DO NOT TOUCH THE WEIGHTS WITH BARE HANDS.

B1.8 Place the 2000 gm (2 Kg) weight on the pan and press **ON/TARE**.

B1.9 The display will show "-C-" momentarily then "C" followed by the next weight to be placed on the pan.

NOTE: Do not disturb the balance when "-C-" is displayed. Disturbances will result in improper calibration.

B1.10 Remove the 2 Kg weight and place the 4000 gm (4 Kg) weight on the pan, then press **ON/TARE**.

B1.11 The display will show "-C-" while the balance recalibrates. When the weight on the pan is displayed (4000.00 gm) along with the current unit indicator, the balance is recalibrated.

NOTE: **DO NOT** REMOVE CALIBRATION WEIGHT UNTIL WEIGHT VALUE IS DISPLAYED AND UNIT INDICATOR APPEARS.

B1.12 Make a dated entry in the Ohaus Precision Balance logbook (RAD-012), noting that the calibration procedure has been performed. Note also any unusual circumstance related to the calibration of the balance.

B1.13 Perform another calibration check. If the certified weights do not measure within ±0.1% of the certified value, have the balance serviced and recalibrated by a qualified technician.

Appendix C. Sample Screening Procedure using the Ludlum Model 19 Radiation Survey Meter

C1. Switch the "AUD ON/OFF" switch to the "ON" position.

C2. Switch the "F/S" switch to the "F" position (fast response).

C3. Turn the Range Selector switch to the "25" position. You should hear a sharp clicking noise, and the meter should read between 1-10 µR/hr. This is caused by background radiation, which is always present.

C4. If the meter does not make a sound or the needle does not move, the battery may need to be replaced. Depress the "BAT" pushbutton switch and ensure that the meter needle falls within the "BAT TEST" marks. If not, replace the battery or use a different meter.

C5. Hold the meter so that the front end of the meter is in close proximity to the sample and read the radiation level of the sample on the red scale of the dial. If the needle goes all the way to the left, select a higher range division and read on the appropriate scale.

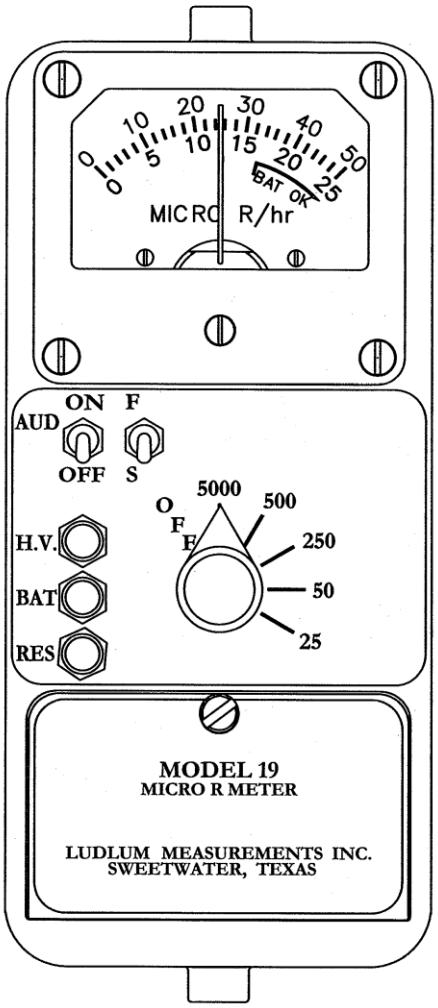
C6. If the sample reading is greater than 1000 µR/hr, do not accept the sample. If the reading is 1000 µR/hr or less, the sample may be accepted.

C7. Write the radiation level and the identification number of the Survey Meter in the Comments section of the Chain of Custody. Initial and date. Place the sample in the appropriate storage area.

C8. Turn the Range Selector Switch to Off.

Five range divisions are provided in the 0-5000 microRoentgen/hr (µR/hr) spectrum. The meter face is made up of two scales, 0-50 and 0-25, plus battery test. The 0-50 scale (black scale) corresponds to the 50, 500 and 5000 positions on the range selector switch. The 0-25 scale (red scale) corresponds to the 25 and 250 positions on the range selector switch.

Range Division	Scale	Reading
25	0-25 (red)	Direct from red scale
50	0-50 (black)	Direct from black scale
250	0-25 (red)	Red scale x 10
500	0-50 (black)	Black scale x 10
5000	0-50 (black)	Black scale x 100



Ludlum Model 19

Radiation Survey Meter

Appendix D. Analysis Codes for Gamma Spectroscopy

Analysis Codes for Gamma Spectroscopy		
Code	**Matrix**	**Target Nuclide(s)**
$GAIRI	**Air cartridge**	**I-131**
$GAIRP	**Air particulate Filter**	**Cs-134; Cs-137**
$GWATER	**Water**	**Mn-54; Co-58; Fe-59; Co-60; Zn-65; Nb-95; Zr-95; I-131; Cs-134; Cs-137; Ba-140; La-140**
$GMILK	**Milk**	**I-131; Cs-134; Cs-137; Ba-140; La-140**
$GIR	**Anion-Selective Resin (Milk)**	**I-131**
$GVEG	**Vegetation**	**I-131; Cs-134; Cs-137**
$GSED	**Sediment**	**Cs-134; Cs-137**
$GFISH	**Fish**	**Mn-54; Co-58; Fe-59; Co-60; Zn-65 Cs-134; Cs-137**
$GNORM	**NORM**	**Ra-226**

Appendix E. Location Codes for Sample Collection

Location Codes for Sample Collection			
Site	**Location Codes**	**Location**	**Type of Sample**
River Bend	METOW	Met. Tower	Air
River Bend	ZACRY	Entergy (Zachary, LA)	Air
Waterford-3	APF01	Met. Tower	Air
Waterford-3	APE30	Entergy (Algiers, LA)	Air
Grand Gulf	STJOE	St. Joseph, La.	Air
Grand Gulf	NEWLT	Newellton, La.	Air
River Bend	RUPSTR	Upstream (Mississippi. River)	Water
River Bend	RDNSTR	Downstream (Mississippi. River)	Water
River Bend	MW-2	Ground Water Well	Water
River Bend	MW-4	Ground Water Well	Water
River Bend	MW-5	Ground Water Well	Water
River Bend	MW-7	Ground Water Well	Water
River Bend	MW-8	Ground Water Well	Water
River Bend	MW-9	Ground Water Well	Water
River Bend	MW-10	Ground Water Well	Water
River Bend	MW-11	Ground Water Well	Water
River Bend	MW-17	Ground Water Well	Water
River Bend	MW-18	Ground Water Well	Water
River Bend	MW-19	Ground Water Well	Water
River Bend	MW-20	Ground Water Well	Water
River Bend	EB-01	Equipment Blank	Water
River Bend	EB-12	Equipment Blank	Water
Waterford-3	DWF02	DOW Water	Water
Waterford-3	DWE05	St. Charles Water Works	Water
Waterford-3	DWP07	St. John Water Works	Water
Waterford-3	SWK01	Surface Water	Water
Grand Gulf	GUPSTR	Upstream (Mississippi. River)	Water
Grand Gulf	GDNSTR	Downstream (Mississippi. River)	Water

Location Codes for Sample Collection			
Site	**Location Codes**	**Location**	**Type of Sample**
Waterford-3	MKE03	Zeringué Dairy	Milk
Waterford-3	MKA31	Ernst & Sons Dairy	Milk
River Bend	GARD1	Garden 1	Vegetation
River Bend	GARD2	Garden 1	Vegetation
Waterford-3	BLQ01	West Bank, 0.8 miles	Vegetation
River Bend	RUPFSH	Upstream (Mississippi. River)	Fish
River Bend	RDNFSH	Downstream (Mississippi. River)	Fish
Waterford-3	FH01	Upstream (Mississippi. River)	Fish
Waterford-3	FH02	Downstream (Mississippi. River)	Fish
River Bend	RUPSED	Upstream (Mississippi. River)	Sediment
River Bend	RDNSED	Downstream (Mississippi. River)	Sediment
Waterford-3	SHWK1	South of Waterford-3	Sediment
Waterford-3	SHWE3	Downstream (Taft, LA)	Sediment
Waterford-3	SHWQ6	Upstream (Reserve, LA)	Sediment

Appendix F. Air Particulate Filter Composite Spreadsheet

Microsoft Excel - Quarterly APF Total Flow Calculation 2008.xls

METOW		ZACRY		APF01		APE30		STJOE		NEWLT	
LIMS ID	Total Flow	LIMS ID	Total Flow	LIMS ID	Total Flow	LIMS ID	Total Flow	LIMS ID	Total Flow	LIMS ID	Total Flow
AL00043	428.4	AL00045	428.4					AL00134	549.2	AL00136	427.3
AL00256	305.8	AL00258	305.9					AL00743	364.4	AL00745	365.4
AL00918	493.1	AL00920	493.1	AL01121	916.6	AL01123	920.0	AL01125	428.0	AL01127	427.1
AL01281	427.3	AL01283	427.4	AL02054	856.3	AL02056	854.4	AL01615	428.7	AL01617	428.4
AL01702	361.8	AL01704	362.6	AL02874	859.8	AL02876	855.7	AL01877	382.2	AL01879	377.6
AL02076	422.0	AL02078	421.2					AL02224	473.9	AL02226	478.3
AL02300	432.0	AL02302	434.1	AL04005	857.2	AL04007	855.0	AL02977	428.0	AL02979	428.0
AL03028	430.5	AL03030	430.1					AL03493	428.4	AL03495	428.3
AL03565	425.4	AL03567	424.9	AL05289	855.9	AL05291	859.9	AL04013	427.4	AL04016	427.7
AL04139	427.1	AL04141	426.5					AL05039	429.0	AL05041	428.9
AL04762	440.1	AL04764	439.1	AL05816	795.1	AL05818	794.1	AL05469	448.4	AL05471	440.9
AL05473	424.3	AL05475	424.5					AL05780	549.0	AL05782	602.1
AL05784	430.5	AL05786	431.8					AL06363	348.3	AL06365	302.3
AL06337	420.0	AL06339	419.2					AL06648	426.5	AL06650	426.5
TOTAL, m^3	5868.3	TOTAL, m^3	5868.8	TOTAL, m^3	5140.9	TOTAL, m^3	5139.1	TOTAL, m^3	6111.4	TOTAL, m^3	5988.8

Start/End Date	Start/End Time	Start/End Date	Start/End Time	Start/End Date	Start/End Time	Start/End Date	Start/End Time	Start/End Date	Start/End Time	Start/End Date	Start/End Time
12/26/2007	12:16	12/26/2007	12:42	12/31/2007	10:50	12/31/2007	14:00	12/24/2007	8:37	12/26/2007	8:46
3/31/2008	10:57	3/31/2008	11:40	3/24/2008	11:20	3/24/2008	14:30	4/1/2008	7:08	4/1/2008	7:33

Sample Location	Mid-Point Date/Time	COMPOSITE SAMPLE ID	Total Flow in m^3
METOW	2/12/08 11:36	AL06570	5868.3
ZACRY	2/12/08 12:11	AL06571	5868.8
APF01	2/11/08 11:05	AL06573	5140.9
APE30	2/11/08 14:15	AL06574	5139.1
STJOE	2/11/08 19:52	AL06551	6111.4
NEWLT	2/12/08 20:09	AL06552	5988.8