

# Multimedia Sampling (Chapter 47)

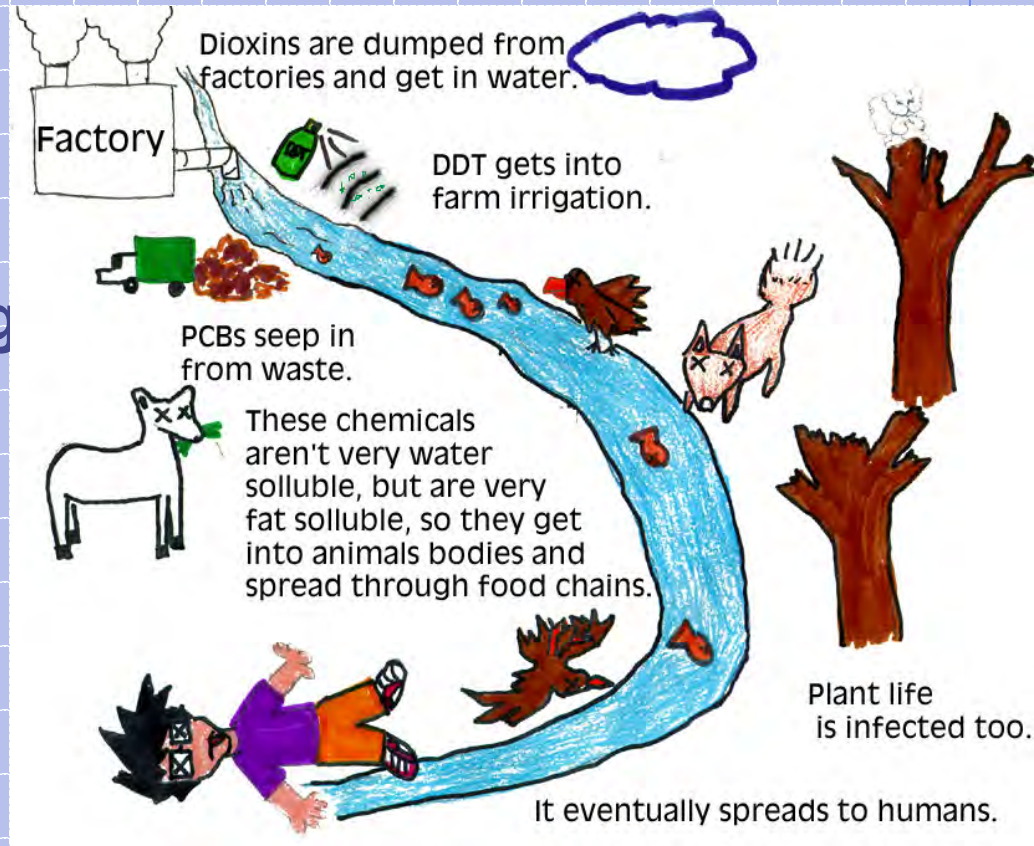


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**Federal Environment Regulatory Overview**

# MULTIMEDIA SAMPLING

- ◆ Introduction
- ◆ Multimedia Samples
- ◆ Analytical Methods
- ◆ Multimedia Sampling Plan
- ◆ Wastewater
- ◆ Air/Soil Gas
- ◆ Groundwater
- ◆ Soil
- ◆ Waste Material



# INTRODUCTION

- ◆ Review the techniques and procedures available for persons who must be concerned with environmental sampling
- ◆ Reason for sampling - to collect a representative portion for analysis, the results of which will describe the true characteristics of the source being sampled

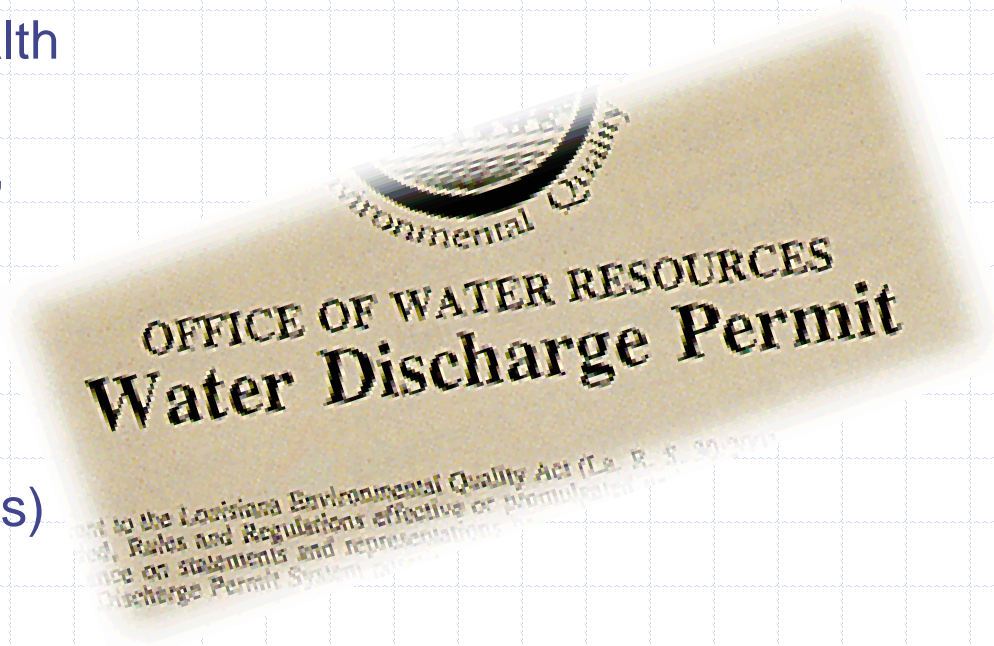
# What is a sample?

- ◆ “To define a sample as representative is to say it is similar in every essential characteristic to the population from which it is being taken. It is important that this similarity be preserved until examination of the sample is complete. That is why sampling protocols are developed for the collection, packaging, labeling, preservation, transportation, storage and documentation of environmental samples.”

# Multimedia sampling is conducted to:

- ◆ Identify contaminants
- ◆ Identify sources
- ◆ Determine extent
- ◆ Prepare Health and Safety Plans
- ◆ Establish threat to public health and environment
- ◆ Evaluate treatment, disposal, and/or remedial options
- ◆ Confirm clean-up
- ◆ Demonstrate compliance

DATA USE OBJECTIVES (DUOs)



# MULTIMEDIA SAMPLES

## ◆ Categorization:

- Hazardous – Onsite
  - ◆ High Potential or Moderate Potential
  - ◆ Concerns
    - Proper health and safety
    - Requires sampling procedures
    - Requires sample shipping procedure
    - Appropriate analytical procedures
- Environmental - Offsite



# Types of Samples

- ◆ Grab Samples
- ◆ Composite Samples
  - Areal
  - Vertical
  - Flow Proportional
  - Time Proportional Composite



# Sampling Strategies

## ◆ Judgmental

- Subjective
- Sample based on historical information
- Generally worst case scenario

## ◆ Random

- Arbitrary
- Usually not done on hazardous waste sites

## ◆ Systematic

- Establish reproducible scheme such as a grid
- Could be combination with random



# MULTIMEDIA SAMPLING PLAN

- ◆ Introduction and Background
- ◆ Objectives
- ◆ Sampling Approach and Methods
- ◆ Organization and Responsibilities
- ◆ Quality Assurance/Quality Control
- ◆ Deliverables



# Introduction and Background

- ◆ Historical search on background of site- land use, aerials, past compliance issues
- ◆ Learn of potential sources, potential source pathways
- ◆ Offsite/onsite reconnaissance
- ◆ Onsite needs – health and safety plan (HASP)
- ◆ Site Maps



# Establish Objectives

## ◆ Data Use Objectives (DUO)

- Specific goals
- What is data needed for?

## ◆ Quality Assurance Objectives

- Reliable
- Verifiable
- Defensible



# Data Use Objectives (DUO)

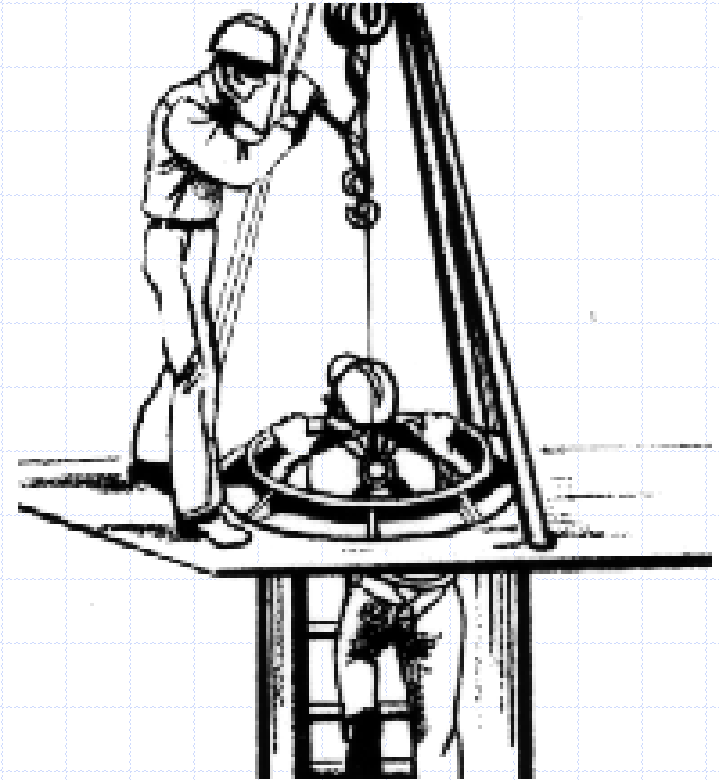
- ◆ What is the Objective of Sampling –  
Examples of DUO
  - Determine RCRA characteristic of materials onsite to classify as hazardous or non-hazardous
  - Determine concentration of VOCs in residential tap water
  - Verify attainment of soil clean-up standards

# Quality Assurance Objectives

- ◆ Specify the level of quality the data has to achieve
- ◆ Screening objective – quick preliminary assessment
- ◆ Verification – verify analytical data, small portion of data used to infer quality of all data
- ◆ Definitive objective – used to assess accuracy of all data; concentrations and analytes

# Sampling Approach and Methods

- ◆ Sampling strategy
- ◆ Sampling procedures
- ◆ Sampling management
- ◆ Sampling containers
- ◆ Sampling shipment
- ◆ Sampling documentation



# Organization and Responsibility

- ◆ Determine who is responsible for which aspect of sampling
- ◆ Who is responsible for:
  - Developing sampling plan
  - Managing the execution of the sampling plan
  - Completing the health and safety plan

# Quality Assurance/Quality Control

- ◆ What procedures are to be used in the field to ensure QA/QC
  - Field equipment calibration
  - Preservation protocols
  - Contamination/decontamination of equipment
  - Collection procedures
  - Sample transport/shipment
- ◆ Lab QA/QC sufficient to conduct data verification



# Deliverables

- Who needs the information?
- What format?
  - Data summary
  - In-depth report



# Wastewater Sampling

## ◆ Objectives

- Regulatory
- Process control
- Research

# Wastewater Sampling (cont.)

## ◆ Sample Types

- Grab sample - characterize water quality at a particular time
- Composite - determine average waste concentrations
  - ◆ time proportional
  - ◆ flow proportional
- Manual sampling - dippers, jars, bottles or pumps
- Automatic sampling
  - ◆ longer term representative samples
  - ◆ intake, transport, controller, collection system and storage

# Sample Collection

- ◆ Proper container - glass or plastic, clear or amber
- ◆ Sampling techniques
  - intake position, intake velocity
  - volume
  - collection system
  - pacing
- ◆ Chain of custody - documented account of change in possession of samples

# Sample Collection (cont.)

## ◆ Documentation

- Field notes during sample collection
- Sample chain-of-custody
- Analytical results
- Reports

# Sample Collection (cont.)

## ◆ Sample preservation

- to maintain sample integrity until examination is completed
- pH adjustment
- chemical addition
- cooling to 40°F
- holding time

# Sample Collection (cont.)

- ◆ Quality control / quality assurance
  - checks to keep sample collection program in control
  - duplicate samples
  - split samples
  - spiked samples
  - field blanks

# Calibration and Maintenance

## ◆ Calibration

- manufacturer's instructions
- documented

## ◆ Maintenance

- equipment requires precise repeatable sample collection
- volume, velocity and settings

## ◆ Cleaning of equipment

- detergent washing, tap water rinse, distilled water rinse



# Safety

## ◆ General safety considerations

- safety harness
- oxygen deficiency meter
- combustible gas indicator
- hydrogen sulfide indicator

## ◆ Site-specific safety considerations

- contact with liquids
- emergency responder

# Wastewater Flow Monitoring

## ◆ Objectives

- Regulatory
- Process control
- Research

## ◆ Flow Measurement Techniques

- Open channel
- Closed pipe
- Volumetric
- Dilution

# Open Channel

## ◆ Primary flow devices

- A hydraulic measuring structure of a known cross sectional area which controls the depth and velocity of the flow.
  - ◆ weir
  - ◆ flume

# Open Channel (cont.)

## Secondary flow devices

- ◆ Instrumentation which senses the water level or depth of flow in the primary flow device. Measure depth, convert to flow rate, indicate, record and totalize.
  - float
  - bubbler
  - ultrasonic
  - submerged pressure transducer
  - dipping probe
  - staff gauge

# Closed Pipe

## ◆ Principle of operation

- velocity meter
- differential pressure

## ◆ Metering devices

- electromagnetic meter
- turbine meter
- ultrasonic meter
- Pitot tube meter
- orifice plate meter

# Closed Pipe (cont.)

## ◆ Volumetric

- $Q = V \times A$  (Flow = velocity x area)
- Manning formula
- Batch discharges (tanks, sumps, etc.)

# Calibration and Maintenance

## ◆ Calibration

- manufacturer=s instructions
- zero, mid-range, high end and span
- documented

## ◆ Maintenance

- equipment requires precise repeatable level measurement and conversion
- depth, flow rate, velocity, and settings

# References:

- ◆ ISCO Open Channel Flow Measurement Handbook
- ◆ EPA - NPDES Storm Water Sampling Guidance Document (EPA 833-B-92-001)
- ◆ EPA - Pretreatment Facility Inspection (A Field Study Training Program) prepared by California State University, Sacramento
- ◆ WDNR Chapter NR 218 Method and Manner of Sampling
- ◆ WDNR Chapter NR 219 Analytical Test Methods and Procedures
- ◆ “Standard Methods for the Examination of Water and Wastewater ???? Edition”
- ◆ EPA - Methods for Chemical Analysis of Water and Wastes (EPA-600/4/79/020).



# AIR SAMPLING GUIDELINES

## ◆ Objectives

- Regulatory
- Process Control
- Research

## ◆ Types of Air Samples

- Ambient air (outdoor)
- Indoor air
- Stack
- Source or equipment emissions
- Soil atmospheres

# Elements of an Air Sampling Program

- ◆ Emission stream
  - point where pollutants are generated
  - emission exhaust stream
- ◆ Frequency
  - periodically
  - continuously
- ◆ Analysis Reference Methods
  - standardized reference methods (EPA)
  - customized
- ◆ Testing location
  - laboratory analysis
  - field testing or determination

# Sampling Methods

- ◆ Canisters - used to collect whole air samples
  - Teflon bags
  - Tedlar bags
  - steel canister
- ◆ Sorbent - pass measured volume of air through a material which absorbs pollutants of concern
  - carbon
  - silica gel
  - alumina
  - organic polymeric sorbents

# Sampling Methods (cont.)

## ◆ Stack gas sampling

- stack sample and velocity traverses
- referenced sampling train
- isokinetic sampling
- compound specific analysis

## ◆ Direct reading instruments

- compound specific analysis
- PID, FID

# Sampling Methods (cont.)

## ◆ Area sampling

- Direct measurements
  - ◆ emission-flux chamber sampling device
  - ◆ measurements taken at several locations
- Indirect measurements
  - ◆ upwind measurements
  - ◆ downwind measurements
- Remote-sensing methods

# Ambient Air Monitoring

- ◆ PSD requirements
- ◆ Chemical specific analyzers for:
  - carbon monoxide
  - nitrogen oxides
  - sulfur dioxide
  - VOC (ozone)
- ◆ High-volume sampler for particulates

# References:

- ◆ EPA - 40CFR53 - Ambient Air Monitoring Reference and Equivalent Methods
- ◆ EPA - 450/4-87-007 “Ambient Monitoring Guidelines for PSD”
- ◆ EPA Handbook Industrial Guide for Air Pollution Control

# GROUNDWATER SAMPLING PROCEDURES

## ◆ Measuring Water Level

- Determine groundwater elevation
- Measuring devices:
  - ◆ popper
  - ◆ tape
  - ◆ electric tape

## ◆ Purging

- Removal of stagnant water
- Purge by pumping or bailing
- Remove four (4) well volumes



# Sampling Procedures

## ◆ Withdrawing Samples

- Sample shortly after purging
- Sample in increasing order of contamination
- Sampling devices:
  - ◆ bailers
  - ◆ pumps
- Special procedures for VOCs
- Cover ground with plastic to prevent well contamination

# Sampling Procedures (cont.)

## ◆ In-field Measurements

- Temperature
- Specific conductance
- pH
- Turbidity
- Odor
- Color

# Sampling Procedures (cont.)

## ◆ Field Filtering

- Inorganic compounds
- Filter size 0.45 micron
- Specified DNR filtering procedure
- Not applicable for VOC samples

## ◆ Sample Preservation

- To maintain sample integrity until laboratory examination
  - ◆ pH adjustment
  - ◆ chemical addition
  - ◆ cooling to 40°F
  - ◆ holding time
- State Lab of Hygiene requirements

# Sampling Procedures (cont.)

## ◆ Sample Handling

- cooling requirements
- shipping requirements

## ◆ Quality Control/Quality Assurance

- checks to keep sample collection program in control
- duplicate samples
- split samples
- spiked samples
- field blanks

## ◆ Chain-of-Custody

- documented account of change in possession of samples

# Sampling Procedures (cont.)

## ◆ Documentation

- DNR form for monitoring wells
  - ◆ person sampling
  - ◆ location
  - ◆ date
  - ◆ equipment used
  - ◆ water level measurements
  - ◆ site purging data
  - ◆ time samples withdrawn
  - ◆ field measurements
  - ◆ conditions
  - ◆ comments

# Sampling Procedures (cont.)

## ◆ Equipment Maintenance

- Calibration and maintenance performed on a regular schedule

## ◆ Recent Developments

- Direct - push technology with on-site laboratory analysis
- Low-flow purging approach

# References:

- ◆ DNR - Groundwater Sampling Procedures Field Manual (PUBL-WR-166 87)

# SOIL SAMPLING GUIDELINES

## ◆ Reasons for Conducting Soil Sampling

- Agricultural
- Biological
- Construction/Engineering
- Environmental
- Geological/Hydrogeological
- Archaeological/Paleontological

## ◆ Soil Sampling Methods

- General shallow soil/sediment sampling
  - ◆ manual collection using a simple tool such as a shovel, trowel, auger, or soil probe



# Sampling Procedures

- ◆ Prevent undue soil disturbance
- ◆ Decontamination of samplers
- ◆ Volume of sample required
- ◆ Transfer to appropriate sample container
- ◆ Composite sampling (not for VOC compounds)
- ◆ Sample handling
  - sample preservation methods
  - sample holding time
  - transportation
  - chain of custody
  - QA/QC methods

# Sampling Procedures (cont.)

## ◆ Sample documentation

- sample identification
- sample collection date and time
- sample location
- observations (color, odor, field instrument readings)
- name of person(s) collecting samples

## ◆ Boring logs

- standard boring log form
- soil description/classification

## ◆ Air monitoring (if applicable)

# Environmental Sampling Parameters

- ◆ Polynuclear Aromatic Hydrocarbons (PAH)
- ◆ Non-Polynuclear Aromatic Hydrocarbons
- ◆ Organics
  - volatile
  - semi-volatile
- ◆ Metals (inorganics)
- ◆ Pesticides/Herbicides
- ◆ PCBs
- ◆ Acid Extractable Compounds

# Environmental Sampling Parameters (cont.)

- ◆ Base/Neutral Extractable Compounds
- ◆ Cyanide
- ◆ Phenols
- ◆ Hazardous Waste Characteristics
  - Ignitability
  - Corrosivity
  - Reactivity
  - Toxicity (TCLP analysis)

# References:

- ◆ Wisconsin Department of Natural Resources  
Chapter NR 716.13
- ◆ EPA SW-846 Test Methods for Evaluating  
Solid Waste
- ◆ EPA - 540/P-87/001 A Compendium of  
Superfund Field Operations Methods
- ◆ US Soil Conservation Service (SCS)  
Procedures

# WASTE MATERIAL SAMPLES

## ◆ Objectives

- Regulatory
  - ◆ generator waste determination
  - ◆ TSDF permit
- Treatability
  - ◆ land ban treatability study
- Research
- Protect Safety/Health

# WASTE MATERIAL SAMPLES (cont.)

## ◆ Samplers

- Composite Liquid Waste Sampler (COLIWASA)
- Solid Waste Samplers
  - ◆ grain samplers
  - ◆ soil auger
  - ◆ sampling trier
  - ◆ soil core sampling device
  - ◆ scoop or trowel
  - ◆ waste pile sampler
- Pond Samplers
  - ◆ beaker
  - ◆ weighted bottle sampler

# Sample Collection

- ◆ Information about the waste
  - hazardous properties
- ◆ Selection of sampler
  - liquids, semi-solids, sludges, solids and mixtures
- ◆ Sample container
  - plastic or glass
  - liners and caps



# Sample Collection (cont.)

- ◆ Sampling plan
  - location
  - number of samples
  - volume
  - protective equipment
- ◆ Sampling procedures
  - drums
  - fiber-drum, bags, etc.
  - vacuum truck
  - pond
  - waste pile
  - storage tank (ASTM)
  - soil

# Sample Collection (cont.)

## ◆ Sample handling

- identification
- labels
- log books
- chain of custody
- shipping/transporting

## ◆ Sample preservation

- to maintain sample integrity until examination is completed
- pH adjustment
- chemical addition
- cooling to 40°F
- holding time

# References:

- ◆ EPA SW-846 Test Methods for Evaluating Solid Waste
- ◆ Sampler and Sampling Procedures for Hazardous Waste Streams EPA-600/2/80-018