ENVIRONMENTAL SAMPLING TRAINING COURSE

GGMC-EPA-GGDMA-UG

Georgetown, February 2001

Training transparencies

ENVIRONMENTAL SAMPLING TRAINING COURSE

Section 1 – Pre-Sampling Planning

At the end of this section, participants will be able to:

- **Identify the purpose of sampling and establish appropriate objectives.**
- **Understand the need for preliminary site background information and their existing types.**
- **Understand the need for a team approach.**

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Section 1 – Pre-Sampling Planning

1. Introduction
2. The purpose of sampling
3. Establishing Sampling objectives

   Exercise: 1.1
4. Collecting background data
5. Developing an organisational framework.

   Exercise: 1.2

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Section 1 – Pre-Sampling Planning

Exercise: 1.1

Give an example of the purpose of sampling and mention associated objectives.

Ans.: Plant area characterization, level of contamination in function of regulation for soil disposal.

Exercise: 1.2

From the previous exercise, what kind of background data would be efficient and how will you organize the activity (team+outline).

Ans.: Plant history, interview of people, chemicals characteristic, regulation, land use, decontamination and waste disposition. 2 persons: 1 for the equipment, 1 for the documentation. Site visit, equipment preparation, characterization, analyses, cross check, report.

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Section 2 – Developing Quality Control Plans

At the end of this section, participants will be able to:

- **Be familiar with the importance of data quality objectives.**
- **Describe summarily what is a quality control plan and its content.**
- **Describe summarily what is a contamination control plan.**
- **Determine appropriate sampling container and preservative.**
- **To monitor sample contamination.**
- **Establish the appropriate documentation elated to sampling procedures.**

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Section 2 – Developing Quality Control Plans

1. Introduction
2. Establishing Data Quality Objectives
3. Quality Control Plans
4. Quality Assurance Plans
5. Contamination Control Plans

Exercise: 2.1

6. Monitoring Sample Contamination
7. Documentation

Exercise: 2.2

Review of the morning

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Section 2 – Developing Quality Control Plans

Exercise: 2.1

Identify Guyanese possible source of contamination and what can be done to avoid them.

Ans.: Collecting: bottles, transporting: heat, analysing: no cleaning between analyses, mixing samples

Exercise: 2.2

You do an inspection to a mining site to check the final effluent, what kind of quality control sample you use and how many?

Ans.:Trip blank, field blank, duplicate

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Section 3 – Selecting Sampling Methods

At the end of this section, participants will be able to:

- **Establish sampling equipment in function of logical criteria.**
- **Propose different types of sampling location strategies.**
- **Use basic statistical tools to evaluate the quantity of sample to take in function of accuracy aimed.**
- **Decide the size and type of sample to be taken.**

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Section 3 – Selecting Sampling Methods

1. Introduction
2. Method Selection Criteria
3. Selecting a Sampling Location
4. Determining Sample Quantity

Exercise: 3.1

5. Determining the Number of Samples

Exercise: 3.2

6. Sample Size
7. Options for Sample Collection
8. Control Site Selection

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Section 3 – Selecting Sampling Methods

Introduction

A lot of sampling methods exist, see section 6 to 14. This section will present some general criteria on method selection (what to look at when selecting a sampling method), then general criteria on sampling location, base on non-statistic and statistic method. A step by step approach will be presented a a tool that can be use to determine the appropriate sample number needed for a given level of accuracy. With the same approach, a other step-by-step approach will presented in complement to show how to evaluate appropriate sample population size.

The section will then finish on some comments about sample size, option for sample collection and control site selection.

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Section 3 – Selecting Sampling Methods

Method selection criteria

- Budget
- Representativeness (sampling method make a true representation of the material being sampled)
- Practicality - simple proven method
- Safety
- All that are limiting factors.

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Section 3 – Selecting Sampling Methods

Selecting a sampling location

Criteria then

Non statistical sampling strategies

Statistical sampling strategies a) Simple random sampling

b)Systematic Sampling

c) Stratified Random Sampling

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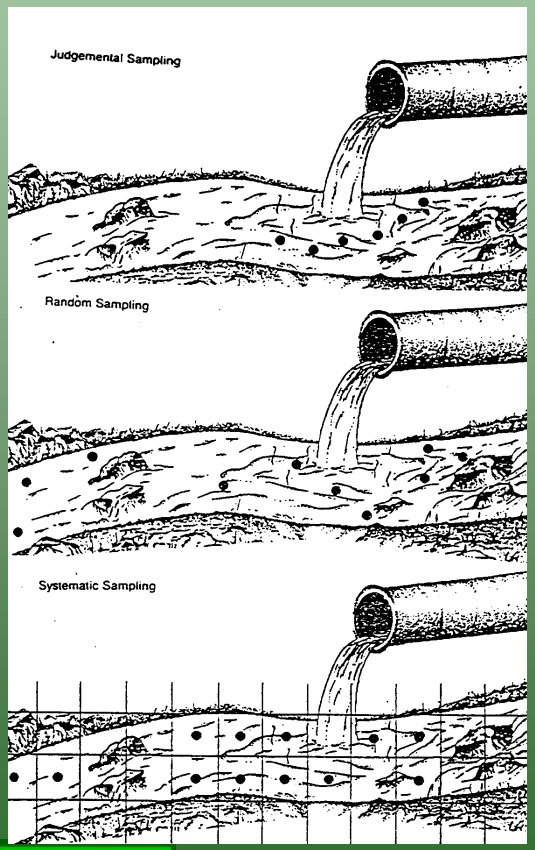
Section 3 – Selecting Sampling Methods



03	47	43	73	86	36	96	47	36	61	46	98	63	71	6
97	74	24	67	62	42	81	14	57	20	42	53	32	37	3
16	76	62	27	66	56	50	26	71	07	32	90	79	78	5
12	56	85	99	26	96	96	68	27	31	05	03	72	93	1
55	59	56	35	64	38	54	82	46	22	31	62	43	09	9
16	22	77	94	39	49	54	43	54	82	17	37	93	23	7
84	42	17	53	31	57.	24	55	06	88	77	04	74	47	6
63	07	63	78	59	16	95	55	67	19	98	10	50	71	7
33	21	12	34	29	78	64	56	07	82	52	42	07	44	3
57	60	86	32	44	09	47	27	96	54	49	17	46	09	5
18	18	07	92	46	44	17	16	58	09	79	83	86	19	6
26	62	38	97	75	84	16	07	44	99	83	11	46	32	2
23	42	40	64	74	82	97	77	77	81	07	45	32	14	0
52	36	28	19	95	50	92	26	11	97	00	56	76	31	3
37	85	94	35	12	83	39	50	08	30	42	34	07	96	8
70	29	17	12	13	40	33	20	38	26	13	89	51	03	7
56	62	18	37	35	96	83	50	87	75	97	12	25	93	4
99	49	57	22	77	88	42	95	45	72	16	64	36	16	0
16	08	15	04	72	33	27	14	34	09	45	59	34	68	4
31	16	93	32	43	50	27	89	87	19	20	15	37	00	4

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Section 3 – Determining the appropriate sample number needed for a given level of accuracy

Mean= X=Sum /n

Variance = V = $\frac{\Sigma (X_i - X)^2}{n - 1}$

Standard deviation = Sd = square root V

Standard error of the mean = Sx= Sd/n

Sx inversely proportional to the square root number of sample.....4 to 16then result/4 instead of 2, then twice bigger so 50% smaller Sx.

Use table of Cumulative distribution to know UCL.

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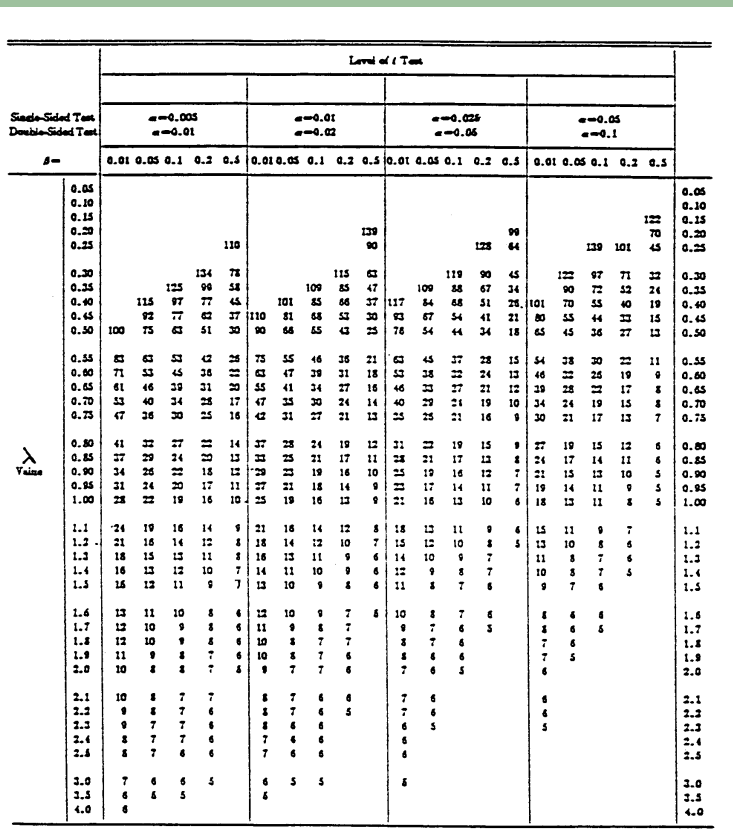
Section 3 – Determining the appropriate sample number needed for a given level of accuracy

p

df	one-tailed 0.55 / two-tailed 0.10	0.75 / 0.50	0.80 / 0.60	0.90 / 0.80	0.95 / 0.90	0.975 / 0.95	0.99 / 0.98	0.995 / 0.99	0.9995 / 0.999	df
1	.158	1.000	1.376	3.078	6.314	12.706	31.821	63.657	636.619	1
2	.142	.816	1.061	1.886	2.920	4.303	6.965	9.925	31.598	2
3	.137	.765	.978	1.638	2.353	3.182	4.541	5.841	12.924	3
4	.134	.741	.941	1.533	2.132	2.776	3.747	4.604	8.610	4
5	.132	.727	.920	1.476	2.015	2.571	3.365	4.032	6.869	5
6	.131	.718	.906	1.440	1.943	2.447	3.143	3.707	5.959	6
7	.130	.711	.896	1.415	1.895	2.365	2.998	3.499	5.408	7
8	.130	.706	.889	1.397	1.860	2.306	2.896	3.355	5.041	8
9	.129	.703	.883	1.383	1.833	2.262	2.821	3.250	4.781	9
10	.129	.700	.879	1.372	1.812	2.228	2.764	3.169	4.587	10
11	.129	.697	.876	1.363	1.796	2.201	2.718	3.106	4.437	11
12	.128	.695	.873	1.356	1.782	2.179	2.681	3.055	4.318	12
13	.128	.694	.870	1.350	1.771	2.160	2.650	3.012	4.221	13
14	.128	.692	.868	1.345	1.761	2.145	2.624	2.977	4.140	14
15	.128	.691	.866	1.341	1.753	2.131	2.602	2.947	4.073	15
16	.128	.690	.865	1.337	1.746	2.120	2.583	2.921	4.015	16
17	.128	.689	.863	1.333	1.740	2.110	2.567	2.898	3.965	17
18	.127	.688	.862	1.330	1.734	2.101	2.552	2.878	3.922	18
19	.127	.688	.861	1.328	1.729	2.093	2.539	2.861	3.883	19
20	.127	.687	.860	1.325	1.725	2.086	2.528	2.845	3.850	20
21	.127	.686	.859	1.323	1.721	2.080	2.518	2.831	3.819	21
22	.127	.686	.858	1.321	1.717	2.074	2.508	2.819	3.792	22
23	.127	.685	.858	1.319	1.714	2.069	2.500	2.807	3.767	23
24	.127	.685	.857	1.318	1.711	2.064	2.492	2.797	3.745	24
25	.127	.684	.856	1.316	1.708	2.060	2.485	2.787	3.725	25
26	.127	.684	.856	1.315	1.706	2.056	2.479	2.779	3.707	26
27	.127	.684	.855	1.314	1.703	2.052	2.473	2.771	3.690	27
28	.127	.683	.855	1.313	1.701	2.048	2.467	2.763	3.674	28
29	.127	.683	.854	1.311	1.699	2.045	2.462	2.756	3.659	29
30	.127	.683	.854	1.310	1.697	2.042	2.457	2.750	3.646	30
40	.126	.681	.851	1.303	1.684	2.021	2.423	2.704	3.551	40
60	.126	.679	.848	1.296	1.671	2.000	2.390	2.660	3.460	60
120	.126	.677	.845	1.289	1.658	1.980	2.358	2.617	3.373	120
∞	.126	.674	.842	1.282	1.645	1.960	2.326	2.576	3.291	∞

NOTE: For one-tailed distributions $\frac{\alpha}{2} = 1\text{-}p$

For two-tailed distributions $\alpha = 1\text{-}p$



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Section 3 – Developing Quality Control Plans

Exercise: 3.1

What is the probability to be over the limit of 200 NTU with the following results:154, 241, 184, 209.

Ans.:to be calculated

Exercise: 3.2

How many samples are required to be sure of the limit?

Ans.:to be calculated

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Section 4 – Developing Sampling Plan

At the end of this section, participants will be able to:

- **Discuss the necessary elements of a sampling plan.**
- **Discussed the steps used in the development of a sample plan.**
- **Define the main element of a safety-plan.**

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Section 4 – Developing Sampling Plan

1. Introduction
2. Work plan
3. Safety plan

Exercise: 4.1

HANDBOOK CONTENT

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Section 4 – Developing Sampling Plan

Exercise: 4.1

What would look like a typical safety plan in Guyana?

Ans.: Group answer, including radio emergency frequencies, transport routes on maps, radio and contact location, safety kit, Amerindian experience, medication, mosquito's protection, safety equipment (glove, etc), detection equipment.

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Section 5 – Preparation

At the end of this section, participants will be able to:

- **Find and choose appropriate containers and preservatives.**
- **Describe the different steps of preparation of a field campaign, summarily what is a quality control plan and its content.**
- **Locate and describe sampling stations.**

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Review of the first day

Section 5 – Preparation

1. Introduction
2. Obtain Container and preservatives
3. Assemble and check field sampling equipment
4. Clean Sampling equipment
5. Calibrate field equipment
6. Locate and describe the sampling station

Exercise: 5.1

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Section 5 – Preparation

Exercise: 5.1

You take a sample in the pool to know if the water is good for swimming, where you take it (location and description of the sampling)

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Section 6 – Surface Water Sampling

At the end of this section, participants will be able to:

- **Be familiar with how water movement and characteristic can influence a sampler obtaining a representative sample of effluent or surface water.**
- **Follow typical sampling methodology.**
- **Be aware of water quality parameters.**
- **To measure or estimate water flow rate.**
- **Avoid typical sampling mistakes.**
- **Use correct water sampling and preservation techniques and to monitor them.**

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Section 6 – Surface Water Sampling

1. Introduction
2. Surface Water Characteristics
3. Selecting sampling locations
4. Options for water sampling collection
5. Calibrate field equipment
6. Common sampling procedures

Exercise: 6.1

7. Flow measurements
8. Problem unique to sampling surface water
9. Water Sample Preservation
10. Monitoring Water sample preservation

Exercise: 6.2

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Section 6 – Surface Water Sampling

Exercise: 6.1

You have to take a sample of the Kawaruk river, 15 meters wide, what do you do?

Answ.:EWI methodes, 10 segments of 1.5 m, 0.6 deppht if curent laminar (I check) and measure from a bridge.

Exercise: 6.2

You do a sampling at Omai, what type of bottle do you use and what preservative?

Answ.: Look in a book for the parameter, then metals + Cyanide ones.

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Section 7 – Soil Sampling

At the end of this section, participants will be able to:

- **Better understand soil sampling strategies.**
- **Be familiar with typical of soil sampling equipment.**
- **Be familiar with waste pile sampling.**

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Section 7 – Soil Sampling

1. Introduction
2. Important soil characteristics to consider when sampling
3. Equipment and procedures
4. Soil sampling for volatile organic compounds
5. Waste pile sampling

Exercise: 7.1

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Section 7 – Soil Sampling

Exercise: 7.1

You want to evaluate the possibility of contamination from the Gold Board, how do you sample?

Answ.:single or sub-samples points, from surface to 10 cm with a sampling auger, keeping the centre and cleaning the sampler in-between.

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Section 8 – Sediments Sampling

At the end of this section, participants will be able to:

- **Be familiar with how sediment is deposited in various type of bodies and human changes.**
- **Describe the various approaches to sediment sampling when determining sampling location.**
- **Be familiar with a variety of different grab samplers and corers.**
- **Be aware of preservation and storage methodologies.**

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Section 8 – Sediments Sampling

1. Introduction
2. Sediment deposition
3. Selecting a sampling station
4. Selecting ssampling eequipment
5. Preservation and storage of sediment samples

Exercise: 8.1

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Section 8 – Sediments Sampling

Exercise: 8.1

You have to take a sediment sample of the Kawaruk river, 8 meters deep, what do you do?

Answ.: Try a grab sampler, 2-3 places and mix the sample (taking out the vegetation), if bad sample, go with the Piston corers. Try to find a diver is not good, because he will take all the time to look for gold!!!!!!

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Section 9 – Groundwater sampling

At the end of this section, participants will be able to:

- **Understand proper monitoring well drilling and construction concepts.**
- **Define well development and purging terms.**
- **Understand basic groundwater sampling and handling procedures**

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Section 9 – Groundwater sampling

1. Introduction
2. Well design
3. Drilling methods
4. Documentation
5. Methods for purging and sample collection
6. Groundwater preservation

Exercise: 9.1

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Section 9 – Groundwater sampling

Exercise: 9.1

You want to monitor the Gas station of GGMC, the soil is sand with clay under and then rock, where do you put the well, what are the following step and how often do you take a sample?

Answ.:The well from the surface to the clay, a little into it, be sure the casing is open with the possible depth of the water table, and put the well downstream of the gas tank.