LEVEL 2 SEMINARS

Environmental Sampling and Analysis

(Greenpeace Research Laboratories Staff)

Tutorial synopses

Tutorial 1 (David Santillo)

An introduction to the design of sampling programmes, including consideration of the purposes of sampling and the limitations to the information which samples can give. The need to formulate questions or hypotheses such that the sampling programme can be designed in order to provide appropriate information. Comparison of systematic, random and judgmental sampling. Selecting appropriate sample sites and deciding how many and what size of samples to collect. Recognising the assumptions involved and being aware of what information samples can and cannot yield.

Tutorial 2 (David Santillo)

Preparing for the field, including the preparation of sampling equipment and containers as appropriate (for chemical, biological and radiological analyses). Techniques to avoid contamination and cross-contamination. Quality control of sampling procedures. Sample preservation and storage prior to analysis. Safety in the field (equipment and other considerations). Variables which must be measured in the field. Recording of sample and sampling information. The need for prior development and validation of analytical methods.

Tutorial 3 (David Santillo)

Introduction to a range of equipment for the quantitative and qualitative sampling of water, soils, sediments, air, etc. Preparation and calibration (where necessary) of sampling equipment. Designing specialised equipment and construction/modification of sampling equipment in the field. Limitations which need consideration when collecting samples. Specific requirements relating to collection of samples for regulatory and legal purposes. Outline of types of methods for chemical analysis, including colourimetric, ionic and chromatographic methods, and the increasing availability of biosensors. Uses and limitations of direct toxicity assessment. Brief introduction to precision and accuracy as lead in to next tutorial.

Tutorial 4 (Iryna Labunska, Kevin Brigden)

A two part tutorial introducing analysis of samples for organic and heavy metal contaminants.

Organics: Introduction to gas chromatography and mass spectrometry. Outline of extraction and clean-up techniques for semi-volatile organic compounds in solid and liquid media. Influence of extraction conditions on compounds extracted. Preparation for analysis of volatile

organic compounds. Outline of quantitative determinations, including use of standards, certified reference materials, spiking for recovery, etc. Limitations to GC/MS techniques. The particular difficulties relating to complex mixtures of chemicals and consequences for regulatory procedures.

Heavy Metals: Introduction to inductively coupled plasma atomic emission spectroscopy (ICP-AES) and atomic absorption spectrophotometry (AAS) techniques used for the determination of major and trace metals in a wide variety of environmental matrices. Outline of sample preparation techniques including microwave and hot plate digestion. Outline of quantitative determinations, including the preparation and use of standards, quality control standards, certified reference materials and other Quality Assurance / Quality Control (QA/QC) procedures.

Tutorial 5 (David Santillo)

Students are provided with a sample site map and analytical data for a fictitious river/estuary system with a number of pollutant sources. The data set is discussed with reference to textbooks and research papers are also provided on toxicology environmental behaviour of compounds, process chemistry, legislation and contamination case studies. Students interpret the data set and are encouraged to comment on issues such as coherence of data set, possible environmental impact of the contaminants in question and location/media that could be sampled in a future study and/or other analyses that would be useful.