Strengthening capacities in the Western Balkans countries
to address environmental problems through remediation of high priority hot spots

Regional Training on Environmental Monitoring and Field Surveillance

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Sanja Bojanić, Regional Programme Manager

Authors:
Lawrence Kapustka, Stewart Williams, Snežana Marstijepović

Editors:
Snežana Marstijepović, Stewart Williams

Proofreading:
Charlotte Rimmer

Design & Production:
Ilija Perić
IDENTITY & PROMOTION

PrePress:
Luka Bošković

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Klodiana Marika, UNDP Albania
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Vladimir Stavrić, UNDP Macedonia
Borko Vulikić, UNDP Montenegro
Agron Bektashi, UNDP Kosovo
Dobrila Simić, UNDP Serbia

Editorial

The workbook gives detailed presentation on training plan, knowledge transfer process and activities. Useful source of knowledge for participants, as much as for all practitioners new in this field. Good toll for knowledge transfer/ dissemination, and example for training organization useful for educators in the region.

Professor Dr.Sc. Boris Krstev
University "Goce Delcev" - Stip, Macedonia

Preface

This workbook contains a summary of the presentations provided by the expert, Dr. Larry Kapustka, followed by the working group summaries from the two-day **Regional Training on Environmental Monitoring and Field Surveillance**. It was held in Bečići, Montenegro on the 6th and 7th May 2009. In addition to the printed materials which are presented in this workbook, through the list of linkages, participants have access to electronic files of presentations made during the entire workshop. Information presented here does not necessarily reflect the policy or views of the UNDP, nor that of the other participants' home countries. Some materials and slides included in the PowerPoint presentations came from the training materials and curriculum prepared for the SAICM Regional Capacity Building Workshop in Africa, conducted on the 1st-6th March 2009 in Dar es Salaam, Tanzania. Permission to use the slides was given by the Society of Environmental Toxicology and Chemistry (SETAC), 1010 North 12th Avenue, Pensacola, FL 32501-3367, USA.

Contents

Introduction

The Western Balkan Environmental programme for strengthening capacity in the region, to address environmental problems, through the remediation of high priority hot spots, is a 3 year, $ 15 million programme funded by the Government of the Netherlands. This programme has united the efforts of 6 countries/territories in the Western Balkans (Albania, Bosnia and Herzegovina, FYR Macedonia, Montenegro, Serbia and UNATSCR 1244 Kosovo) regarding environmental and development issues in the region. Eight polluted industrial hotspots in six countries/territories have been selected for cleanup and remediation. The physical works are on-going and are planned to be finished by April 2010.

In line with the hotspot clean-up, interventions defined in the programme document, environmental monitoring and field surveillance at all eight hotspots will demonstrate whether the physical works have contributed to improving the environmental situation, and will establish a baseline for developing and setting in place a continuous environmental monitoring programme. Due to this, UNDP Montenegro, under the umbrella of the Western Balkan Environmental Programme, has organized a two day workshop on environmental monitoring and field surveillance.

The Western Balkan Environmental Monitoring and Field Surveillance Workshop took place on May 6th–7th 2009, in Becici, Montenegro. It hosted practitioners who are involved in conducting, planning or assessing environmental monitoring and field surveillance, as well as stakeholders from six countries/territories involved in the Western Balkan Environmental Programme. The technical backstop for United Nations Environmental Programme (UNEP) GRID Arendal: Environment & Security initiative, Dr. Philip Peck participated in the training and on the second day, he gave a presentation on monitoring needs for abandoned mining sites. The training was led by Dr. Larry Kapustka, an international consultant, and by Mr. Stewart Williams, Chief Technical Advisor for the RPMU.

The purpose of the workshop was to present a regional snapshot of the participating countries/territories in relation to the environmental monitoring and field surveillance that had been conducted and was still needed, and

to provide participants with further skills through providing training in environmental monitoring and in the provision of tools and resources.

The training was structured into three learning modules, intergrated with country presentations given by practitioners from each country/territory and also from presentations which were given by UNDP national project coordinators on the sites they are remediating. The training modules were organized as follows:

- First training module: Environmental Monitoring (Principles and Rationale);
- Second training module: Environmental Monitoring (Techniques and Standards);
- Third training module: Applications and Implementation Strategies.

Content Summary

The structure of this workbook follows the agenda of the Environmental Monitoring and Field Surveillance Workshop, and begins with the presentation of key challenges faced by participants. This is followed by the three presentations made by the international consultant, Dr Larry Kapustka. Two sections report the outcomes of break-out groups (one on a hypothetical case and one on strategies for addressing three priority hot spots). The agenda of the workshop appears in Appendix A. A summary of the presentation on the remediation of mining sites, given by Philip Peck, is given in Appendix B. Available e-learning modules on environmental monitoring appear in Appendix C. Supplemental information, pertaining to eco-toxicology/environmental toxicology, is presented in Appendix D. A list of relevant websites appears in Appendix E. In Appendix F guidance materials on techniques and methods for field sampling of water, air, soil and sediments can be found. Finally, a list of key references, associated with materials from the three formal presentations, appears in Appendix G.

Key Challenges

The focus of this opening session was to identify the key challenges facing participants in their work on high priority hot spots. After each participant had prepared their list, the challenges were entered onto flip charts and the session was opened for discussion. The challenges are listed by country/ territory.

Montenegro:

» Lack of an incentive system for prioritising environmental issues which are high on the political agenda

UNATSCR 1244 Kosovo:

» Improvement of monitoring network and equipment

» Staff training

» Database

Albania:

» Certification and accreditation of AEF Lab (ISO)

» Capacity training on monitoring systems for sampling, measurement, data processing and storage

» Establishment of web-base in AEF

FYR Macedonia:

» The absence of a law on soil which would regulate problems related to soil contamination, degradation, remediation, etc.

» Lack of financial resources for the establishment and maintenance of a proper monitoring system for air quality and emissions into the air, also for soil and water monitoring

Serbia:

UNDP:

» Limited project budget for monitoring

» No previous detailed monitoring programme for the hot spot, Vrbas, to refer to

» Limited number of previous monitoring results (only basic ones)

Ministry of Environment and Spatial planning:

» Implementation of EU legislation

» Improvement of cooperation between institutions

» Lack of budget, inadequate financing and lack of economical incentives

» Obsolete and national legislation, also not harmonized with EU regulations

» Irrational usage of natural resources (water)

» Non-existent national database

» Standards not fully compliant with the EU

» Lack of institutional and other capacities

Bosnia and Herzegovina:

» Lack of political willingness

» Lack of EU funds available for environmental work in BH

» Lack of educated human resources

» Slow and inefficient decision making at a state level

» Lack of awareness/education at the level of the wider community

» Funds for environmental protection projects at a state level (domestic)

» Waste management

» Monitoring of air pollution

Even though political and legal obstacles / limitations were mentioned by most of the country / territory representatives, collectively, the three most commonly identified key challenges facing the region were limited financial resources, a limited number of trained and experienced staff, and limited access to information pertaining to hot spot monitoring and remediation. Several participants commented on the need improving the sharing of information and for the development of a database that could easily be accessed. Consistency or harmonisation of regulations, particularly those which comply with EU directives, was at least a sense of frustration, if not a key challenge facing most of the participants.

Financial Resources

Financial resource limitations were frequently cited as a significant challenge, even in countries which had well established regulatory programmes, especially due to the current global economic situation. This occurs, in part, as many view environmental management as an expensive burden to business communities and to governments. Yet, over the past three decades of the modern environmental era, environmental advances have resulted in improved health for humans, improved conditions for ecological systems which provide many economically important goods and services, and improved efficiency (a better bottom line) as companies have taken a more active role towards minimising waste and emissions.

The financial resource challenges will continue to be problematic, but there are several initiatives that could be undertaken to improve the situation:

» The managers and technical experts involved in hot spot characterization and remediation should look for opportunities to extend their limited resources. This might entail working collaboratively with industry, universities, local governments, and international non-governmental organizations.

» To be effective in this endeavor, practitioners will need to develop effective ways to communicate the immediate and long-range benefits that have been realised as a result of characterizing the hazards, mitigating risks, and verifying effectiveness through targeted monitoring.

» One opportunity to begin to demonstrate efficiency would be to identify available expertise within each of the Western Balkan countries and then to develop a reciprocal exchange of services, in lieu of each country developing such a capacity in all disciplines.

Trained and Experienced Staff

This limitation is linked closely to the limited financial resources avaiable. The fastest way to adexpand expertise would be to develop a network of colleagues available for a reciprocal exchange of services. A related activity would be to undertake a gap analysis, using a matrix of requisite talents, required across the breadth of the hot spot programme. Once gaps have been identified, programme managers could approach local and regional universities to see whether an emphasis could be placed on developing curricula that would attract students to fill these gaps. In some cases, it might be possible to obtain corporate sponsorships to help to offset tuition costs or to provide internships for students interested in these particular fields of study.

In relation to specialised educational programs, project managers could help identify research topics which, if developed, could be undertaken by both undergraduate and post-graduate students as part of their degree programs. Internships of this sort can often lead to employment that brings an already experienced person into the project.

On a more immediate schedule, technical experts might be encouraged to develop personalised technical enhancement activities, through which they could dedicate anything from a few, to several hours, per week, to engage in relevant e-Learning opportunities that are available through UNITAR, UNIDO, and various other sites described elsewhere in this workbook.
Finally, each technical expert could identify a network of experts within and outside the Western Balkans to engage in periodic dialogues about challenges encountered in their projects. Though, at first, it may seem to add extra time to an already busy schedule, reliance on a network of experts to test ideas and seek advice should accelerate the pace of progress in a project. This is due to the fact that staff will consequently approach their work with an added confidence gained through collaboration.

Access to Information

Various free-access databases pertaining to hazards, toxicity, and monitoring exist in Europe and North America (see links to OECD, UNITAR, and US EPA CLU-IN that appear elsewhere in this workbook). The network of technical experts in the Western Balkans may wish to identify a select task group to identify specific database needs within the region. Once the parameters of such needs have been identified, task groups can determine how best to obtain and distribute available information to the larger group of practitioners in the region. Regularly scheduled conference calls could provide continuing updates to exchange information on the status of reports and emerging challenges.

Workshop Presentations

I Module: Environmental Monitoring – Principles and Standards

Environmental media at potentially hazardous waste sites were sampled:

- to determine the nature and extent of contamination,
- to enable informed decision-making regarding selection amongst alternative management options, and
- to monitor conditions after the remediation options had been implemented

In this session, the basic components of environmental risk assessment were discussed as an organizing framework for making environmental management decisions. Historical trends and international agreements pertaining to environmental management were reviewed. This set the stage for discussions later in the workshop on trade-offs, involving:

- quality and quantity of data,
- benefits versus costs, and
- uncertainties.

This module established the technical foundations of sampling design, as used within the context of tiered environmental risk assessments, used to inform decision-makers. The learning objectives were:

- to become conversant in the terminology associated with tiered environmental risk assessments, and
- to understand the importance of linking sampling efforts to management objectives, assessment and measurement endpoints, and data quality objectives.

II Module: Environmental Monitoring – Techniques and Standards

This session explored the basic approaches to designing sampling programs to characterise site conditions. Emphasis was placed on linking sampling and analysis activities with agreed management objectives. We focused on the:

- use of conceptual models to identify measurement endpoints along potential exposure pathways, including both primary and secondary releases,

- » methods to acquire data both from chemical analyses and bioassays,
- » the data quality objectives process, and
- » differences procedures across jurisdictions.

The session examined methods used to establish toxicity threshold values and clean-up standards both from a technical perspective and also from regulatory approaches by various jurisdictions, but with an emphasis on EU interpretations. This module established the technical foundations for sampling design, as used to characterise the nature and extent of contamination, and to monitor conditions following remediation. The learning objectives were:

- » to understand the use of a site-specific conceptual model, pertaining to exposure pathways;
- » to be able to link management objectives, assessment endpoints, measurement endpoints and methods of analysis, to data quality objectives; and
- » to become acquainted with the processes used to develop environmental standards (i.e., toxicity thresholds and clean-up criteria).

III Module: Applications and Implementation Strategies

This session explored the development of sampling programs to characterise site conditions. Emphasis was placed on trade-offs encountered in the effort to obtain data that was representative, sufficiently complete (adequate for the intended purposes), and affordable. The session examined:

- » Precision and accuracy,
- » Detection limits,
- » Significant figures,
- » Background versus baseline,
- » Methods to estimate sample size requirements,
- » Statistical power,
- » Placement of sampling stations, and
- » Frequency of sampling.

This module provided details on application and implementation strategies in the design of a sampling/monitoring programme. Specific objectives were:

- to be able to justify the following components of a sampling plan:
  - number of samples,
  - placement of sampling stations, and
  - frequency of sampling;

- to be able to construct the elements of a specific project
  - including affordable sampling and an analysis plan (SAP), and
  - a quality assurance project plan (QAPP).

Management Approaches

The materials in the three formal presentations reflect the collective experiences of various colleagues working on different sites, especially in North America. There are three critical aspects, related to successful management that are aimed at lowering risks associated with contaminated sites:

1. Risk management and risk characterization must be coordinated at the earliest opportunity, especially with regard to goals and objectives, timelines, and budgetary realities;
2. Management should promote open dialogue between affected stakeholders, throughout the process, in order to ensure that stakeholders' values are protected and in order to engage stakeholders in discussions about decisions to be made; and

The project team (technical experts) also needs to engage with the decision makers to be clear about the members of the project team. They should also strive to become trans-disciplinary (in contrast with multi-disciplinary)
Challenges to remediation options, as well as other inefficiencies, often arise if one or more of these features have been ignored. In order of listing, the following paragraphs elaborate on the potential problems that are likely to arise if the relevant factor is ignored.
Explicit coordination between management and technical experts is needed

even for what may seem routine activities. All too often, one or other of the parties makes an assumption that work to be carried out is obvious, but much experience shows that different people bring different perspectives to their work. Even if the work-plan for a new project can be encapsulated in a few pages, it is important to ensure that all parties agree on the scope, duration, and costs before embarking on any work. Part of coordination involves understanding what information was provided to launch the project. Was it a report of a spillage? An observation of waste piles? A sign of impending structural failure regarding containing waste? Reports of illnesses in a specific area? Regardless of the origin, a preliminary site reconnaissance should be carried out by qualified persons to help to set the scope of work. Typically, even a cursory walk-around (with appropriate levels of personal protection) can lead to some obvious priority activities. This can lead management and technical persons to agree on stages of investigation as well as on criteria to allow for progression to the second tier of work, or to determine the fact that certain issues do not warrant further work.

Dialogue with affected stakeholders is important for several reasons. First, it is quite possible that the affected stakeholder knows a great deal about the situation and can be very useful in establishing the scope of work. Because the management unit and the technical experts often come from outside the immediate community where the site is located, engagement of stakeholders is especially important to allay suspicions and fears which often develop. Ultimately, some decision will be made, either that there is not a problem which warrants attention, or that there should be some combination of engineering and institutional controls. The affected stakeholders will ultimately be the ones who have to live with the decision. The success of the project usually relates to the extent that stakeholders have participated in the dialogue and agreed with decisions. If stakeholders are not engaged, it is very likely that they will impede implementation either unwittingly or intentionally1.

A trans-disciplinary approach by technical team members maximizes the efficiency and effectiveness of work being done. Often, technical experts have a limited understanding of the methods and data requirements outside their own specialty. As a result, it is easy for them to miss opportunities to coordinate sampling and other field work. If the concentration of contaminants in fish

1 The story of the cattle grazing and paths being established on the cap might be quite different if the local residents had understood the purpose of the cap.

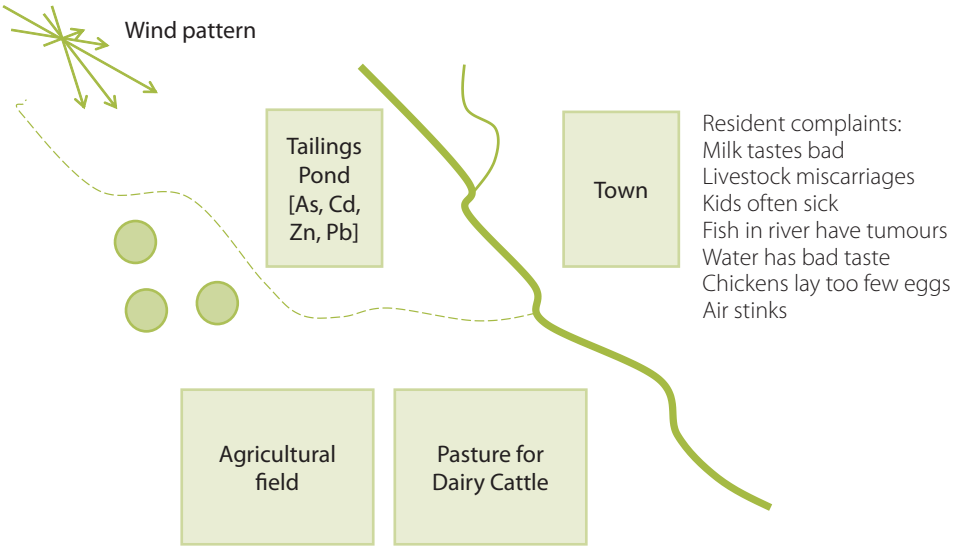
tissue is required for assessing risks to humans, then the sampling of water, sediments and food items of the fish species should be coordinated. All too often, different teams are sent to sites to gather different measurements (e.g., water quality measurements under one work-plan, sediments under another, food items under yet another plan, and finally fish tissue is obtained). Differences in the locations and the times of sampling can greatly compromise the results, if not most of the data. These problems are relatively easy to overcome through good dialogue and result in substantial savings both in costs for sampling and analyses.

Workshop Activities

I Group work: Placing Sampling Stations Across a Landscape

As part of Module 3, participants were divided into three groups and asked to design a sampling plan to determine if there were real problems associated with potential hot spots near a community that had registered numerous complaints (Figure 1). A summary of plans by the three groups follows.

Figure 1. Schematic Drawing of a Candidate Hot spot



Lines designate streams, Circles are miscellaneous waste piles from mining operations, oil drums, includes tires, electrical transformers, etc.

Design a sampling plan to determine if there are real problems.
Initial budget: 10,000 Euros

Group 1

1. Gathering of existing data:
    a. River water quality
    b. Soil contamination
    c. Air pollution training
    d. Health data (human and animal)

2. Site survey / identification:
    a. Interviews with populations, Government, NGO

3. Sampling recommendations
    a. Toxic dust – 3 locations - monthly analyses for a year
    b. Water quality – 3 locations (2 rivers and 1 stream) – monthly analyses for a year
    c. Ground water – 3 piezometers
    d. Soil quality – 2 locations x 3 samples
    e. Air quality – 3 locations x once a month

4. Resource mobilization – no money left!

Group 2

1. Surface water analysis at 8 points (metals, PCB, pesticides)
2. Ground water analysis near drums (metals, PCB, pesticides)
3. Soil analysis (metals, PCB, pesticides)
4. Milk analysis

Group 3

I Stage (General survey) Essential information:

1. Meteorological parameters: wind direction, precipitation
2. River flow
3. Geomorphologic parameters
4. Water quality (surface, underground water)
5. Air quality
6. Soil quality

II Stage (In depth analysis)

1. Sampling soil: agricultural area, pasture, town
2. Sampling air: town, tailing ponds, pasture, agricultural area
3. Sampling water: stream (upstream and downstream), river (3 locations –upstream, next to the town and downstream), sediments
4. Bioaccumulation: fish, milk, meat (cattle), vegetables (agricultural field)

Consultant's Comments:

Obviously in an artificial setting, such as a workshop, there is not enough time to develop the rationale for particular aspects of the plans. However, there were many insightful suggestions put forward by the groups. Perhaps the most important feature of the plans which emerged was identified by Group 1 in its first two topics: 1) gathering existing data, 2) interviewing the population and relevant authorities. These efforts have been singled out here to emphasise the importance of pursuing inexpensive leads first as a way to save scarce monetary resources. A walk around the site with local residents and authorities can lead a trained observer to spot critical situations that will guide him towards further efforts. A few phone calls can uncover useful hints about a situation. And in searching for existing data, one can readily get a sense

of whether any useful information might be extracted (e.g., if water quality monitoring stations are located in, or near, the area of interest, one might rely on that data instead of ordering up new analyses). Group 3's stage I "Essential Information" seems to head in the same direction, although it was not stated as clearly.

The remaining activities, presented by Group 1, Group 2's list, and the in-depth plans of Group 3, are generally similar in that each of the complaints registered by the general public is addressed to some degree. The challenge, of course, comes in the placement of sampling locations, determining how many samples to take (for those not specifying a number), and whether or not the budget would cover all of the proposed analyses. I suspect that, at least in part, the lists have been strongly influenced by the disciplines represented in each group. The purpose of this exercise was to illustrate how quickly limited resources can vanish. For each component in the plan, there would come a time when a justification for each analyses would be requested. A useful habit to get into, is to work through such justifications in advance, gauging how confident one is about the justification, and considering modifications to the plan whilst emphasising the components which are most readily justifiable.

Summary

1. The first steps to be undertaken are:
    - » a reconnaissance walk-through to observe the various areas (tailings, waste piles, etc.);
    - » to talk to the residents about the issues they raise in an attempt to understand the gravity of the issues raised, (are the problems transitory or persistent?); and
    - » to acquire relevant existing information from the area (monitoring reports, medical reports, etc.).

2. Assuming that none of the complaints can be dismissed, to prepare a simplified work plan which includes:

    - » a clear statement of the goal of the work (to obtain field data that can confirm or dismiss linkages between contaminants and residents' complaints)

- to specify the number and location of samples to be collected and analysed (which will depend on the costs of personnel, equipment and supplies to collect the samples and the costs to analyse for contaminants)
  - Composite samples to be collected from tailings ponds - analytes to be metals and pH
  - Composite samples to be collected from waste piles (if all are of the same material, one composite of the three might suffice, but if resources permit, it would be preferable to obtain a composite from each of the three piles - analytes depend on suspected contaminants, based on observation of materials and from interviews/records of past activities)
  - Composite samples of water used by humans (either individual wells, cisterns, or community water sources) - analytes to be metals, pesticides, coliform bacteria, nitrite, and other contaminants of interest, inferred from observations and interviews
  - Composite samples of fish collected in rivers - analytes to be metals, pesticides, and other contaminants of interest inferred from observations and interviews
  - Composite samples from soils in pastures and fields - analytes to be metals, pesticides, and other contaminants of interest, inferred from observations and interviews

Observations regarding milk, eggs, livestock miscarriage and air quality might be addressed through interviews and general observations alone. Direct analyses could be deferred until after the scoping level analytical results have been evaluated.

II Group Work: Drafting Environmental Monitoring Plans for Hot Spots

The final workshop activity was to address environmental monitoring plans for three selected hot spots. The results of those efforts are summarised below.

Group 1: Bosnia and Herzegovina and UNATSCR 1244 Kosovo – Monitoring Programme for Artana / Novo Brdo Mine

- Tailing No. 1 approx. 300000 – 400000 tons
- Tailing No. 2 approx. 1.6 million tons

Completed work:

- Riverbed protection T1
- Riverbed protection T2
- Mine water treatment – passive treatment

Monitoring (Sampling programme):

- Water monitoring (Krivareka River): Analysis before remediation activities
  - Before the mine (pH, TDS, metals – Pb, Zn, Cd)
  - After T2
  - Mine waters
  - Close to settlements
  - Flow rate
  - Water quality
- Air monitoring: one point – direction of wind (Pb, Zn, Cd, SO2, TDP)
- Soil monitoring: erosion control, metals, pH
- Underground monitoring: piezometer around tailings, pH, metals

Group 2: Montenegro and Albania - Monitoring Programme for Mojkovac Mine

- Ground water (upstream and downstream)
- Regular visual inspections (stability of the dump) – annually or after a big storm
- Survey points for the dump (1-2 a year)
- Appropriate building codes
- Appropriate vegetation maintenance
- Introduction of a monitoring plan (Mojkovac incl.) from EPA to financing by the Government of Montenegro

Group 3: Serbia and FYR of Macedonia **-** Monitoring Programme for Bucim Mine

- Objective: comparison of ground, surface and drinking water quality, soil quality before and after project intervention
- Monitoring plan:
- Environmental monitoring:
  a. Ground, surface and drinking water quality at the same locations
  b. Soil quality, air monitoring (sing. particulate matters)
  c. Hydrobiological parameters according to guidance of the EU WFD (implemented in the national water law)
- Engineering monitoring
  a. Existing piezometers + geodetic beacons + instruments – annual measuring (auscultation)
  b. Conditionally, seismic stability, back stability analysis
- Human health monitoring
  a. Respiratory organs monitoring
  b. Metals (kidney tests)
  c. Mortality

Consultant's Comment:

As with the previous exercise, there really is not enough time to develop a detailed plan in the short span of a workshop session. Rather, the purpose for such break-out groups is to begin to apply some of the information learned during the workshop whilst it is still fresh. The hope, of course, is that with continued work, the features will become routine. In this particular activity, there appears to be a good opportunity to apply the core message that was delivered by Dr. Phillip Peck, not only to mine sites, but to any hot spot. The application of Dr. Peck`s message is reflected, in part, in the plan presented by Group 3, namely by considering some of the stability issues under the heading of Engineering Monitoring. Even if the objectives for monitoring are thought to be routine, there is merit in stating them again explicitly, with each new stage of a project. Often some objectives disappear if there is clear understanding that a risk has been mitigated. In other situations, the objectives may evolve with slightly different emphases. But most importantly, the persons and groups who make decisions on funding priorities will not know the specific objectives, concerns, and challenges for each site. The urgent need for modifying a cap to make it into an impervious roadway may not be obvious to someone outside of the immediate area or region—relevant informations, results of a field survey, are needed in order to make an informed decision.

The presentations by the hot spot managers and technical experts described the sites and the sampling efforts that have been done (or are planned) to characterise environmental concentrations of various chemicals. The group planning activity carried out near the end of the workshop summarised the continuing monitoring efforts. There are several useful steps that were described in the three instructional sessions that would help to develop more cohesive and focused monitoring plans. Some will consider the steps detailed below to be repetitious of work already completed, but recognise that many, if not most persons, who will determine whether the work should receive funding approval or who will ultimately use the information collected, may not be familiar with these details. Please note that the paragraphs in italics are comments and suggestions made by Dr. Larry Kapustka.

1. Clarify specific environmental management goals and objectives.

    a. Each of the hot spots was identified as such, based on some historical information. But what are the specific management goals and objectives that will be satisfied by sampling/monitoring efforts?

    b. What will the information be used for? Often, the initial sampling efforts are intended to determine if certain environmental media is hazardous (i.e., what is there and at what level of concentration). If there is sufficient reason to do more, then more detailed sampling is often done to characterise its nature (the types of chemicals including speciation of substances and the concentrations in various media) and its extent (where do the chemicals reside in three-dimensional space).

    c. Associated with the characterization of the nature and extent of chemicals, it is important to anticipate the types of management that might be triggered by the information. Will the most contaminated zones be excavated? Sequestered? Will institutional controls be established to minimise exposure to substances?

"My assessment, from presentations and the short planning session, is that the environmental management goals and objectives have not been captured explicitly. From my years of experience on similar projects, this is one of the main reasons that projects fail. "Everyone" assumes that they know why work is being carried out and what will happen when the data is reported—rarely are these assumptions correct. I urge each group to get the environmental management goals and objectives of their project in writing in planning documents. Specify the decisions that will be made. Identify the person or persons who will make these decisions. Find out if other affected stakeholders will have input into the decision process. And very importantly, recognise critical factors such as budget and timing as various milestones along the project. Refer to these often as plans are implemented"

2. Delineate the extent of the landscape/waterscape of interest to stakeholders

    a. The expanse of the area to be sampled initially and monitored subsequently is determined by the environmental setting and the interests of its stakeholders. Note that local residents may have different considerations and expectations from other stakeholders.

b. The determination of the area to be evaluated reflects both the management goals and the bio-geophysical characteristics of an area. Iterations through this step often occur as a conceptual model is developed and refined with newer information.

"Each of the projects have made a reasonable job of illustrating the spatial relationships with regard to hazardous materials and the airshed and watershed into their surroundings. I caution those involved to be prepared to expand or contract the area of focus as new insights arise. I have observed project areas expand by orders of magnitude and I have seen others contract to a very small percentage of the initial area of concern. Any changes in spatial extent should be documented with clear reasoning for the expansion or the contraction of the site."

3. Develop a Site-Specific **Conceptual Model**

a. The conceptual model is a depiction of the dominant and relevant pathways that connect the stressors (biological, chemical, or physical hazards) to the receptors of interest (including humans).

b. The conceptual model should inform all engaged in the project about the current and future location of hazards. Is there a plausible mechanism that moves the hazardous materials into surface water? Groundwater? Air? Biota?

"Again, based on the presentations and on the short planning session regarding the environmental management goals and objectives, none of the groups appear to have developed a good conceptual model of exposure pathways linking hazards to receptors. Some narratives were offered that formed the core of a conceptual model, but explicit depictions were not organised into a good conceptual framework. As with the management goals, project teams often assume they understand the setting. But the issues that cause a structural engineer to perk up are not the same issues that may worry an ecologist or water resource person. Take the time to reach an agreed conceptual model as discussed in the presentations."

4. Identify relevant chemicals of concern (CoC) and other stressors (physical and biotic)

"Each of the groups did a good job of identifying the relevant stressors, at least in terms of the starting point. A good conceptual image would be useful to consider

transformational changes in chemicals, especially as they move through different media and into biota".

5. Select assessment endpoints (values to be protected)

"As discussed in the presentations, it is crucial to identify specific entities, attributes, and locations of the values to be protected. Does groundwater meet drinking water standards? What is the structural integrity of dikes holding tailings?"

6. Define Data Quality Objectives

a. levels of precision and accuracy needed to evaluate relationships between stressors and receptor effects

b. requires iteration to consider what is measurable and with what level of certitude

"I sensed that this topic was new to most, if not all, of the participants. Thus, I am not surprised that the hastily developed plans in the workshop didn't consider the DQOs. To do so, one first needs to have stated the management goals and identified the assessment endpoints. If the goal is to have safe drinking water, then one can examine the relevant drinking water criteria, and from this determine the required precision and accuracy for the project. As discussed during the workshop, this is an important step to control costs whilst obtaining relevant data."

7. Describe analytical methods and measurement endpoints to be used

"This step can require several iterations of the process cycling though the DQOs, assessment endpoints, management goals, and conceptual models. Some parameters may have several analytical procedures available for consideration. As with several of the steps above, explicit details should be captured rather than leaving it to individuals to make assumptions. For example, many water quality parameters are based on filtered samples, others are based on unfiltered samples. For soils or sediments, there is a huge difference between concentrations reported on a dry weight basis versus a wet weight basis. Even if you and your project team are familiar with what you do, unless the details are presented with instructions to an analytical laboratory and are repeated in data tables and in reports, others will not know which is which. Indeed, within a few months, members of your project team are likely to have forgotten exactly what was done."

Whether devising an initial sampling effort or evaluating an existing monitoring plan, take the time to do detailed thought experiments.

- What would you lose in terms of critical information, if you had to get by with one less sampling station (due to budget limitations)?
- What would happen if you could only sample once per year, when you had thought you would sample three times per year?
- When will you know that you have sufficient data to recommend shifting to less monitoring, or to recommend stopping it altogether?
- What new information would cause you to request substantially more monitoring?
- Have you identified all of the critical parameters to be monitored?

Appendix A: Agenda of the Regional Training on Environmental Monitoring and Field Surveillance

AGENDA

Becici, Montenegro, 6th-7th of May 2009

Wednesday, 6th May

8:15 – 8:30	Registration of Participants	
08:30 – 08:35	Welcome and Introductions	Sanja Bojanic Regional Programme Manager
08:35 – 08:50	Introduction to Workshop and Training Objectives	Stewart Williams Chief Technical Advisor
08.50 – 10:00	Identification of Key Challenges for Practitioners/ Site Managers (group participation)	Dr Larry Kapustka International Consultant
10.00-11.00	Country/Territory Presentations - Part I (15 min presentations + 5 min Q&A, per presentation) 1. Albania; 2.FYR Macedonia; 3. Serbia	Practitioners from Regional Countries/Territories
11:00 – 11:30	Coffee Break	

11.30-13.00	Training Session 1: Environmental Monitoring Principles & Rationale	Dr Larry Kapustka International Consultant
13:00-14:30	Lunch Break	
14:30-15:30	Country/Territory Presentations - Part II (15 min presentations + 5 min Q&A, per presentation) 4. Montenegro; 5. UNATSCR 1244 Kosovo; 6. Bosnia & Herzegovina	Practitioners from Regional Countries/Territories
15:30-16:00	Coffee Break	
16:00-17:30	Training Session 2: Monitoring Techniques and Standards	Dr Larry Kapustka International Consultant
19:00	Dinner	

Thursday, 7th May

08:30 – 08:45	Gathering of Participants	
08:45 – 9.45	Country/Territory Hotspot Presentations - Part I (15 min presentations + 5 min Q&A, per presentation). 1. UNATSCR 1244 Kosovo; 2. Serbia; 3. Montenegro;	National Project Coordinators
9:45 – 11:15	Training Session 3: Applications and Implementation Strategies	Dr Larry Kapustka International Consultant
11:15 – 11:45	Coffee Break	
11:45 – 12:45	Country/Territory Hotspot Presentations - Part II (15 min presentations + 5 min Q&A, per presentation) 1. FYR Macedonia; 2. Bosnia & Herzegovina; 3. Albania	National Project Coodinators
12:45 – 14:15	Lunch Break	
14:15 – 15:00	Monitoring Needs for Abandoned Mining Sites – (Experiences from the UNEP/ADA Project in the Western Balkans)	Dr Phillip Peck UNEP Technical Advisor
15.00 – 16:30	Drafting Environmental Monitoring Plans for Hot Spots - (group participation)	Dr Larry Kapustka International Consultant

16:30 – 17:00	Coffee Break	
17.00-17.25	Workshop Evaluation	Stewart Williams Chief Technical Advisor
17:25-17:30	Workshop Closure	Stewart Williams Chief Technical Advisor
19:00	Dinner	

Appendix B: Presentation Given by Dr. Philip Peck, UNEP Technical Advisor

Monitoring Needs for Abandoned Mining Sites with experience and examples from the UNEP/ADA Project in the Western Balkans

This presentation was to introduce:

- Mine legacy problems around the world and in the Western Balkans
- Systematising mine legacy risks
- Identifying monitoring needs for orphaned or abandoned mine sites or mine facilities. The primary focus is sites that have been abandoned

The central principle of the presentation was "**A mine is a waste management project** – whatever earnings remain after paying for waste management is the real profit of the operation". In the introductory part, Mr. Peck gave a brief overview of mining environmental evolution and general information on mine site monitoring.

The main issues that were addressed in the presentation were ways in which abandoned mine sites are polluting the environment and negatively impacting on human health, what are the exposure pathways that link abandoned mining sites with closely located inhabitations/cities/ villages and their populations, followed by showcases from the region and from the USA and Canada.

Abandoned mine sites have a negative impact on the environment due to the generation of and occurrence of mine waste and contaminated soil, mine drainage to surface water, the pollution of irrigation water and sediment contamination. Special attention is given to multiple releases of tailings and examples of cross-boundary waterway pollution in some abandoned mine sites in SEE. In his presentation, Mr. Peck also addressed the risks associated with abandoned mine tailings (compromised structural stability of the tailings,

inappropriate disposal of tailings) and abandoned mine facilities, followed by showcases of hazardous situations that occurred in Europe, the USA and Canada. More information was provided on environmental issues and health safety issues. A special emphasis was placed on the importance of an environmental monitoring plan, the requirements of a monitoring plan, how to develop one and what should be taken into consideration when designing a monitoring plan.

Appendix C: E-Learning Modules

There are a number of related training activities supported by various of the member organisations of the Inter-Organisation Programme for the Sound Management of Chemicals (IOMC):

1. The United Nations Institute for Training and Research (www.unitar.org/chemicals-and-waste-management-at-unitar) provides a wide range of publications and a calendar of events related to managing chemicals. UNITAR has developed e-Learning modules www.unitar.org/e-learning) on international law, diplomacy, and governance, relevant to the management of chemicals in the environment. UNITAR also maintains a virtual library on CD-Roms on key topics and global thematic workshops. Guidance and training materials used in over 100 countries are currently being updated.

2. The United Nations Industrial Development Organization (UNIDO) supports a number of e-Learning modules at www.unido.org/index.php?id=5157.

3. The Organization for Economic Cooperation and Development (OECD) has information on multiple aspects of chemical hazards and risk assessment (http://www.oecd.org/department/0,3355,en_2649_34373_1_1_1_1_1,00.html)

4. The US EPA maintains a site (CLU-IN, launched in 1996) that focuses on training and technology, related to many aspects of chemical management. The Hazardous Waste Clean-Up Information (CLU-IN) Web Site (http://www.clu-in.org) provides information about innovative treatment and site characterisation technology relevant to the hazardous waste remediation community. It describes programmes, organisations, publications, and other tools for federal and state personnel, consulting engineers, technology developers and vendors, remediation contractors, researchers, community groups, and individual citizens. The site was developed by US EPA, but is intended as a forum for all waste remediation stakeholders.

CLU-IN has a calendar of EPA training courses, notices of upcoming meetings, files for downloading, forthcoming internet seminars, training exchange opportunities, conferences, and a host of archived seminars and webcasts. These may be viewed on line or saved and viewed as PowerPoint files. Many of the files have embedded audio files, allowing the user to listen to the materials, just as in a classroom setting.

The "Database" and the "Software and Tools" offer access to many downloadable files pertinent to the characterisation and management of hazardous wastes. Some of the databases and tools are tailored to address legislation in the US, but most are suitable for use under any jurisdiction.

A modeling tool EPI Suite™ v4.00 uses a suite of physical/chemical properties and environmental fate estimation models to estimate the exposure of receptors to chemicals. This tool is intended for use in chemical screening, especially when empirical data is not available. Go to http://www.epa.gov/opptintr/exposure/pubs/episuite.htm for a free download and other information regarding EPI Suite v4.00, which can be operated in Windows®, Windows NT®, Windows XP/XP Professional®, or Windows Vista®.

Appendix D: Annotated List: Selected Text Books Ecotoxicology/Environmental Toxicology

Chapman PM, Adams WJ. 2006. Assessing the Hazard of Metals and Inorganic Metal Substances in Aquatic and Terrestrial Systems. SETAC Press.

Are persistence, bioaccumulation, and toxicity adequate and appropriate criteria for determining the hazard posed by metals and inorganic metal substances entering the environment? If not, what is a reasonable and scientifically-defensible alternative? This overriding question brought together 47 scientists, managers, and policymakers from 7 countries for a Pellston Workshop, convened by the Society of Environmental Toxicology and Chemistry (SETAC) in Pensacola, Florida, USA. They, in fact, found that the individual PBT criteria are limited in their ability to assess hazards for metals and inorganic metal substances. They recommended, instead, that a critical load modelling approach, termed the "Unit World Model" (UWM), which integrates appropriate components of PBT into a consolidated framework, be used. Details of the UWM, applicable to both aquatic and terrestrial environments, are provided herein.

Klečka G, Boethling B, Franklin J, Grady L, Graham D, Howard PH, Kannan K, Larson RJ, Mackay D, Muir D, van de Meent D. 2000. Evaluation of Persistence and Long-Range Transport of Organic Chemicals in the Environment. SETAC Press.

Persistent organic pollutants (POPs) are bio-accumulative, toxic organic compounds of natural or anthropogenic origin that resist photolytic, chemical, & biological degradation. They have low water solubility & high lipid solubility, resulting in bioaccumulation in fatty tissues of living organisms. POPs may be transported in the environment at low concentrations by movement of fresh and marine waters. Because of their semi-volatility, POPs can also be transported long distances in the atmosphere, resulting in widespread distribution around the earth, including regions where they were never produced or used. Thus, both humans and ecosystems may be exposed.

Solomon KR, Brock TCM, De Zwart D, Dyer S, Posthuma L, Richards S. 2008. Extrapolation Practice for Eco-toxicological Effect Characterization of Chemicals. SETAC Press.

A wide-ranging compilation of techniques, Extrapolation Practice for Eco-toxicological Effect Characterization of Chemicals describes methods of extrapolation in the framework of ecological risk assessment. The book identifies data needs and situations where these extrapolations can be most usefully applied, making it a practical guide to the application of extrapolation procedures. It focuses on the extrapolation of chemical effects and covers the extrapolation of exposures in the context of interactions between toxicants and the matrix.

Williams RT. 2005. Human Pharmaceuticals: Assessing the Impacts on Aquatic Ecosystems. SETAC Press.

Are human pharmaceuticals affecting aquatic ecosystems? Does the increasing detection of pharmaceuticals in surface waters justify the increasing concerns about the impacts of ongoing exposure? Are the existing environmental science and data appropriate for answering key questions about such bioactive chemicals? The answers to these and related questions prompted respected scientists from academia, government, and business to produce Human Pharmaceuticals: Assessing the Impacts on Aquatic Ecosystems. Beginning with a workshop and ending with months of discussion and revision, this eminent group evaluated the adequacy of existing risk assessment science as applied to pharmaceuticals; developed research recommendations to address identified shortcomings; identified sources of human pharmaceuticals in the environment; summarised data from detections worldwide; examined the characteristics of bioactivity; and discussed the complexity and far-reaching implications for risk management.

Dubreuil A. 2005. Life-Cycle Assessment of Metals: Issues and Research Directions. SETAC Press.

In order to create a bridge between life-cycle assessment experts and scientific and technology experts in metals, Natural Resources Canada co-organised with the International Council on Mining and Metals a workshop on LCA and metals. The 2002 Montréal workshop was sponsored by the United Nations Environment Programme, the Society of Environmental Toxicology and Chemistry, and the Asia-Pacific Economic Cooperation Expert Group on

Minerals and Energy Exploration and Development. Sixty experts from 17 countries participated, including representatives of the steel and aluminum sectors. Information on the mining, production, use, and disposal of metals was compared with existing LCA methodologies in order to evaluate gaps and enhance relevancy, and a short list of recommendations was captured under four themes: life-cycle inventory, metal mining, human and environmental toxicity of metals, and LCA and developing countries. Some of the recommendations have been incorporated into the UNEP/SETAC Life-Cycle Initiative.

Walker JD. 2004. Quantitative Structure–Activity Relationships for Pollution Prevention, Toxicity Screening, Risk Assessment, and Web Applications. SETAC Press.

From the first chapter for new practitioners to the last chapter for QSAR developers and users, this book presents a wide spectrum of current practices related to the regulatory acceptance of QSARs. A unique chapter features hundreds of references from journal publications, book chapters, and documents published in the last 25 years, giving a rich overview of QSARs' role in promoting pollution prevention, implementing toxicity screening, conducting risk assessments, and employing Web applications.

Whole Effluent Toxicity CD-ROM. SETAC Press.

Offers more than 80 easily searchable state and federal manuals, sources of technical information and guidance on whole effluent toxicity (WET) testing and methods, toxicity reduction, and implementation of aquatic toxicity regulations. Representative of the current status and historical contribution of WET, the CD is a valuable laboratory tool.

Calow P. 1997. Handbook of Ecotoxicology. Blackwell Science.

This book combines two-volumes that had been published separately. The first volume contains 22 chapters describing approaches and methods for obtaining ecotoxicity information for freshwater, marine, and terrestrial systems. The second volume addresses risk management decision making that pertains to different hazardous substances.

Clements WH, Newman MC. 2002. *Community Eco-toxicology*. John Wiley & Sons, Ltd. ISBN: 9780471495192

Also available as: Clements W, Newman MC. 2008. *Community Ecotoxicology eBook*. John Wiley & Sons, Ltd. ISBN: 9780470855140 Communities consist of overlapping populations that interact in time and space. Ecological effects of contaminants may occur at several levels of biological organisation, from individuals to the entire biosphere. Because the impact of contaminants on one population will influence other species within the community, accurate predictions and assessments can be made only by considering the entire system. This is the first book dedicated to community ecotoxicology - the study of the effects of contaminants and other stressors on species abundance, diversity and interactions. Community Ecotoxicology is the second book in the Hierarchical Ecotoxicology Series, which is designed to bridge the gap between general ecotoxicology textbooks and highly specialised books. Each book in the series focuses on one level of biological organisation, highlighting key concepts and defining important connections between levels of organisation. Identification and discussion of ecotoxicological paradigms form the backbone of each book. Community Ecotoxicology is written for all ecotoxicologists, environmental consultants and environmental scientists. It is a good supplementary text for postgraduates and undergraduates studying ecotoxicology, ecology and environmental science.

Hopkin SP. 2001. Principles of Ecotoxicology, Second Edition. Taylor & Francis Books Ltd.

This text identifies the major classes of pollutants and their environmental fate before moving on to consider the effects that they might have on individual organisms and on ecosystems. There is a progression from the molecular basis of pollutant toxicity to consequent effects at higher levels of organization - cellular whole-organism population community and ecosystem. This second edition contains new data on topical subjects such as organochloride pesticides endocrine disrupters aquatic toxicity industrial waste and ecotoxicity testing. The multidisciplinary nature of the first edition remains combining the disciplines of chemistry biochemistry toxicology physiology population ecology and population genetics.

Landis WG, Yu M-H. 2004. Introduction to Environmental Toxicology: Impacts of Chemicals Upon Ecological Systems, Third Edition. CRC Press.

The rapidly evolving field of environmental toxicology involves the study of toxic compounds and their effect on living organisms, as well as their fate within the natural environment. Since publication of the first edition, Introduction to Environmental Toxicology has found a secure place among the major texts and references in this field. Introduction to Environmental Toxicology, Third Edition seamlessly covers processes and impacts from the molecular level all the way up to population levels. While retaining the strengths of previous editions, the third edition includes a new chapter on fluoride, an update on endocrine disruption, a discussion of the use of models to reconstruct concentration-response curves, expansion of the metals chapter, and new developments in ecological risk assessment for management decisions at site to regional scales. It is an ideal text for introducing students to the fields of ecotoxicology and risk assessment.

Newman MC, Clements WH. 2007. Ecotoxicology: A Comprehensive Treatment. CRC Press.

This book focuses on integrating ecotoxicological concepts across a range of hierarchical levels. While providing the detail and practical application of concepts often found in more specialized books this work synthesises the best qualities of a general textbook and the narrower, more specific scope of a technical reference. The authors create a volume flexible enough to cover a variety of instructional vantages and thorough enough to engender a respect for the importance of understanding and integrating concepts from all levels of biological organisation. Divided into six sections, the book builds progressively from the bio-molecular level toward a discussion of effects on the global biosphere. It begins with the fundamentals of hierarchical ecotoxicology and vantages for exploring ecotoxicological issues. The second section introduces organismal ecotoxicology and examines effects to biochemicals, cells, organs, organ systems, and whole organisms, and bioaccumulation and bioavailability of contaminants. Population ecotoxicology, section three, places the discussion in the larger context of entire populations by analysing epidemiology, population dynamics, demographics, genetics, and natural

selection. Section four encompasses issues of community ecotoxicology. This section presents biotic and abiotic factors influencing communities, biomonitoring and community response, and the application of multimetric and multivariate approaches. Section five evaluates the entire ecosystem by describing assessment approaches, identifying patterns, analysing relationships between species, and reviewing the effects of global atmospheric stressors. A detailed conclusion integrating the concepts discussed and promoting a balanced assessment of the overarching paradigms rounds out the coverage in section six.

Newman MC, Unger MA. 2002. Fundamentals of Ecotoxicology, Second Edition. Lewis Publishers

Presents a treatment of ecotoxicology ranging from molecular to global perspectives. This book focuses on lower levels of organisation and extends their discussion to include landscape, regional, and biospheric topics, imparting a perspective as broad as the problems facing practicing professionals.

Newman MC. 2001. Population Ecotoxicology. John Wiley & Son. ISBN: 9780471988182

This text for ecotoxicologists, environmental consultants, and environmental scientists, explores the science of contaminants in the biosphere and toxicant effects on populations. Topics covered include: The population context for ecotoxicology Epidemiology of non-infectious disease in populations, Population dynamics and demography, Translating individual effects to population effects using energy allocation theory and phenotypic plasticity Toxicant-related natural selection The effect of toxicants on the genetic qualities of populations The Hierarchical Ecotoxicology Series is a sequence of five books designed to bridge a widening gap between general ecotoxicology textbooks and highly specialised books. Each book in the series focuses on one level of biological organisation at a time, highlighting key concepts and defining important connections between levels of organisation. Identification and discussion of ecotoxicological paradigms form the backbone of each book.

Van Leeuwen CJ, Vermeire TG. 2007. Risk Assessment of Chemicals: An Introduction, Second Edition. Springer

This book is the 2nd edition of a book published in 1995. The first book was written parallel to major developments in the science of risk assessment

following the introduction of EU-legislation on industrial chemicals in the period 1970-1995. The present edition reflects the progress and experience since 1995 and again aims at providing background and training material for a new generation of risk assessors, specifically for those who will be involved in implementing legislation in the EU (REACH, the new legislative framework for industrial chemicals) and, in addition, the USA, Japan and Canada. The book is an introduction to risk assessment of chemicals and contains basic background information on sources, emissions, distribution and fate processes for the estimation of exposure of plant and animal species in the environment and humans exposed via the environment, consumer products, and at the workplace. This book includes chapters on environmental chemistry, toxicology and ecotoxicology as well as information on data requirements, data estimation methodologies and intelligent testing strategies. It describes the basic principles and methods of risk assessment in the legislative frameworks of the EU, USA, Japan, and Canada. It also provides an overview of the OECD Chemicals Program. The book is intended to be used by those who are involved in risk assessment of chemicals in government, research institutes, academia and industry as well as by students in technology, health and environmental sciences.

Walker CH, Hopkin SP, Sibly RM, Peakall DB. 2005. Principles of Ecotoxicology, Third Edition. CRC Press ISBN: 9780849336355

Presenting a multidisciplinary perspective in a concise format, Principles of Ecotoxicology, Third Edition discusses the fundamental chemical and ecological nature of pollution processes while identifying the major classes of pollutants and their environmental fate. The first edition was originally created to fill the need for a textbook that covered the basic principles of a developing and wide-ranging field and the second edition expanded on that theme. Keeping the focus on principles over practice that has made each incarnation of this textbook so popular, the third edition brings the text up to date and strengthens coverage in areas that have come to the forefront of the field. The third edition features new material on pollutants that are receiving closer scrutiny, naturally occurring poisons, the history of chemical warfare, population risk assessment, community structure, neonicotinoids, endocrine disruption, and neurotoxicity. A new section on extrapolating from molecular interaction to the consequent population changes highlights the molecules to ecosystem approach and provides the groundwork for discussions on the

employment of biomarker strategies in field studies. A major theme of the new material is how the concepts discussed can contribute to improved methods of environmental risk assessment. With updates to every chapter, this text provides essential information for students in easy to use and understandable format.

Designation: E 1689 – 95 (Reapproved 2008) Standard Guide for Developing Conceptual Site Models for Contaminated Sites1

1. Scope 1.1 This guide is intended to assist in the development of conceptual site models to be used for the following: (*1*) integration of technical information from various sources, (*2*) support the selection of sample locations for establishing background concentrations of substances, (*3*) identify data needs and guide data collection activities, and (*4*) evaluate the risk to human health and the environment posed by a contaminated site. This guide generally describes the major components of conceptual site models, provides an outline for developing models, and presents an example of the parts of a model. This guide does not provide a detailed description of a site-specific conceptual site model because conditions at contaminated sites can vary greatly from one site to another.

Appendix E: Relevant Websites

- ASTM-I (Standards): www.astm.org
- Basel Convention: http://www.basel.int/
- DQO Training: http://epa.gov/quality//trcourse.html#intro_dqos
- European Chemicals Agency: http://ec.europa.eu/echa/home_en.html
- European Chemicals Bureau: http://ecb.jrc.it/reach/
- European Commission http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm
- Helpdesks EU Member States: http://www.reachright.ie
  - http://ec.europa.eu/enterprise/reach/index_en.htm
  - http://ecb.jrc.it/DOCUMENTS/REACH/REACH_in_brief_0207.pdf
  - http://www.epa.gov/nerleerd/stat2.htm
  - http://www.library.uiuc.edu/envi/toxigateway.htm
  - http://www.senternovem.nl/reach
- International Labour Organization: http://www.ilo.org/public/english/protection/safework/cis/products/safetytm/c170.htm
- Montreal Protocol: http://ozone.unep.org/Publications/MP_Handbook/Section_1.1_The_Montreal_Protocol/ and http://www.epa.gov/ozone/science/ods/classone.html
- Rotterdam Convention: http://www.pic.int/home.php?type=s&id=7
- SAICM: http://www.saicm.org/index.php?ql=h&content=home
- Stockholm Convention: http://chm.pops.int/
- US EPA on DQOs: http://epa.gov/quality/dqos.html
- US EPA on Hazardous Waste Cleanup and Training: http://www.clu-in.org
- US EPA on Risk Assessment: http://www.gov/oswer/riskassessment
- On-line Resource Locator of Topics Related to Eco-toxicology can be found at http://www.library.uiuc.edu/envi/toxigateway.htm

Appendix F: Guidance material on techniques and methods for field sampling of water, air, soil and sediment

There are a number of documents available on websites that provide guidance for designing sampling strategies at contaminated sites. The advantage of accessing government sites is that generally there are no copyright concerns to deal with, it is acceptable to just cite the sources when used. The disadvantage, for some, is that there is not a mechanism to provide regular updates of the materials. Consensus based standards such as those from ASTM-International have required reviews and updates.

The Ontario Guidance for Sampling Contaminated Sites (a 1996 publication) presents a thorough treatment of sampling issues. The full document will be sent separately as a PDF. In addition, I will be sending PDFs of guidance documents pertaining to sampling air, water, groundwater, soil, and sediments.

The following Health Canada website provides free-access information on a number of relevant topics, including air quality, contaminated sites, health assessment, water quality, and the engagement of stakeholders. Each of the side panels takes the user to topic specific information. For example, http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php provides information on water quality. In the list of references (shown partially in the screenshot below) are a number of links to documents from Canada and the US EPA.

A number of states, provinces, and countries have guidance for sampling sediments:

a. http://www.evergladesplan.org/pm/recover/recover_docs/qasr/qasr_sec_07_2006.pdf
b. http://www.epa.state.oh.us/dsw/guidance/sedman2001.pdf
c. http://www.epa.gov/glnpo/arcs/EPA-905-B94-002/B94002-ch3.html
d. http://www.epa.gov/region09/qa/fieldsamp.html

Standards: The home page for ASTM-International (www.astm.org) has a link to standards at the top of the left panel. In addition to standards, there is a link to training courses for selected methods that are offered periodically on WebEx. This standards link takes one to a page (screenshot below) with a search capability for key words or browsing categories. Browse "Environmental Toxicology" yields 244 standards, including those that I identified by the alphanumeric code in the workshop presentation on toxicity test methods; "environmental assessment yields 47 standards (second screenshot below). Note that the site also links to ISO and UOP standards. Though these standards have charges (generally about US$25 per standard), please note that membership (US$75) provides the member with free downloads of standards from a particular volume.

Appendix G: Selected Reference Materials

In addition to the annotated reference list provided with the initial draft of the workbook, the following books and articles provide overviews and some case studies of contaminated sites.

- ASTM-I. 2009. E-1689 Standard Guide for Developing Conceptual Site Models for Contaminated Sites. *Annual Book of Standards*. American Society for Testing and Materials-International, Conshohocken, Pennsylvania USA
- ASTM-I. 2009. E2348 Standard Guide for Framework for a Consensus-based Environmental Decision-making Process. . *Annual Book of Standards*. American Society for Testing and Materials-International, Conshohocken, Pennsylvania USA
- Bailer AJ, OrisJT. 1997. Estimating Inhibition Concentrations for Different Response Scales Using Generalized Linear Models. *Environ Toxicol Chem*16:15554-1559.
- Barnthouse L. 2008. The Strengths of the Ecological Risk Assessment Process: Linking Science to Decision Making. . *Integrated Environ. Assess. Management* 4:299-305.
- Chapman PM, Caldwell RS, Chapman PF. 1996. A Warning: NOECs are Inappropriate for Regulatory Use. *Environ Toxicol Chem*15:77-79.
- Chapman PM, Dexter RN, Long ER. 1987. Synoptic Measures of Sediment Contamination, Toxicity, and Infaunalcommunity Structure (the Sediment Quality Triad) in San Francisco Bay. *Mar. Ecol. Prog. Ser.*37:75-96.
- Chapman PM, Power EA, Burton GA. 1992. Integrative Assessments in Aquatic Ecosystems in Burton GA ed. *Sediment Toxicity Assessment*, Lewis Publishers, Chelsea, MI pp 313-340.
- Cormier SM. 2008. A Synopsis of Immediate and Deliberative Environmental Assessments. pp. 21-29 in Linkov I, Ferguson E, Magar VS. (eds) *Real-time and Deliberative Decision Making*. Springer, The Netherlands. 456 pp.

» Dale VH, Biddinger GR, Newman MC et al. 2008. Enhancing the Ecological Risk Assessment Process. *Integrated Environ. Assess. Management* 4:306-313.

» De RuiterPC, NeutelA-M, & Moore JC. 1995. Energetics, Patterns of Interaction Strengths, and Stability in Real Ecosystems. Science 269:1257–1260

» Environment Canada. 2005. *Guidance Document on Statistical Methods for Environmental Toxicity Tests*. Report EPS 1/RM/46—March. Methods Development and Applications Section, Environmental Toxicology Centre, Ottawa

» Hoekstra JA, Van EwijkPH. 1993. Alternatives of the NOEL. *Environ Toxicol Chem*12: 187–194.

» Kapustka L, McCormick R, Froese K. 2008. Social and Ecological Challenges within the Realm of Environmental Security. pp 203 –211 in Linkov I, Ferguson E, Magar VS. (eds) *Real-time and Deliberative Decision Making*. Springer, The Netherlands. 456 pp.

» Kapustka LA, Karandinos M, Goncharova N. 2006. Methods and Tools in Ecotoxicology and Ecological Risk Assessment: Working Group Report pp 371-378 in Arapis G, Goncharova N (eds.) *Ecotoxicology, Ecological Risk Assessment, and Multiple Stressors.* Kluwer Press, The Netherlands.

» Kapustka LA. 2006. *Current Developments in Ecotoxicology and Ecological Risk Assessment*, pp 3-24 in Arapis G, Goncharova N (eds.) *Ecotoxicology, Ecological Risk Assessment, and Multiple Stressors.* Kluwer Press, The Netherlands.

» Kapustka L. 2008. Limitations of the Current Practices used to Perform Ecological Risk Assessment. *Integrated Environ. Assess. Management* 4:290-298.

» Kapustka L. 2002. Natural Resources Injury Report on Riparian and Upland Areas of the National Park Service –Grant-KohrsRanch National Historic Site, Clark Fork River, Montana. US Department of Interior, National Park Service.

» Kiker GA, Bridges TS, Varghese A, Seager TP, Linkov I. 2005. Application of MulticriteriaDecision Analyses in Environmental Decisions Making. *Integr. Environ. Assess. Manag. 1:95-108.*

» KluwerPress, The Netherlands. Kapustka L. 2008. Limitations of the Current Practices used to Perform Ecological Risk Assessment. *Integrated Environ. Assess. Management* 4:290-298.

» Laskowski R. 1995. Some Good Reasons to Ban the Use of NOEC, LOEC and Related Concepts in Ecotoxicology. *Oikos*73:140-144.

» Linkov I, SatterstromFK, KikerGA, Bridges TS, Benjamin SL, BelluckDA. 2006. From Optimization to Adaptation: Shifting Paradigms in Environmental Management and their Application to Remedial Decisions. *Integr. Environ. Assess. Manag. 2:92-98.*

» Maltezou SP, Biswas AK, Sutter H (Eds). 1987. *Hazardous Waste Management*. United Nations Industrial Development Organization and International Association for Clean Technology, TYCOOLY, London and New York.

» OECD (Organization for Economic Cooperation and Development). 1998. *OECD Series on Testing and Assessment Number 10: Report of the OECD Workshop on Statistical Analysis of Aquatic Toxicity Data.*ENV/MC/CHEM(98)18. Environmental Health and Safety Publications, Paris, France.

» Pimm SL, Lawton JH, Cohen JE. 1991. Food Web Patterns and their Consequences. Nature 350:669-674 6-7

» Posthuma L, Suter GW, Traas TP. 2002. *Species Sensitivity Distributions in Ecotoxicology*. Lewis Publishers.

» Suter GW, Efroymson RA, Sample BE, Jones DA. 2000. *Ecological Risk Assessment for Contaminated Sites*. Lewis Press, Boca Raton, FL

» Suter GW. 2008. Ecological Risk Assessment in the United States Environmental Protection Agency: A Historical Overview. *Integrated Environ. Assess. Management* 4:285-289.

» UNEP. 2006. Strategic Approach to International Chemical Management. United Nations Environment Programme, Geneva

» US Presidential/Congressional Commission on Risk Assessment and Risk Management. 1997. Final Report, Volumes 1 and 2, Washington, DC.

» Van Leeuwen, C.J. 2007. Introduction. In: Risk Assessment of Chemicals. In: *Risk Assessment of Chemicals. An Introduction (2nd edition)*. Van Leeuwen, C.J. and T.G. Vermeire, eds. Springer Publishers, Dordrecht, The Netherlands, pp 1-36.

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