PERFORMANCE MONITORING WORKSHOP

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GOALS The purpose of this workshop was to exchange ideas and to learn about monitoring tools available.

What is performance monitoring?

Basically this means measuring in some way what impact the development has on the environment.

This monitoring is done for many reasons and to achieve several objectives including:

- to ensure compliance with all applicable regulations,
- to demonstrate due diligence,
- to validate predictions made about design performance, environmental impact assessments, and modelling results,
- to identify any new environmental concerns that were not predicted,
- to ensure that objectives are being met (eg. decommissioning),
- to feed back information to the operation so that they can react to problems should they arise,
- to measure the functioning status of the ecosystem, such as deterioration or recovery,
- to determine when closure has been reached.

How does performance monitoring relate to:

- **EIA**
  - can check on EIA predictions,
  - can look at incremental impact of new development in relation to existing impacts for a number of industries in an area (= cumulative impacts),
  - can demonstrate due diligence by identifying problems in the beginning and then taking action to minimize or prevent them (= proactive),
  - can identify potential contaminant groups,
  - can identify areas of the affected environment where contaminants accumulate,
  - can identify sensitive habitats.

- **Compliance**
  - there are several distinctly different categories of performance monitoring relating to compliance; there is monitoring relating to compliance with regulated limits, monitoring related to action levels, and monitoring related to ambient environment quality guidelines,
  - quality assurance and control (QA/QC) is essential for this type of monitoring,
  - compliance monitoring may reveal a problem that requires further investigation and more sophisticated techniques (eg. Toxicity Identification Evaluation),
  - compliance monitoring provides essential information on the ongoing impact of the development. This information is used by the company to assess and make decisions, and take action in regards to the development. The information is used by government and the public to check on the ongoing impact of the development.

- **Environmental Management**
  - monitoring provides essential feedback to operation's personnel, enabling them to identify problems at an early stage and to take corrective action,
  - the success of a monitoring program as it relates to environmental management depends to large extent on having major stakeholder's input and involvement (eg. CEO, public, local landowners, Indian bands, etc.)

What are some important issues related to performance monitoring?

Numerous issues were identified by the group including:

- what is it we are really looking for when we monitor the ambient environment?
- if we measure an impact, what is the cause and is it due to the development or some other factor?
- what do we compare our monitoring results to when evaluating these data?
- how do we compare data collected 20 years ago with that collected today, knowing that sampling and analytical methods and accuracy have changed?
- how do we measure with any confidence and what judgements should we make on chemical levels measured at the parts per trillion or quadrillion range?
- should we be monitoring concentrations or loadings of contaminants?

- what proportion of short term (= relative) versus long term (= cumulative) monitoring should we do?
- just how far do we go with our quality assurance programs?
- how many samples do we collect and how much money should we be spending on monitoring?
- how is the monitoring data perceived, who gets it, and how is it used?
- how long must we monitor for?
- what is the rationale for the monitoring that is done and for the limits, action levels, and guidelines to which the monitoring information is compared?
- how do we design on overall program that will include all the elements?
- how do we deal with environmental components and sampling media that are difficult to sample in a representative way (eg. soil of sediment) or that show naturally high variability (eg. fish)?
- what monitoring will be required in the future as a result of discovery of new problems and/or changes in government regulations.
- are monitoring programs inclusive and flexible enough to do the job we want them to do?
- what are the zones of impact, mixing zones, and accumulation zones?

Discussion of selected issues related to performance monitoring

The group selected five of the above listed issues to discuss in individual discussion groups. The issues and major points of discussion are outlined below.

- How much money should be spent on monitoring and how should cost-effectiveness be determined?
  - the EIS should be the basis for determining what needs to be done,
  - more or less monitoring may be done as a result of corporate policy (ie: pro-active companies may wish to do more, reactive companies less),
  - the government may require more monitoring to build its data base; should companies fund baseline work?
  - there may be additional costs related to neighbour complaints, even though compliance with regulations has been met; therefore, community consultation is important,
  - routine monitoring may uncover problems that were not foreseen that require additional investigation and expenditure; therefore, there should be contingency planning,

- monitoring costs can be reduced through periodic reviews, rationalization, prioritization and scheduling of "big ticket" items over several years, and by making use of in-house expertise rather than consultants,
- goal should be to focus monitoring on parameters that are the most meaningful/relevant to the ultimate goal of protecting ecological integrity.

- Quality Assurance/Quality Control(QA/QC) - How do you choose a lab in the first place, or if you aren't happy with your present lab, what do you do? The group concluded that you should take the following steps:
  - choose three labs who are accredited (e.g. CAEL, ISO or by peer group) for further investigation,
  - send each lab typical samples for analysis of selected parameters,
  - send each lab blanks, duplicates and spiked samples for analysis,
  - identify a contact person in the laboratories for future communications,
  - visit their facilities and talk to each of them about their suitability for specific work you have and their QA/QC program,
  - based on the above investigation choose two labs, one as a main, the other as a contingency backup.

- What do you look at when looking at a QA/QC program for sampling?
  - have a clear objective,
  - take appropriate number of samples,
  - choose sampling locations appropriate to your objective,
  - ensure that the sampler is trained in using the proper sampling methods,
  - use "standard" procedures,
  - do regular audits of sampling procedures,
  - establish a chain of custody for all samples from the time they are collected until they are analyzed.
  - develop a contingency plan for re-sampling or reanalyzing should anomalous results occur.

- What is the rationale for limits?
  - there is a need for limits (and guidelines) based on site specifics in addition to those based on regional/global bases,

- look at regional limits but develop site specific limits whenever possible,
- we need more baseline information for areas that are being developed so that we can develop site-specific limits,
- we need to do conduct periodic reviews of monitoring data and limits to refocus monitoring efforts
- limits will change as further technological advances are made and as further research is completed (eg. toxicology),
- public opinion often influences reaction to monitoring data (eg. even though a limit is not exceeded the public may still lobby for action to be taken),
- there appears to be no clear approach to air quality limits (eg. some jurisdictions use ambient limits, others use individual source or overall facility source limits).

▸ Due Diligence

- it was the group's opinion that risk assessment was the best tool to assess liabilities,
- risk assessment and due diligence are highly specialized topics that require involvement by experts in these areas,
- there are currently methodologies available that can be used for risk assessment (see Canadian Standards Association, CCME),
- it needs to be recognized that there are existing versus residual liabilities,
- industry, government, and the public share residual liability even though it is not always recognized as such. Eventually a decision has to be made that an endpoint has been reached in terms of closure and decommissioning. This decision is made by regulations but there is usually an ongoing residual risk that is accepted as part of this decision.
- there are numerous methods and mechanisms for financial assurance available.

▸ Ecological Integrity

Ecological Integrity is a worthwhile approach to measuring performance (we focussed on reclamation - and what is walk away situation particularly those with hazardous sites). Raised consultation, no answers, but

- difficult to define,
- will vary from land use to land use,
- will vary from mine to mine,
- time is a critical element which should be reflected in definition,

- in reclamation bonding.

- **Biodiversity** - should be defined in practical terms. Difficulties in using this concept were noted.

- **Aspect of time** - to what degree is this linked with reclamation bonding.

- "State of dynamic equilibrium" is more realistic than striving for stability. Taking account of how natural processes work.

- Recognizes that erosion is part of natural landscape.

- Human activity should be accepted as part of ecological integrity. Our ability to manage environmental liabilities may be one measure of ecological integrity. (Question: Should mines be held accountable to a different standard).

- Time frame is a critical part of ecological integrity. Over several generations or more society may have to deal with long term liabilities.

- We need more information on functioning of natural ecosystems. Selecting key indicators is perhaps best way of defining ecological integrity
  - e.g. biomass, growth, reproductive success,
  - what are early warning signals for loss of integrity? (need more research)

Reclaim Signoff

Definitive acceptance limits may not be feasible; so we may have to rely on models.

- Agreement that an approach should not be limited by an engineering focus, but draw on life scenarios.
- if ecological integrity is worthwhile it should give us ability to define where we will be at a certain point in time. Mining needs a practical endpoint or signoff for mining companies and society to proceed/move on.
- while possibility of trust fund was raised to deal with perpetual care such as tailing ponds, funds are best retained by companies with responsibility to pay down liabilities on an ongoing basis.

Environmental Effects Monitoring and the Mining Industry

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What is EEM?

- A requirement under the federal Fisheries Act which calls for a sequential series of monitoring and interpretation cycles with the goal of identifying the magnitude and extent of effects from industrial discharges in the receiving environment.
- Beginning in 1992, all new effluent regulations will require regulated sites to conduct EEM.
- The first industry with new effluent regulations was the Pulp and Paper industry.

What are the components of EEM?

Pre-Design
Study Design
Core Study
Site-Specific Studies

- Pre-Design and Study Reports submitted to regional Authorization Officer of Environment Canada
- Authorization Officer advised by Technical Advisory Panel

Pre-Design Study

- one time only
- scoping, information gathering, definition of study parameters
  - plume delineation
  - habitat inventory and classification
  - resource inventory
  - mill history
  - historical receiving environment data
  - effluent characterization

Study Design

- based upon Pre-Design information
- defines study area, reference area
- selects sentinel species
- specifies sample sites, sample numbers and sample timing
- identifies supporting information that will be obtained (e.g. chemical)
- outlines QA/QC program

Core Study

- every three years
  - invertebrate community assessment
  - adult fish survey
  - supporting data: water/sediment quality, body burdens
- sublethal toxicity tests (quarterly; reported yearly)

"Site-Specific" Studies

- "triggered" by a number of factors; e.g. documented concerns about fish tainting, observed effects on benthic invertebrates
- will be more common in the second and subsequent cycles

The Process Leading to EEM:
Learnings from the Pulp and Paper Experience

- Lack of well-defined goals and objectives
- National consistency versus site-specific conditions
- Difficulties with consultative process

Learnings, cont'd.

- Federal/Provincial Coordination Problems
- Inexperienced Regional Regulatory Personnel
- Inadequate Technical Guidance Document
- Lack of Consensus on Interpretation of EEM Data

Goals and Objectives

- was the central issue at initial workshops involving both government and industry
- should go beyond general statements of principle
- should be unambiguous, measurable, relevant
- should incorporate concerns about cost-effectiveness and credibility

Example of General and Specific Objectives

"to assess the adequacy of national regulations for protecting fish, fish habitat and the use of fisheries resources"

VERSUS

"95% confidence that there will be no greater difference in fish growth between a study area and a reference area than that observed to be natural variability"

Data Interpretation

- government approach remains vague
- no statements regarding expected confidence levels (e.g. want to be 95% confident of detecting a 30% difference)
- lack of specific objectives hampers study design e.g. selection of appropriate sample sizes

Interpretation, cont'd

- adult fish survey source of much of the concern
  - simple parametric hypothesis testing may not be appropriate
  - very little known about natural variability, seasonal distribution, relationships to habitat, true extent of "exposure", resource use
  - very difficult to decide upon sentinel species, size of study area, reference areas
  - high probability of spurious cause/effect relationships

Summary of Some Key Learnings from the Pulp and Paper Experience

- **true consultation is vital**
- **input from practitioners of biological monitoring would address some of the cost/practicality issues**
- **have a clear, scientifically-credible framework for the monitoring program (e.g. criteria for problem definition, exposure assessment, effects assessment and data interpretation)**

Key Learnings, cont'd

- striking a balance between uniform regulations and flexibility to address site-specific conditions can be very difficult
- clear statements of a few basic principles of study design would be a great help (e.g. unambiguous, measurable, sensitive, specific, practical and relevant endpoints)
- beware of unproven "indicators" of effects

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