Wednesday, April 30, 2008
Stream H – Remediation of Sediments

Topic Keynote

LOCATION: GRAND BALLROOM D

8:45 am - 9:30 am

Beth Power, MSc, RPBio
Azimuth Consulting Group Inc,

Beth Power has been an environmental consultant for over 20 years, specializing in contaminated sediments, ecological risk assessment (ERA) and science policy. In the early 1990s, she led the consultant team that developed the Canadian Council of Ministers of the Environment guidance documents for ERA, which are still in use to some extent. Since then, Beth has continued to contribute to BC and federal guidance and she has conducted numerous ecological risk assessments for: ports and harbours, contaminated sites, industrial discharge environments, non-point source issues and brownfields developments. The interplay between contaminated sediment assessment and sediment management/remediation has been a consistent theme in much of Beth's work. Beth is appointed to the BC Roster of Professional Experts and a contracted external reviewer for the BC Ministry of Environment – in both cases for review of ERAs prepared in support of instruments under the BC Contaminated Sites Regulations.

All presentations will be delivered in English, unless noted otherwise.

WEDNESDAY, APRIL 30, 2008

9:30 am - 9:55 am

Monitored Natural Recovery at Contaminated Sediment Sites in Canada and the United States

Victor S. Magar[1], Karen Merritt[1], Roger Santiago[2], Janette Anderson[2]
[1]ENVIRON International Corporation
[2]Environment Canada

Environmental restoration of contaminated sites poses a major challenge in Canada and the United States due to the sheer number and diversity of sites and past activities that have released contaminants into the environment. Contaminated sediment issues can be significant for sites located near ecologically-sensitive aquatic environments, with costs totaling millions or hundreds of millions of dollars for remedies that rely solely on traditional dredging and capping techniques. Monitored Natural Recovery (MNR) is an alternative, and increasingly accepted remedy, that involves leaving contaminated sediments in place while monitoring the performance of the natural physical, chemical, and biological processes that physically isolate, transform, and/or reduce the bioavailability and mobility of sediment contaminants. Though MNR usually requires a much more intensive monitoring program than capping or dredging, MNR avoids construction costs while retaining the potential to achieve remedial action objectives, resulting in substantial cost savings, whether implemented as a stand-alone remedy, or in combination with other remedies. This presentation will provide a brief overview of MNR, including key definitions, processes, objectives, and considerations for MNR, and will discuss opportunities to enhance MNR using innovative materials or thin-layer capping. Case studies will be discussed, drawing on sites in Canada and the U.S.

9:55 am - 10:20 am

Application of the Decision-Making Framework for Sediment Contamination

Christine Thomas[1], M.Sc., Lorne Doig[1], Ph.D., Blair McDonald[1], M.E.T., R.P.Bio, Michael Z'Graggen[1], M.R.M., Jeanette Southwood[1], M.A.Sc., P. Eng., Lina Letiecq[2], M.Sc.
[1]Golder Associates Ltd.
[2]Public Works and Government Services

Transport Canada (TC) is actively evaluating their higher priority aquatic sites in the Ontario Region for divestiture, remediation or risk management. In order to assist with decisions regarding future management action for these sites, TC decided to implement the innovative Decision-Making Framework for Sediment Contamination (the Framework; Chapman and Anderson, 2005). Implementation of this framework is intended to provide TC with alternatives for consistently managing contaminated sediments in a cost-effective and environmentally sound manner.

The purpose of the current study was to implement the first three steps of the framework for the Kingston Outer Harbour. Step one of the framework includes the evaluation of existing data and preparation of a problem formulation. Step two involves the development of a sampling and analysis plan that outlines an appropriate strategy to address data gaps identified and otherwise implement the remainder of the steps of the framework. Step three involves consideration and comparison to reference conditions. Given that the current study was based on a review of existing information and no suitable reference locations were identified, only steps one and two could be completed. This presentation provides an example of how the framework can be applied to waterlots with other examples also discussed.

10:50 am - 11:15 am

Randle Reef Sediment Remediation Project

Roger Santiago[1], Erin Hartman[1], Anne Borgmann[1], Bill Fitzgerald[2], Cheriene Vieira[3]
[1]Environment Canada
[2]Hamilton Port Authority
[3]Ontario Ministry of the Environment

The governments of Canada and the United States have recognized contaminated sediment issues as major problem in the Great Lakes ecosystem. In 1985, these two countries identified 43 areas of concern (AOC) where impaired water quality prevented full beneficial use of rivers, bays, harbours and ports.

Randle Reef (a Hamilton Harbour AOC) is one of Canada's most contaminated sediment sites. Proposed remediation for this site involves constructing a 9.5 hectare engineered containment facility (ECF) that will manage PAH and heavy metal contaminated sediments in two ways: (1) the ECF will be constructed on top of some of the most highly contaminated sediments (in-situ 130,000 m^3), isolating those sediments in place; and, (2) other highly contaminated sediments (500,000 m^3), will be dredged and placed inside the ECF. The engineering design for this project is underway and will be completed in the summer of 2008.

Environment Canada has contracted an independent study to quantify the economic and non-monetary benefits related to the remediation of contaminated sediments in Randle Reef. Preliminary results identify over $126 million in return on investment for this sediment cleanup project which is estimated at $90 million.

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WEDNESDAY, APRIL 30, 2008

11:15 am - 11:40 am

Evaluation of Contaminant Sources and Export in the Fulton Creek Watershed, Northern Saskatchewan

Helen Manolopoulos[1], Bruce Halbert[1], Carl Paton[2], Jeno M. Scharer[3]
[1]SENES Consultants Limited
[2]Cameco Corporation
[3]University of Waterloo

This investigation was undertaken to apportion sources of radium-226, selenium, TDS, and uranium in the Fulton Creek watershed and ascertain their impact on Beaverlodge Lake in Northern Saskatchewan. A proprietary computer dispersion model called LAKEVIEW, developed by SENES Consultants Limited, was employed. Model calibration by the Metropolis-Hastings algorithm was carried out in two lakes, with 24 years of monitoring data augmented with sediment and porewater sampling results. The model captured the time dependent trend for all variables; the observed and predicted data were successfully tested for "goodness of fit" using chi square statistics. Using iterative quadratic programming, sediments in two lakes were proven to be the principal sources of the contaminants. Long-term water quality simulations were carried out for a 300-year period. A continued downward trend was predicted for selenium, TDS and uranium, while radium-226 was predicted to peak in 20 years before the decline.

The response of Beaverlodge Lake to a 50% and 90% hypothetical reduction of the external loads and sediment fluxes in the watershed was also investigated. Radium-226 concentrations were the most sensitive to 50% source reduction giving 11% to 23% concentration reduction in the Beaverlodge Lake basins. Other contaminant responses to similar load reductions ranged from 1% to 9% for selenium, 0.4% to 4% for TDS, and 3% to 10% for uranium. The response to 90% source reduction was about double of the 50% reduction. Sediments in the various segments of Beaverlodge Lake were proven to be neither sources nor significant sinks of the contaminants.

11:40 am - 12:05 pm

Criteria for the Assessment of Sediment Quality in Quebec and Application Frameworks: Prevention, Dredging and Remediation

C. Bélanger[1], L. Boudreau[2], C. Gagnon[1], I. Guay[2], L. Martel[2], P. Michon[2], M. Pelletier[1], S. Thibodeau[1]
[1]Environment Canada
[2]Ministère du Développement durable, de l'Environnement et des Parcs du Québec

This presentation will be delivered in French.

This presentation will report on the new sediment quality criteria adopted by Environment Canada and the Quebec Ministère du Développement durable, de l'Environnement et des Parcs, and the process leading to their development. The presentation also contains relevant and, in certain cases, unpublished information on natural and ambient concentrations of various substances in the sediments of the St. Lawrence River. Lastly, an overview of the guidelines and recommendations for interpreting and applying these quality criteria will be presented.

Following an assessment of new available data and guidelines developed by other jurisdictions, it was concluded that the interim criteria published in 1992 should be replaced by new quality criteria based on the approach of the Canadian Council of Ministers of the Environment (CCME).

To the two reference values adopted by the CCME (a threshold effect level (TEL) and a probable effect level (PEL)), three other levels were derived to define all of the intervention levels needed for sediment management in Quebec. These were defined using the CCME database and a calculation method similar to the one used to determine the TEL and PEL. They are: (1) the rare effect level (REL); (2) the occasional effect level (OEL); and, (3) the frequent effect level (FEL).

This set of criteria is a screening tool for assessing the level of contamination of sediment.

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WEDNESDAY, APRIL 30, 2008

1:30 pm - 1:55 pm

Assessment and Mitigation of Ecological Risks Posed by Mercury and PCBs in Peninsula Harbour Sediment, Lake Superior

Miranda Henning[1], Katrina Leigh[1], Karen Merritt[1],
Victor M. Magar[1], Roger Santiago[2]
[1]ENVIRON International Corporation
[2]Great Lakes Areas of Concern Section, Environment Canada

To understand the extent to which sediment management is warranted in Peninsula Harbour, risks to benthic invertebrates, fish, and wildlife from mercury and polychlorinated biphenyls (PCBs) were estimated. Based on multiple lines of evidence, benthic invertebrates are not at significant risk. Current mercury levels may reduce reproductive success in bottom-feeding fish species, which may propagate to the population level, but other fish species do not appear to be adversely affected. Waterfowl are unlikely to be adversely affected. Individual reproductive success may be reduced in piscivorous raptors and piscivorous mammals by current concentrations of mercury and PCBs, respectively. However, risk estimates are not so high as to suggest mortality and are unlikely to have population-level consequences. Indeed, the quality and quantity of suitable habitat for mink and otters along the Peninsula Harbour shoreline is limited.

The effectiveness, feasibility and costs of sediment management options (dredging and capping) were evaluated before developing a conceptual design for the two favored alternatives. Management is designed to both decrease biological exposure to mercury and PCBs and prevent the hot spot from serving as an ongoing source of contamination to the wider ecosystem.

1:55 pm - 2:20 pm

Active Capping for the Management of Contaminated Sediments

Danny Reible[1], Roger Santiago[2], Miranda Henning[3]
[1]University of Texas
[2]Great Lakes Areas of Concern Section, Environment Canada
[3]ENVIRON International Corp.

Recent research has improved in-situ management options for contaminated sediment through the development of active capping, in which a sediment cap is designed to serve as a permeable, reactive or adsorptive barrier. Active capping can reduce the potential for exposure and risk associated with the simple passive barrier in conventional sand capping. This approach is under consideration or being demonstrated at sites within both Canada and the United States, but also at a variety of sites in the border waters between the two countries. In this presentation, the current status and prospects for increased use of active capping will be discussed, including the effectiveness and limitations of existing approaches. Current research to expand the options and/or improve the effectiveness of existing approaches will be described. Appropriate technologies will be identified for particular contamination situations. Current research efforts to evaluate and monitor effectiveness in the field will be summarized. The presentation will emphasize data from laboratory and field demonstrations, especially in the border waters, that illustrate the applicability and effectiveness of active capping options.

2:50 pm - 3:50 pm

Panel Discussion – Live and Unplugged

All presentations will be delivered in English, unless noted otherwise.