EXAMINATION GUIDE FOR EXAM CANDIDATES

ROSTER OF APPROVED PROFESSIONALS EXAMINATION
TECHNICAL –- RISK ASSESSMENT

Roster Qualifications and Functions

The Roster of Approved Professionals (the Roster) is a roster of individuals who have proven, through examination and experience, their expert knowledge in contaminated site assessment, management, and remediation.

Members of the Roster are authorized, under section 49(1) of the Contaminated Sites Regulation (CSR), to recommend to the British Columbia Ministry of Environment (MOE) issuance of Approvals in Principle, Certificates of Compliance, Determinations that a site is or is not contaminated, Contaminated Soil Relocation Agreements and approval of background release exemptions (based on Table 1 of Protocol 4) for low to moderate risk sites.

There are two categories of Approved Professionals: Standards Assessment Specialists, whose recommendations are based on application of the numerical standards of the CSR; and Risk Assessment Specialists, whose recommendations are based on application of the risk based standards of the CSR.

The qualifying examination is offered in three parts: Technical – Standards Assessment, Technical – Risk Assessment, and Regulatory. To be appointed to the Roster, candidates must achieve a pass in both the regulatory part and the technical part associated with the category in which they seek appointment. Candidates must satisfy all minimum requirements in the year of appointment.

More information on the Roster is available at www.csapsociety.bc.ca.

Examination Format

The examination is offered in a computer-based format and is held in a computer lab. The Technical – Risk Assessment part of the examination consists of approximately **70 multiple-choice questions** worth 1 point each. Candidates will be given **5 hours** to complete the Technical – Risk Assessment part of the examination. A basic, non-programmable calculator (Texas Instruments TI-30Xa Solar), a #2 mechanical pencil, an eraser, and a package of page markers (eg *Post-it Brand* flags) will be provided to, and retrieved from, candidates with their examination paper. Candidates will not be permitted to use their own calculator or writing instruments.

A reference binder will **NOT** be supplied for the 2008 examination. Candidates will be provided with a list of reference materials (*see Attachment 2*) to help prepare for the examination. Candidates are expected to prepare their own reference material which can be brought into and used during the examination. The examination is not limited to testing knowledge of only those materials in the reference list.

Objectives of the Technical - Risk Assessment Part of the Exam

The objectives of the Technical – Risk Assessment part of the examination include the testing of the understanding and application of combined aspects of ecology, toxicology and environmental chemistry for the review of human health and ecological risk assessments. Candidates are also expected to have a general understanding of related areas such as, for example, basic contaminant transport in various media.

Examination Content and Guide to Preparation

This Guide to Examination Candidates is intended to give candidates guidance in their preparation for the exam. The information contained in this document and its attachments is to assist only and is subject to change. Areas and materials not specifically mentioned may also be examined.

Information useful in preparing for the exam is included in the following attachments

1. Syllabus
2. List of Reference Materials

Revised Oct 9, 2009

ATTACHMENT 1 – SYLLABUS

Candidates should read the Guide to Examination Candidates – Roster of Approved Professionals Examination – Technical – Risk Assessment before reading this syllabus. The percentage in brackets indicates the approximate percentage of the examination that will cover each major content area. While the ½ percentage weightings appear to be quite specific; they are, in fact, approximate only. Particularly important areas of knowledge include:

ECOLOGICAL RISK ASSESSMENT

1. **Problem Formulation (17.5%)**
    a. Risk Assessment Planning
    b. Integration of Available Information
    c. Identification of stressors
    d. Potentially Exposed Receptors
    e. Selecting Assessment and Measurement Endpoints
    f. Conceptual Models
    g. Data Gap Analysis
    h. Sampling and Analysis Plan

2. **Exposure Assessment (12.5%)**
    a. Characterization of Exposure
    b. Evaluating Data and Models for Analysis
        i. Strengths and Limitations of Different Types of Data
        ii. Literature Data – relevant species, study conditions
        iii. Site Data/Observations - measurement and assessment endpoints; species diversity, richness, abundance
    c. Measurement and/or Modeling Studies

3. **Effects Assessment (12.5%)**
    a. Quantitative and Qualitative Site Observations
        i. Terrestrial Receptors
        ii. Aquatic Receptors
    b. Bioassays
        i. Field studies
        ii. Laboratory toxicity tests
    c. Toxicity Reference Values
        i. Selection
        ii. Derivation
    d. Ecosystem – context of scale relative to contaminated sites
    e. Ecological Responses
        i. Stressor-Response Analysis
        ii. Establishing Cause-and-Effect Relationships
        iii. Linking Measures of Effect to Assessment Endpoints

4. **Risk Characterization (5%)**
    a. Quotient Method
    b. Observation Method
    c. Weight of Evidence
    d. Reporting Risks

SYLLABUS CONT'D

5. **Uncertainty Analysis (2.5%)**
    a. Identifying Major Types of Uncertainty
    b. Use of Uncertainty Factors
    c. Sensitivity Analysis

HUMAN HEALTH RISK ASSESSMENT

1. **Problem Formulation (17.5%)**
    a. Data Collection
        i. Background Information Useful for Data Collection
        ii. Review of Available Site Information
        iii. Addressing Modeling Parameter Needs
        iv. Preliminary Identification of Potential Human Exposure
        v. Strategy for Sample Collection
        vi. QA/QC Measures
    b. Data Evaluation
        i. Combining Data Available from Site Investigations
        ii. Evaluation of Analytical Methods
        iii. Evaluation of Quantitation Limits
    c. Chemicals of Potential Concern
        i. Comparison of Samples with Criteria/Guidelines
        ii. Comparison of Samples with Standards
    d. Potentially Exposed Receptors
    e. Potential Exposure Pathways
    f. Conceptual Model
    g. Data Gap Analysis

2. **Exposure Assessment (17.5%)**
    a. Characterization of Exposure Setting
        i. Characterize Physical Setting
        ii. Characterize Exposed Receptors
        iii. Identification of Exposure Routes
        iv. Identification of Reasonable Maximum Exposure
    b. Quantification of Exposure: Determining Exposure Concentrations
        i. Estimation of Chemical Intakes
        ii. Exposure Concentrations in Various Media
        iii. Combining Chemical Intakes Across Pathways

3. **Toxicity Assessment (7.5%)**
    a. Types of Toxicological Information Considered in Toxicity Assessment
    b. Toxicity Assessment for Noncarcinogenic Effects
    c. Toxicity Assessment for Carcinogenic Effects
    d. Identifying Appropriate Toxicity Values for Site Risk Assessment
    e. Evaluating Chemicals for which no Regulatory Toxicity Values are Available

SYLLABUS CONT'D

4. **Risk Characterization (5%)**
    a. Quantifying Risks
        i. Risks for Individual Substances
        ii. Risks for Multiple Substances
    b. Combining Risks Across Exposure Pathways
    c. Consideration of Site-Specific Human Studies
    d. Risk Characterization Results

5. **Uncertainty Analysis (2.5%)**
    a. Identifying Major Types of Uncertainty
    b. Use of Uncertainty Factors
    c. Sensitivity Analysis

ATTACHMENT 2 – LIST OF REFERENCE MATERIALS

Candidates should read the **Guide to Examination Candidates – Roster of Approved Professionals Examination – Technical – Risk Assessment** before reading this attachment. This list of reference materials includes materials upon which some, but not all, of the exam questions have been developed. Other questions are drawn from the general principles to be tested and, in some instances, what is considered to be general knowledge. In addition to relevant portions of those materials listed here, candidates should study generally accepted, up-to-date texts in the subject matter to be tested.

BCMELP (British Columbia Ministry of Environment, Lands and Parks). JanuAry 1998. Recommended Guidance and Checklist for Tier 1 Ecological Risk Assessment of Contaminated Sites in British Columbia. Protocol 1 of Contaminated Sites Regulation. Prepared by the Ecological Risk Assessment Guidance Team [W.G. Landis, A.J. Markiewicz, and V. Wilson, Western Washington University; A. Fairbrother, Ecological Planning and Toxicology, Inc.; and G. Mann, EVS Environment Consultants] www.env.gov.bc.ca/epd/remediation/policy_procedure_protocol/index.htm

BCMOE (British Columbia Ministry of Environment). Effective August 1, 2008. Protocol 13 For Contaminated Sites. Screening Level Risk Assessment. www.env.gov.bc.ca/epd/remediation/policy_procedure_protocol/index.htm

BCMOE (British Columbia Ministry of Environment). July 9, 2007. Technical Guidance 7 on Contaminated Sites. Supplemental Guidance for Risk Assessments. www.env.gov.bc.ca/epd/remediation/guidance/index.htm

BC Ministry of Environment- Technical Guidance Document 4 (2009) Vapour Investigation and Remediation – DRAFT Q&As for Draft Guidance for Vapour Investigation and remediaion http://www.env.gov.bc.ca/epd/remediation/guidance/index.htm

BCMOE (British Columbia Ministry of Environment). August, 2005. Technical Guidance 19 on Contaminated Sites. Assessing and Managing Contaminated Sediments. www.env.gov.bc.ca/epd/remediation/guidancel/index.htm

BCMELP (British Columbia Ministry of Environment, Lands and Parks). 2000. Tier 1 Ecological Risk Assessment Policy Decision Summary. Prepared by the Ecological Risk Assessment Guidance Team for BC Ministry of Environment. Last updated November 15, 2000. www.env.gov.bc.ca/epd/remediation/policy_procedure_protocol/index.htm

BCMWLAP (British Columbia Ministry of Water, Land and Air Protection). 2004. Criteria for Managing Contaminated Sediment in British Columbia, Technical Appendix. www.env.gov.bc.ca/epd/remediation/standards_criteria/index.htm

BC Ministry of Environment- Protocol 6- Eligibility of Applications for Review by Approved Professionals http://www.env.gov.bc.ca/epd/remediation/policy_procedure_protocol/

BC Ministry of Environment- Protocol 13- Screening Level Risk Assessment http://www.env.gov.bc.ca/epd/remediation/policy_procedure_protocol/protocols/pdf/protocol_13.pdf

BC Ministry of Environment- Soil Vapour FAQs http://www.env.gov.bc.ca/epd/remediation/faq/index.htm#10

CCME (Canadian Council of Ministers of Environment). 1996. A Framework for Ecological Risk Assessment: General Guidance. Prepared by the CCME Subcommittee on Environmental Quality for Contaminated Sites for the National Contaminated Sites Remediation Program. March 1996. www.ccme.ca/publications/

CCME (Canadian Council of Ministers of Environment). 1997. A Framework for Ecological Risk Assessment: Technical Appendices. Prepared by the CCME Subcommittee on Environmental Quality for Contaminated Sites for the National Contaminated Sites Remediation Program. March 1997. www.ccme.ca/publications/

CCME (Canadian Council of Ministers of Environment). Environmental Quality Guidelines. www.ccme.ca/pub;ications/

CCME (Canadian Council of Ministers of Environment). 2006: A Protocol for the Derivation of Environmental and Human Health Soil Quality Guidelines. www.ccme.ca/publications/

EC (Environment Canada). 1992. Biological Test Method: Test of Larval Growth and Survival using Fathead Minnows. Environment Canada, Environmental Protection, Conservation and Protection. EC-EPS 1/RM/22, Ottawa, Canada.

EC (Environment Canada). 1994. A Framework for Ecological Risk Assessment at Contaminated Sites in Canada: Review and Recommendations. Prepared by C. Gaudet, EVS Environment Consultants, and Environmental and Social Systems Analysts for the National Contaminated Sites Remediation Program. Scientific Series No. 199.

HC (Health Canada). 2004. Federal Contaminated Site Risk Assessment in Canada. Part 1: Guidance on Human Health Preliminary Quantitative Risk Assessment. Prepared by Environmental Health Assessment Services Safe Environment Programme. www.hc-sc.gc.ca/ewh-semt/contamsite/risk-risque-eng.php

HC (Health Canada). 2004. Federal Contaminated Site Risk Assessment in Canada. Part 2: Health Canada Toxicological Reference Values. Prepared by Environmental Health Assessment Services Safe Environment Programme. www.hc-sc.gc.ca/ewh-semt/contamsite/risk-risque-eng.php

Province of BC. 2004. *Environmental Management Act* [SBC 2003] Chapter 53. Queen's Printer, Victoria BC. www.env.gov.bc.ca/epd/remediation/leg_regs/ema.htm

Province of BC. 2007. Contaminated Sites Regulation. Queen's Printer, Victoria BC. www.env.gov.bc.ca/epd/remediation/leg_regs/csr.htm

Suter, G. W., II. 1993. Ecological Risk Assessment. Ann Arbor, MI: Lewis Publishers.

Toxicology Excellence for Risk Assessment (TERA). http://www.tera.org/

US Department of Energy Oak Ridge Operations Publications and on-line Risk Assessment Information System (RAIS). http://risk.lsd.ornl.gov/

USEPA. 1989. United States Environmental Protection Agency, Office of Emergency and Remedial Response, December 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A), Interim Final. EPA/540/1-89/002. www.epa.gov/oswer/riskassessment/ragsa/index.htm

USEPA. 1989. United States Environmental Protection Agency, Office of Emergency and Remedial Response, December 1989. Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), Interim. EPA/540/R/99/005. www.epa.gov/oswer/riskassessment/ragse/index.htm

USEPA (United States Environmental Protection Agency). June 1997. Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments. Interim Final. EPA 540-R-97-006 www.epa.gov/oswer/riskassessment/ecorisk/ecorisk.htm

USEPA (United States Environmental Protection Agency). April 1998. Guidelines for Ecological Risk Assessment. EPA/630/R-95/002F. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=12460#Download

USEPA. 1999. Risk Assessment Guidance for Superfund, Volume 3 Process for Conducting Probabilistic Risk Assessment. www.epa.gov/oswer/riskassessment/rags3adt/index.htm

USEPA (United States Environmental Protection Agency). August 1997. Exposure Factors Handbook. (Volume 1 –General Factors; Volume II – Food Ingestion Factors; Volume III – Activity Factors). EPA/600/P-95/002Fa,Fb,Fc http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=12464

USEPA. Integrated Risk Information System (IRIS) Guidance Documents. www.epa.gov/iris/index.html

Health Canada (2008). Final Draft Guidance Manual for Environmental Site Characterization in Support of Human Health Risk Assessment. Volume 1 Technical Guidance. To obtain a copy of this document, send a request to the following e-mail address: cs-sc@hc-sc.gc.ca

Science Advisory Board for Contaminated Sites in British Columbia (February 2006). Guidance on Site Characterization for Evaluation of Soil Vapour Intrusion into Buildings http://www.sabcs.chem.uvic.ca/guidance%20on%20site%20characterization%20for%20evaluation%20of%20soil%20vapour%20intrusion%20into%20buildings.pdf

Health Canada (2008). Federal Contaminated Risk Assessment in Canada: Guidance on Human Health Risk Assessment of Soil Vapour Intrusion to the Indoor Environment. To obtain a copy of this document, send a request to the following e-mail address: cs-sc@hc-sc.gc.ca

Health Canada (2008). Federal Contaminated Risk Assessment in Canada Part IV: Spreadsheet Tool for Human Health Preliminary Quantitative Risk Assessment (PQRA). To obtain a copy of this model, send a request to the following e-mail address: cs-sc@hc-sc.gc.ca

Johnson PC, Ettinger R (1991). Heuristic Model for Predicting the Intrusion Rate of Contaminant Vapours into Buildings. Environmental Science and Technology 25(8):1445–1452. http://www.epa.gov/oswer/riskassessment/airmodel/johnson_ettinger.htm

Golder Associates (200)Guidance for Detailed Risk Assessment (DERA) in British Columbia submitted for the Science Advisory Board for Contaminated Sites in British Columbia http://www.sabcs.chem.uvic.ca/FINAL%20rpt-0330_06%20SAB-DERA%20Guidance%20Manual.pdf