EXAMINATION GUIDE FOR EXAM CANDIDATES

ROSTER OF APPROVED PROFESSIONALS EXAMINATION
TECHNICAL –- NUMERICAL STANDARDS

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 BC Ministry of Environment and Climate Change Strategy (BC ENV) 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 (as per Table 1 and Table 2 of Protocol 6 - Eligibility of Applications for Review by Approved Professionals).

There are two categories of Approved Professionals: Numerical Standards Assessment Specialists, whose recommendations are based on the application of the numerical standards of the CSR; and Risk-based Standards Assessment Specialists, whose recommendations are based on the 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.
Please email admin@csapsociety.bc.ca for the Approved Professional Roster Pack.

Examination Format

In line with the mission of the Society of Contaminated Sites Approved Professionals (CSAP) of British Columbia "to serve government, the public and industry by evaluating and advancing the practice and quality of contaminated sites management within BC's regulatory framework" (CSAP, n.d.), the CSAP Society is designing and developing two oral assessments which will be used to measure the application of technical knowledge and decision-making in the areas of numerical standards and risk-based standards, respectively. Starting in September 2023, these oral assessments will replace the existing knowledge-based technical exams for numerical standards and risk-based standards, which were used to measure technical knowledge. The knowledge-based regulatory exam will still be active. To become an Approved Professional (AP), candidates are required to pass the knowledge-based regulatory exam and either or both the numerical-based and risk-based standards oral assessments, based on the designation for which they are eligible.

Oral assessments are performance-based assessments (Swanson, Norman, & Linn, 1995) or judge-mediated examinations (Stone, Beltyukova, & Fox, 2008) that have been successfully used to assess the application of knowledge and decision-making for over a century. The decision to replace the knowledge-based written exams with performance-based oral assessments was informed by a comprehensive practice analysis. In general, the practice analysis provided explicit evidence of the alignment of the primary tasks of an Approved Professional

with the most appropriate method of assessment.

Throughout the design and development process, the CSAP Society is committed to ensuring a valid, reliable, and fair assessment process that is based on rigorous psychometric testing standards as recommended by American and Canadian psychometric experts from the American Educational Research Association, American Psychological Association, and the National Council on Measurement in Education (AERA, APA, & NCME, 2014).

The design and development of the CSAP Oral Assessments were conducted by a committee of experienced Approved Professionals through the guidance of a psychometric consultant contracted by the CSAP Society, who ensured rigorous psychometric testing standards were met at every stage of the process. The Approved Professionals, who served as subject matter experts, provided assessment content expertise that informed the practice analysis, blueprint development, question writing, and standard-setting process. Throughout this process, the psychometric consultant collected critical validity evidence to ensure the oral assessment design and development process is valid, reliable, fair, and defensible.

The oral assessment for numerical standards consists of up to 40 scenario-based questions. The duration of the assessment will be three hours. Each candidate will be assessed independently by a panel of two examiners. The examiners are carefully instructed to evaluate each candidate objectively; they will only be provided with the candidate's name and associated organization/employer to determine if there exists a conflict of interest. The CSAP Society will make every effort to ensure there are no conflicts of interest between examiners and candidates. The examiners will be using a structured and validated scoring guide that has been designed to minimize bias or any extraneous factors that are not related to what is being assessed. The examiners will be scoring your responses independently and will not be interacting with one another during the scoring process. The score assigned to each candidate for each question will be based on agreement between the examiners and will be analyzed by the psychometric consultant to ensure a high level of scoring reliability and measurement precision.

In the first hour and a half, candidates will be given scenario-based questions to review and prepare their responses. A basic, non-programmable calculator (Texas Instruments TI-30Xa Solar), a #2 mechanical pencil, an eraser, and a package of page markers (e.g. 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 calculators or writing instruments. A reference binder will NOT be supplied for the 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 printed reference materials which can be brought into and used during the examination. Laptops or electronic materials are NOT permitted. The examination is not limited to testing knowledge of only those materials in the reference list.

In the next hour and a half, the oral assessment will be conducted, whereby the examiners will ask each question and the candidate will provide their responses orally.

After the oral assessment, the examiners will take 15 minutes to document findings, take a break, and then transition to the next candidate. This is a typical oral assessment administration process as recommended by psychometric experts (Swanson, Norman, & Linn, 1995). The oral assessment process will be audio recorded for quality control and training purposes.

The scenarios have been designed to reflect real-life situations encountered by Approved Professionals in practice. Please take the hour and a half to carefully read over and formulate your responses to the scenario-based questions. Please make sure to answer each question carefully and to be prepared to discuss how you obtained the answer, including what references you consulted as well as the reasoning or rationale behind the process of arriving at your response to the question.

To get familiar with the oral assessment format, the CSAP Society will provide two sample question(s) 2-3

weeks before the assessment day.

Requested accommodations will be reviewed on a case-by-case basis. Accommodations that do not interfere with accurate and valid measurement of the construct of the oral assessment will likely be granted and would be provided to candidates after their documented need for the requested accommodation has been approved by the CSAP Society.

Upon entering the assessment site, the candidates will be asked to surrender their cell phones and other communication devices such as smartwatches. The candidates may be asked to wait before entering the prep room and later to the oral assessment room, two candidates at a time. As mentioned before, each candidate will be assessed independently by two examiners.

Objectives of the Technical Standards Assessment Exam

The objectives of the Technical – Numerical Standards assessment part of the examination include the testing of the understanding and application of combined aspects of soil science, geology, environmental engineering, hydrology, hydrogeology, environmental chemistry, biochemistry, contaminant fate and transport, and basic risk assessment principles for the review of standards assessments. Candidates are also expected to have a general understanding of related areas such as sampling and laboratory testing methods, statistical analysis, contaminants associated with specific site activities and methods to remediate them.

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

ATTACHMENT 1 – SYLLABUS

Candidates should read the Guide to Examination Candidates – Roster of Approved Professionals Examination – Technical – Numerical Standards before reading this syllabus. The percentage in brackets indicates the approximate percentage of the examination that will cover each major content area. Particularly important areas of knowledge include:

NUMERICAL STANDARDS ASSESSMENT

1. Historical and Visual Site Information (11%)

a) APEC and PCOC: Identify all applicable potential APEC and PCOC based on review of existing information from various sources and based on assessment of site conditions observed during a site reconnaissance.

2. Assessment of Affected Media and Migration Pathway (16%)

a) Soil: Interpret site geology and soil stratigraphy.
b) Hydrogeology: Assess groundwater flow and contaminant transport (dissolved and Non-aqueous phase liquids - NAPL).
c) Surface hydrology: Interpret significance of precipitation on a contaminated site in terms of contaminant transport (surface water, groundwater, soil and sediment).
d) Sediment: Interpret sediment characteristics and its significance for contaminant distribution and release.
e) Soil vapour: Understand soil vapour concentrations and migration.
f) Air: Understand impact on indoor and outdoor air quality by dust and vapours from site contamination.
g) Biota: Understand significance of food-chain transfers and the significance of observations such as stressed vegetation and effects on aquatic life.

3. Contaminant Characteristics (15%)

a) Chemistry and biochemistry: Interpret physical, chemical and biological properties of contaminants and their significance on fate, transport, treatment and relative human health and ecological risks.
b) Chemical composition of mixtures: Understand the significance of chemical compositions of common types of contamination substances including but not limited to: fuels, lubricants, solvents, paints, wood preservatives, coal tar, metal plating, and landfill leachate.
c) Sources of Contamination: Be familiar with common residential, commercial and industrial activities that may result in site contamination including but not limited to: Fuel storage and handling, metal fabrication, wood preservation, solvent cleaning, coal gasification, and landfilling.

4. Investigation Approach and Methods (16%)

a) Sampling rationale: Interpret available information to develop a defensible sampling rationale that will satisfy the investigation objectives.
b) Sampling plans: Assess sampling plans to determine whether they are consistent with the investigation objectives and sampling rationale.
c) Sampling techniques: Understand the significance of the use of proper equipment and methods for sampling of soil, sediment, groundwater, surface water and soil vapour.
d) Field observations and records: Assess field records in terms of adequacy for data interpretation included but not limited to: Borehole logs, well installation details, visual/olfactory signs of contamination, sampling details, etc.
e) Laboratory testing methods: Understand applicability and limitations of common laboratory sampling methods including but not limited to: Gas chromatography, gas chromatography/mass spectroscopy, infrared spectroscopy, petroleum analytical methods (e.g., LEPH/HEPH vs. EPH).
f) Field screening techniques: Understand applicability and limitations of common laboratory sampling methods including but not limited to: soil vapour headspace, immunoassay, colorimetric, pH/conductivity/temperature, X-ray fluorescence.

g) QA/QC practices: Assess field and laboratory work in terms of acceptable QA/QC methods and interpretation.

5. Data Synthesis and Interpretation (21%)

a) Data integration and presentation: Assess the investigation data in terms of adequate presentation in tables and figures.
b) Adequacy of testing: Review sampling programs to assess the adequacy of the testing performed (number, type and location of samples).
c) Nature and extent of contamination: Assess APEC and AEC: number, types, characteristics, PCOC, delineation.
d) Nature and extent of migration pathways: Assess migration pathways: types, characteristics, preferential routes, relative importance.
e) Background conditions: Assess regional and local background conditions.

6. Risk Assessment Principles and Screening (7%)

a) Problem formulation: Identify/screen sources, exposure pathways, receptors
b) Acceptable risk: Carcinogens, Non-carcinogens.
c) Exposure scenarios: Interpret current and future site uses.
d) High risk: Recognize imminent and high risk to human health and environment, and immediate risks to public welfare (e.g., explosion hazard, etc.).

7. **Remediation Design, Implementation and Confirmation (14%)**

a) Remediation techniques: Be familiar with common soil, sediment, groundwater, water and soil vapour remediation methods.
b) Remedial design: Understand technical, regulatory and cost aspects of common remediation methods, and be able to evaluate the selection of appropriate alternatives.
c) Remediation implementation: Understand health and safety standards, construction techniques/constraints, monitoring requirements, and requirements associated with off-site transport and disposal of contamination and record keeping.
d) Remediation Confirmation: Assess confirmatory sampling program and results in terms of adequacy to demonstrate the site meets the applicable requirements of a remediated site.

ATTACHMENT 2 – LIST OF REFERENCE MATERIALS

Candidates should read the **Guide to Examination Candidates – Roster of Approved Professionals Examination – Technical – Standards 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. (Note: BC ENV = BC Ministry of Environment and Climate Change Strategy; USEPA = United States Environmental Protection Agency)

1. ALS Laboratory Group. *CCME Hydrocarbon Reference Library*: https://www.academia.edu/31351034/CANADA CCME Hydrocarbon Reference Library | Cam Quach - Academia.edu or https://alsglobal.com

2. BC ENV. Procedure 8: Definitions and Acronyms for Contaminated Sites, February 1, 2023. https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources/procedures

3. BC ENV. *Protocol* for Contaminated Sites Documents - up to and including May 13, 2021. https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/legislation-and-protocols

   i) Protocol 1: Guidance and Checklist for Tier 1 Ecological Risk Assessment of Contaminated Sites in British Columbia
   ii) Protocol 2: Site-Specific Numerical Soil Standards
   ii) Protocol 3: Blending, Mixing, or Dilution as a Remediation Approach
   iv) Protocol 4: Determining Background Soil Quality
   v) Protocol 6: Eligibility of Applications for Review by Approved Professionals
   vi) Protocol 8: Security for Contaminated Sites
   vii) Protocol 9: Determining Background Groundwater Quality
   viii) Protocol 10: Hardness Dependent Site-Specific Freshwater Water Quality Standard for Zinc
   ix) Protocol 11: Upper Cap Concentrations of Substances
   x) Protocol 12: Site Risk Classification System, Reclassification and Reporting
   xi) Protocol 13: Screening Level Risk Assessment
   xii) Protocol 14: Requirements for Determining Barite Sites
   xiii) Protocol 15: Soil Treatment Facility Design and Operation for Bioremediation of Hydrocarbon Contaminated Soil
   xiv) Protocol 16: Determining the Presence and Mobility of Nonaqueous Phase Liquids and Odorous Substances
   xv) Protocol 17: Requirements for Notifications of Independent Remediation and Offsite Migration
   xvi) Protocol 18: Criteria for Establishing Multiple Land Uses at Sites
   xvii) Protocol 19: Site Investigation and Reporting
   xviii) Protocol 20: Detailed Ecological Risk Assessment Requirements
   xix) Protocol 21: Water Use Determinations
   xx) Protocol 22: Application of Vapour Attenuation Factors to Characterize Vapour Contamination
   xxi) Protocol 27: Soil Leachate Tests for Use in Deriving Site-Specific Numerical Soil Standards
   xxii) Protocol 28: 2016 Standards Derivation Methods - Chapter 4
   xxiii) Protocol 30: Classifying Substances as Carcinogenic

4. BC ENV. *Technical Guidance* on Contaminated Sites Documents – visit the following website to view the most current version of the BC ENV Technical Guidance documents: https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources/technical-guidance

i) TG1: Site Characterization and Confirmation Testing
ii) TG2: Statistical Criteria for Characterizing a Volume of Contaminated Material
iii) TG4: Vapour Investigation and Remediation
iv) TG5: Sampling and Determining Soil pH at Soil Relocation Receiving Sites
v) TG6: Assessment of Hydraulic Properties for Water Use Determinations
vi) TG8: Groundwater Investigation and Characterization
vii) TG9: Chlorophenol Aquatic Life Water Quality Standards
viii) TG10: Guidance for a Stage 1 Preliminary Site Investigation
ix) TG11: Guidance for a Stage 2 Preliminary Site Investigation and Detailed Site Investigation
x) TG12: Statistics for Contaminated Sites
xi) TG13: Groundwater Protection Model
xii) TG14: Operations of Soil Treatment Facilities for the Bioremediation of Hydrocarbon Contaminated Soil
xiii) TG15: Concentration Limits for the Protection of Aquatic Receiving Environments
xiv) TG22: Use of Monitored Natural Attenuation for Groundwater Remediation DRAFT
xv) TG24: Site Specific Numerical Soil Standards Model Parameters

5. BC Ministry of Environment, *British Columbia Environmental Laboratory Manual* (April 2020 version). Environmental Monitoring, Reporting & Economics Section, Knowledge Management Branch, B.C., Ministry of Environment; https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-environmental-laboratory-manual?keyword=bc&keyword=environmental&keyword=laboratory&keyword=manual

6. BC Ministry of Environment, BC Field Sampling Manual. (2013 - 2020 versions) *Note: Field Sampling Manual is in the process of being revised and section version dates vary.

7. BC Ministry of Environment, Guidance and Resources, Performance Verification Plan webpage: https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/guidance-resources/performance-verification-plans

8. BC Ministry of Environment, Background Concentrations in Soil webpage: https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/investigating-sites/background-concentrations/background-concentrations-in-soil

9. ASTM E1943-98: Standard Guide for Remediation of Groundwater by Natural Attenuation at Petroleum Release Sites (Reapproved 2010).

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13. Canadian Standards Association *(R2016). Phase I Environmental Site Assessment. CSA Z768-01.*

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21. Contaminated Sites Approved Professionals of British Columbia (CSAP), Technical Review Committee, (June 10, 2020). Petroleum Hydrocarbon PCOC Data Review, Soil and Groundwater, prepared by SLR Consulting (Canada) Ltd.

22. Contaminated Sites Approved Professionals of British Columbia (CSAP), (2019). *Guidance for the Assessment and Remediation of Per- and Polyfluoroalkyl Substances in British Columbia*, prepared by SLR Consulting (Canada) Ltd.

23. Contaminated Sites Approved Professionals of British Columbia (CSAP), CSAP MNA Toolkits, Toolkits #2, July 8, 2016. https://csapsociety.bc.ca/csap-toolkits/

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28. Federal Remediation Technology Roundtable (FRTR), (2002). *Remediation Technologies Screening Matrix and Reference Guide*, Version 4.0. http://www.frtr.gov/matrix2/top_page.html

29. Federal Contaminated Site Risk Assessment in Canada, Part I: Guidance on Human Health Preliminary Quantitative Risk Assessment (PQRA), Version 2.0 (2010) Revised 2012.

30. Federal Contaminated Sites Action Plan (FCSAP), Ecological Risk Assessment Guidance, Module 2: Development of Site-specific Toxicity Reference Values, March 2010.

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59. Province of British Columbia (2016). *Groundwater Protection Regulation (GWPR),* B.C. Reg. 39/2016, including amendments up to December 1, 2022.

60. Province of British Columbia (2017). *Hazardous Waste Regulation (HWR), B.C. Reg. 6*3/88, including amendments up March 30, 2022.

61. Province of British Columbia (2021), BC Approved Water Quality Guidelines and BC Working Water Quality Guidelines: https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines

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