



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.

Approved Professionals are authorized, under section 49(1) of the Contaminated Sites Regulation (CSR), to recommend to the BC Ministry of Environment and Parks (BC ENV) issuance of Approvals in Principle, Certificates of Compliance, Determinations that a site is or is not contaminated, and approval of background release exemptions (as per 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 – Numerical 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 exams@csapsociety.bc.ca for the Approved Professional Roster Pack.

Examination Format

The Technical - Numerical Standards examination is offered in a computer-based format and is held in a computer lab. The examination consists of approximately **70 multiple-choice questions** worth 1 point each. Candidates are given **4 hours** to complete the Regulatory examination. A basic, non-programmable calculator (Texas Instruments TI-30Xa Solar), a #2 mechanical pencil, an eraser, writing papers 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.

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, but can include any related materials considered relevant knowledge for an Approved Professional.

Objectives of the Technical Numerical Standards Assessment Exam

The objectives of the Technical – Numerical Standards assessment 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 Parks; USEPA = United States Environmental Protection Agency.)

1. ALS Environmental. (n.d.) *Hydrocarbon Distribution Report Reference Library*. Available on request from ALS Environmental.
2. BC Ministry of Environment and Parks. (2004). *Water Stewardship Well Protection Toolkit Files*. Ministry of Environment; Government of British Columbia. <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/drinking-water/source-water/source-water-protection/well-protection-toolkit>
3. BC Ministry of Environment and Parks. (2023, February 1). *Definitions for Contaminated Sites*. Government of British Columbia. <https://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/procedures/procedure8.pdf>.
4. BC Ministry of Environment and Parks. (2024, May 27). *B.C. Environmental Laboratory Manual*. Laboratory Standards and Quality Assurance; Government of British Columbia. <https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-environmental-laboratory-manual>.
5. BC Ministry of Environment and Parks. (2024, May 27). *B.C. Field Sampling Manual*. Laboratory Standards and Quality Assurance; Government of British Columbia. <https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual>.
6. BC Ministry of Environment and Parks. (2025, February 11). *Ambient water quality guidelines*. <https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines>.
7. BC Ministry of Environment and Parks. (2026a, September 26). *Legislation and Protocols*. Site Remediation; Government of British Columbia. Up to and including September 26, 2026. <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*
8. BC Ministry of Environment and Parks. (2026b, September 26). *Contaminated sites guidance and resources, Technical Guidance*. Site Remediation; Government of British Columbia.
<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*
9. BC Ministry of Environment and Parks. (2026c, September 9). *Site Remediation*. Site Remediation Web Pages, including all sub-pages and links - up to and including Sept 9th, 2026:
<https://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation>.
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https://www.researchgate.net/publication/339717621_The_Design_Performance_and_Analysis_of_Slug_Tests_2nd_Ed.
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<https://ccme.ca/en/res/2010-pah-csqg-scd-1445-en.pdf>.
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<https://publications.gc.ca/site/eng/9.939044/publication.html>.

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16. Contaminated Sites Approved Professionals of British Columbia (CSAP). CSAP Soil Vapour Advice and Practice Guidelines Development Panel (2009). *Soil Vapour Advice and Practice Guidelines Development – Stage 1*. <https://csapsociety.bc.ca/wp-content/uploads/Soil-Vapour-Panel-Stage-1-FINAL-Oct-09.pdf>.
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18. Contaminated Sites Approved Professionals of British Columbia (CSAP) & prepared by SLR Consulting (Canada) Ltd. (2015). *Bioaccumulation Research Project*.
<https://csapsociety.bc.ca/wp-content/uploads/CSAP-Bioaccumulation-Report..pdf>.
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<https://csapsociety.bc.ca/wp-content/uploads/r-PCOC-Guidance-June-2018-V1.0-002.pdf>.
21. Contaminated Sites Approved Professionals of British Columbia (CSAP), & prepared by SLR Consulting (Canada) Ltd. (2019). *Guidance for the Assessment and Remediation of Per- and Polyfluoroalkyl Substances in British Columbia*. <https://csapsociety.bc.ca/wp-content/uploads/Final-PFAS-Guidance-Documents-dated-2019-05-28.pdf>.
22. Contaminated Sites Approved Professionals of British Columbia (CSAP), Prepared by ARIS Environmental Ltd. and Golder Associates Ltd. (2020). *Guidance on the Assessment of the Soil Vapour to Air Pathway*.
https://csapsociety.bc.ca/wp-content/uploads/CSAP-Vapour-Guidance-Update-31August_20.pdf
23. Contaminated Sites Approved Professionals of British Columbia (CSAP), Technical Review Committee, & prepared by SLR Consulting (Canada) Ltd. (2020, June 10). *Petroleum Hydrocarbon PCOC Data Review, Soil and Groundwater*. <https://csapsociety.bc.ca/wp-content/uploads/CSAP-Petroleum-Hydrocarbon-PCOC-Review-v2-Final-2020-06-10.pdf>.
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36. Gilbert, R.O. (1987). *Statistical Methods for Environmental Pollution Monitoring*. Van Nostrand Reinhold.
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37. Golder Associates Ltd. (2010). *Technical Guidance for Contaminated Sites: Groundwater Investigation in Site Assessment (2nd Edition)*. Prepared for BC Ministry of Environment.
<https://www2.gov.bc.ca/assets/gov/environment/air-land-water/site-remediation/docs/bulletins/tech-guide-gw.pdf>.
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<https://www.gsienv.com/software/data-management-and-stats-tool/data-managment-tool/>.
39. *Handbook of Environmental Data on Organic Chemicals, Volume 1*. (2001). John Wiley & Sons Inc.
<https://catalogimages.wiley.com/images/db/pdf/0471374903.01.pdf>.
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41. Health Canada. (2016). *Perfluorooctane Sulfonate (PFOS) in Drinking Water*. (2016, September 2). Government of Canada. <https://www.canada.ca/en/health-canada/programs/consultation-perfluorooctane-sulfonate-pfos-in-drinking-water/document.html#a712>
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