CANADIAN REGISTRATION BOARD OF OCCUPATIONAL HYGIENISTS

ROHT

(Registered Occupational Hygiene Technologist)

Examination Handbook

For additional information, contact:
The Registrar

registrar@crboh.ca

Table of Contents

1. Examination Eligibility

Eligibility for the examination is based on having a combination of academic qualifications and professional experience.

For the most current information, review the "ROHT Eligibility" criteria document on our website: https://crboh.ca/examination/eligibility-exam-process-roht/

In addition to the academic and professional requirements:

- More than 50% of each year for which credit is claimed must be spent in occupational hygiene or closely related activities;
- Applicant must be engaged in occupational hygiene activities at the time the application is submitted; and
- Two professional references must be submitted based on the candidate's occupational hygiene work from ROH's or ROHT's or other similarly accredited persons who are familiar with the candidate's work. Other designations that may be accepted would be: CIH, CSP, CRSP, P.Eng., etc. References must fill out and submit the "ROHT Professional Reference Questionnaire"
- If two references cannot be provided, it is acceptable to have 1 professional reference and provide examples of your occupational hygiene work. Examples may include: assessment reports, research papers, etc.

1.1 Examination Format

The ROHT examination process is a written examination consisting of multiple choice, short answer, and essay questions. The examination is administered twice per year (spring/fall) There are two sessions, the first is an online multiple-choice session and the second is an in person short answer/essay session. Both sessions run for a maximum duration of 3.5 hours. The first part (online multiple choice) will have to have a successful pass prior to writing Part 2. Part 1 is held two weeks prior to Part 2. You will be notified by the registrar upon successful completion.

Part 1 – Multiple Choice

This section consists of approximately 150 multiple choice questions, all of equal value. The multiple-choice section is designed to test factual and technical knowledge of candidates.

Part 2 – Short Answer/Essay

This section consists of 2 full length essay questions and approximately 25 short answer/essay questions. Essay and short answer questions are individually weighted according to difficulty. All questions must be answered. Point form answers are not acceptable.

2. Examination Preparation

Candidates should consider their knowledge and experience within the areas of competency listed below. This process may assist candidates in identifying their strengths and weaknesses and enable them to suitably focus their efforts during examination preparation. Some examples of representative sample questions (multiple choice and short answer/essay style) and a listing of useful references in occupational hygiene are provided.

2.1 Sample Multiple Choice Questions:

1. The compound hexane is an:
   a. alkane
   b. alkene
   c. olefin
   d. none of the above

2. Which instrument uses chemiluminescence?
   a. LEL detector
   b. Mercury detector
   c. Halide detector
   d. Ozone detector

3. The pressure in a container is 5 psi at 0 degrees Celsius. The cylinder is allowed to warm up to 60 degrees Celsius. What is the new pressure in the gas cylinder?
   a. 10 psi
   b. 6 psi
   c. 3 psi
   d. 20 psi

2.2 Sample Short Answer Questions

1. Classify the following three products under WHMIS:
   a. Oxygen
   b. Hydrogen Sulfide
   c. Sodium Hydroxide

2. In each case, specify the hazard symbol(s), the class designation(s), and the name(s) of each class. Briefly describe the hazards and normal precautions associated with the handling of each product.

3. What is the diameter of a circular duct (in inches) if Q = 4000 cfm and the velocity pressure is 2.55" wg? Show all calculations in your answer.

4. The laboratory reports 130 micrograms of toluene desorbed from a charcoal tube. The sampling period was 15 minutes at a flow rate of 75 ml/min. What was the ambient concentration of toluene in ppm? Show all steps used in calculating your answer (assume MW = 92)

2.3 Sample Essay Question

Your company has recently moved into a newly renovated section of a high-rise office building in downtown Calgary. Within a few weeks your department started to receive a number of complaints from building occupants. General complaints include eye and upper airway irritation, headaches, nausea, and stuffy building air. Some of the data processing groups are also complaining of sore necks and wrists.

You suspect there may be issues with indoor air quality in the building, and possibly some workstation ergonomic issues with the data processing group. Map out a strategy for how you would assess each of these situations. In your answer briefly discuss the sources of information you would target to assist with problem analysis; the sampling protocol you would recommend (if any); and, subject to your findings, the principal control measures you would expect to include as part of your final report to management.

3. Examination Grading Process and Appeals

The CRBOH Administrative Office is responsible for ALL contact with examination candidates. This includes the receipt of application forms, review and decision-making regarding eligibility, exam location/date/time and selection of proctors. The Administrative Office handles all inquiries from candidates. The Administrative Office assigns each candidate a Candidate Identification Number. To ensure that marking is carried out "blind", Examination Committee members do not have access to these identifiers.

Written examinations are marked by the ROHT Examination Committee. Multiple choice questions are marked by the online software system, which has been set up prior to the examination. The short answer/essay style questions are marked independently by at least two members of the Committee. The results are collated by the Chair and any anomalies or inconsistencies are reviewed. The chair of the Committee forwards the results to the Board of Directors with the recommendation of the Committee as to whether the candidate should be granted a pass or fail.

Candidates who wish to appeal the results of an examination must provide their appeal in writing to the Registrar within 30 days of receiving the examination results.

The minimum grade necessary to pass the ROHT examination is as follows:

Section 1 – Multiple Choice 50%

Section 2 – Short Answer/Essay 50%

Overall Combined Score 60%

4. Useful References in Occupational Hygiene

The following list of texts, manuals, journals, regulations, standards, and guidelines are provided to give candidates examples of the types of materials they should be reviewing in preparation for the examination. The list is not meant to be complete or exhaustive.

Candidates are expected to use professional judgment in selection of other reading material for exam preparation. Candidates are expected to use the most recent edition available.

4.1 Texts

- Casare Accident Prevention Manual for Industrial Operations; National Safety Council
- Air Monitoring Instrumentation; C.J. Maslansky and S.P. Maslansky
- Air Sampling Instruments, ACGIH
- AIHA Noise and Hearing Conservation Manual
- Building Air Quality; U.S. EPA and NIOSH
- Bioaerosols: Assessment and Control: ACGIH Bioaerosols Committee;J.Macher
- Casarette and Doull's Toxicology: The Basic Science of Poisons; C.D.Klaassen
- Chemical Hazards of the Workplace; Proctor & Hughes
- Ergonomics Design for People at Work, Volumes 1 and 2; Eastman Kodak Company
- Fundamentals of Industrial Hygiene; B.A. Plog and T. Hogan
- In-Plant Practices for Job Related Health Hazards Control, Volumes 1 and 2;L.V. Cralley and L.J. Cralley
- Industrial Hygiene Management; J.T. Garrett, L.J. Cralley and L.V. Cralley
- Modern Industrial Hygiene; J.L. Perkins
- Noise and Noise Control; M.J. Crocker and F.M. Kessler
- Practical Loss Control Leadership; F.E. Bird and G.L. Germain
- Recognition of Health Hazards in Industry: A Review of Materials and Processes; W.A. Burgess
- The Dose Makes the Poison: A Plain Language Guide to Toxicology; M.A.Ottoboni
- Guide d'échantillonnage des contaminants de l'air en milieu de travail, IRSST.

4.2 Manuals (latest editions)

- Handbook of Chemistry and Physics
- ACGIH Industrial Ventilation: A Manual of Recommended Practice
- NIOSH Guide to Industrial Respiratory Protection
- NIOSH Manual of Analytical Methods
- ACGIH Air Sampling Instruments Handbook
- AIHA The Noise Manual
- NIOSH Occupational Exposure: Sampling Strategy Manual

4.3 Regulations, Standards, Guidelines

- Occupational Health & Safety Legislation (Act & Regulations) within at least one Canadian jurisdiction
- Workplace Hazardous Materials Information System Regulation
- Transportation of Dangerous Goods Act (federal)
- ACGIH: The Documentation of TLVs and BEIs
- ACGIH: TLVs: Threshold Limit Values and Biological Exposure Indices

4.4 Workbooks

- IAQ and HVAC Workbook; D.J. Burton
- Industrial Ventilation Workbook; D.J. Burton
- Occupational Health Workbook (formerly Industrial Hygiene Workbook); D.J. Burton

5. Areas of Competency

5.1 Basic Science

General concepts of chemistry, physics, mathematics, anatomy, physiology, and biology as they relate to the discipline of occupational hygiene.

- How gases behave
- How vapour moves
- Familiar with all the different formulas
- Skin notations, particulate size in relation to deposition
- Volatility of different chemicals
- Adding logos's
- SDS familiarity/WHMIS
- Concentration/dilutions
- Unit conversions
- mean, median, mode, Standard deviation
- How noise impacts different parts of the ear

5.2 Regulations, Standards, Guidelines

General understanding of occupational health, safety, and hygiene legislation in at least one Canadian jurisdiction is expected. Understanding of relevant industry standards and guidelines from various sources (e.g., CSA, ANSI, NIOSH, ACGIH, ASHRAE, ISO) is also expected. In addition, general knowledge on the following is important:

- How to develop a program (chemical approval, respiratory protection, noise and hearing conservation)
- What jurisdiction different workplaces fall into (Provincial, Federal, Municipal) and which regulations or guidelines apply.

5.3 Hazard Recognition and Effects

Understanding of general concepts of toxicology as well as potential health effects of chemical, physical, biological and ergonomic hazards in the workplace. This includes recognition of routes and symptoms of exposure.

- Understanding disease relation to agent (e.g.: fibrosis, leukemia, absorption, mesothelioma)
- Occupational carcinogens
- Routes of entry
- Synergies of different agents
- Carpal tunnel syndrome
- Noise induced hearing loss
- Indoor air quality

5.4 Evaluation

Detailed understanding of the types of field instruments required for assessment as well as knowledge of exposure limits, analytical methods, and related hygiene calculations.

- Importance of calibration
- Air sampling equipment
- Filter types for different agents
- Flow rates
- Size selection/cyclones
- Adsorption
- Impingers
- NIOSH methods (e.g., 7500, 7602, 0600)
- Blank samples
- Calculations based on analytical result
- Span calibration, drift calibration
- Diffusion badges

5.5 Control

Understanding of the types and effectiveness of engineering, administrative and personal controls used to manage workplace hazards. Knowledge of ventilation calculations will also be required.

- Capture velocity
- Duct velocity
- What type of ventilation would you expect at different work sites (woodworking shop, welding)
- Noise controls (shielding, isolation, PPE, etc.)
- Noise Reduction Ratings for Hearing Protection
- Vibration controls
- Respiratory protection (applied protection factors, fit factors (quantitative vs qualitative), maximum use concentrations
- Administration controls (work rest ratios, procedures, training, etc.)

5.6 Miscellaneous

Understanding of training strategies, program and policy development, labour relations issues, related safety principles and statistical calculations.

- Workplace health and safety committees; their role in the workplace
- Consultation with workers (employee reps)
- Confined space
- 4 head safety gas detection (LEL, OEL, Flash points)

6. Useful Equations for CRBOH Examinations

The following list of equations is intended to assist candidates in preparation for the CRBOH ROHT examination. It will also be provided for use during completion of the examination. This list is not meant to be complete or exhaustive. Consequently, use of any or all of these equations will not necessarily result in successful completion of the ROHT examination.

6.1 General Practice and Statistics

$ppm = \frac{V_{contam}}{V_{air}} x\, 10^6$	$ppm = \frac{P_v}{P_{atm}} x\, 10^6$	$ppm = \frac{mg/m^3 \text{ x } 24.45}{m.w.}$	$\frac{P_1V_1}{nRT_1} = \frac{P_2V_2}{nRT_2}$
$LCL_{as} = \frac{TWA}{OEL} - SAE$		$pH = -\log_{10}[H^+]$	
$TLV_{mix} = \frac{C_1}{TLV_1} + \frac{C_2}{TLV_2} + \ldots + \frac{C_n}{TLV_n}$		$TLV_{mix} = \frac{1}{\frac{F_1}{TLV_1} + \frac{F_2}{TLV_2} + \ldots + \frac{F_n}{TLV_n}}$	
$\overline{X} = \frac{X_1 + X_2 + \ldots + X_n}{n}$		$SD = \sqrt{\frac{\Sigma(\overline{x} - x_i)^2}{n-1}}$	
$GSD = \frac{84.13\%tile\ value}{50\%tile\ value}$		$GSD = \frac{50\%tile\ value}{15.87\%tile\ value}$	
$SAE = 1.645\, CV_{total}$			

6.2 Noise

$Lp = 20\,(\log \frac{P}{P_o})$	$Lp_2 = Lp_1 + 20 \log(\frac{d_1}{d_2})$
$f_2 = \sqrt{2}\, f_1$	$f = \frac{(N)(RPM)}{60}$
$f = \frac{c}{\lambda}$	

6.3 Ventilation

$Q = VA$	$V = 4005\sqrt{VP}$ (imperial units) $V = 4.04\sqrt{VP}$ (metric units)
$TP = VP + SP$	$VP_{ave} = (\frac{\sqrt{VP_1} + \sqrt{VP_2} + \ldots + \sqrt{VP_n}}{n})^2$
$N_{Changes} = \frac{60Q}{V_{room}}$	

6.4 Radiation

$I_2 = I_1(\frac{d_1}{d_2})^2$

6.5 Heat/Cold Stress

$WBGT = 0.7\,t_{nwb} + 0.2\,t_g + 0.1\,t_{db}$	$WBGT = 0.7\,t_{nwb} + 0.3\,t_g$

6.6 Constants

$gas\ constant, R = 8.314\ J/mole\ °K$	$molar\ vol\ at\ 25°C, 1\ atm = 24.45\ l$
$density\ of\ air = 1.2\ kg/m^3\ @\ 760\ mmHg, 21°C$	

6.7 Conversions

$°F = 9/5\ (°C) + 32$	$°R = °F + 460$	$°K = °C + 273$	$1\ ft^3 = 28.32\ l$
$1\ atm = 14.7\ psi = 760\ mm\ Hg = 29.92\ in\ Hg = 33.93\ ft\ water = 1013.25\ mbar = 101,325\ pascals$			
$1\ ft^3 = 7.481\ U.S.\ gal$	$1\ l = 1.06\ qt$	$1\ inch = 2.54\ cm$	$1\ lb = 453.6\ gm$
$1\ gram = 15.43\ grains$	$1\ BTU = 1054.8\ joules = 0.293\ watt\ hr$		$1\ Gray = 100\ Rad$
$1\ Curie = 3.7 \times 10^{10}\ disint/\ \mathrm{sec}\ (Becquerel)$		$1\ Sievert = 100\ Rem$	
$1\ Tesla = 10,000\ Gauss$		$g = 981\ cm/\mathrm{sec}^2 = 32\ ft/\mathrm{sec}^2$	