A Body of Knowledge (BoK) represents a collection of knowledge and skills within a profession that are generally known to its members and recognized as essential in the profession’s practice. The Certified Mine Safety Professional (CMSP) BoK has been developed by subject matter experts from across the spectrum of mining commodities, methods, mine size, and geographical distribution worldwide. It was validated through a Job Assessment Survey conducted across a second set of practicing, mining safety and health, subject matter experts. The Board of Directors of International Academy of Mine Safety & Health of the Society for Mining, Metallurgy & Exploration (IAMSH of SME) believe the CMSP BoK is most relevant as a reflection of the potential scope of practice for mine safety and health professionals, rather than just a tool to facilitate preparation for the CMSP examination. This is especially true for those committed to sustainable, safety and health management excellence. Relative to the examination, the weighting of the BoK domains remain fixed until a subsequent revision. The domains are reflective and not prescriptive.

I. FUNDAMENTAL KNOWLEDGE OF SCIENCE & ENGINEERING: 10 QUESTIONS

A. Science & Mathematics  2 questions

1. Mathematics & statistics
   a. Calculation of accident frequency
      i. LTA, DART
      ii. Fatality statistics
      iii. Comparison to industry averages
   b. Prioritizing incident numbers
      i. Tying statistics to action on safety programs
   c. Basic Pareto charting
      i. Steps of creating a chart
      ii. Measuring events
      iii. Graphing events on Pareto
   d. Calculation of accident severity
      i. LTA
      ii. RWDA

2. Chemistry
   a. Oxidation
   b. Fire tetrahedron
   c. Mine gases
   d. Inert gases

3. Physics
   a. Suspended weight
   b. Friction
   c. Momentum
4. Toxicology
   a. Carcinogens
   b. Receptors
   c. LD50
   d. Silica
   e. Coal dust
   f. Mine Gases
   g. Alcohol
   h. Drugs

5. Human anatomy & physiology
   a. Proper lifting – NIOSH lifting equation
   b. Shift length – metabolism
   c. Sleep (fatigue), time awake vs. risk
   d. Eyesight

6. Psychology
   a. Maslow’s Hierarchy
   b. Teaming
   c. Acting alone
   d. Behavioral

B. Mining

1. Mining life cycle
   a. Prospecting
   b. Exploration
   c. Feasibility
   d. Mine construction
   e. Operations
   f. Mine closure
   g. Sustainability

2. Mining methods
   a. Underground room & pillar
   b. Underground longwall
   c. Underground caving
   d. Underground stoping – supported back
   e. Underground stoping – instable back
   f. Surface open pit
   g. Surface strip mining
   h. Solution mining
   i. Placer mining

3. Mining equipment
   a. Tracked
   b. Trackless – Rubber-tired
   c. Swing
   d. Fixed position
   e. Supply equipment
   f. Mantripping
   g. Hoisting
   h. Automation

4. Mining processes
   a. Surge pile surface
   b. Underground raw ore
   c. Crushing
   d. Mineral processing & mills
   e. Refinery
   f. Smelting
C. Mining Engineering

1. Fundamentals of mining geology
   a. Ore deposits overview
   b. Rock types (igneous, metamorphic, sedimentary)

2. Fundamental mining engineering principles
   a. Demand load
   b. Design for supply to the load
   c. Mine ventilation systems
   d. Bleeder, bleederless, gobs, sealing, old works

3. Mine planning
   a. Long range, 1 to 10-year plans
   b. Short range, 1 week to 2 months
   c. Interface of Safety to short range plans

4. Mining ventilation
   a. Resistance to flow
   b. Fans
   c. Circuits

5. Ground control plans, principles and methods
   a. Pillar sizing
   b. Roof bolt design – primary systems
   c. Standing support – secondary systems
   d. Stress shadowing

6. Fundamentals of rock mechanics
   a. Stable rock
   b. Instable rock
   c. Geologic hazards

II. LEADERSHIP, ORGANIZATION & CULTURE:

A. Leadership

1. Key leadership models
   a. Maslow
   b. X,Y
   c. Army leadership method

2. Leadership styles
   a. Assertiveness
   b. Collaborative
   c. Direct

3. Management vs leadership activities
   a. Planning, organizing, controlling
   b. Sig Sigma: DIMAC
      i. Define
      ii. Investigate
      iii. Measure
      iv. Apply
      v. Control - feedback

4. Leadership competencies linked to safety
   a. Mine communication
   b. Departmental communication
   c. Individual communication
   d. Structure teaming communication – risk analysis
5. Leadership development
   a. Miners training
   b. 1st line supervisors training
   c. Middle management training
   d. General management training

6. Linkage to culture & climate
   a. Observational
   b. Spot inspection technique

7. Assessment of leadership problems
   a. Micro, macro management
   b. Situational effectiveness

B. Culture
   3 questions

   1. Fundamentals of safety culture
      a. Positive reinforcement
      b. Repetition of safe behavior
      c. Executive support
      d. Partnership (2 miners)
      e. Identify Culture Characteristics

   2. Culture/climate assessment/measurement
      a. Measuring safety culture
      b. Measuring climate

   3. Culture enhancement
      a. Program promotion methods
      b. Incentivizing methods
      c. Importance of consistency
      d. Quid pro quo of safety

C. Loss Control and Economics
   4 questions

   1. Basic mining economics & terminology
      a. The cost of mining – cost centers
      b. The cost of mining – activity based

   2. Modeling direct & indirect loss
      a. The direct cost of loss
      b. The indirect cost of loss
      c. The cultural aspect of loss

D. Responsibility & Accountability
   4 questions

   1. Differentiating responsibility & accountability
      a. Definitions
      b. Practical examples

   2. Applying responsibility & account. to S&H management
      a. Mine organizational structures
      b. Reporting relationships

   3. Discipline (versus responsibility & accountability)
      a. Progressive, how and when to apply
      b. Termination, how and when to apply

   4. Management by objectives
      a. Programming methods
      b. Forms
      c. Meeting and follow-up scheduling

   5. Establishing goals
      a. Appropriate
      b. Attainable
      c. Proactive
      d. Measurable
      e. Renewed
III. SAFETY, HEALTH & RISK MANAGEMENT: 50 QUESTIONS

A. Risk Management 12 questions

1. Mining-specific hazards
   a. Underground
   b. Surface
   c. Plant
   d. To/from work

2. Non-specific hazards

3. Energy sources
   a. Mechanical
   b. Potential
   c. Kinetic
   d. Hydraulic
   e. Electrical
   f. De-energizing

4. Hazard identification techniques
   a. Manufacturer supplied
   b. MSDS sheet
   c. Mine inventory

5. Situational awareness
   a. Dupont’s STOP program
   b. MSHA’s SLAM program
   c. NMA’s Core program

6. Risk assessment approaches & techniques
   a. Pad & pencil
   b. Formalized individual
   c. Formalized team approach
   d. Risk assessment matrix
   e. Bow Tie
   f. Fishbone
   g. Probability and variants
   h. Pre-task

7. Risk controls
   a. Job procedure
   b. Engineering
   c. Administration
   d. Regulatory
   e. Freedom to act culture

8. Fatal risk management principles
   a. Assessment by survey at the mine
   b. Assessment by history – other mines
   c. Assessment by history – MSHA/OSHA library

9. Characteristics of risk
   a. Potential risk to incidents to accident to fatalities…the Safety Triangle

10. Acceptable risk
    a. Probability-based
    b. Observational-based
    c. Intentional-conscious
    d. Habitual

11. Safe operation procedures/safe work instructions
    a. 3 step procedure after the Safety and Loss Control Institute of Atlanta Georgia

12. Hierarchy of control

13. Personal protective equipment
    a. Basic line
    b. Additional (i.e. gloves)
    c. Specialized
14. Risk control verification
   a. Tying risk analysis program to safety results

15. Management of change
   a. GE Change Acceleration process

B. Human Factors/Behavior  
   8 questions
   1. Key theories of human behavior
   2. Key elements of human error
   3. Assessment of error & at-risk behavior
   4. Error & behavior measurement
   5. Error mitigation techniques
   6. Behavior modification techniques
   7. Mobile equipment design
      a. Ergonomics
   8. Fixed equipment design
      a. Ergonomics
   9. Fatigue & alertness assurance
   10. Fitness for duty

C. Occupational Hygiene  
   4 questions
   1. Basic principles of occupational hygiene
   2. Methods of exposure assessment
      a. Body organ transmission
      b. Basic laboratory assessment
      c. Epidemiological timeline
      d. LD50
   3. Occupational Exposure Limits (OELs)
      a. STEL's, NIOSH standards
   4. Exposure assessment data analysis

D. Occupational Health  
   4 questions
   1. Basics principles of occupational medicine
   2. Linkage between exposure & dysfunction
   3. Mining-specific occupational disease
   4. Non-specific occupational disease (e.g., NIHL)
   5. Medical surveillance
      a. Safety program participation
      b. Implementing Worker’s Compensation Insurance
   6. Working with health professionals & other stakeholders
   7. Principles of ergonomics
   8. Ergonomic risk assessment
   9. Ergonomic risk mitigation
      a. Equipment manufacturer interface
E. Education, Training & Competency

1. Adult learning theory
   a. Do as I say
   b. Do as I do
2. Education & training methods
3. Education & training needs assessment
4. On-the-job training, safe work instruction, task training
5. Competency verification
   a. On-the-job testing methods
6. Training & education effectiveness assessment

F. Emergency & Crisis Management

1. Emergency preparedness & response
   a. Notification hierarchy
   b. Order of response
2. Mine rescue organization & training
   a. Equipment
   b. Communications
   c. Mapping
   d. Fresh-air base, safe harbor
   e. First-aid and evacuation
   f. Role of Mine safety Department
   g. Training regime
3. Incident management & communication
   a. TV
   b. Lawyer
   c. Spokesman
4. Recovery

G. Incident Reporting & Investigation

1. Incident definitions & categorization
2. Near miss reporting, investigation & analysis
   a. Near misses in safety triangle research
3. Incident investigation techniques
4. Root cause analysis techniques
5. Key models & theories
IV. MANAGEMENT SYSTEMS, REGULATION & ASSURANCE: 15 QUESTIONS

A. Management Systems 10 questions

1. Principles of safety management systems
   a. Behavioral-based safety
   b. DuPont’s STOP
   c. MSHA’s SLAM
   d. NMA CORE

2. Governance, structure & functionality

3. Consensus management system standards

4. Management system metrics

5. Management system auditing

6. Continuous improvement principles

7. Systems vs. Programs
   a. Elements of a full program

B. Regulation & Legislation 5 questions

1. Regulatory requirements of area(s) of responsibility for H&S professional
   a. Major worldwide mine safety law

2. Integrating management systems & regulation

3. Techniques for regulatory compliance
   a. Inspector protocol

V. PROFESSIONAL SKILLS, CONDUCT & ETHICS: 10 QUESTIONS

A. Professional Skills 8 questions

1. Strategy development & program management

2. Persuasion (ability to influence opinion)

3. Inter-personal communication (verbal, non-verbal and written)

4. Project management

5. Personnel & performance management

6. Interpreting relevant safety & health research

7. Using information technology (hardware & software for S&H)

8. Data analysis, trending, interpretation & action (upon)

9. Time management

10. Problem-solving

11. Delegation

12. Managing up

13. Networking & collaboration

14. Advocacy (internal & external)

15. Recognition & reinforcement

B. Professional Ethics 2 questions

1. Related codes of ethics
   a. Canadian requirements for Professional Engineering Licensure
   b. IAMSH / CMSP code of ethics
   c. NIOSH code of ethics
   d. Medical code of ethics (Hippocratic Oath)