

Human Safety

Hebron Environmental Review

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Associate Professor,
Anesthesiology,

Specialist in Diving & Hyperbaric Medicine

Biography

- Staff anesthesiologist
- Commenced hyperbaric medicine with a fellowship at the University of Toronto in 1986
- Medical Director of the Hyperbaric Medicine Service in St. John's, Newfoundland and Labrador
- Recognized as a specialist in diving and hyperbaric medicine by the Canada-Newfoundland and Labrador Offshore Petroleum Board.

Biography

- President and founder of the Canadian Chapter of the Undersea and Hyperbaric Medical Society (CC_UHMS)
- Chair of the Standards of Practice and Patient Safety Committee of the CC_UHMS
- Promotes high quality safe standards of care and research in hyperbaric medicine

Biography

- Medical coverage of offshore diving operations through Atlantic Offshore Medical Services (AOMS)

“Benefits”



Context

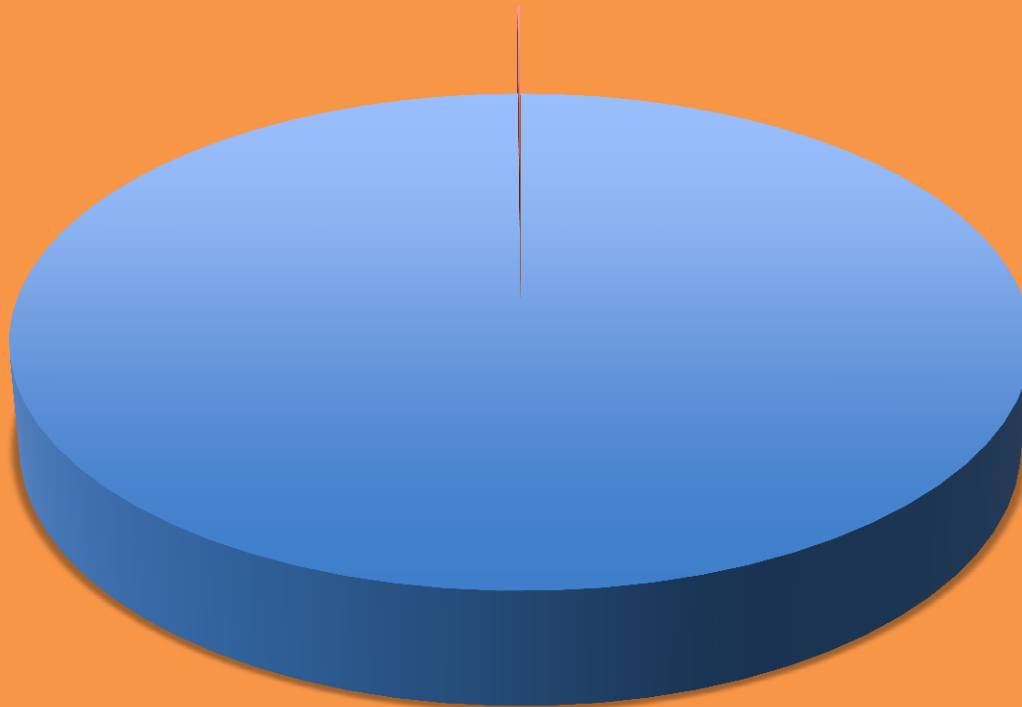
- Crash of Cougar flight 491 helicopter with death of 17 of the 18 people on board mostly due to drowning
- Public inquiry led by Commissioner Robert Wells
- Saturation divers died of lack of oxygen inside a hyperbaric chamber in the Persian Gulf when Dive Support Vessel sank in bad weather

Context

- Absence of physician certification in diving and hyperbaric medicine
- Lack of standards in hyperbaric medicine
- Probability of survival in the ocean from a helicopter ditching or crash is very low
- Extreme environmental conditions affect likelihood of survival in emergency evacuation of an offshore production or drilling facility

Share of the benefits pie?!

Benefits



- Engineering
- Human Safety
-
-

Benefits process

- Research and Development
- Education and training

Two components in this presentation

Diving & Hyperbaric Medicine

- Diving operations remain important to offshore oil and gas
- Diving and hyperbaric medicine physicians have an essential role

Humans in Extreme Environments

- Harsh environmental conditions associated with offshore oil and gas exploration and production create important safety concerns

DIVING & HYPERBARIC MEDICINE

Role of hyperbaric medicine and hyperbaric chambers in offshore development

- “Saturation divers” live inside hyperbaric chambers under pressure and perform deep ocean work on the sea floor
 - Medical coverage is mandatory
- Treatment of decompression illness and arterial gas embolism
- Safe decompression from working depths offshore Newfoundland and Labrador takes about 4 days

Role of hyperbaric medicine and hyperbaric chambers in offshore development

- Risk of arterial air embolism in helicopter escape and helicopter escape training using emergency breathing equipment

CNLOPB diving regulations

- Medical kit has not been revised for decades and is grossly out of date
 - Required medical kit and equipment are not adequate
- Diving regulations are outdated

Some examples of developments since CNLOPB diving regulations

- Pulse oximeter
- AED – Automated Emergency Defibrillators
- ECG – expectation for 12-lead ECG to be available
- Many changes in medical equipment and supplies
- Changes in airway management
 - Laryngeal masks
 - Video laryngoscopes

Developments since CNLOPB diving regulations

- Offshore email and internet
- Internet video and audio communications
 - Average teenager or pre-teen makes greater use of communication technologies than offshore diving operations
- Use of medical simulation / patient simulators
 - Potential uses for training of diver medics, physicians and nurses

Developments since CNLOPB diving regulations

- Increasing age of divers
- Changes in many medical standards and treatments, for example
 - Coronary artery stents
 - Many drug treatments
- Changes in Canadian Standards Association (CSA) standards related to diving and hyperbaric chambers

Offshore diving medical regulations

- Revising regulations related to medical requirements for offshore diving requires input from experts but this does take time and therefore has a cost
- Need to update regulations

Qualifications of Diving Medicine Physicians

- CSA Standards provide useful guideline related to appropriate physician qualification
 - CSA does not certify / credential / train physicians
- In Canada up until now (2011) there has been no formal or national certification process or recognition for diving and hyperbaric medicine physicians



Canadian Chapter of the Undersea and Hyperbaric Medical Society (CC_UHMS)

Federally registered not-for-profit
corporation
Based in Newfoundland and Labrador

Established 2010

www.cc-uhms.ca

CC_UHMS

- Board of Directors representing all areas of Canada

CC_UHMS objectives

- To be recognized by, and function as the national hyperbaric medical society in Canada and as the national Chapter of the Undersea and Hyperbaric Medical Society (UHMS) in Canada in a manner compatible with the constitution and bylaws of the UHMS and applicable Canadian laws and regulations pertaining to non-for-profit medical societies

CC_UHMS objectives

- To be recognized and function as the national specialty organization for hyperbaric physicians in Canada

CC_UHMS objectives

- To be recognized and function as a national organization for other health care and technical professionals involved in hyperbaric treatment and diving research and activities, and a forum for such professionals to interact and work with diving and hyperbaric medicine physicians to further the goals of the Corporation

CC_UHMS objectives

- To promote scientific and clinical excellence in hyperbaric and diving medicine and the availability of high quality, safe, effective and appropriate hyperbaric medical care by:
 - Developing, establishing and providing accreditation programs for hyperbaric treatment facilities
 - Fostering and participating in scientific research related to hyperbaric and diving medicine, undersea and altered pressure environments
 - Promoting awareness and understanding amongst physicians, other health care professionals and the public about the appropriate indications for hyperbaric treatment
 - Developing, providing or supporting education, training, certification and credentialing programs for physicians, scientists, health care professionals and technical personnel related to hyperbaric and diving medical care
 - Developing, promulgating and encouraging compliance with professional guidelines and standards of care related to hyperbaric treatment and diving medicine

CC_UHMS objectives

- To provide a forum for communication among individuals and groups involved in life sciences and other disciplines concerned with:
 - Basic and applied studies related to human factors aspects of the underwater and hyperbaric environments
 - Extending human activity and safety in these environments
 - Promoting public information concerning the problems and achievements in use of these environments

CC_UHMS objectives

- To provide a forum for Canada-wide and international cooperation of different disciplines to achieve the above objectives of the Corporation

CC_UHMS

- Standing committees:
 - Standards of practice and patient safety
 - Accreditation
 - **Credentials and certification**
 - Hyperbaric oxygen treatment
 - **Diving medicine**
 - Economics and human resources
 - Government liaison, public relations and communications
 - Finance
 - Membership and organization
 - **Research**
 - **Education**

CSA standards

1. CAN/CSA –Z180.1 (R2010) – Compressed Breathing Air and Systems
2. CAN/CSA- Z275.1-05 – Hyperbaric Facilities
3. CAN/CSA- Z275.4 -02 (R2008) – Competency Standards for Diving Operations
4. CAN/CSA – Z275.2-11 – Occupational Safety Code for Diving Operations
5. CAN/CSA – Z275.3-09 – Occupational safety code for work in compressed air environments
6. CAN/CSA – Z275.5 – 05 – Occupational Diver Training
7. CAN/CSA – Z275.6-11 – Unexploded explosive ordinance (UXO) and munitions diving

CSA standards

- CAN/CSA- Z275.4 -02 (R2008) – Competency Standards for Diving Operations
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 - 26. Diving and Hyperbaric Physicians

26.1 Categories for Hyperbaric Physicians

Competency in hyperbaric medicine can be broadly divided into three categories defined as follows:

- (a) Level 1 – a physician with basic training in diving medicine who is capable of screening workers for exposure to pressure and advising on the management of pressure-related accidents
- (b) Level 2 – a physician with advanced training in diving medicine who is capable of all the activities of a Level 1 physician and additionally is able to manage all aspects of pressure-related accidents, including entering the chamber to attend the injured worker; and
- (c) Level 3 – a physician who has advance training in diving medicine and has practical experience with the management of diving-related illness and injury such that he or she is thoroughly familiar with all aspects and hazards of pressure and underwater exposures and can manage any pressure-related accident, including saturation and long-term management

26.2 Competency Criteria

26.2.1 Level 1

To be certified at this level, physicians shall be able to demonstrate that they:

- a) Are in possession of a license to practice in one of the territories or provinces of Canada
- b) Have completed a basic training course in diving medicine;
- c) Have an effective working knowledge of the physical laws affecting the diver and the underwater operation;
- d) Have an understanding of the interaction that occurs between these physical laws and the diver's physiology and of the implications of this interaction for the diver

26.2 Competency Criteria

- e) Have a sufficient awareness of the pathological conditions that can arise as a consequence of exposure to pressure;
- f) Have the ability to perform a competent physical evaluation of diving candidates, divers and caisson workers;
- g) Are familiar with the management steps to be followed in the event of an accident or other adverse condition arising as a consequence of diving operations; and
- h) Are knowledgeable with respect to the appropriate steps to be taken in the initial investigation of any diving incidents, accidents, or fatalities, including but not limited to the appropriate autopsy protocol to be followed in the event of death

26.2 Competency Criteria

26.2.2 Level 2

Level 2 physicians shall

- a) Meet all the requirements for Level 1 physicians;
- b) Be familiar with the general principles of management for all forms of decompression illness, including the various tables and the appropriate application;
- c) Be sufficiently physically fit to participate in chamber diving operations. (They shall not be required to meet the physical fitness standard where they are able to delegate to other qualified personnel all medical acts that would require to elevated pressure.);
- d) Have completed training with regard to the safe operation of hyperbaric facilities, and be familiar with CSA Standard Z275.1; and
- e) Have sufficient practical experience with any chamber systems in use to ensure appropriate application of CSA Standard Z275.1

26.2 Competency Criteria

26.2.3 Level 3

Level 3 physicians shall

- a) Meet the requirements for Level 1 and Level 2 physicians;
- b) Have additional training and / or experience in the management of pressure-related accidents, including the use of saturation methods and long-term follow-up;
- c) Be thoroughly familiar with all aspects and hazards of pressure and underwater environments; and
- d) Have an understanding of the various standards applicable to the safe conduct of the diving operations underway and of their application.

Qualifications of Diving Medicine Physicians

- Fitness to Dive Course (Vancouver, Oct. 2011) intended to meet the requirements for Level 1 hyperbaric physician in CSA Z275.4-02
- CC_UHMS intends to initiate formal training and certification process
 - Diploma program from Royal College of Physicians and Surgeons of Canada (available to all physicians) / Canadian College of Family Physicians
 - Fitness to Dive course will become a component of the Diploma course
- Credentials Committee of the CC_UHMS can review training and qualifications of hyperbaric physicians and provide report

Diving Medicine Committee of the CC_UHMS

- The committee is working on:
 - Fitness standards
 - Physician training requirements and training programs
 - Hyperbaric treatment issues
 - Standards of practice
 - Research requirements

Diving Regulations

- Many provincial / territorial / federal / joint jurisdictions have regulations pertaining to occupational diving
 - Some variation in requirements
 - Many jurisdictions refer to CSA standards
 - Regulations often enforced by Occupational Health and Safety departments, Workers Compensation Commissions or government appointed agency

Diving Regulations

- Regulations vary in different countries
- Diving regulations in the U.K. and Norway are widely recognized and may be utilized by major offshore diving companies
- Offshore diving requirements less developed in Canada

Expectations of diving employers

- Diving operators do not receive detailed medical reports on divers, just the medical certificate
 - Expectation that there is a common standard and that divers who meet the requirements are fit to work in all conditions
 - May or may not agree to hire divers with particular medical restrictions (often depends on compatibility with specific work tasks)

Different jurisdictions

- Diving medical in one province may or may not be accepted in a different jurisdiction
- Certification of hyperbaric physicians expected to result in broad acceptance of medical certification of fitness to dive across Canada and internationally

Diver Certification Board of Canada (DCBC)

- Currently maintains a list of “recognized diving physicians”
 - This is simply a self declaration of individual physicians
- CC_UHMS intends to begin to maintain a list of Diving and Hyperbaric Physicians who have taken appropriate training courses and who are certified for determining Fitness to Dive
 - Will support link from DCBC website

CC_UHMS diving / hyperbaric physicians list

- The Credentials Committee and the Board of Directors of the CC_UHMS will be considering the issue of maintaining a list of physicians who meet the expected standard for undertaking occupational dive medicals
- Provincial / territorial / federal agencies may maintain their own list (Work Safe BC has a list on its website)

Hyperbaric chamber facilities

- Capabilities in St. John's degraded
 - Multi-place chamber aging, difficult to maintain
 - Need for a new chamber
 - Staffing issues
 - Including qualifications and training requirements
 - University no longer supporting the hyperbaric facility

CC_UHMS: Diving Medicine Committee

- Very limited / minimal resources
- Funding would assist with
 - Development of physician training programs needed to ensure properly qualified and certified diving & hyperbaric physicians are available in Canada
 - Development of medical and fitness standards
 - Participation in updating regulations and standards
 - Research related to offshore diving medicine
 - Access to simulators to help with training medical and other hyperbaric personnel

Diploma in diving and hyperbaric medicine

- Cost of application to the Royal College of Physicians and Surgeons of Canada is over \$14,000
- Developing the training program and examinations will also require resources
- Obvious benefits to diving operations to have proper certification of hyperbaric physicians and developed standards for fitness certification and medical coverage of offshore diving

Medicine of saturation diving

- Minimal availability of training programs for physicians related to saturation diving
- “SatMed” course and conference being considered for St. John’s but support needed to make this possible

HUMANS IN EXTREME ENVIRONMENTS

Extreme environments initiative

- Multi-disciplinary collaboration centered at Memorial University
- Links to:
 - Other Canadian academic / military / commercial centres and agencies
 - International centres and agencies (space agencies, universities)
- Leading role of Faculty of Medicine and the Environmental Sciences program

Extreme environments initiative

- Purpose of the initiative is:
 - Development and delivery of courses related to humans in extreme environments
 - Research and development related to humans in extreme environments
- At Memorial University - involvement of
 - Marine Institute Offshore Safety and Survival Centre
 - Medicine
 - Science / Environmental Science
 - Kinesiology
 - Engineering

Human safety in extreme environments

- Conditions offshore in Newfoundland and Labrador constitute some of the most extreme environments for development of oil and gas industries
- Relatively little support of initiatives related to human safety in such hazardous extreme environments
- Investment in research, development, education, training and service capabilities would be expected to result in long-term benefits to:
 - Hebron and other offshore oil and gas development
 - Safety of personnel working offshore in Newfoundland and Labrador, Canada and elsewhere

Extreme environments initiative

- **Primary purposes:**
 - R&D in Human Health and Safety
 - Education and Training
- **Secondary purposes:**
 - Enhanced service capabilities enabled by achieving primary purposes

Extreme environments initiative

- **Specific Objectives:**

- To provide an occupational health and safety environment at current world standards and beyond in order to
- Enhance the competitiveness of the Project in national and international context

Extreme environments initiative

- Support for program start-up initiatives and for early R&D from Hebron benefits program would help to “kick-start” extreme environments initiative
- In the mid-to-long-term, training, education, R&D and other services related to human safety and performance in extreme environments have the potential to be self-sustaining from course fees and other revenues

Extreme environments initiative

- **Objectives:**

- Compile overview of state-of-the-art elsewhere in the world, especially in North Sea
- Design and optimisation of procedures and of equipment to meet these standards and to reach beyond
- Enhanced emergency hyperbaric treatment capabilities are needed to enable safe conduct of realistic helicopter escape training
- Identification of risk areas in the training of offshore personnel
- Design of protocols and equipment for monitoring of stress levels during the training

Extreme environments initiative

- Survivability of dry and wet exposures; safety education and training , development of innovative means of subject's tracking and location and of information about their physiological status
 - **Education and Training**
- Optimisation of ship-borne and air-borne search and rescue procedures, including the use of emerging satellite technologies and development of smart tools for tactical and strategic use of rescue assets
 - **Education and Training**

Extreme environments initiative

- Fatigue on- and off-duty as factors contributing to accident, including assessment of human performance and probability of errors in adverse environmental conditions and in survival situations.
 - **Education and Training**
- Individual monitoring of personal at risk at worksites by personal health monitors, including vital data monitoring and advanced spectroscopic methods for exposure to hazardous materials
 - **Enhanced Service capabilities**

Extreme environments initiative

- Emergency medical care on offshore installations and on standby vessels, with emphasis on interactive, audiovisual links in real time, on tele-presence during triage of mass casualties and on 24/7/365 real-time audiovisual link to relevant medical specialties. > **S + Direct benefit to remote communities in NL as spin-off**

Extreme environments initiative

- **HPSE Program** (Human Physiology, Performance and Safety in Extreme environments)
- Implement HPSE program to improve understanding, operational safety and performance to meet the needs of specific target clients such as:
 - Offshore personnel
 - Graduate students
 - Agencies involved in military and rescue operations
- Establishing a centre for offshore human safety research at Memorial University

Helicopter underwater escape training

- Use of helicopter transportation is essential for offshore operations in Newfoundland and Labrador
- Effective breath-hold time in very cold water is considerably shorter than the time needed to escape from an inverted submerged helicopter
- Drowning is therefore very likely

Helicopter underwater escape training

- Use of small compressed air cylinders to enable breathing during escape has potential to improve survival
- Current training with this breathing equipment is restricted to trainees being rotated on a mounted chair to submerge only the head
 - Minimal risk of air embolism
- This training does not simulate real conditions

Helicopter underwater escape training

- Underwater breathing equipment is not used for simulated helicopter escapes as there is a risk of arterial air embolism
- Enhanced hyperbaric medicine services and even a hyperbaric chamber on site at the training facility are needed for more realistic helicopter escape training
- Research is needed to validate the safety and effectiveness of the enhanced training

Summary

- The Benefits agreement for the Hebron project should provide support for programs to enhance human safety in the extreme environments encountered including related to:
 - Diving and hyperbaric work
 - Helicopter transportation
 - Cold, harsh and hazardous work environments
 - Rescue of workers in peril in offshore and other extreme environments

Opportunities from the Hebron benefits program to enhance human safety

- Application process not clear
- There is some expertise in Newfoundland and Labrador related to:
 - Diving and Hyperbaric Medicine
 - Human physiology, Performance and Safety in Extreme environments (HPSE)
- However, benefits to Newfoundland and Labrador, Canada, the Hebron project and offshore development in Canada in general will result from support of:
 - Research and Development
 - Education and Training
 - Facilities and capabilities for hyperbaric treatment

Human safety

- Specific areas of focus
 - Development of Diving and Hyperbaric Medicine
 - Including physician certification and diving medicine standards
 - Enhanced hyperbaric capabilities for training and treatment
 - Review and revision of Canada – Newfoundland and Labrador regulations to bring these up to date
 - Advanced and more realistic helicopter escape training involving use of underwater breathing apparatus during escapes
 - Research, development, education and training programs related to human physiology, performance and safety in extreme environments