

# Animal Hyperbaric Oxygen Therapy Standards of Care 2020



Veterinary Hyperbaric Association

**Index**

Introduction .....	Page 3
Scope and Purpose	
Chambers and Facilities .....	Page 4
Operations: Patient Management and Operational Safety .....	Page 5
Appendix 1 – Minimal Knowledge Base .....	Page 7
Appendix 2 - Organizations – Laws, Standards, Codes and Practices .....	Page 16

# Animal Hyperbaric Oxygen Therapy Standards of Care 2020

## Standard of Care:

- The standard of care is determined by the level of care that would be exercised by the average, reasonably prudent professional in the same line of work. Standards of care may include written statements describing the rules, actions, or conditions that direct patient care. Standards of care guide practice and can be used to evaluate performance.

## Introduction

- The purpose of this document is to present the recommended practices for the good care for animals undergoing hyperbaric oxygen therapy. These guidelines are based on the existing experience and knowledge from experts in animal hyperbaric therapy and extrapolation from experts and professional associations in human hyperbaric medicine and research.
- The scope of this document includes:
  - ◇ Hyperbaric chambers, equipment and facilities as they relate to safety and animal therapy.
  - ◇ Operating procedures as they relate to patient care and safety.
  - ◇ Oversight and management
  - ◇ Education and training
  - ◇ Incident/accident prevention and management
  - ◇ Documentation
- This document should be used as a reference and a guide that applies to all facilities providing hyperbaric oxygen therapy to animals in clinical and/or research setting. This document does not provide mandatory requirements but references those United States governing documents and other resources that may contain mandatory laws, codes and standards. This document may be used to evaluate performance (Appendix 2).
  - ◇ The National Fire Protection Agency provides the NFPA 99 document on Standards for Health Care Facilities (2002). In this document Chapter 20 contains standards for hyperbaric facilities with an emphasis on human hyperbaric facilities and operations. Within this chapter animal hyperbaric chambers are classified. At the time of this document's inception, animal hyperbaric chambers were being utilized mostly for research and there is a limited number of guidelines and standards pertaining to facilities practicing the "clinical" application of hyperbaric therapy in animals for the treatment of specific diseases. Types of chambers have evolved and a new classification may be necessary with additional standards. However, NFPA 99 Chapter 20 should be used at the present time to develop animal hyperbaric facilities and to acquire quality equipment. Many of the principles found in this document apply across species

and are relevant to animal facilities and programs. In addition, NFPA 150, Standard on Fire and Life Safety in Animal Housing Facilities, 2016 edition contains specific standards for animal facilities including veterinary hospitals. This document, in the future, may contain more detailed and specific information on animal hyperbaric facilities and equipment.

### **Chambers and Facilities:**

- Facilities structure [NFPA 99 20.2.1, NFPA 150 – Animal Facilities]
  - ◇ Access and evacuation
    - Suggested configuration:
      - Prefer a separate room dedicated to hyperbaric therapy.
      - Easy access for patient and personnel movement in and out
      - Easy access for emergency evacuation
        - Suggested: 2 entrance/exit points
        - Determination of evacuation route
        - Documentation and training
  - ◇ Ground and anti-static [ NFPA 99 20.3.5, 20.3.6]
    - Ground access – building or separate ground<sup>7</sup>
    - Suggested: antistatic mats at chamber entrance and control panel
    - Humidity regulation > 35%
  - ◇ Temperature and humidity
    - Climate control
      - Central climate control (heat and cooling)
      - Preferred: Humidity > 35%
  - ◇ Bulk gas access/compressed gas storage [NFPA 99 20.3.3, Compressed Gas Association CGA, FDA]
    - Safe storage of compressed gas cylinders
    - Bulk gas sources
      - Local and national codes
      - Supply lines to hyperbaric chambers
  - ◇ Maintenance – biosecurity
    - Protocols for management of patients with contagious diseases
    - Chamber cleaning and disinfection protocol
      - Oxygen compatible disinfectants
  - ◇ Security
    - Prevention of unauthorized access and use
- HBO Chambers [NFPA 99 - 20.2.2 thru 20.2.9]
  - ◇ Construction [NFPA 99 - 20.1.5, ASME - BPVC & PVHO]
    - Approved for medical use
    - Codes: ASME, PVHO, etc.
  - ◇ Installation
    - Installed by qualified service representative
    - Assessment of proper function and documentation
- Ancillary Equipment [NFPA 99 – 20.3.2]
  - ◇ Medical devices and other equipment
  - ◇ Guidelines, regulations, laws, codes

- ◊ For animal oxygen pressurized chambers, ancillary equipment should not be placed in the chamber.

### **Operations: The Standard of Care - Patient Management and Operational Safety**

- Patient Care and Safety

- ◊ Efficacy – Access and Patient selection

Indications for animal hyperbaric oxygen therapy shall be determined by each hyperbaric facility. Extrapolation from human indications and clinical experience may be used to determine efficacy. At the time of this writing there was not a specific, evidenced based, published indications list for animals.

Patients to be treated should have been examined by /referred by a veterinarian.

Decision to treat should be made in consultation with the hyperbaric medical veterinarian.

All patients should be assessed by hyperbaric medical veterinarian prior to treatment to determine fitness for hyperbaric oxygen treatment.

- ◊ Patient information

A routine clinical record should be kept on each patient.

History, any physical examination results, diagnosis/diagnostics, current treatments.

If the patient is a referral, the contact information for the referring veterinarian should be part of the record.

- ◊ Patient Preparation

Each facility should develop and document a protocol for pretreatment patient evaluation.

Minimal evaluation should include:

Review of history, diagnosis, current problems, current treatments, diagnostic results

Recent use of topical compounds

Pretreatment physical examination – minimum TPR, thoracic auscultation, mentation, behavior,

Unusual items that would accompany patient into the chamber

- Personnel and Administration

- ◊ The hyperbaric team – ideal basic team composition

Oversight

Medical director [veterinarian(s)] – knowledge of hyperbaric therapy  
Safety director [veterinarians, technician (CHT-V)]

Basic hyperbaric team

Ideal basic team composition - minimum recommended team size is two people.

Ideally when the chamber is in operation two people should be involved, minimally, the second person should be in the area

- ◊ Training

Minimum Skills (See Appendix 1)

Completion of approved basic training course

Ideally all members of the team should have completed this training

Completion of a safety director's course

Completion of CHT-V certification [ <http://www.nbdhmt.org/chtv.asp> ]

One person may have more than one credential to fulfill the standard  
Incident and accident management training [NFPA 99 – 20.3.1]

All members of the hyperbaric team should receive initial and ongoing  
training in incident and emergency management

Maintenance of skills

All hyperbaric personnel should maintain their skills  
through repeated training and continuing education.

All training should be documented by the facility.

- Chamber operations

- ◊ Standard operating procedures – based on chamber operational training,  
information from training courses for personnel,  
laws/codes/standards/recommended practice/guidelines

Each facility should develop a standard operating procedures manual or  
document for their chamber and facility

Chamber operation

Manuals – manufacturer

Operation quick reference manual

Incident and emergency prevention

Patient safety procedures

Patient evaluation and preparation

“Go” and “No Go” list

Risk assessment plan

Fire prevention equipment

Biosecurity procedures

Incident and emergency management

Patient emergencies

Emergency decompression procedures

Fire management

Patient and personnel evacuation procedures

Documentation

Patient log (& individual treatment form)

Chamber maintenance and testing

All training sessions

## Appendix 1

### Minimum Knowledge Base Competency Domains

- Essential physics and physiology of gases and pressure and their application in hyperbaric medicine.
  - Proper application of hyperbaric oxygen therapy requires a thorough knowledge and understanding of the physics and physiology associated with increased pressure. The physical and physiologic concepts are important in understanding how hyperbaric oxygen therapy works, the problems that can develop in the body with increasing pressures and oxygen and the mechanisms by which hyperbaric oxygen therapy is beneficial in the management of disease.
  
- Competencies
  - Units of pressure used in diving and hyperbaric oxygen therapy and conversion of one unit to another.
  - Terminology used in hyperbaric oxygen therapy.
  - Knowledge of the important gas laws associated with pressure and their application in hyperbaric therapy.
    - Boyle's Law (calculating air volumes and air consumption).
    - Dalton's Law (partial pressure of gases at various depths, alveolar oxygen concentration).
    - Charles' Law (the relationship between pressure changes and temperature changes).
    - Henry's Law (the effect of partial pressures on the solubility of various gases in liquids and their corresponding effects on decompression).
  - The principles of heat transfer by conduction, convection and radiation.
    - Define conduction, convection and radiation.
    - Explain how these concepts are related to hyperbaric therapy.
  - Barotrauma – direct and indirect effects of pressure change. Barotrauma can result from the physical and physiologic effects of pressure applied during hyperbaric oxygen therapy. Identification, prevention and/or management of barotrauma events is an important aspect of the placing patients in a hyperbaric environment. Recognition and management of pressure related problems in animals.
    - Define barotrauma (direct effects of changing ambient pressure).
    - Explain the physical laws of gas behavior that contribute or are related to the development of barotrauma.
    - List the most common sites for the occurrence of barotrauma.
    - For each site of barotrauma be able to describe the following aspects:
      - Time of occurrence, Physiology and pathophysiology of the syndrome, signs and symptoms in animals, treatment and prevention.
  - Indirect effects of pressure – list the most common indirect effects of pressure.
    - For each effect describe the following aspects: Physiology and pathophysiology of the syndrome, signs and symptoms in animals, patient management, treatment and prevention.

Possess the capability to provide clinical support and assist in the prevention and/or management of pressure related problems.

- Squeeze and other barotraumas.
- Carbon dioxide (CO<sub>2</sub>) retention.
- Carbon monoxide (CO) poisoning.
- Hyperbaric chamber gas contamination.
- Anoxic and hypoxic events.
- Hypothermic and hyperthermic events.
- Effects of elevated partial pressures of oxygen.
- Review Dalton's Law.

Know the signs of oxygen toxicity.

- Acute toxicity.

- Chronic toxicity.

- Possess the capability to provide clinical support and assist in the prevention and/or management of toxicity due to high oxygen partial pressure in various species.

Relevant basic anatomy and physiology of animal species pertaining to the following systems.

knowledge of animal structure and function is key in understanding normal and abnormal states and managing disease. These basics are also important in monitoring and managing the effects of pressure and hyperoxia in the hyperbaric patient.

- Species: Basic, Canine, Feline, Equine, Others (bovine, caprine, porcine, camelid, avian, reptile, other exotic)

- Systems: Musculoskeletal, Neurological, Integumentary, Cardiovascular, Respiratory

Indications and contraindications for the use of hyperbaric therapy in animals and the mechanism(s) of action in each indication. The hyperbaric technician should be able to list the indications for hyperbaric therapy and what effects of hyperbaric therapy are beneficial for these indications. Knowledge of the general mechanisms and effects of hyperbaric oxygen is necessary to discuss the efficacy in disease processes. The hyperbaric technician should be able to list and discuss the mechanisms associated with contraindications for use of hyperbaric therapy in animals.

General mechanisms and physiologic effects of hyperbaric oxygen therapy.

- Cardiovascular effects.

- Pulmonary system.

- Immune system including effects on infectious agents.

- Wound healing and tissue salvage.

- Bone repair.

- Central nervous system effects.

- Oxygen radical production.

- Ophthalmic system.

Indications for use of hyperbaric oxygen therapy in animals.

- Veterinarians and veterinary technicians should know the UHMS approved indications for humans (all apply to animals except maybe DCS).

Animal related indications:

Discuss understanding of rationale for hyperbaric oxygen therapy treatment in these various conditions.

List expected benefits for conditions and indications.

Contraindications for the use of hyperbaric oxygen therapy in animals. Contraindications may be categorized as absolute or relative (based on human criteria).

Absolute contraindications.

Untreated pneumothorax.

Untreated guttural pouch disease in equidae.

Untreated middle and external ear diseases.

Relative contraindications.

High fever.

Viral infections.

Previous thoracic surgery.

Previous spontaneous pneumothorax.

Emphysema plus CO<sub>2</sub> retention.

Seizure disorders.

Chronic sinusitis and other upper respiratory infections.

Optic neuritis.

Certain drugs – doxorubicin, bleomycin, disulfiram, cis-platinum, mafenide acetate.

Gas systems and animal hyperbaric chamber operation.

The certified hyperbaric technician should have a thorough knowledge of hyperbaric chambers and should be able to demonstrate basic chamber operation including patient evaluation and preparation.

Classification of chambers and identification of the basic components of any hyperbaric chamber.

Be familiar with NFPA classifications for hyperbaric chambers (A,B,C,) and how this applies to hyperbaric chambers used in veterinary medicine.

Be able to describe the basic common components of a hyperbaric chamber, their purpose or use.

Gases and gas quality.

Oxygen purity and its importance.

Methods for identifying gas impurities.

Principles and use of gas analyzers.

Calibrate gas analyzers.

Gas line filtration.

Be able to follow supply gas lines and describe components associated with them; trace supply gases from origin the patient.

Understand and/or conduct procedures for chamber operations and life support systems.

Mathematical calculations of gas usage.

### Patient Care and Safety

Know how to prepare an animal patient for hyperbaric therapy including: a review of the patient's history, medical/surgical condition as it might be affected by hyperbaric conditions, evaluation of current treatments, medications etc. as they might be affected by or affect hyperbaric therapy, be able to assure that they are not "no go" substances, materials etc. associated with the patient prior to therapy, be able to conduct a pre therapy examination of the patients physical status (TPR), etc.

### Chamber operations

Appreciate the unique differences between monoplace and multiplace chambers.  
 The various substances and materials, which are prohibited inside a chamber, such as medical preparations, combustible materials, etc.  
 Pre and post dive checks of a hyperbaric chamber complex using specific checklists.  
 The monitoring of internal chamber operations.  
 Monitor the chamber for depth, temperature and humidity using available types of equipment.  
 Rationale for gas stratification and its prevention.  
 The principles of operation of various items of equipment used in a typical hyperbaric system, such as compressors, fire suppression systems, oxygen supply.  
 How to carry out normal operations, and basic inspections of gas and air systems.  
 Treatment protocols and procedures for multiple indications. Risks/benefits involved with emergency decompression.  
 Proper identification of various gas cylinders; mandatory hospital grade gases and proper handling and storage of gas cylinders.  
 The checks and user maintenance needed after using a hyperbaric chamber.  
 Maintain a legible and accurate record of all aspects of a hyperbaric system.

### Systems, Standards and Codes

The characteristics of and maintenance requirements for acrylic viewpoints/cylinders.  
 Emergency preparedness for fire, loss of oxygen, medical complications.  
 The use of various types of fire suppression systems including routine maintenance and operational checks.  
 Familiarity with the following regulatory agencies and other related organizations:  
 Food and Drug Administration (FDA), Occupational, Safety and Health Administration  
 (OSHA),  
 National Fire Protection Association (NFPA),  
 American Society of Mechanical Engineers (ASME), American Society of Mechanical Engineers' Committee on Pressure Vessels for Human Occupancy (ASME PVHO),  
 Veterinary Hyperbaric Medicine Society (VHMS),  
 Undersea and Hyperbaric Medical Society (UHMS),  
 Other governing bodies in state of operation; including veterinary, racing and performance

The certified hyperbaric technician should be able to demonstrate a thorough knowledge of chamber and facility safety.

- Basics of fire safety.
- Explain components of fire.
- Explain differences of fire in the hyperbaric oxygen environment. • Define ignition temperature and flash point.
- Know possible sources of ignition in a hyperbaric chamber.
- Know basic methods for fire prevention in and outside the chamber.
- Basics of operational chamber safety.
- Vessel integrity. • Handling of compressed gases.
- Electrical safety and grounding.
- HBOT staff training and qualifications.
- Safety standards.
- How to develop a “GO – NO - GO” list and apply risk assessment operational safety. The decision tree.
- Infection control.
- Know and demonstrate knowledge of standard universal precautions.
- Recognize patient and equipment risk factors for cross-contamination.
- Describe care and cleaning of hyperbaric chambers.
- State reasons for cleanliness in the hyperbaric facility.

#### Intern Training Clinical Competencies

##### Hyperbaric facility orientation

- Reviews and understands the hyperbaric Safety Manual for the facility
- Completes hyperbaric facility tour
- Identifies location of emergency procedures guidelines
- Identifies location of personal protective equipment
- Identifies location of hyperbaric log and maintenance books
- Identifies location of no smoking / oxygen in use signs
- Identifies location of operator breathing source/mask for each chamber
- Demonstrates how to access facility fire alarm system
- Identify backup system for electrical failure
- Identify bulk oxygen storage tank and surrounding area
- Identify patient education for hyperbaric treatments
- List items allowed/not allowed in hyperbaric chamber
- State requirements for fire drills
- Hyperbaric therapy facility policy review.

The trainee should be familiar with and be able to state the policy for:

- Hyperbaric veterinarian and operator presence during hyperbaric treatment
- Role and duties of the Safety Director
- Policy on gas handling
- Policy on gas storage
- Policy on storage of hazardous materials
- Policy for housekeeping in hyperbaric area
- Policy for smoking in the chamber area
- State requirements for ongoing safety education.

Generalized Clinical Knowledge:

- Have a basic understanding of the risks, side effects and hazards of certain medications in the hyperbaric chamber.
- Describe the signs, symptoms and treatment of hyper- and hypothermia
- Describe the effects of gases on the body and their limits under pressure
- Describe the effects of pressure on the body and the principles of decompression and therapeutic procedures
- Safe animal handling skills.
- Have relevant knowledge to communicate with all levels of hyperbaric medical team (including techs, Dr's, etc).

Patient assessment :

- Basic medical terminology
- Medical record keeping, including documentation such as photographs, videos, wound measurements, labeling, etc.
- Know and demonstrate knowledge of current appropriate referral conditions for hyperbaric oxygen treatment.
- Demonstrate knowledge of treatment plan and know the duties of each staff member involved and discuss and understand the rationale for treatment plan.
- Review patient's reason for referral.
- Demonstrate knowledge of side-effects of hyperbaric therapy (see 2.0 under competencies).
- Knows species variations.
- Have a basic understanding in the operation of biomedical devices within your facility.
- Be able to carry out relevant diagnostic and clinical procedures such as: a. Ability to report to supervising medical personal an accurate medical history b. Blood glucose levels c. Assess patient for pain and document d. Obtain vital signs, pulse, respiratory rate, body temperature. e. Observe for changes in neurological status f. Know when to use appropriate clean or sterile techniques g. Collection and removal of patient waste products h. Assist in patient care procedures; dressing changes etc.

Prepare patient for treatment:

- Safe loading and unloading of patients
- Ensure ONLY approved materials for inside chamber use
- Provide comfort measures within approved safety constraints.
- Comply with all facility quality control measures

Patient Preparation & Hyperbaric Treatment:

- Demonstrates knowledge of animal behavior that might indicate anxiety and fear of being placed in a chamber and behavior that might lead to potential for injury during placement or treatment in the chamber.
- Demonstrates knowledge of anxiety and fear related to feelings of confinement anxiety associated with hyperbaric chamber.
- Demonstrates knowledge of potential for oxygen toxicity related to delivery of 100% oxygen at an increased atmospheric pressure

Demonstrates basic knowledge pain related to associated medical problems  
 Demonstrates knowledge of discomfort related to temperature and humidity

#### Barotrauma Management:

Know and demonstrate knowledge of the signs and symptoms of barotrauma in various species.  
 Know and demonstrate knowledge of the immediate management of barotrauma.

#### Oxygen Toxicity Management:

Know and demonstrate knowledge of the signs and symptoms of central nervous system  
 intolerance to hyperbaric doses oxygen.

Know and demonstrate knowledge of the signs and symptoms of pulmonary oxygen toxicity.

Know and demonstrate knowledge of the various methods that serve to reduce the likelihood of  
 immediate management of CNS toxicity.

List the complicating factors associated with the development of pulmonary oxygen toxicity.

#### Pulmonary Barotrauma:

Know and demonstrate knowledge of risk factors for pulmonary barotraumas on ascent.

Know and demonstrate knowledge of immediate management of suspected pulmonary  
 barotrauma on ascent.

State the differential diagnosis of:

cerebral arterial gas embolism

pneumothorax

tension

pneumothorax

mediastinal emphysema

subcutaneous emphysema.

#### Cardiopulmonary Complications:

Proficiency in obtaining vital signs

Knowledge of common clinical signs of severe, acute onset, cardiovascular distress.

Proficiency in basic CPR

#### Wound Care:

Appreciate the general principles of wound homeostasis, infection control and treatment  
 and wound healing and non-surgical wound care.

Assist in the evaluation of wounds

Assist in the limited debridement of wounds, wound dressings and their respective  
 applications.

#### Chamber Equipment

Know and demonstrate knowledge of the routing of the compressed gas supply

Demonstrate emergency shut-off procedures on chamber

Demonstrate use of and the reason for adjusting the flow meter during HBO treatment

Show location of exhaust valve on outside wall

Demonstrate acrylic inspection and documentation; know the characteristics of and  
 maintenance requirements for acrylic viewports/cylinders.

Identify stamp on HBO chamber per ANSI/ASME PVHO PVHO-1 standard

Identify oxygen level gauge

Verify integrity of chamber ground wire

Gas handling:

Identify contents of compressed gas cylinders and ensure contents legibly marked on the exterior of cylinder

High pressure gas cylinders are stored in assigned locations and accessible only to authorized personnel

Hi pressure gas cylinders are not stored near flammable materials

Large gas cylinders are stored in such a manner that they are restrained from being knocked over large gas cylinders are transported by the use of a hand truck that provides a means of restraining the cylinder

Valve protection valves are in place

Pressure reducing regulators are used to reduce the pressure from the cylinder to the supply line

PPE used when handling liquid oxygen cylinders

Demonstrates working knowledge of hyperbaric regulatory guidelines to include ASME, PVHO, ANSI, NFPA, UHMS, VHMS

Demonstrate completion of daily, weekly, monthly, semiannual and annual maintenance and testing logs.

Documentation:

Demonstrates understanding of documentation requirements

Know and demonstrate knowledge of all forms, electronic medical record, and paperwork used to document patient treatment.

Complete pre-treatment patient assessment and treatment protocol forms.

Complete ancillary patient chart notes and post treatment documentation.

Complete a record of a typical patient hyperbaric treatment.

Demonstrate completion of daily patient treatment logs per chamber.

Chamber Operations:

Chamber Standard Operating Procedures

Demonstrate inspection and understanding of chamber console panel layout

Locate and operate automatic controls

Locate and operate manual controls

Demonstrate compression and decompression of the chamber

Checklists and Treatment Protocols:

Demonstrate knowledge of chamber checklists

Demonstrate knowledge of patient checklists

Demonstrate knowledge of decompression protocols

State when chambers are to be cleaned.

**Pressure Safety:**

Know and demonstrate knowledge of correct procedure for operating/securing door of chamber.

List the potential pressure hazards in and around the chamber

**Infection Control:**

Know and demonstrate knowledge of standard universal precautions.

Use of approved disinfectants for chamber and equipment; recognizing the risks associated with off gassing of chemicals in the chamber.

Hand washing

Personal protective equipment (PPE)

Recognize patient and equipment risk factors for cross-contamination

Demonstrate care and cleaning of hyperbaric chamber.

State reasons for cleanliness in hyperbaric area.

**Fire Safety:**

Demonstrate knowledge of possible ignition sources

List items not allowed in hyperbaric chamber

Demonstrate knowledge for fire emergency -in chamber, in immediate area of chamber, in hyperbaric room, in facility.

Fire Extinguishing System-Know location of fire extinguishers and fire alarms.

Demonstrate use of portable fire extinguisher

## Appendix 2 Organizations Laws, Standards, Codes, and Practices

1. American Society of Mechanical Engineers (ASME)
  - Boiler and Pressure Vessel Codes (BPVC)
  - Pressure Vessel Human Occupancy (PVHO)
2. Compressed Gas Association CGA)
3. Food and Drug Administration (FDA)
4. National Fire Protection Association (NFPA)
  - NFPA 99
  - NFPA 150
5. Occupational Safety and Health Administration (OSHA)
6. National Board of Boiler and Pressure Vessel Inspectors (NBBI)
7. American National Standards Institute (ANSI)
8. National Board of Diving and Hyperbaric Medical Technology (NBDHMT)
9. Veterinary Hyperbaric Medicine Society (VHMS)
10. Undersea and Hyperbaric Medicine Society (UHMS)

### NFPA 99 Standards for Health Care Facilities Chapter 20 Hyperbaric Facilities Chapters

- 20.1.5 Classification of Chambers
- 20.2.1 Housing for Hyperbaric Facilities
- 20.2.2 Fabrication of Hyperbaric Chambers
- 20.2.3 Illumination
- 20.2.4 Chamber ventilation
- 20.2.5 General requirements
- 20.2.6 Fire Protection in Class B and Class C chambers
- 20.2.7 Electrical systems
- 20.2.8 Intercommunications
- 20.2.8 communication and Monitoring
- 20.2.9 Other Equipment and Fixtures
- 20.2.10 Administration and Maintenance
- 20.3.1 General – Purpose, recognition of Hazards, responsibility, rules and regulations, general requirements, personnel
- 20.3.2 Equipment
- 20.3.3 Handling Gases
- 20.3.4 Maintenance
- 20.3.5 Electrical safeguard
- 20.3.6 Electrostatic Safeguards