TECHNICAL COMMITTEE ON OXYGEN-ENRICHED ATMOSPHERES
First Draft Meeting Agenda
NFPA Headquarters, Quincy, MA

April 22, 2014, 1 PM - 5 PM EDT
April 23, 2014, 8 AM - 3 PM EDT

Note: Lunch will be provided on Day 1 and Day 2 starting at 12:00PM. Continental breakfast will be served at 7:30AM on Day 2.

1. Welcome. Richard Barry, Chair

2. Introductions and Update of Committee Roster. (attached)

3. Approval of minutes from Pre First Draft Meeting held by conference call on December 12, 2013. (attached)

4. Staff updates. Laura Montville, NFPA Staff
   a) Committee membership update.
   b) Fall 2015 revision cycle schedule. (attached)
   c) New Process Presentation.

5. Review of Public Inputs NFPA 53. (attached)

6. Additional items for consideration.
   a) Selecting nonmetallic materials for oxygen systems: oxygen index, autoignition temperature, and heat of combustion data. Barry Newton

7. Fire Protection Research Foundation presentation. Amanda Kimball, Research Project Manager


10. Adjourn.
<table>
<thead>
<tr>
<th>Name</th>
<th>Role</th>
<th>Address Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Richard C. Barry</td>
<td>Chair</td>
<td>OXY-AAA 01/10/2008 Healogics, 5220 Belfort Road, Suite 130 Jacksonville, FL 32256</td>
</tr>
<tr>
<td>Jolene E. Cormier</td>
<td>Principal</td>
<td>OXY-AAA 8/9/2011 Healogics, Irving Comprehensive Wound Care &amp; Hyperbaric Clinic, 2240 East Trinity Mills Road, #1212 Carrollton, TX 75006</td>
</tr>
<tr>
<td>Kim Phillips Dunleavy</td>
<td>Principal</td>
<td>OXY-AAA 3/2/2010 Dunleavy Technical Services Inc., 50 de Belcaro Blainville, QC J7B 1P1 Canada</td>
</tr>
<tr>
<td>Jack D. Fry</td>
<td>Principal</td>
<td>OXY-AAA 10/18/2011 Los Angeles Fire Department, 1550 Silver Birch Lane Fallbrook, CA 92028</td>
</tr>
<tr>
<td>Joseph Million</td>
<td>Principal</td>
<td>OXY-AAA 07/29/2013 Praxair, 175 East Park Drive Tonawanda, NY 14150</td>
</tr>
<tr>
<td>Keisa Rosales</td>
<td>Principal</td>
<td>OXY-AAA 01/10/2008 Jacobs Technology Inc., 12600 NASA Road Las Cruces, NM 88012</td>
</tr>
<tr>
<td>Joel Stoltzfus</td>
<td>Principal</td>
<td>OXY-AAA 1/1/1991 National Aeronautics &amp; Space Administration, White Sands Test Facility, PO Drawer MM Las Cruces, NM 88004</td>
</tr>
<tr>
<td>Alain Colson</td>
<td>Principal</td>
<td>OXY-AAA 7/23/2008 Air Liquide, 57, Avenue Carnot Champigny-sur-Marne, 94503 France</td>
</tr>
<tr>
<td>Sean Dee</td>
<td>Principal</td>
<td>OXY-AAA 07/29/2013 Exponent, 4580 Weaver Parkway, Suite 100 Warerville, IL 60564</td>
</tr>
<tr>
<td>Sean Faughnan</td>
<td>Principal</td>
<td>OXY-AAA 8/5/2009 East Orange General Hospital, 310 Central Avenue, Suite 209 East Orange, NJ 07018</td>
</tr>
<tr>
<td>Craig H. Kampmier</td>
<td>Principal</td>
<td>OXY-AAA 08/09/2012 Swansea Fire Department, 50 New Gardners Neck Road Swansea, MA 02777</td>
</tr>
<tr>
<td>Jerrold Sameth</td>
<td>Principal</td>
<td>OXY-AAA 07/29/2013 Compressed Gas Association, Inc., 14501 George Carter Way Chantilly, VA 20151</td>
</tr>
<tr>
<td>Frederick Williams</td>
<td>Principal</td>
<td>OXY-AAA 1/1/1973 US Naval Research Laboratory, Code 6183 Washington, DC 20375-5000</td>
</tr>
<tr>
<td>Name</td>
<td>Role</td>
<td>Organization</td>
</tr>
<tr>
<td>--------------------</td>
<td>-----------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>Walter Joslyn</td>
<td>Alternate</td>
<td>CDA Technical Institute</td>
</tr>
<tr>
<td></td>
<td>OXY-AAA</td>
<td>10/23/2013</td>
</tr>
<tr>
<td>Robert Nelson</td>
<td>Alternate</td>
<td>Los Angeles Fire Department</td>
</tr>
<tr>
<td></td>
<td>OXY-AAA</td>
<td>E 10/29/2012</td>
</tr>
<tr>
<td>James White</td>
<td>Alternate</td>
<td>Praxair</td>
</tr>
<tr>
<td></td>
<td>OXY-AAA</td>
<td>M 07/29/2013</td>
</tr>
<tr>
<td>Laura E. Montville</td>
<td>Staff Liaison</td>
<td>National Fire Protection Association</td>
</tr>
<tr>
<td></td>
<td>OXY-AAA</td>
<td>7/15/2013</td>
</tr>
</tbody>
</table>
Technical Committee on Oxygen Enriched Atmospheres  
Minutes  
Conference Call/Adobe Connect  
Pre-First Draft Meeting  
December 12, 2013 11:00 AM – 1:00 PM EDT

Richard Barry, Healogics, FL  
Alain Colson, Air Liquide, France  
Sean Dee, Exponent, IL  
Craig Kampmier, Swansea Fire Department, MA  
Barry Newton, Wendell Hull & Associates, Inc., NM  
Jerry Sameth, Compressed Gas Association, Inc., VA  
Thomas Witte, Air Products and Chemicals, Inc., FL  
Laura Montville, NFPA Staff Liaison

1. Call to Order. The meeting was called to order at 11:04 AM.

2. Introduction of Attendees.

3. Approval of minutes from Pre First Draft Meeting held by conference call on September 19, 2013. Minutes of the previous meeting were approved by the committee.

4. Task Group Updates.

   a. Fire Experience Annex. Richard, Alain, and Barry provided paragraphs that can be added to Annex D, to address topics including filters and strainers, LOX pumps, monoplace hyperbaric chambers, PCTFE valve seats, aluminum-bodied regulators, and deep sea equipment. Additional sections will be written to include an oxygen centrifugal compressor fire, a 6-inch ball valve fire in a nickel refinery, and a 12-inch butterfly valve
a. Fire in a power plant. A member of this group will submit these new sections as Public Input before the January 3 deadline.

b. Utilization of Oxygen Enriched Atmospheres. Annex E currently contains oxygen index data but the industry typically looks at autoignition temperature and heat of combustion of materials as well. The committee showed interest in adding this data to Annex E and drafting a paragraph in Annex C that provides general guidance when selecting nonmetallic materials for oxygen systems by referring to these three properties. Barry will submit data for oxygen index, autoignition temperature, and heat of combustion to be added to Annex E.

c. NFPA 56 review. Sean Dee reviewed NFPA 56 and reported on his findings. He does not see much overlap between the two documents but Laura will put him in touch with a NFPA 56 Technical Committee member to confirm and discuss. Sean will also draft a formal response to the NFPA 56 Technical Committee’s email.

d. New oxygen pipeline design, dangers, and materials section. The committee members decided to refer readers to CGA G-4.4 and EIGA documents instead of adding a new section to this document.

5. New Business.
   a. Incoming Chair. Thomas Witte, CGA representative. His nomination has been sent to Standards Council for their meeting in March 2014.

   b. First Draft meeting: April 22-23, 2014 in Quincy, MA. The committee has decided to start the meeting at 1:00 PM on April 22, allowing for travel in the morning. Lunch will be available at noon as you arrive. We will conclude the meeting by 3:00 PM on April 23.

6. Adjournment. The meeting was adjourned at 12:01 PM.
**2015 FALL REVISION CYCLE**

*Public Input Dates may vary according to standards and schedules for Revision Cycles may change. Please check the NFPA Website for the most up-to-date information on Public Input Closing Dates and schedules at www.nfpa.org/document# (i.e. www.nfpa.org/101) and click on the Next Edition tab.*

<table>
<thead>
<tr>
<th>Process Stage</th>
<th>Process Step</th>
<th>Dates for TC</th>
<th>Dates for TC with CC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Input Stage (First Draft)</td>
<td>Public Input Closing Date for Paper Submittal*</td>
<td>11/29/2013</td>
<td>11/29/2013</td>
</tr>
<tr>
<td></td>
<td>Public Input Closing Date for Online Submittal (e-PI)*</td>
<td>1/3/2014</td>
<td>1/3/2014</td>
</tr>
<tr>
<td></td>
<td>Final Date for TC First Draft Meeting</td>
<td>6/13/2014</td>
<td>3/14/2014</td>
</tr>
<tr>
<td></td>
<td>Posting of First Draft and TC Ballot</td>
<td>8/1/2014</td>
<td>4/25/2014</td>
</tr>
<tr>
<td></td>
<td>Final date for Receipt of TC First Draft ballot</td>
<td>8/22/2014</td>
<td>5/16/2014</td>
</tr>
<tr>
<td></td>
<td>Posting of First Draft for CC Meeting</td>
<td>5/30/2014</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final date for CC First Draft Meeting</td>
<td>7/11/2014</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Posting of First Draft and CC Ballot</td>
<td>8/1/2014</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final date for Receipt of CC First Draft ballot</td>
<td>8/22/2014</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final date for Receipt of CC First Draft ballot - recirc</td>
<td>8/29/2014</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Post First Draft Report</strong> for Public Comment</td>
<td>9/5/2014</td>
<td>9/5/2014</td>
</tr>
<tr>
<td>Comment Stage (Second Draft)</td>
<td>Public Comment Closing Date for Paper Submittal*</td>
<td>10/10/2014</td>
<td>10/10/2014</td>
</tr>
<tr>
<td></td>
<td>Public Comment Closing Date for Online Submittal (e-PC)*</td>
<td>11/14/2014</td>
<td>11/14/2014</td>
</tr>
<tr>
<td></td>
<td>Final Date to Publish Notice of Consent Standards (Standards that received no Comments)</td>
<td>11/28/2014</td>
<td>11/28/2014</td>
</tr>
<tr>
<td></td>
<td>Appeal Closing Date for Consent Standards (Standards that received no Comments)</td>
<td>12/12/2014</td>
<td>12/12/2014</td>
</tr>
<tr>
<td></td>
<td>Final date for TC Second Draft Meeting</td>
<td>5/1/2015</td>
<td>1/23/2015</td>
</tr>
<tr>
<td></td>
<td>Posting of Second Draft and TC Ballot</td>
<td>6/12/2015</td>
<td>3/6/2015</td>
</tr>
<tr>
<td></td>
<td>Final date for receipt of TC Second Draft ballot - recirc</td>
<td>7/10/2015</td>
<td>4/3/2015</td>
</tr>
<tr>
<td></td>
<td>Posting of Second Draft for CC Meeting</td>
<td>4/10/2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final date for CC Second Draft Meeting</td>
<td>5/22/2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Posting of Second Draft for CC Ballot</td>
<td>6/12/2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final date for Receipt of CC Second Draft ballot</td>
<td>7/3/2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Final date for Receipt of CC Second Draft ballot - recirc</td>
<td>7/10/2015</td>
<td></td>
</tr>
</tbody>
</table>

**Tech Session Preparation & Issuance**

<table>
<thead>
<tr>
<th>Process Step</th>
<th>Dates for TC</th>
<th>Dates for TC with CC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notice of Intent to Make a Motion (NITMAM) Closing Date</td>
<td>8/21/2015</td>
<td>8/21/2015</td>
</tr>
<tr>
<td>Posting of Certified Amending Motions (CAMs) and Consent Standards</td>
<td>10/16/2015</td>
<td>10/16/2015</td>
</tr>
<tr>
<td>Appeal Closing Date for Consent Standards (15 days)</td>
<td>10/31/2015</td>
<td>10/31/2015</td>
</tr>
<tr>
<td>SC Issuance Date for Consent Standards (10 days)</td>
<td>11/10/2015</td>
<td>11/10/2015</td>
</tr>
</tbody>
</table>

**Tech Session**

| Association Meeting for Standards with CAMs                                  | 6/6-9/2016   | 6/6-9/2016           |

**Appeals and Issuance**


Approved_____ October 30, 2012_______ Revised_____ March 7, 2013________
Public Input No. 13-NFPA 53-2013 [ Section No. 2.2 ]

2.2 NFPA Publications.
National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

Statement of Problem and Substantiation for Public Input

Update to referenced publications.

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Affiliation: HEALOGICS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Dec 16 16:37:22 EST 2013
Public Input No. 2-NFPA 53-2013 [ Section No. 2.3 ]

2.3 Other Publications.
2.3.1 API Publication.
American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005-4070.

2.3.2 ASME Publications.
American Society of Mechanical Engineers, Three Park Avenue, New York, NY 10016-5990.

2.3.3 CGA Publications.
Compressed Gas Association, 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923.

2.3.4 U.S. Government Publications.

2.3.5 Other Publications.
Schmidt and Forney, 1975.

Statement of Problem and Substantiation for Public Input

Many Compressed Gas Association documents should be referenced in this NFPA 53. The codes and standards that should be added are under NFPA section 2.3.3 CGA publications. The following should be added:
*CGA G-4.1 Cleaning Equipment for O2 Service
CGA G-4.4 Oxygen Pipeline and Piping Systems
CGA G-4.6 Oxygen Compressor and Installation Guideline
CGA G-4.7 Installation Guide for Stationary Electric Motor Driven Centrifugal Liquid Oxygen Pumps
CGA G-4.8 Safe use of Aluminum Structured Packing for Oxygen Distillation
CGA G-4.9 Safe Use of Brazed Aluminum Heat Exchangers for Producing Pressurized Oxygen
CGA G-4.10 Design Considerations to Mitigate the Potential Risks of Toxicity When Using Nonmetallic Materials in High Pressure Oxygen Breathing Gas Systems
CGA G-4.11 Reciprocating Compressors for Oxygen Service
CGA G-4.13 Centrifugal Compressors for Oxygen Service"

Note under the reference CGA G-4 Oxygen, 1994. The current date is outdated (1994). However in all the added document reference and the existing reference to G-4, I would suggest no dates (1994) be used as these are updated every 3-5 years and would outdate the references for every NFPA update. This should follow the NFPA standard for addition of years to codes and standards.

Submitter Information Verification

Submitter Full Name: Thomas Witte
Organization: Air Products and Chemicals, In
Affiliation: Compressed Gas Association
Street Address:
City:
State:
Zip:
Submittal Date: Mon Oct 21 15:02:27 EDT 2013
Public Input No. 10-NFPA 53-2013 [Section No. C.1.3]

<table>
<thead>
<tr>
<th>C.1.3</th>
</tr>
</thead>
<tbody>
<tr>
<td>OEs routinely exist or are utilized intentionally in medical practice, industry, underwater tunneling and caisson work, space and deep-sea exploration, and hyperbaric chambers, and commercial and military aviation. Such atmospheres are inherent to oxygen processing, transporting, and storage facilities. OEs can develop inadvertently at any time when oxygen or compressed air is transported, stored, or utilized.</td>
</tr>
</tbody>
</table>

Statement of Problem and Substantiation for Public Input

Greater than 2,600 hyperbaric chambers are in use, in the USA along. The current C.1.3 does not mention the growing field of hyperbarics.

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Street Address:
City:
State:
Zip:
Submittal Date: Mon Dec 16 16:08:14 EST 2013
C.3.2.2
Chapter 14, “Other Health Care Facilities,” of NFPA 99 covers nonhospital use.

Statement of Problem and Substantiation for Public Input

The current edition of NFPA 99 - Health Care Facilities Code (2012 ed.) does not include a chapter titled "Other Health Care Facilities."

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Affiliation: HEALOGICS
Street Address: HEALOGICS
City: HEALOGICS
State: HEALOGICS
Zip: HEALOGICS
Submittal Date: Mon Dec 16 16:20:26 EST 2013
C.3.4
The medical profession uses pressure, uses hyperbaric, chambers to allow hypersaturation, supersaturation of patients with oxygen. The patient, with or without attendants, is placed in a chamber, hyperbaric chamber, that is sealed and pressurized, sometimes to 4 atm absolute or greater. Generally, pressurization is accomplished with compressed air, and the patient breathes pure oxygen from a mask. However, in some single-occupant (patient only) chambers, the atmosphere is pure oxygen. Although there might be some flammability-inhibiting effect of the increased nitrogen present in compressed air, this effect is more than offset by the increased partial pressure of the oxygen present (up to 5 atm). (See Chapter 20, See “Hyperbaric Facilities,” of NFPA 99.)

A particularly hazardous OEA exists in a chamber pressurized with oxygen or in a compressed-air chamber with inadequate ventilation when pure oxygen is spilled from the therapy apparatus; therefore adherence to NFPA 99 “Hyperbaric Facilities” chapter, is highly recommended.

Statement of Problem and Substantiation for Public Input

Updated to include proper terminology. Also, chapter numbers change in NFPA 99, but the title of Hyperbaric Facilities has remained.

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Affiliation: HEALOGICS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Dec 16 16:26:03 EST 2013
D.x.y - Oxygen Pipeline

A significant number of violent oxygen fires were experienced in the Industry over last 20 years where long distance oxygen pipeline are operated up to 6.4 MPa (928 psi), and some of them have similar root cause. A pressure reducing station was present to supply the user of the oxygen and each station was equipped with a filter or a strainer upstream. Ignition occurred in the filter or the strainer while the oxygen was flowing at a velocity higher than the maximal velocity based on current applicable “impingement” velocity curve as per CGA EIGA Harmonized Document. The ignition mechanism was “particle impact” of oxidized or non-oxidized particles and any kind of debris that travelled in the pipeline. Flammable materials such as stainless steel mesh, or carbon steel filter or strainer housing were found and are capable to ignite or to propagate combustion. In addition, piping reducers were used upstream strainers and filters leading to gaseous oxygen acceleration at the inlet of strainers and filters.

The decision was made to use non-flammable materials such as Nickel, Monel®, bronze to prevent ignition of the strainer mesh and to verify the piping design so that gaseous oxygen velocity would always remain within acceptable range of the impingement velocity curve and without any acceleration.

Statement of Problem and Substantiation for Public Input

New info.

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Street Address:
City:
State:
Zip:
Submittal Date: Mon Dec 16 15:58:15 EST 2013
D.y.z – Electric-Motor of Liquid Oxygen Pump

Ignition occurred in the electric-motor or the electric-motor bearing of LOX transfer or process pumps operated in the Industry from very low pressure up to 10 MPa. Oxygen enrichment of the electric-motor itself or of the electric-motor driven end bearing led to a “flash fire” with or without ignition and significant combustion of the electric-motor and the roller bearing.

A first root cause of the oxygen enrichment was due to oxygen leak from the cold end across the seal system of the pump due to mechanical issue of the seal system; i.e. mechanical seal, labyrinth seal or dry gas seal.

A second root cause of these incidents was due to inappropriate lubricant selection for the electric-motor bearing.

Different protections were installed to prevent oxygen enrichment of the electric-motor bearing. Appropriate instrumentation to detect oxygen leakage was installed, e.g. using pressure differential across the seal system and low temperature detection. In addition, the lubricant of the electric-motor bearing was selected based on the required mechanical properties based on instructions of the LOX pump manufacturer.

Statement of Problem and Substantiation for Public Input

New information.

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Street Address:
City:
State:
Zip:
Submittal Date: Mon Dec 16 15:59:53 EST 2013
6-Inch Industrial Ball Valve Fire in Nickel Refinery

During 2001 a fire occurred in a 6-in. ball valve being used as a pipeline isolation valve for the oxygen supply to a Nickel Refinery. The operator was killed in the incident when he opened the valve under a pressure differential. The valve was designed with spring-assisted seats on both the upstream and downstream sides of the ball. The valve body, bonnet, ball, stem, and hard seat were all carbon steel. The seals were primarily Buna-N throughout. The valve was equipped with two seat lubrication injection fittings located external to the upstream and downstream seat assemblies to allow the seat and ball to be lubricated during periodic maintenance cycles. The valve was tagged as “cleaned for oxygen service” but exemplar valves also installed at the refinery revealed that hydrocarbon-based general purpose grease had been used to re-lubricate the seat assemblies after cleaning.

Just prior to the fire, the valve had been closed in preparation for a system shutdown; and a leak check was performed on the valve by bleeding off pressure downstream and monitoring the pressure differential across the valve. During this leak check, system data indicated that the upstream pressure was approximately 550 psig (3.8 MPa) and the downstream pressure was approximately 510 psig (3.5 MPa), or roughly a 40-psig (0.28-MPa) differential pressure. At this point, the valve was re-opened to establish flow and provide full system pressure. As the valve was being opened manually, using a hand wheel, a fire developed within the valve that consumed most of the valve internals, surrounding valve body, and burned out downstream piping and flanges. Ignition was believed to have developed from frictional heating as the spring loaded seat assembly shifted position during the valve opening flow transient. The first material ignited was believed to be the hydrocarbon grease used to lubricate the seat assembly. The ignition of the grease initiated a strong kindling chain that promoted the thin wave spring elements, Buna N seat and eventually the carbon steel body of the valve.


Statement of Problem and Substantiation for Public Input

New Information.

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Street Address:
City:
State:
Zip:
Submittal Date: Mon Dec 16 16:02:22 EST 2013
D.2.2.12
Over 30 fires were reported to the Food and Drug Administration (FDA) involving aluminum bodied medical oxygen regulators in the 1990s. These incidents were reported to have caused severe burns to health care workers and patients and each fire was described as “explosion-like” when the fire erupted from the regulator body. Many of the incidents occurred during emergency medical use or during routine equipment checkouts. The incidents led to at least one fatality. Catastrophic burnout of the aluminum-bodied regulator and release of oxygen into the surroundings, sometimes causing secondary fires, was characteristic of each of these incidents. Depending on the circumstances of the incident, the active ignition mechanisms were reported to include particle impact, contaminant promoted ignition, and adiabatic compression. Several of the fires were believed to have been caused by particulate debris entrained in the oxygen flow stream that originated in the high-pressure cylinders. Each incident reported exhibited unique characteristics for ignition; however, the regulator design, allowing exposure of aluminum to the active ignition mechanisms resulted in sustained combustion of the aluminum regulator body in high-pressure oxygen. The FDA eventually issued a safety alert on the regulator design and a mandatory recall of these medical devices was initiated.


Statement of Problem and Substantiation for Public Input

The proposed 2.2.xx case study is adding information to the Medical section regarding a recent medical fire.

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Street Address:
City:
State:
Zip:
Submittal Date: Mon Dec 16 15:46:06 EST 2013
D2.2.13 In early 1997 eight fires were reported to the Food and Drug Administration (FDA) involving cylinder valves installed on M6, M7, and M9 size medical cylinders within the United States. The following elements were common in each of the reported incidents:

1. All incidents involved medical oxygen cylinders and cylinder valves,
2. All oxygen cylinders and cylinder valves were manufactured in 1996 or 1997,
3. All oxygen cylinders were constructed of aluminum,
4. All cylinder valves contained polychlorotrifluoroethylene (PCTFE) plastic seats,
5. All ignitions were understood to have occurred upon opening the cylinder valve for the first time after the cylinder was filled,
6. The cylinder valve PCTFE plastic seat ignited in each incident,
7. Patients who were breathing from the cylinder gas reported a strong “chlorine odor”,
8. A regulator and/or conserver were attached at the time of each reported incident.

The fires resulted in a recall of approximately 8000 cylinders matching the date codes felt to be in question. While all of the fires are understood to have initiated upon opening the cylinder valves, some of the cylinders had been filled, emptied, and refilled as many as four times prior to the incidents.

The dimensional stability of polychlorotrifluoroethylene (PCTFE) valve seats used in gas cylinder valve and regulator applications was suspected as a causative factor due to severe extrusion that was observed in exemplar valves. Therefore the stability of the PCTFE seats was evaluated by thermomechanical analysis (TMA). The testing focused on two commercial grades of PCTFE: Kel-F® 81 and Neoflon® M440H, including actual PCTFE valve seats obtained from different manufacturers. The effects of resin grade, percent crystallinity, and process history on TMA heat deflection were evaluated. The testing indicated that significant property variation within the PCTFE resin family could result from the thermal history during molding and machining operations. Such property variation could cause severe loss of the mechanical properties and lead to severe extrusion for normal valve seat loads. When exposed to high-pressure oxygen dynamics and flow transients, ignition was believed to result as the plastic seat extruded from loading that was well beyond the diminished mechanical properties. As a result of these fires, ASTM International G04 and D20 subcommittees worked jointly to develop specifications for properly molding and machining PCTFE materials to help avoid the property losses that were believed to have led to these fires (see ASTM D7211 and D7194).


**Statement of Problem and Substantiation for Public Input**

The proposed 2.2.xx case study is adding information to the Medical section regarding a recent fire.

**Submitter Information Verification**

Submitter Full Name: RICHARD BARRY  
Organization: HEALOGICS  
Street Address:  
City:  
State:  
Zip:  
Submittal Date: Mon Dec 16 15:49:44 EST 2013
D.2.2.11
A 4-year old male child (patient) and 62-year old female (grandmother to the patient) were placed inside a monoplace hyperbaric chamber (NFPA Class B) and pressurized with 100% oxygen to a depth of 1.75 ata (gauge pressure of 11.01 psi). Patient and Grandmother were wearing their own clothing; they did not change into garments provided by the treating facility as the facility did not provide garments. Approximately 20 minutes into the therapy session, a fire started inside the hyperbaric chamber. The grandmother expired less than 24 hours after removal from the hyperbaric chamber and the patient expired approximately 40 days after removal; both due to thermal burns from the hyperbaric chamber fire.

Attributing to the cause of the fire is electrostatic discharge inside the hyperbaric chamber and failure to follow NFPA 99 – Health Care Facilities, as cited and described below (but not limited to):

- 20.2.7.4.1 – failure to properly ground chamber
- 20.3.1.3.5 – failure to conduct routine maintenance
- 20.3.1.4.4 – failure to have emergency procedure for in-chamber fire
- 20.3.1.4.7 – failure for chamber staff to be physically present
- 20.3.1.5.3.2 – failure to patient grounding
- 20.3.1.5.7 – failure to ensure appropriate garments
- 20.2.8.2.1 – failure to provide intercommunication system


Statement of Problem and Substantiation for Public Input

The proposed 2.2.11 case study is adding information to the Medical section regarding a recent hyperbaric chamber fire.

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Affiliation: HEALOGICS
Street Address: 
City: 
State: 
Zip: 
Submittal Date: Mon Dec 16 12:50:23 EST 2013
Public Input No. 6-NFPA 53-2013 [ New Section after D.2.8 ]

D.2.8.5

The Canadian Underwater Mine-countermeasures Apparatus (CUMA) is a self-contained, semi-closed circuit underwater breathing apparatus used by the Canadian Forces for underwater mine search, investigation, and disposal. On November 30, 2001, the Experimental Diving Unit staff at Defense Research and Development Canada – Toronto was preparing for an experimental dive using the CUMA Version 2 (V2) in their facility's hyperbaric chamber. A fire occurred in the CUMA V2 as the Team Leader (diver wearing the CUMA V2) opened the oxygen sphere valve. The fire was severe, ejecting fire and molten metal for a distance of approximately 7 feet from the diver's back-mounted unit, and lasting for an extended duration before the diver's teammates were able to remove the backpack and extinguish the fire. No one was seriously injured in the incident. Key materials were sampled as required and chemical analyses on samples were done to obtain positive material identification. The evidence indicated that the local origin of the fire was within the first-stage regulator close to the non-metal seat. The evidence also indicated that operationally induced ignition mechanisms developing during valve opening, and incompatible materials, were causative factors in the ignition and propagation of the fire.


Statement of Problem and Substantiation for Public Input

The proposed 2.8.xx case study is adding information to the deep see (diving) section regarding a recent fire.

Submitter Information Verification

Submitter Full Name: RICHARD BARRY
Organization: HEALOGICS
Street Address:
City:
State:
Zip:
Submittal Date: Mon Dec 16 15:53:41 EST 2013