

PPE CASE



Personal Protective Equipment Conformity Assessment Studies and Evaluations

Evaluation of Three Self-Contained Breathing Apparatus Involved in a Fatality in the Fire Service

San Antonio County Fire Department Request for three Scott® Safety Air-Pak® Model AP50 4.5 units

The National Institute for Occupational Safety and Health (NIOSH) conducts a Fire Fighter Fatality Investigation and Prevention Program, which is executed by its Division of Safety Research. In support of this Program, NIOSH's National Personal Protective Technology Laboratory (NPPTL) inspects and evaluates the Self-Contained Breathing Apparatus (SCBA) that was being used by the fire fighter during a fatality.

This report provides a summary of NPPTL's inspection and evaluation methods, and findings for the three SCBAs that were being used by the San Antonio Fire Department fire fighters during a fatal event. The SCBAs being used were the Scott® Safety Air-Pak® Model AP50 4.5, 45 minute, 4500 psi unit. The San Antonio Fire Department was advised that NIOSH NPPTL would provide a written report of the investigation and any applicable test results.

What NIOSH Did to Protect the Worker

Upon receipt of the SCBAs, NPPTL managed the custody of evidence throughout the entire inspection and evaluation process at its Morgantown, West Virginia facility. NPPTL staff inspected all of the SCBA components and documented their findings with written and photographic evidence. NPPTL also tested two of the SCBAs to determine conformance to NPPTL's approval requirements as outlined in Title 42, Code of Federal Regulations, Part 84 (42 CFR 84). Further testing was conducted to provide an indication of the conformance of each SCBA to the National Fire Protection Association (NFPA) Air Flow Performance requirements of NFPA 1981, Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service, 1997 Edition. If the inspection or evaluation data suggested that the SCBA units may have contributed to the near miss, NPPTL would have

NIOSH received three SCBAs used by three fire fighters involved in a fatality. Two of the SCBAs were not found to contribute to the fatality. The other respirator was damaged in the event and could not be tested.

A qualified service technician must inspect, repair, test, clean, and replace damaged components of any SCBA involved in an incident before it may be returned to service.

engaged in corrective action to ensure that no other users of the product would experience an incident. In this case, no such corrective action was necessary. NPPTL then managed the disposition of the SCBAs.

Chain of Custody

The SCBA units were delivered via FedEx in a cardboard box to Lab H1513 in the NIOSH facility in Morgantown, West Virginia on February 8, 2017.

On June 13, 2017, NPPTL employees Jay Tarley and Jeremy Gouzd inspected the SCBA units. The SCBA units remained in Lab H1513 throughout the entire inspection and testing process.

The SCBAs were identified as belonging to the San Antonio Fire Department-and were visually examined, component by component, in the condition received to determine the conformance of the units to the NIOSH-approved configuration. The units were both identified as the Scott® Safety Air-Pak® Model AP50 4.5, 45 minute, 4500 psi unit, with NIOSH Approval Number TC-13F-0715CBRN.

SCBA Inspection

The inspection process was initiated by Jay Tarley and Jeremy Gouzd once the SCBA units were delivered via FedEx to Lab H1513. The SCBAs were identified as belonging to the San Antonio Fire Department and were visually examined, component by component, in the condition received to determine the conformance of the units to the NIOSH-approved configuration. The units were both identified as the Scott® Safety Air-Pak® Model AP50 4.5, 45 minute, 4500 psi unit, NIOSH Approval Number TC-13F-0715CBRN.

As Received (pictured below) SCBA Unit #1

- This unit received extensive fire damage and could not be inspected or tested



Figure 1: SCBA Unit #1 as received

Components and Observations for SCBA Unit #1 (Figure 1) (“right” or “left” are from the user’s perspective) (see Figures in Appendix)

Unit #1 had extensive heat damage and could not be inspected or tested.

Overall condition (Figures 1 and 2)

As Received (pictured below) SCBA Unit #2

- Corrosion residue found on metal components of unit
- Cylinder received full and closed
- Bypass was closed
- Donning switch off, regulator inactive
- Mask mounted regulator (MMR) was not connected to facepiece



Figure 2: SCBA Unit #2 and cylinder as received

Components and Observations for SCBA Unit #2 (Figure 2) (“right” or “left” are from the user’s perspective) (see Figures in Appendix)

Facepiece (Figures 3 - 6)

- Facepiece seal P/N: 31001740; Large; MFG date: 05/2015
- Nosecup P/N: 201128 1; Size: Large; MFG date: 4th Q 2015
- Retaining ring MFG date: 04/2015; P/N: 31002810; Lot# 061715; FT 968
- Lens P/N: 805337-13/-33/-36; MFG date: 11/2014
- Overall condition good, very dirty, very smoky
- Lens was clouded, dirty, with scratches
- Lens had thermal insult
- Hairnet was fair, but dirty
- Hairnet markings: 5655; 119950
- Hairnet straps good, straps moved freely held in place, held securely to facepiece
- Attachment points for straps were good
- The facepiece seal was in good condition
- Regulator interface area was in good condition

Mask Mounted Regulator (MMR) (Figures 7 - 8)

- Air-Pak® X3 with Vibralert and Heads Up Display (HUD)
- Regulator assembly P/N: 200077-50; S/N:115S1528000122; MFG date: 07-06-15
- Other markings; A3Q15 stamped; 099X scribed/written
- Overall condition fair with signs of heat damage
- Outer case good and front label was also in good, but dirty condition
- Donning switch was in good condition
- Bypass found open, bypass knob in good shape
- Sealing area was dirty with no signs of fraying around the edge, but had minimal scratches
- Regulator could be attached and removed
- Locking assembly functioned, but sticky
- HUD fully intact

Low Pressure Regulator Hose (Figure 9)

- P/N: SCOTT 31901446
- Overall condition was fair to poor; signs of heat damage and abrasion
- Attached from pack at Quick Disconnect
- Quick Disconnect was in good condition and functioned
- Line ran through the shoulder strap to the reducer

Pressure Reducer Assembly (Figures 10, 11)

- P/N: 201030-02
- S/N 115S1525020969
- MFG date: 06-18-15
- Overall condition was dirty with residual
- All airline connections were secure with no sign of heat damage

High Pressure Hose and Cylinder Attachment (Figure 12)

- Overall condition was good, but dirty and signs of corrosion
- Cylinder attachments threads dirty, corroded, threads on and off, “O” ring in place
- RIC/UAC system connector markings: Eaton FD17-1002-10-04
- RIC/UAC system connector cover in good condition, connection dirty

Buddy Breather (Figure 13)

- Auxiliary hose was in pouch and in good condition

PASS Console Assembly (Figures 14 and 15)

- Scott label; P/N: unreadable
- X3 Console assembly: unreadable
- MFG date: unreadable
- Overall condition was good
- Lines in good shape—pressure/electrical
- Gauge lens good and readable
- Protective casing good
- SEI label present

Straps and Buckles (Figure 16)

- Overall strap condition was fair with significant signs of corrosion and heat damage
- Both shoulder straps attached at the top of the backframe
- Hose lines and wires passed through shoulder straps
- All adjustable buckles moved and held in place
- Waist area buckle latched and released
- Lumbar strap was in good condition; with heavy dye-sublimation

Compressed Air Cylinder and Cylinder Valve Assembly (Figures 17 - 20)

- Scott P/N 10009673
- DOT-E-10915-4500; IL 245112
- TC-SU-5134-310
- Luxfer P/N: L65G-2; REE 118

-
- Hydro date: 5/2006 45 Minute, 4500 PSI
 - Overall condition was fair, with signs of heat damage
 - Gauge not easily readable; signs of heat damage
 - Threads dirty with corrosion
 - Rubber bumper had heavy signs of heat damage
 - As received cylinder valve closed and empty

As Received (pictured below) SCBA Unit #3

- SCBA Unit #3 was delivered by FedEx in a cardboard box to Lab H1513
- Corrosion residual found on threads on cylinder attachment
- Cylinder was received empty and closed
- Donning switch was off with regulator intact
- MMR was connected to waist belt



Figure 3: SCBA Unit #3 and cylinder as received

Components and Observations for SCBA Unit #3 (Figure 3) (“right” or “left” are from the user’s perspective) (see Figures in Appendix)

Facepiece (Figures 21 - 24)

- Facepiece seal P/N: 31001739 1; MFG date: 11/2013
- Nosecup P/N: 201127 1; Size: Medium; MFG date: 3rd Q 2013
- Retaining ring MFG date: 11/13; P/N: 31002809
- Lens P/N: 805337
- Overall condition was fair, but very dirty
- Lens was fair, but dirty, with scratches
- Hairnet was fair, but very dirty
- Hairnet straps good, straps moved freely, held in place, and held securely to facepiece
- Attachment points for straps were good
- The facepiece seal was in good condition
- Regulator interface area was dirty and smoky

Mask Mounted Regulator (MMR) (Figures 25 - 27)

- Air-Pak® AirPak® X3 with Vibralert and with Heads Up Display (HUD)
- Regulator assembly P/N: 200077-50; S/N: 115S1526023933; MFG date: 6-25-15
- Other markings; 11 HR; X865
- MMR was attached to waist belt
- Overall condition was fair with no sign of heat damage
- Outer case good and front label was also in good, but dirty condition
- Donning switch was in good condition
- Bypass closed, bypass knob was in good shape
- Sealing area dirty with some signs of fraying around the edge and had minimal scratches
- Regulator could be attached and removed
- Locking assembly functioned
- HUD fully intact

Low Pressure Regulator Hose (Figures 28 and 29)

- P/N: unreadable
- Overall condition was good
- Attached from pack at Quick Disconnect
- Quick Disconnect in good condition and functioned
- Line runs through the shoulder strap to the reducer

Pressure Reducer Assembly (Figures 30)

- P/N: 201030-02;
- S/N 115S152600198
- MFG date: 6-22-15
- Overall condition was good, but dirty
- All airline connections were secure with no sign of heat damage

High Pressure Hose and Cylinder Attachment (Figures 31, 32)

- Overall condition was good, but dirty

- Cylinder attachments threads dirty, corroded, threads on and off, “O” ring in place
- RIC/UAC system connector markings: Eaton FD17-1002-10-04
- RIC/UAC system connector cover in good condition, connection dirty

Buddy Breather (Figure 34)

- Auxiliary hose was in pouch, in good condition

PASS Console Assembly (Figures 35 and 36)

- Scott label; P/N: 20112-11
- X3 Console assembly SENS 4500 1/3
- MFG date: 6-21-15
- Overall condition was good
- Lines in good shape—pressure/electrical
- Gauge lens good and readable
- Protective casing good
- SEI label present

PASS Control Module with PAK-Alert (Figure 37)

- Scott P/N: 201160-02
- Scott S/N: 115S1525026228
- MFG date: 6-20-15
- ID sticker: 00259155
- Other markings: X3305
- Overall condition was good
- Held securely to backframe
- Wire connection connected to PASS device
- Wire held secure to backframe and ran to console assembly

Back frame Assembly (Figure 38)

- P/N: unreadable
- SEI label readable; NFPA 1981 2013 edition
- NIOSH Approval Number TC-13F-0715CBRN
- Other marking: 11P-FF1 in yellow marking and sticker
- Other markings: Yellow marker-COSA 990541
- Overall condition good, no bends/cracks in wire frame, or plate
- Normal wear and tear
- Shoulder straps were attached to the frame
- Cylinder strap latch good condition and functional

Straps and Buckles (Figure 38)

- Overall strap condition was good
- Both shoulder straps attached at the top of the backframe
- Hose lines and wires passed through shoulder straps
- All adjustable buckles moved and held in place
- Waist area buckle latched and released
- Lumbar strap was in good condition; slight dye-sublimation

**Compressed Air Cylinder and Cylinder Valve Assembly
(Figures 39 - 42)**

- Scott P/N 10009673
- DOT-E-10915-4500; IL 245130
- TC-SU-5134-310
- Luxfer P/N: L65G-2; REE 118
- Hydro date: 5/2006 45 Minute, 4500 PSI
- Overall condition was good
- Gauge readable
- Threads dirty with corrosion
- Rubber bumper missing; metal attachment for bumper loose
- As received cylinder valve closed and was empty

SCBA Testing

The SCBA unit was tested using the six NIOSH test methods and one NFPA test method as described in **Table 1**.

Table 1. Summary of results from testing SCBA Unit #2.

NIOSH Tests	Description of Results	PASS/ FAIL
<p>Positive Pressure Test -NIOSH Test Procedure No. 120 42 CFR Part 84 Reference: Subpart H, § 84.70 (a)(2)(ii) Requirement: <i>The pressure inside the facepiece in relation to the immediate environment is positive during both inhalation and exhalation.</i> Procedure: A breathing machine with a 622 kg.-m./min. cam operating at 24 RPM with a 40-liter per minute flow rate (115 liters per minute peak flow) is connected to an anthropometric head for cycling. A pressure tap in the head is connected to a transducer which in turn is connected to a strip chart recorder for determining the pressure in the facepiece.</p>	<p>The unit met the test requirement. The inhalation breathing resistance did not become negative during the test. *The PASS unit functioned, the digital remote functioned and there was a HUD. *The corresponding cylinder was used Inhalation Breathing Resistance: (inches of water column) = 0.35</p>	<p>PASS</p>
<p>Rated Service Time Test- NIOSH Test Procedure No. 121 42 CFR Part 84 Reference: Subpart F, § 84.53 (a) and Subpart H, § 84.95 (a) and (b) Requirement: <i>Service time will be measured while the apparatus is operated by a breathing machine as described in § 84.88. The open-circuit apparatus will be classified according to the length of time it supplies air or oxygen to the breathing machine. Classifications are listed in § 84.53.</i> Procedure: A breathing machine with a 622 kg.-m./min. cam operating at 24 RPM with a 40 liters per minute flow rate is connected to an anthropometric head for cycling. A pressure tap in the head is connected to a transducer which in turn is connected to a strip chart recorder for determining the pressure in the facepiece. The breathing machine is run until the inhalation portion of the breathing curve falls below the minimum requirement.</p>	<p>The SCBA met the test requirement. The measured service time (adjusted to correspond with the recorded breathing cycles) was more than the rated service time of 45 minutes. The PASS unit functioned during the test. The SCBA did not go negative on inhalation; therefore, maintained positive pressure in the facepiece. The measured service time (adjusted to correspond with the recorded breathing cycles) was more than the rated service time of 45 minutes. The PASS functioned. Measured Service Time: 50 Minutes 84 Seconds</p>	<p>PASS</p>

<p>Static Pressure Test- NIOSH Test Procedure No. 122 42 CFR Part 84 Reference: Subpart H, § 84.91 (d) Requirement: <i>The static pressure (at zero flow) in the facepiece shall not exceed 38 mm. (1.5 inches) water-column height.</i> Procedure: The facepiece is fitted to an anthropometric head for testing. A pressure tap in the head is connected to a calibrated manometer. Full cylinder pressure is applied to the unit at zero flow and a reading from the manometer is recorded.</p>	<p>The SCBA met the test requirement. Facepiece Static Pressure:(inches of water column)= 1.17</p>	<p>PASS</p>						
<p>Gas Flow Test- NIOSH Test Procedure No. 123 42 CFR Part 84 Reference: Subpart H, § 84.93 (b) and (c) Requirement: <i>The flow from the apparatus shall be greater than 200 liters per minute when the pressure in the facepiece of demand apparatus is lowered by 51 mm. (2 inches) water column height when full container pressure is applied. Where pressure demand apparatus are tested, the flow will be measured at zero gage pressure in the facepiece.</i> Procedure: A pressure tap in the anthropometric head is connected to a manometer for determining when the pressure inside the facepiece is at zero. A mass flow meter is connected in line between the anthropometric head and an adjustable vacuum source to measure flow. The SCBA cylinder is replaced by a test stand which is adjusted initially to full cylinder pressure. The vacuum source is adjusted during the test to maintain the desired pressure inside the facepiece. Once the proper facepiece pressure has stabilized, a flow reading is recorded. The procedure is then repeated with the test stand adjusted to 500 psig.</p>	<p>The SCBA met the test requirement.</p> <table border="1"> <thead> <tr> <th>Applied Pressure</th> <th>Air Flow (liters per min.)</th> </tr> </thead> <tbody> <tr> <td>4500 psig</td> <td>484.2</td> </tr> <tr> <td>500 psig</td> <td>481.4</td> </tr> </tbody> </table>	Applied Pressure	Air Flow (liters per min.)	4500 psig	484.2	500 psig	481.4	<p>PASS PASS</p>
Applied Pressure	Air Flow (liters per min.)							
4500 psig	484.2							
500 psig	481.4							
<p>Exhalation Resistance Test- NIOSH Test Procedure No. 122 42 CFR Part 84 Reference: Subpart H, § 84.91 (c) Requirement: <i>The exhalation resistance of pressure-demand apparatus shall not exceed the static pressure in the facepiece by more than 51 mm. (2 inches) water-column height.</i> Procedure: The facepiece is mounted on an anthropometric head form. A probe in the head form is connected to a slant manometer for measuring exhalation breathing resistance. The air flow through the apparatus is adjusted to a rate of 85 liters per minute and the exhalation resistance is recorded.</p>	<p>The SCBA met the test requirement.</p> <p>Exhalation Breathing Resistance: (inches of water column)= 2.09 Static Pressure: (inches of water column)= 1.17 Difference: (inches of water column)= 0.92</p>	<p>PASS</p>						

<p>Remaining Service Life Indicator Test- NIOSH Test Procedure No. 124 42 CFR Part 84 Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)</p> <p>Requirement: <i>Each remaining service life indicator or warning device shall give an alarm when the remaining service life of the apparatus is reduced within a range of 20 to 25 percent of its rated service time or pressure.</i></p> <p><i>This requirement is modified under § 84.63(c) as follows: For apparatus which do not have a method of manually turning off remote gage in the event of a gage or gage line failure the remaining service life indicator is required to be set at 25% ± 2% of the rated service time or pressure.</i></p> <p>Procedure: A calibrated gauge is connected in line between the air supply and the first-stage regulator. The unit is then allowed to gradually bleed down. When the low-air alarm is activated, the pressure on the gauge is recorded. This procedure is repeated six times. The average of the six readings is calculated and recorded.</p>	<p>As these SCBA models do not have a remote gauge shutoff, the test requirement is 33% +4 -0%.</p> <table border="1"> <thead> <tr> <th></th> <th>Electric</th> <th>Vibralert</th> </tr> </thead> <tbody> <tr> <td>Run #</td> <td>Alarm Point (psi)</td> <td>Alarm Point (psi)</td> </tr> <tr> <td>1</td> <td>----</td> <td>1580</td> </tr> <tr> <td>2</td> <td>----</td> <td>1570</td> </tr> <tr> <td>3</td> <td>----</td> <td>1570</td> </tr> <tr> <td>4</td> <td>----</td> <td>1570</td> </tr> <tr> <td>5</td> <td>----</td> <td>1570</td> </tr> <tr> <td>6</td> <td>----</td> <td>1560</td> </tr> <tr> <td>Average</td> <td>----</td> <td>1570</td> </tr> </tbody> </table> <p>The electronics did not work = FAIL Vibralert = PASS</p>		Electric	Vibralert	Run #	Alarm Point (psi)	Alarm Point (psi)	1	----	1580	2	----	1570	3	----	1570	4	----	1570	5	----	1570	6	----	1560	Average	----	1570	<p>FAIL</p> <p>PASS</p>
	Electric	Vibralert																											
Run #	Alarm Point (psi)	Alarm Point (psi)																											
1	----	1580																											
2	----	1570																											
3	----	1570																											
4	----	1570																											
5	----	1570																											
6	----	1560																											
Average	----	1570																											

National Fire Protection Association (NFPA) Test (in accordance with NFPA 1981, 1997 Edition):

NFPA Test	Description of Results	PASS/FAIL
<p>NFPA Air Flow Performance Test—NFPA 1981 (1997 Edition) Reference: Chapter 5, Performance Requirements, Sec. 5-1.1</p> <p>Requirement: <i>SCBA shall be tested for air flow performance as specified in Section 6-1, Air Flow Performance Test, and the SCBA facepiece pressure shall not be less than 0.0 in. (0.0 mm) water column and nor greater than 3½ in. (89 mm) water column above ambient pressure from the time the test begins until the time the test is concluded.</i></p> <p>Procedure: The required equipment specified in the NFPA standards were used to conduct the tests on this unit. A pressure tap in the head is connected to a transducer which in turn is connected to a flatbed chart recorder for determining the pressure in the facepiece.</p>	<p>The SCBA passed this test. PASS, HUD, and alarm systems were functional.</p> <p>Maximum Facepiece Pressure: (inches of water column)= 2.51 Minimum Facepiece Pressure: (inches of water column)= 0.60</p>	<p>PASS</p> <p>PASS</p>

Data Logger Information for SCBA Unit #2 tested and evaluated

Time	Date	Off To Sensing	Sensing To Off	PreAlarm To Alarm	Manual Alarm	Alarm Reset	Low Battery	Sensing To PreAlarm	Clock Reset Pending	Clock Reset	Power On Reset	SEMS Link Down	SEMS Link UP	EVAC	EVAC ACK	Bluetooth Connect	Bluetooth Disconnect
14:46:26	6/22/2017	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
20:49:42	7/9/2126	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
20:46:24	7/9/2126	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20:46:20	7/9/2126	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
6:03:06	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
6:02:46	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
6:02:24	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
6:02:04	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
6:01:42	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
6:01:20	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
6:01:00	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
6:00:38	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
6:00:16	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
13:59:54	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
13:59:34	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
13:59:12	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
13:58:44	7/6/2126	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-

13:33:04	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
13:32:46	7/6/2126	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
13:32:42	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
13:32:22	7/6/2126	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
12:53:56	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
12:53:36	7/6/2126	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
12:51:02	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
12:49:50	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
12:49:28	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
12:49:06	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
12:48:42	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
12:48:16	7/6/2126	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
12:44:40	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
12:44:18	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
12:43:54	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
12:43:32	7/6/2126	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
13:21:00	7/6/2126	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
13:21:20	7/6/2126	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
21:50:58	5/18/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
21:47:10	5/18/2017	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10:05:42	5/15/2017	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10:03:46	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-

10:01:32	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:58:08	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:57:44	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:56:54	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:56:16	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:54:26	5/15/2017	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9:48:26	5/15/2017	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9:46:54	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:45:54	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:44:10	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:35:08	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:27:38	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:24:54	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:24:18	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:23:30	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:23:08	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:22:30	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
9:22:02	5/15/2017	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SCBA Testing

The SCBA unit was tested using the six NIOSH test methods and one NFPA test method as described in **Table 2**.

Table 2. Summary of results from testing SCBA Unit #3.

NIOSH Tests	Description of Results	PASS/ FAIL
<p>Positive Pressure Test -NIOSH Test Procedure No. 120 42 CFR Part 84 Reference: Subpart H, § 84.70 (a)(2)(ii) Requirement: <i>The pressure inside the facepiece in relation to the immediate environment is positive during both inhalation and exhalation.</i> Procedure: A breathing machine with a 622 kg.-m./min. cam operating at 24 RPM with a 40-liter per minute flow rate (115 liters per minute peak flow) is connected to an anthropometric head for cycling. A pressure tap in the head is connected to a transducer which in turn is connected to a strip chart recorder for determining the pressure in the facepiece.</p>	<p>The unit met the test requirement. The inhalation breathing resistance did not become negative during the test. *The PASS unit functioned, the digital remote functioned and there was a HUD. *The corresponding cylinder was used Inhalation Breathing Resistance: (inches of water column) = 0.30</p>	<p>PASS</p>
<p>Rated Service Time Test- NIOSH Test Procedure No. 121 42 CFR Part 84 Reference: Subpart F, § 84.53 (a) and Subpart H, § 84.95 (a) and (b) Requirement: <i>Service time will be measured while the apparatus is operated by a breathing machine as described in § 84.88. The open-circuit apparatus will be classified according to the length of time it supplies air or oxygen to the breathing machine. Classifications are listed in § 84.53.</i> Procedure: A breathing machine with a 622 kg.-m./min. cam operating at 24 RPM with a 40 liters per minute flow rate is connected to an anthropometric head for cycling. A pressure tap in the head is connected to a transducer which in turn is connected to a strip chart recorder for determining the pressure in the facepiece. The breathing machine is run until the inhalation portion of the breathing curve falls below the minimum requirement.</p>	<p>The SCBA met the test requirement. The measured service time (adjusted to correspond with the recorded breathing cycles) was more than the rated service time of 45 minutes. The PASS unit functioned during the test. The SCBA did not go negative on inhalation; therefore, maintained positive pressure in the facepiece. The measured service time (adjusted to correspond with the recorded breathing cycles) was more than the rated service time of 45 minutes. The PASS functioned. Measured Service Time: 49 Minutes 72 Seconds</p>	<p>PASS</p>

<p>Static Pressure Test- NIOSH Test Procedure No. 122 42 CFR Part 84 Reference: Subpart H, § 84.91 (d) Requirement: <i>The static pressure (at zero flow) in the facepiece shall not exceed 38 mm. (1.5 inches) water-column height.</i> Procedure: The facepiece is fitted to an anthropometric head for testing. A pressure tap in the head is connected to a calibrated manometer. Full cylinder pressure is applied to the unit at zero flow and a reading from the manometer is recorded.</p>	<p>The SCBA met the test requirement. Facepiece Static Pressure:(inches of water column)= 1.02</p>	<p>PASS</p>						
<p>Gas Flow Test- NIOSH Test Procedure No. 123 42 CFR Part 84 Reference: Subpart H, § 84.93 (b) and (c) Requirement: <i>The flow from the apparatus shall be greater than 200 liters per minute when the pressure in the facepiece of demand apparatus is lowered by 51 mm. (2 inches) water column height when full container pressure is applied. Where pressure demand apparatus are tested, the flow will be measured at zero gage pressure in the facepiece.</i> Procedure: A pressure tap in the anthropometric head is connected to a manometer for determining when the pressure inside the facepiece is at zero. A mass flow meter is connected in line between the anthropometric head and an adjustable vacuum source to measure flow. The SCBA cylinder is replaced by a test stand which is adjusted initially to full cylinder pressure. The vacuum source is adjusted during the test to maintain the desired pressure inside the facepiece. Once the proper facepiece pressure has stabilized, a flow reading is recorded. The procedure is then repeated with the test stand adjusted to 500 psig.</p>	<p>The SCBA met the test requirement.</p> <table border="1"> <thead> <tr> <th>Applied Pressure</th> <th>Air Flow (liters per min.)</th> </tr> </thead> <tbody> <tr> <td>4500 psig</td> <td>481.39</td> </tr> <tr> <td>500 psig</td> <td>526.7</td> </tr> </tbody> </table>	Applied Pressure	Air Flow (liters per min.)	4500 psig	481.39	500 psig	526.7	<p>PASS PASS</p>
Applied Pressure	Air Flow (liters per min.)							
4500 psig	481.39							
500 psig	526.7							
<p>Exhalation Resistance Test- NIOSH Test Procedure No. 122 42 CFR Part 84 Reference: Subpart H, § 84.91 (c) Requirement: <i>The exhalation resistance of pressure-demand apparatus shall not exceed the static pressure in the facepiece by more than 51 mm. (2 inches) water-column height.</i> Procedure: The facepiece is mounted on an anthropometric head form. A probe in the head form is connected to a slant manometer for measuring exhalation breathing resistance. The air flow through the apparatus is adjusted to a rate of 85 liters per minute and the exhalation resistance is recorded.</p>	<p>The SCBA met the test requirement.</p> <p>Exhalation Breathing Resistance: (inches of water column)= 2.06 Static Pressure: (inches of water column)= 1.02 Difference: (inches of water column)= 1.04</p>	<p>PASS</p>						

<p>Remaining Service Life Indicator Test- NIOSH Test Procedure No. 124 42 CFR Part 84 Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)</p> <p>Requirement: <i>Each remaining service life indicator or warning device shall give an alarm when the remaining service life of the apparatus is reduced within a range of 20 to 25 percent of its rated service time or pressure. This requirement is modified under § 84.63(c) as follows: For apparatus which do not have a method of manually turning off remote gage in the event of a gage or gage line failure the remaining service life indicator is required to be set at 25% ± 2% of the rated service time or pressure.</i></p> <p>Procedure: A calibrated gauge is connected in line between the air supply and the first-stage regulator. The unit is then allowed to gradually bleed down. When the low-air alarm is activated, the pressure on the gauge is recorded. This procedure is repeated six times. The average of the six readings is calculated and recorded.</p>	<p>As these SCBA models do not have a remote gauge shutoff, the test requirement is 33% +4 -0%.</p> <table border="1"> <thead> <tr> <th></th> <th>Electric</th> <th>Vibralert</th> </tr> <tr> <th>Run #</th> <th>Alarm Point (psi)</th> <th>Alarm Point (psi)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1530</td> <td>1580</td> </tr> <tr> <td>2</td> <td>1530</td> <td>1570</td> </tr> <tr> <td>3</td> <td>1535</td> <td>1580</td> </tr> <tr> <td>4</td> <td>1540</td> <td>1570</td> </tr> <tr> <td>5</td> <td>1530</td> <td>1570</td> </tr> <tr> <td>6</td> <td>1535</td> <td>1560</td> </tr> <tr> <td>Average</td> <td>1533.33</td> <td>1576.66</td> </tr> </tbody> </table>		Electric	Vibralert	Run #	Alarm Point (psi)	Alarm Point (psi)	1	1530	1580	2	1530	1570	3	1535	1580	4	1540	1570	5	1530	1570	6	1535	1560	Average	1533.33	1576.66	<p>PASS PASS</p>
	Electric	Vibralert																											
Run #	Alarm Point (psi)	Alarm Point (psi)																											
1	1530	1580																											
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5	1530	1570																											
6	1535	1560																											
Average	1533.33	1576.66																											

National Fire Protection Association (NFPA) Test (in accordance with NFPA 1981, 1997 Edition):

NFPA Test	Description of Results	PASS/ FAIL
<p>NFPA Air Flow Performance Test—NFPA 1981 (1997 Edition) Reference: Chapter 5, Performance Requirements, Sec. 5-1.1</p> <p>Requirement: <i>SCBA shall be tested for air flow performance as specified in Section 6-1, Air Flow Performance Test, and the SCBA facepiece pressure shall not be less than 0.0 in. (0.0 mm) water column and nor greater than 3½ in. (89 mm) water column above ambient pressure from the time the test begins until the time the test is concluded.</i></p> <p>Procedure: The required equipment specified in the NFPA standards were used to conduct the tests on this unit. A pressure tap in the head is connected to a transducer which in turn is connected to a flatbed chart recorder for determining the pressure in the facepiece.</p>	<p>The SCBA passed this test. PASS, HUD, and alarm systems were functional.</p> <p>Maximum Facepiece Pressure: (inches of water column)= 2.6 Minimum Facepiece Pressure: (inches of water column)= 0.55</p>	<p>PASS PASS</p>

Data Logger Information for SCBA Unit #3 tested and evaluated

Time	Date	Off To Sensing	Sensing To	PreAlarm To Alarm	Manual Alarm Reset	Low Battery	Sensing To PreAlarm	Clock Reset Pending	Clock Reset	Power On Reset	SEMS Link Down	SEMS Link UP	EVAC	EVAC ACK	Bluetooth Connect	Bluetooth Disconnect
14:25:36	6/19/2017	-	-	-	-	-	-	-	X	-	-	-	-	-	-	-
13:43:26	6/19/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
13:42:30	6/19/2017	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
13:42:26	6/19/2017	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
13:42:24	6/19/2017	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
13:42:20	6/19/2017	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
13:42:18	6/19/2017	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
13:42:14	6/19/2017	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
13:42:08	6/19/2017	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
13:42:04	6/19/2017	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
13:42:02	6/19/2017	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
13:41:58	6/19/2017	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
13:41:54	6/19/2017	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
13:41:50	6/19/2017	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
13:41:22	6/19/2017	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
13:40:18	6/19/2017	-	-	-	-	-	-	-	-	X	-	-	-	-	-	-
9:05:50	6/8/2017	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
9:05:40	6/8/2017	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
1:37:36	6/8/2017	-	-	-	X	-	-	-	-	-	-	-	-	-	-	-
22:27:48	5/18/2017	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
22:27:44	5/18/2017	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
22:27:40	5/18/2017	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
22:27:28	5/18/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
22:27:06	5/18/2017	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
22:22:30	5/18/2017	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
22:22:18	5/18/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
22:21:18	5/18/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
22:19:30	5/18/2017	-	-	-	-	X	-	-	-	-	-	-	-	-	-	-
22:17:22	5/18/2017	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
22:17:14	5/18/2017	-	-	-	-	-	-	-	-	-	X	-	-	-	-	-
22:16:36	5/18/2017	-	-	X	-	-	-	-	-	-	-	-	-	-	-	-
22:16:24	5/18/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
22:15:42	5/18/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
22:10:14	5/18/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
22:06:52	5/18/2017	-	-	-	-	-	-	-	-	-	-	X	-	-	-	-
21:56:16	5/18/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
21:51:50	5/18/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-
21:51:20	5/18/2017	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-

20:56:20	5/15/2017	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-
20:56:14	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
20:53:32	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
20:49:44	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
20:39:40	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
20:32:54	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
20:29:00	5/15/2017	-	-	-	-	-	-	X	-	-	-	-	-	-	-	-	-
20:28:28	5/15/2017	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Disposition of SCBA

Following testing on June 19, 2017, both SCBA units were returned to secure storage in Lab H1513 at the NIOSH facility in Morgantown, West Virginia.

Synopsis of Findings

The SCBA units inspected and evaluated by NPPTL were Scott® Safety Air-Pak® Model AP50 4.5, 45 minute, 4500 psi unit with NIOSH Approval Number TC-13F-0715CBRN. A corresponding facepiece was provided for the units. Unit #1 had excessive heat damage, and could not be inspected or tested. The cylinders in Units #2 and #3 were delivered empty and closed. The mask mounted regulator on Unit #2 was loose while the MMR on Unit #3 was attached to the waist belt. Overall, the units were in good condition. The NFPA approval labels were present and readable. The PASS, HUD, and alarm systems functioned on both units 2 and 3.

Both SCBA units met the requirements of the NIOSH Positive Pressure Test, as the units maintained a positive pressure for the 45 minute minimum duration of the test. The units passed all of the other NIOSH tests.

In light of the information obtained during this investigation, NIOSH NPPTL has proposed no further action on its part at this time. The SCBA units were returned to the SCBA bags to be transported back to the San Antonio Fire Department.

CASE Conclusion

No evidence was identified to suggest that the SCBA units inspected and evaluated contributed to the fatality. NIOSH determined that there was no need for corrective action with regards to the approval holder or users of the SCBAs manufactured under the approval number granted to this product.

Actions to be Taken by the Fire Departments with SCBAs Involved in an Incident

- Any SCBA unit involved in an incident may not be placed back in service until the SCBA has been repaired, tested, cleaned, and any damaged components replaced and inspected by a qualified service technician, including such testing and other maintenance activities as prescribed by the schedule from the SCBA manufacturer.
- All SCBA units, even those not involved in an incident, must undergo a flow test on at least an annual basis.

Actions the PPE Users, Selectors, and Purchasers May Take to Further Protect Themselves and Others from Hazards

- Sign up for NPPTL's Listserv at <https://www.cdc.gov/niosh/npptl/sub-NPPTL.html> to receive email notifications relevant to PPE.

To request additional information about this report, contact NPPTL at ppeconcerns@cdc.gov, and reference NIOSH Task Number 21618 in your request.

For more information related to personal protective equipment, visit the NIOSH NPPTL website <https://www.cdc.gov/niosh/npptl/>

To receive documents or other information about occupational safety and health topics, contact NIOSH:

Telephone: 1-800-CDC-INFO (1-800-232-4636)

TTY: 1-888-232-6348

CDC INFO: www.cdc.gov/info

Or visit the NIOSH website at <https://www.cdc.gov/niosh/>

For a monthly update on news at NIOSH, subscribe to *NIOSH eNews* by visiting <https://www.cdc.gov/niosh/eNews/>

Appendix Photographs to Support Inspection Findings for SCBA Units #1, #2, and #3.

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Figure 1: Overall condition of Unit #1



Figure 2: Facepiece remains of Unit #1



Figure 3: Unit #2 overall condition



Figure 4: Top view of facepiece



Figure 5: Side view of facepiece



Figure 6: Inside view of facepiece



Figure 7: MMR with identifying markings

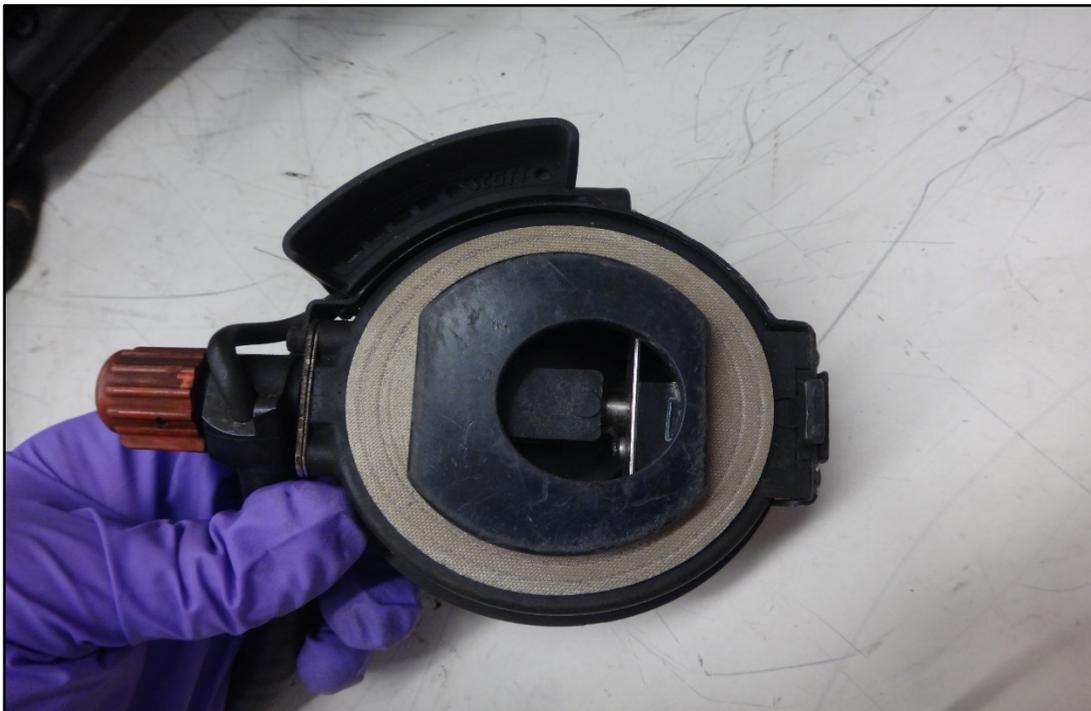


Figure 8: Inside flange of MMR



Figure 9: Low pressure hose and Quick Disconnect



Figure 10: Pressure reducer assembly



Figure 11: RIC UAC system connector



Figure 12: High pressure hose and cylinder attachment



Figure 13: Buddy breather



Figure 14: PASS console

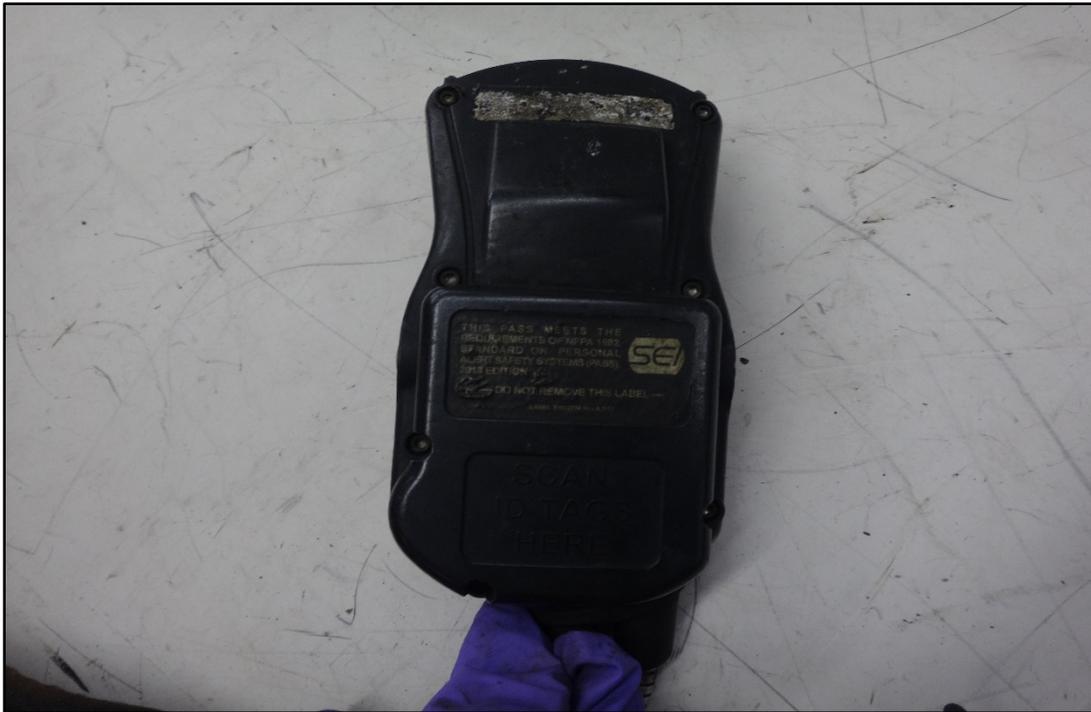


Figure 15: Back view of PASS console, SEI label



Figure 16: Straps and buckles



Figure 17: Overall condition of cylinder

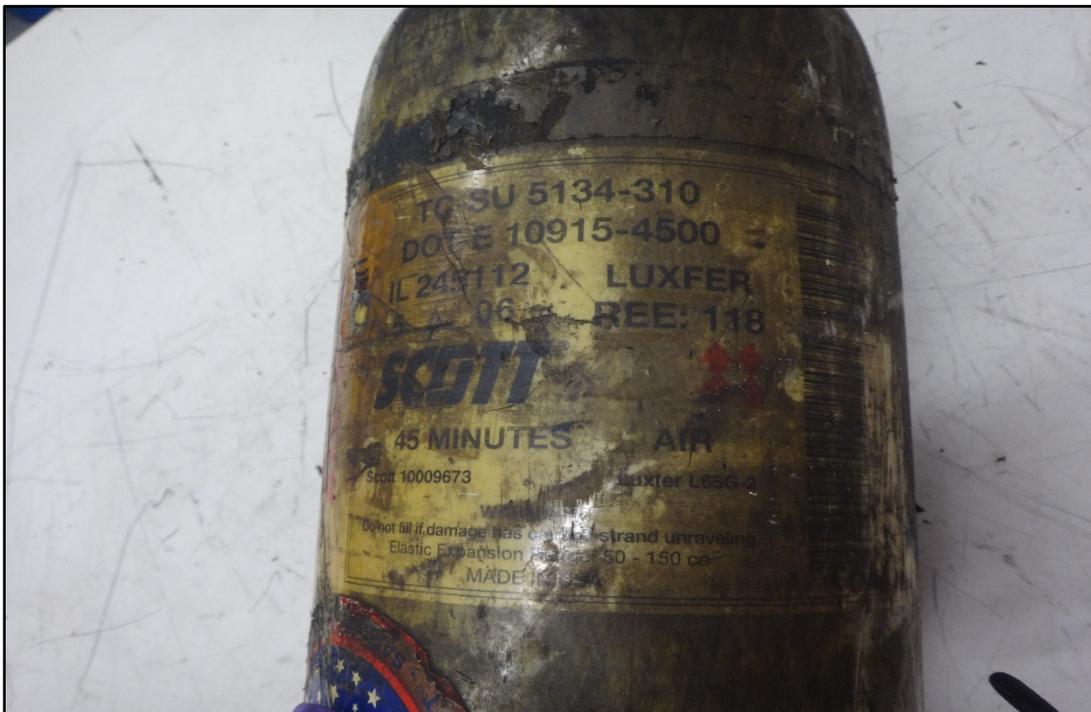


Figure 18: Cylinder label



Figure 19: Cylinder gauge heat damage



Figure 20: All components of Unit #3 to be examined



Figure 21: Top view of facepiece



Figure 22: Inside view of facepiece



Figure 23: Smoke stains inside of facepiece



Figure 24: Smoke stains visible on inside of facepiece lens



Figure 25: MMR with identifying markings



Figure 26: Sticker on MMR with identifying markings



Figure 27: Inside flange of MMR



Figure 28: Low pressure hose and Quick Disconnect



Figure 29: Quick Disconnect

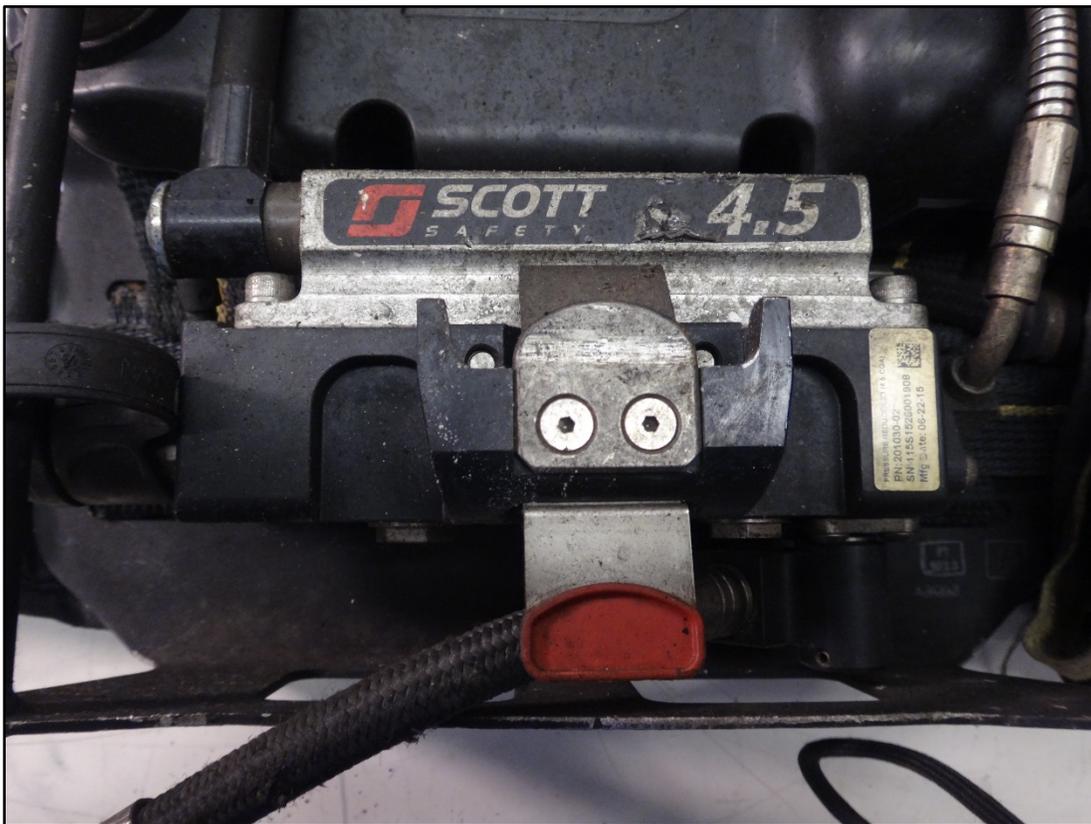


Figure 30: Pressure reducer assembly



Figure 31: RIC UAC system connector with cap on



Figure 32: High pressure hose and cylinder attachment



Figure 33: RIC UAC system connector with cap off



Figure 34: Buddy breather



Figure 35: PASS console



Figure 36: Back view of PASS console, SEI label



Figure 37: PASS control module



Figure 38: Straps and buckles



Figure 39: Overall condition of cylinder



Figure 40: Cylinder label

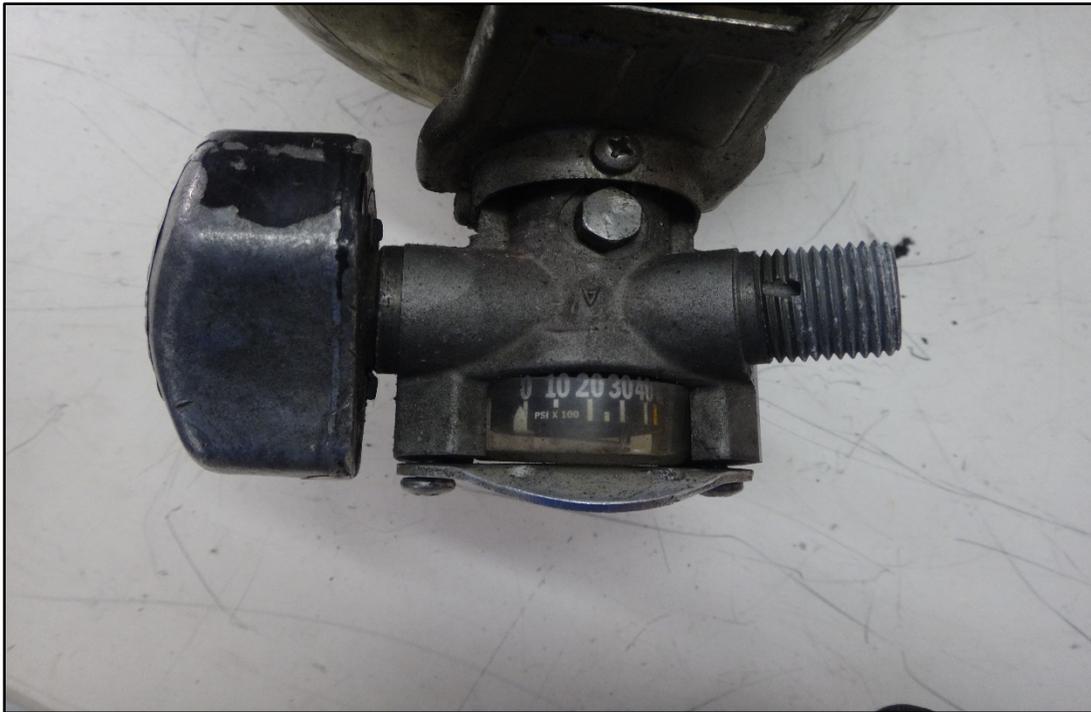


Figure 41: Cylinder gauge



Figure 42: View of cylinder threads

Disclaimer

The purpose of this effort was to determine the conformance of a respirator to the NIOSH approval requirements found in Title 42, *Code of Federal Regulations*, Part 84. A number of performance tests are selected from the complete list of Part 84 requirements and each respirator is tested in its “**as received**” condition to determine its conformance to those performance requirements. Each respirator is also inspected to determine its conformance to the quality assurance documentation on file at NIOSH.

In order to gain additional information about its overall performance, each respirator may also be subjected to other recognized test parameters, such as National Fire Protection Association (NFPA) consensus standards. While the test results give an indication of the respirator’s conformance to the NFPA approval requirements, NIOSH does not actively correlate the test results from its NFPA test equipment with those of certification organizations which list NFPA-compliant products. Thus, the NFPA test results are provided for information purposes only.

Selected tests are conducted only after it has been determined that each respirator is in a condition that is safe to be pressurized, handled, and tested. Respirators whose condition has deteriorated to the point where the health and safety of NIOSH personnel and/or property is at risk will not be tested.



Centers for Disease Control
and Prevention
National Institute for Occupational
Safety and Health