

PPE CASE



Personal Protective Equipment Conformity Assessment Studies and Evaluations

Evaluation of Two Self-Contained Breathing Apparatus Involved in a Near Miss in the Fire Service

Loudoun County Fire Department Request for two 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 personal protective equipment (PPE) that was being used by the fire fighter during a near miss event.

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

NIOSH evaluated two SCBAs used by two fire fighters involved in a near miss. The SCBAs were not found to contribute to the near miss.

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.

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 inspected all SCBA components and documented their findings with written and photographic evidence. NPPTL also tested 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

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

Chain of Custody

The SCBA units were hand delivered, by two personnel from the Loudoun County Fire Department, to Lab H1513 in the NIOSH facility in Morgantown, West Virginia on February 8, 2017.

On February 8, 2017, NPPTL employees Jay Tarley and Angie Andrews inspected the SCBA units. The SCBA units remained in Lab H1513 throughout the entire inspection and testing process.

The SCBAs were identified as the Loudoun County Fire Department SCBAs 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-212CBRN.

SCBA Inspection

The inspection process was initiated by Jay Tarley and Angie Andrews once the SCBA units were hand delivered to Lab H1513 by two personnel from the Loudoun County Fire Department. The SCBAs were identified as the Loudoun County Fire Department SCBAs 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-212CBRN.

As Received (pictured below) SCBA unit 60105

- SCBA unit 60105 was hand delivered in a SCBA bag to Lab H1513 by two personnel from the Loudoun County Fire Department.
- Cylinder was received full and closed.
- Bypass was closed.
- Donning switch was off with regulator inactive.
- Mask-mounted regulator (MMR) was connected to facepiece.



SCBA unit 60105 facepiece, and cylinder as received.

Components and Observations for SCBA Unit 60105 (Figure 1) (“Right” or “left” are from the user’s perspective) (see Figures in Appendix)

Facepiece (Figures 2 - 5)

- Facepiece rim assembly 3100281; M/N: AV3000
- Facepiece seal P/N: 3100178; MFG date: 03/2014
- Nosecup P/N: 210026; MFG date: 1st Q 2016
- Lens P/N: 805337; MFG date: 3/14
- Other markings: scribed on facepiece retaining rim 10888
- Overall condition: very good, but very dirty.
- Lot number label present, but unreadable.
- Lens good, but dirty, couldn’t see through it.
- Hairnet good, but dirty.
- Hairnet straps good, straps moved freely held in place and held securely to facepiece.
- Attachment points for straps good.
- The facepiece skirt in excellent condition.
- Regulator interface area good, no debris

Mask Mounted Regulator (MMR) (Figures 6 - 8)

- AirPak® Plus E-Z Flo™ regulator with Vibralert and with Heads-Up Display (HUD)
- Regulator assembly P/N: 10002940
- Side of rim: 60105; On top sticker: 60105
- Inside flange#: 11550636002969AB; 60105
- Overall condition, was fair with no sign of heat damage.
- Outer case was good and front label was also good, but dirty condition.
- Donning switch was in good condition.
- Quick Disconnect was present and attached.
- Bypass closed, bypass knob in good shape.
- Inside flange was dirty with signs of fraying or wear around the edges, had minimal scratches, dirty.
- Sealing area mostly dirty with signs of fraying around the edge, had minimal scratches.
- Regulator could be attached and removed.
- Locking assembly functioned.

Low Pressure Regulator Hose (Figures 9 - 11)

- 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 12 and 13)

- P/N: 802220-03; Scott P/N: 1000137; Loudoun County barcode: 10002941
- S/N: 040400306; MFG Date: Not found
- Loudoun County flow test sticker: 1/2017
- Overall condition was good, but dirty.

- All airline connections were secure with no sign of heat damage.

High Pressure Hose and Cylinder Attachment (Figures 14 - 16)

- Cylinder Attachment P/N: 802228-151014
- Cylinder attachment threads dirty, threads on and off, and “O” ring in place.
- RIC UAC markings: Parker RGX-N-05; 16WX.
- Overall condition was good, but dirty.
- RIC UAC cover in good condition, connection dirty.

Auxiliary Hose

- N/A

Console Assembly PASS (Figures 17 and 18)

- Barcode: not visible; US Patent#: 50,097,826
- P/N: not visible.
- Overall condition was good.
- Lines in good shape—pressure/electrical.
- Gauge lens was good and readable.
- Protective casing was good.
- No rubber attachment strap present.
- SEI label was present.

PASS Control Module with PAK-Alert (Figures 19 and 20)

- Scott P/N: 200451-02-12
- Scott S/N: 11551033003394SR; MFG date: 8/17/2010
- Overall condition was good.
- Held securely to backframe.
- Wire connection connected to PASS.
- Wire held secure to backframe and connected to console assembly.

Backframe Assembly (Figures 21 - 23)

- P/N: 804415-01
- SEI label was readable; SCBA was upgraded to NFPA 1981 2007 edition
- NIOSH Approval Number label: TC-13F-212CBRN.
- Other identifying markings: Yellow sticker: PT E601-R; Orange sticker: 60105
- Overall good condition, no bends/cracks in wire frame, or plate.
- Shoulder straps were attached to the frame.
- Cylinder strap latch was in fair condition and functional.

Straps and Buckles (Figure 24)

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

Compressed Air Cylinder and Cylinder Valve Assembly (Figures 25 - 28)

- Scott Safety P/N: 917145, Lot # 2823757
- DOT-SP-10915-4500; TC-SU-5134-310
- Scott P/N: 805588BC0318; IL 361365
- Luxfer P/N: L65G-146; UN 1002; REE 118
- Hydrostatic date: 5/14; 45 Minute, 4500 PSI
- Yellow sticker with next hydro due date: 5/2019
- Marking on stem: 804722-BC0318
- Overall condition was good.
- Gauge was readable.
- Threads were clean.
- As received cylinder valve was closed and cylinder full.
- Rubber bumper at base of cylinder valve was in good condition.

As Received (pictured below) SCBA unit 60129

- SCBA unit 60129 was hand delivered to Lab H1513 by Loudoun County Fire Department.
- Cylinder received full and closed.
- Bypass was closed.
- Donning switch off, regulator inactive.
- Mask-mounted regulator (MMR) connected to facepiece.



SCBA unit 60129 facepiece and cylinder as received.

Components and Observations for SCBA Unit 60129 (Figure 29) (“Right” or “left” are from the user’s perspective) (see Figures in Appendix)

Facepiece (Figures 30 and 31)

- Facepiece bezel# 31002809; M/N: AV-3000HT; MFG date: 4/2014
- Facepiece seal P/N: 310017392; Lot# 050714; MFG date: 04/2014
- Nosecup P/N: 2011271; Size: Medium; MFG date: 1st Q 2016
- Other markings: scribed on facepiece retaining rim 10321
- Lens P/N: 805337; Lens retaining piece date: 1/2014
- Overall condition good, but very dirty
- Lens was good, but dirty, can’t see through it.
- Hairnet was good, but dirty.
- 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 good, no debris

Mask Mounted Regulator (MMR) (Figures 32 - 34)

- AirPak® Plus E-Z Flo™ regulator with Vibralert and with Heads-Up Display (HUD)
- Regulator assembly P/N: 20007-02; S/N: 0505005179 AB
- Loudoun County Sticker 10002162
- Sticker in front 60129
- Side of rim: 60129 E-Z Flo
- U.S. Patent #: N/A
- Inside flange#: 0505005179AB; 60129
- Overall condition fair with no sign of heat damage.
- Outer case good and front label was also in good, but dirty condition.
- Donning switch is in good condition.
- Quick Disconnect present and attached.
- Bypass closed, bypass knob in good shape.
- Inside flange is dirty with signs of fraying or wear around the edges, had minimal scratches, dirty.
- Sealing area mostly dirty with signs of fraying around the edge, had minimal scratches.
- Regulator could be attached and removed.
- Locking assembly functioned.
- HUD has tear in it

Low Pressure Regulator Hose (Figures 35 and 36)

- P/N: non visible
- 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 37 - 39)

- P/N: 802220-03; Scott P/N: 1001057;
- S/N N070211; Loudoun County barcode: 10002986
- S/N: 0404003050AB; MFG Date: Not found
- Loudoun County flow test sticker: 2/2016
- Overall condition was good, but dirty.
- All airline connections were secure with no sign of heat damage.
- P/N etched inside pressure reducer.

High Pressure Hose and Cylinder Attachment (Figures 40 - 43)

- Cylinder Attachment P/N: 802228-05
- Overall condition was good, but dirty.
- Cylinder attachments threads dirty, 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.

Auxiliary Hose

- N/A

PASS Console Assembly (Figures 44 and 45)

- Barcode: not visible; US Patent#: 5,097,826; P/N: not found
- Overall condition good.
- Lines in good shape—pressure/electrical.
- Gauge lens good and readable.
- Protective casing good.
- Rubber attachment strap present.
- SEI label present.

PASS Control Module with PAK-Alert (Figures 46 and 47)

- Scott P/N: 200451-02-12
- Scott S/N: 115S1028001903SR
- Manufacture date: 07/13/2010
- Overall condition is good.
- Held securely to backframe.
- Wire connection connected to PASS device.
- Wire held secure to backframe and ran to console assembly.

Backframe Assembly (Figures 48 and 49)

- P/N: 804415-01
- SEI label readable; NFPA 1981 2007 edition upgrade from 2002
- NIOSH Approval Number TC-13F-212CBRN
- Yellow sticker: PT T601-O; Orange sticker: 60129
- Other marking: etched in metal SP-20#4
- Overall condition good, no bends/cracks in wire frame, or plate.
- Shoulder straps were attached to the frame.
- Cylinder strap latch fair condition and functional.

Straps and Buckles (Figure 50)

- Overall strap condition good.
- Dye-sublimation on both shoulder straps; front and side waist straps.
- 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 in good condition; fraying and dye-sublimation.

Compressed Air Cylinder and Cylinder Valve Assembly (Figures 51 - 54)

- Scott P/N 10009673, LOT # 2823757
- DOT-SP-10915-4500; IL 408920
- TC-SU-5134-310
- Scott P/N: 805588BC0318
- Luxfer P/N: L65G-2; REE 118: UN 1002
- Hydro date: 10/2016 45 Minute, 4500 PSI
- Yellow sticker with next hydro due date: 10/2021
- Overall condition good.
- Gauge readable.
- Threads clean.
- As received cylinder valve closed and cylinder full.
- Rubber bumper at base of cylinder valve was in good condition.

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 #60105 against established tests.

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 did function, the digital remote did function and there was a HUD. *The corresponding cylinder was used Inhalation Breathing Resistance: (inches of water column) = 0.075</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 did function 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 did function. Measured Service Time: 50 Minutes 58 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. Cylinder 61029 was used for this test.</p> <p>Facepiece Static Pressure:(inches of water column)= 0.70</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="0"> <tr> <td>Applied Pressure</td> <td>Air Flow (liters per min.)</td> </tr> <tr> <td>4500 psig</td> <td>438.9</td> </tr> <tr> <td>500 psig</td> <td>543.7</td> </tr> </table>	Applied Pressure	Air Flow (liters per min.)	4500 psig	438.9	500 psig	543.7	<p>PASS PASS</p>
Applied Pressure	Air Flow (liters per min.)							
4500 psig	438.9							
500 psig	543.7							
<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. *Cylinder 60129 was used for this test.</p> <p>Exhalation Breathing Resistance: (inches of water column)= 1.9 Static Pressure: (inches of water column)= 0.70 Difference: (inches of water column)= 1.2</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> <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 25% ± 2%.</p> <table border="1" data-bbox="1283 289 1858 609"> <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>1125</td> <td>1060</td> </tr> <tr> <td>2</td> <td>1125</td> <td>1050</td> </tr> <tr> <td>3</td> <td>1125</td> <td>1050</td> </tr> <tr> <td>4</td> <td>1125</td> <td>1050</td> </tr> <tr> <td>5</td> <td>1125</td> <td>1050</td> </tr> <tr> <td>6</td> <td>1125</td> <td>1050</td> </tr> <tr> <td>Average</td> <td>1125</td> <td>1051.67</td> </tr> </tbody> </table>		Electric	Vibralert	Run #	Alarm Point (psi)	Alarm Point (psi)	1	1125	1060	2	1125	1050	3	1125	1050	4	1125	1050	5	1125	1050	6	1125	1050	Average	1125	1051.67	<p>PASS PASS</p>
	Electric	Vibralert																											
Run #	Alarm Point (psi)	Alarm Point (psi)																											
1	1125	1060																											
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4	1125	1050																											
5	1125	1050																											
6	1125	1050																											
Average	1125	1051.67																											

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 unit was functional, HUD was functional and Alarm systems were functional.</p> <p>*Cylinder 60129 was used for this test.</p> <p>Maximum Facepiece Pressure: (inches of water column)= 2.375 Minimum Facepiece Pressure: (inches of water column)= 0.40</p>	<p>PASS PASS</p>

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
16:23:06	1/10/2017	-	X	-	-	-	-	-	-	-	-
16:22:22	1/10/2017	-	-	-	-	-	-	X	-	-	-
16:21:56	1/10/2017	-	-	-	-	-	-	X	-	-	-
16:21:14	1/10/2017	-	-	-	-	-	-	X	-	-	-
16:20:26	1/10/2017	-	-	-	-	-	-	X	-	-	-
16:18:54	1/10/2017	X	-	-	-	-	-	-	-	-	-
16:16:12	1/10/2017	-	X	-	-	-	-	-	-	-	-
16:15:54	1/10/2017	-	-	-	-	-	-	X	-	-	-
15:52:58	1/10/2017	X	-	-	-	-	-	-	-	-	-
7:32:38	1/10/2017	-	X	-	-	-	-	-	-	-	-
7:32:36	1/10/2017	-	-	-	-	X	-	-	-	-	-
7:32:34	1/10/2017	-	-	-	X	-	-	-	-	-	-
7:32:34	1/10/2017	-	-	-	-	X	-	-	-	-	-
7:32:32	1/10/2017	-	-	X	-	-	-	-	-	-	-
7:32:20	1/10/2017	-	-	-	-	-	-	X	-	-	-
7:31:50	1/10/2017	X	-	-	-	-	-	-	-	-	-
16:17:48	1/9/2017	-	X	-	-	-	-	-	-	-	-
16:17:36	1/9/2017	-	-	-	-	-	-	X	-	-	-
16:17:16	1/9/2017	-	-	-	-	X	-	-	-	-	-
16:17:12	1/9/2017	-	-	-	X	-	-	-	-	-	-
16:17:10	1/9/2017	-	-	-	-	X	-	-	-	-	-
16:17:06	1/9/2017	-	-	X	-	-	-	-	-	-	-
16:16:54	1/9/2017	-	-	-	-	-	-	X	-	-	-
16:16:18	1/9/2017	X	-	-	-	-	-	-	-	-	-

Data Logger Information for SCBA unit 60105 tested and evaluated.

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 #60129 against established tests.

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 first failed at 1800 psi 691 cycles 28.13 and -0.02 INWC.</p> <p>*-0.25 is the lowest failed pressure during rated time.</p> <p>PASS and HUD were both functional.</p> <p>Inhalation Breathing Resistance: (inches of water column) = -0.25</p>	<p>FAIL</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 did function 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. PASS did function.</p> <p>Measured Service Time: 51 Minutes 59 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. Cylinder #60105 was used for this test.</p> <p>Facepiece Static Pressure:(inches of water column)= 0.92</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="0"> <tr> <td>Applied Pressure</td> <td>Air Flow (liters per min.)</td> </tr> <tr> <td>4500 psig</td> <td>458.74</td> </tr> <tr> <td>500 psig</td> <td>656.95</td> </tr> </table>	Applied Pressure	Air Flow (liters per min.)	4500 psig	458.74	500 psig	656.95	<p>PASS PASS</p>
Applied Pressure	Air Flow (liters per min.)							
4500 psig	458.74							
500 psig	656.95							
<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. *Cylinder #60105 was used for this test.</p> <p>Exhalation Breathing Resistance: (inches of water column)= 2.1 Static Pressure: (inches of water column)= 0.92 Difference: (inches of water column)= 1.18</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> <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 25% ± 2%.</p> <table border="1" data-bbox="1283 289 1858 609"> <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>1125</td> <td>1060</td> </tr> <tr> <td>2</td> <td>1125</td> <td>1070</td> </tr> <tr> <td>3</td> <td>1125</td> <td>1070</td> </tr> <tr> <td>4</td> <td>1125</td> <td>1070</td> </tr> <tr> <td>5</td> <td>1125</td> <td>1070</td> </tr> <tr> <td>6</td> <td>1120</td> <td>1060</td> </tr> <tr> <td>Average</td> <td>1124.17</td> <td>1066.67</td> </tr> </tbody> </table>		Electric	Vibralert	Run #	Alarm Point (psi)	Alarm Point (psi)	1	1125	1060	2	1125	1070	3	1125	1070	4	1125	1070	5	1125	1070	6	1120	1060	Average	1124.17	1066.67	<p>PASS PASS</p>
	Electric	Vibralert																											
Run #	Alarm Point (psi)	Alarm Point (psi)																											
1	1125	1060																											
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Average	1124.17	1066.67																											

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>*Cylinder #60105 was used for this test.</p> <p>Maximum Facepiece Pressure: (inches of water column)= 2.7 Minimum Facepiece Pressure: (inches of water column)= 0.15</p>	<p>PASS PASS</p>

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
12:37:36	1/30/2017	-	-	-	-	-	-	-	-	X	-
12:37:06	1/30/2017	-	-	-	-	-	-	-	X	-	-
14:25:38	1/17/2017	-	-	-	-	-	-	-	-	X	-
14:08:46	1/17/2017	-	-	-	-	-	-	-	X	-	-
17:27:24	1/10/2017	-	X	-	-	-	-	-	-	-	-
17:26:52	1/10/2017	-	-	-	-	-	-	X	-	-	-
17:11:48	1/10/2017	X	-	-	-	-	-	-	-	-	-
6:06:12	1/9/2017	-	X	-	-	-	-	-	-	-	-
6:05:48	1/9/2017	-	-	-	-	X	-	-	-	-	-
6:05:44	1/9/2017	-	-	-	X	-	-	-	-	-	-
6:05:42	1/9/2017	-	-	-	-	X	-	-	-	-	-
6:05:42	1/9/2017	-	-	X	-	-	-	-	-	-	-
6:05:30	1/9/2017	-	-	-	-	-	-	X	-	-	-
6:05:08	1/9/2017	X	-	-	-	-	-	-	-	-	-
5:40:28	1/8/2017	-	X	-	-	-	-	-	-	-	-
5:40:28	1/8/2017	-	-	-	-	X	-	-	-	-	-
5:40:24	1/8/2017	-	-	-	X	-	-	-	-	-	-
5:40:24	1/8/2017	-	-	-	-	X	-	-	-	-	-
5:40:22	1/8/2017	-	-	X	-	-	-	-	-	-	-
5:40:10	1/8/2017	-	-	-	-	-	-	X	-	-	-
5:39:32	1/8/2017	X	-	-	-	-	-	-	-	-	-

Data Logger Information for SCBA unit #60129 tested and evaluated.

Disposition of SCBA

Following testing on February 8, 2017, both SCBA units were returned to the SCBA bags the two personnel from Loudoun County Fire Department transported the SCBA units in.

Synopsis of Findings

The SCBA units inspected and evaluated by NPPTL were both the Scott® Safety Air-Pak® Model AP50 4.5, 45 minute, 4500 psi unit, NIOSH Approval Number TC-13F-212CBRN. A corresponding facepiece was provided for both units. The units did not show any signs of heat damage, but exhibited signs of normal wear and tear. Both cylinders were hand delivered closed and gauges reading full. The mask-mounted regulator was connected to the facepiece. The units were in good overall condition. The NFPA approval label were present and readable. Both units' PASS, HUD, and alarm systems functioned.

The SCBA unit 60105 met the requirements of the NIOSH Positive Pressure Test, as the unit did maintain a positive pressure for the 45 minute minimum duration of the unit. The unit passed all of the other NIOSH tests. The SCBA unit 60129 did not meet the requirements of all six NIOSH SCBA certification tests. The unit failed the NIOSH Positive Pressure test (Standard Test Procedure Number 120, 42 CFR Part 84 Reference: Subpart H, 84.70 (a)(2)(ii)). The unit passed the NFPA "Airflow Performance" test. The fire department had two of their SCBA maintenance technicians present during the testing and were aware of the failure and were confident of it being a maintenance issue.

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 Loudoun County Fire Department by the two personnel who hand delivered them to the NIOSH facility.

CASE Conclusion

No evidence was identified to suggest that the SCBA units inspected and evaluated contributed to the near miss. NIOSH determined that there was no need for corrective action with regards to the approval holder or users of 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 21374 in your request.

For more information related to personal protective equipment, visit the NIOSH website 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 www.cdc.gov/niosh

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Appendix Photographs to Support Inspection Findings for SCBA unit 60105 and unit 60129

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Figure 1: All components of SCBA 60105 unit to be examined.



Figure 2: Top view of facepiece.



Figure 3: Facepiece hairnet and straps.



Figure 4: Inside view of facepiece, skirt, and nosecup.



Figure 5: Inside of nosecup.



Figure 6: MMR with identifying markings.



Figure 7: Inside flange of MMR with identifying markings.



Figure 8: Side view of flange of MMR.

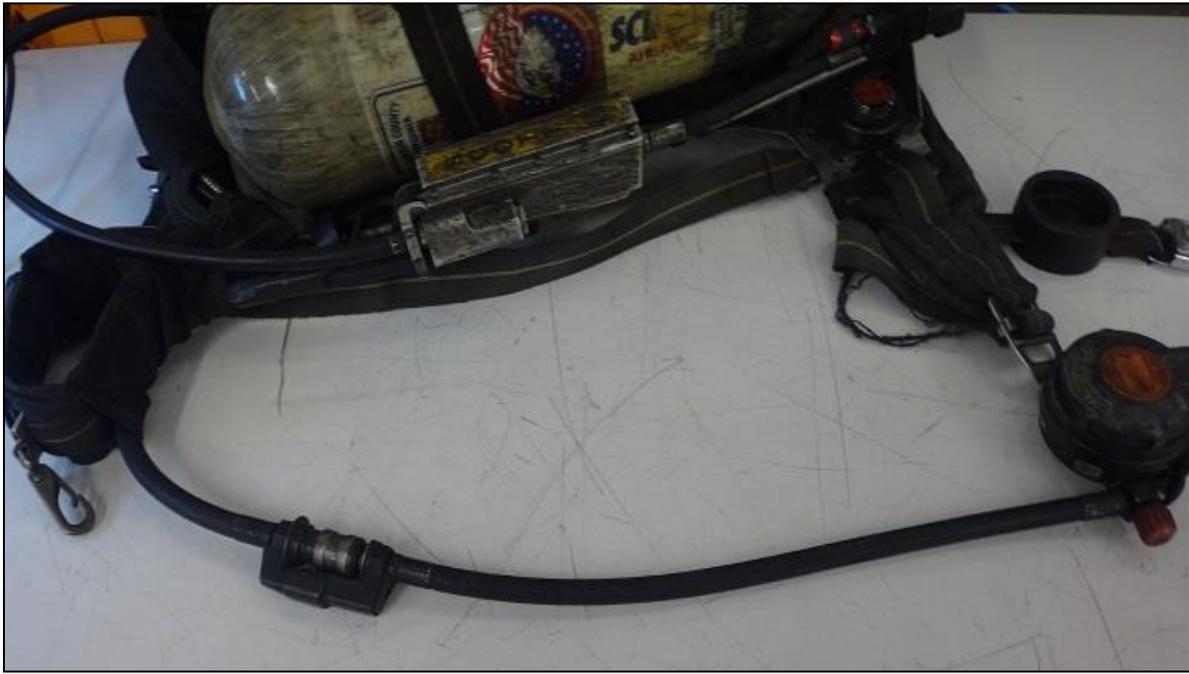


Figure 9: Low pressure hose.



Figure 10: Low pressure connection.



Figure 11: Quick Disconnect.



Figure 12: Pressure reducer assembly.

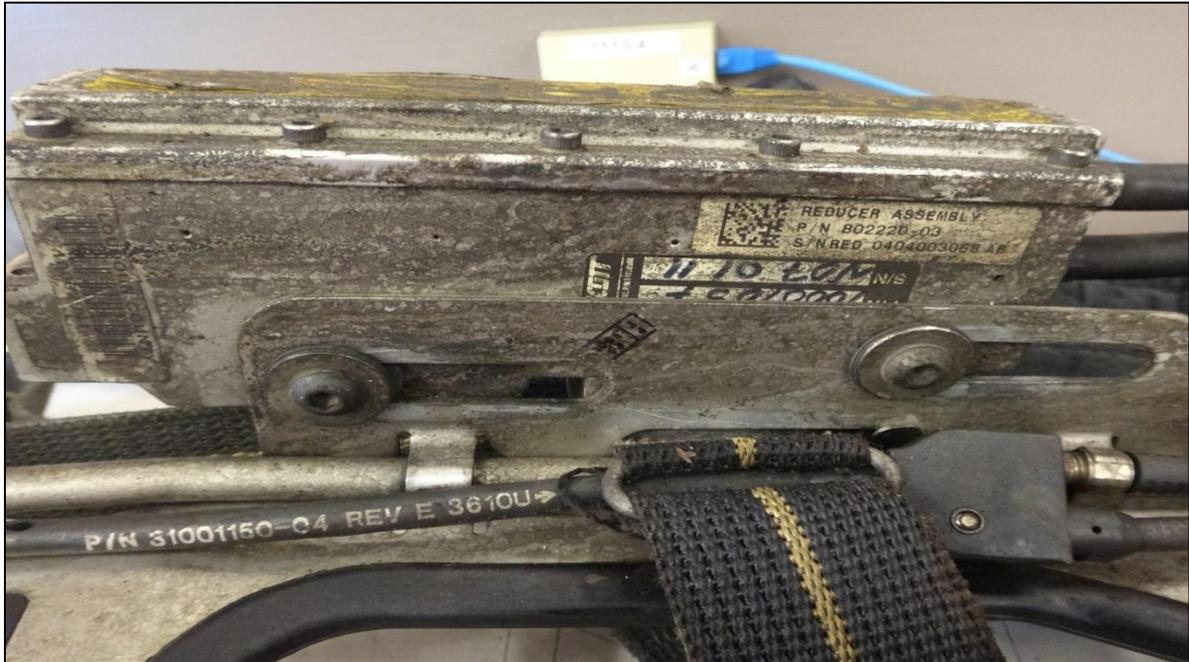


Figure 13: Interior view of pressure reducer assembly.



Figure 14: High pressure hose and cylinder attachment.



Figure 15: Cylinder attachment threads and O-ring.



Figure 16: RIC UAC system connector.



Figure 17: PASS console.



Figure 18: Back view of PASS console, SEI label.



Figure 19: PASS control module.



Figure 22: Labels on backframe.



Figure 23: SCBA flow test sticker.

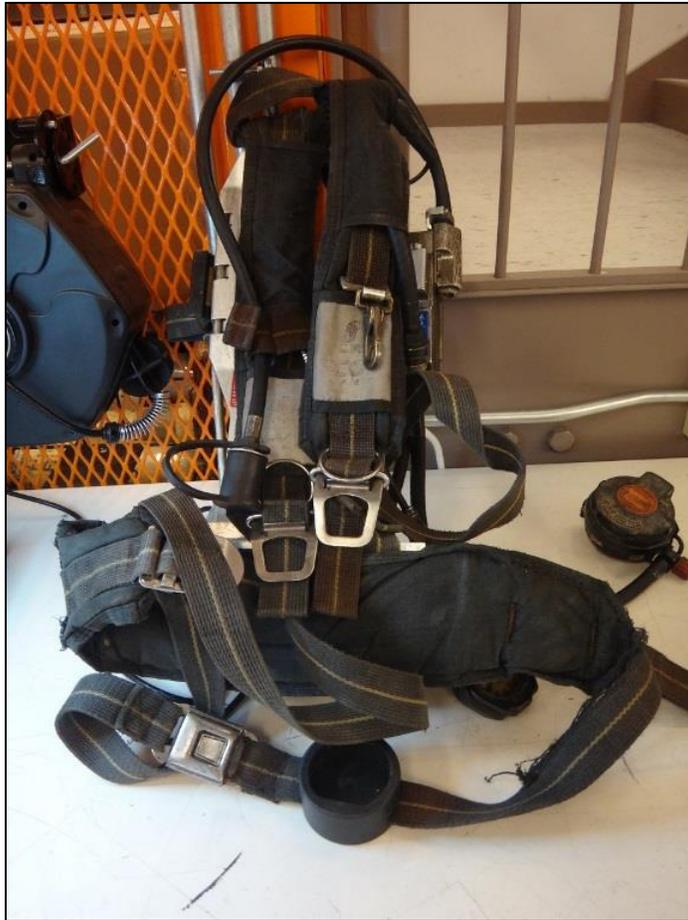


Figure 24: Straps and buckles.



Figure 25: Overall condition of cylinder.



Figure 26: Cylinder strap.



Figure 27: Cylinder threads.



Figure 28: Cylinder gauge is readable.



Figure 29: All components of SCBA 60129 unit to be examined.



Figure 30: Facepiece with MMR attached.



Figure 31: Facepiece hairnet and straps.



Figure 32: MMR with identifying marking.



Figure 33: Inside flange, MMR, and identifying markings.



Figure 34: Side view of flange on MMR.



Figure 35: MMR, low pressure hose with Quick Disconnect.



Figure 36: Quick Disconnect.



Figure 37: Interior view of pressure reducer assembly and identifying markings.



Figure 38: Pressure reducer assembly.

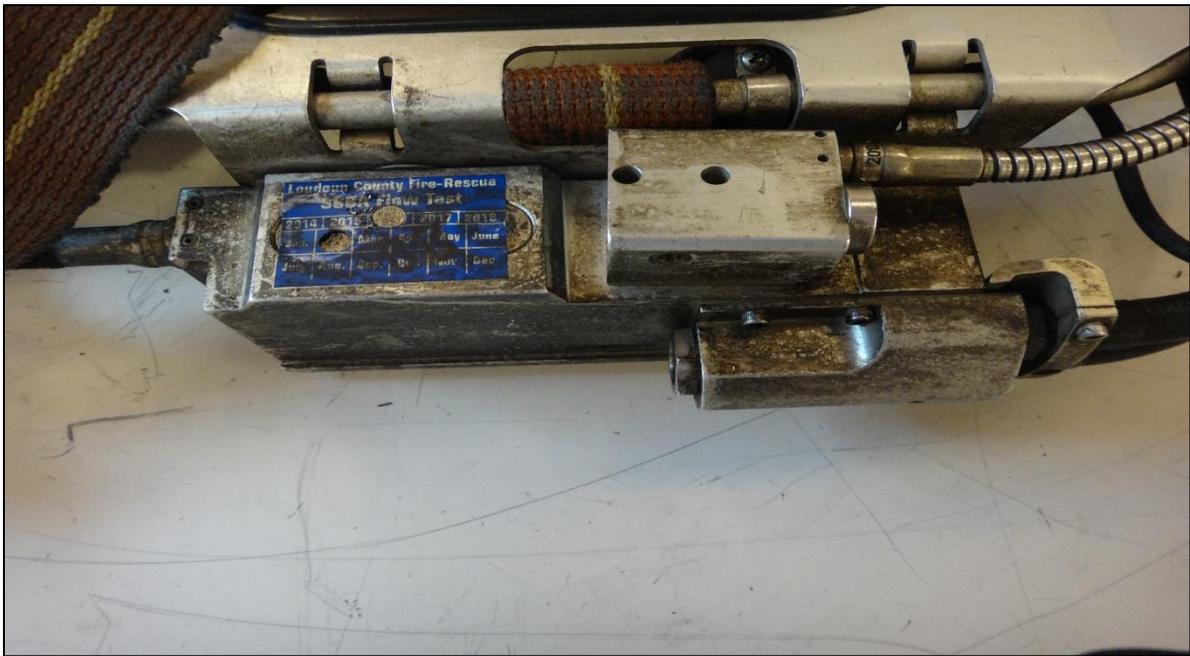


Figure 39: Pressure reducer assembly with SCBA flow test sticker.



Figure 40: High pressure hose and cylinder attachment.



Figure 41: Cylinder attachment threads.



Figure 42: Dust cap for the RIC UAC system connector.



Figure 43: RIC UAC system connector.



Figure 44: PASS control console.



Figure 45: SEI label on the back of the PASS console.



Figure 46: Control module.



Figure 49: Back view of backframe and NIOSH label.



Figure 50: Straps and buckles.



Figure 51: Identifying information on cylinder.

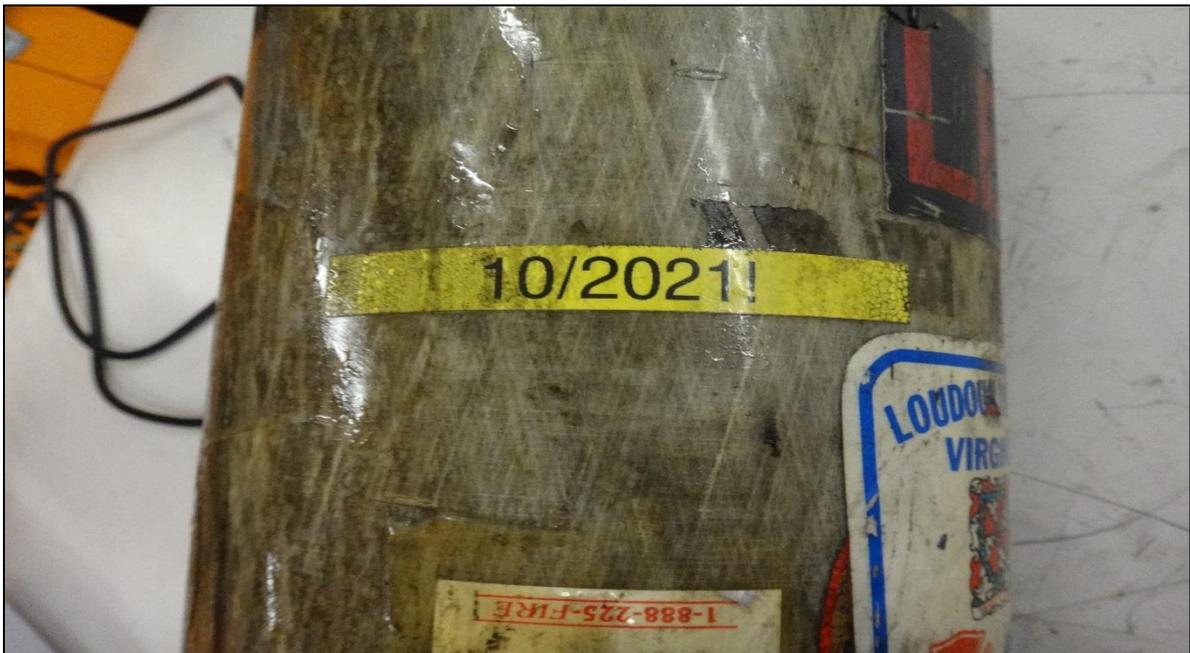


Figure 52: Label on cylinder.



Figure 53: Hydrostatic test date sticker.



Figure 54: Cylinder gauge is readable, view of 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.

