

PPE CASE



Personal Protective Equipment Conformity Assessment Studies and Evaluations

Evaluation of Two Self-Contained Breathing Apparatus for Potential Contribution to a Fatal Event in the Fire Service

Pineville, North Carolina Fire Department Request for Scott® Safety Air-Pak® 4.5, 4500 psi, 30 minute units with NIOSH Approval Number TC-13F-76CBRN (August 3, 2016)

As part of the ***National Institute for Occupational Safety and Health (NIOSH) Fire Fighter Fatality Investigation and Prevention Program (FFFIPP)***, the National Personal Protective Technology Laboratory (NPPTL) agreed to examine and evaluate two SCBA units identified as Scott® Safety model Air-Pak® 4.5, 4500 psi, 30 minute, self-contained breathing apparatus (SCBA).

This SCBA status investigation was assigned NIOSH Task Number 20922. The NIOSH Division of Safety Research (NIOSH/DSR) and the Pineville Fire Department were advised that NIOSH/ NPPTL would provide a written report of the inspections and any applicable test results.

The SCBA units were hand delivered to the NIOSH facility in Morgantown, West Virginia on June 28, 2016. The units were taken to the lower floor of the lab, room 1513, for secured storage. The SCBA units were then removed from storage for inspection on August 12, 2016 and placed back into secured storage until the testing on August 15, 2016.

NIOSH evaluated two SCBA units used by fire fighters involved in a fatal event. The SCBAs were not found to contribute to the fatalities.

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

Disclaimer

The purpose of Respirator Status Investigations is to determine the conformance of each 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.

Investigator Information

The self-contained breathing apparatus (SCBA) performance tests were conducted by Karis Kline (Contractor) and Jeremy Gouzd (Fellow). The SCBA inspections were performed by Karis Kline and Jeremy Gouzd. This report was written by Jeremy Gouzd (Fellow). The investigators are part of the Evaluation and Testing Branch, National Personal Protective Technology Laboratory, National Institute for Occupational Safety and Health, located in Morgantown, West Virginia.

NIOSH Task Number 20922

SCBA Inspection

The units were removed from the packaging in the lower floor of the lab, room 1513, and inspected on August 12, 2016 by Jeremy Gouzd and Karis Kline. The SCBA units were identified as the Pineville Fire Department SCBAs. Each SCBA was extensively examined, component by component, in the condition received to determine the conformance of the unit to the NIOSH-approved configuration. The units were identified as the Scott® Safety Company model Air-Pak® 4.5, 30 minute, 4500 psi units, NIOSH approval number TC-13F-76CBRN. The visual inspection process was documented photographically.

The complete SCBA inspection is summarized in **Appendix I**. The condition of each major component of the SCBA that was photographed with a digital camera is contained in **Appendix III**.

SCBA Testing

The purpose of the testing was to determine the conformance of each SCBA to the approval performance requirements of 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) Airflow Performance requirements of NFPA 1981, *Standard on Open-Circuit Self-Contained Breathing Apparatus for the Fire Service*, 1997 Edition.

NIOSH SCBA Certification Tests (in accordance with the performance requirements of 42 CFR 84):

1. Positive Pressure Test [§ 84.70(a)(2)(ii)]
2. Rated Service Time Test (duration) [§ 84.95]
3. Static Pressure Test [§ 84.91(d)]
4. Gas Flow Test [§ 84.93]
5. Exhalation Resistance Test [§ 84.91(c)]
6. Remaining Service Life Indicator Test (low-air alarm) [§ 84.83(f)]

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

7. Airflow Performance Test [Chapter 5, 5-1.1]

Appendix II contains the complete NIOSH test report for the SCBA. **Tables ONE and TWO** summarize the NIOSH and NFPA test results.

Summary and Conclusions

Two SCBA units were submitted to NIOSH/DSR by the Pineville Fire Department for evaluation. The SCBA units were delivered to NIOSH on June 28, 2016 and extensively inspected on August 12, 2016. The units were identified as Scott® Safety model Air-Pak® 4.5, 4500 psi, 30-minute, SCBA (NIOSH approval numbers, TC-13F-76CBRN). Corresponding facepieces were provided with the units. The units did not show any signs of heat damage, but exhibited signs of normal wear and tear for the unit. Only one unit arrived with a corresponding cylinder, this unit will be identified as “Unit 1” for the remainder of this report. The cylinder gauge showed that the tank was empty. The mask mounted regulator (MMR) and sealing areas in both units were mostly clean. The locking assemblies did function, and the inside flanges had minimal to no scratching. The NFPA approval label was present and readable on both units. The personal alert safety systems (PASS) functioned and overall condition was good. For detailed test results see appendices below.

In light of the information obtained during this investigation, NIOSH has proposed no further action on its part at this time. The SCBA units were returned to storage pending return to the Pineville Fire Department. If these units are to be placed back in service, the SCBAs must be repaired, tested, cleaned, and any damaged components must be replaced and inspected by a qualified service technician. This includes such testing and other maintenance activities as prescribed by the schedule from the SCBA manufacturer. Typically a flow test is required on at least an annual basis.

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, should undergo a flow test on an annual basis at a minimum.

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

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

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 I

Unit 1

SCBA Inspection Report



National Personal Protective Technology Laboratory, Evaluation and Testing Branch

Respirator Field Problem

Incoming Inspection Report Summary – Unit #1

Task Number: TN-20922 Unit 1	Requestor: NIOSH/DSR for Pineville Fire Department
Date Received: June 28, 2016	
Date Inspected: August 12, 2016	Description: Fatality
Manufacturer: Scott® Safety	Inspected by: Jay Tarley, Jeremy Gouzd, Karis Kline
Approval Number: TC-13F-76CBRN	SCBA Type: Open-Circuit, Pressure-Demand

The SCBA was received by hand delivery, not contained in any box or bag (refer to **Figure 1** in **Appendix III - Unit 1**).

Contact Agency: NIOSH/DSR for the Pineville Fire Department.

As received:

- Cylinder included, empty
- By-pass in the open position
- Donning switch off, regulator inactive
- MMR locked in to waist strap
- Name tag included reading

Components and Observations – Unit #1

NOTE: All references to “right” or “left” are from the user’s perspective.

1. Facepiece (refer to **Figures 2-6** in **Appendix III - Unit 1**):

Facepiece assembly; P/N 31002810 Medium Model: AV3000 MFG date: 5/13

Facepiece Seal P/N: 310017392 MFG date: 9/13

Nose cup P/N: 2011272 Medium MFG Date: 3rd quarter 2013

Lens Sealing Ring Lot #101413 on sticker

Other Markings: “Engine 3” etched on facepiece seal, Sticker on Lens “E-3-C”

- Overall condition is fair, some missing parts and covered in debris
- Lot number label is present
- Lens is good with some scratches

- Hairnet straps good, straps move freely hold in place, held securely to facepiece, slightly dirty
- Attachment points for straps are good
- The facepiece seal “rubber” portion is good
- Regulator interface area is good, some debris
- Missing voice amplifier on right side
- Missing nose cup exhalation valve

2. MMR with HUD (refer to **Figures 7-8** in **Appendix III - Unit 1**):

AirPAK plus CBRN with Vibralert and E-Z flow regulator.

Regulator assembly P/N: 20077-31

Other Markings: FT838 Stamp; A2Q18 Stamp; 3F sticker on front of regulator

S/N: 115S1325012964

MFG Date: 6-19-13

- Overall condition, is good with light wear and tear
- Outer case is good with stickers present
- Donning switch and cover are in good working condition
- Secured to low pressure line
- By-pass in the open position
- By-pass knob normal wear and tear
- Inside flange good, clean
- Sealing area clean
- Locking assembly does function

3. Low Pressure Line (refer to **Figure 9** in **Appendix III - Unit 1**):

Scott partial part number: 1033

- Overall condition is good, no rips or tears
- Secured at all attachments points
- Quick disconnect not present
- Line runs through the shoulder strap to the reducer

4. 4.5 Pressure Reducer Assembly (refer to **Figures 10-13** in **Appendix III - Unit 1**):

P/N: 200925-02

Marking: Pineville Sticker

S/N: 115S1325000555

MFD: 6-17-13

HUD Connection PN: 31001150-02

- Overall condition is good and clean.
- All airline connections are secure

5. High Pressure Line & Cylinder Attachment (refer to **Figures 14-18** in **Appendix III - Unit 1**):

Cylinder Attachment P/N: 80228-15

Other marking: FT882 stamp

MFG Date: 06/13

- Overall condition is good, some scratches
- Cylinder attachments thread clean, threads on and off, O-ring in place
- Quick fill and cover in good shape
 - Parker RGX-N-05
 - 22SW
- Pressure relief valve is good

6. Console Assembly PASS Version (refer to **Figures 19-20** in **Appendix III- Unit 1**):

Scott® Label present:

PN: Partial- 0XXX-01

SN: 15S1324005614

MFG Date: 0613

SEI Label: NFPA 1982, 2007 ed

- Overall condition is good, light wear and tear
- Lines in good shape – pressure/electrical
- Gauge lens is readable
- Protective casing good
- Rubber attachment strap present, attached to the PASS console and shoulder strap

7. PASS HUD Control Module (refer to **Figures 21-22** in **Appendix III- Unit 1**):

P/N: 200451-01,-11

200451-02, -12 with Pak tracker

Scott PN: 200451-02

SN: 115S1325000722

FCCID: T5E200451

IC #: 6453A-200451

MFG Date: 6-17-13

Other Marking: NIOSH CBRN Agent Approved Sticker

- Overall condition is good
- Held securely to backframe
- Wire connection connected to PASS device
- Wire held secure to backframe and runs to console assembly

Changed batteries due to low battery alert when unit was pressurized

8. Backframe Assembly (refer to **Figures 23-26** in **Appendix III- Unit 1**):

S/N: 115S1324001400

PN: 200275-01

Other markings: A2Q13 FT808 Stamped, 3F Sticker, MES Sticker

SEI Label attached, NFPA 1981, 2007 Edition

- Overall fair condition, no bends/cracks in wire frame
- Shoulder straps were attached to the frame
- Cylinder strap and latch are in good condition
- Cylinder strap adjuster functional
- Cylinder strap and latch is clean and functional
- CBRN label present
- NIOSH label present, TC-13F-76CBRN

9. Straps & Buckles (refer to **Figures 27-29** in **Appendix III - Unit 1**):

- Overall strap condition is good, slight heat sublimation on left shoulder
- Both Shoulder straps attached at the top of the back frame
- Hose lines and wires pass through shoulder straps
- All adjustable buckles move and hold in place
- Waist area buckle latches and releases
- Lumbar strap in good condition
- Rescue rope in bag attached

10. Auxiliary Hose (refer to **Figures 30-31** in **Appendix III - Unit 1**):

Stamps: A2Q13, P1 with 816 below it

- Quick connect for the female connection is stuck in the release position
- Otherwise clean and in good condition

11. Cylinder & Valve Assembly (refer to **Figures 32-36** in **Appendix III - Unit 1**):

Some DOT and other information

DOT SP 10915-4500

Scott® P/N:10009671

TC-SU-5134-310

Scott® logo visible

OK 370371 Luxfer REE 78

Luxfer P/N: not visible due to placard sticker Manufacture Date: 12/14 45 Minute, 4500 PSIG

Cylinder Valve SN: 11551502010157

Hydro Date: 02/15

Other Markings: Pineville Fire Department Sticker, non-flammable label, Black "17" sticker, Pineville Fire Rescue sticker

- Overall condition is good, light wear and tear; small gouge in clear coat toward bottom of cylinder
- Gauge is readable
- Threads are ok
- As received cylinder valve fully closed with No air remaining
- Rubber bumper at base on cylinder valve is in good condition
- Scott® Cylinder Valve Assembly Sticker: 804721-

Appendix I

Unit 2

SCBA Inspection Report



National Personal Protective Technology Laboratory, Evaluation and Testing Branch

Respirator Field Problem Incoming Inspection Report Summary – Unit #2

Task Number: TN-20922 Unit 2	Requestor: NIOSH/DSR for Pineville Fire Department
Date Received: June 28, 2016	
Date Inspected: August 12, 2016	Description: Fatality
Manufacturer: Scott® Safety	Inspected by: Jay Tarley, Jeremy Gouz, Kairs Kline
Approval Number: TC-13F-76CBRN	SCBA Type: Open-Circuit, Pressure-Demand

The SCBA was received by hand delivery, contained within a paper bag (refer to **Figures 1-3 in Appendix III - Unit 2**).

Contact Agency: NIOSH/DSR for the Pineville Fire Department.

As received:

- Cylinder not included
- By-pass in the open position
- Donning switch off, regulator inactive
- MMR locked in to waist strap

Components and Observations – Unit #2

NOTE: All references to “right” or “left” are from the user’s perspective.

1. Facepiece (refer to **Figures 4-7 in Appendix III - Unit 2**):

Facepiece assembly; P/N 31002810 Large Model: AV3000 MFG date: 9/13

Facepiece Seal P/N: 31001740 MFG date: 9/13

Nose cup P/N: 201128 Large MFG Date: 3rd quarter 2013

Lens Sealing ring Lot #102613 on sticker

Other Markings: Name Label on lens sealing ring and at base of lens

- Overall condition is good with some debris on the inside of lens, some dried fluid in nose cup
- Lot number label is present
- Lens is good with some scratches

- Hairnet straps good, straps move freely hold in place, held securely to facepiece, slightly dirty; missing red size dot on bottom right strap
- Attachment points for straps are good
- The facepiece seal “rubber” portion is good
- Regulator interface area is good

2. MMR with HUD (refer to **Figures 8-10** in **Appendix III - Unit 2**):

Air-Pak® plus CBRN with Vibralert and E-Z flo regulator.

Regulator assembly P/N: 200077-31

Other Markings: 3E Sticker at the top of MMR

S/N: 115S1325012959

MFG Date: 6-19-13

- Overall condition, is good
- Outer case is good with stickers present
- Donning switch and cover are in good working condition
- Secured to low pressure line
- By-pass in the open position
- By-pass knob normal wear and tear
- Inside Flange good, clean
- Sealing area clean
- Locking assembly does function

3. Low Pressure Line (refer to **Figure 11** in **Appendix III - Unit 2**):

Scott partial part number: 31001446 (partial)

- Overall condition is good, no rips or tears
- Secured at all attachments points
- Quick disconnect not present
- Line runs through the shoulder strap to the reducer

4. 4.5 Pressure Reducer Assembly (refer to **Figures 12-15** in **Appendix III - Unit 2**):

P/N: 200925-02

Marking: Pineville Sticker

S/N: 115S13250_0005 (Partial)

MFD: 6-19-13

HUD Connection PN: 31001150-02

- Overall condition is good and clean
- All airline connections are secure

5. High Pressure Line & Cylinder Attachment (refer to **Figures 16-19** in **Appendix III - Unit 2**):

Cylinder Attachment P/N: 80228-15

Other marking: FT882 stamp

MFG Date: 06/13

- Overall condition is good, some scratches

- Cylinder attachments thread clean, threads on and off, O-ring in place.
- Quick fill and cover is slightly dented:
 - Parker RGX-N-05
 - 02SW
- Pressure relief valve is good

6. Console Assembly PASS Version (refer to **Figures 20-21** in **Appendix III - Unit 2**):

Scott® Label present but not readable

SEI Label: NFPA 1982, 2007 ed

- Overall condition is good, light wear and tear, minimal debris
- Lines in good shape – pressure/electrical
- Gauge lens is readable
- Protective casing good
- Rubber attachment strap present, attached to the PASS console and shoulder strap

7. PASS HUD Control Module (refer to **Figures 22-23** in **Appendix III - Unit 2**):

P/N: 200451-01,-11

200451-02, -12 with Pak tracker

Scott® PN: 200451-02

SN: 115S133401541

FCCID: T5E200451

IC #: 6453A-200451

MFG Date: 8-22-13

Other Marking: NIOSH CBRN Agent Approved Sticker

- Overall condition is good
- Held securely to backframe
- Wire connection connected to PASS device
- Wire held secure to backframe and runs to console assembly

Changed batteries due to low battery alert when unit was pressurized

8. Backframe Assembly (refer to **Figures 24-27** in **Appendix III - Unit 2**):

S/N: 115S1324001406

PN: 200275-01

Other markings: A2Q13 FT808 Stamped, 3E Sticker, MES Sticker

SEI Label attached, NFPA 1981, 2007 Edition

- Overall fair condition, no bends/cracks in wire frame
- Shoulder straps were attached to the frame
- Cylinder strap and latch are in good condition

- Cylinder strap adjuster functional
- Cylinder strap and latch is clean and functional, some heat sublimation
- CBRN label present
- NIOSH label present, TC-13F-76CBRN

9. Straps & Buckles (refer to **Figures 28-30** in **Appendix III - Unit 2**):

- Overall strap condition is good, some debris and heat sublimation
- Both Shoulder straps attached at the top of the backframe
- Hose lines and wires pass through shoulder straps
- All adjustable buckles move and hold in place
- Waist area buckle latches and releases
- Lumbar strap in good condition
- Rescue rope in bag attached

10. Auxiliary Hose (refer to **Figures 31-32** in **Appendix III - Unit 2**):

- Quick connect for the female connection is stuck in the release position
- Otherwise clean and in good condition

11. Cylinder & Valve Assembly

Not present.

Appendix II

Unit 1

SCBA Test Results



National Personal Protective Technology Laboratory, Evaluation and Testing Branch

SCBA Test Report – Unit 1

Task Number: TN-20922
Manufacturer: Scott® Safety
NIOSH Approval Number: TC-13F-76CBRN
Tests Performed by: Jeremy Gouzd, Karis Kline
Report written by: Karis Kline
Date of Report: August 25, 2016

I. Background

June 28, 2016, an SCBA unit from the Pineville Fire Department was delivered to the NIOSH facility in Morgantown, West Virginia. The unit was initially removed from the shipping container August 12, 2016, in lab H-1513, for inspection by Jeremy Gouzd (Fellow) and Karis Kline (Contractor) of the Morgantown Testing Team (MTT), NPPTL. The SCBA was identified as the Pineville Fire Department SCBA, Unit 1. The SCBA was extensively examined, component by component, in the condition received to determine the conformance of each unit to the NIOSH-approved configuration. The unit was identified as the Scott® Safety Company model Air-Pak® 4.5, 30 minute, 4500 psi unit, NIOSH approval numbers TC-13F-76CBRN. The visual inspection process was documented photographically.

II. Test Outlines

1. **POSITIVE PRESSURE TEST – NIOSH Test Procedure No. 120**

42 CFR Part 84 Reference: Subpart H, § 84.70 (a)(2)(ii)

Requirement:

The pressure inside the facepiece in relation to the immediate environment is positive during both inhalation and exhalation.

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.

Results: The unit was tested on August 15, 2016 and met the test requirement. The facepiece used was the facepiece provided by Pineville Fire Department. The HUD, remote gauge, and donning switch functioned normally.

Inhalation Breathing Resistance (inches of water column):	0.11
Pass/Fail:	PASS

2. 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:

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.

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.

Results: Tested on August 15, 2016, the SCBA met the test requirement.

Test Notes: The measured service time (adjusted to correspond with the recorded breathing cycles) was more than the rated service time of 30 minutes. The PASS unit did function during the test. The SCBA did not go negative on inhalation but maintained positive pressure in the facepiece at the same level. Prior to testing, the batteries in this unit were changed by NIOSH as the ones provided were dead.

Measured Service	Minutes Seconds	
Time:	34	47
Pass / Fail	PASS	

3. STATIC PRESSURE TEST – NIOSH Test Procedure No. 122

42 CFR Part 84 Reference: Subpart H, § 84.91 (d)

Requirement:

The static pressure (at zero flow) in the facepiece shall not exceed 38 mm (1.5 inches) water-column height.

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.

Results: Tested on August 15, 2016, the SCBA met the test requirement.

Facepiece Static Pressure (inches of water column):	1.43
Pass/Fail:	Pass

4. GAS FLOW TEST – NIOSH Test Procedure No. 123

42 CFR Part 84 Reference: Subpart H, § 84.93 (b) and (c)

Requirement:

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.

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.

Result: Tested on August 15, 2016 the SCBA met the test requirement. The by-pass appeared to function normally.

Applied Pressure	Airflow (liters per minute)	Pass/Fail
4500psig	458.74	Pass
500 psig	478.56	Pass

5. EXHALATION RESISTANCE TEST – NIOSH Test Procedure No. 122

42 CFR Part 84 Reference: Subpart H, § 84.91 (c)

Requirement:

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.

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 airflow through the apparatus is adjusted to a rate of 85 liters per minute and the exhalation resistance is recorded.

Results: Tested on August 15, 2016, the SCBA met the test requirement.

Exhalation Breathing Resistance (inches of water column):	1.99
Static Pressure (inches of water column):	1.43
Difference (inches of water column):	.56
Pass/Fail:	Pass

6. 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)

Requirement:

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.*

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.

Results: Tested on August 15, 2016. The test requirement is 25% ± 2%.

Run #	Alarm Point (psig) Vibralert	Alarm Point (psig) HUD
1.	1160	1120
2.	1160	1130
3.	1160	1130
4.	1150	1120
5.	1150	1130
6.	1150	1125
Avg.	1155	1126
Pass/Fail	PASS	PASS

7. NFPA AIR FLOW PERFORMANCE TEST

NFPA 1981 (1997 Edition) Reference: Chapter 5, Performance Requirements, Sec. 5-1.1

Requirement:

SCBA shall be tested for airflow performance as specified in Section 6-1, Airflow Performance Test, and the SCBA facepiece pressure shall not be less than 0.0 in (0.0 mm) water-column 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.

Procedure:

The required equipment specified in the NFPA standards were used to conduct the tests on this units. 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.

Results: The SCBA passed this test.

Test Notes: PASS unit was functional. HUD was functional. Alarm systems were functional. Used a stock Scott Facepiece from NIOSH inventory.

Maximum Facepiece Pressure (inches of water column):	2.8
Minimum Facepiece Pressure (inches of water column):	0.41
Pass/Fail:	PASS

III. Disposition

Following testing, the SCBA unit was returned to the package in which it was hand delivered to NIOSH and placed in secured storage. The unit was then shipped back to the fire department.

The results of all tests are summarized in Tables ONE and TWO which follow.

TABLE ONE – Summary of NIOSH Test Results-Unit 1

Task Number: 20922
Manufacturer: Scott® Safety
NIOSH Approval Number: TC-13F-212CBRN
Tests Performed By: Jeremy Gouz, Karis Kline
Dates of Tests: August 15, 2016

TEST/42 CFR PART 84 REFERENCE	STANDARD	RESULT	PASS	FAIL
1. POSITIVE PRESSURE TEST Reference: Subpart H, § 84.70 (a)(2)(ii)	≥ 0.00 INWC	0.11 INWC	X	
2. RATED SERVICE TIME TEST Reference: Subpart F, § 84.53 (a), Subpart H, § 84.95 (a) and (b)	≥ 30 min	34 min 47 s	X	
3. STATIC PRESSURE TEST Reference: Subpart H, § 84.91 (d)	≤ 1.50 INWC	1.43 INWC	X	
4. GAS FLOW TEST (at Full Cylinder Pressure) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	458.74 LPM	X	
4. GAS FLOW TEST (at 500 psig) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	478.56 LPM	X	
5. EXHALATION RESISTANCE TEST Reference: Subpart H, § 84.91 (c)	Difference ≤ 2.00 INWC	.56 INWC	X	
6. REMAINING SERVICE LIFE INDICATOR TEST (vibrating alarm) Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psig	1155 PSIG	X	
6. REMAINING SERVICE LIFE INDICATOR TEST (light alarm HUD) Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psig	1126 PSIG	X	

NOTE: The Positive Pressure Test and Rated Service Life Test are run simultaneously.

TABLE TWO – Summary of NFPA Test Results-Unit 1

TEST/REFERENCE	STANDARD	RESULT	PASS	FAIL
7. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≤ 3.50 INWC Exhalation Resistance	2.8 INWC	X	
7. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≥ 0.00 INWC Inhalation Resistance	0.41 INWC	X	

Appendix II

Unit 2

SCBA Test Results



National Personal Protective Technology Laboratory, Evaluation and Testing Branch

SCBA Test Report - Unit 2

Task Number: TN-20922
Manufacturer: Scott® Safety
NIOSH Approval Number: TC-13F-76CBRN
Tests Performed by: Jeremy Gouzd, Karis Kline
Report written by: Karis Kline
Date of Report: August 25, 2016

IV. Background

June 28, 2016, an SCBA unit from the Pineville Fire Department was delivered to the NIOSH facility in Morgantown, West Virginia. The unit was initially removed from the shipping container August 12, 2016 in lab H-1513 for inspection by Jeremy Gouzd (Fellow) and Karis Kline (Contractor) of the Morgantown Testing Team (MTT), NPPTL. The SCBA was identified as the Pineville Fire Department SCBA, Unit 2. The SCBA was extensively examined, component by component, in the condition received to determine the conformance of each unit to the NIOSH-approved configuration. The unit was identified as the Scott® Safety Company model Air-Pak® 4.5, 30 minute, 4500 psi units, NIOSH approval numbers TC-13F-76CBRN. The visual inspection process was documented photographically.

V. Test Outlines

1. **POSITIVE PRESSURE TEST – NIOSH Test Procedure No. 120**

42 CFR Part 84 Reference: Subpart H, § 84.70 (a)(2)(ii)

Requirement:

The pressure inside the facepiece in relation to the immediate environment is positive during both inhalation and exhalation.

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.

Results: The unit was tested on August 15, 2016 and met the test requirement. The facepiece used was the facepiece provided by Pineville Fire Department. The HUD, remote gauge, and donning switch functioned normally.

Inhalation Breathing Resistance (inches of water column):	0.025
Pass/Fail:	PASS

2. 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:

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.

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.

Results: Tested on August 15, 2016, the SCBA met the test requirement.

Test Notes: The measured service time (adjusted to correspond with the recorded breathing cycles) was more than the rated service time of 30 minutes. The PASS unit did function during the test. The SCBA did not go negative on inhalation but maintained positive pressure in the facepiece at the same level. Prior to testing, the batteries in this unit were changed by NIOSH as the ones provided were dead.

Measured Service	Minutes Seconds
Time:	34 55
Pass/Fail:	PASS

3. STATIC PRESSURE TEST – NIOSH Test Procedure No. 122
42 CFR Part 84 Reference: Subpart H, § 84.91 (d)

Requirement:

The static pressure (at zero flow) in the facepiece shall not exceed 38 mm (1.5 inches) water-column height.

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.

Results: Tested on August 15, 2016, the SCBA met the test requirement.

Facepiece Static Pressure (inches of water column):	0.93
Pass/Fail:	Pass

4. GAS FLOW TEST – NIOSH Test Procedure No. 123
42 CFR Part 84 Reference: Subpart H, § 84.93 (b) and (c)

Requirement:

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.

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

Results: Tested on August 15, 2016 the SCBA met the test requirement. The by-pass appeared to function normally.

Applied Pressure	Airflow (liters per minute)	Pass/Fail
4500psig	472.9	Pass
500 psig	464.4	Pass

5. EXHALATION RESISTANCE TEST – NIOSH Test Procedure No. 122
42 CFR Part 84 Reference: Subpart H, § 84.91 (c)

Requirement:

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.

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 airflow through the apparatus is adjusted to a rate of 85 liters per minute and the exhalation resistance is recorded.

Results: Tested on August 15, 2016, the SCBA met the test requirement.

Exhalation Breathing Resistance (inches of water column):	2.03
Static Pressure (inches of water column):	0.93
Difference (inches of water column):	1.1
Pass/Fail:	Pass

6. 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)

Requirement:

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.*

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.

Results: Tested on August 15, 2016. The test requirement is 25% ± 2%.

Run #	Alarm Point (psig) Vibralert	Alarm Point (psig) HUD
1.	1150	1130
2.	1150	1130
3.	1150	1125
4.	1140	1125
5.	1150	1130
6.	1150	1130
Avg.	1048	1128
Pass/Fail	PASS	PASS

7. NFPA AIR FLOW PERFORMANCE TEST

NFPA 1981 (1997 Edition) Reference: Chapter 5, Performance Requirements, Sec. 5-1.1

Requirement:

SCBA shall be tested for airflow performance as specified in Section 6-1, Airflow Performance Test, and the SCBA facepiece pressure shall not be less than 0.0 in (0.0 mm) water-column 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.

Procedure:

The required equipment specified in the NFPA standards were used to conduct the tests on these units. 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.

Results: The SCBA passed this test.

Test Notes: PASS unit was functional. HUD was functional. Alarm systems were functional. Used a stock Scott Facepiece from NIOSH inventory.

Maximum Facepiece Pressure (inches of water column):	2.825
Minimum Facepiece Pressure (inches of water column):	0.3
Pass/Fail	PASS

VI. Disposition:

Following testing, the SCBA unit was returned to the package in which it was hand delivered to NIOSH and placed in secured storage. The unit was then shipped back to the fire department.

The results of all tests are summarized in Tables THREE and FOUR which follow.

TABLE THREE – Summary of NIOSH Test Results-Unit 2

Task Number: 20922
Manufacturer: Scott® Safety
NIOSH Approval Number: TC-13F-212CBRN
Tests Performed By: Jeremy Gouz, Karis Kline
Dates of Tests: August 15, 2016

TEST/42 CFR PART 84 REFERENCE	STANDARD	RESULT	PASS	FAIL
1. POSITIVE PRESSURE TEST Reference: Subpart H, § 84.70 (a)(2)(ii)	≥ 0.00 INWC	0.025 INWC	X	
2. RATED SERVICE TIME TEST Reference: Subpart F, § 84.53 (a), Subpart H, § 84.95 (a) and (b)	≥ 30 min	34 min 55 s	X	
3. STATIC PRESSURE TEST Reference: Subpart H, § 84.91 (d)	≤ 1.50 INWC	0.93 INWC	X	
4. GAS FLOW TEST (at Full Cylinder Pressure) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	472.9 LPM	X	
4. GAS FLOW TEST (at 500 psig) Reference: Subpart H, § 84.93 (b) and (c)	≥ 200 lpm	464.4 LPM	X	
5. EXHALATION RESISTANCE TEST Reference: Subpart H, § 84.91 (c)	Difference ≤ 2.00 INWC	1.1 INWC	X	
6. REMAINING SERVICE LIFE INDICATOR TEST (Vibrating Alarm) Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psig	1048 PSIG	X	
6. REMAINING SERVICE LIFE INDICATOR TEST (Light Alarm HUD) Reference: Subpart H, § 84.83 (f) and Subpart G, § 84.63 (c)	Between 1035 and 1215 psig	1128 PSIG	X	

NOTE: The Positive Pressure Test and Rated Service Life Test are run simultaneously.

TABLE FOUR – Summary of NFPA Test Results-Unit 2

TEST/REFERENCE	STANDARD	RESULT	PASS	FAIL
7. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≤ 3.50 INWC Exhalation Resistance	2.835 INWC	X	
7. NFPA AIRFLOW PERFORMANCE Reference: NFPA 1981 (1997 Edition), Section 5-1.1	≥ 0.00 INWC Inhalation Resistance	0.3 INWC	X	

Appendix III

Unit 1

SCBA Inspection Report

Figure 1: Overview of SCBA unit as received
Figure 2: Overview of facepiece
Figure 3: Inside view, missing exhalation valve
Figure 4: Outside identifying markings
Figure 5: Missing voice amplifier
Figure 6: Identifying size/markings
Figure 7: Mask mounted regulator (MMR)
Figure 8: Inside flange, MMR
Figure 9: Low pressure hose
Figure 10: Pressure reducer assembly from side view
Figure 11: Interior view of pressure reducer assembly
Figure 12: Pressure reducer bottom view
Figure 13: HUD connection
Figure 14: High pressure hose and cylinder attachment overview
Figure 15: Cylinder attachment threads overview
Figure 16: Quick fill port on cylinder attachment
Figure 17: Overview of cylinder attachment with relief valve
Figure 18: Identifying markings on cylinder attachment
Figure 19: High pressure line to overview of PASS console
Figure 20: Back of PASS console, SEI label
Figure 21: Overview of control module
Figure 22: Identifying information on control module
Figure 23: Overview of inside of backframe
Figure 24: SEI label on backframe
Figure 25: Identifying markings on backframe
Figure 26: Overview of back view of backframe and labels
Figure 27: Overview of straps and buckles
Figure 28: Cylinder strap
Figure 29: Rescue rope
Figure 30: Auxiliary hose in pouch
Figure 31: Auxiliary hose out of pouch
Figure 32: Overview of cylinder
Figure 33: Overview of cylinder label
Figure 34: View of threads
Figure 35: Cylinder gauge is readable, identifying markings
Figure 36: Small nick in cylinder



Figure 1: Overview of SCBA unit as received



Figure 2: Overview of facepiece



Figure 3: Inside view, missing exhalation valve



Figure 4: Outside identifying markings



Figure 5: Missing voice amplifier



Figure 6: Identifying size/markings



Figure 7: Mask mounted regulator (MMR)

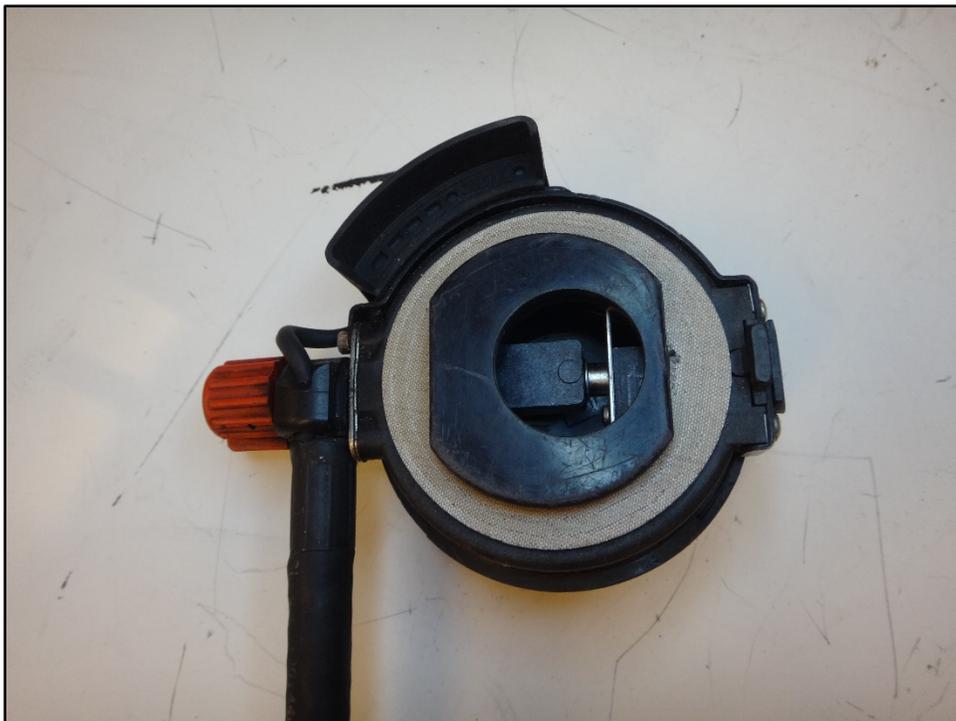


Figure 8: Inside flange, MMR



Figure 9: Low pressure hose



Figure 10: Pressure reducer assembly from side view



Figure 11: Interior view of pressure reducer assembly



Figure 12: Pressure reducer bottom view



Figure 13: HUD connection

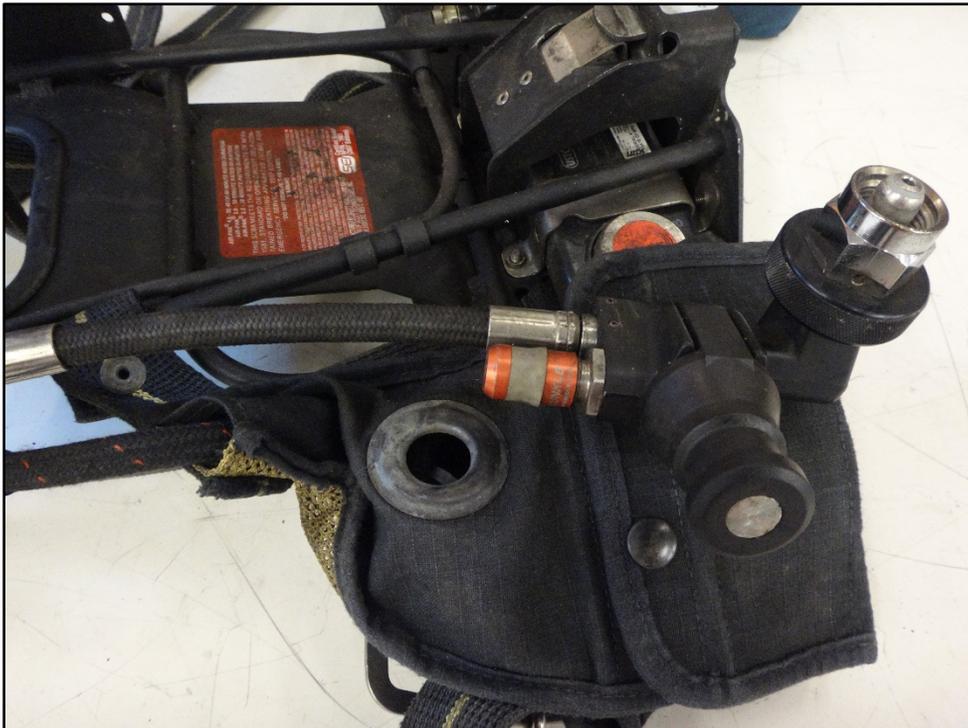


Figure 14: High pressure hose and cylinder attachment overview



Figure 15: Cylinder attachment threads overview



Figure 16: Quick fill port on cylinder attachment



Figure 17: Overview of cylinder attachment with relief valve



Figure 18: Identifying markings on cylinder attachment



Figure 19: High pressure line to overview of PASS console



Figure 20: Back of PASS console, SEI label



Figure 21: Overview of control module



Figure 22: Identifying information on control module



Figure 23: Overview of inside of backframe

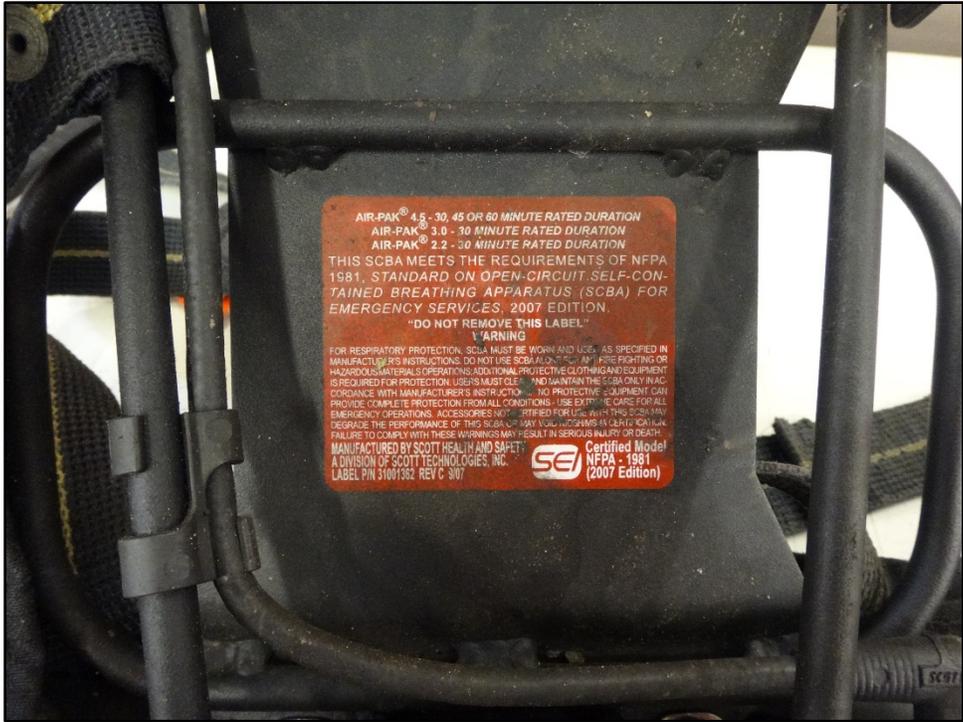


Figure 24: SEI label on backframe

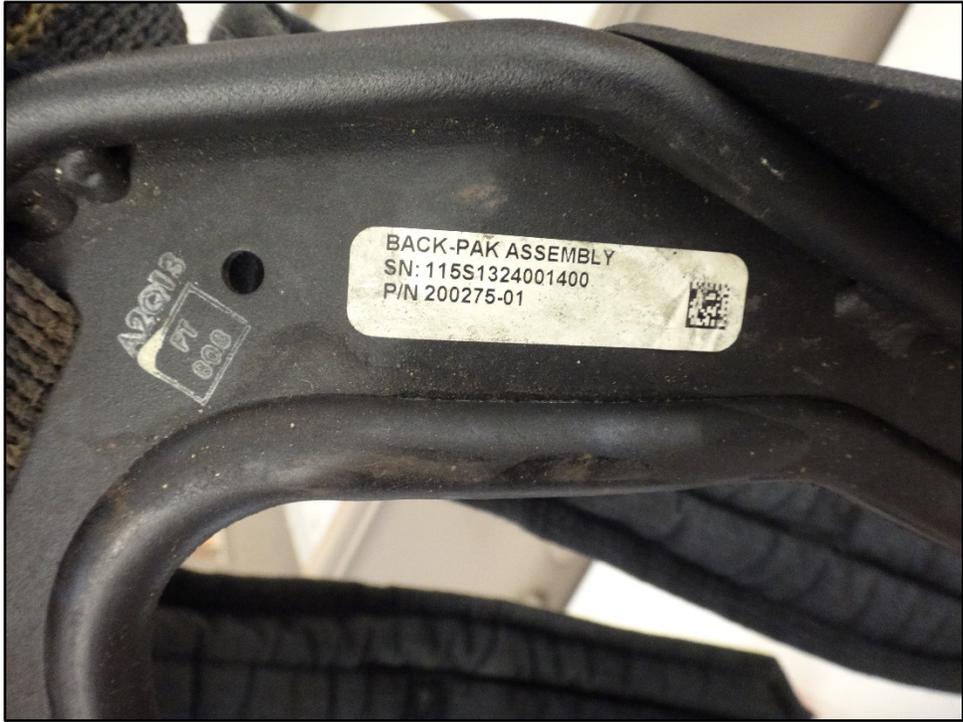


Figure 25: Identifying markings on backframe



Figure 26: Overview of back view of backframe and labels



Figure 27: Overview of straps and buckles



Figure 28: Cylinder strap



Figure 29: Rescue rope



Figure 30: Auxiliary hose in pouch



Figure 31: Auxiliary hose out of pouch



Figure 34: View of threads



Figure 35: Cylinder gauge is readable, identifying markings



Figure 36: Small nick in cylinder

Appendix III

Unit 2

SCBA Inspection Report

Figure 1: Overview of SCBA unit as received
Figure 2: Identifying information on packaging
Figure 3: Overview of unit as received
Figure 4: Overview of facepiece
Figure 5: Inside view
Figure 6: Outside identifying markings
Figure 7: Identifying name tag
Figure 8: Mask mounted regulator (MMR)
Figure 9: Inside flange, MMR
Figure 10: Identifying markings on MMR
Figure 11: Low pressure hose
Figure 12: Pressure reducer assembly from side view
Figure 13: Interior view of pressure reducer assembly
Figure 14: Pressure reducer bottom view
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Figure 28: Overview of straps and buckles
Figure 29: Cylinder strap
Figure 30: Rescue rope
Figure 31: Auxiliary hose in pouch
Figure 32: Auxiliary hose out of pouch

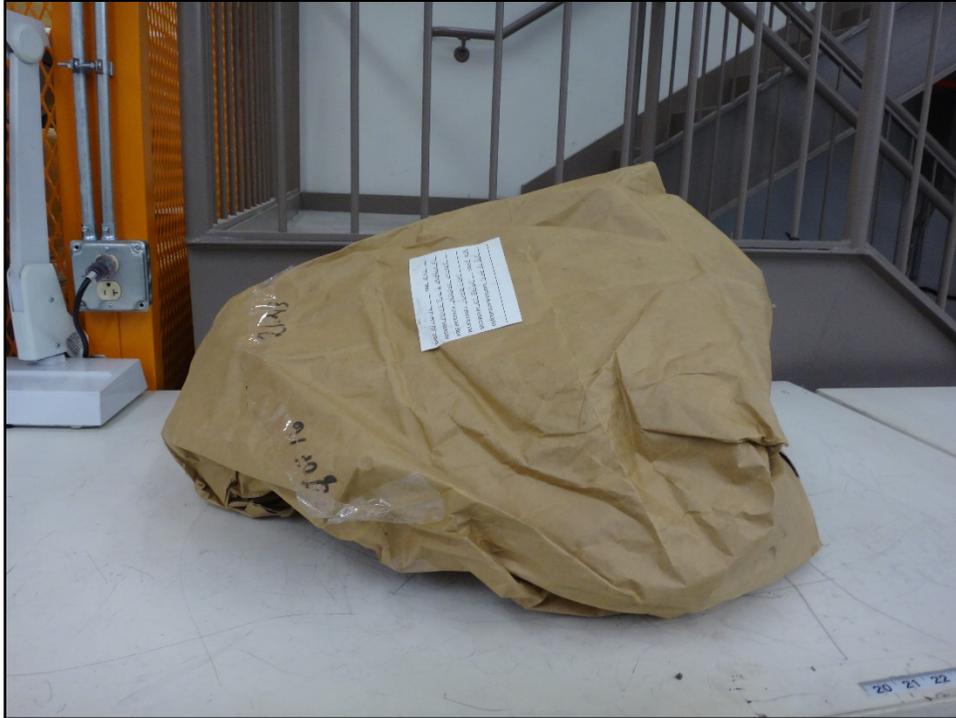


Figure 1: Overview of SCBA unit as received

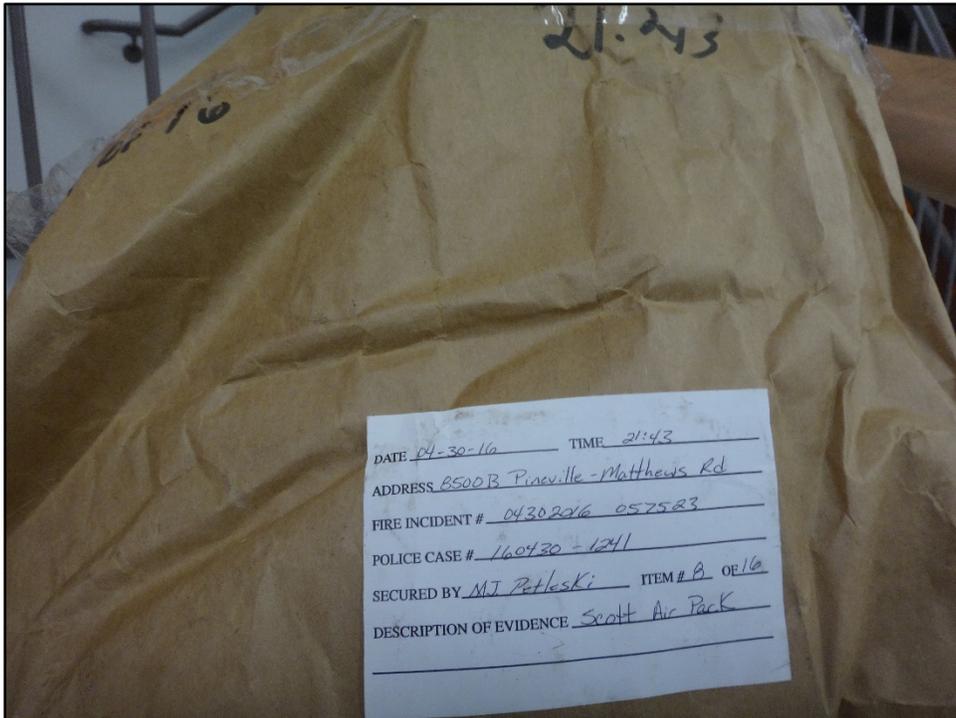


Figure 2: Identifying information on packaging



Figure 3: Overview of unit as received



Figure 4: Overview of facepiece



Figure 5: Inside view



Figure 6: Outside identifying markings



Figure 7: Identifying nametag



Figure 8: Mask mounted regulator (MMR)



Figure 9: Inside flange, MMR



Figure 10: Identifying markings on MMR



Figure 11: Low pressure hose



Figure 12: Pressure reducer assembly from side view



Figure 13: Interior view of pressure reducer assembly



Figure 14: Pressure reducer bottom view



Figure 15: HUD connection



Figure 16: High pressure hose and cylinder attachment overview



Figure 17: Cylinder attachment threads overview



Figure 18: Quick fill port on cylinder attachment



Figure 19: Identifying markings on cylinder attachment



Figure 20: High pressure line to overview of PASS console



Figure 21: Back of PASS console, SEI label



Figure 22: Overview of control module



Figure 23: Identifying information on control module



Figure 24: Overview of inside of backframe



Figure 25: SEI label on Backframe



Figure 26: Identifying markings on backframe



Figure 27: Overview of back view of backframe and labels



Figure 28: Overview of straps and buckles



Figure 29: Cylinder strap



Figure 30: Rescue rope



Figure 31: Auxiliary hose in pouch



Figure 32: Auxiliary hose out of pouch