Administrative Procedure		Revision Date: March 18, 2013	Number
Signature:	CITY OF DURHAM FIRE DEPARTMENT *Office of the Fire Chief*	Subject: **SCBA Evaluation Program Results**	

The Durham Fire Department initiated a program to evaluate self-contained breathing apparatus (SCBA) compliant with National Fire Protection Association (NFPA) standard 1981/1982 2013 edition. The department initiated this program in anticipation of replacing its current stock of SCBA with new 2013 compliant models. The department extended invitations to all manufacturers who submitted an SCBA to NFPA for 2013 approval. Program guidance information was provided to each manufacturer along with the invitation.

Manufacturers invited to participate in the Durham Fire Department's SCBA evaluation program were instructed to conduct a presentation for the Durham Fire Department administrative staff, training staff that included the following information:

- a detailed description of the SCBA`s major components;
- instructions on donning, doffing, and operation;
- emergency procedures, such as bypass and buddy-breathing operations;
- basic troubleshooting and operational level maintenance for problems encountered in the field;
- cleaning and disinfecting procedures for the SCBA after use;
- filling cylinders from departmental fill stations, both stationary and mobile;
- Detailed overview of maintenance for Mobile Support personnel;

The manufacturer`s representatives were further asked to provide at least four SCBAs, and sufficient spare cylinders for fire department testing, as well as provide copies of the operator`s and service manuals and technical SCBA specifications.

Invitations were sent to the following individuals;

- Warren Ritter – Interpiro
- Lauren Wiesner – Avon
- Jon Anderson – Scott
- John Green – Draeger
- Scott Graham – MSA

Presentations were made to Durham Fire Department staff on the following dates;

- Interspiro – November 19, 2013
- Avon-ISI – November 20, 2013
- Scott – November 20, 2013
- Draeger – November 21, 2013
- MSA – November 22, 2013

The controlled testing phase of the SCBA evaluation program took place from January 14, 2014 to March 16, 2014. During this phase of the program each manufacturer's SCBA was put through the paces, and all of the operational functions and manufacturer`s recommended procedures were be tested. The following line companies were chosen by the Assistant Chief of Operations to participate in the Controlled testing Phase;

- Engine 1 A-Shift
- Engine 1 B-Shift
- Engine 1 C-Shift
- Engine 5 A-Shift
- Ladder 2 C-Shift

The evolutions in the Controlled Testing Phase consisted of practical scenarios that simulated actual firefighting situations and tested the limits of the SCBAs submitted for evaluation. At no time during the Controlled Testing Phase did the evaluators or the SCBA being evaluated enter an IDLH environment.

Composite Test Results

Manufacturer	Engine 1 A	Engine 1B	Engine 1C	Ladder 2C	Engine 5A	Composite Score
Avon ISI	**N/A ***	968	335	**N/A ***	**N/A ***	**1303**
Interspiro	444	527	535	408	431	**2345**
Draeger	758	735	448	490	534	**2965**
MSA	856	1177	522	535	662	**3752**
Scott	1042	992	616	629	813	**4092**

* - This SCBA experienced a failure during the process and was removed from consideration at that time. No further testing was performed.

Individual Feedback

Avon/ISI

Deltair – Manufacturer Information

- Optically correct, double curve visor with widest field of view
- Integrated, low profile AirSwitch™ reduces snag hazards while delivering controllable air
- Built in microphone and Heads Up Display (HUD) requiring no additional batteries
- State-of-the-art electronics processor unit protected inside the clamshell backframe
- Intelligent power management greatly increases time between battery changes
- Quick change single source battery pack uses only 6 C-Cells to reduce maintenance, time and cost
- Superior voice clarity from integrated non-mask mounted Voice Amplifier provided as standard
- HUD allows for user and team visibility of unit status
- Quick user identification through reflective harness and luminescent cylinder markings
- Padded lumbar support with balancing side arms transfer unit weight onto wearer's hips, taking the load off of the upper back and shoulders
- Body contoured, extra padded shoulder straps with adjustable chest strap setting provide a more natural fit to the user
- Communication controls and PASS integrated into one ergonomic console using just three buttons
- Angled pressure gauge on pivoting console ensures quick access when checking cylinder status
- AirSwitch mask regulator allows rapid switching between ambient and cylinder air
- All user interface controls color coded for easy identification

The evaluation process determined that the Avon pack will not suit the needs of the Durham Fire Department for the following reasons:

1. This pack experienced a failure during testing. The second stage regulator froze in the open position and began to free flow air into the evaluator's facepiece. All attempts to halt this free flow of air were unsuccessful. The bottle eventually had to be shut off to stop the failure. Subsequent to this, evaluations with this pack were discontinued. This constitutes a major safety concern and therefore this pack cannot be recommended for purchase.
2. Numerous evaluators indicated a difficulty with obtaining a seal with this facepiece.

3. The face piece has the second stage regulator permanently mounted to it. The movement to initiate the off-air breathing was better than in the Interspiro, but still counter-intuitive. In addition during crisis, for instance when evaluators ran completely out of air, muscle memory automatically took over and the evaluators attempted to remove the regulator, rather than engage the off air breathing mechanism. This is a safety concern, and therefore a face piece with a permanently mounted second stage regulator cannot be recommended for use.
4. Because of the facepiece mounted second stage regulator, a separate solution must be purchased for using APRs and PAPRs. This increases the cost of ownership.
5. Larger air bottle makes the pack heavier than the current issue pack. In addition this larger bottle creates a larger profile. This caused some evaluators to have issues negotiating some obstacles in the maze, which they normally would have been able to clear.

<u>Interspiro</u>

Spiromatic S7 – Manufacturer Information

- Integrated PASS and SCBA computer with 360° lights
    - High visibility and powerful sound SCBA computer protected under cylinder
- SpiroGuide Digital Display
    - Powerful backlight PASS status indicators and easy operation buttons
- Simple, Proven S-Mask Design
    - Secure, integrated second stage regulator Ambient air hatch with instant-on air High performance breathing
- Robust and comfortable harness
    - Optimal weight distribution
- Adjustable in four size from inside of harness
    - Easy adjustment for different body size
- Large rescue handle
    - Easy to grab and drag out fire fighter in an emergency
- Wireless Heads-Up Display (HUD)
    - Easy installation in mask

The evaluation process determined that the Interspiro pack will not suit the needs of the Durham Fire Department for the following reasons:

1. This pack was extremely difficult to breathe. During increased workload evaluators universally indicated that they felt as if they had to "suck" the air out of the bottle. This lead to premature fatigue on the part of the evaluators, and shortened their effective work time. The sales representative and manufacturer representative claimed that it was not possible to "over-breathe" the regulator. The evaluation process however proved that this claim was unfounded.
2. The HUD for this SCBA needed to be linked wirelessly to the pack, prior to turning the air bottle on and charging the system. This process was rarely successful during the evaluation, and seemed excessive. There are a number of fires that occur in Durham right at shift change, which would not allow an opportunity for firefighters to link their facepiece to the pack, prior to use. This design seemed poorly thought out.
3. Larger air bottle makes the pack heavier than the current issue pack. In addition this larger bottle creates a larger profile. This caused some evaluators to have issues negotiating some obstacles in the maze, which they normally would have been able to clear.
4. The face piece has the second stage regulator permanently mounted to it. The movement to initiate the off-air breathing was not very intuitive and seemed poorly designed. In addition during crisis, for instance when evaluators ran completely out of air, muscle memory automatically took over and the evaluators attempted to remove the regulator, rather than engage the off air breathing mechanism. This is a safety concern, and therefore a face piece with a permanently mounted second stage regulator cannot be recommended for use.
5. Because there are electronics in the face piece that are not sealed, the face piece cannot be cleaned via the dunk and slosh method that the department is accustom to.
6. Because of the facepiece mounted second stage regulator, a separate solution must be purchased for using APRs and PAPRs. This increases the cost of ownership.
7. The bypass valve accidentally activated on numerous occasions. Evaluators determined that this valve could be accidentally activated far too easily.
8. Some evaluators experienced facepiece fogging during off air breathing.
9. The buddy breathing hose was determined to be too short to ergonomically accomplish the task for which it was designed.
10. Several rubber components of the pack broke during testing.

Draeger

PSS 7000 – Manufacturer Information

- A new harness system for extra comfort and wear resistance
- A backplate that provides unrestrictive movement
- Rapid, secure cylinder change-outs to save precious time
- An integrated safety system to monitor air supply time
- Smart card technology for "Real Time" information
- Powered for total reliability

The evaluation process determined that the Draeger pack will not suit the needs of the Durham Fire Department for the following reasons:

1. This pack has only a digital display on the control module, one of which lost power during the evaluation process. Without the presence of a mechanical display, in addition to the digital display, the evaluators were not able to monitor their air pressure. This constitutes a safety concern and therefore this pack cannot be recommended for use.
2. The connection between the second stage regulator and the face piece is at an awkward angle. In addition, there were a number of instances where the second stage regulator became detached from the face piece during testing, even though the evaluators thought they had a secure connection. This constitutes a safety concern and therefore this pack cannot be recommended for use.
3. The HUD for this pack is user removable from the face piece. This set up contains an inherent risk of these HUD units being lost or misplaced, if not properly secured by the user. In addition, these HUD units require a power source separate from the main pack power source, which increases the cost of ownership.
4. Larger air bottle makes the pack heavier than the current issue pack. In addition this larger bottle creates a larger profile. This caused some evaluators to have issues negotiating some obstacles in the maze, which they normally would have been able to clear.
5. The tacky material on the straps caused issues when donning and doffing the pack in a confined area. This material caused the straps to twist and roll when the evaluators attempted to don and doff the pack in the SCBA maze. In every case, the evaluator simply chose to push the pack ahead of them through the remainder of the maze, rather than continue to attempt to don the unit.
6. Some evaluators experienced facepiece fogging during off air breathing.

MSA

G1 – Manufacturer Information

- Facepiece is lightweight and compact: no electronics needed
    - Open port design with cross contamination protection
    - Comfortable and easy to use, with low breathing resistance on and off air
- Control module provides dual color LCD and analog displays
    - Display automatically turns on when control module is lifted into viewing position
    - Large print makes display easy to read
    - Provides more data and functionality than ever before
    - No matter which button is pressed, necessary information displays
- Improved visibility through buddy lights and reflective material
    - 4 buddy lights
    - 2 control module lights
    - Regulator light
- Heads up display (HUD) shows remaining cylinder pressure in 4 increments via colored LEDs
    - Clear and easy to understand and interpret provided information
- Electronic communications are integrated into every unit
    - Loud, clear communication
    - Removes inhalation breathing noise
- G1 SCBA ergonomics
    - Swiveling, adjustable lumbar pad manages SCBA weight
    - Improved comfort, balance, fit
- Central power system for all electronics
    - Only one power source
    - Uses either alkaline or rechargeable battery
    - No need for multiple battery sizes
    - Low cost of ownership
- Available in easily-upgradeable threaded or quick-connect cylinder attachment
    - Quick attachment and replacement for return to the fireground
- Integrated technology for future expansion
    - Bluetooth, RFID, Near Field Communication (NFC), long-range radio
    - Customizable — Built to meet your specific needs
    - Control module and HUD display required information; easily adapt to your existing standard operating procedure
    - Wires/hoses can be routed as necessary

The evaluation process determined that the MSA G1 pack will suit the needs of the Durham Fire Department. The evaluation process did highlight some minor operations issues however. These are as follows;

- The low air alarm bell is extremely loud, so much so that in an enclosed area it hampered voice communications. This issue is further magnified when several low air alarm bells are active in close proximity to one another.
- Facepiece condensation around the nose cup was noted on every evaluation. There was not an extensive amount of condensation however it was noted in every instance, during peak regulator demand.
- The left shoulder strap on one of the packs came apart during the RIT drill portion of one of the evaluations. This issue was quickly resolved at the conclusion of the drill, and required no special tools or skills to remedy.
- During two evaluations the bypass valve opened accidentally when brushed against by the evaluator's shoulder.
- In one instance an evaluator experienced an accidental disconnection of the 2nd stage regulator from the facepiece. It apparently did not seat properly when the evaluator initially made the connection. The unit functioned normally for a period of time, however during physical activity, the 2nd stage regulator disconnected from the facepiece.
- Several evaluators indicated difficulty with maintaining a proper facepiece seal, particularly with the 4-point attachment system. The five-point harness did seem to provide a better seal however there were some instances where, even with the five-point harness, evaluators had difficulty maintaining a seal.
- There was no buddy breathing attachment or the MSA Quick-Fill/ExtendAir II system included on any of the evaluation packs. Therefore this operation could not be evaluated during the process.

Scott

X3 – Manufacturer Information

The Scott Safety Air-Pak X3 SCBA was designed not only to exceed the new requirements outlined in the 2013 Edition of the 1981 and 1982 standards, but also to exceed customer expectations for what an Air-Pak SCBA should be. Scott Safety incorporated end-user feedback in every step of the design process to deliver to the fire service the next platform of Air-Pak SCBA.

The Air-Pak X3 SCBA improves comfort through new shoulder strap designs, better weight management, and improved hose and wire management resulting in the cleanest Air-Pak SCBA on the market. Fire ground communications are enhanced with the introduction of the AV-3000 HT facepiece, EPIC 3 Communications, a new "external" HUD and optimally positioned "buddy" lights. The Air-Pak X3 can be ordered with either a CGA cylinder connection or a Snap-Change cylinder connection.

- Available with CGA or Snap-Change Cylinder Connection
- Available in 2.2, 4.5, or 5.5 Cylinder Pressures
- "External" HUD for Easy Air Status Updates of the Team
- Dual Redundant Pressure Reducer
- Vibralert Tactile Alarm at 33% of remaining cylinder pressure
- "Check Console" Indicator when PASS Console requires attention
- Enhanced Comfort
- Articulating shoulder strap
- Improved Hose and Wire Management
- Reduced Cost of Ownership

The evaluation process determined that the Scott X3 pack will suit the needs of the Durham Fire Department. The evaluation process did highlight some minor operations issues however. These are as follows;

- The back frame was not adjustable for different torso sizes. Most evaluators indicated that this pack sat lower on their back than the others evaluated. Some evaluators had difficulty reaching the cylinder valve to charge the pack.
- There was no cross contamination protection built into the facepiece.
- Buddy lights were not always visible from all directions.

Warranty Information

Manufacturer	Electronics	Pneumatics	Power Source	Soft Goods
Avon ISI	10	15	1	
Interspiro	5	15		10
Draeger	3	15		10
MSA	15	15		15
Scott	5	15		10

Conclusion

Through the evaluation process, it was determined that the Interspiro Spiromatic S7, the Avon Deltair, and the Draeger PS 7000 SCBA would not suit the needs of the Durham Fire Department. These products were eliminated from contention largely due to safety and ease of transition issues. The remaining two SCBAs, the MSA G1 and Scott X3 were both found to meet the needs of the Durham Fire Department, however the Scott X3 was the preferred product.

MSA G1

The MSA G1 took established and dependable components from their Firehawk series of SCBA, improved them, and then coupled them with an impressive suite of electronics and ergonomic features to create the G1. The voice amplifier on the G1 was superior to all others tested. There was little to no feedback and communication was clear and intelligible. The dual display control module had both a mechanical and digital display, which could be read easily and was highly rated in usability and in function. The adjustable swivel back frame on the G1 proved to be one of the most comfortable tested. The G1 had the best system of buddy lights of any SCBA tested. Evaluators could instantly determine the air supply of their "buddy" from any angle, in any environment. Another feature that scored high marks was the way in which the 2nd stage regulator disconnected from the facepiece. The same buttons that are used to disconnect the 2nd stage regulator from the facepiece also shut off the air supply. With other facepiece mounted units, this operation requires two separate steps. The MSA G1 has the best warranty of any SCBA tested at 15 years bumper to bumper.

Universally, however, evaluators commented that while the G1 boasted an impressive array of features, they were concerned about reliability because this was the first generation of this SCBA. Their apprehension centered on the ability of the system components on the G1 to function without issue throughout the life span of the product. During the evaluation process a number of operational issues were noted including; the volume of the low air alarm hampering voice communications, facepiece condensation, a shoulder strap coming undone, the bypass opening unintentionally, an errant disconnection of the second stage regulator, and difficulty with facepiece seal. The MSA manufacturer representatives, to their credit, do stipulate that the G1 is still in the final stages of development, and that there are still bugs to be worked out. Further product development and refinement may bring resolution to the afore mentioned operational concerns, however at the time of this evaluation those issues remain unresolved.

Scott X3

The Scott X3 is a bulletproof SCBA and is built on a foundation of reliable and proven components. Every single evaluator indicated that the lighter weight of the 5500 psi pack, in combination with the lower profile of the 45 minute 5.5 cylinder, provided a tremendous benefit to the user. Moreover, every single evaluator indicated that the Scott X3 provided the greatest volume of air per breath. These two factors lead many evaluators to comment that they had more energy in reserve after completing the evaluations with a Scott pack, as compared to other manufacturers. Evaluators also consumed less air when performing the drills with the X3, as compared to other units. The X3 has the most secure connection of the 2nd stage regulator to facepiece. The X3 was the only pack which employed a detachable 2nd stage regulator, that did not experience an accidental disconnection of the 2nd stage regulator from the facepiece, during evaluations. In addition, the VibraAlert low air alarm, which is unique to Scott air packs, was a highly rated feature on the X3.

The X3 leaves room for improvement in the employment of technology on the unit itself. There is no digital display on the control module to both augment the mechanical gauge and to provide additional information or data (temperature, time to empty, pack identifier etc.) to the user. Evaluators who depend on spectacles for vision were not able to accurately read the mechanical air gauge when not wearing their corrective lenses, in some cases. These same evaluators were able to accurately determine their air supply when using SCBAs that augmented the mechanical air gauge, with a digital display. The buddy light system on the X3 is limited in scope. Evaluators commented that they found it more difficult to determine the air supply of their "buddy" from a quick look when using the X3, as compared to other units. The lack of cross contamination protection in the AV-3000 facepiece is also a concern. While the fire department issues individual facepieces, the lack of cross contamination protection could contribute to transmission of unwanted germs from employee to employee. Therefore, a procedure to disinfect the 2nd stage regulator and the start of every shift would be required. During a number of the drills, when the evaluator disconnected the second stage regulator, water (perspiration), was seen draining out of the regulator. The impact of this continual accumulation of fluid in the 2nd stage regulator could be a concern over time. The second stage regulator, however, can be submerged in water and field decontaminated, without the worry of damage to any internal components or electronics, according to the manufacturer.

One additional consideration with the Scott X3 is the 5500 psi air pressure. The evaluation process clearly demonstrated an advantage to changing from 4500 to 5500 psi, with a 45 minute cylinder. However converting to a higher pressure would require the replacement of components in our current inventory of air filling stations. While the compressors and cascade bottles are capable of filling cylinders to 5500 psi, the blast containment vessels are not rated for the increased pressure. The blast containment vessels on the stationary unit in Station 1 and on Mobile Support 1 would need to be replaced. In addition the entire system on Mobile Support 2 would need to be replaced. That system is an older one and is not capable of achieving this higher pressure. The up fit of this equipment will add to the total cost of transition.

Appendix A

Double Click on Image for Brochure

HYDRO-STAT. INC.

INTERSPIRO

SPIROMATIC S7

Self Contained Breathing Apparatus

Integrated PASS and SCBA computer
- High visibility 360° lights
- Powerful sound
- SCBA computer protected under cylinder

SpiroGuide Digital Display
- Powerful backlight
- PASS status indicators and easy operation buttons
- Department selectable displays

Simple, Proven S-Mask Design
- Secure, integrated second stage regulator
- Ambient air hatch with instant-on air
- High performance breathing

Robust and comfortable harness
- Easy adjustment for body size
- Optimal weight distribution
- Large rescue handle

Double Click on Image for Brochure

Dräger PSS™ 7000
Self Contained Breathing Apparatus

The Dräger PSS™ 7000 is a new generation of self-contained breathing apparatus (SCBA) that provides greater comfort, durability, and safety while meeting the world's toughest standards for firefighting equipment. As such, the Dräger PSS™ 7000 is yet another example of one of the world's largest SCBA manufacturer's commitment to first responders.

SATISFYING THE MOST RIGOROUS EXPECTATIONS

The Dräger PSS™ 7000 was developed from scratch with the input of firefighters throughout North America. Combining the latest in electronics and materials, the Dräger PSS™ 7000 meets all of the National Fire Protection Agency (NFPA) 2007 standards – the most current edition of some of the world's toughest standards for self-contained breathing apparatus.

As a result, the Dräger PSS™ 7000 is not only technologically advanced, it has been proven to satisfy the most rigorous demands of firefighting. Following are key features that distinguish the Dräger PSS™ 7000 as the state-of-the-art breathing apparatus for first responders.

A NEW HARNESS SYSTEM FOR EXTRA COMFORT AND WEAR RESISTANCE

A key feature of the Dräger PSS™ 7000 is a newly designed harness suspension system that provides the ultimate in comfort and wear. The system features advanced compression-molded comfort padding. Its high temperature performance and exceptional wear resistance make it particularly suitable for firefighters. Additionally, the high grip anti-slide outer surface of the harness is made from a vulcanized chloroprene rubber for the necessary stability to keep the harness securely in position. Finally, new improvements made to the harness friction buckle design make it quick and easy to don and doff the Dräger PSS™ 7000 SCBA.

A BACKPLATE THAT PROVIDES UNRESTRICTED MOVEMENT

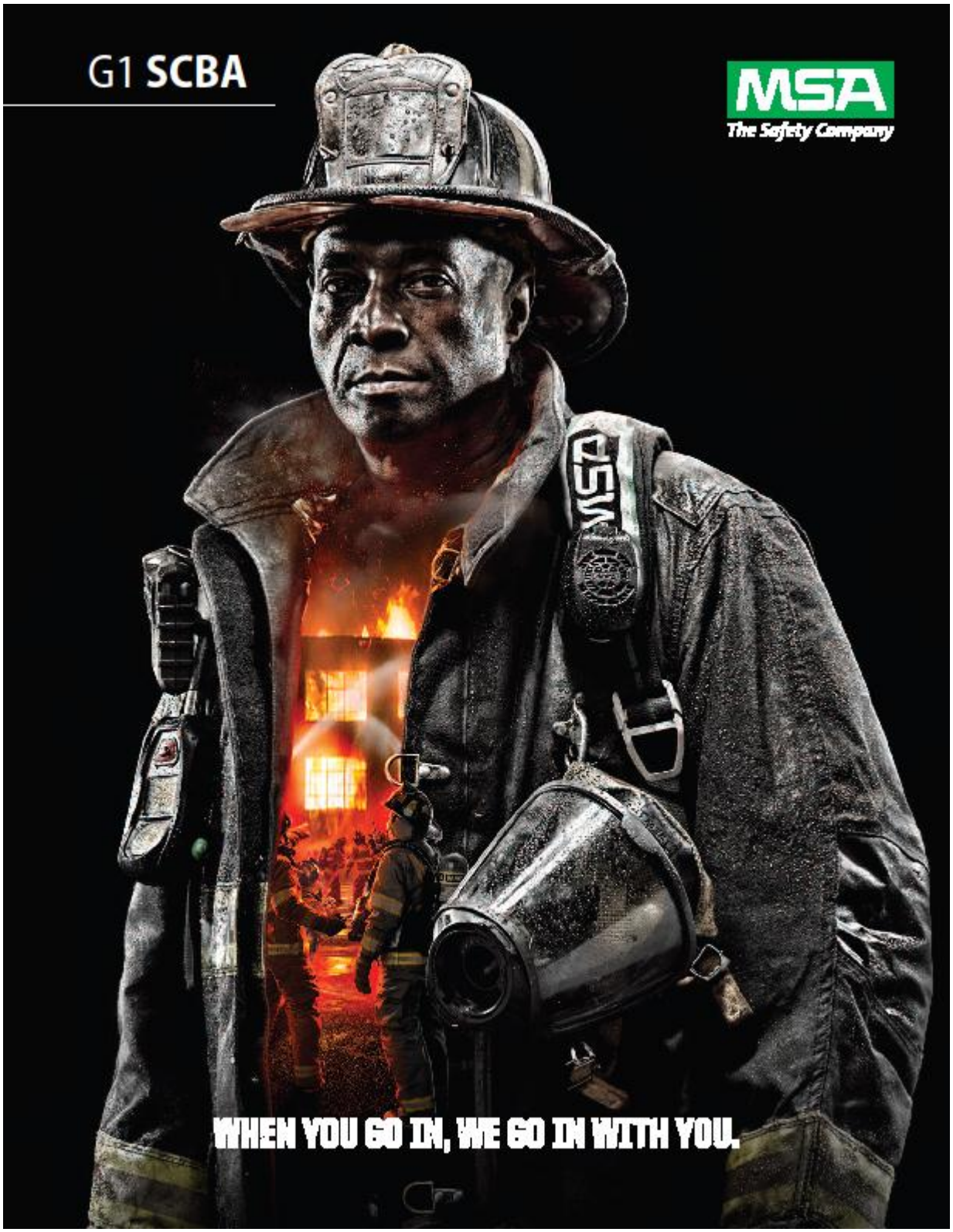
To fit the torso lengths of different firefighters, the Dräger PSS™ 7000's carbon fiber composite backplate features a unique 3-position height adjustment. This feature allows the wearer to adjust the height of the backplate within seconds.

The Dräger PSS™ 7000 was also designed to move with the user, allowing for unrestricted movement. The backplate automatically lengthens and pivots to accommodate the user's movements, and the unique self-adjusting, pivoting waistbelt allows the backplate to do this.

In addition to an increased range of movement, the weight of the Dräger PSS™ 7000 rides on the hips to reduce back strain. This also increases stability and balance by providing a lower center of gravity. Ultimately, the design of the Dräger PSS™ 7000 allows the wearer to work more effectively with less fatigue.

Dräger PSS™ 7000

Double Click on Image for Brochure



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NFPA 2013 EDITION SCOTT PRODUCTS

SCOTT AIR-PAK AND ACCESSORIES

Double Click on Image for Brochure

Appendix B

Administrative Procedure	CITY OF DURHAM FIRE DEPARTMENT *Office of the Fire Chief*	Revision Date: October 25, 2013	Number
Signature:		Subject: SCBA Evaluation Program Guidance	

I. Purpose

The purpose is to establish guidelines for evaluating self-contained breathing apparatus compliant with NFPA 1981, 2013 edition for departmental use.

II. Definitions

A. Company Officer - the ranking firefighter who has been assigned supervisory responsibility.

B. Firefighter - any fire-trained member of the Durham Fire Department without regard to rank or title.

C. Evaluator - any fire-trained member of the Durham Fire Department without regard to rank or title who has been assigned to evaluate SCBAs in accordance with the SCBA evaluation program.

D. Self-Contained Breathing Apparatus (SCBA) - positive pressure breathing apparatus that meets all requirements set forth in the NFPA 1981, 2013 edition "Standard on Open-Circuit Self-Contained Breathing Apparatus for Fire and Emergency Services".

E. Fit Test - The use of an established protocol to quantitatively evaluate the fit of a respirator on an individual.

F. Immediately Dangerous to Life and Health (IDLH) - An atmosphere that poses an immediate threat to life, would cause irreversible adverse health effects, or would impair an individual’s ability to escape a dangerous atmosphere.

G. Supplied Air Respirator - An atmosphere supplying respirator for which the source of breathing is not designed to be carried by the user.

H. Rapid Intervention Team (RIT) Pack - a portable SCBA cylinder and associated hose, fittings, adapters and tools, that is used to rescue and supply air to a downed firefighter during a mayday scenario.

I. Rapid Intervention Connection System (RIC) – a universal air connection fitting connected directly to the first stage pressure reducer to allow refilling of the cylinder with breathing air.

III. Responsibility

A. Assistant Chief of Planning and Administration - Shall be responsible for the administration of the SCBA evaluation program.

B. Assistant Chief of Operations - Shall be responsible for selecting and providing personnel from the Operations Division to participate in the SCBA evaluation program.

C. Assistant Chief of Special Operations - Shall be responsible managing the orientation phase and developing scenarios for and managing the controlled testing phases of the SCBA evaluation program.

D. Evaluators – Shall be responsible for participating in the orientation and controlled testing phases of the SCBA evaluation program, and providing objective, unbiased feedback using the proper documentation.

IV. Procedure

A. Orientation Phase

Manufacturers invited to participate in the Durham Fire Department's SCBA evaluation program shall conduct a presentation for the Durham Fire Department administrative staff, training staff and select Durham Police Department personnel. This presentation should include the following:

- a detailed description of the SCBA`s major components;
- instructions on donning, doffing, and operation;
- emergency procedures, such as bypass and buddy-breathing operations;
- basic troubleshooting and operational level maintenance for problems encountered in the field;
- cleaning and disinfecting procedures for the SCBA after use;
- filling cylinders from departmental fill stations, both stationary and mobile;
- Detailed overview of maintenance for SCBA maintenance

personnel;

The manufacturer`s representative shall provide at least four SCBAs, and sufficient spare cylinders for fire department testing, as well as provide copies of the operator`s and service manuals and technical SCBA specifications. In addition the manufacturer will provide RIC fittings and other adapters, as necessary, so that these packs will be compatible with the Durham Fire Department's current RIC packs and fill stations. Further, it will be the responsibility of the manufacturer to provide fittings compatible with the Durham Fire Department's current Porta-Count machine or provide a Porta-Count machine compatible with their product, to allow for fit testing of evaluators. If an operational level training DVD is available, the manufacturer will provide this as well. The manufacturer will also provide any optional features such as, but not limited to, radio communication devices, voice-amplification devices, supplied airlines, and confined space products and accessories, for evaluation. Should a manufacturer furnish an SCBA for evaluation that is designed to operate at a pressure other than 4500 psi, that manufacturer must also provide a means to fill the cylinders used in conjunction with their product. In addition, the Durham Police Department's Biological and Chemical Emergency Response Team will be participating in this evaluation process. Manufacturers are encouraged to provide any accessories that are compatible with their 2013 compliant SCBA that may be applicable to law enforcement organizations.

Throughout all phases of testing a dedicated representative from the SCBA manufacturer shall be available for contact either via phone or e-mail.

Once trained by the manufacturers, it is then the Durham Fire Department training staff's responsibility to train the firefighters and company officers who are to perform the actual evaluation. Each firefighter and company officer should be instructed in the operations listed above before being permitted to wear the SCBA during testing. A firefighter or company officer "detailed" to an evaluating company should not use the new SCBA unless previously checked off for attending the training sessions.

Each firefighter and company officer participating in the evaluation must be thoroughly familiar with all operations of the SCBA being tested. Thorough training will overcome many of the objections associated with anything new and will give the firefighter confidence before using the SCBA in the field. Procedures such as donning, doffing, operating all valves and gauges, changing cylinders, and sanitizing must be practiced until they are routine. In addition, each firefighter and company officer involved in the evaluation process will be fit-tested.

B. Controlled Testing Phase

Once initial orientation training is completed, the SCBA evaluation will move to the training grounds for the Controlled Testing Phase. This part of

the evaluation will allow fire department staff and the evaluators to test and to rate the functions of each SCBA under controlled conditions.

During the Controlled Testing Phase, the SCBA should be put through the paces, and all of the operational functions and manufacturer`s recommended procedures should be tested. The evolutions in the Controlled Testing Phase should consist of practical scenarios that simulate actual firefighting situations. **At no time during the Controlled Testing Phase will the evaluators or the SCBA being evaluated enter an IDLH environment.** Evaluators should practice donning and doffing; normal operations such as search and rescue, ventilation, and fire attack; and emergency procedures such as bypass function and buddy breathing. Practice should continue until each firefighter has a firm grip of the operating principles and the confidence necessary to use the breathing apparatus in the field. The purpose of the Controlled Testing Phase is to evaluate the ergonomics of each SCBA under consideration. At the conclusion of the Controlled Testing Phase, each evaluator will fill out and submit and Air Pack Evaluation Form.

C. Process for Controlled Testing Phase

The evaluation process will be organized in the following fashion. Line companies will be selected by the Assistant Chief of Operations to participate in SCBA evaluation. The number of line companies selected will be equal to the number of manufacturers submitting SCBA for evaluation. Once line companies are notified of their involvement in the SCBA evaluation process, they will be scheduled for a three day evaluation period. The three day evaluation period will be organized in the following fashion;

- Day one – Line personnel will be oriented and trained on the SCBA assigned to them for evaluation. In addition line personnel will be mask fit tested for the SCBA assigned to them for evaluation.
- Day Two – Line personnel will complete the Biddle Physical Agility Test using the SCBA assigned to them for evaluation.
- Day Three – Line personnel will complete the Rapid Intervention Drill, using the SCBA assigned to them for evaluation.

Once all line companies have concluded a three day evaluation period with the SCBA assigned to them, they will be assigned an SCBA from a different manufacturer. This process of evaluation and product rotation will continue until all line companies have had the opportunity to evaluate all of the SCBA submitted for evaluation.

Appendix C

CITY OF DURHAM | NORTH CAROLINA
FIRE DEPARTMENT
2008 EAST CLUB BOULEVARD • DURHAM, NC 27704
919.560.4242 • FAX 919-560-4256
www.durhamnc.gov

To: Manufacturer Rep

From: Andy Sannipoli, Assistant Fire Chief

CC: Dan Curia, Fire Chief
Chris Iannuzzi, Deputy Chief

Date: Date

Re: Self-Contained Breathing Apparatus (SCBA) Evaluation Invitation

The Durham Fire Department is initiating a program to evaluate self-contained breathing apparatus that are compliant with National Fire Protection Association (NFPA) standard 1981/1982 2013 edition. We have initiated this program in anticipation of replacing our current stock of SCBA with new 2013 compliant models. We would like to extend an invitation for your company to participate in this evaluation program. Guidance information for manufacturers is provided in the text below. We look forward to interacting with you and having the opportunity to evaluate your product.

Guidance for Manufacturers

Manufacturers invited to participate in the Durham Fire Department's SCBA evaluation program shall conduct a presentation for the Durham Fire Department administrative staff, training staff and select Durham Police Department personnel. This presentation should include the following:

- a detailed description of the SCBA`s major components;
- instructions on donning, doffing, and operation;
- emergency procedures, such as bypass and buddy-breathing operations;
- basic troubleshooting and operational level maintenance for problems encountered in the field;
- cleaning and disinfecting procedures for the SCBA after use;
- filling cylinders from departmental fill stations, both stationary and mobile;
- Detailed overview of maintenance for Mobile Support personnel;

The manufacturer`s representative shall provide at least four SCBAs, and

sufficient spare cylinders for fire department testing, as well as provide copies of the operator`s and service manuals and technical SCBA specifications. In addition the manufacturer will provide RIC fittings and other adapters, as necessary, so that these packs will be compatible with the Durham Fire Department's current RIT packs and fill stations. Further, it will be the responsibility of the manufacturer to provide fittings compatible with the Durham Fire Department's current Porta-Count machine or provide a Porta-Count machine compatible with their product, to allow for fit testing of evaluators. If an operational level training DVD is available, the manufacturer will provide this a well. The manufacturer will also provide any optional features such as, but not limited to, radio communication devices, voice-amplification devices, supplied airlines, and confined space products and accessories, for evaluation. In addition, the Durham Police Department's Biological and Chemical Emergency Response Team will be participating in this evaluation process. Manufacturers are encouraged to provide any accessories that are compatible with their 2013 compliant SCBA that may be applicable to law enforcement organizations.

The Durham Fire Department and Durham Police Department will then conduct a Controlled Testing Phase. During the Controlled Testing Phase, the SCBA will be put through the paces, and all of the operational functions and manufacturer`s recommended procedures will be tested. The evolutions in the Controlled Testing Phase will consist of practical scenarios that simulate actual firefighting and law enforcement situations. At no time during the Controlled Testing Phase will the evaluators or the SCBA being evaluated enter an IDLH environment.

Throughout all phases of testing a dedicated representative from the SCBA manufacturer shall be available for contact either via phone or e-mail.

Appendix D

CITY OF DURHAM | NORTH CAROLINA
FIRE DEPARTMENT
2008 EAST CLUB BOULEVARD • DURHAM, NC 27704
919.560.4242 • FAX 919-560-4256
www.durhamnc.gov

To: Manufacturer Rep

From: Andy Sannipoli, Assistant Fire Chief

CC: Dan Curia, Fire Chief
Chris Iannuzzi, Deputy Chief

Date: Date

Re: Self-Contained Breathing Apparatus (SCBA) Evaluation Completion

Warren,

I wanted take this opportunity to let you know that we have completed our evaluations of the (Manufacturer) SCBA. I would like to thank (Manufacturer) for their cooperation and participation in our evaluation process. Please make arraignments to come by the Fire Administration Building at 2008 E. Club Blvd. and pick up the evaluation equipment at your convenience. Once again, thank you for participating in our process.

Appendix E

Instructions: Please fill out this form at the conclusion of the evaluation period for the air pack in question. Please be as thorough, honest and impartial as possible in your evaluation. Use the five point rating scale to evaluate each of the criteria listed below. When you have completed the form, please

Rating System

1 = Unacceptable
2 = Poor
3 = Fair
4 = Good
5 = Outstanding

Face Piece	Score	Additional Considerations	Comments
Field of Vision			
Face piece and head net/straps fit and comfort			
Off air breathing		How easy is it and does it fog up?	
Fogging while on air			
Ease of seal check		Does it seal?	
Comfort of nose cup			
Clarity of speech			
Ease of attachment to second stage regulator			
Spectacle kit			
Overall design and function			
Total for Face Piece	0		

Frame/Harness	Score	Additional Considerations	Comments
Comfort of the pack		With and without the bottle	
Weight Distribution			
Ease of donning		From both a seated position and from the ground	
Cylinder retention			
Adjustability/Straps			
Mobility			
RIT/Drag system			
Location and usability of PASS, gauges etc.			
Overall design and function			
Total for Frame/Harness	0		

PASS	Score	Additional Considerations	Comments
Visual signal			
Location			
Sensitivity of the motion detector			
Audible signal			

Ease of manual activation with gloves			
Ease of resetting with gloves			
Power supply		What type of power source, battery or pneumatic? Redundancy?	
Overall design and function			
Total for PASS	0		

Voice Amplifier	Score	Additional Considerations	Comments
Location			
Battery compartment			
Size			
Durability			
Clarity of speech/Background interference			
Interference with vision			
Radio interface			
Overall design and function			
Total for Voice Amplifier	0		

Heads Up Display	Score	Additional Considerations	Comments
Location/Interference with vision			
Visibility of the lights			
Interference with other SCBA's in close proximity			
Durability			
Features		Dimming, manual activation, refresh etc.	
Readability/Clarity of display			
Power source		What is the power source? If it is a battery, how is the battery life?	
Overall design and function			
Total for Heads Up Display	0		

1st Stage Regulator	Score	Additional Considerations	Comments
Location			
Ease of breakdown/Reassembly		Work with MS1 personnel to score this item	
Redundancy			
Durability			
Protection			
Overall design and function			
Total for 1st Stage Regulator	0		

2nd Stage Regulator	Score	Additional Considerations	Comments
Profile		Work with MS1 personnel to score this item	
Interference with vision			
Ease of breakdown/Reassembly			
Ease of attachment to face piece with gloves			
Ease of removal from face piece with gloves			
Positive docking/Swivel			
Ease of operating bypass with gloves			
Ease of first breath operation/Reset			
Standard work rate breathing			
Heavy work rate breathing			
Durability			
Standby storage			
Length of hose			
Overall design and function			
Total for 2nd Stage Regulator	0		

Air Monitoring/Low Air Alarm	Score	Additional Considerations	Comments
Primary gauge visibility/Backlighting			
Remote gauge visibility/Backlighting			
Primary low air warning/Alarm effectiveness		Indicate in comments whether audible or tactile alarm	
Secondary low air warning/Alarm effectiveness		Indicate in comments whether audible or tactile alarm	
Overall design and function			
Total for Air Monitoring/Low Air Alarm	0		

Cylinder	Score	Additional Considerations	Comments
Connection to 1st Stage Regulator		Is there a quick connect feature?	
Ease of cylinder change		With and without gloves	
Profile			
Fit/Stability in the harness			
Iridescent properties			
Locking hand wheel on valve			
Location/Protection of hand wheel			
Overall design and function			
Total for Cylinder	0		

RIC/Buddy Breather	Score	Additional Considerations	Comments
Location			
Length of hose			
Ease of connection with gloves			
Accessibility			
Compatibility			
Overall design and function			
Total for RIC/Buddy Breather	0		

Other Features	Score	Additional Considerations	Comments
Entanglement issues			
RIT bag			
Escape pack/Supplied air respirator			
Compatibility with current testing equipment			
Bluetooth or wifi connectivity			
Compatibility with current fill stations			
Air pressure combinations		4500 or 5500 or both?	
Manufacturer service and support		Manuals, educational materials, parts, technical support.	
Total for Other Features	0		

Overall Score for Air Pack	0		

Comments:

Please print this form and fill out the following by hand

Printed Name: _____

Personnel Number: _____

Signature: _____

Date: _____

Durham Fire Department Physical Ability Test - Events Description

Candidates will wear the following mandatory safety equipment: Full turnout gear and SCBA. It is the candidate's responsibility to make sure they are wearing all mandatory equipment before they begin the test. All candidates will be breathing air from the SCBA throughout the test. All candidates are encouraged to proceed as quickly as is safe within each event but are required to walk between events.

EVENT 1: DRY HOSE DEPLOYMENT

Description: Candidate advances three (3) sections of uncharged pre-connected 1.75-inch hose 150 feet around two obstacles and one corner placing the hose nozzle in the marked box.

Muscles involved: Legs and trunk.

Suggested exercises: Walking lunges, split squats, squats, hip sled, leg press, calf raise, resistance sprints (uphill), stair running.

EVENT 2: CHARGED HOSE DEPLOYMENT

Description: Candidate advances three (3) sections of charged pre-connected 1.75 hose 70 feet. The nozzle of the hose is placed in the marked box and the candidate walks to the next event.

Muscles involved: Legs, trunk, upper back, and biceps.

Suggested exercises: Bent knee Deadlift, pull over, resisted trunk rotations (e.g. Medicine ball or dumbbell resisted), hammer biceps curls.

EVENT 3: HALYARD RAISE

Description: Candidate raises and lowers the fly section of a 35-foot aluminum extension ladder. The resistance for each pull is approximately 45 pounds. Candidates must use a hand over hand method to raise the ladder using the upper body only as the lower body is positioned to stabilize the ladder. If the rope slips through the candidates hand while either raising or lowering the ladder the candidate will be required to lower the ladder and restart the event. If the rope slips a second time the candidate will be disqualified.

Muscles involved: Trunk, shoulders, upper back, chest, lats, biceps, triceps, and forearms.

Suggested exercises: Lat pulldowns using a narrow grip, one arm rowing, forward and lateral shoulder raises, pull ups, chinups, wrist curls, wrist rolls, weight plate hand squeeze, and gripper device.

EVENT 4: ROOF WALK

Description: Candidate ascends and descends a 12-foot distance walking/crawling on the rungs of a 12-foot roof ladder while carrying a 20-pound chain saw. The candidate must hit every rung while ascending the ladder. If the candidate misses a rung on the way up the ladder they will be required to back down and restart the event. Candidate will be required to touch the saw to the net at the top of the ladder, then descend the ladder and place the chain saw on the ground in the box.

Muscles involved: Legs and trunk to balance the body, arms, hands to grip chain saw.

Suggested exercises: Training with on exercises that require balance walking lunge with dumbbells.

EVENT 5: ATTIC CRAWL

Description: Candidate crawls a distance of 20 feet across an attic prop.

Muscles involved: Whole body.

Suggested exercises: Crawling on hands and knees or hands and feet in a low crouched position.

EVENT 6: ROOF VENTILATION

Description: Candidate will ascend a ladder to the roof of a building. The candidate will pick up an eight-(8) pound sledgehammer from the designated area. The candidate will then proceed to strike the large tire a total of 30 times. The candidate must raise the hammer above the helmet for each of the 30 strikes and must maintain control of the sledgehammer at all times. Failure to strike properly will result in the repetition not being counted.
The following are examples of three methods that may be used by the candidates. With the first method the candidate slides their top hand to the top of the sledgehammer and back down to the bottom of the sledgehammer for each strike. In the second method the candidate places both hands at the bottom of the sledgehammer for each strike and does not slide the hands. With the third method the student separates the top and bottom hand and swings the sledge without sliding the top hand down. The first method described is the preferred method.

Muscles involved: Trunk, shoulders, chest, upper back, biceps, triceps and forearms.

Suggested exercises: Chopping wood, striking solid object with sledgehammer, chest press, shoulder press, upper body rowing (upright row, bent over row), hammer curls, triceps extensions, forearm curls, gripper device, trunk rotations.

EVENT 7: VICTIM REMOVAL

Description: Candidate carries or drags a 154 pound dummy for 13 feet and maneuvers around a cone and returns the dummy to the space provided. Total distance of drag is 26 feet.

Muscles involved: Legs, trunk, upper body, and forearms.

Suggested exercises: Drag a sandbag or a friend. Deadlift, clean, squat, lunge, backwards running with resistance, trunk extensions, shoulder shrug, reverse arm curls, forearm curls, gripper device.

EVENT 8: LADDER REMOVAL/CARRY

Description: Candidate removes a 24 foot aluminum extension ladder (72 pounds) from mounted hooks, carries the ladder 54 feet around a diamond shaped course, and replaces the ladder to the mounted hooks in the same place that it was previously hung. There are three (3) acceptable methods of carrying the ladder. With all methods the candidate should begin by finding the balance point marked in red on the ladder. The first method is a “high shoulder carry”. The entire ladder sits on the top of the candidates’ shoulder. Candidates may place the ladder directly on their shoulder from the mounted hooks and proceed around the designated area, replacing the ladder to the hooks directly from the shoulder. The second method is the “low shoulder carry”. In the low shoulder carry the top beam of the ladder sits on the top of the candidates’ shoulder. Candidates may place the ladder directly on their shoulder from the mounted hooks and proceed around the designated, area, replacing the ladder to the hooks directly from the shoulder. The third method is the “suitcase carry”. In this method the top beam of the ladder is held

in one arm like a suitcase. While performing this event, candidates are allowed only two interventions. If a candidate requires a third intervention the candidate will be disqualified. An intervention includes any of the following:

1. Candidate grounds the ladder. Grounding means placing the ladder on the ground to gain stability.
2. Candidate drops the ladder
3. Candidate loses control of the ladder and the proctor assists in grounding.
4. The rungs of the ladder fall over the head and neck of the candidate. In this case the proctor will assist in the removal and grounding of the ladder.

Muscles involved: Legs, trunk, upper back, shoulders, and arms.

Suggested exercises: Front squats, lunges, split squat or squat with weight held over head, back extensions, overhead press, incline press, dumbbell raise, triceps extension, side bends with overhead pulley for trunk.

EVENT 9: STAIR CLIMB WITH HOSE

Description: Candidate climbs four (4) flights of stairs with a 50 pound hose bundle and places the bundle on the landing of the fourth floor. The bundle may be placed over the left or right shoulder and will be placed in the designated area on the fourth floor. Candidates may skip steps when going up the steps of the tower.

Muscles involved: Legs, trunk and shoulders.

Suggested exercises: Power clean (for lifting bundle to shoulder), dead lifts, split squats, lunges, hiss sprints, tower or stair runs with weight, and calf raises.

EVENT 10: HOSE HOIST

Description: The candidate will hoist up a rope attached to a nozzle and 100 feet of 2.5 inch hose. The hose must be hoisted until it come in contact with the hose roller in the 4th floor window. Once the hose comes in contact with the hose roller, it must be lowered back to the ground. After completing the hoist the candidate must pick up the hose pack from Event 9 return to the ground floor and place it in the box. Candidates must hit every step when descending the tower.

Muscles involved: Trunk, upper back, biceps, shoulders and forearms.

Suggested exercises: Upright row, one arm bent over dumbbell rows, horizontal rows, external rotation cable pull, forward dumbbell shoulder raise in bent over position, biceps curls, and forearm curls.

EVENT 11: CRAWLING SEARCH

Description: Candidate crawls on hands and knees through one circuit in the lower portion of the SCBA maze.

Muscles involved: Whole body.

Suggested exercises: Crawling.

DURHAM
1869
CITY OF MEDICINE

Memorandum

CITY OF DURHAM

To: Andy Sannipoli, Assistant Chief

From: Daniel M. Curia, Fire Chief

Date: March 28, 2014

Re: SCBA Focus Groups

Chief Sannipoli:

The following is a brief overview of our discussions with A, B, and C Shift personnel concerning their evaluations and opinions of the SCBA recently evaluated for potential purchase. The meetings were held at Fire Station 1 on March 20, 21, and 24. Overwhelmingly, personnel indicated a greater satisfaction with the SCBA from Scott Safety, although they also indicated that the MSA SCBA would be an acceptable purchase in a 5500 psi configuration. Below are bullet points I noted during the conversations:

Scott Safety SCBA Pro's and Con's	MSA SCBA Pro's and Con's
Simple to use	Marginally more comfortable than Scott
Not too many bells and whistles (indicated as a positive attribute)	Questioned durability of SCBA and used the LCD as an example
Liked the PASS at the bottom of the SCBA	Loud bell
There was an open face piece	Good back plate
Liked the ¼ turn to lock the regulator to the face piece	Rigid low pressure hose
Liked the Vibra-alert	Liked the telemetry
Would like for the back plate to have a swivel back	Liked the voice amp
Good air flow	Needs a 5.5 solution
Less effort required to breathe the SCBA	Tacky straps (indicated as a negative)
Easy	No buddy breathing capability with SCBA submitted
	On multiple occasions, HUD did not work
	Indicated that there are too many bells and whistles

I will submit my handwritten notes to you for use and documentation.

There were a few consensus features that all agreed were needed for the DFD. These were a snap change or quick change bottle feature, a 5500 psi solution, and an SCBA with trans-fill capabilities.

Thank you for all the time and effort you have put into this project. I know this is an exhausting effort but one that is vital to the on-going success of the Durham Fire Department. I truly appreciate your leadership during this process.

c: Chris Iannuzzi, Deputy Chief