Port of Seattle Fire Department

Personal Protective Clothing Selection

Randy Krause
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<th>Airport</th>
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**NOTE:** Boston is transitioning to structural and phasing out proximity so I placed them in the structural category.
Three major areas of concern

- Health and welfare of the Firefighter
- Replacement, repair and maintenance of proximity ensembles and its associated costs
- Inability to appropriately inspect and clean PPE
References:

- NFPA 1971, Standard on Protective Ensembles for Structural Fire Fighting and Proximity Fire Fighting

- NFPA 1851, Standard on Selection, Care and Maintenance of protective ensembles for Structural and Proximity Firefighting

- NFPA 403, Standard for Aircraft Rescue and Firefighting Services at Airports
Identification of the Problem

- NFPA 1851, Draft establishes a 3 year replacement cycle for proximity ensemble outer garments. (based on manufacturer recommendation)

- NFPA 1851, Final, committee reverses course and establishes a 5 year replacement cycle for proximity ensemble outer garments

- NFPA 1851, is a retroactive document and the replacement date is from the date of manufacture.
Identification of the Problem

- **NFPA 1971 Basic requirements for both types of PPE**
  - Additional requirements for structural PPE

- **THL (Total Heat Loss) = Breathability of the Ensemble**
  - Proximity PrPPE does not have this requirement as the silver material prevents the passage of heat within the garment to be released to atmosphere. (Where is OSHA here)
  - OSHA, interpretation: Airport Firefighters must wear proximity Firefighting ensembles. (Based on What?) It is permissive to fight structure fires in proximity PrPPE because proximity PPE exceeds the standard for structural firefighting = Catch 22
Thermal Protective Performance (Sizing PPE and Air Gap)
Heat Transfer Model

- A heat transfer model for protective clothing worn by firefighters.
- Heat transfer through fire fighter’s clothing
- Many burn injuries to fire fighters occur even when there is little or no thermal degradation of their protective gear.
- Heat transfer = processes of conduction, convection and thermal radiation.
Firefighters as young as 33 can have serious or life-threatening cardiac events as a direct result of heat exhaustion or heat stroke. Heat exhaustion or heat stroke are clearly associated with damage to the heart.

Heat Related Illness

- Fabrics associated with protective clothing affect heat stress, if maximum evaporative cooling cannot meet the required evaporation the body will store heat and core body temperature will rise. The more permeability, the more vapor evaporation and less the core temperature is affected.

• POSFD, Spokane, Boeing – spoke to the issue during the WAC 296-305 rewrite.
• Committee agreed on the definition of a fuselage as a structure
• POSFD submitted that selection of PPE should be based on a valid hazard analysis and risk management plan
• Committee agreed and WISHA will take back to legal review and OSHA.
• Air Force and Navy are addressing OSHA through NFPA 1500 committee 2, Aug 2008
• Port of Seattle Health & Safety agree the selection of PPE is based on a hazard analysis and risk management Plan
• Defensible position, that most likely will not be challenged WISHA and may be reversed at OSHA
How does this affect the Department

- 1/3 of the Departments PrPPE is due for replacement in 2008 and at a minimum 1/3 will need to be replaced per year for the next 2 years.

- Replacement of the PrPPE outer garment is established at 90% of a completely new ensemble.

- Ensemble if contaminated cannot be de-contaminated and it cannot be advanced inspected if it is not clean.

- Reference: NFPA 1851 Advanced inspection and cleaning are an annual requirement.
By law (OSHA), employers have a responsibility to protect their employees by providing them with Personal Protective Equipment that is selected based on a written hazard assessment and, appropriate for the hazards they are expected to encounter.
NFPA 1500

- 7.1.1 The fire department shall provide each member with protective clothing and protective equipment that is designed to provide protection from the hazards to which the member is likely to be exposed and is suitable for the tasks that the member is expected to perform.

- The technical committee’s intent is that members utilize the appropriate protective clothing designed specifically for the type of fire-fighting activities for which the member is engaged. The type of fire-fighting activity is based upon the particular fire-fighting techniques used, such as using limited agents or chemicals, rather than the types of fuels involved.
Risk Assessment and Selection of PPE

• **Risk Assessment**
  - Detailed information as to our Responses, Frequency and Potential Severity if it does happen

• **Hazard Analysis**
  - The Port of Seattle Fire Departments responsibility is to establish the specific protection needs we have relative to the department’s response activity and circumstances
How do we manage the Risk

1. Control the Environment: Establish a defensive firefighting policy that applies to all aviation fuel fires including aircraft, fuel farm and fuel systems fires

   - Defensive: Conduct mass application operations using primary agent without dismounting the apparatus
   - Transition: Only after the fire intensity is reduced by 90% within the area of concern
   - Offensive: Expanded area of concern is controlled conduct interior firefighting and rescue operations
   - The Port of Seattle Fire Department does not fight proximity Fires! Consider applying the term “approach firefighting” as this language applies to what we actually do.
How do we manage the risks

2. In conjunction with WISHA and NFPA 1500 adopt the philosophy that an Aircraft Fuselage is a Structure

- Works in conjunction with ARFF fire suppression of Class B Fires
- Structural firefighting strategies and tactical considerations apply
- SCBA – Respiratory protection applies
- 2 in 2 out rule applies
- Standby team and then RIT team concept applies
- Works with structural PPE
What have we established?

1. Aviation fuel fires are combated utilizing a defensive strategy
2. An Aircraft fuselage is a structure
3. We do not conduct proximity firefighting, initially we conduct defensive approach firefighting
4. The risks have been identified
5. The risks have been analyzed
6. Risk reduction will be conducted through policy, procedure, training and enforcement
7. We can transition safely to structural PPE
**PPE Inspections**

- **Routine Inspections**
  - Conducted by the firefighter, after each use. Probably does not require a routine inspection after routine calls rather after each response where the PPE has potential to be soiled or damaged.

- **Advanced Inspection**
  - Conducted by a person who is authorized and trained to conduct such inspections. Can be done by an (ISP), Independent Service Provider.
  - Takes 3-3.5 hours to complete, requires purchase of inspection devices and includes both the ensemble and ensemble elements.
  - Takes the ensemble and ensemble elements out of service as the thermal liner and moisture barrier must be removed from the outer shell and reversed.

- **Minimum requirement, must be advanced inspected every 12 months**
PPE Cleaning

- **Routine cleaning**
  - Requires a paper wipe test to detect soiling
  - Includes non-invasive cleaning with a damp cloth and detergent.
  - PPE cannot be soiled or contaminated beyond a reasonable degree.

- **Advanced Cleaning**
  - Requires taking the PPE out of service, and disassembly of the ensemble
  - Soaking the outer garment and machine wash separately from the thermal liner and moisture barrier.
  - We do not have the equipment to complete the advanced cleaning with an extractor and dryer.
  - Qualified ISP can be contracted to complete the advanced cleaning and post cleaning advanced inspection for a cost per ensemble.

- **Minimum requirement, must be done at least every 12 months.**
Summary:
Globe G-Xtreme Structural PPE

- PPE can be routine and advanced cleaned.
- PPE can be routine and advanced inspected
- PPE has a (THL) requirement vs. PrPPE which equates to decreased likelihood of firefighter injury/death
- Costs of replacing structural PPE are reduced as the ensemble has a 10 year replacement cycle as apposed to PrPPE at 5 years. Cost of repair is decreased.
- ISP can advance clean and inspect the garments at approximately $80.00 per set every 12 months.
- POSFD can offset the costs provided we acquire an extractor and train selected individuals in how to conduct an advanced cleaning without damaging the ensemble.
Potential problems that will need to be addressed.

- Advanced cleaning and inspection requires taking the ensemble and ensemble elements out of service
- Each inspection takes manpower and time to complete
- Costs of an extractor and upgrades to the room for electrical and drainage
- What happens if we have a major incident/accident which require taking the gear out of service to be cleaned, inspected and potentially repaired
- What happens if we have a major incident/accident which requires the ensemble to be destroyed
- PPE takes 2-3 months to purchase and deliver.
Resolution suggestions

- Within 2-3 years we replace 100% of PrPPE with structural PPE.
- Contract with ISP to conduct advanced cleaning and inspection every 12 months until we have the capability to do it ourselves.
- At 5 years purchase a second set of structural PPE for each individual or at a minimum purchase adequate common sized and all uncommon sizes as needed to offset the liability associated with contamination or destruction of PPE
- Every 5 years from the date of manufacture, purchase a second ensemble, advance clean and inspect the existing ensemble and rotate the old set out of service to supply. Firefighters get a completely new ensemble every 5 years.
- Within 5 years budget for the Fire Station PPE cleaning room and extractor
- Conduct our own cleaning and inspection program per NFPA 1851 program
PPE Deployment

- The first deployment of PPE is based on the following requirements
  - PrPPE that is at or over 5 years old
  - Company officers and actors that are most often assigned to Engine and Aid work
  - Total 33 ensembles

- Fit the remainder of the Department members and budget for 2009 / 2010 replacement per approved budget

- Note: We may maintain the PrPPE for ARFF training in October 2008, thereafter it will be decommissioned as it cannot be used for any purpose other than non-fire related training.
(1) Fire departments that expect to respond to aircraft fires shall meet the applicable portions of the 2008 edition of NFPA 402, Guide for Aircraft Rescue and Firefighting Operations.

(2) Airport based fire departments shall meet the applicable portions of the 2008 edition of the NFPA 402, Guide to Aircraft Rescue and Firefighting Operations.
B.3 Control Time. After defining the critical area to be protected and developing a system of fire protection categories, RFFP-I turned its attention to the issues of discharge rates and the extinguishing agents to be applied to the critical area. The Panel concluded that fire control time and fire extinguishment time within the critical area should be considered individually and defined as follows:

(1) **Control time:** The time required from the arrival of the first fire-fighting vehicle to the time the initial intensity of the fire is reduced by 90 percent.

(2) **Extinguishment time:** The time required from arrival of the first fire-fighting vehicle to the time the fire is completely extinguished (Hewes 1970, p. 2-2).

Q1: Quantity of water for foam production for initial control of the pool fire.

Q2: Quantity of water for foam production to continue control or fully extinguish the pool fire.

Q3: Water available for interior fire fighting.
<table>
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<tr>
<th>Type of Hazard</th>
<th>Primary Hazard</th>
<th>Average Daily Operations</th>
<th>Risk Factor</th>
<th>Area of Practical Critical Area</th>
<th>Compliance with NFPA 403 Q¹</th>
<th>Compliance with NFPA 403 Q²</th>
<th>Compliance with NFPA 403 Q³</th>
<th>Ancillary Agent Capacity</th>
<th>Risk Reduction Factors</th>
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<tbody>
<tr>
<td><strong>Aircraft</strong></td>
<td>Fuel Load in US Gal.</td>
<td>Operations = Take Offs and Landings</td>
<td>1= lowest Risk, 5= highest Risk</td>
<td>R= Rate of Agent Application T= One Minute</td>
<td>Q¹ = 2620 Gallons of agent or 29% of the 1st Alarm Assignment</td>
<td>Q² = 7,070 Gallons for PCA/TCA Control and Ext,</td>
<td>Q³ = 2500 Water Required for Interior Fire Operations</td>
<td>Enhanced agent in addition to Q¹, Q² &amp; Q³</td>
<td>Apply Strategy of Mass Application NFPA 403</td>
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<td><strong>Large Frame</strong></td>
<td>B-747 B-777 MD-11</td>
<td>57,285 to 63,705</td>
<td>38 or 4.5% of the total daily Operations</td>
<td>5 of 5</td>
<td>PCA=18,324 ft² Q¹ = 2382 gallons T=1 Minute</td>
<td>Q¹ = 26% of the 1st Alarm Assignment</td>
<td>Q² = 76% of the 1st Alarm Assignment</td>
<td>Q³ is provided by Structural Apparatus 250 gallons T=10 min or 2500 gallons</td>
<td>1500 lbs PPK Dry Chemical and 500 lbs Halitron-1</td>
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<td><strong>Medium Frame</strong></td>
<td>B-767 B 757 A-330</td>
<td>23,980 to 36,750</td>
<td>64 or 7.6% of the total daily Operations</td>
<td>5 of 5</td>
<td>PCA= 13,240 ft² Q¹ = 1721 gallons T=1 Minute</td>
<td>Q¹ = 20% of the 1st Alarm Assignment</td>
<td>Q² = 76% of the 1st Alarm Assignment</td>
<td>Q³ is provided by Structural Apparatus</td>
<td>1500 lbs PPK Dry Chemical and 500 lbs Halitron-1</td>
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<td><strong>Medium Frame</strong></td>
<td>B737 Series, A-320 MD-80 Series</td>
<td>7,837 to 11,466</td>
<td>410 or 49% of Daily landings and Departures</td>
<td>4 of 5</td>
<td>PCA=10,198 Ft² Q¹ = 1325 gallons T=1 Minute</td>
<td>Q¹ = 15% of the 1st Alarm Assignment</td>
<td>Q² = 56% of the 1st Alarm Assignment</td>
<td>Q³ is provided by Structural Apparatus</td>
<td>1500 lbs PPK Dry Chemical and 500 lbs Halitron-1</td>
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<td><strong>Small Frame</strong></td>
<td>CRJ200-900 Series</td>
<td>2,975 or Less</td>
<td>312 or 37.1% of the total daily Operations</td>
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<td>PCA=9,287 Ft² Q¹ = 1207 gallons T=1 Minute</td>
<td>Q¹ = 13.5% of the 1st Alarm Assignment</td>
<td>Q² = 43% of the 1st Alarm Assignment</td>
<td>Q³ is provided by Structural Apparatus</td>
<td>1500 lbs PPK Dry Chemical and 500 lbs Halitron-1</td>
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Firefighters may transition from defensive operations to offensive firefighting operations when the following conditions have been met.

At the direction of the Incident Commander and only if the fire has been significantly reduced to allow firefighters in structural PPE to approach the area safely.

High conductive and radiant heat levels have been reduced by no less than 90% in the practical critical area.

Firefighters will not be in close proximity to high levels of convective or radiant thermal heat.

At least one standby ARFF vehicle assigned to protect firefighters on the ground is in place. The standby ARFF vehicle will shield/protect firefighters deploying hand lines from areas of high radiant heat.

The standby ARFF vehicle shall maintain the foam blanket by reapplying AFFF solution periodically or at the direction of the Incident Commander or Safety Officer.
NFPA Definitions of Offensive/Defensive

1. NFPA 1500 3.3.69.4 Offensive Operations. Actions generally performed in the interior of involved structures that involve a direct attack on a fire to directly control and extinguish the fire.

2. NFPA 1500 3.3.69.1 Defensive Operations. Actions that are intended to control a fire by limiting its spread to a defined area, avoiding the
Position Paper
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