Government of
Northwest Territories

Northwest Territories Defensive Firefighter Training

SESSION 2

PERSONAL PROTECTIVE EQUIPMENT

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SESSION 2 – PERSONAL PROTECTIVE EQUIPMENT

INTRODUCTION

Northwest Territories Defensive Firefighter Training (NWT-DFT) is a competency-based learning program for community fire departments operating at a defensive level of service. This workbook provides volunteer firefighters with the knowledge to apply to achieving 34 required skills. When successfully assessed, students and volunteer NWT firefighters will have met the basic requirements to appropriately respond to fire scenes at a safe distance from structure fires. Skills in the NWT-DFT program are to be assessed based on validated learning outcomes from the National Fire Protection Association (NFPA) 1001 standard.

Defensive firefighters typically wear structural firefighting Personal Protective Equipment (PPE) but is not always required. A hazard assessment should be done to determine PPE requirements based on the job and tasks being conducted.

If you are using structural firefighting gear in a defensive firefighting role, please consult *Appendix 1: Structural Firefighter PPE* for further details.

LEARNING OUTCOMES

1. Discuss the purposes and limitations of PPE items
2. Discuss the care and maintenance of PPE
3. Discuss the necessary criteria of the following items in defensive firefighting: fire helmet; protective coat; protective pants; boots; gloves; and face/eye protection
4. Practice the proper storage and arrangement for PPE
5. Skill 2-1: Don approved PPE in less than one minute
6. Skill 2-2: Doff approved PPE and restoring to operational readiness

Digital versions of all books in the NWT Defensive Firefighter Training program are available for download and/or printing here:
https://communitylearning.learnworlds.com/defensive-fire

PPE OVERVIEW

Purpose of PPE

The overall purpose of firefighting Personal Protective Equipment (PPE) is to provide protection while ensuring mobility and comfort in diverse environments. For defensive firefighters PPE should:

- Have tough outer layers to protect from cuts and abrasions
- Protect against heat
- Have water repellent properties
- Be high visibility with fluorescent/reflective trim

Even with PPE, firefighters are not immune to harm and must always stay cautious and aware of dangers. Protective clothing also has limitations that affect the firefighter:

- May be difficult to don (put on) quickly
- Heavy/restrictive, limits ability to move around
- Retains body heat, which can lead to overheating
- Defensive level PPE is not suitable if too close to a fire

As a defensive firefighter, you should never be able to feel excessive heat given off by fire. If you do, you are too close and not in a defensive position.

WHAT TO WEAR UNDER PPE

Wear natural fibre clothing (cotton or wool) or properly rated fire-resistant clothing underneath your PPE. Synthetic fibres (nylon, polyester, spandex, and rayon) should be avoided. They can melt at relatively low temperatures and cause burn injuries if the firefighter is accidentally exposed to fire, even when worn under PPE.

Synthetic fiber clothing is made from man-made fibers, usually derived from petrochemicals:

- Polyester
- Nylon
- Acrylic
- Spandex
- Rayon

Natural fiber clothing is made from materials that come from plants, animals, or minerals:

- Cotton
- Wool
- Silk
- Linen
- Hemp
- Bamboo

TAKING CARE OF PPE

Manufacturer instructions for cleaning, maintaining, and inspecting firefighter gear usually include the following general guidelines.

Cleaning	Wash gear with warm (not hot) water after exposure to fire, chemicals, or biological contaminants. Use a front-loading washing machine with a mild detergent. Avoid bleach or fabric softeners as they can damage the fabric.
	Air dry the gear out of direct sunlight or use a tumble dryer on a low-heat setting. Avoid high heat, as it can degrade the protective materials.
	For heavy contamination, send the gear to a professional cleaning service that specializes in firefighter PPE.
Maintenance	Inspect after each use for cuts, tears, abrasions, or signs of thermal damage.
	Do not attempt to repair the gear yourself. Any damage should be repaired by an authorized service provider using approved materials and methods.
	Store gear in a cool, dry place away from direct sunlight or chemicals. Avoid storing in areas with high humidity or temperature fluctuations.
Inspection	Do a thorough inspection once a month regardless of whether gear is used. Follow SOPs. Look for signs of wear, damage, or contamination.
	Keep a log of inspections - document any damage found and repairs completed.

STRUCTURAL PPE

When structural firefighting gear is being used it must be compliant with the NFPA 1971 standard for care and maintenance.

- Advanced (verified service provider) cleaning required once a year or after contamination exposure
- Repairs must be performed using materials and methods approved by the PPE manufacturer
- Inspection after each use, conduct advanced monthly and/or annual inspections
- Never use bleach or fabric softener
- Document all cleanings, inspections and repairs

DEFENSIVE LEVEL PPE REQUIREMENTS

Defensive firefighters need to follow safety guidelines and use appropriate PPE as outlined by the NWT/Nu Workers' Safety and Compensation Commission (WSCC). The WSCC's Firefighter Code of Practice specifies that defensive firefighters should use PPE that includes, but is not limited to:

- High-visibility protective clothing (coat and pants) that is heat, water and puncture resistant
- Helmets
- Gloves
- Boots (*Canadian Standards Association approved*)

PPE	Criteria	Example
Helmet	• Lightweight yet durable • Equipped with chin straps to ensure secure fitting • Must include a brim to shield from sun and rain • Provisions for attaching face/eye protection from smoke, dust, and debris	
Eye Safety	• Designed to provide protection from debris, embers, projectiles, smoke and particulates • Heat resistant • Compatible with other PPE • Anti-fog coating (recommended)	
Gloves	• Made from flame- and water-resistant materials • Designed to offer dexterity while protecting from heat, abrasions, and minor cuts	
Boots	• High-topped (8 inches) to protect the ankles • Made from heat- and slip-resistant materials • Designed to offer support and protection from water, punctures, cuts, and burns	

DEFENSIVE LEVEL PPE REQUIREMENTS

PPE	Criteria	Example
Protective Clothing (coat and pants)	• Flame-resistant to minimize the risk of ignition and fire spread on the clothing • High-visibility reflective trim is often included to ensure firefighters can be seen in low-visibility conditions such as smoke, dim lighting, or poor weather • Designed to allow ease of movement • Designed to shield against abrasions, cuts, and other external hazards • Water-repellent to protect against moisture • Vented to reduce the risk of heat stress	

If structural firefighting gear is being used it must be compliant with the NFPA 1971 standards that may be more rigorous than the criteria stated above.

Consult APPENDIX 1: Structural Firefighter PPE for more details.

KNOW YOUR ROLE!

Would you go scuba diving without any training?
What if you had all the right gear? Probably not.

Even if you have high-quality structural firefighting gear, you must never take part in activities outside the defensive firefighter role without proper training. Defensive firefighters stay at a safe distance from the fire, usually more than 10 metres away. The exact distance depends on factors like wind, fire behaviour, and available resources. In some extreme situations, they may need to stay even further back.

Defensive firefighting focuses on protecting people and property by slowing or stopping the fire. Firefighters wearing structural PPE must NEVER take on tasks outside their role. Doing so puts themselves, their team, and the entire operation at risk.

PPE Terms

- **Bunker Gear:** PPE was traditionally kept by the firefighter's bunk at the fire station so sometimes referred to as bunker gear
- **Turnout Gear:** Turnout can refer to responding to a call
- **Donning:** Putting on
- **Doffing:** Taking off

PPE STORAGE AND STAGING

PPE Storage

To ensure the gear remains functional, safe, and free from contamination, firefighter PPE should always be stored in a designated and clean environment, typically at the fire station. Never store dirty or contaminated firefighter PPE at home because of the potential to spread contaminants from dirty PPE. Gear should be stored:

- In easy-to-access areas near the response vehicle or station entrance
- Away from sharp edges or dirty surfaces to prevent damage
- Away from direct sunlight and excessive heat sources to prevent damage
- In ventilated areas free of moisture, reducing the risk of mold or bacterial growth

Never wear damaged or dirty PPE. Damaged PPE may fail. Dirty PPE may be toxic. Contaminated or damaged gear should be cleaned, repaired or replaced.

PPE Staging

PPE should be arranged or staged in a way that allows firefighters to don (put on) quickly when it is being stored. It should also be donned in a way that provides for maximum protection:

- Arrange pants with legs completely over the tops of each boot. Step into each pant leg and boot without disrupting the layers
- Arrange the remaining PPE so that you can quickly don in the following order: coat, followed by helmet, and then the gloves

Make sure all PPE is donned properly. Have your donned PPE checked over by a partner before entering a fire vehicle (apparatus).

SKILL DRILLS

SKILL DRILLS

Practice the following skills. Each step will be assessed in the NWT Defensive Firefighter Training program

SKILL DRILL 2-1: Donning PPE

This skill should be completed in less than one minute when you are assessed on the skill. Don't worry if you go over a minute the first few times you practice. It is better to make sure you don the protective clothing correctly first.

1	Place your equipment in a logical order for donning
2	If using a protective hood, place hood over your head and down around your neck
3	Put on your boots
4	Pull up your protective pants
5	Place the suspenders over your shoulders (if applicable)
6	Secure the front of the pants
7	Put on your protective coat
8	Close the front of the coat
9	Place your helmet on your head and adjust the chin strap securely
10	Turn up your coat collar, and secure it in front
11	Put on your gloves
12	Have your partner check your clothing

SKILL DRILL 2-2: Doffing PPE

Make sure to restore the PPE to operational readiness after the completion of doffing (see page 8).

1	Remove your gloves
2	Open the collar of your protective coat
3	Release the helmet chin strap
4	Remove your helmet
5	Remove your protective coat
6	Remove your protective pants and boots
7	Remove your protective hood

LEARNING DEBRIEF

REMEMBER

- Developing proper work habits during training in this course helps ensure safety later
- Do not attempt anything you feel is beyond your ability or knowledge
- Tell someone if you see something that you feel is an unsafe practice
- Continue to learn teamwork and practice working as a team
- A firefighter injured during training should not return until medically cleared for duty

Reflect on the following questions. Jot down notes or sketches in the spaces provided.

Why is it important to understand both the purposes and limitations of PPE you are using when responding to a fire?	
How can your learning today impact your safety and effectiveness as a firefighter?	
Why is it important for a defensive firefighter to stay within their role and avoid taking unnecessary risks, even when wearing full structural PPE? What could happen if they go beyond their training?	

APPENDICES

APPENDIX 1: Structural Firefighter PPE

Some NWT community fire departments have structural gear and PPE that is used by defensive firefighters. Structural PPE is designed for high-heat environments and direct fire exposure, typical in interior firefighting. While defensive firefighters operate from a distance, structural PPE can still provide enhanced protection from radiant heat and unexpected fire spread. There are some important factors that defensive firefighters need to be aware of when using structural PPE.

RISK OF OVERHEATING

Structural PPE is bulky and insulated, which can lead to heat stress or exhaustion. Defensive firefighters need to monitor their body temperature and stay hydrated.

FALSE SENSE OF SECURITY

Wearing structural PPE might give a false sense of invincibility, leading defensive firefighters to take unnecessary risks. It's important to remember that your role is to stay at a safe distance and avoid direct engagement with the fire.

LIMITED MOBILITY

The bulkiness of structural PPE can limit movement and agility. Defensive firefighters should ensure they can move efficiently while wearing the gear, especially when performing tasks like handling hoses or equipment.

IF STRUCTURAL FIREFIGHTING GEAR IS BEING USED IT MUST BE COMPLIANT WITH THE NFPA 1971 STANDARD FOR CARE AND MAINTENANCE.

UNDER NWT LEGISLATION, DEFENSIVE FIREFIGHTERS SHOULD NEVER BE IN SITUATIONS WHERE RESPIRATORY PROTECTION IS REQUIRED. THIS MEANS IT IS THE RESPONSIBILITY OF FIREFIGHTERS TO ENSURE THEY ARE NOT DIRECTLY EXPOSED TO HARMFUL RESPIRATORY ENVIRONMENTS.

NO MATTER THE GEAR A DEFENSIVE FIREFIGHTER IS WEARING, YOU SHOULD NEVER FEEL AN UNCOMFORTABLE AMOUNT OF HEAT GIVEN OFF BY FIRE. IF YOU DO, YOU ARE TOO CLOSE AND NOT IN A DEFENSIVE POSITION.

APPENDIX 1: Structural Firefighter PPE

If structural firefighting gear is being used PERFORMANCE REQUIREMENTS must be compliant with the NFPA 1971. Below are the Standards on Protective Ensembles for Structural and Proximity Firefighting (NFPA 1971):

PPE	Criteria
Coat and Pants	• Thermal Protective Performance (TPP): Must have a minimum TPP rating of 35. This means the garment must provide sufficient protection from heat exposure that causes second-degree burns. • Total Heat Loss (THL): Must have a minimum THL rating of 205 W/m², ensuring the material allows for adequate body heat dissipation to prevent heat stress. • Flame Resistance: Outer shell material must not melt, drip, or ignite when exposed to flame for 12 seconds. • Seam Strength: Seams must withstand a minimum of 357 N of tensile strength.
Helmet	• Impact Resistance: Must withstand an impact of 11.1 J from a falling object without causing deformation that could harm the wearer. • Retention System Strength: Chinstrap must withstand a force of 136 N without failure. • Heat Resistance: Must endure temperatures of 260°C for 5 minutes without deformation or loss of integrity.
Gloves	• Thermal Insulation: Gloves must have a minimum Thermal Protective Performance (TPP) rating of 20. • Dexterity Test: Must allow the wearer to pick up small objects, demonstrating sufficient dexterity. • Cut Resistance: Gloves must have a minimum cut resistance rating of 2.5 on the ASTM F1790 scale.
Boots	• Thermal Insulation: Must have a Thermal Conductive Heat Resistance (CCHR) rating ensuring the inside temperature does not rise more than 22°C after exposure to 260°C for 30 minutes. • Puncture Resistance: Must resist penetration from a force of 1200 N applied through a 4.5 mm diameter probe. • Slip Resistance: Must pass slip resistance tests on wet, dry, and oily surfaces as per ASTM standards.

APPENDIX 1: Structural Firefighter PPE

If structural firefighting gear is being used, the staging and donning requirements must be compliant with the NFPA 1971.

Staging structural PPE

- All components of the PPE (helmet, coat, pants, gloves, boots, hood) should be arranged in an orderly manner to allow for quick access
- The coat should be placed with opening facing outward so the firefighter can quickly slide into it
- Boots should be positioned for easy access, inside bunker pants, with the toes pointing outward
- Gloves should be positioned in a way they are easily accessible and ready to be donned immediately

Donning structural PPE

Step 1: Don Protective Hood

- Put on the protective hood first to ensure that your neck and face are protected
- Adjust the hood so it covers the ears, neck, and extends under face protection

Step 2: Don Firefighting Pants (Bunker Pants)

- Step into the firefighting pants (bunker pants), making sure the cuffs are properly adjusted around the boots to prevent debris and heat from entering
- Pull the pants up to the waist and secure the suspenders if necessary

Step 3: Don Firefighting Coat (Bunker Coat)

- Put on the firefighting coat (turnout coat), ensuring the collar is positioned correctly to avoid gaps
- Zip up and fasten the coat to ensure a tight, secure fit. Ensure that the cuffs are snug and that the coat overlaps the pants to prevent heat exposure

Step 4: Don SCBA (Self-Contained Breathing Apparatus)

- N/A

Step 5: Don Firefighting Helmet

- Put on the fire helmet, adjusting the chin strap to secure it
- Make sure the helmet fits comfortably and does not obstruct vision or hearing

Step 5: Don Gloves

- Put on firefighting gloves last to avoid getting caught in any of the equipment
- Ensure that the gloves fit snugly and are free from defects

Step 7: Final Check

- Perform a final check to ensure all gear is properly adjusted, and there are no gaps in the protection
- Verify that all components, like gloves, hood, and helmet, are securely in place and operational

GLOSSARY OF TERMS

Communications

- **ABC Button:** Customizable preset button on radios
- **Channel Selector:** Dial or button to change radio channels
- **Communication Feedback Loop:** Confirming messages by repeating them back
- **Decoding:** Interpreting the received message
- **Emergency Button:** Sends alert for immediate help
- **Emergency Line:** Dedicated line for urgent calls
- **Emergency Traffic:** High-priority message overrides others
- **Encoding:** Turning thoughts into a message
- **Feedback:** Receiver's response to a message
- **Message:** Information being communicated
- **Monitor/Scan Buttons:** Used to listen to multiple radio channels
- **Noise:** Anything that disrupts communication
- **Portable Radio:** Handheld radio for communication
- **Push-to-Talk (PTT) Button:** Press to talk on a radio
- **Receiver:** Person who gets the message
- **Sender:** Person who sends the message
- **Transmission:** Sending a message over radio

Equipment

- **Apparatus:** Firefighting vehicle
- **Deck Gun:** Fixed, high-volume water device on fire trucks
- **Dry Barrel Hydrant:** A hydrant that drains to prevent freezing
- **Handline:** Hose operated by hand
- **Hose Appliance:** Tools used with fire hoses to control flow
- **Hose Couplings:** Connect hoses to each other or a water source
- **Hose Lays:** How hoses are arranged from source to scene
- **Hose Loads:** Hose stacking methods for easy deployment
- **Nozzle:** Controls water stream from a hose
- **Pumper Truck/Attack Engine:** Vehicle with pump, hose, and water for fire attack
- **SCBA** (Self-Contained Breathing Apparatus): Air tank and mask for breathing in smoke-filled areas
- **Standpipe:** Built-in pipe system for supplying water inside buildings
- **Storz-Type Coupling:** Quick-connect hose ends without threads
- **Suction Hose:** Pulls water from static sources
- **Supply Hose:** Delivers water from source to pump
- **Threaded Couplings:** Screw-type hose connections
- **Turnout Gear:** Protective clothing worn during responses

Education and Training

- **Codes and Standards:** Laws and guidelines for fire safety
- **Exit Drills In The Home (EDITH):** Practice home fire escape plans
- **Home Safety Surveys:** Checking homes for fire safety issues
- **NFPA (National Fire Protection Association):** Sets fire safety standards

Fire Science

- **Backdraft:** Explosive ignition when oxygen re-enters a smoldering fire
- **Combustion:** Chemical process of burning
- **Conduction:** Heat transfer through contact
- **Convection:** Heat movement through air or gas
- **Decay Stage:** Fire slows as fuel runs out
- **Fire Tetrahedron:** Fire needs heat, fuel, oxygen, and a chemical reaction to burn
- **Fire Triangle:** Fire needs heat, fuel, and oxygen to start
- **Flashover:** Sudden full-room ignition
- **Fully-Developed Stage:** Maximum burning
- **Growth Stage:** Fire starts spreading and intensifying
- **Heat Transfer:** Movement of heat via conduction, convection, or radiation
- **Incipient Stage:** Fire just igniting
- **Light (Thermal) Energy:** Heat and light given off by fire
- **Mechanical Energy:** Energy from movement, sometimes causes sparks
- **Oxidation:** Reaction of fuel with oxygen
- **Pyrolysis:** Breakdown of material from heat before ignition
- **Radiation:** Heat traveling in waves
- **Smoke Colour:** Helps indicate type of material burning
- **Smoke Explosion:** Ignition of trapped fire gases

Incident Command Structure

- **Chain of Command:** Order of authority
- **Division:** Personnel and resources assigned to a geographic location
- **Emergency Management Organization (EMO):** Coordinates emergency responses
- **Group:** Personnel and resources assigned to a specific task
- **Incident Action Plan (IAP):** Plan for managing an incident
- **Incident Command System (ICS):** Structured approach to managing emergencies
- **Incident Commander (IC):** Person in charge of an incident
- **Operations Function:** Part of ICS that manages tactical operations
- **Span of Control:** Number of people a leader can manage (usually 3–7)
- **Single Resource:** One unit (e.g., one engine or person)
- **Unity of Command:** Each person reports to only one boss

Operations and Tactics

- **Advancing Hose:** Moving hose toward the fire
- **Attack Hose:** Used directly on the fire
- **Charged Hose:** Filled with water, ready to use
- **Defensive Operations:** Fighting fire from a distance
- **Establishing Command:** Identifying who's in charge
- **Evolution:** Planned firefighting tasks or maneuvers
- **Exposure:** Nearby object at risk of catching fire
- **Freelancing:** Acting without direction during an incident
- **Initiating Response:** Units are en route
- **Overhaul:** Checking for and putting out hidden fire
- **PAR (Personnel Accountability Report):** Roll call for safety
- **Rehabilitation:** Rest and recovery for firefighters
- **Salvage:** Protecting property during/after firefighting
- **Scene Size-Up:** Assessing what's happening at the scene
- **Size-Up:** First look and judgment of the fire scene
- **Staging Area:** Place where people/equipment wait near the scene

PPE and Safety

- **Accountability Tag:** Tracks firefighter location and status
- **Bunker Gear:** Full protective firefighting gear
- **Carcinogens:** Cancer-causing substances from fire/smoke
- **Critical Incident Stress Management (CISM):** Mental health support after tough calls
- **Freelancing:** Acting without direction during an incident
- **PPE (Defensive):** Gear for indirect fire attack
- **PPE (Structural):** Gear for entering burning buildings
- **Rehab Officer:** Person monitoring health in rehab area
- **Safety Culture:** Shared values and actions for safety
- **Unacceptable Risk:** Danger too high to allow action

Radio Language and Protocols

- **Arrival on Scene:** Unit has reached the incident
- **Cancelling Response:** Units not needed anymore
- **Clearing the Scene:** Leaving the scene, ready for next call
- **Incident Type:** Describes the emergency
- **Location Indicators:** Help identify where something is
- **Phonetic Alphabet:** A set of code words used to clearly communicate letters over radio
- **Priorities:** Life safety, property protection, incident control
- **Resource Request:** Ask for more units/equipment
- **Situation Report:** Update on the current status

Water Supply

- **Dry Hydrant:** Pipe for pulling water from lakes or ponds
- **Portable Pump:** Moveable water pump
- **Portable Tank:** Temporary water holding tank at the scene
- **Pumper Truck/Attack Engine:** Vehicle with pump, hose, and water for fire attack
- **Static Water Supply:** Water from non-pressurized sources like ponds
- **Water Fill Station:** Spot for refilling water trucks
- **Water Shuttling:** Moving water from water source to scene