Canadian CBRN PPE Standards and Guidance

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The project objectives

- **To provide guidance to first responders in the use and selection of protective equipment in order to enhance preparation for response to a CB incident**
  - To drive the development of equipment guidelines and standards in this area for Canada

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The approach

- **R&D and guidance development in concert**
  - Specialists and responders participate in program
- **Determining what's needed**
  - Model scenarios
  - Understand responder roles, requirements and response procedures
  - Research toxicology of C,B,R agents

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The approach

- **Determining what's possible**
  - Model protective performance of clothing and respirators
  - Measure protection under realistic (workplace) conditions
  - Examine a variety of styles of protective equipment
  - Measure performance using a wide variety of appropriate agent simulants, toxic industrial chemicals

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The approach

- **Setting and meeting new requirements**
  - Develop standard assessment methods
  - Set requirements
  - Drive PPE standard development
  - Assist industry in understanding, assessing and meeting new performance requirements

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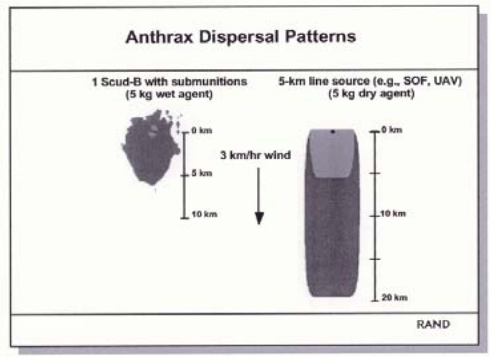
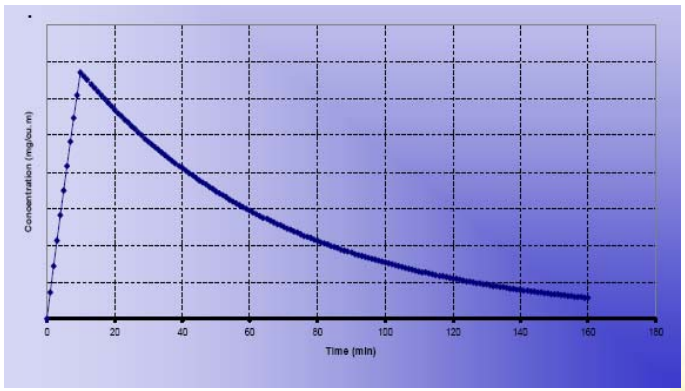
Standards development and guidance

- **Systematic approach to advice based on all-hazards approach, operational requirements and reasonable maximum exposures**
- **Initial emphasis is on practical advice for managing the situation in combination with PPE selection**



Scenario development and release modeling

- **A variety of C, B, R scenarios have been developed and evaluated consistent with the Canadian environment**
  - Include indoor, outdoor release and contagious events
  - Modeling of release events has been performed



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Scenario development and release modeling

- **Some basic initial assumptions:**
  - Scenarios can be divided into those where a limited release volume is likely, and those where large volume release is possible
    - Use ERG 2004 small vs large release guidelines for chemicals to assist in defining perimeters
  - Vast overkill is unlikely
  - Agents are most likely to be chosen for lethality potential

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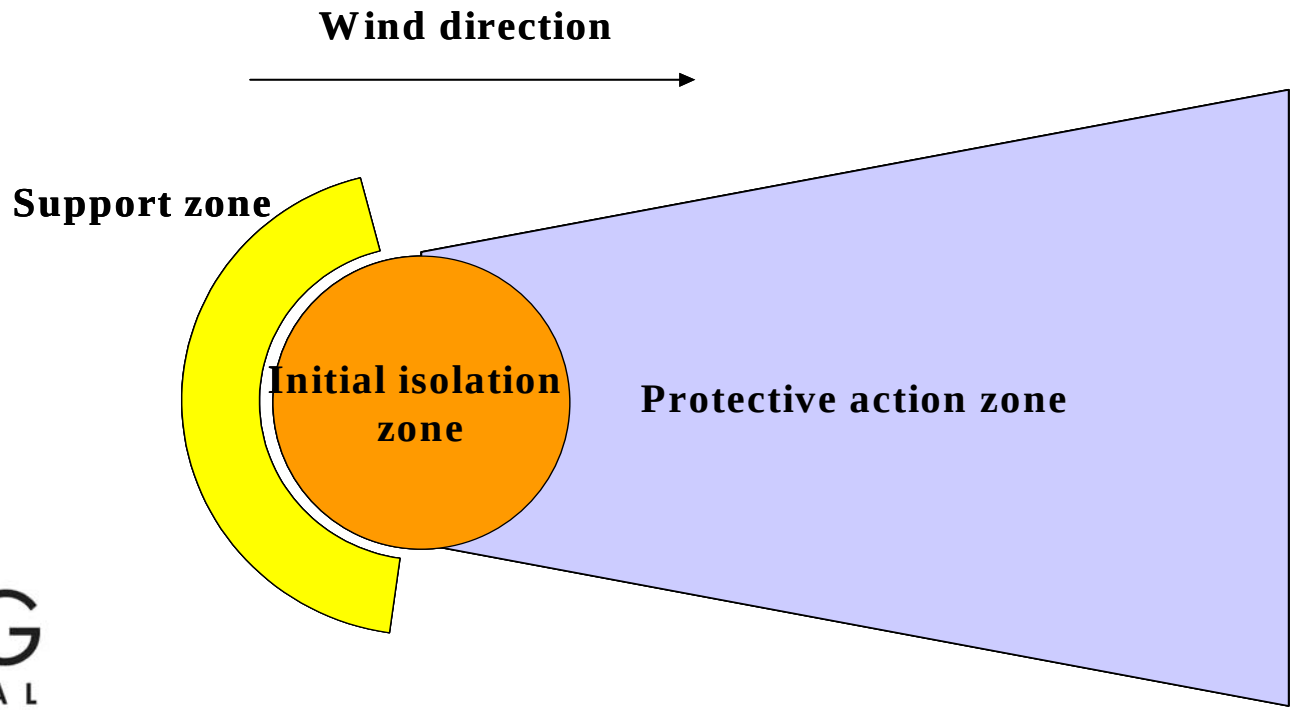
FR working zones

- **Based on ERG 2004 with some modifications**



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Roles and responsibilities in a CBRN event

Developed with assistance of FR working groups

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Service	Type of event	Duties: Rad	Duties: Chem	Duties: Bio	Location of ops	Work rate[1]
Hospital first receivers - Decon Team	R, B, C indoor release or outdoor release	decon	decon	decon	outside hospital; hospital located in cold zone; exposure to contaminated casualties	Moderate
Hospital first receivers	R, B, C, indoor release or outdoor release	treatment	treatment	treatment	inside hospital: hospital located in cold zone	Moderate
Hospital first receivers	R, B, C, indoor release or outdoor release	treatment	treatment	treatment	inside hospital: hospital located in protective action zone	Moderate
Hospital first receivers	Bio, contagious			high volume normal duties	protective action zone	Moderate
EMS, general duty	R, B, C, indoor release	T, T & T[2]	T, T & T	T, T & T	cold zone perimeter of event	Moderate
EMS, specialists	R, B, C, indoor release	Rescue and T, T & T	Rescue and T, T & T	Rescue and T, T & T	isolation, support	Heavy
EMS, general duty	R, B, C, outdoor release	T, T & T	T, T & T	T, T & T	protective action zone	Moderate
EMS, specialists	R, B, C, outdoor release	treatment & rescue	treatment & rescue	treatment & rescue	isolation, support, protective action zone	Heavy
EMS, general duty	Bio, contagious			high volume normal	protective action zone	Moderate

- also performed for police, fire

Guidance on PPE use during release event

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Major issues identified

- **Recognize differences between Hazmat and CBRN terrorism events**

Hazmat release event	CBRN terrorism event
Known substances, known amounts	Unknown substances, unknown amounts (all hazards approach)
Toxicity variable, usually low to moderate Primarily chemical, may include radiological	Toxicity likely to be high Biological agents, including infectious materials, included
Often outdoor release with relatively small area of effect	More likely to be either indoor release or covering very large outdoor area
Specific emergency plan in place	Planning must be generic
Not targeted	Targeted location and timing, may be weaponized for efficient delivery
Usually not criminal event	Criminal event
Event may last hours to days	Event may last hours to months

- **Initial approach to event must be all-hazards**

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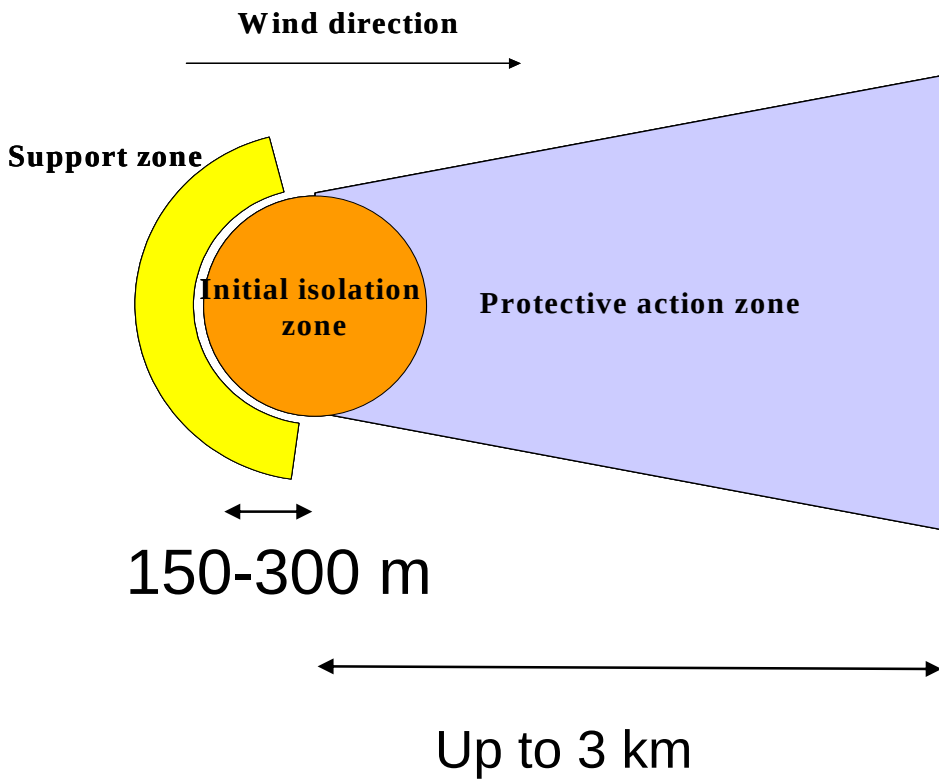
Major issues identified: approach to scene

- **Approach to suspected unknown event from up to 3 km distance must include good respiratory protection for <u>all</u> responders**
  - Protective action zone and support zone may contain concentrations well above IDLH
  - Support zone at sufficient distance



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Major issues identified: characterization of event

- **Important to recognize scale/nature of event as soon as possible in order to choose appropriate protective levels**
  - Use appropriate indicators
  - Look for vehicles, reservoirs, ground-level air intakes which might indicate release of amounts larger than man-portable (200 kg)
  - Number of serious casualties relative to number exposed
  - Bio or rad dissemination devices

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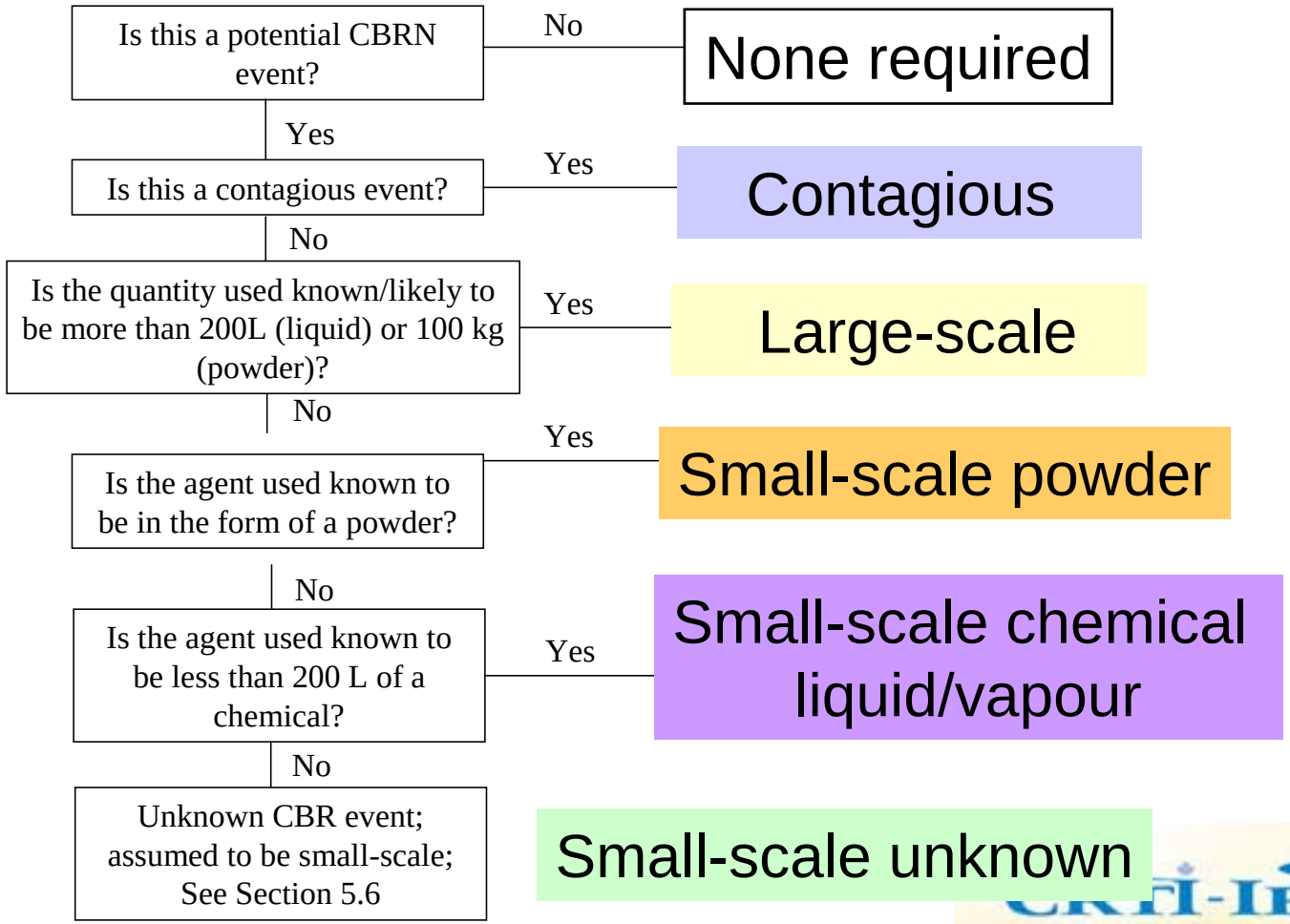
Decision tree for selection of PPE for CBRN events



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Setting protection requirements

- Model dispersion based on type, size of release
- Select various categories of worst-case agents, based on toxicity, ability to penetrate protective systems
- Establish acceptable exposure levels based on reasonable assumption of risk for single, acute exposure conditions
- Understand responder roles and locations

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Guidance document

- **Selection and use of personal protective equipment for the Canadian first responder to a CBRN terrorism event: Interim Guidance Document (Oct. 2005)**
  - Found at http://www.rmc.ca/academic/chem/research/crti/projectreports_e.html

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Table 2. Protection requirements for an unknown small-scale release event.

Event	PPE class	Zone/Protection requirement	Suggested style	Relevant standards	Other comments
Unknown small-scale release	RPD	Initial isolation zone: NIOSH SCBA CBRN equivalent protection, SWPF of > 20,000	SCBA	NIOSH CBRN approved SCBA	30 minute total time in isolation zone followed by immediate decontamination.
	DPE	Initial isolation zone: NFPA 1991 (2005 edn) protection	Totally-encapsulating vapour tight (Level A) suit	NFPA 1991 (2005 edn)	Full skin decontamination should be implemented on exit to support zone after 30 minutes.
	RPD	Support or protective action zone: SWPF of > 10,000 and protection against 40,000 $mg.min.m^{-3}$ of chemicals of most concern	SCBA Other ASR APR or PAPR	NIOSH CBRN approved SCBA None None	Use for several hours makes ASR/APR/PAPR use more practical No ASR/APR/PAPR have been demonstrated to have required capability
	DPE	Support or protective action zone: NFPA 1994 (2006 edn) class 2 equivalent protection; plus Class 2 shower test for decon role	Class 2 or similar	NFPA 1994 (2006 edn), or NFPA 1971 (2006 edn), CBRN option, for firefighter turnout gear	

Major issues identified: respiratory protection

- **CBRN-approved SCBA must be used in isolation zone until magnitude of event has been established**
- **If scale/nature of release can be estimated**
  - If large-scale chemical released, then APR cannot be used even in support/protective action zones
  - If small-scale rad, bio incident, APR use is possible in support zone/protective action zones
    - APR use may be possible in isolation zone if event identified as rad/bio

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Major issues identified: respiratory protection

- **Chemicals of concern have been identified against which NIOSH CBRN-approved or military air purifying respirators may not provide sufficient protection**
  - Canadian standard should include requirements for protection against these chemicals for small-scale events in support/protective action zones
  - Existing active carbon systems are being investigated for their performance
  - Modeling is being performed in order to assist in improved design
  - Plan to develop new APR cartridges

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Major issues identified: respiratory protection

- **Fitting of respirators and workplace protection factors have significant impact on ability of air-purifying respirators to provide adequate protection**
  - Procedure for rapid on-site fit-testing for fundamental fit of respirator using condensation nuclei counters has been developed
- **Appropriate individual fit-testing for high protection levels is a requirement**
  - NIOSH CBRN APR requires laboratory PF of 2,000
  - However higher PFs should be achievable/desirable during individual fit-testing

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Major issues identified: body protection

- **Have provided input to *NFPA 1994 (2006 edn)* and *NFPA 1971 (2006 edn)* in order to bring standards requirements more closely in line with types of chemical hazards and updated toxicity estimates, using MIST assessments for certification**
  - Focus on hazmat/fire requirements
  - Comfort/burden specifications have been improved
  - Still over-emphasis on “total” rather than “toxicologically relevant” protection
    - More information on dermally toxic chemicals needed

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Major issues identified: body protection

- **A number of garments for hazmat response and turnout gear for CBRN rescue are under development by industry and US government teams**
  - are being evaluated against NFPA 1994 and 1971 (2006 edn) requirements

Major issues identified: body protection

- **Garments certified against standard will not be available till 2006**
- **Garments are particularly focused on isolation zone and decon team requirements**
- **Canadian standard is planned to include more classes of clothing**
  - To ensure match between functional requirements and minimal burden vs required protection for all categories
  - Need to understand performance and capabilities of air-permeable active carbon garments

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Major issues identified: systems integration

- **Systems should be certified with clothing and respirator worn together**
- **Integration between respirator, clothing, specialized helmets is critical**
    - Current NIOSH approval procedures do not measure respiratory protection of system

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The way ahead

- Continue to develop realistic performance evaluation methodologies for certification
- Continue to model and measure performance
- Work with CSA and CGSB to establish Canadian standards committee (summer 2006) for standards in 2008/9
- Work with industry to assist in development of appropriate systems to meet projected standards requirements (Canadian, NFPA 1994/1971)
- Assist in certification vs NFPA 1994, 1971 (2006 edn)