



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire

CNSC EOC Technical Assessment and Evaluation Initiatives

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18 June 2014



Outline

CNSC – Who are we?

CANDU Technology – What is different?

Response During a Nuclear Emergency

CNSC Emergency Operations Centre

EOC Technical Assessment Section

Technical Assessment Section Tools

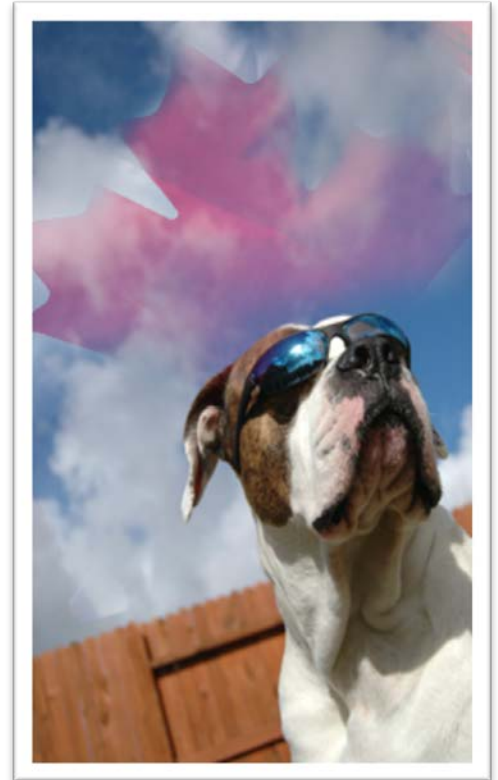


Canadian Nuclear Safety Commission



Regulates the use of nuclear energy and materials to protect the **health, safety** and **security** of Canadians and the **environment**; and to **implement** Canada's **international commitments** on the peaceful use of nuclear energy.

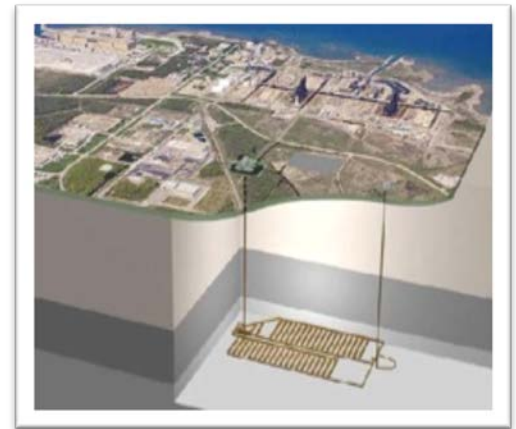
Canada's Nuclear Watchdog



CNSC Regulates All Nuclear-Related Facilities and Activities



- Uranium mines and mills
- Uranium fuel fabricators and processing
- Nuclear power plants
- Waste management facilities
- Nuclear substance processing
- Industrial and medical applications
- Nuclear research and educational
- Export/import control



Major Nuclear Facilities Located Across Canada



- 19 Nuclear Power Reactors on 4 Sites
- 6 active uranium mines/mills in northern Saskatchewan
- 3,300 licences / 2,500 licensees
- 840 staff
- Resources: \$161.5 m
(70% cost-recovered from licensees)



CANDU Core Arrangement

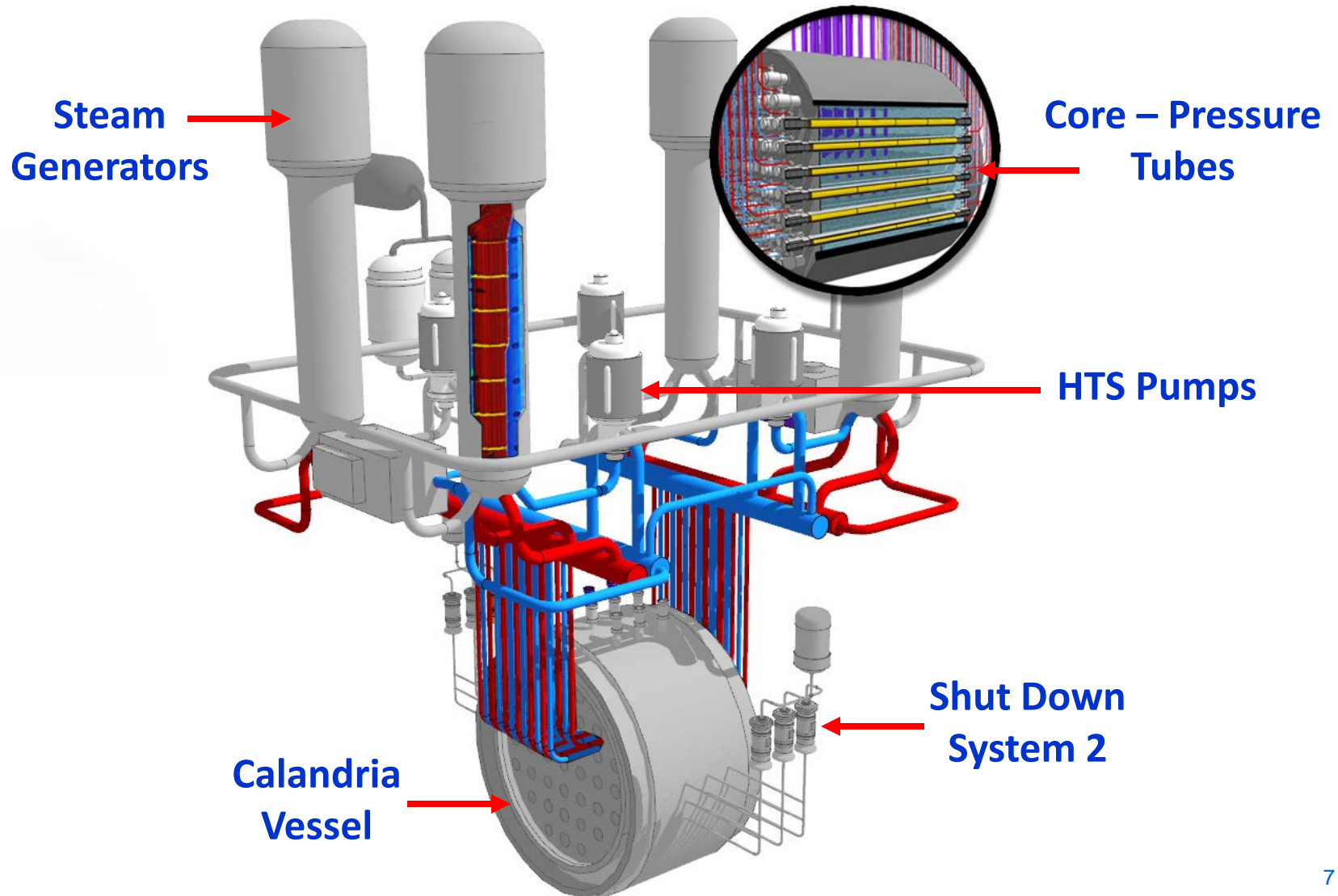


Heavy Water



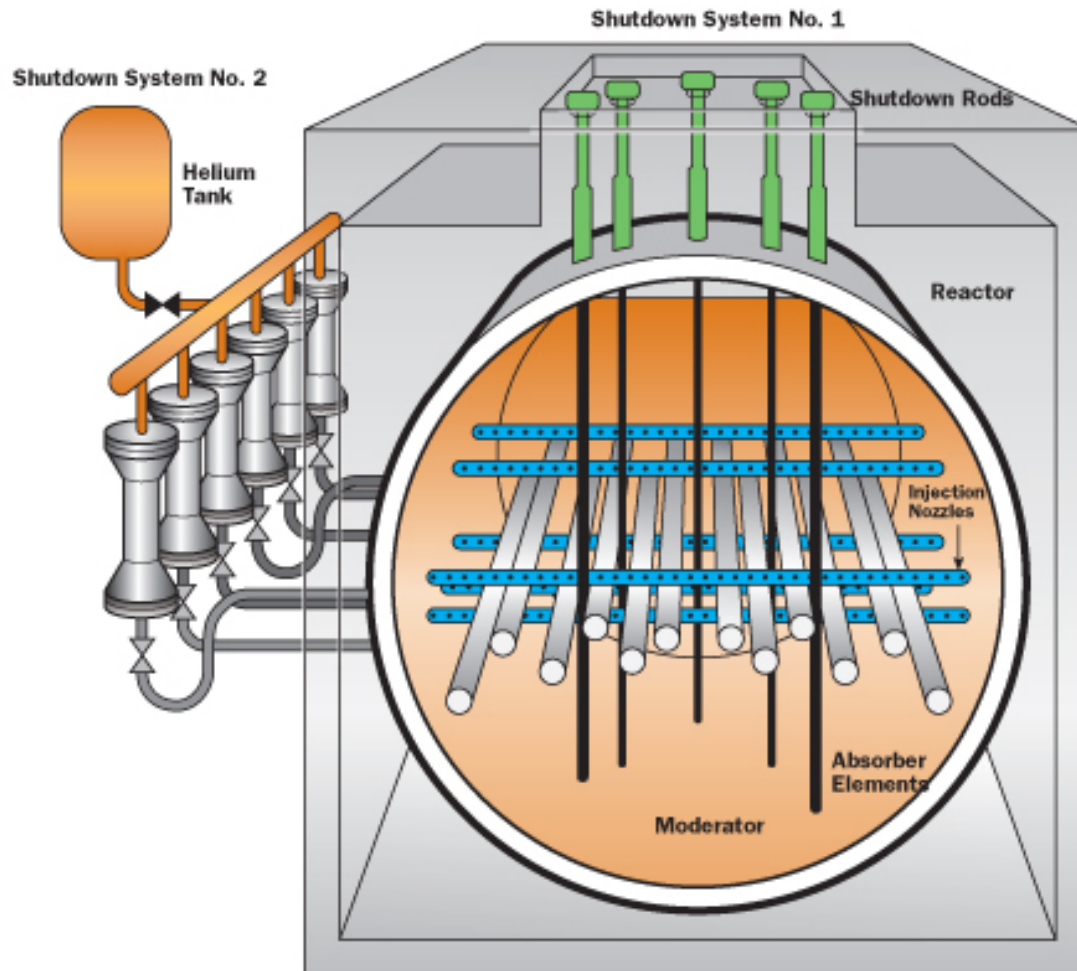
Natural Uranium

CANDU HTS Layout



CANDU Shutdown Systems

CANDU Technology



Overall Response to a Nuclear Emergency

- **Licensees**

- Onsite emergency response

ONTARIOPOWER
GENERATION

BrucePower


Énergie NB Power

- **Provincial & Municipal governments**

- Offsite actions
- Protective actions within their borders



- **Federal Government**

- provides support to province for off-site response
- Through the Federal Nuclear Emergency Plan (FNEP)



Federal Government Emergency Response

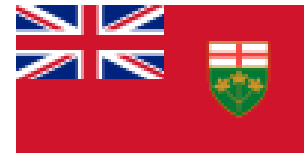
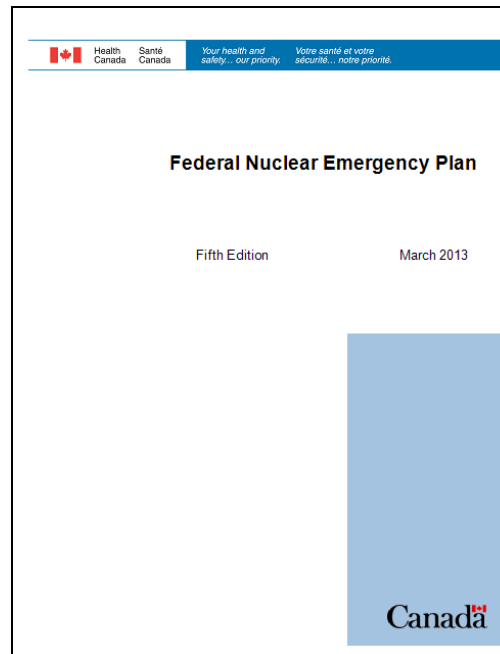
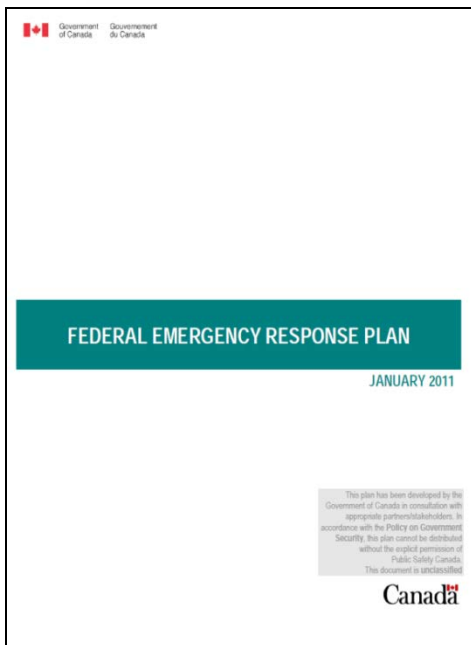


- **Federal Emergency Response Plan (FERP)**
All-hazards plan led by Public Safety Canada.



- **Federal Nuclear Emergency Plan (FNEP)**

An event-specific Annex to the FERP, led by Health Canada

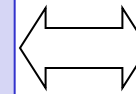


Where CNSC Fits In

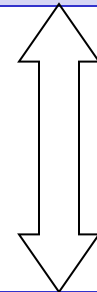


Government Operations Centre

- Technical Assessment Group
 - CSNC is a member



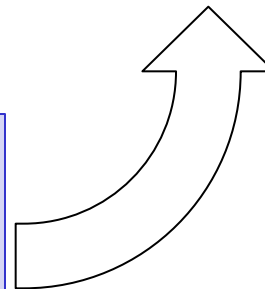
CNSC EOC



Licensee

Provincial Operations Centre

- Municipalities
- Licensee
- CNSC has two seats



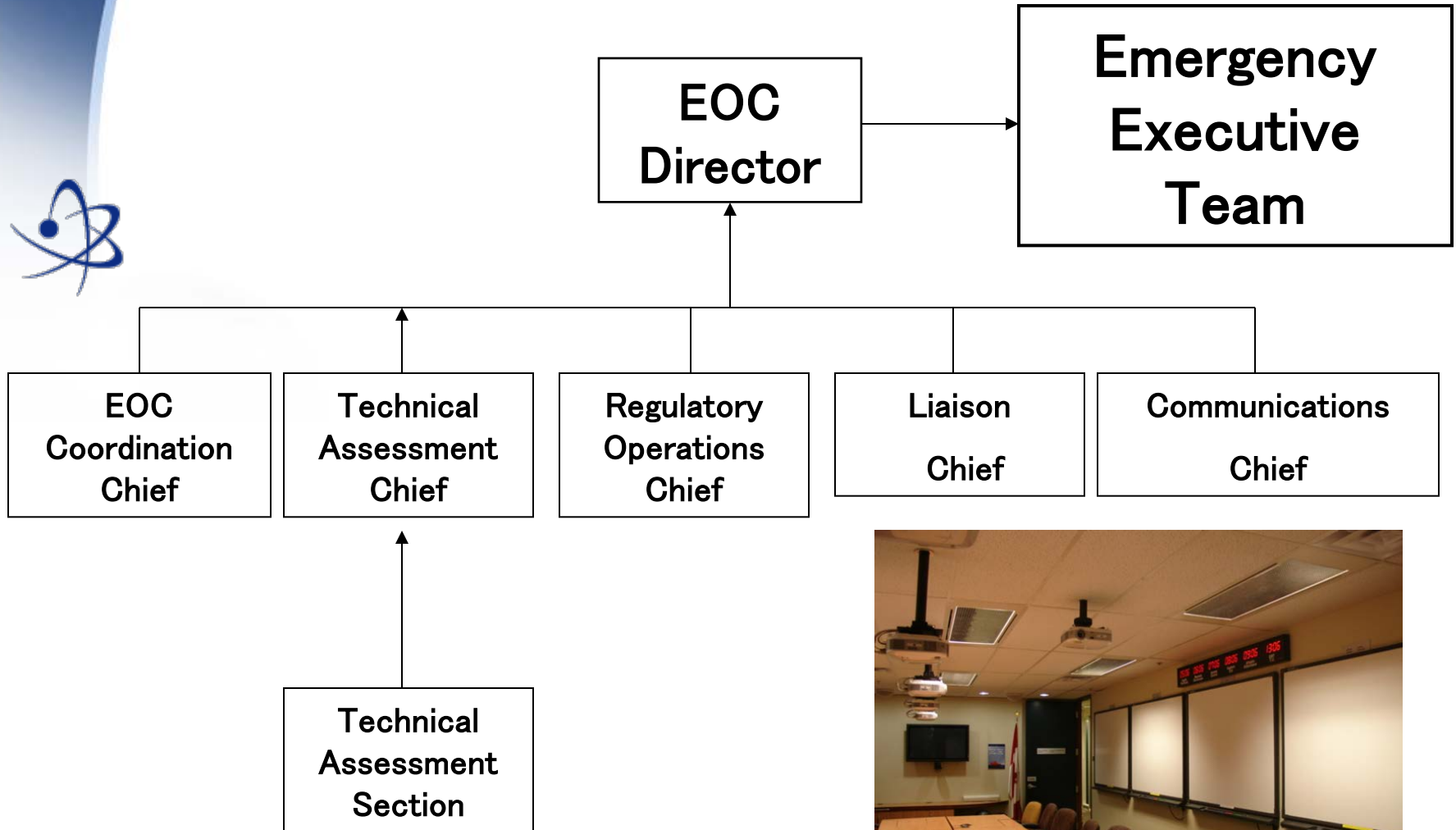
Canadian Nuclear Safety Commission Mandate

Emergency Operations

1. CNSC maintains regulatory oversight of nuclear emergency activities of the licensee.
2. The CNSC participates in Canada's whole-of-government response.



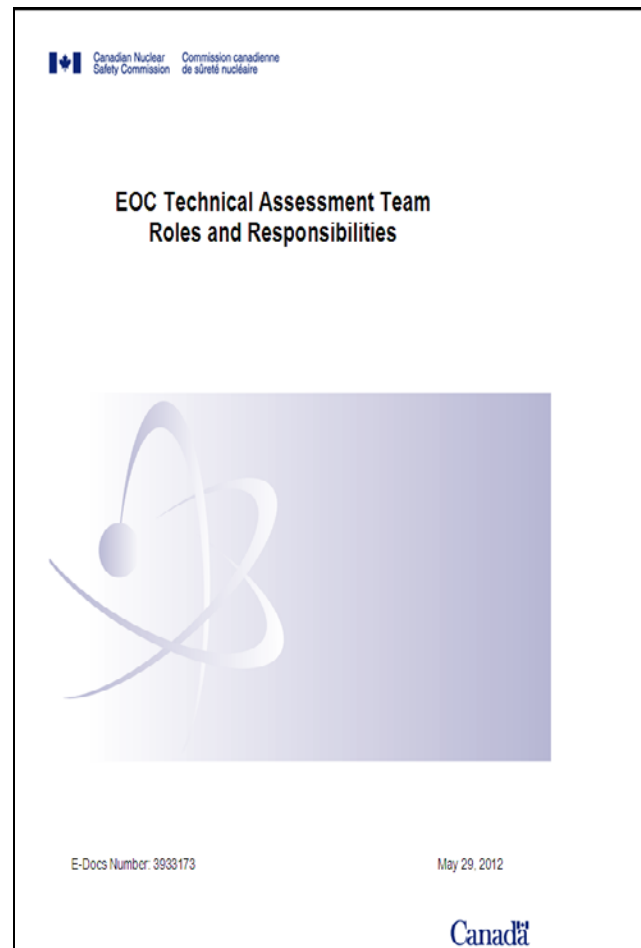
CNSC Emergency Operations Centre



Roles and Responsibilities

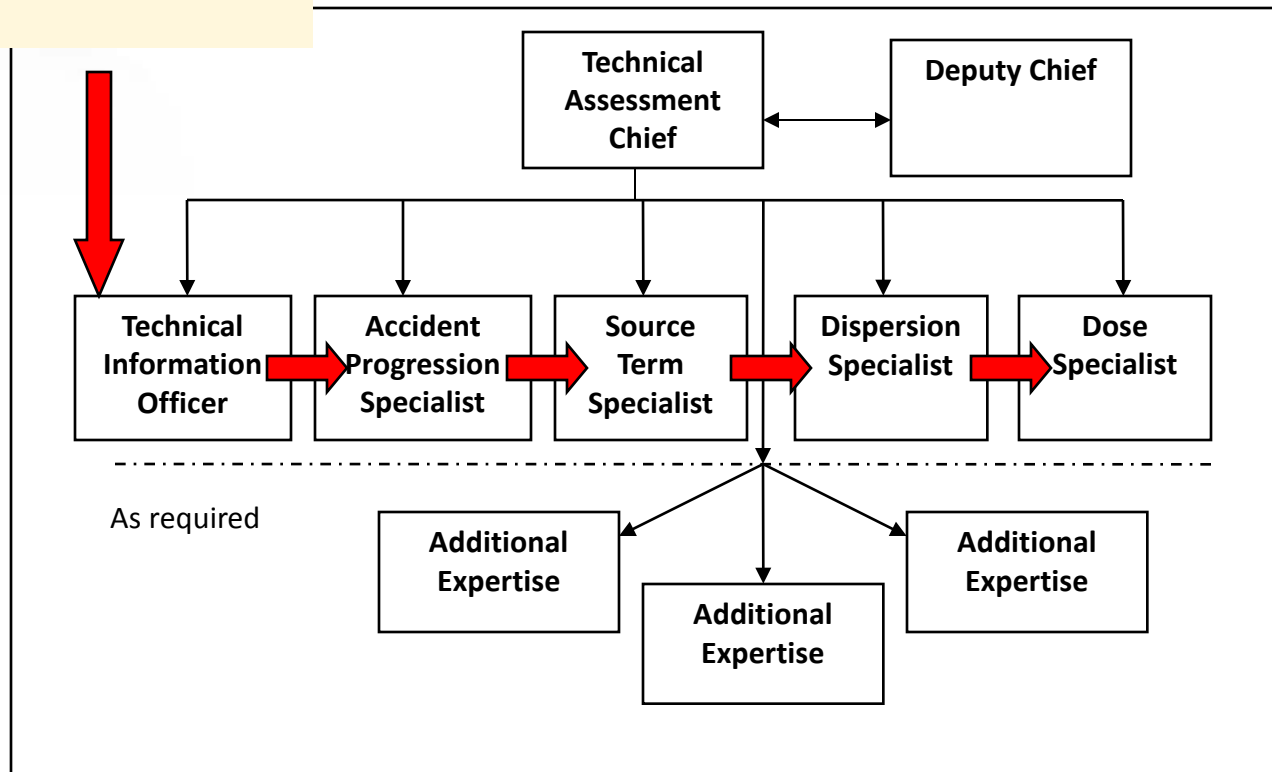
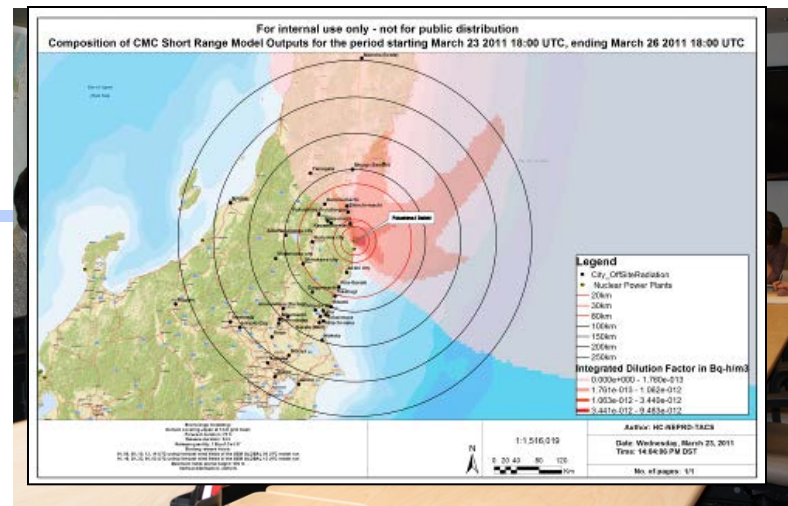
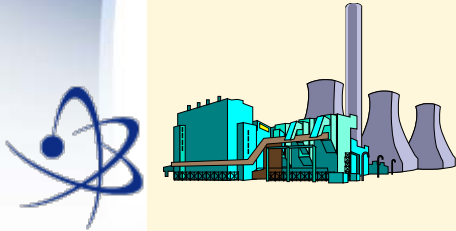
EOC Technical Assessment Section provide information and advice on:

- Accident progression
- Source term calculation
- Radioactive Dispersion
- Site and public dose

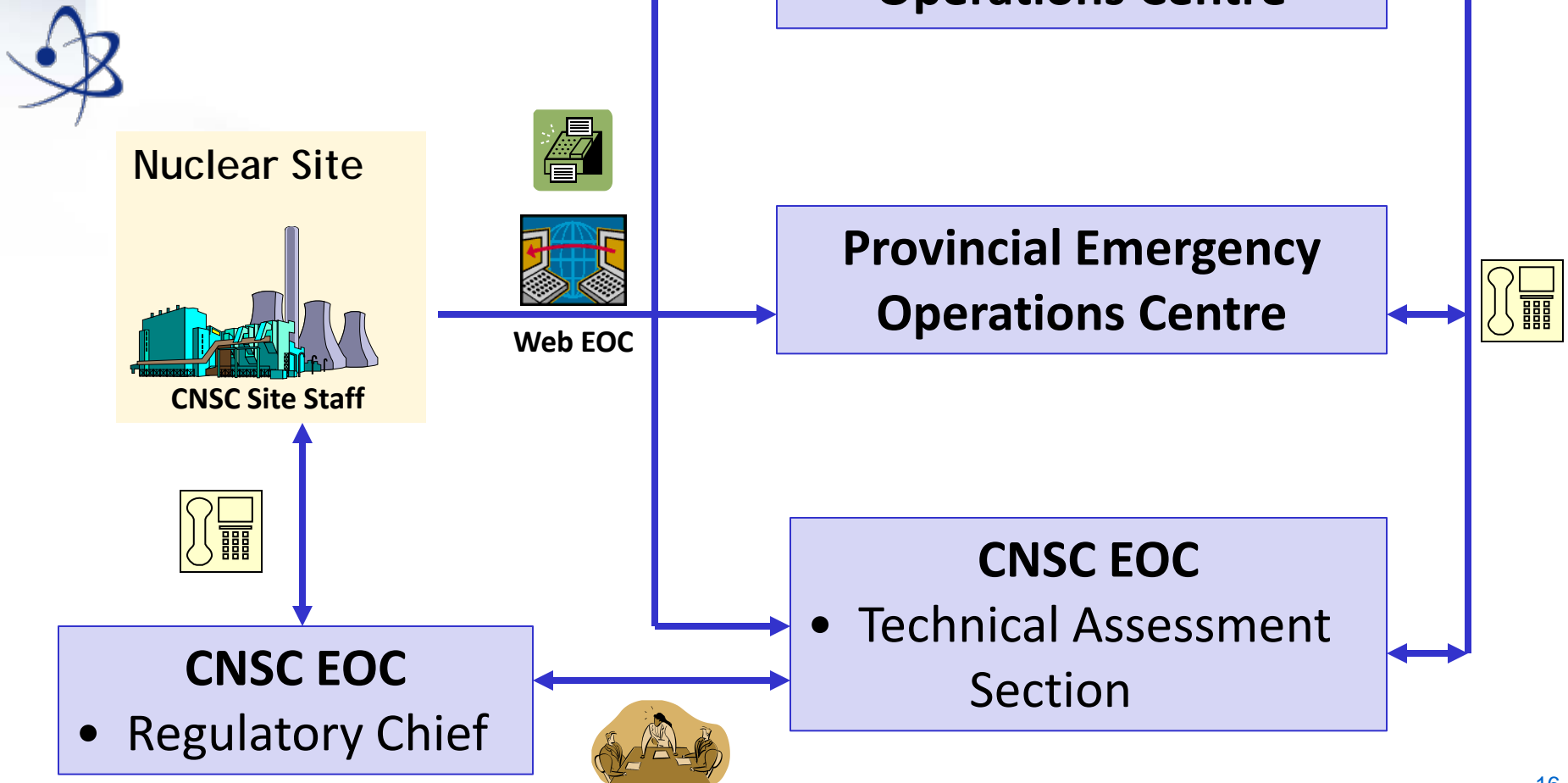


Technical Assessment Section

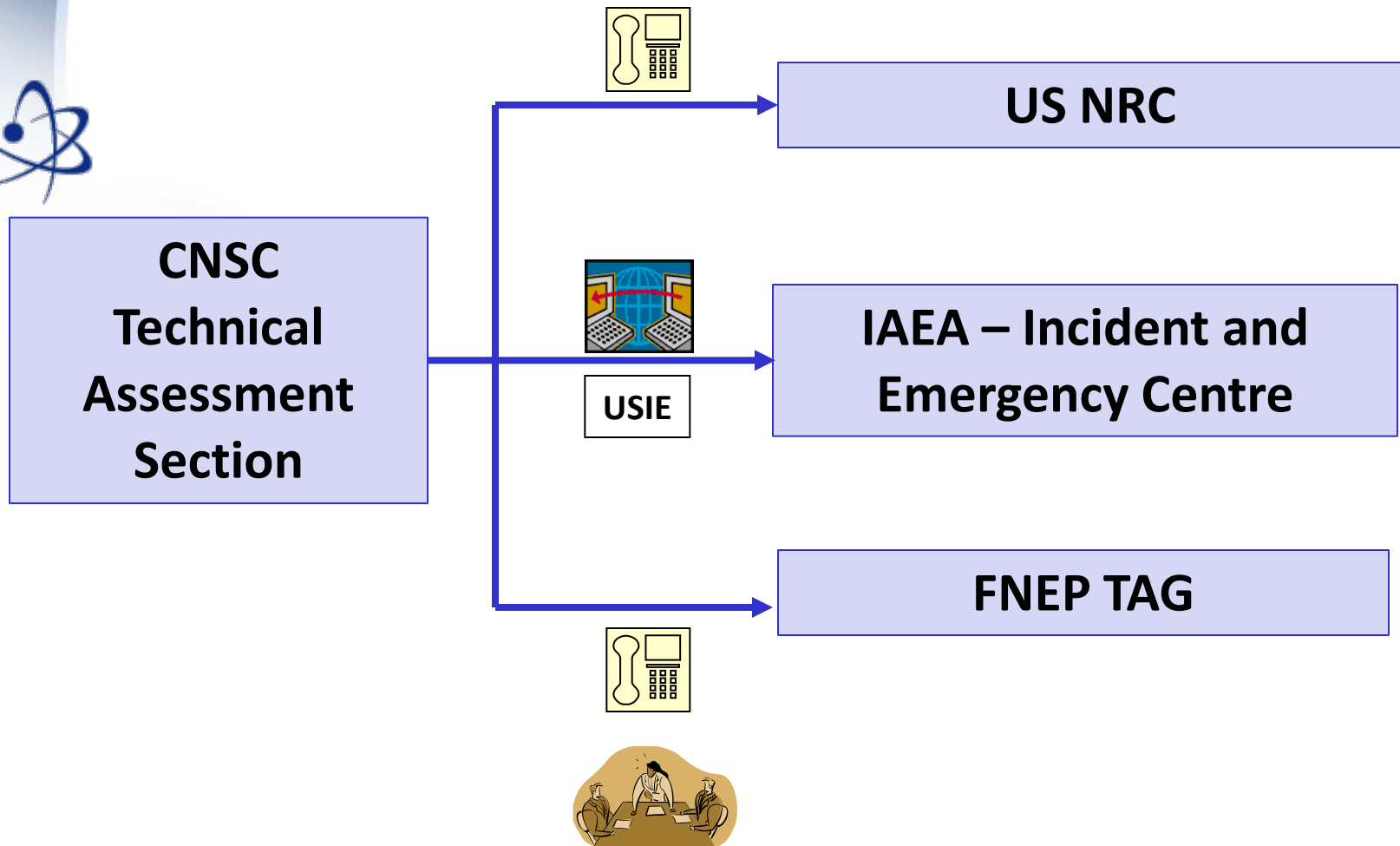
Nuclear Site



Information Flow – Plant Parameter Data



Information Flow – Federal and International



Tools used by Technical Assessment Section

Accident Progression Specialist – NPP Accident handbook.

Source Term Specialist – VETA

Dispersion Specialist – RASCAL & ERP

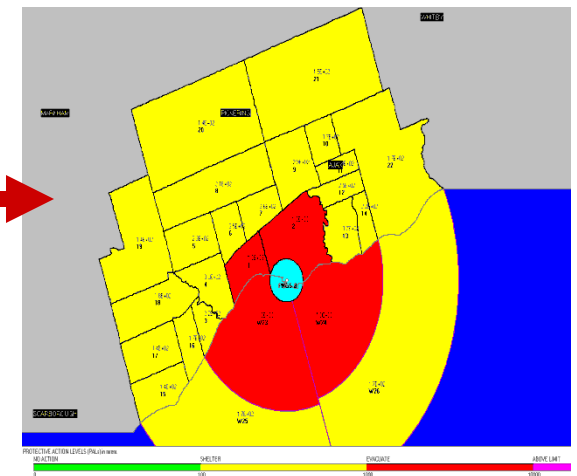
Dose Specialist – RASCAL and associated standards



Accident Progression Analysis



Source Term Calculation



Dispersion and Dose Assessment

Accident Progression Specialist Tools

NPP Accident Handbook

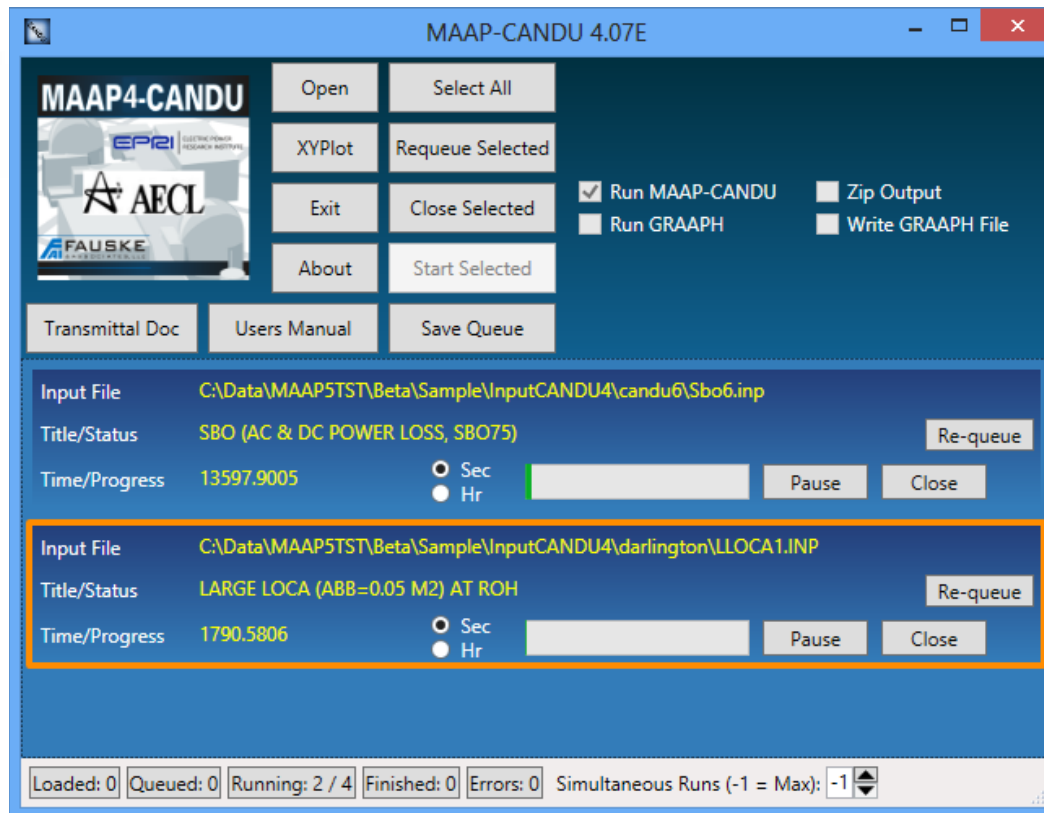
Compilation of MAAP-CANDU Severe Accident Analysis
Complete data set of plant systems with drawings
Contains SAMG package
Presently available for PLGS and DNGS



Accident Progression Specialist Tools

MAAP GRAPE - GRaphical Assessment Package Extension

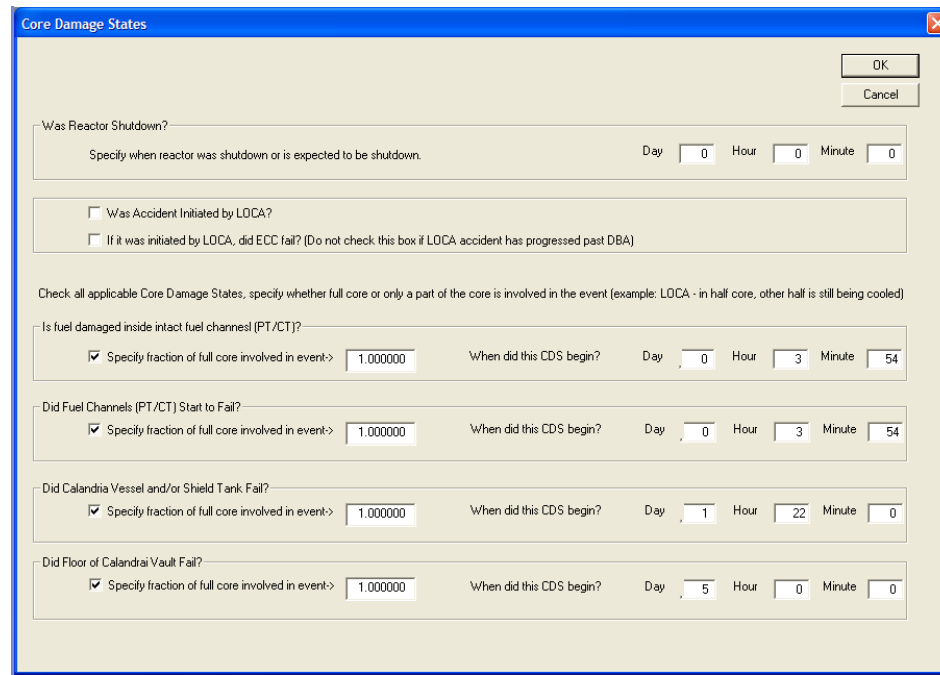
- A software package to visually display MAAP-CANDU results. Work being done by FAI.
- Final version presently being tested by AECL.



Tools Source Term Specialist

VETA

- Developed in house
- Used to predict releases from CANDU reactors
- Has a database of all Canadian reactors



The screenshot shows a software window titled "Core Damage States" with a standard Windows-style title bar (blue with a red close button). The window contains several sections for data entry:

- Was Reactor Shutdown?**: A section with a text prompt "Specify when reactor was shutdown or is expected to be shutdown." and three spinners for Day (0), Hour (0), and Minute (0). There are "OK" and "Cancel" buttons at the top right.
- Was Accident Initiated by LOCA?**: A section with two checkboxes: "Was Accident Initiated by LOCA?" (unchecked) and "If it was initiated by LOCA, did ECC fail? (Do not check this box if LOCA accident has progressed past DBA)" (unchecked).
- Is fuel damaged inside intact fuel channels (PT/CT)?**: A section with a checked checkbox "Specify fraction of full core involved in event->" and a spinner set to 1.000000. It also has a "When did this CDS begin?" section with Day (0), Hour (3), and Minute (54) spinners.
- Did Fuel Channels (PT/CT) Start to Fail?**: A section with a checked checkbox "Specify fraction of full core involved in event->" and a spinner set to 1.000000. It also has a "When did this CDS begin?" section with Day (0), Hour (3), and Minute (54) spinners.
- Did Calandria Vessel and/or Shield Tank Fail?**: A section with a checked checkbox "Specify fraction of full core involved in event->" and a spinner set to 1.000000. It also has a "When did this CDS begin?" section with Day (1), Hour (22), and Minute (0) spinners.
- Did Floor of Calandria Vault Fail?**: A section with a checked checkbox "Specify fraction of full core involved in event->" and a spinner set to 1.000000. It also has a "When did this CDS begin?" section with Day (5), Hour (0), and Minute (0) spinners.

Dispersion Specialist Tools

RASCAL (Radiological Assessment System for Consequence Analysis)

Developed by Oak Ridge

- Used by USNRC
- Used by CNSC staff to model Fukushima
- Has a database of every American (and Mexican) power reactor

VETA

Vermont Yankee Test.STD - Source Term to Dose Model

File Options Nuclide Data Viewer Site / Facility Data Viewer Help

Follow the steps below to define and run a problem. Use the Tabs below to review information.

Event Type
NPP Reactor

Event Location
Vermont Yankee

Source Term
Time Core Is Uncovered

Release Path
Dry Well

Meteorology
Actual Observations

Calculate Doses

Detailed Results

Save Case

Case Summary

Event Type Nuclear Power Plant

Location

Name: Vermont Yankee
City, county, state: Vernon, Windham, VT
Lat / Long / Elev: 42.7803° N, 72.5158° W, 84 m
Time zone: Eastern
Population (2000): 2,912 / 10,385 / 33,759 (2 / 5 / 10 mi)

Reactor Parameters

Reactor power: 1912 MW(t)
Average fuel burn-up: 30000 MWD / MTU
Containment type: BWR Mark I
Containment volume: 1.34E+05 ft³
Design pressure: 56 psig
Design leak rate: 0.50 %/d
Coolant volume: 2.10E+04 gal
Assemblies in core: 368

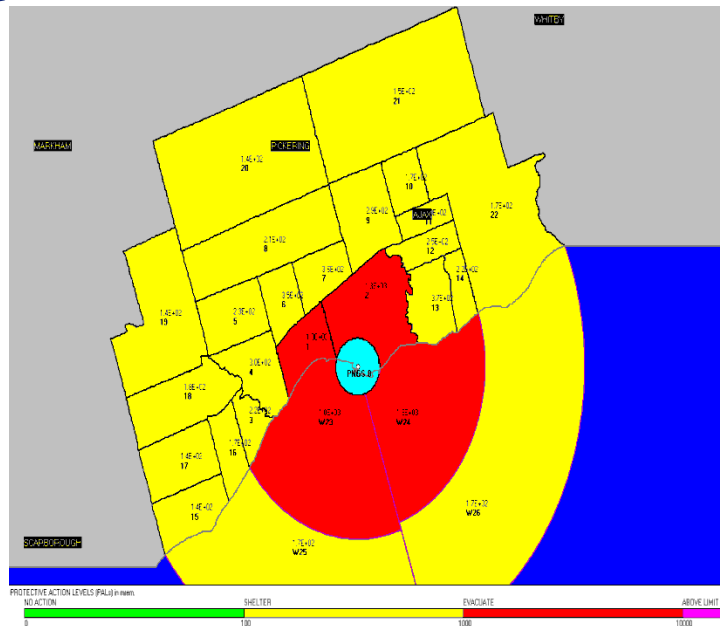
Print

Case Summary Source Term Summary Maximum Dose Values

Dispersion Specialist Tools

Emergency Response Projection (ERP)

- Developed by Ontario Hydro Nuclear Studies and Safety Department
- Used by licensees and the province of Ontario to model accident progression at the Darlington, Pickering, and Bruce sites



Way Ahead

Presently = *Functional* Technical Assessment

Goal – Technical Assessment in-line with best international practice

Path Forward:

1. Bi-Lateral exchange with international regulators:

IRSN

US NRC

2. International Benchmarking Projects:

NEA, CSNI, WGAMA - FASTRUN

IAEA International EOC Benchmarking



Way Ahead

EOC Improvement Project

1. Develop a new *Accident Assessment Tool*
2. Source Term Code for the *Spent Fuel Bay*
3. Improved *Dispersion Mapping with GIS* and real time radiological data
4. IAEA RANET for CANDU Technology
5. Constant improvements to EOC venue.



Summary

In the event of a nuclear emergency the CNSC is ready to respond.

Working with our international partners to continuously improve our response capability.



Thank you – Questions?

