

Dark Days at Pickering

Restarting Pickering Nuclear after
Blackout 2003

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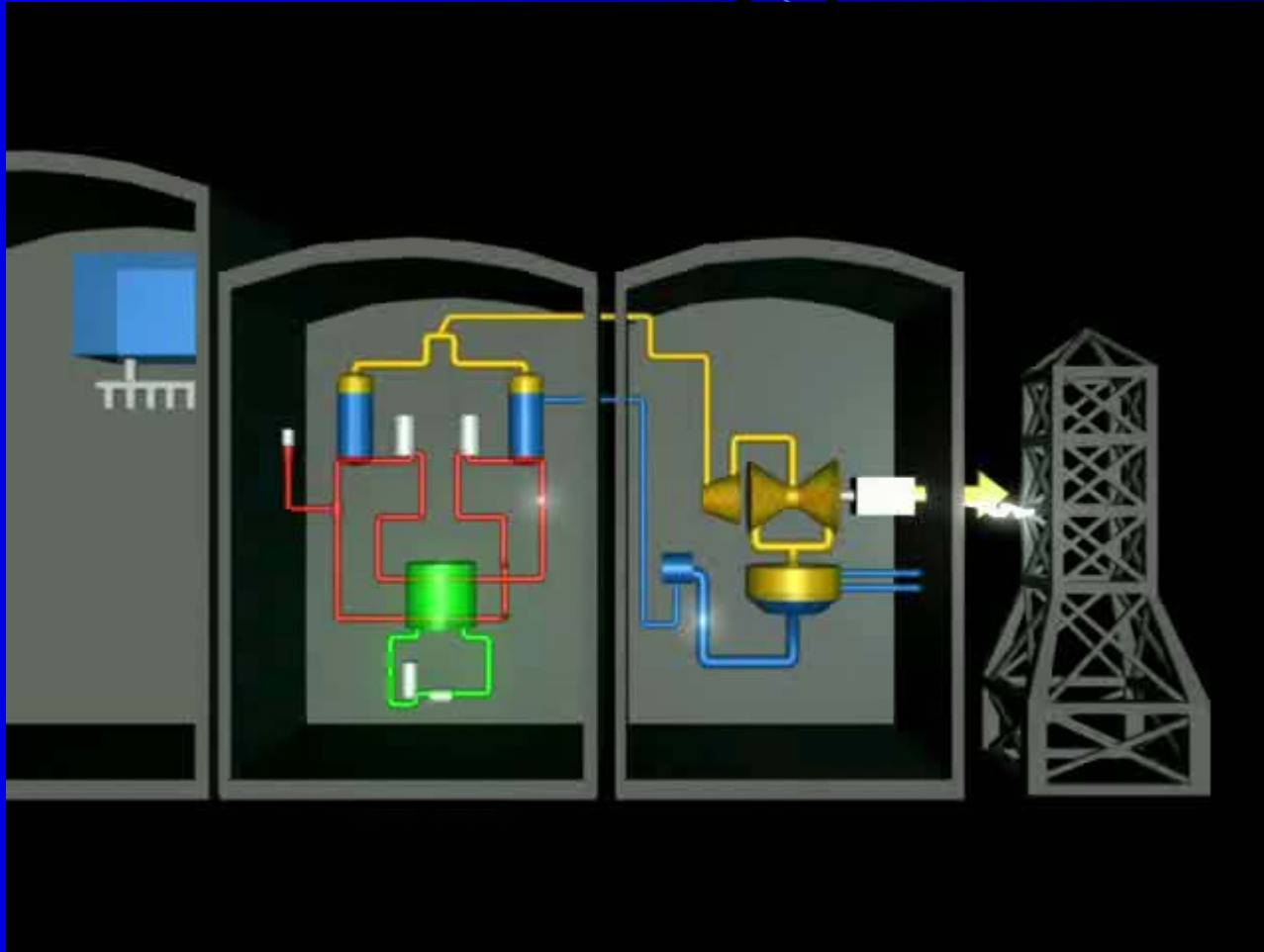
Pickering Nuclear Power Station

Location: Pickering, Ontario

- consists 8 CANDU reactors (Canadian-Deuterium-Uranium)**
- Pickering A consists of Units 1-4, maximum power 515 MW**
- Pickering B consists of Units 5-8, maximum power 516 MW**



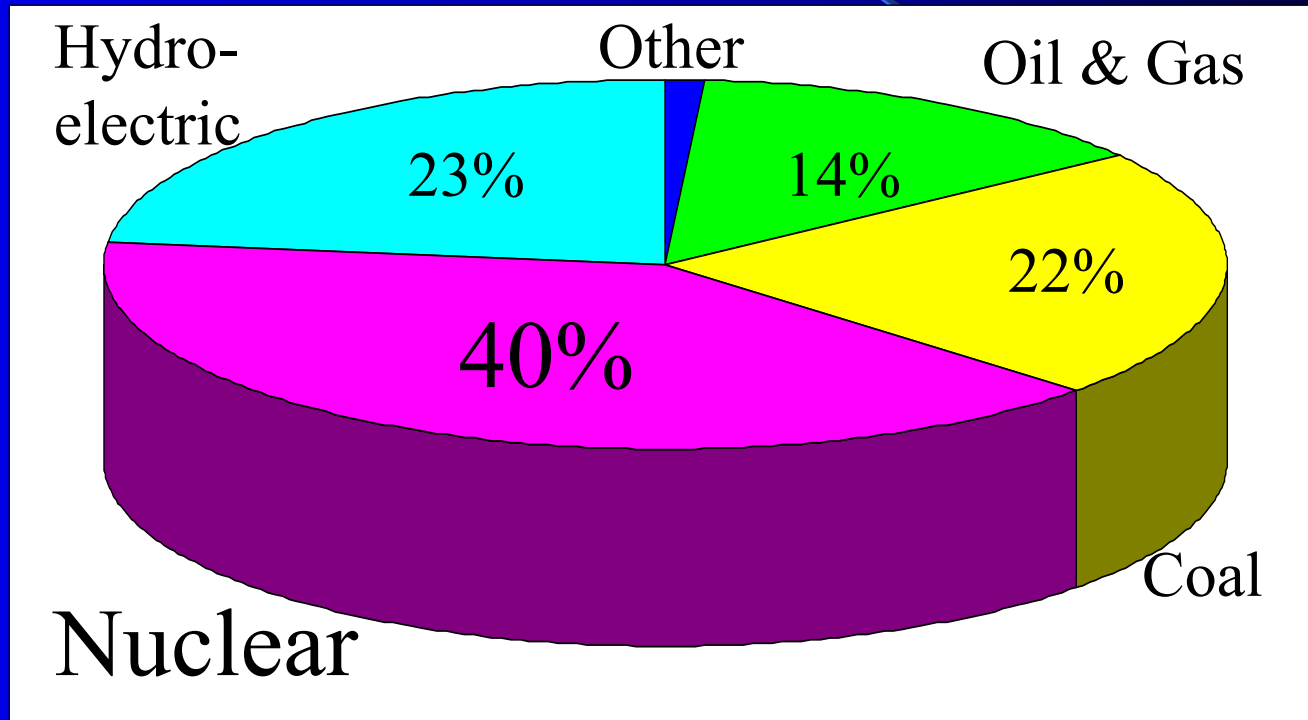
How is electricity produced?



What can trip a reactor?

PARAMETER	EXAMPLE
High Neutron Power	Loss of Reactivity control, LOCA
High Coolant Pressure	LOCA from low power
High Building Pressure	LOCA, steam line break
Low Pressurizer level	Small LOCA
Low steam generator	Steam and feedwater line breaks
Low steam generator pressure	Steam line break

Energy situation in Ontario



At the time of the Blackout, Ontario demanded over 24000 MW of electricity.

What happened August 14th?

4:10 Eastern Standard Time- In Northeastern Ohio failure of several transmission lines and tripping of generators

4:10:38 pm-Main transmission line in that area failed

4:11:00 pm- Pickering Nuclear Station Shutdown

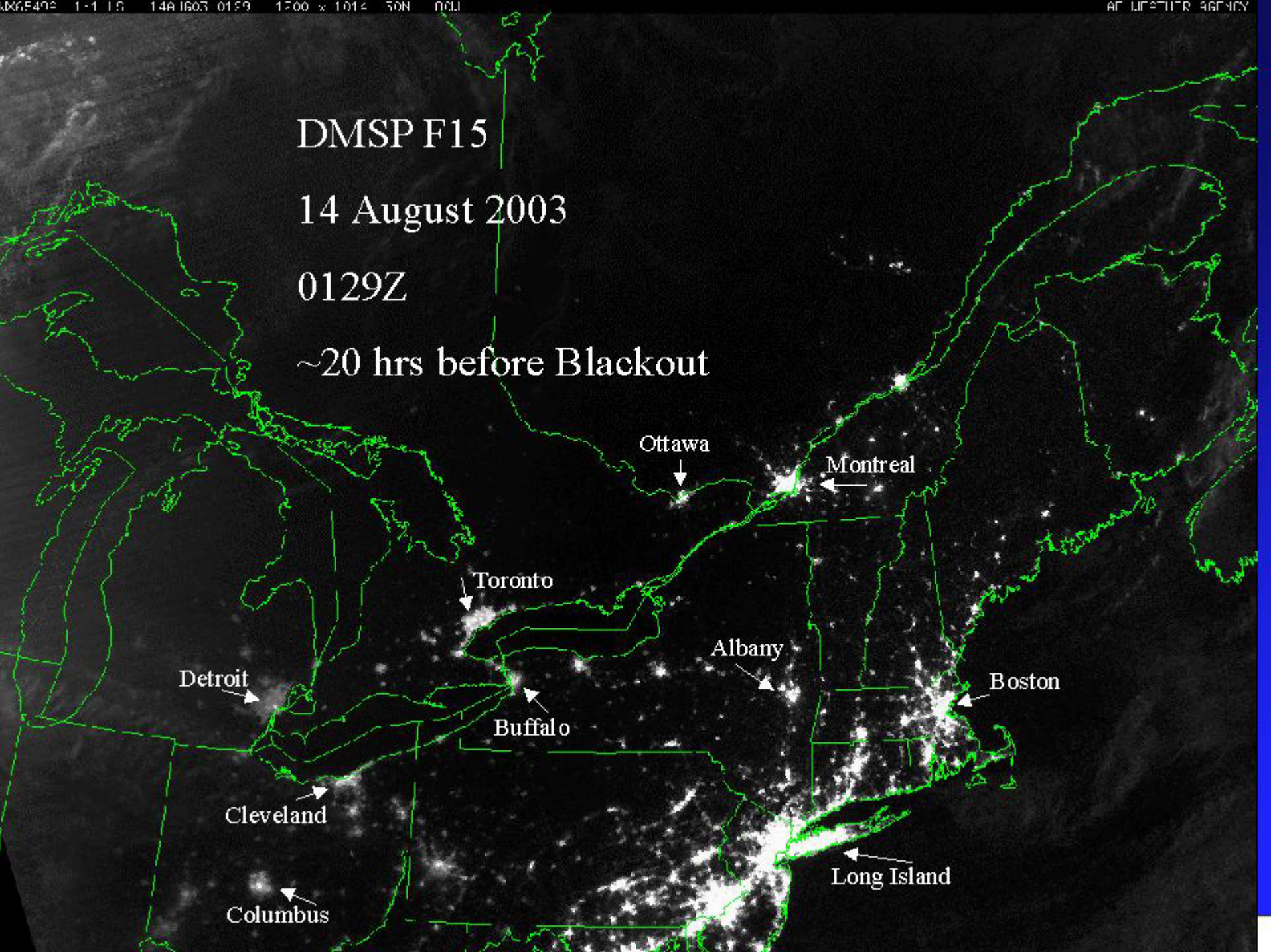
4:13:00 pm- cascading sequence complete

DMSP F15

14 August 2003

0129Z

~20 hrs before Blackout



Detroit

Cleveland

Columbus

Toronto

Buffalo

Ottawa

Montreal

Albany

Boston

Long Island

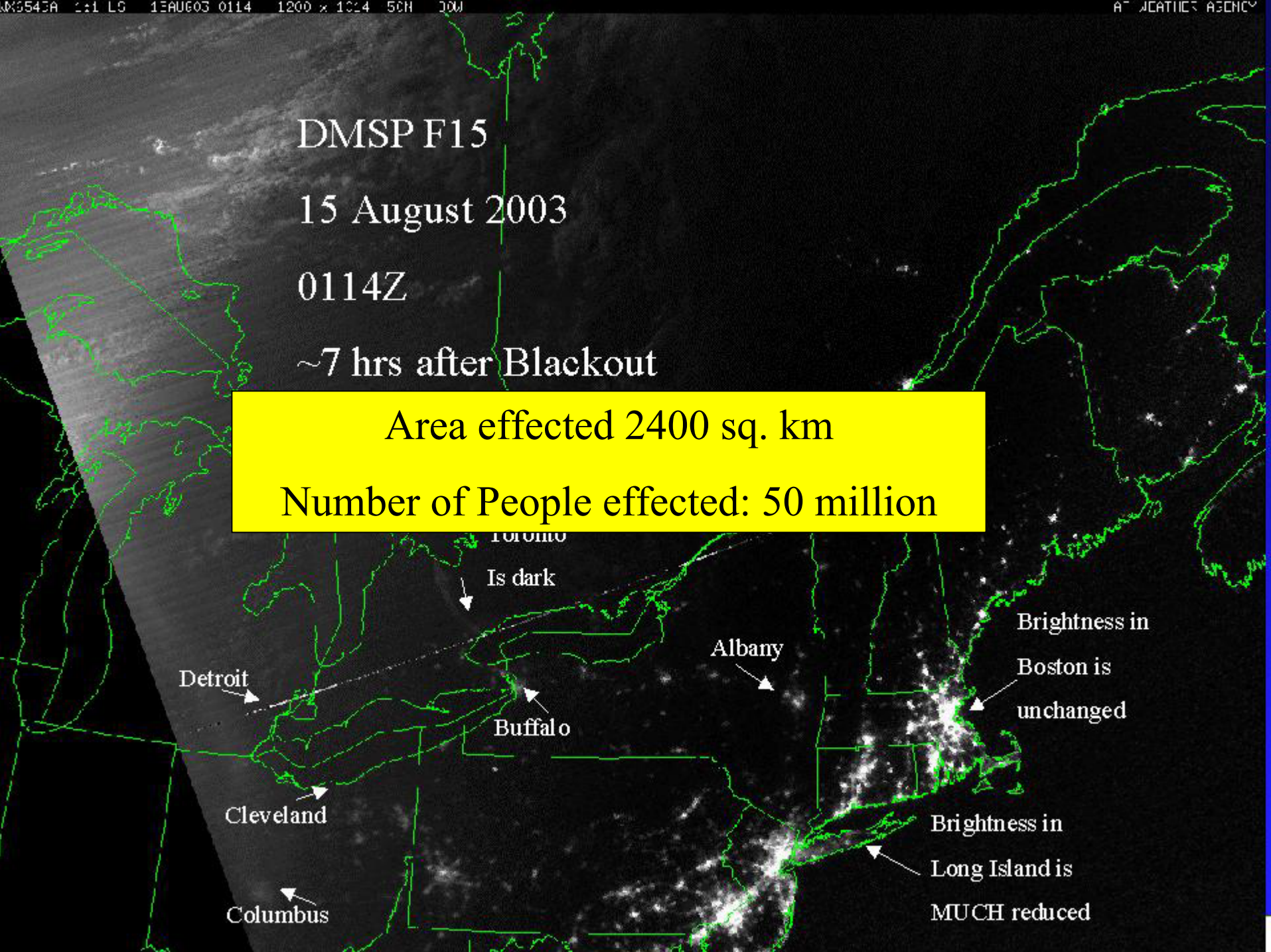
DMSP F15

15 August 2003

0114Z

~7 hrs after Blackout

Area effected 2400 sq. km
Number of People effected: 50 million



Toronto

Is dark

Detroit

Cleveland

Columbus

Buffalo

Albany

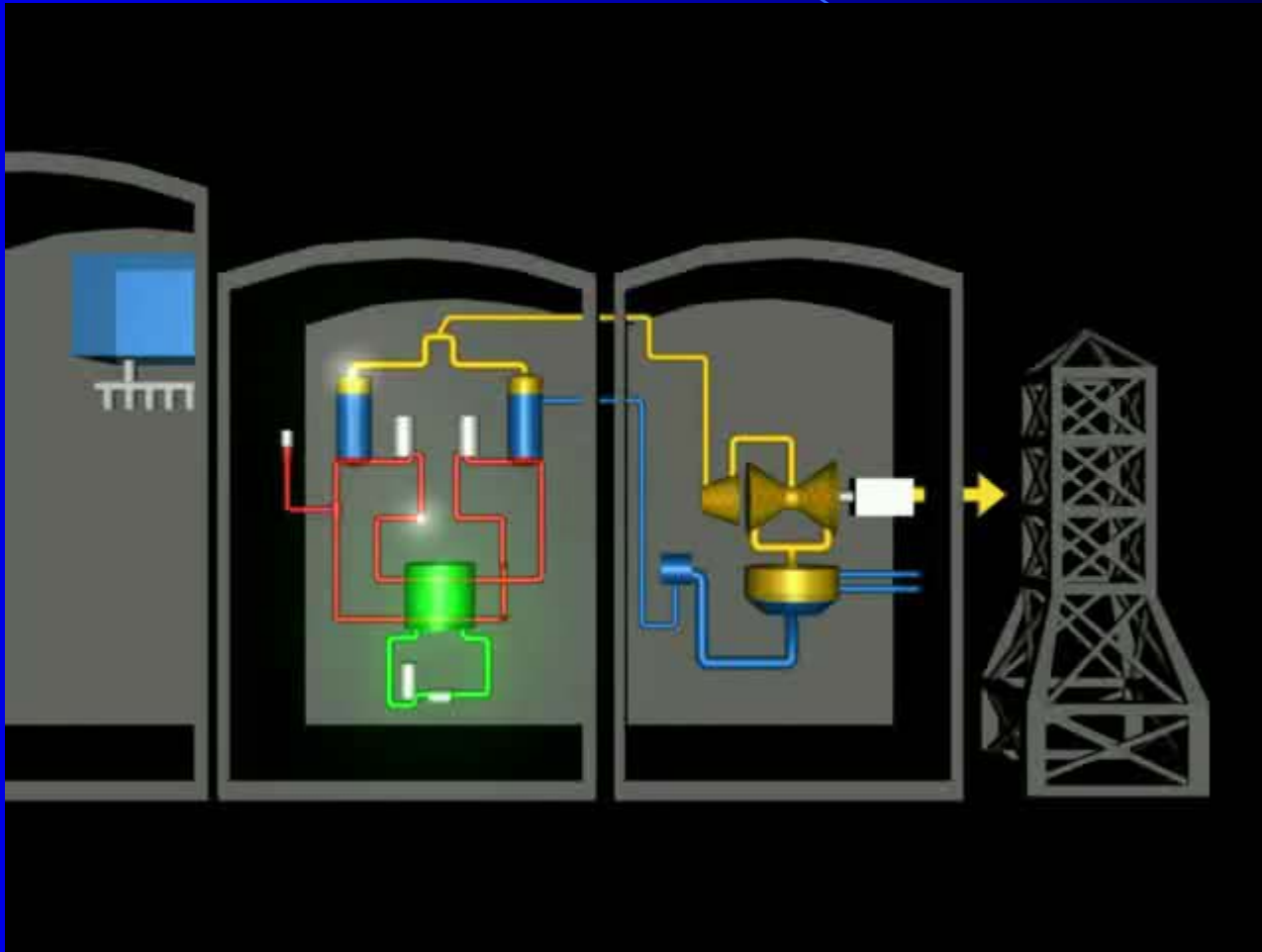
Brightness in

Boston is
unchanged

Brightness in

Long Island is
MUCH reduced

What did this do to Pickering?



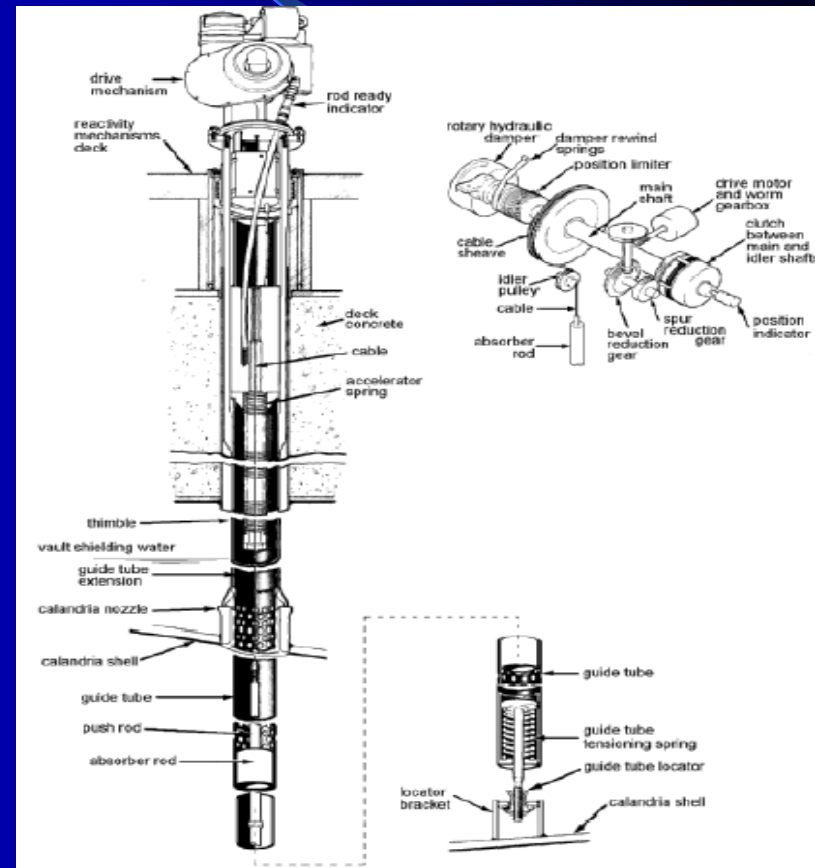
Safety Systems at Pickering

Four safety systems available in Pickering Units

- Shutdown System 1- solid shut off rods are inserted into reactor
- Shutdown System 2- liquid “poison” injected in moderator
- Emergency Coolant Injection System- supplies coolant to all reactor headers
- Containment System- uses pressure to keep contaminants inside building in case of an accident

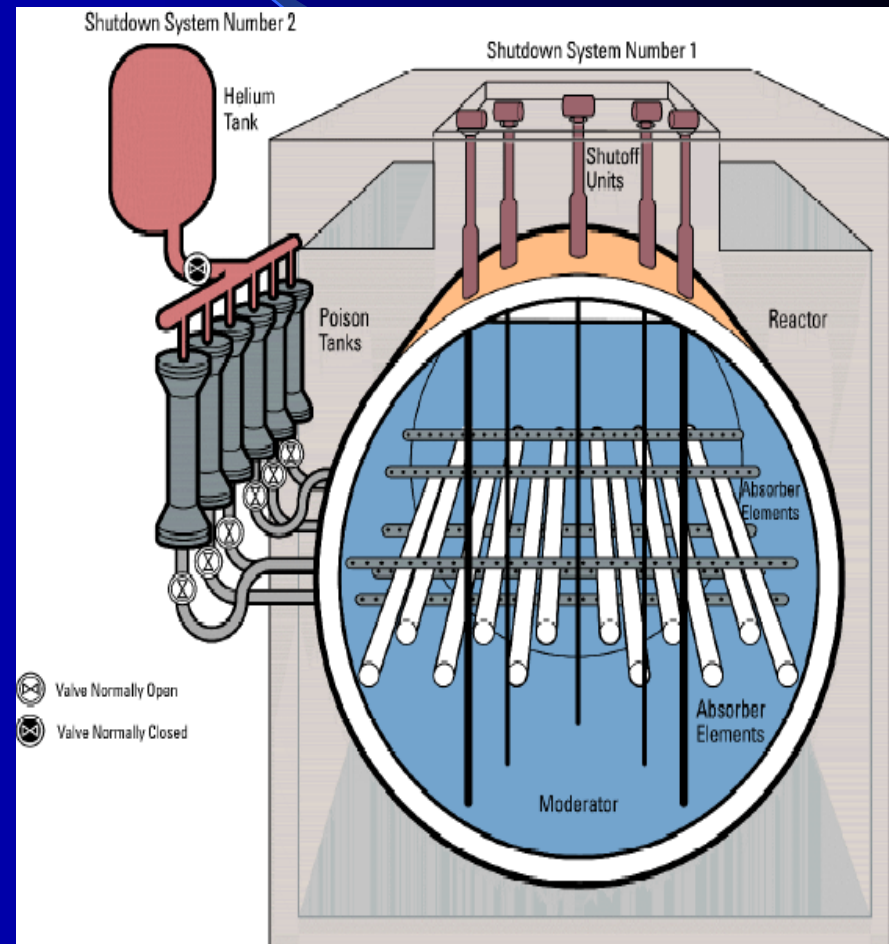
Shutdown System 1 (SDS1)

- Cadmium rods
- Absorbs neutrons and terminates power
- Full insertion takes less than 2 seconds



Shutdown System 2 (SDS2)

- Uses high density neutron absorbing isotopes
- Gadolinium nitrate
- Less than 2 seconds to stop power production



Restarting Reactor after GSS

- Boron is dissolved into the moderator water for long term control
- Dump valves are reset
- Moderator water is pumped into the calandria
- Boron and other poisons are removed through ion exchange system until the reactor is critical
- Total time= 40 hours

Equipment Problems

- Loss of Emergency Coolant Injection System
- Backup system delayed because of faulty pumps
- Not enough standby electrical generating power



Darlington and Bruce stations

- have condenser steam discharge valves
- transfers 100% steam flow, bypassing turbines
- able to keep the reactor working at 60% or more
- no major equipment problems

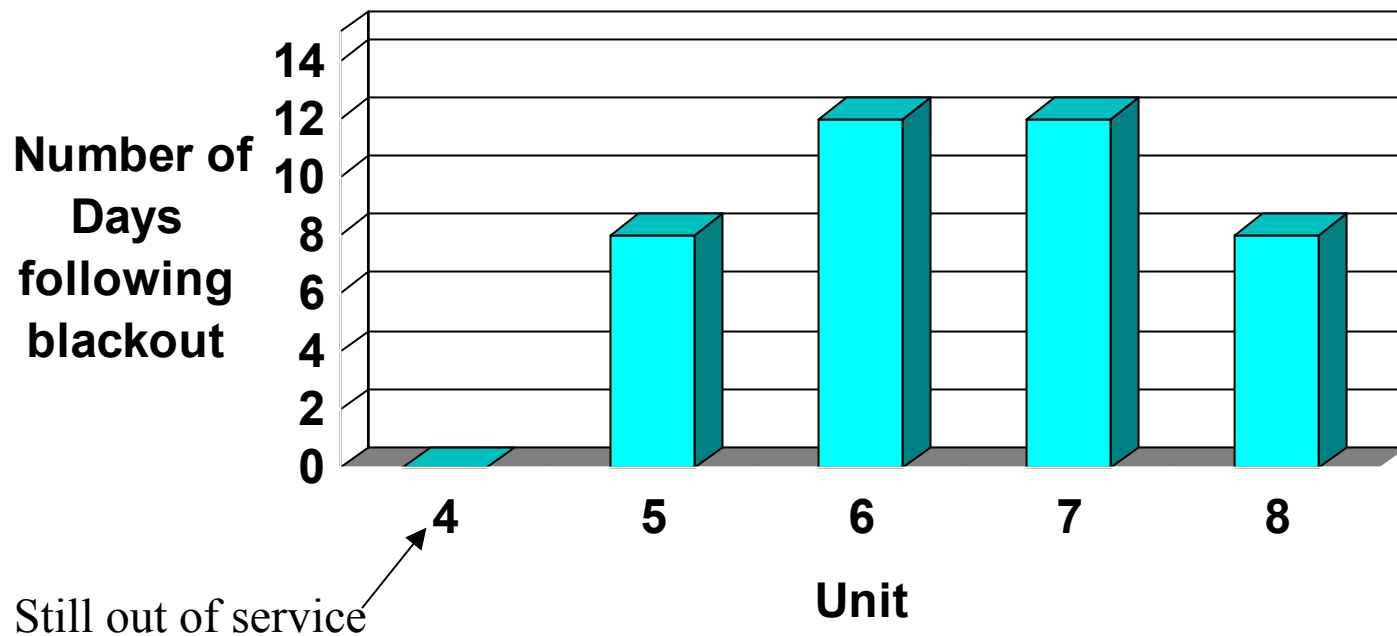


Effect on Radiation Protection Department

- Availability of detection instruments
- Monitoring all exiting personnel for contamination
- Ensure that Health Physicist available at Site Emergency Center
- Provide adequate staffing for 24 hour service

Summary

Restart of Pickering Units



Acknowledgements

- Robin Manley, RHP Pickering Nuclear
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- Enoch Tung, Tech Support ☺

Recommended Site

- <http://canteach.candu.org>