

Belarus NPP is an
Inherently Dangerous Technology

A Slide Show

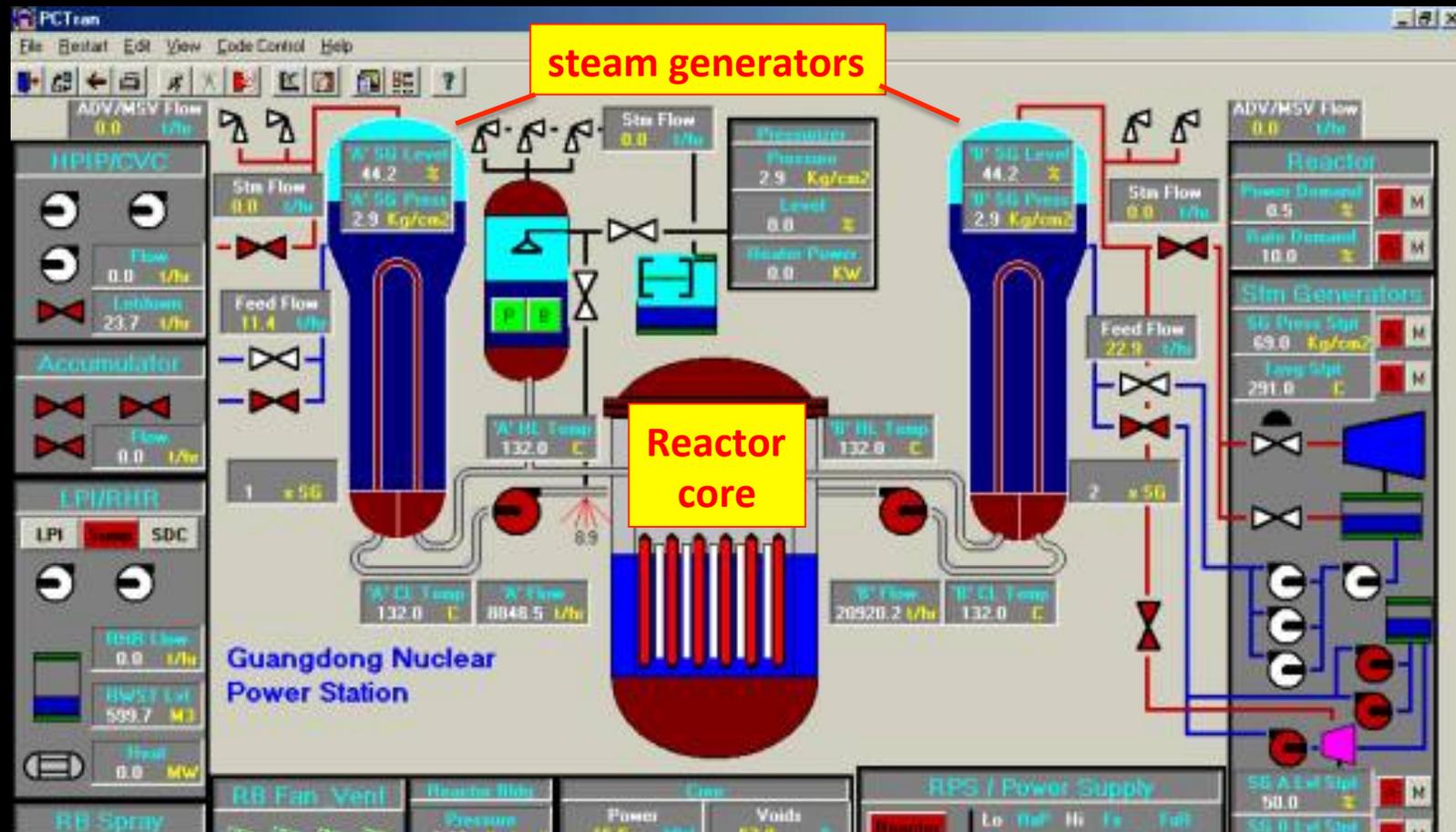
prepared for
the Anniversary of
the Chernobyl Disaster
April 25-26 2017

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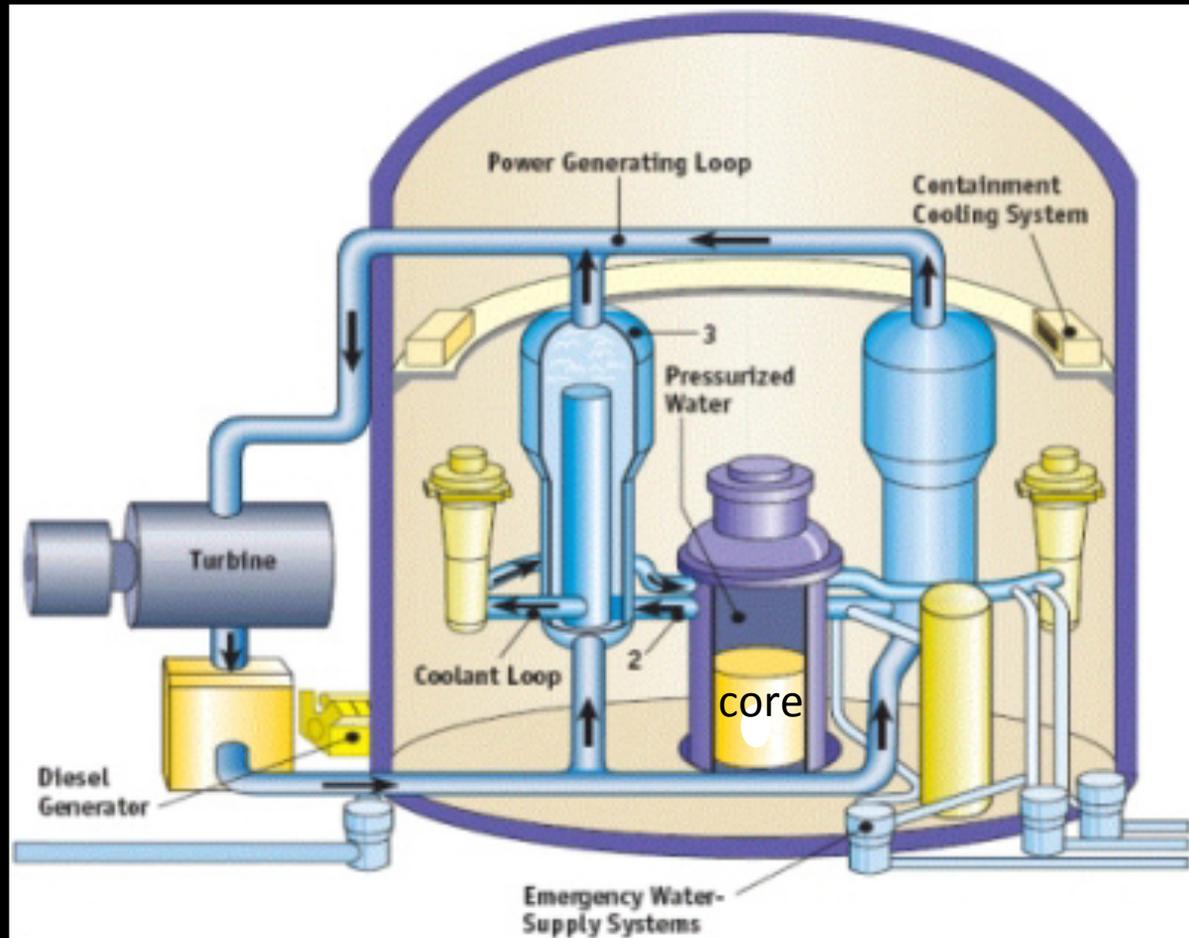
www.ccnr.org

How a PWR nuclear reactor works



1. In the core, uranium atoms are split, releasing heat.
2. The heat boils water in vessels called steam generators
3. The steam is used to spin a turbine to generate electricity.
4. ***But hundreds of unwanted radioactive byproducts are created in the core.***

Every reactor core becomes a warehouse of radioactive poisons.



What makes a nuclear reactor dangerous is anything that allows the nuclear waste to escape from the core.

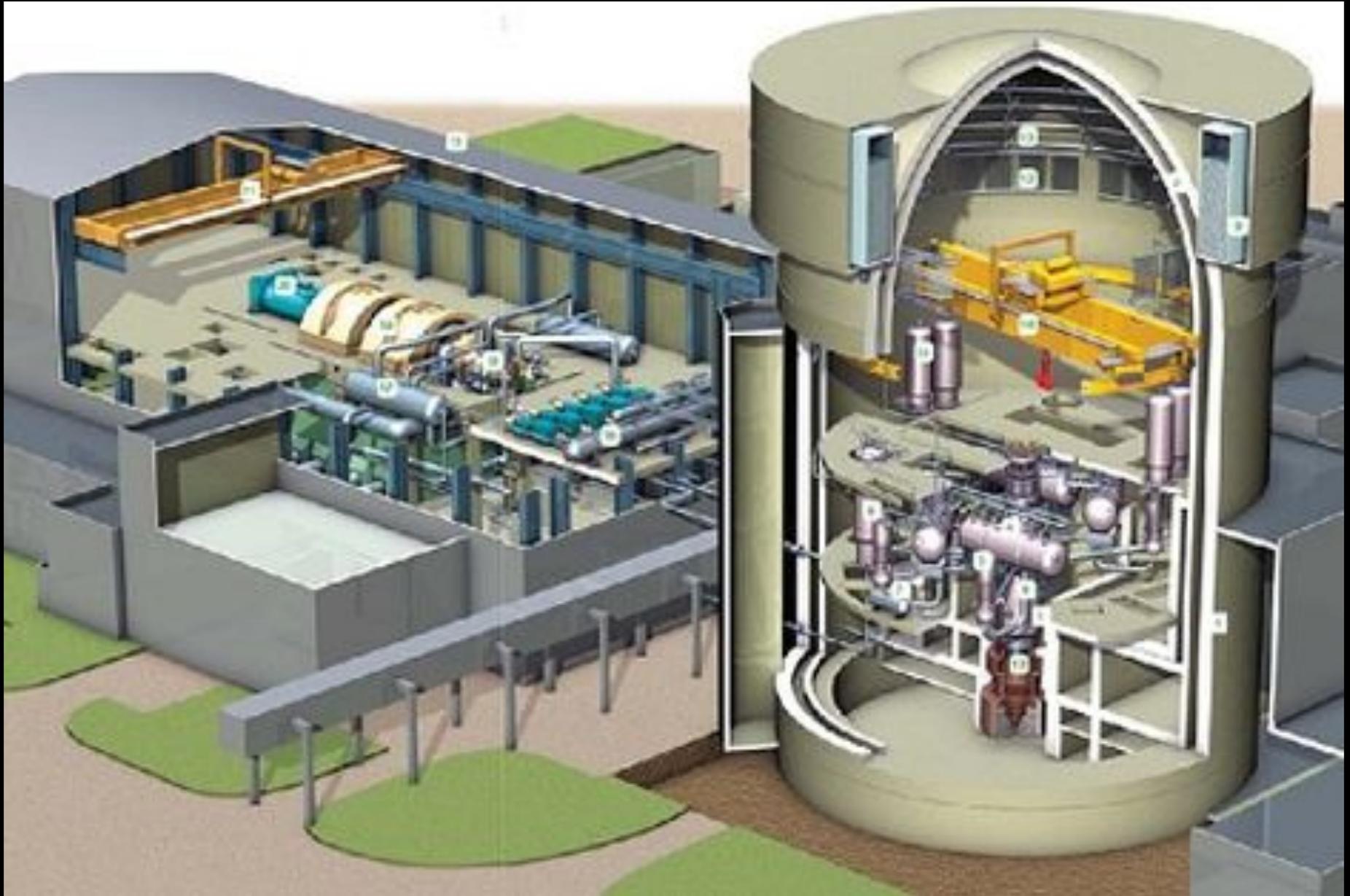
Belarus NPP under construction



Cooling tower on the left.

Nuclear Power Plant on the right.

Inside a V V E R nuclear power plant



Electricity production on the left.

Nuclear reactor on the right.

Reactor vessel for Belarus NPP – the “core”



The core: where nuclear energy is released and radioactive waste is created.

What is Nuclear Energy?

Every atom has a tiny center called the **NUCLEUS**. It is surrounded by one or more orbiting electrons.



Photo: Robert Del Tredici

Chemical energy involves only the exchange of electrons . . .



Battlefield explosion



Forest fire

. . . **but nuclear energy** comes from the nucleus – it is **millions of times more powerful** than chemical energy



H-Bomb Blast

NUCLEAR ENERGY:
NOT SO MUCH
EXPERIENCE !

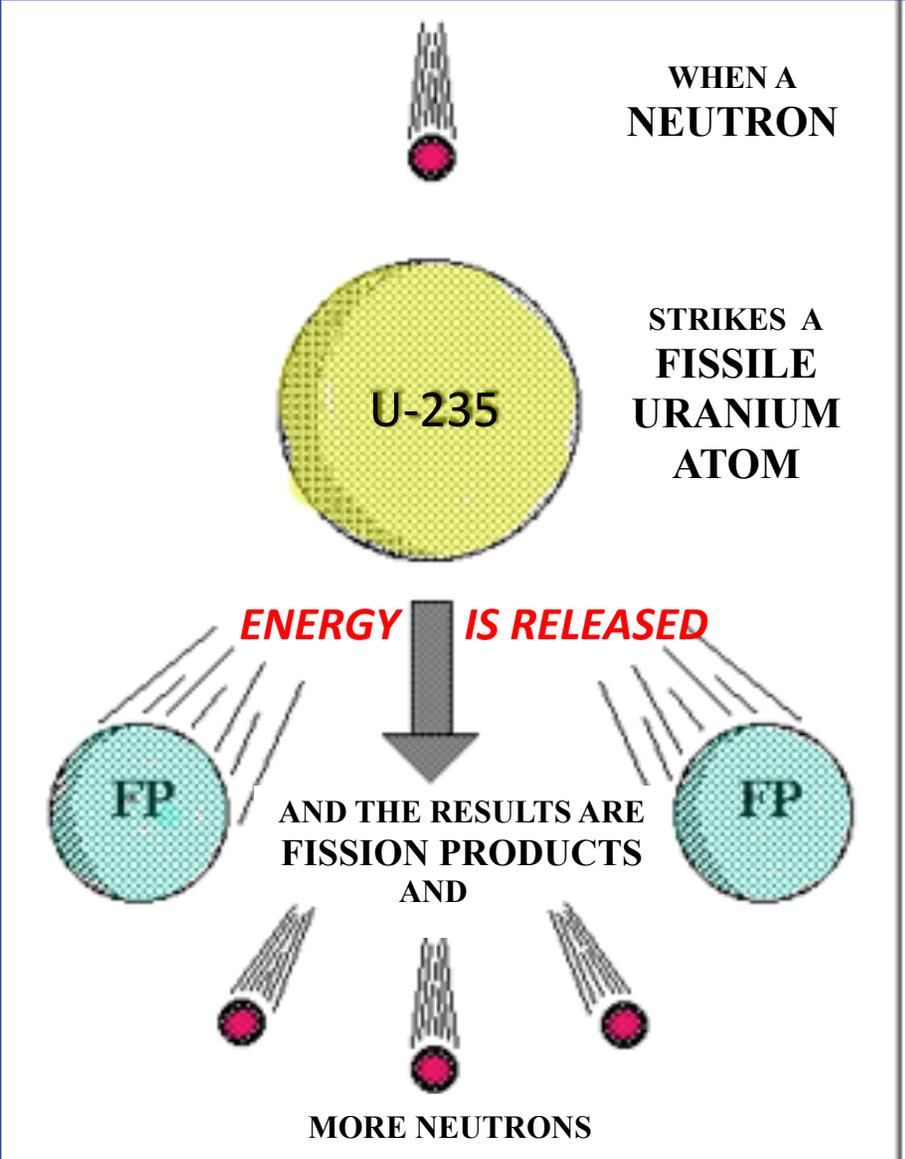
TWO types of nuclear energy

1. **NUCLEAR FISSION** – energy source
the nucleus is “split” by neutrons
2. **RADIOACTIVITY** – unwanted byproduct
the nucleus spontaneously “disintegrates”

Nuclear Fission can be speeded up, slowed down, or stopped.

Radioactivity is unstoppable. Nobody can shut it off.

What is Nuclear Fission?



What are Fission Products?



Photo: Robert Del Tredici

Russian monument to the Splitting of the Atom

Fission Products are broken pieces of split atoms (shown here as hemispheres)

There are hundreds of different kinds of FP – all of them fiercely radioactive

More about Fission Products

Fission products are **unwanted byproducts** of fission.

They are **millions of times more radioactive** than fresh fuel.

Unlike the nuclear chain reaction, based on the nuclear fission process, **radioactivity cannot be shut off.**

That's why we have a nuclear waste problem.

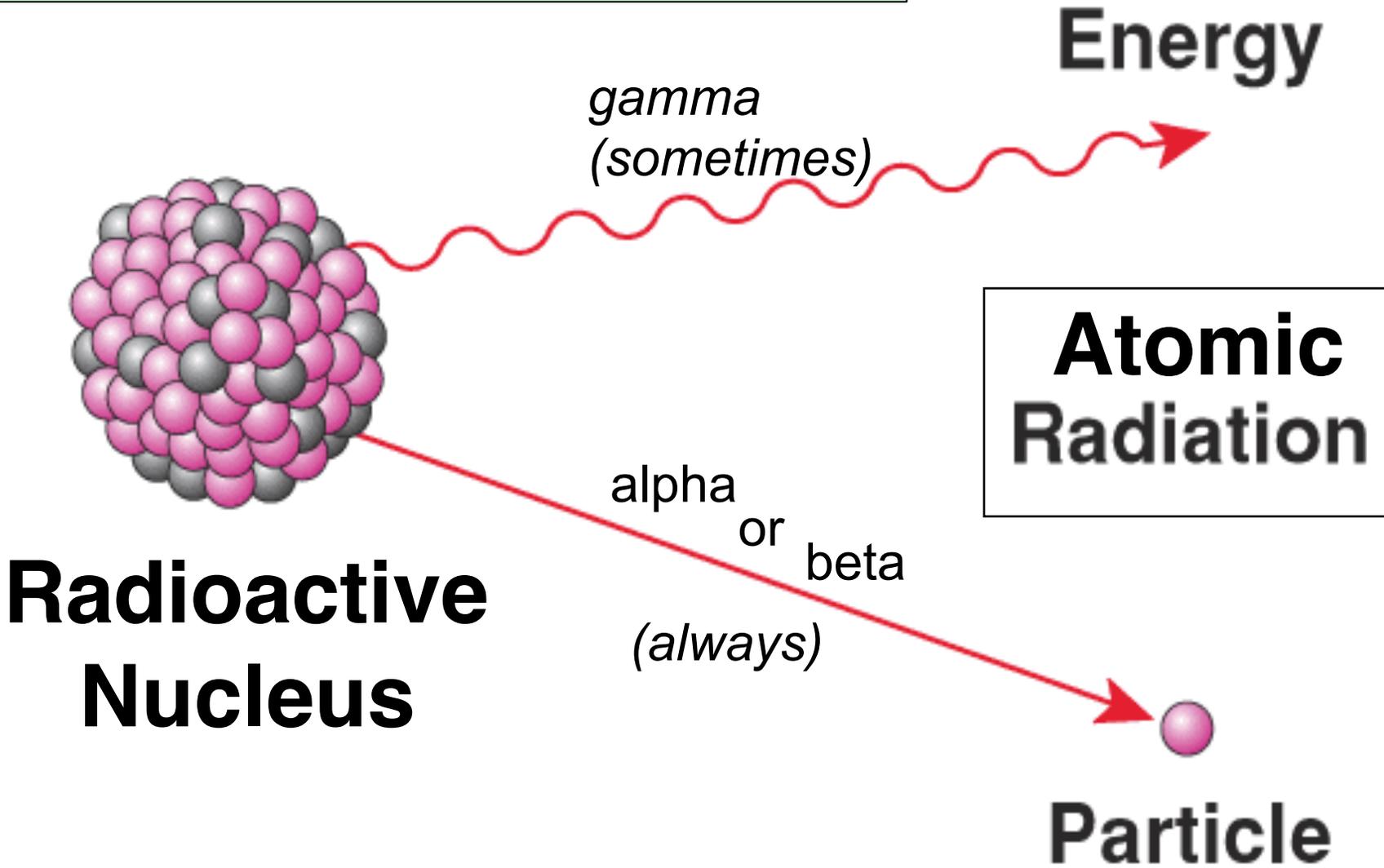
And that's why we have meltdowns!

What is Radioactivity?

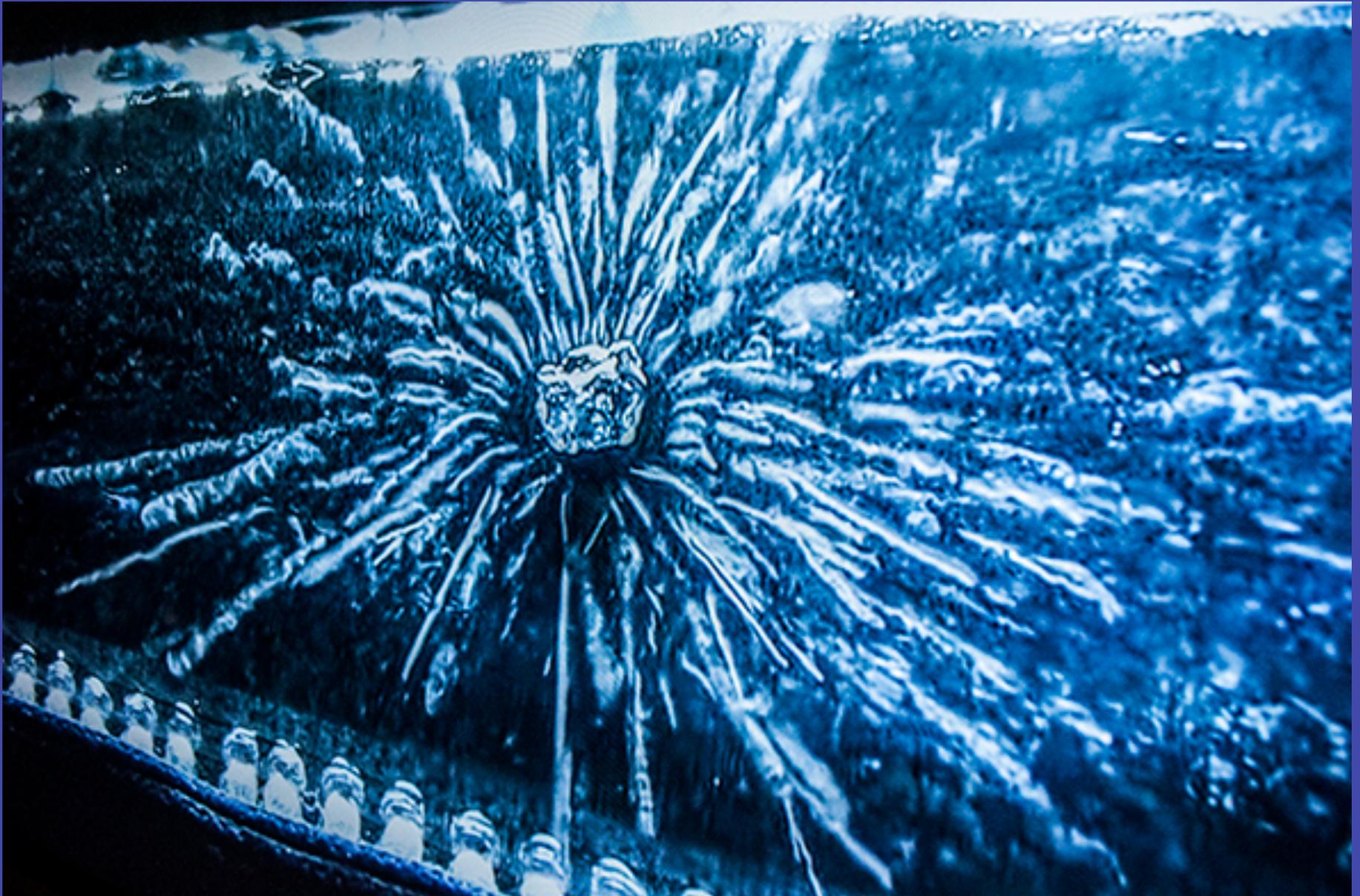
Radioactivity is
a form of nuclear energy
that cannot be shut off or slowed down.

RADIOACTIVITY is the spontaneous disintegration of an unstable nucleus, giving off highly energetic emissions that can break chemical bonds easily.

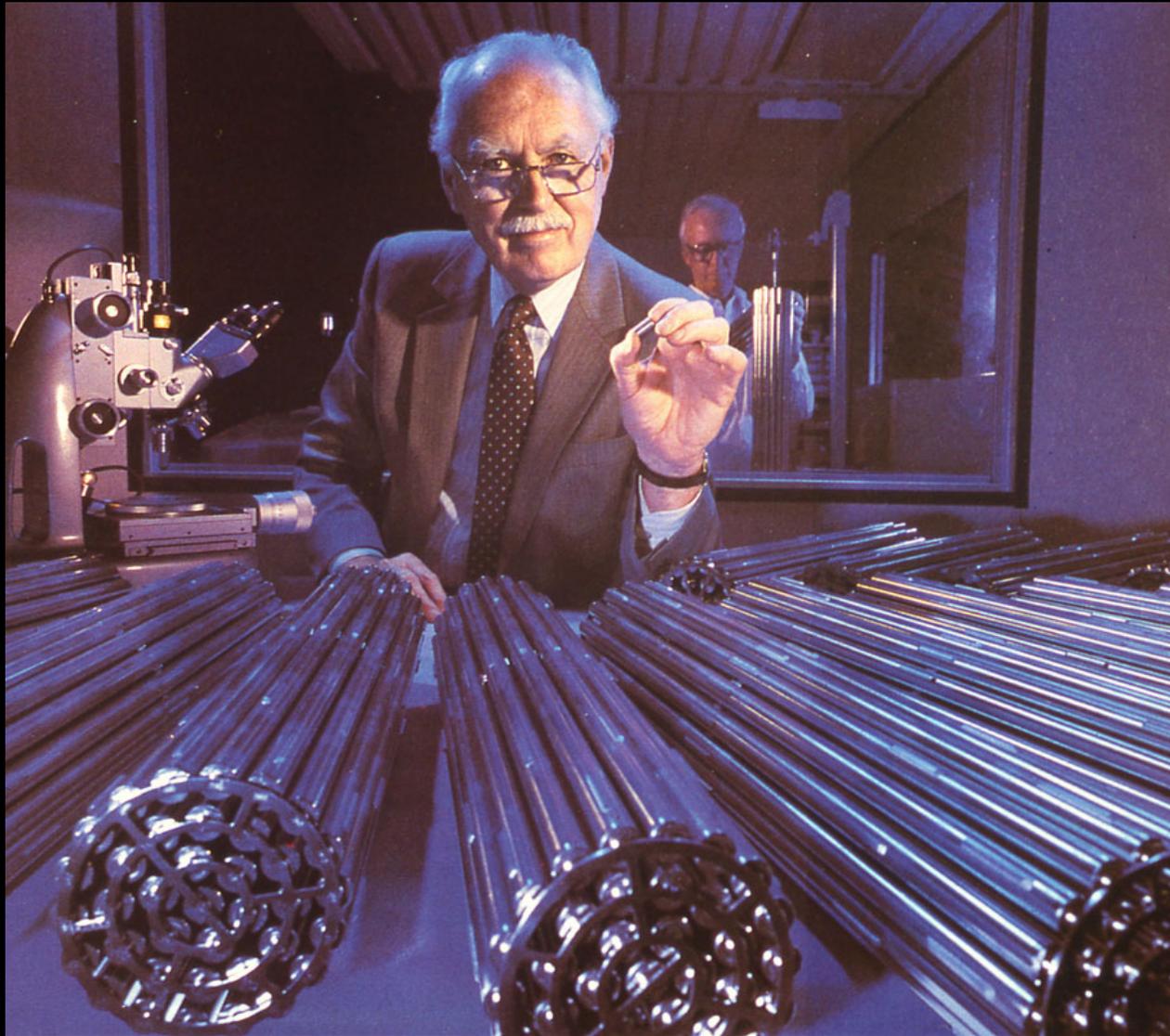
What is Atomic Radiation?



Alpha, Beta, and Gamma “rays” are normally invisible



But in a “cloud chamber” you can see the tracks of all 3 types of emissions from uranium ore



Nuclear fuel rods and pellets can be handled safely before use,
Once used, the fission products will deliver a lethal dose of radiation in seconds.

"Small Wonder" : Canadian Nuclear Association Ad

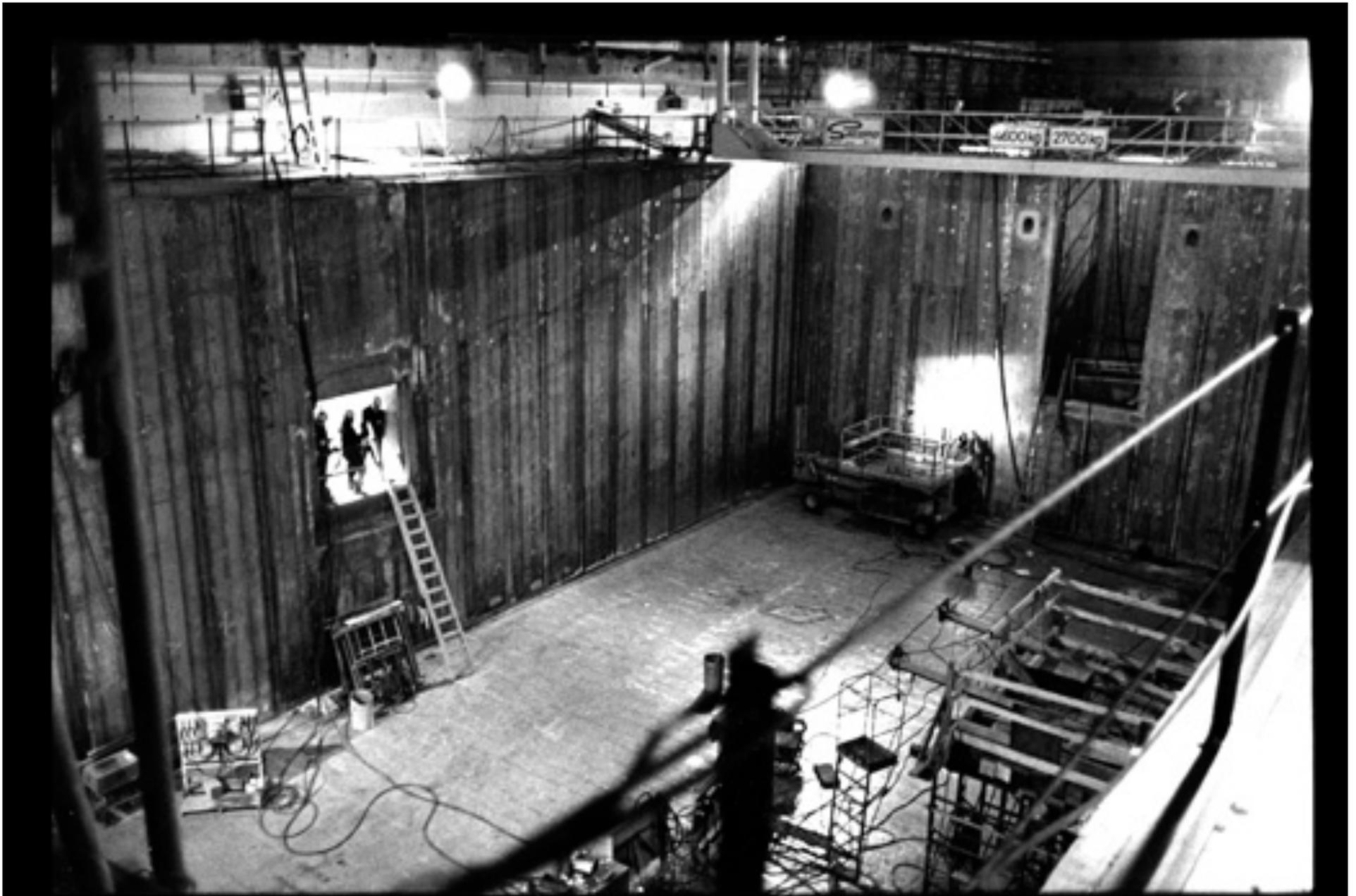
What is Decay Heat?

Fission products are so intensely radioactive that they *generate heat even after the reactor is shut down*

This unstoppable energy is called “decay heat”

Heat makes the temperature rise, and the temperature *will keep climbing unless that heat is removed*

Even after shutdown, if the reactor core can't be cooled, *the temperature will rise to extreme levels*



Irradiated fuel must be cooled for years by **circulating water in a spent fuel pool**.

Photo: Robert Del Tredici



Units 1 to 4 of Fukushima Daiichi Nuclear Power Station.

*All reactors were **safely shut down immediately** after earthquake.*

BUT RADIOACTIVE DECAY HEAT CONTINUES; IT CANNOT BE SHUT OFF



*Unit 3 explodes
March 14, 2011*

*Decay heat causes chemical reactions that produce hydrogen gas
and powerful explosions occur DAYS LATER.
in this way fission products are released and are scattered abroad*



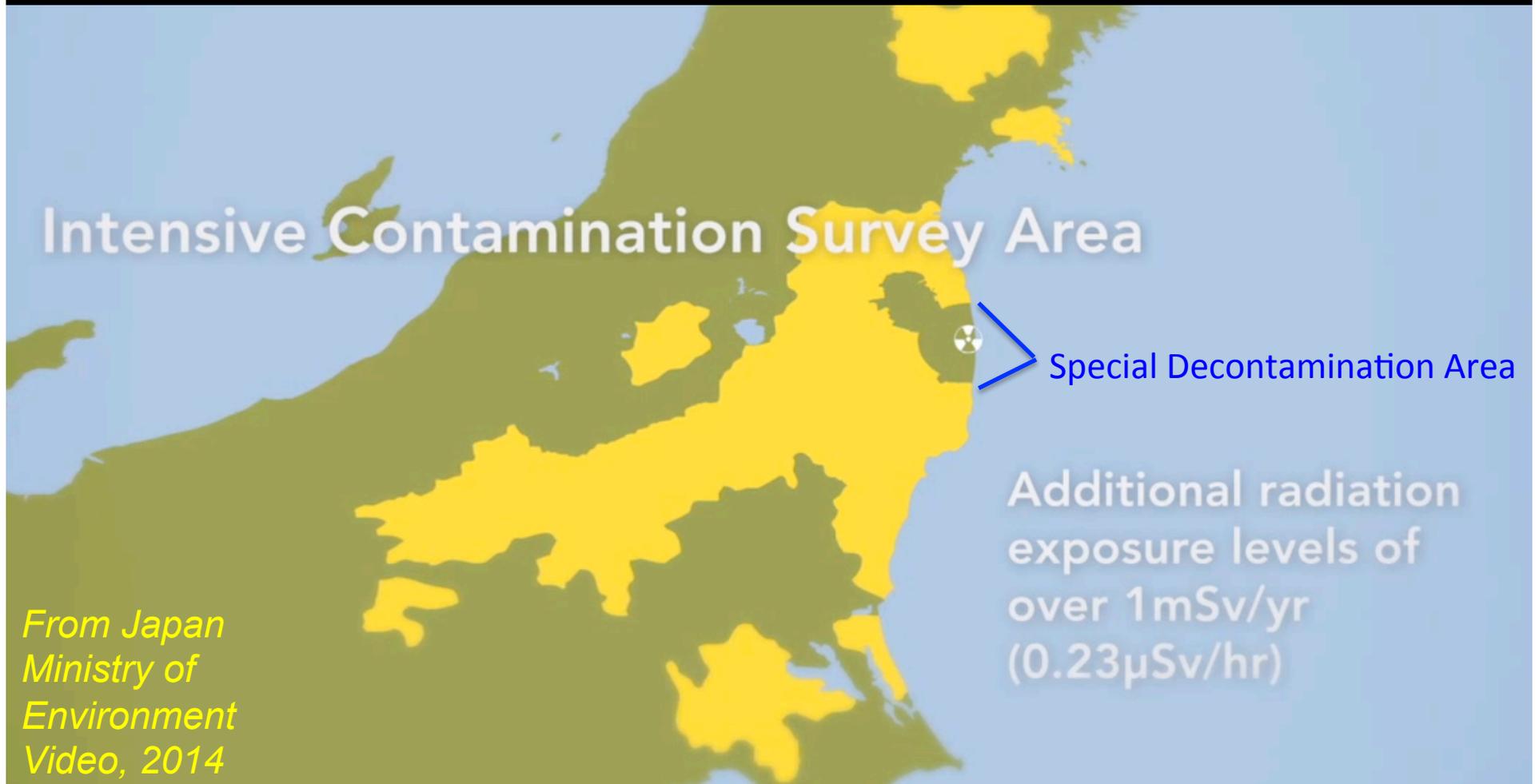
This massive damage is caused not by the earthquake or tsunami but by **overheating nuclear waste**.



Without cooling to remove decay heat the fuel temperatures soars.
The nuclear fuel melts at 5000 degrees F (2800 degrees C).

Radioactive Contamination in Japan

Intensive contamination extends over 200 km south – right down to the outskirts of Tokyo



The cleanup target of 1 millisievert per year is the maximum exposure allowed for a member of the public in Canada



*From Japan
Ministry of
Environment
Video, 2014*

Contaminated soil removed from forest floor – but only within 200m of habitation

*From Japan
Ministry of
Environment
Video, 2014*



Tens of thousands of plastic bags filled with radioactive soil and debris are piled up.

Every day
400 tons of
water are
pumped
down into
the melted
cores



When that
water returns
to the surface
It is heavily
contaminated
with fission
products.

“Intermediate Level Waste” : contaminated with fission products



Over 1500 steel tanks are filled with radioactive water; more tanks built every week

Back to Belarus NPP

PCTran
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VVER1000/320 or AES 90/91/92 NPP

Feed/Bleed

MSV/ARV Flow	0.0 l/h
HPI	23.0 l/h
Feed	44.6 l/h
Bleed	45.0 l/h
Boron	1500.0 ppm
Nonc. Acid Inp/Dilution	0

EWST

Div 1 P N2	59.0 Bar
Liq Vol	400.0 M3
Flow	0.0 l/h
Div 2 P N2	15.0 Bar
Liq Vol	960.0 M3
Flow	0.0 l/h

LPI/RHR

LPI Sump SDC	
RHR Flow	0.0 l/h
RWST Lvl	3600.0 M3
Heat	0.0 MW

Containment

Sparg Flow	0.0 l/h
Heat	0.0 MW
Vent Flow	5.0 l/h
Heat	0.0 MW
Pressure	1.03 Bar
Level	2.80 M
Temperature	50.0 C
Hydrogen	0.00 %

Core

Power	2982.1 MW
Power	99.40 %
Tavg	305.0 C
Reactivity	-0.0032 %dk/k
Voids	0.0 %
Max Fuel Temp	786.4 C
Max Clad Temp	545.7 C

RPS

Reactor	Off
Turbine	Off
EG Bus A	Off
EG Bus B	Off
ECCS LL	Off
Lo Rad ¹ Pwr SGP	Off
Hi Fx Full Thud Pat SGP ¹ Rad ¹	Off
Lo Hi Rad ¹ RRP ¹ Pat SGP ¹ SGP	Off

Reactor

Power Demand	100.0 %
Rate Demand	10.0 %
SG Press Stp	63.0 Bar
Temp Stp	305.0 C
SG A Lvl Stp	2.45 M
SG B Lvl Stp	2.45 M
Level Stp	6.96 M
Press Stp	155.0 Bar

Core Parameters:

- Pressure: 155.0 Bar
- Level: 6.95 M
- Heater Power: 40.3 KW
- Pressure: 1.03 Bar
- Temp: 50.00 C
- IX Rate: 0.0 MW
- YR Flow: 0.0 l/h

Primary Loop (A):

- SG Press: 63.0 Bar
- 'A' WB Lvl: 2.45 M
- 'A' HL Temp: 319.7 C
- 'A' CL Temp: 290.3 C
- 'A' Flow: 15900.0 l/h

Secondary Loop (B):

- SG Press: 63.0 Bar
- 'B' WB Lvl: 2.45 M
- 'B' HL Temp: 319.6 C
- 'B' CL Temp: 290.4 C
- 'B' Flow: 47700.0 l/h

Other Parameters:

- Stm Flow: 0.0 l/h
- Stm Flow: 4435.2 l/h
- Feed Flow: 1481.9 l/h
- Feed Flow: 4437.5 l/h
- MSV/ARV Flow: 0.0 l/h
- BHU-K/MSV Flow: 0.0 l/h

Belarus NPP Reactor Vessel is Loaded on Train



July 10 2016

First Reactor vessel for Belarus NPP “dropped”

Rosatom’s deputy director general, Alexander Lokshin, said the vessel “slipped down slowly and touched the ground softly” in the 10 July incident. Rosatom “stands ready to replace it with another if that would help restore public confidence in the project.”

www.world-nuclear-news.org/NN-Belarus-plant-suspended-after-installation-mishap-02081601.html

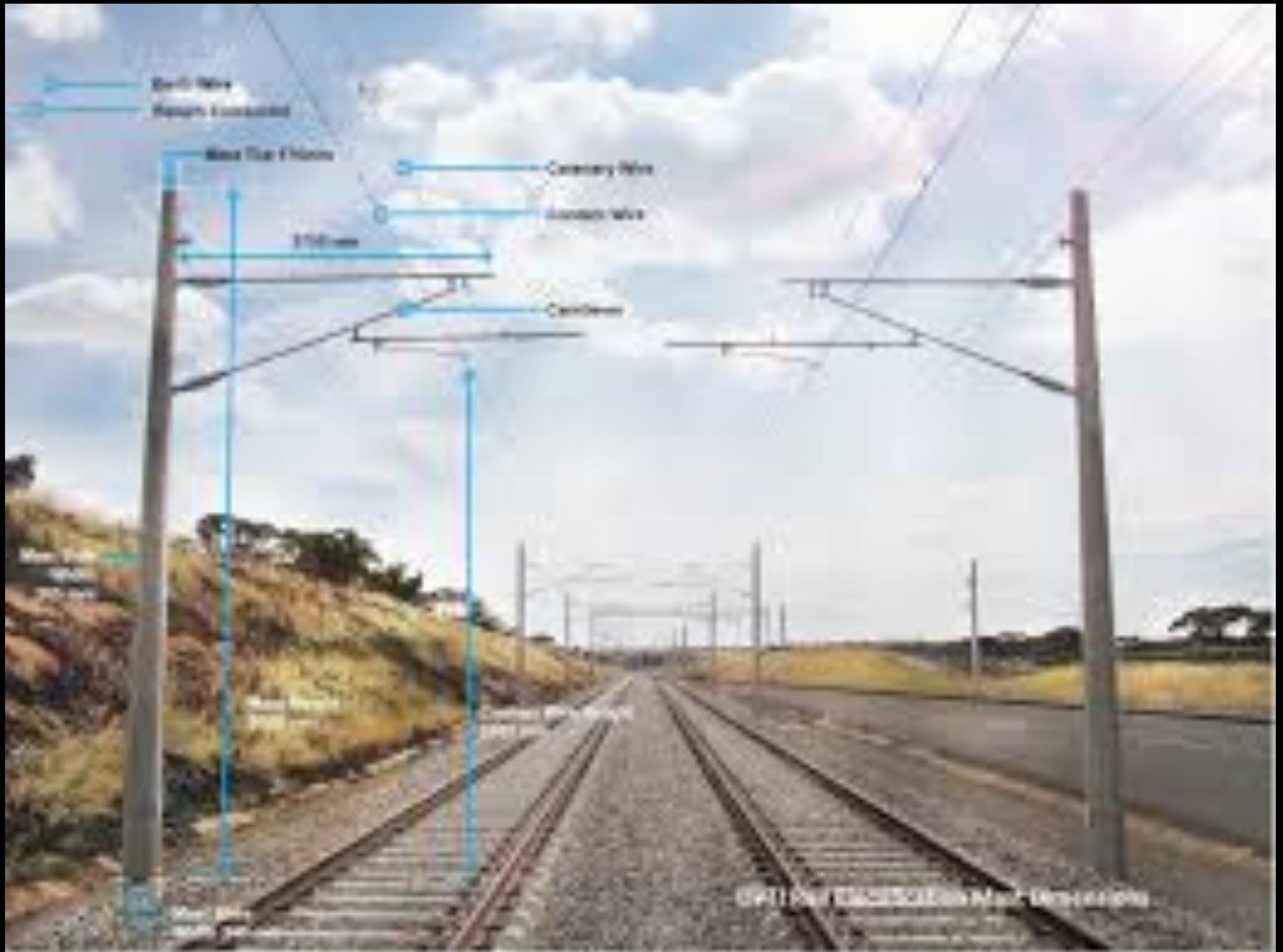
A month later Belarusian authorities announced that the vessel would be replaced *because it was impossible to confirm the safety of the vessel*

<http://belarusfeed.com/media-report-new-incident-with-belnpp-reactor/>

December 26 2016



Replacement reactor vessel “slightly hit a railway catenary mast”



CP1101 13/05/2018 13:04:10

The two incidents raise almost identical concerns and should be dealt with in exactly the same way. The second vessel should be replaced with a third.

Better yet, Belarus should cancel plans to build a new reactor which, like the Chernobyl unit that melted down in 1986, has the power to:

- ruin the economy of Belarus,
- drive citizens into exile from their homes,
- devastate the health of an entire generation of children, and
- render fertile land unusable for decades if not centuries

If for any reason the reactor vessel should fail, or (much more likely) if an incident arises where there is no power to run the pumps needed to cool the core, there will be a core meltdown.

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THE END

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