# Nuclear Waste Crisis

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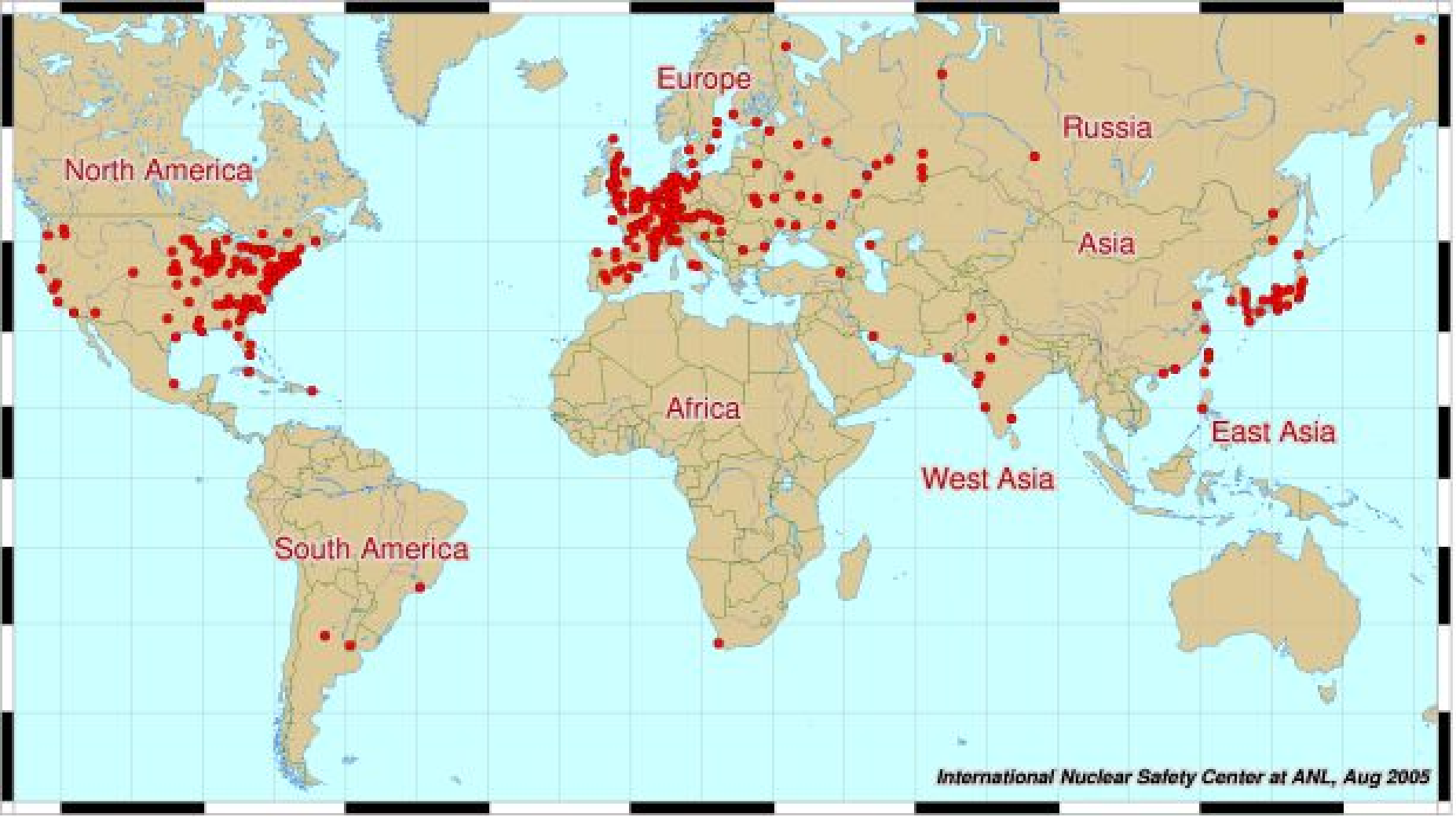
# Nuclear Energy

- 14% of the world's energy
- Reactors split uranium atoms in a process called fission
- The heat from fission creates steam which powers a turbine which generates electricity


Europe
Russia
North America
Asia
Africa
East Asia
West Asia
South America
International Nuclear Safety Center at ANL, Aug 2005
60˚
45˚
30˚
15˚
0˚
-15˚
-30˚
-45˚
240˚
270˚
300˚
330˚
0˚
30˚
60˚
90˚
120˚
150˚

# Radioactive Waste

- Nuclear waste is the material that nuclear fuel becomes after it is used in a reactor
- Hazardous for tens of thousands of years
- 20 metric tons produced a year by one plant
- Entire industry generates 2,000-2,300 metric tons yearly

# Nuclear Accidents

- 4 major nuclear reactor accidents to date


SL-1, Idaho, 1961


Three Mile Island, Pennsylvania, 1979
www.IImageWorld.com


Chernobyl, Ukraine, 1986


Fukushima, Japan, 2012

# Chernobyl

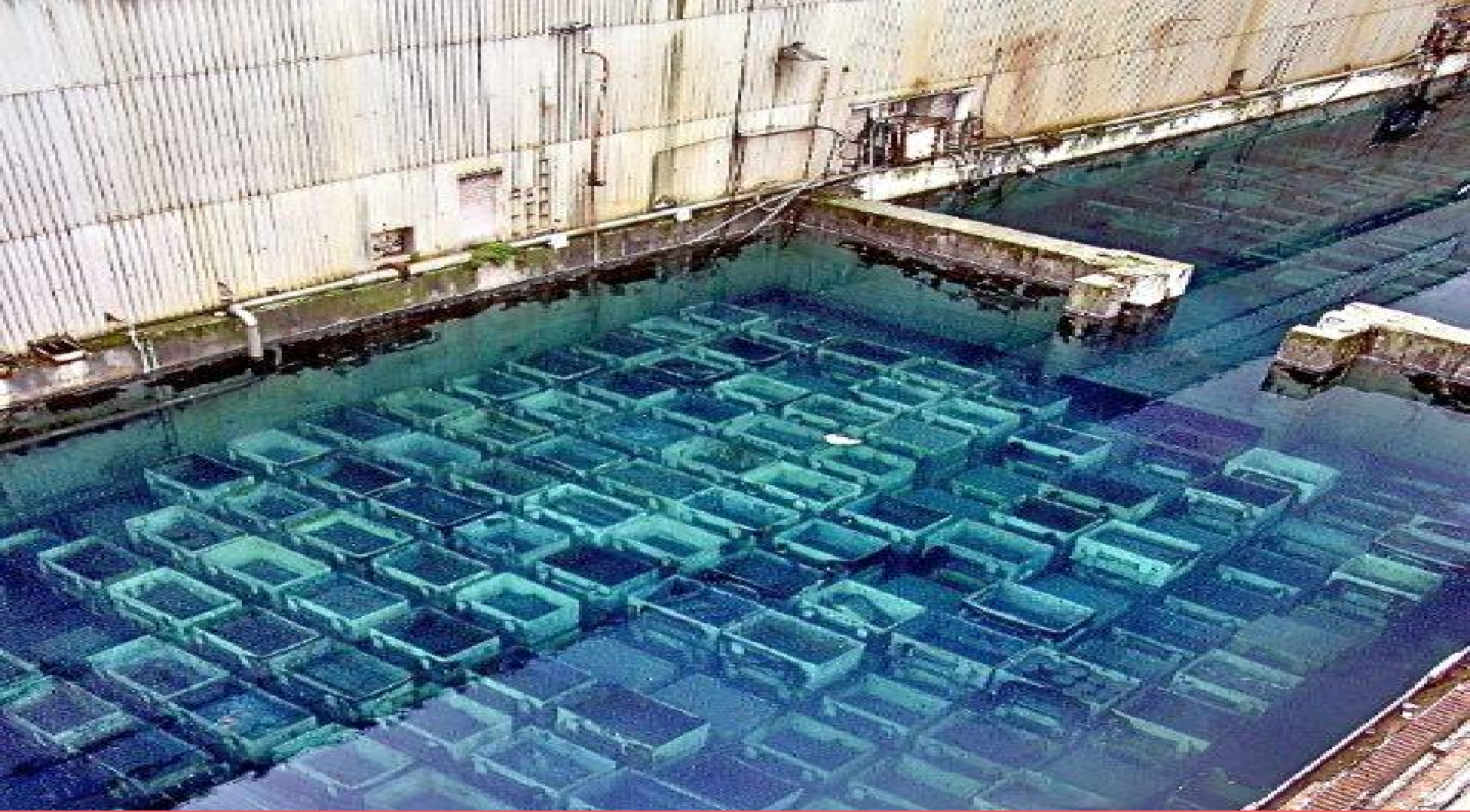
- Nuclear accident in Soviet Ukraine
- Spewed 30% of the leftover radioactive fuel into atmosphere
- 7,000 children in Belarus and Ukraine died from thyroid cancer
- Surrounding areas uninhabitable for the next 100,000 years
- Created corium, lava-like material made of nuclear fuel, concrete, sand, reactor materials

# Elephant's Foot

- Corium first found
- Elephant's foot measured at 10,000 roentgens per hour in 1986
- Recommended radiation dose is 5.701 roentgens per hour
- 4 minutes of exposure- vomiting and nausea
- 300 seconds- 2 days to live

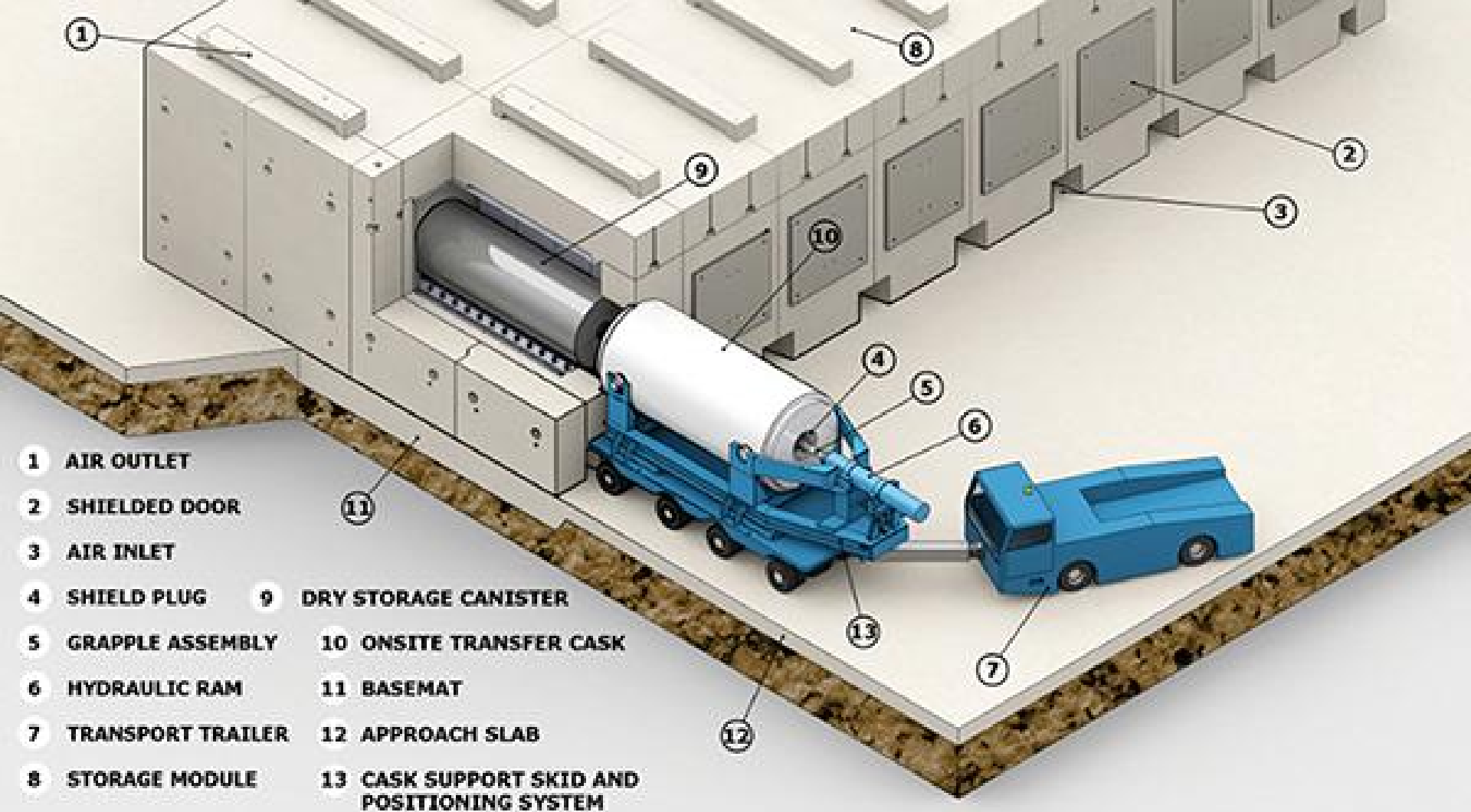
# Sellafield

- Nuclear fuel reprocessing site in England
- Houses two most hazardous buildings in Western Europe
- B30- houses anything  broken inside the plant
- Dumped in storage pond and is very difficult to remove because it could leak
- Holds 80% of the UK’s nuclear waste
- 6,000 tonnes of waste- exceeds limit of 5,500 tonnes



# Solution #1- Onsite Casks

- Keeping spent fuel rods in onsite casks made from steel and concrete
- Pro: Easy and efficient
- Con: Not disposal, just storage, could leak and release radiation




1 AIR OUTLET
2 SHIELDED DOOR
3 AIR INLET
4 SHIELD PLUG
5 GRAPPLE ASSEMBLY
6 HYDRAULIC RAM
7 TRANSPORT TRAILER
8 STORAGE MODULE
9 DRY STORAGE CANISTER
10 ONSITE TRANSFER CASK
11 BASEMAT
12 APPROACH SLAB
13 CASK SUPPORT SKID AND POSITIONING SYSTEM

# Solution #2- Repository Storage

- Storing the waste in an underground chamber
- Pro: Away from people, granite creates natural barrier to contain escaping liquids
- Con: Seismic activity and volcanation could disturb the chamber, could escape and poison groundwater and soil

# Solution #3- Waste-eating Bacteria

- Introduce bacteria that eat hazardous and radioactive waste and revert it back to water
- Pro: Does not require sunlight to change solids into harmless water, easy and efficient way to dispose of the waste without harming human or animal life, bacteria can survive in hazardous conditions
- Con: No cons so far

# Implementing Solution

- Use steel and concrete casks to store the radioactive waste
- Pump bacteria and water into the cask
- Keep on-site so risk of contamination by transportation is lowered

# Future Tests

- Can bacteria survive on the radioactive waste alone
- How long will it take the bacteria to eat waste
- How much bacteria will it take to eat 1 tonne of waste
- How long will it take to breed the bacteria
- How long will they live

# Consumer

- Sell bacteria out to nuclear reactor corporations
- Sell to scientific research groups

# Cost

- Pay for bacteria
- Pay for research
- Pay for pumping system and regulators
- Pay for materials to build storage casks

# Competition

- So far, no competition because new technology
- Never been on a large enough scale to create a company

# Why we should do this

- Clean up nuclear waste produced by unpreventable nuclear accidents
- Efficient, safe, and easy to implement
- Low risk of contamination by keeping it on-site
- Potentially saving lives that could otherwise be lost due to radiation leakage
- Could reduce nuclear waste by 100%