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Protecting People and the Environment

NRC Activities Regarding Recent Japanese Earthquake

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Agenda

- Key Points
- Earthquake Description & Impact on Japanese Nuclear Power Plant
- United States Seismic Design for Existing and Future Nuclear Power Plants
- Lessons Learned

Key Points

- All Japanese nuclear power plants nearest to the earthquake were shut down safely.
- US plants are designed for postulated seismic activity at each site.
- NRC has an established process for utilizing lessons learned from events.

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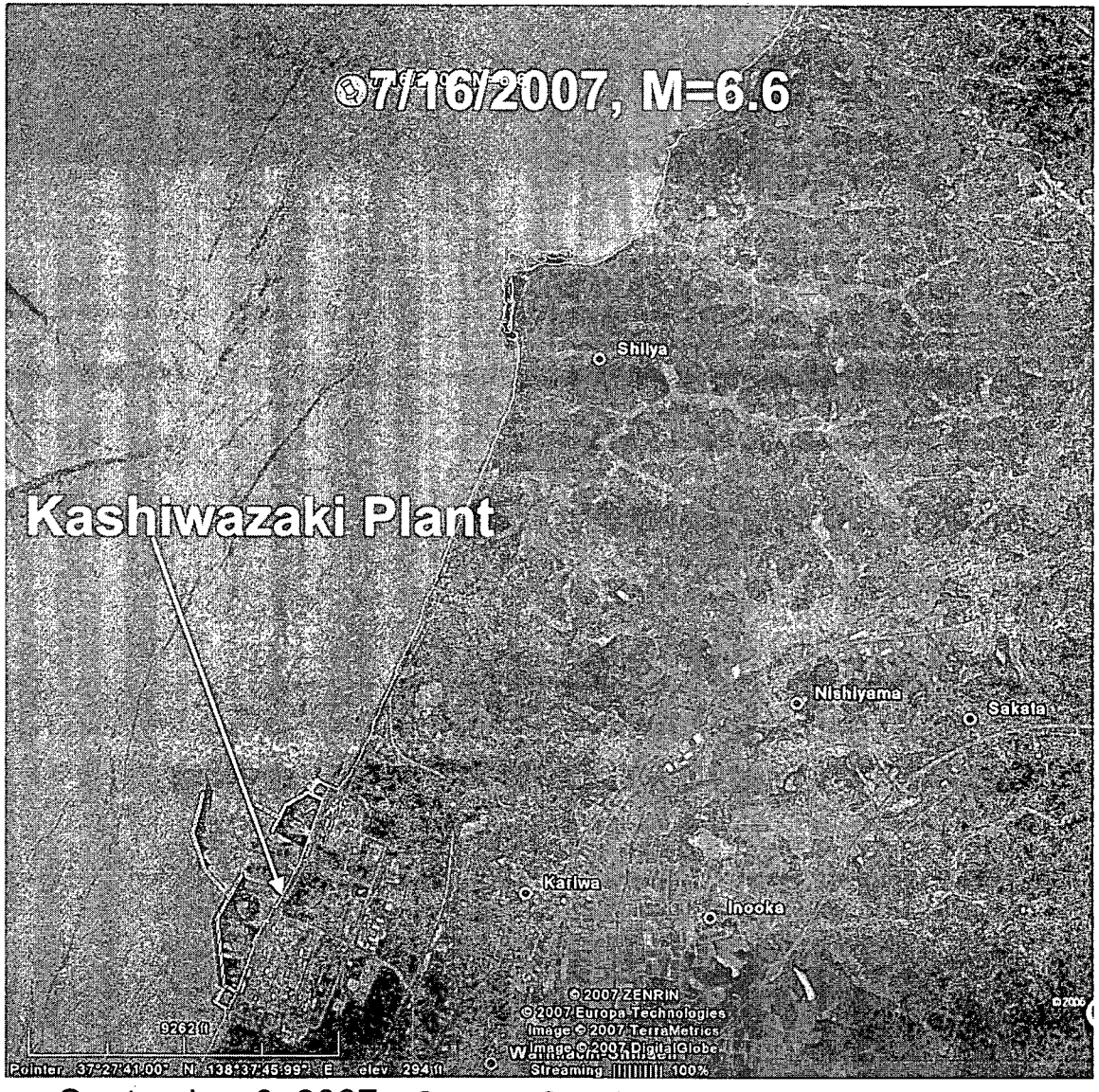
Earthquake Description

- Niigata Earthquake occurred on July 16, 2007, at 10:13 AM local time
- Earthquake magnitude was 6.6
- Quake epicenter was about 16 km from the Kashiwazaki-Kariwa Nuclear Power Plant.
- Quake occurred 17 km beneath the surface
- Earthquake caused a reported 11 fatalities, multiple injuries, collapsed houses, cracked highways.

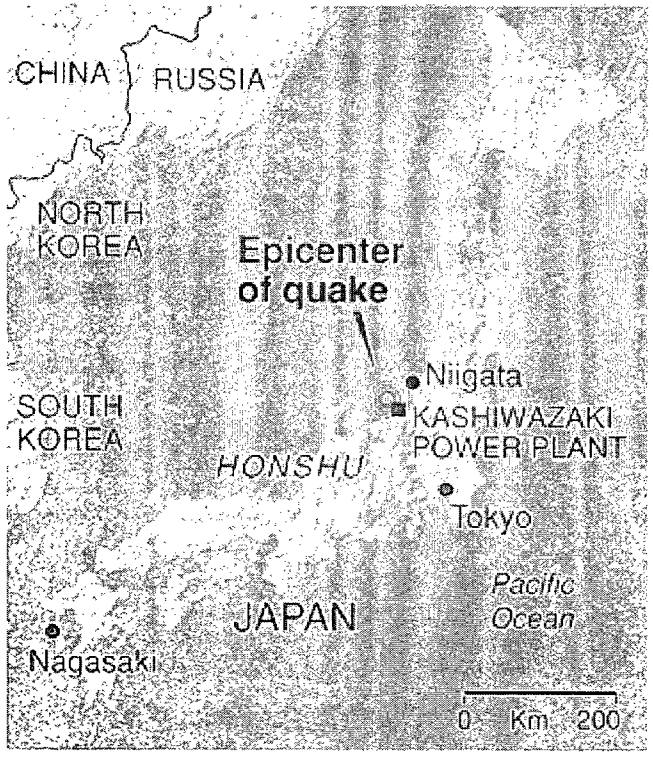
Kashiwazaki-Kariwa Nuclear Power Plant Description

- World's largest nuclear power plant output capacity
- 7-Unit plant produces 8,210 MW (Palo Verde, largest US plant – 3,880 MW)
- Units 3, 4, and 7 operating before event
- Unit 2 starting up
- Units 1, 5, and 6 shut down

Location of Earthquake & Plant



September 6, 2007 *Source: Google Earth*



Source: International Herald Tribune

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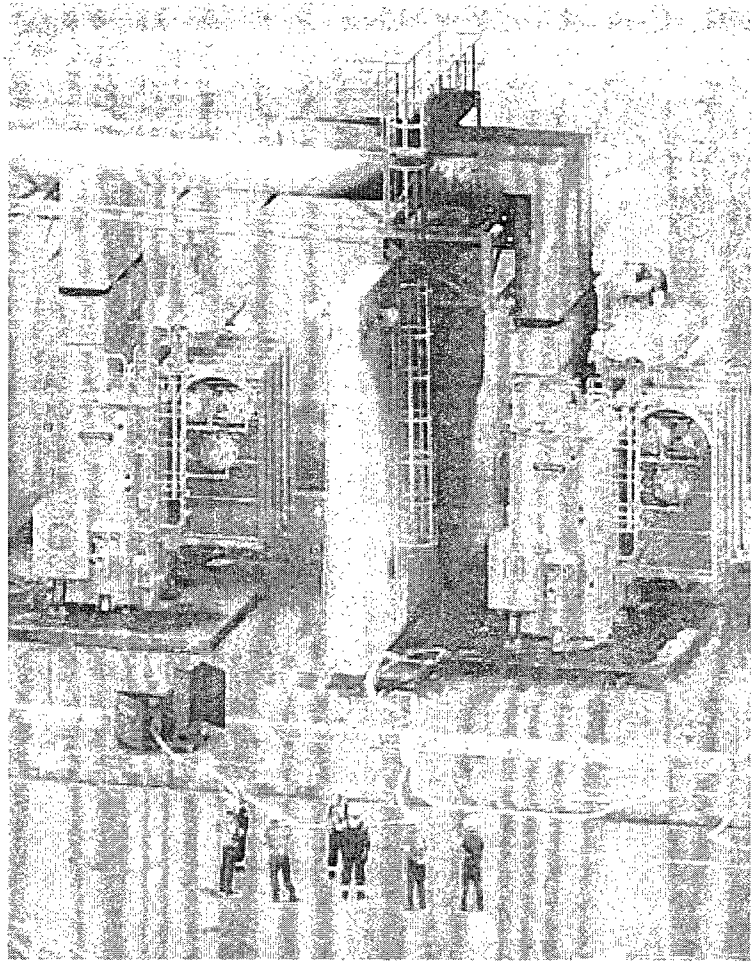
Impact on Kashiwazaki-Kariwa

- Peak ground acceleration higher than plant design
- Operating units automatically shut down
- Transformer fire outside Unit 3
- Small liquid, gaseous, and particulate radiological releases
- Drums of low level solid radioactive waste fell over
- Reactor building crane damaged
- Minor damage to other plant equipment
- Eleven workers suffered minor injuries

Auxiliary Transformer Fire

- Fire in Unit 3 auxiliary transformer.
- Fire extinguished in ~2 hours after quake
- Fire had no impact on radiological safety and no impact to the public.



(Source: Associated Press)

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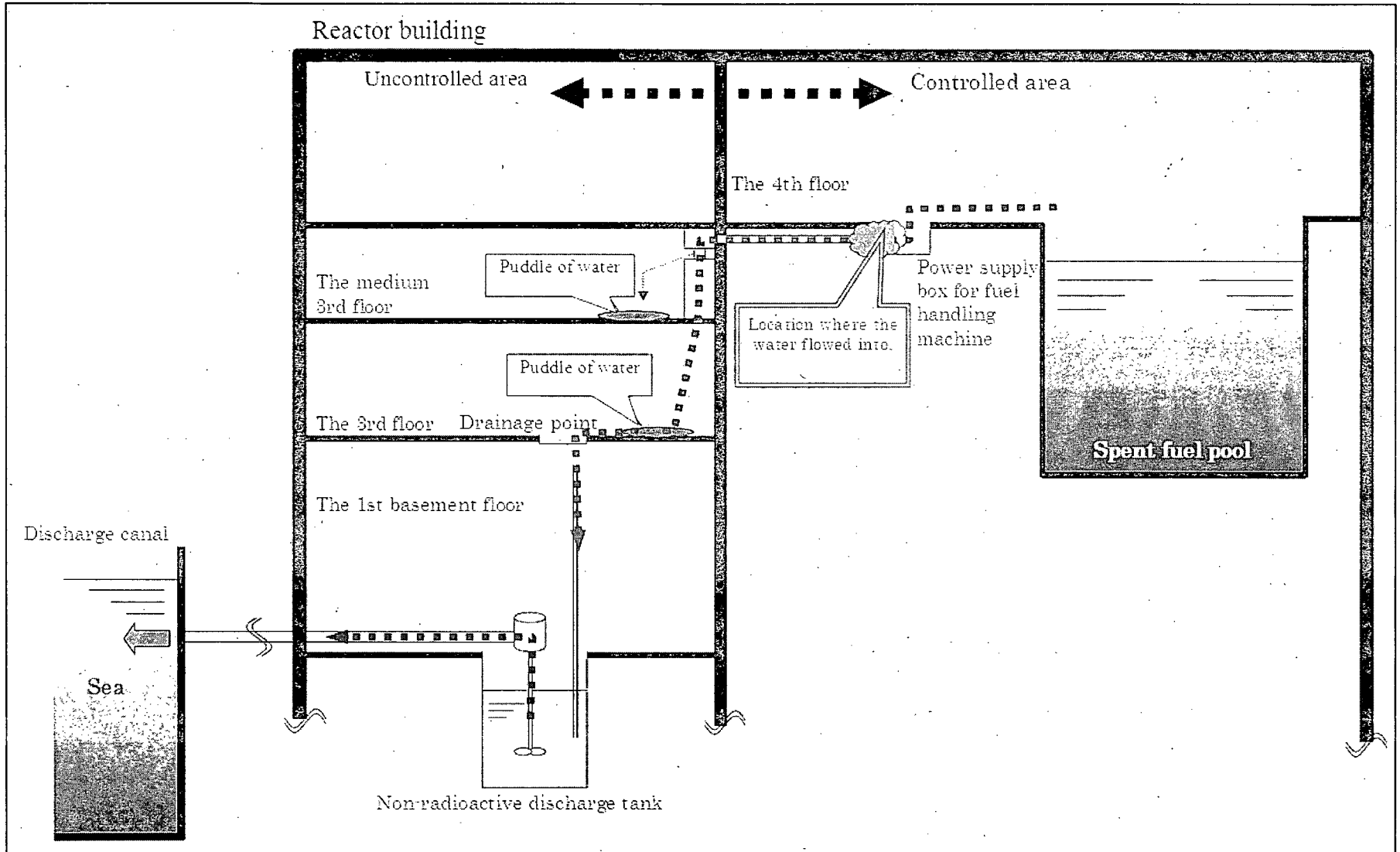
Liquid, Gaseous, and Particulate Radiological Release

- Approximately 317 gallons of water discharged into Sea of Japan after leaking through floor
- Radioactive iodine and other radioactive particulate matter found only at the Unit 7 ventilation stack.
- Total amount of radioactivity released very low (estimated dose to public less than 1 millionth of annual limit).
- No impact on public health and safety.

Liquid Radiological Release Flowpath

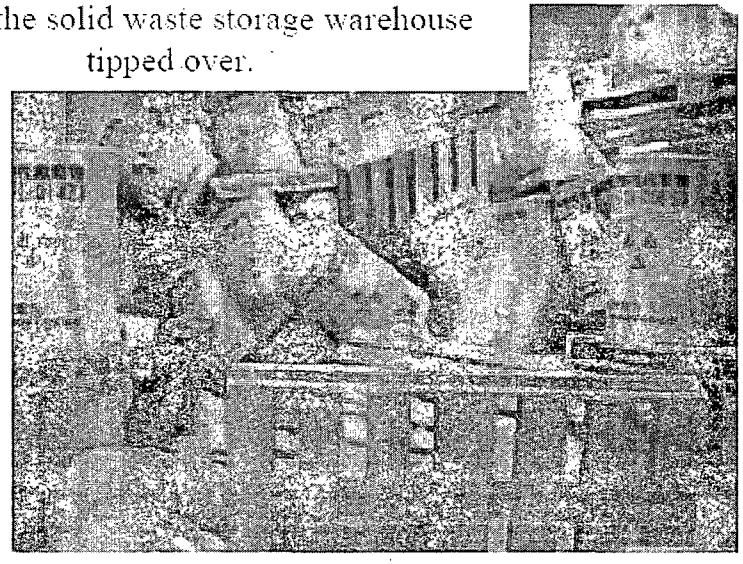


Schematic diagram of the water flow into the non-radioactive discharge tank and the water discharge to the sea at Unit 6

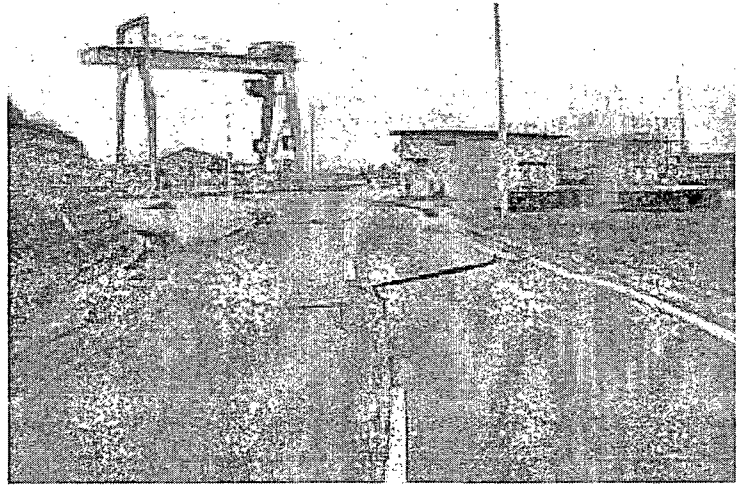
Source: Nuclear and Industrial Safety Agency

Other Issues Identified at Plant

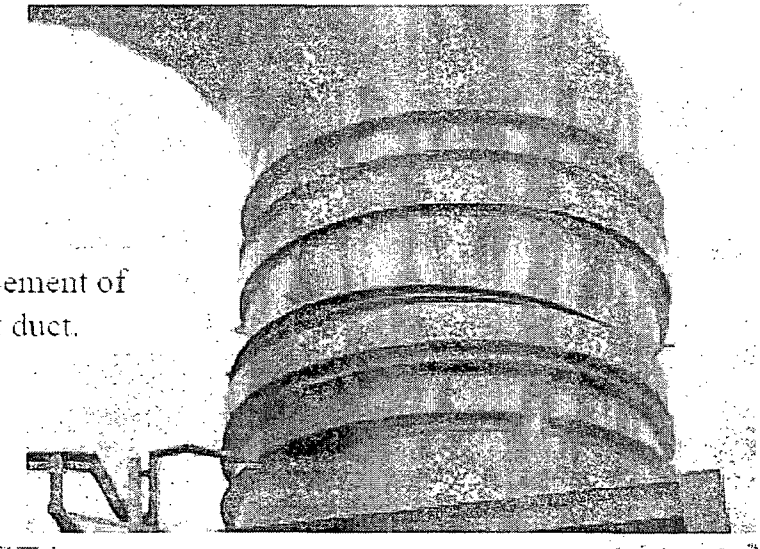
Several hundred drums containing low-level waste in the solid waste storage warehouse tipped over.

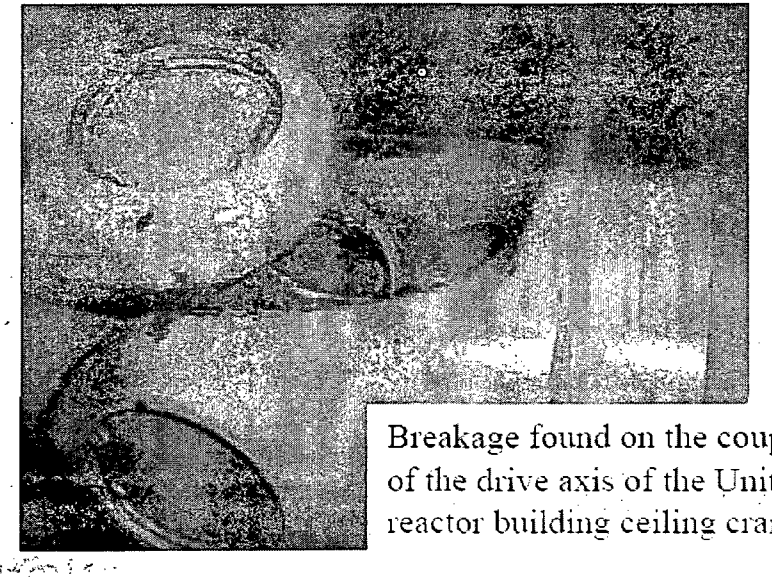


Access road in the site. (Close to the Unit 5 water discharge outlet.)



Displacement of exhaust duct.





Breakage found on the coupling of the drive axis of the Unit 6 reactor building ceiling crane.

US Reactor Seismic Design

- Existing US reactors are robustly designed to withstand site-specific earthquakes
- Only 2 US nuclear power plants with active faults located nearby. Both will automatically shut down during a seismic event above a specified limit.
- Plants in the US located in areas of considerably less seismic activity than California have seismic instruments installed for manual shutdown

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NRC Seismic Activities

- NRC focused on seismic safety since 1970s:
  - Seismic Safety Margins Research Program
  - Implemented lessons learned from earthquake experience at non-nuclear facilities
  - Plant walk-downs and adequate anchorages for various structures
  - Assessed the ability of plant equipment to withstand accidents beyond the plant's design and concluded there were large margins of safety

New Reactor Seismic Design in US

- NRC recently issued new seismic guidance for new reactors.
- Guidance incorporates comprehensive, state of the art scientific methods.
- NRC will review new reactor applications to verify that the latest earthquake hazard information has been considered for each site.

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Lessons Learned

- Japanese plant withstood ground acceleration higher than the plant was designed for with no damage to systems and structures necessary for nuclear safety.
- NRC will continue to collect and evaluate information related to this event to identify any actions necessary to be implemented at operating and future reactors, if any are needed.