Byron Loss of Annulus Cooling Event

Presentation for NRC

Kevin Donovan
Manager, Dry Cask Storage Program
Exelon Generation Company
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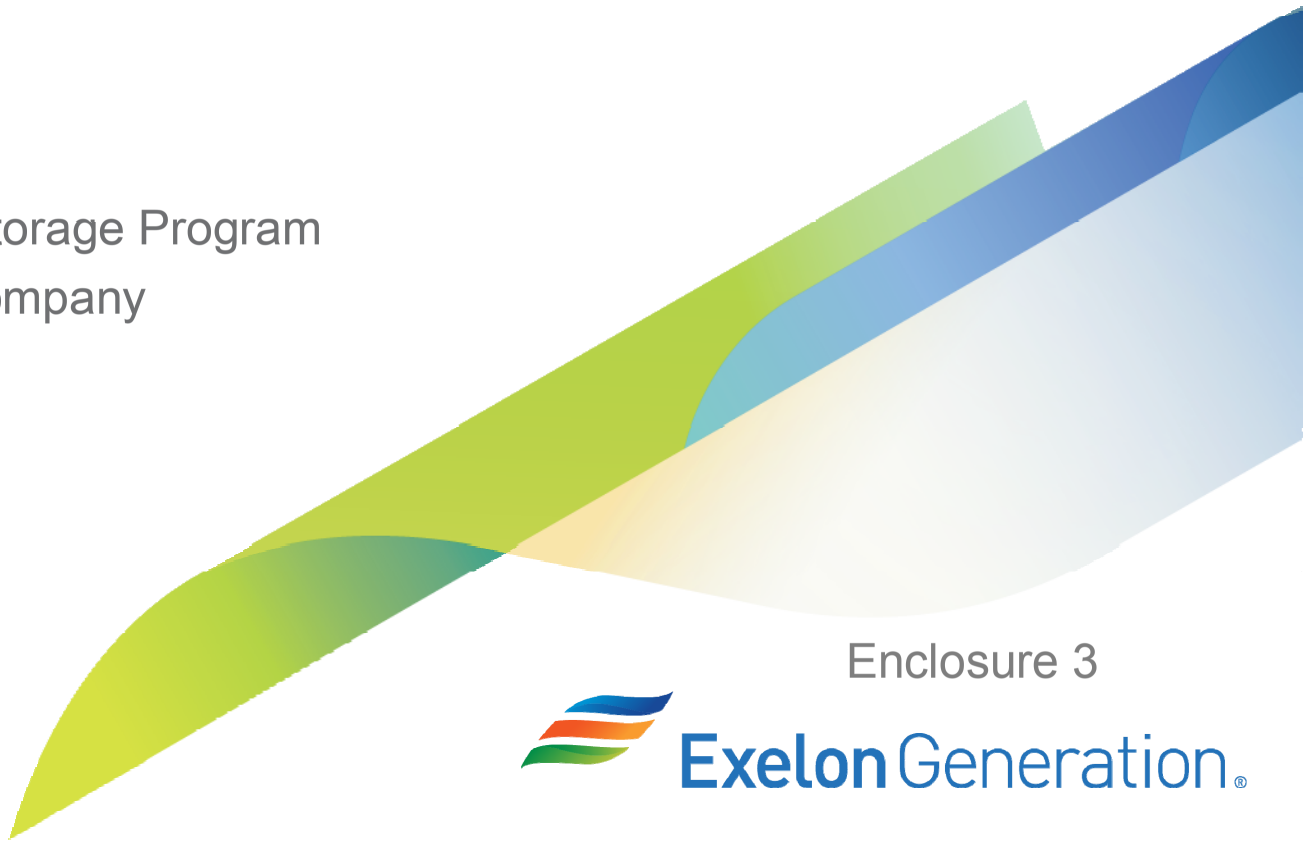

Enclosure 3

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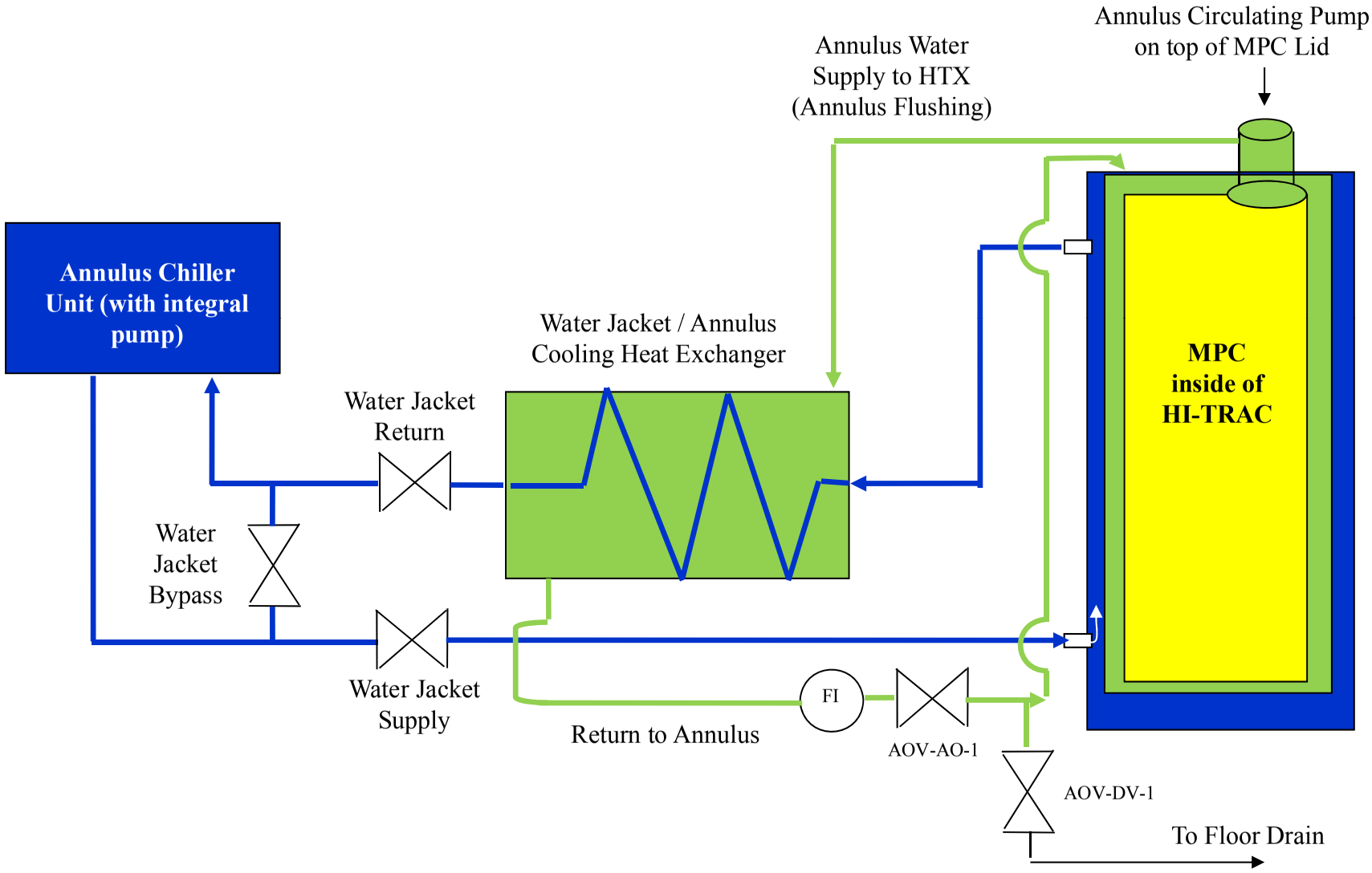
Event Description

- In August, 2010, Byron Station was loading the first of six (6) HI-STORM 100 cask systems in their initial dry cask storage (DCS) campaign
- During the evening of August 28 or morning of August 29, a failure (chiller trip) of the annulus cooling system occurred and went undetected until approximately 0700h on August 29, resulting in an uncontrolled temperature increase
- At the time of the chiller trip, vacuum drying was secured and HI-TRAC water jacket cooling was in service
  - Vacuum drying system was isolated at the MPC
- HI-TRAC/MPC annulus flushing was also secured at the time (inappropriate act)
  - Annulus flushing required by FSAR for MPC-32

Event Significance

- Event significant in that it revealed a lapse in practicing nuclear safety fundamentals, specifically maintaining nuclear fuel cooling
  - At no time was there any risk to public health and safety
- The loss of the annulus cooling system was non-consequential, in that no safety limits were exceeded
  - FSAR design operating limit for the annulus cooling system of $\leq 125^{o}F$ was assumed to have been exceeded
  - Event did not challenge the design fuel clad temperature limit based on the cask heat load of 21.1 kW
    - Campaign maximum loading was 24 kW
    - It is postulated that with a heat load of 28 kW this limit may have been challenged

Annulus Cooling System Description



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Annulus Cooling System Description (cont'd)

- The annulus cooling system is made up of two major components:
  - Annulus chiller unit provides cool water to both the annulus and the HI-TRAC water jacket during vacuum drying activities
  - Annulus cooling heat exchanger is used to keep annulus cooling water separated from the HI-TRAC jacket cooling water
- For purposes of clarity, there is no water exchange with the MPC provided by this system

Annulus Cooling System Description (cont'd)

- For annulus cooling (annulus flushing), a pump takes a suction from the annulus water on top of the MPC, pumps it through the annulus cooling heat exchanger (shell side) where it is cooled, and returns it to the opposite side on the top of the MPC
- For HI-TRAC water jacket cooling, a separate pump on the annulus chiller skid pumps water through the HI-TRAC water jacket and through the annulus chiller heat exchanger (tube side), and returns it to the chiller skid

Licensing Basis Considerations

- The procedures for establishing and maintaining annulus cooling were lacking in requirements to ensure the $\leq$125^{o}F annulus temperature limit specified by the FSAR was not exceeded
- Further review determined that the event did not challenge the design fuel clad temperature limit
- The issues surrounding this event were investigated under the Exelon Corrective Action Program (IR 1107151)
- The event and lessons learned were communicated with the industry via the INPO Operating Experience Program (OE32015/OE32411)
- NRC issued Information Notice 2011-10 to communicate the issue to the industry

Conclusions

- A failure of the annulus cooling system went undetected, resulting in uncontrolled temperature increase in
  - FSAR design operating limit of the annulus coolant was assumed to have been exceeded
- Vacuum drying was secured at the time of the chiller trip (isolation valves closed at the MPC)
- Event did not challenge the fuel clad temperature limit
- Revealed a lapse in practicing nuclear safety fundamentals, specifically maintaining nuclear fuel cooling
- Issues addressed within the Corrective Action Program
- Operating experience shared with the industry
- NRC issued Information Notice 2011-10

Questions or Comments?