NRC/NEI Meeting on HCVS Phase 2 OIP Template

July 13, 2015

BWR OWNERS' GROUP

NUCLEAR ENERGY INSTITUTE

Topics

- Schedule
- Potential FAQ topics
- Phase 1 topics – Missile Protection
- Phase 2 OIP Structure
- Phase 2 OIP Major Elements
- Projected Consensus Items

Schedule

Date	Activity
07-13-15	Phase 2 OIP Template Structure Meeting
07-28-15	Phase 2 Mk I OIP Pilot Initial Review Meeting
08-25-15	Phase 2 MK I Pilot Detailed Review and Mk II Differences Meeting
09-14/15-15	NEI 13-02 Revision 1 Workshop, Baltimore
09-25-15	NEI Submit to NRC Revision 1 of Phase 1-2 OIP template for endorsement
10-05-15	Receive NRC Endorsement of Revision 1 of Phase 1-2 OIP template
12-31-15	Plants submit Phase 2 OIP to NRC

Deliverables

Date	Action	Supporting
~~07-10-15~~	~~NEI sends NRC Draft Presentation for July 13 meeting~~	July 13 Mtg
07-13-15	NEI sends NRC Draft AX Phase 1-2 OIP Template (~50%)	July 13 Mtg
07-21-15	NRC sends NEI comments on Template AX	July 28 Mtg
07-24-15	NEI sends NRC Draft Presentation for July 28 meeting	July 28 Mtg
07-27-15	NEI sends NRC Draft BX Phase 1-2 OIP Template (~80%) and Draft HAX Hatch Pilot OIP (~70%)	July 28 Mtg
08-12-15	NRC sends NEI comments on Template BX and Pilot HAX	Aug 25 Mtg
08-19-15	NEI sends NRC Draft CX Phase 1-2 OIP Template (~95%) and HBX Hatch Pilot OIP (~90%)	Aug 25 Mtg
08-21-15	NEI sends NRC Draft Nine Mile 2 Pilot Phase 1-2 OIP Differences Summary and Draft Presentation for August 25 meeting	Aug 25 Mtg
09-02-15	NRC sends NEI comments on Template CX, Pilot HBX and Differences Pilot	Sep 14-15 Workshop
09-08-15	NEI Publish Draft 0E1 Phase 1-2 OIP Template for Workshop	Sep 14-15 Workshop
09-25-15	NEI Submit to NRC Revision 1 of Phase 1-2 OIP template for endorsement	Oct 5 NRC Endorsement

Potential FAQ Topics

- HCVS-FAQ-10: Severe accident Multi-unit capability
- HCVS-FAQ-11: Plant SA response to core ex-vessel
- HCVS-FAQ-12: Potential limitations on Operator actions based on gap release and core relocation
- HCVS-FAQ-13: Verification of first 24 hour time sensitive actions

Severe accident Multi-unit capability

- ELAP/LUHS can occur at more than one unit at a multi-unit site
  - EA-12-049 requires multi-unit FLEX response capability and concurrent deployment
- Assume FLEX may not work at one unit on a site
  - Conservative CPRR analysis assumes FLEX is successful 60% of the time
  - Fukushima Daini 1-4 and Daiichi 5&6
- EA-13-109 and NEI 13-02 require full SAWA capability for each unit
- Event progression timing, even with a common initiating event, will not be the same among units at a multi-unit site
  - Not all units may lose power simultaneously
  - Fukushima Daiichi and Daini event experience

Severe accident Multi-unit capability

- At Fukushima Daiichi, with no pre-planned FLEX, units 2 and 3 responded differently with different timing of RCIC/HPCI loss with subsequent core damage
- At Fukushima Daini, with no pre-planned FLEX, FLEX-like actions and minimal power enabled avoided core damage at any unit
- EA-12-049 ensures much greater reliability of FLEX actions through
  - Engineered connection points and strategies
  - Hazard protection
  - Time validations
  - Program configuration control
  - Procedures
  - Training (includes drills and exercises)
- Risk of event decreases as severity of event increases
- SAWA is similar to FLEX water injection, and may be the same flow path

Plant SA response to core ex-vessel

- EA-13-109 requires capability to protect containment from overpressure during a Severe Accident (SA)
  - From SECY-15-0085, "Order EA-13-109, …. to ensure that vents on BWR Mark I and II containments will remain functional in the conditions following reactor core damage."
- The order response must show the unit(s) are capable of operating HCVS and SAWA during a SA and protecting other actions from the venting operation (pipe routing, etc.)
  - "The HCVS shall also be designed to account for radiological conditions that would impede personnel actions needed for event response." (Order Section 1.1.4)
  - "The HCVS controls and indications shall be accessible and functional under a range of plant conditions, including severe accident conditions, extended loss of AC power, and inadequate containment cooling." (Order Section 1.1.4)
- Protection of other plant actions from the SA are not required

Potential limitations on Operator actions based on gap release and core relocation

- Radiological evaluations supporting actions in the Reactor Building should build on HCVS-WP-02 and NEI 13-02 Revision 1 guidance using the following considerations:
  - Structural shielding, such as the bio shield wall and containment remain intact after event
  - Timing of actions relative to expected dose rates that may exist under severe accident conditions
  - Source term content and expected locations of source term that may exist under severe accident conditions.
    - Operating source term bounds the shutdown source term while the core remains inside the RPV.
    - Core source term (non-gaseous) shielded until RPV breach by permanent Containment shielding
  - Time frame between start of core damage until RPV breach by core debris (T=1 hour and 8 hours respectively)
  - Scaling factor to obtain plant specific source term from the generic source term derived from HCVS-WP-02

Potential limitations on Operator actions based on gap release and core relocation

Basis

- RCIC failure at T=0 establishes the limiting action times in the Reactor Building from a radiological perspective
  - Core damage starts at T=1 hour
  - RPV breach occurs at T=8 hours
- Noble gas from gap release migrates to the wetwell air space by the SRV/ERV relief path. Conservatively accounting for transport through vacuum breakers 20% of noble gas source term is in the Drywell airspace while 80% is in Torus/Suppression Chamber airspace.
- Early in-vessel release aerosols migrate to the wetwell by the SRV/ERV relief path and are scrubbed and retained by the Suppression Pool
- Core source term shielding (bio shield) is not displaced and will provide post event shielding
- HCVS vent line source term does not exist until first vent usage under severe accident conditions
- Radiological evaluations should only consider dose rates from noble gas from initial gap release through continued core degradation until RPV breach occurs

Phase 1 Topics

- NRC comments on Tornado Missile BWROG White Paper
  - Potential for damage above and below 30 feet
  - Use of NEI 12-06 guidance/applicability to NEI 13-02
  - HCVS protection inside and outside of buildings
  - Use of average vs. bounding information and risk evaluation
  - Define heavy duty piping
  - Potential for HCVS pipe damage
  - Surrounding structures as tornado missile sources
  - Establishment of ground elevation
  - Establishment of impacted zone surrounding the HCVS piping
  - Evaluation of 5 risk parameters (RG-1.174)
  - RIS 2006-23 / Use of TORMIS and TORMIS versions / NRC SER (9/26/83)
  - Must also consider wind loading
  - FSG contingencies for damaged HCVS piping

Phase 1 Topics

- Responses to NRC comments are being developed with appropriate revision to the paper
- General approach
  - HCVS components below 30 feet will be missile protected both inside or outside of buildings
  - HCVS components above 30 feet will either be missile protected if inside a robust structure or be evaluated using a risk informed alternative to missile protection
  - The portion of HCVS piping that is within the Reactor Building that is also sheet metal is well above 30 feet above grade

Phase 1 Topics

- General approach continued
  - Grade elevation will be defined in the paper with consideration of RG 1.76 Revision 1
  - "Heavy duty" as it applies to pipe is intended to convey the robust nature of such piping as it is used for a hardened vent system and is not intended to specify a standard pipe schedule designator (e.g., EX, Std, etc.)
  - The paper is not intended to indicate that the HCVS pipe will not be damaged if impacted, but that the impact is unlikely and damage is not likely to cause a loss of pipe function
  - Surrounding building contribution to tornado missile sources are considered and included in the 50,000 available missiles

Phase 1 Topics

- General approach continued
  - With respect to RG 1.174, the HCVS is neither single failure proof nor redundant. However, DID is considered in the review of location of the vent in relation to offsite power and safe shutdown equipment
  - The version of TORMIS used in support of this evaluation is the same version addressed in NRC Safety Evaluation Report dated September 26, 1983
  - The paper does not exempt licensees from considering wind load on the stack and associated supports
  - Industry will consider FSG contingencies as a DID measure to the risk informed alternative to missile protection for those portions of the HCVS that are 30 feet above grade

Phase 1 Topics

- Tornado Missile Paper Schedule

Date	Activity
07-13-15	Establish general approach for comment resolution
07-28-15	Complete comment responses and draft paper
08-25-15	NEI submit revised paper for endorsement
09-25-15	Receive NRC Endorsement of Tornado Missile Paper

Phase 1 Topics

- Structure of the JLD/NRR Actions
  - Audit
  - Guidance on audit and SE
  - SE on Phase 1 or both Phase 1&2

Phase 2 OIP Structure

- Assumption additions
- Statement of choices for conditional actions
- SAWA/SAWM/SADV Characteristics
- SAWA/SADV Figures
- Time Sensitive Actions
- Evaluation methods for credited flow paths and electrical circuits
- Data for plant parameters

Phase 2 OIP Elements

- Assumptions for Phase 2, mainly for plant specific characteristics
- Listing of time sensitive actions for SAWA
- Description of SAWA flow path
- Listing of SAWM generic SAMG changes
- Listing of Plant Suppression Pool Plant Characteristics
- Statement of timeline for use of WW vent (7 days)
- Statement of reliance on a SADV if applicable
- Statement of design evaluation parameters used for SAWA

Consensus Items

- Operator actions to use external water source connections
- Generic procedure statements
- V&V acceptance
- Hazard levels