Addressing off-site consequence criteria using PSA Level 3 - Enhanced Scoping Study

NPSAG/NKS Level 3 PSA
2nd Year Seminar
January 20th, 2015

Lloyd's Register Consulting

Working together for a safer world

Agenda

09:00	Coffee/Tea Registration
09:30	Introduction / Project organization • Project organization • First year activities • Ongoing international work • Finnish Pilot project • Swedish Pilot project organization • Guidance document plan
10:30	Coffee break
11:00	Finnish Pilot Study
12:15	Lunch
13:00	Swedish Pilot Study • Swedish Pilot Study • Input specification • Methodology Specification • Scope of Analysis
14:30	Coffee Break
15:00	Workshop
16:00	Workshop Review & Closing
16:30	Adjourn

Background & Objective

- Currently Level 1 and 2 PSA/PRA methodologies are well established and the analysis are a natural part of many NPP's safety analysis.
- In light of the Fukushima, international standard/guideline development, new builds and development of new/updated regulation a need to explore the potential use Level 3 PSA has been identified.
- The project is defined as an enhanced scoping study with objective to explore questions such as:
  - What are the needs for Level 3 PSA?
  - For whom would a Level 3 PSA be beneficial and what kind of results (risk metrics) should then be used?
  - What is going on in the international community with respect to Level 3 PSA guideline & standards.
- The project is defined as a 3 year R&D project where the ultimate objective of the project is to develop a Nordic **guidance document** on Level 3 PSA.

- **Seminar objective is to present the work that has been performed during Year 2 and to discuss with stakeholders and other seminar participants the continued work during year 3 (2015).**

Project funding and organisation

- Funding of the project is provided by:
  - Nordic PSA Group (NPSAG, www.npsag.org)
    - Stakeholders: FKA, RAB, OKG, and SSM
  - Nordic nuclear safety research (NKS, www.nks.org)
  - Finnish Research Programme on Nuclear Power Plant Safety (SAFIR, http://safir2014.vtt.fi)
    - Stakeholders: TVO, Fortum, Fennovoima, and STUK

Project funding and organisation (continued)

- Project working group consists of:
  - Lloyd's Register Consulting
  - RiskPilot
  - VTT
  - ÅF
  - *Vattenfall*

Organisation	Funded by
Lloyd's Register Consulting	
Risk Pilot	NPSAG & NKS
ES-Konsult	
Vattenfall	NKS & Internal
VTT	SAFIR & NKS

Project organization

Task	Leading org.	
Task 0 – Industry Survey	ÅF	
Task 1 – Appropriate Risk Metrics	Risk Pilot	
Task 2 – Regulation, guides and standards	LR Consulting	
Task 3 – Guidance document	All	
Task 4 – Pilot application and tools	VTT	LR / RP / ÅF
Project management	LR Consulting	

Project organization

Task	2013	2014	2015
Task 0 – Industry Survey	100%	-	-
Task 1 – Appropriate Risk Metrics	100%	-	-
Task 2 – Regulation, guides and standards	75%	25%	-
Task 4 – Pilot application and tools	-	50%	50%
Task 3 – Guidance document	-	33%	67%
Project management	33%	33%	33%

Review of first year activities (2013)

Deliverable	Date
Detailed project plan	May 2013
Project seminar 1	Jan. 2014
First year report	

Major Sub-report
Task 0 - Survey of Level 3 PSA Industrial Purpose/Application
Task 1 - Risk Metrics
Status of Task 2 - Regulation & Standards
Status of Pilot Application (SAFIR/PRADA – VTT)

Task 0 Industrial survey

- Lead by ÅF (ES Konsult)
- The purpose of the questionnaire was to collect base information about current international practices and motivations of utilities and regulators for Level 3 PSA.
  - Even though Level 3 PSA is required only in a few countries, the interest is broader.
  - The results from the questionnaire will contribute to the scope and contents of the Task 3 guidance document and the development of the Task 4 Pilot project.
- The results of the questionnaire highlighted many varied insights, interests, and concerns for Level 3 PSA.

Task 0 Industrial survey

The possible advantages of Level 3 PSA were summarized as follows:

- Facilitate communication with insurance companies and the analysis could lead to better insurance possibilities
- Better understanding of societal risks of commercial nuclear power and thereby improve preparedness work
- Provide better design and siting considerations for new construction projects
- Cost benefit metric for plant retrofits

Challenges cited by survey participants

- Uncertainties of Level 3 PSA calculations
- Lacking information on Level 3 PSA

Task 1 Risk metrics

- Lead by Risk Pilot
- Task 1 identified three primary categories of Level 3 PSA risk metrics:
  - Health effects
  - Environment effects
  - Economic effects
- Health effects:
  - It was determined that Health effects need to be a focus of the pilot project as it is fundamental to what one thinks of when discussing Level 3 PSA.
- Environmental effects:
  - Nearly as fundamental as health effects
  - This could be essential when discussing filtered venting for example.
- Economic effects:
  - may not be "necessary" but is of high interest.

Task 1 Risk metrics

- There are a number of open issues, e.g.
  - how far in time and place the estimations need to be done, i.e.,
    - what is the time frame for the risk metrics
    - how far away from the plant should the impact be accounted for?

- The pilot study, which is planned within the project, should elaborate more on these risk metrics
- The pilot study should also elaborate how Level 2 PSA release category related risk metrics could be used as surrogates for Level 3 PSA criteria.

Task 2 guides and standards

- Lead by LR Consulting
- ASME/ANS Level 3 PSA Standard (58.25)
  - Started 2004
  - In draft state
  - Unsteady progress (periods of significant progress followed by periods of little)
    - Modest progress in last 2 years
  - USNRC participation required for continuation
- International Atomic Energy Agency (IAEA)
  - Currently, work ongoing on development of updated guidance
  - (1996) Safety Series guide on Level 3 PSA
  - (2012) Technical meeting
  - (2013 – Present) Consultant meetings on Level 3 PSA TECDOC

Task 4 Finnish pilot project

- Lead by VTT
- The Finnish project began during 2013. The Swedish part of the project will being during 2013.
- The Finnish pilot project will investigate the Fukushima scenario.
- Will be covered separately by Tero.

Development of 2nd year activities (2014)

- Pilot projects
  - Swedish (startup)
  - Finnish (continuation)
- Guidance document
  - Draft outline
  - Work in earnest to being June 2015
- International activities
  - IAEA TECDOC
  - USNRC Level 3 PRA project updates

Swedish pilot project - Goals

- Clarify what insights that can be gained from a Level 3 PSA
  - Demonstrate what additional can be gained in addition to Level 2 PSA
  - (e.g. when threshold criteria are imposed on nuclear releases what if threshold is exceeded marginally or substantially)
- Demonstrate the resources required to perform a Level 3 PSA
- Develop clearer understanding of what the key uncertainties are
- Determine how the existing release category structure fits-in to off-site consequence needs
- Gain insight in the application of the risk metrics proposed in Task 1
  - Support the guidance document and provide practical background to the guidance

Swedish pilot project – Goals (cont.)

- Demonstrate and capture lessons learned and applied/communicated in Guidance Document.
- Identify development needs and future work
- Provide additional, practical insight, for contributing to external organizations e.g. IAEA
- What is the risk importance of the filter system
  - could be key to include environmental / contaminated area
- To what level of detail can certain conclusions be drawn, how well do "shortcuts" and surrogates provide insight to off-site consequence analysis?

Swedish pilot project – organization

- A series of reports will be developed over the course of the pilot project:
  - Swedish pilot project plan
  - Input specification
  - Scope of analysis
  - Methodology specification
  - Application and result interpretation

Swedish pilot project – Input specification

- Level 3 PSA Pilot Study input specification
  - Based on LENA requirements / assumptions what inputs are need
  - what formats are required
  - What limitations have been found
  - What additional information could be useful.
- Report is completed

Swedish pilot project – organization

- Scope of analysis
  - Describe how project intends to satisfy as many of the project goals with the resources available
  - What is the extent that will be modelled
    - Distances
    - Time frames
    - Risk Metrics
    - Countermeasures / Protective actions
  - Description of intended
    - Result formats
    - Whether uncertainties will be included
  - Currently ongoing
  - Start concurrently with Methods report

Swedish pilot project – organization

- Methodology specification
  - Describe methods used by LENA
  - Describe methods for calculating
    - Acute effects
    - Latent health effects
    - Land contamination
    - Economic impact
    - Countermeasures
- Application and result interpretation
  - Present results and discuss findings
  - Discuss how process can be improved, issues and difficulties
  - Discuss how Pilot results can be applied (or how they cannot)

Guidance document

- The guidance document represents the central deliverable of the project.
- Will be focus of 2015 work
  - The guidance document will be influenced by:
    - Pilot projects
    - IAEA Level 3 PSA TECDOC (Completed draft and Technical Meeting 2015)
    - ANS/ASME 58.25 Level 3 PRA standard (Progress expected during 2015)
- Purpose of guidance document
  - A summary on industrial purposes for performing Level 3 PSA
  - Recommended risk metrics for Level 3 PSA
  - Requirements on existing Level 1 & Level 2 studies set by the Level 3 PSA analysis.
  - Collection of current regulations, guides, and standards toward Level 3 PSA
  - Methodology guidance

Guidance document

- Guidance document plan
  - First draft outline has been created
  - Guidance document planning meeting in June with stakeholders
  - Such a schedule allows for IAEA and ANS/ASME Level 3 Standard work to firm up a bit more.
  - Completion of pilot studies

- How should guidance document cooperation be managed with stakeholders?
  - What would stakeholders like to contribute
  - How frequent should this collaboration be
  - Point of discussion in workshop

Agenda

09:00	Coffee/Tea Registration
09:30	Introduction / Project organization • Project organization • First year activities • Ongoing international work • Finnish Pilot project • Swedish Pilot project organization • Guidance document plan
10:30	Coffee break
11:00	Finnish Pilot Study
12:15	Lunch
13:00	Swedish Pilot Study • Swedish Pilot Study • Input specification • Methodology Specification • Scope of Analysis
14:30	Coffee Break
15:00	Workshop
16:00	Workshop Review & Closing
16:30	Adjourn

Andrew Wallin Caldwell
Consultant
T +46 722447313 E Andy.Wallin-Caldwell@lr.org

Lloyd's Register Consulting
www.lr.org/consulting

Lloyd's Register Consulting

Working together for a safer world