

DATABASE FOR STORING SCREENING EVALUATION WORKSHEETS FOR SEISMIC PRA WALKDOWNS

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PETRI SAARANTA



Agenda

- Background
- Screening Evaluation Worksheets
- Database development
- Database views
- Pilot test – Seismic walkdown of a nuclear power plant
- Conclusion

Background

- Development of SPRA for NPP involves performing plant walkdowns
 - Estimation of seismic capacities for risk-significant SSCs
- Information collected on Screening Evaluation Worksheets (SEWS)
- A full-scope seismic walkdown involves several hundred SSCs in the seismic equipment list
 - Thousands of pages of printed SEWS
- A database was developed to store the information collected with SEWS electronically and allow using a touchscreen tablet device as the input method
- Purpose of the Seismic Walkdown Database (SWDB) is to
 - Ease the preparation of walkdowns
 - Ease the handling of SEWSs
 - Reduce the amount of weight to carry during walkdowns
 - Ease the final reporting of plant walkdowns

Screening Evaluation Worksheet

- Example SEWS from EPRI report 3002012994
- The EPRI report includes 23 different SEWSs for different types of equipment

Sheet 1/3

SCREENING EVALUATION WORK SHEET

Plant Name : Unit :

PART A. DESCRIPTION

Equip. ID. No. Equip. Class

Equipment Description:

Equipment Location: Bldg. Floor El. Room, Row/Col

Manufacturer, Model, Etc.

Seismic Input Elevation

PART B. PUMP EVALUATION

	Y	N	U	N/A
1. Is the pump of good seismic design ?	☐	☐	☐	☐
Base flexibility				
Shaft restraints				
Casings				
Differential structural motion				
Nozzle loadings				
Unsupported components				
2. No other pump concerns?	☐	☐	☐	☐
Is the pump itself screened out?	☐	☐	☐	

PART C. ANCHORAGE EVALUATION

1. Is strength assessment based on:				
Judgement (supported by generic analysis)?	☐			
Specific analysis?	☐			
Other?				
2. Is strength adequate?	☐	☐	☐	☐
(number, size, spacing, free-edge, gap under base, tightness)				
3. Is stiffness adequate?	☐	☐	☐	☐
4. No other anchorage concerns?	☐	☐	☐	☐
Indication of cracking in the anchorage area				
Is the anchorage adequate?	☐	☐	☐	

Sheet 2/3

SCREENING EVALUATION WORK SHEET

Equip. ID. No. Equip. Class

PART D. SYSTEMS INTERACTION EFFECTS

	Y	N	U	N/A
1. Is the pump free from influence by adjacent elements?	☐	☐	☐	☐
Pump contains soft targets				
Flexibility of attached lines				
Collapse of nearby equipments or structures				
Masonry block walls				
2. No potential sources could flood or spill onto pump?	☐	☐	☐	☐
3. No other interaction concerns ?	☐	☐	☐	☐
Is the pump free from interaction effects?	☐	☐	☐	

COMMENTS:

Is the pump free of need for further investigation ?	☐	☐
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Evaluated by:		Date
Evaluated by:		

Database development

- The walkdown database contains
 - Seismic Equipment List (SEL)
 - Screening Evaluation Worksheets (SEWSs)
 - The SEWS recommended by EPRI were used in the database development
- Main database tables summarized below:

Table EquipmentClasses

- Contains the 23 different equipment classes

Table Equipment

- Equipment ID
- Equipment Class
- Description, Room, etc.

Table SEWSQuestions

- Equipment class
- The questions from the SEWS corresponding the equipment class

Table EvaluationOutcomes

- Equip. ID, Equip. Class
- The evaluation outcomes for the specific Equip. ID

Database views

Form view

- Allows inputting information to the database tables
- SEWS lookup by Equipment ID and filtering by room

SEWS

SCREENING EVALUATION WORK SHEET

Find Equipment

Filter by Room

Plant Name: Unit:

PART A. DESCRIPTION

Equip. ID. No. Equip. Class

Equipment Description

Equipment Location: Building Floor El. Room

Manufacturer, Model, Etc.

Seismic Input Elevation

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PART B. PUMP EVALUATION

	☐	☐	☐	☐
1. Is the pump of good seismic design?	☒	☐	☐	☐
Driver and pump attached to common base				
Lateral load resistant system				
Shaft restraint				
Vibration isolation system				
Nozzle loadings				
Unsupported components				
2. No other pump concerns?	☒	☐	☐	☐
Is the pump itself screened out?	☒	☐	☐	

PART C. ANCHORAGE EVALUATION

1. Is strength assessment based on:

Judgement (supported by generic analysis)? ☒

Specific analysis? ☐

Other?

	☐	☐	☐	☐
2. Is strength adequate? (number, size, spacing, free-edge, gap under base, tightness)	☒	☐	☐	☐
3. Is stiffness adequate?	☒	☐	☐	☐
4. No other anchorage concerns?	☒	☐	☐	☐
Indication of cracking in the anchorage area	☒	☐	☐	

Record: 1 of 2 Unfiltered Search

Report view

- Intended for printing out a PDF appendix to walkdown report
- Can be also used to print SEWS to paper if it is preferred over using a tablet

SCREENING EVALUATION WORK SHEET

Plant Name: _____ Unit:

Equip. ID. Equip. Class

PART A. DESCRIPTION

System:

Equipment Description:

Equipment Location: Bldg. Floor El. Room

Manufacturer, Model, Etc

Seismic Input Elevation:

PART B. VALVE EVALUATION

	Y	N	U	N/A
1. Is the valve of good seismic design? Pipe of one inch diameter or greater Cast iron parts Operator height Operator and yoke mounting	☐	☐	☐	☐
2. No other valve concerns?	☐	☐	☐	☐
Is the valve itself screened out?	☐	☐	☐	

PART C. SYSTEMS INTERACTION EFFECTS

	Y	N	U	N/A
1. Is the valve free from influence by adjacent elements? Valve contains soft targets Flexibility of attached lines Collapse of nearby equipments or structures Masonry block walls	☐	☐	☐	☐
2. No potential sources could flood or spill onto valve?	☐	☐	☐	☐
3. No other interaction concerns?	☐	☐	☐	☐
Is the valve free from interaction effects?	☐	☐	☐	

Pilot test

- The SWDB was tested in planning of a full-scope seismic walkdown for a NPP in Europe
- The plant did not allow bringing a tablet for walkdowns
 - The database was used to generate partly pre-filled SEWS prior to the walkdowns
- The main benefits of using the database noticed in the pilot test:
 - Easy information input to fill the Part A of the SEWSs
 - Sorting the SEWS by room, since the walkdown plans were based on the rooms to be visited each day
- Possibilities for improvement noticed in the pilot test:
 - Adding a summary report to list all components by room / print out the SEL

Conclusion

- A database can be used to electronically collect and store large amounts information from walkdowns to support development of seismic PRA
 - Easier information collecting, storing and organizing before, during and after walkdowns
- Using a touchscreen tablet device would allow easier preparation of walkdown, reduce the weight to carry during walkdowns and ease walkdown reporting
- The database was pilot tested in planning of a seismic walkdown
 - Even though a tablet could not be brought to the plant, the database was found useful in the planning of the walkdown
- Future improvements
 - Adding a summary report of the SEL
 - Adding support for alternative SEWSs
 - Explore possibility to include walkdown photos

Questions?



Thank You

petri.saaranta@jensenhughes.com



Petri Saaranta
Nuclear Safety Consultant

Alternative Screening Evaluation Worksheets

- Alternative SEWSs exist
- Right is an example of SQUG (Seismic Quality Utility Group) GIP (Generic Implementation Procedure) SEWS
- The Seismic Walkdown Database can be configured to use any choice of SEWS with a minor effort

Revision 3A
Status Y N U

Screening Evaluation Work Sheet (SEWS) Sheet 1 of 2

Equipment ID No. _____ Equip. Class 6 – Vertical Pumps

Equipment Description _____

Location: Bldg. _____ Floor El. _____ Room, Row/Col _____

Manufacturer, Model, Etc. (optional but recommended^[2]) _____

Horsepower/Motor Rating (opt.) _____ RPM (opt.) _____ Head (opt.) _____ Flow Rate (opt.) _____

Seismic Capacity vs. Demand

1. Elevation where equipment receives seismic input	
2. Elevation of seismic input below about 40' from grade	Y N U N/A
3. Equipment has fundamental frequency above about 8 Hz	Y N U N/A
4. Capacity based on: Existing Documentation	DOC
Bounding Spectrum	BS
1.5 x Bounding Spectrum	ABS
5. Demand based on: Ground Response Spectrum	GRS
1.5 x Ground Response Spectrum	AGS
Conserv. Desc. In-Str. Resp. Spec.	CRS
Realistic M-Ctr. In-Str. Resp. Spec.	RRS

Does capacity exceed demand? ^[3](Indicate at right (*) and in Comments if a special exception to enveloping of seismic demand spectrum is invoked per Section 4.2 of the GIP.) Y N U

Caveats – Bounding Spectrum (Identify with an asterisk (*) those caveats which are met by intent without meeting the specific wording of the caveat rule and explain the reason for this conclusion in the Comments section below.)

1. Equipment is included in earthquake experience equipment class	Y N U N/A
2. Casing and impeller shaft not cantilevered more than 20 feet, with radial bearing at bottom to support shaft	Y N U N/A
3. No risk of excessive nozzle loads such as gross pipe motion or differential displacement	Y N U N/A
4. Attached lines (cooling, air, electrical) have adequate flexibility	Y N U N/A
5. Anchorage adequate (See checklist, below, for details.)	Y N U N/A
6. Relays mounted on equipment evaluated	Y N U N/A
7. Have you looked for and found no other adverse concerns?	Y N U N/A

Is the intent of all the caveats met for Bounding Spectrum? Y N U N/A

Anchorage

1. Appropriate equipment characteristics determined (mass, CG, natural freq., damping, center of rotation)	Y N U N/A
2. Type of anchorage covered by GIP	Y N U N/A
3. Sizes and locations of anchors determined	Y N U N/A
4. Anchorage installation adequate, e.g., weld quality and length, nuts and washers, expansion anchor tightness	Y N U N/A

G.6-1

Revision 3A

Screening Evaluation Work Sheet (SEWS) Sheet 2 of 2

Equipment ID No. _____ Equip. Class 6 – Vertical Pumps

Equipment Description _____

Anchorage (cont'd)

5. Factors affecting anchorage capacity or margin of safety considered: embedment length, anchor spacing, free-edge distance, concrete strength/condition and concrete cracking	Y N U N/A
6. For bolted anchorages, gap under base less than 1/4-inch	Y N U N/A
7. Factors affecting essential relays considered: gap under base, capacity reduction for expansion anchors	Y N U N/A
8. Base has adequate stiffness and effect of prying action on anchors considered	Y N U N/A
9. Strength of equipment base and load path to CG adequate	Y N U N/A
10. Embedded steel, grout pad, or large concrete pad adequacy evaluated	Y N U N/A
11. ^[6] Anchorage capacity exceeds demand	Y N U N/A

Are anchorage requirements met? Y N U

Interaction Effects

1. Soft targets free from impact by nearby equipment or structures	Y N U N/A
2. If equipment contains sensitive relays, equipment free from all impact by nearby equipment or structures	Y N U N/A
3. Attached lines have adequate flexibility	Y N U N/A
4. Overhead equipment or distribution systems are not likely to collapse	Y N U N/A
5. Have you looked for and found no other adverse concerns?	Y N U N/A

Is equipment free of interaction effects? Y N U

^[4]Does the Equipment Meet the GIP Criteria? Y N U

Comments

Evaluated by: _____ Date: _____

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