SMA and SPRA Status Report of Taipower

Taiwan Power Company

SEP. 2013

Background

- New faults identified near nuclear power plant sites in Taiwan
- Seismic risk may exceed the design basis
- Risk assessment follow U.S. requirements

Review Level Earthquake

- USNRC SRM to SECY-93-087
  - "The Commission approved the use of 1.67 times the Design Basis SSE for margin-type assessment of seismic events “
  - NUREG/CR-0098 median centered rock site response spectrum
  - TPC almost completed this assessment and reinforcement ongoing.

	SSE	1.67SSE
CS	0.3G	0.5G
KS	0.4G	0.67G
MS	0.4G	0.67G

IPEEE

- GL 88-20 Supplement 4
- Individual Plant Examination of External Events (IPEEE) for Severe Accident Vulnerabilities – 10CFR50.54(f)
- NUREG-1407 – Procedural and Submittal Guidance June 1991

Acceptable Methodologies

- Seismic Margin (SMA)
  - NRC Method – event/fault tree approach to delineate accident sequence
  - EPRI Method – ‘success path’ approach to shutdown and remain for 72 hours
- Seismic PRA (SPRA)
  - New Seismic PRA Analysis
  - Use of an Existing PRA

SMA Tasks

- Walkdown
- Relay Evaluation
- Soil Failure
- Screening Criteria
- Seismic Input – NUREG/CR-0098 median
- Evaluation of Outliers - HCLPF Calculations

SMA SSEL Development Overview

- Based on USNRC GL 88-20, Supplement 4, and NUREG-1407, EPRI Method
- Develop plant-specific safety function models (Success Path Logic Diagrams SPLDs)
- Identify systems that can accomplish these success paths
- Identify primary and alternate success paths based on operational and system considerations

SMA SSEL Development Overview (Continued)

- Identify important components within these systems
- Develop walkdown List
- Perform system walkdown and operator interviews
- Finalize SSEL and walkdown list

Key SMA References

- EPRI Report NP-6041-SL, Rev. 1, A Methodology for Nuclear Power Plant Seismic Margin, August 1991
- ASME/ANS RA-Sa-2009 – Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications

HCLPF

- Confidence in a Low Probability of Failure
- 95% of confidence in less than 5% probability of failure
- For a single mean fragility, HCLPF capacity of a component is equivalent to about 1% composite probability of failure

Component HCLPF Evaluation

- Evaluation Bases
  - Scaling of existing analyses
  - FSAR (contains design result summary)
  - New Analysis
- Evaluation Approach (Criteria Review)
  - Demand (Response)
  - Capacity (Strength)

CIVIL STRUCTURES HCLPF

CS		KS		MS	
Combination Structure（聯合廠房）	0.79 g	Control Building（控制廠房）	0.74 g	Reactor Building/Containment Exterior Shell（反應爐廠房）	1.22 g
Emergency Pump House（緊急泵室）	1.97 g	Reactor Building（反應爐廠房）	1.10 g	NSCW Pump House（廠用海水系統泵室）	1.45 g
Condensate Storage Tank（冷凝水儲存槽）	0.41 g	Control Building（柴油發電機廠房）	0.73 g	Auxiliary/Control Building（輔助/控制廠房）	0.78 g
Diesel Generator Fuel Oil Tank（緊急發電機柴油儲存槽）	0.43 g	Reactor Auxiliary Building（反應爐輔助廠房）	0.71 g	Diesel Generator Building（柴油發電機廠房）	0.79 g
		Turbine Building（汽機廠房）	0.77 g	Component Cooling Water Building（核機冷卻水廠房）	1.90 g

CS TK-40-1A

- Diesel Generator Fuel Oil Tank
- HCLPF = 0.43g
- HCLPF = 0.50g if limited the fluid level to 26.3 ft
- Required at least 253 in = 21 ft-1 in post Fukushima

CS TK-4-1A

- Condensate Storage Tank
- HCLPF = 0.41g
- HCLPF = 0.50g if limited the water level to 24.4 ft

- Walkdown List includes pumps, valves, panels, instrument racks, switchgear, load centers, MCCs, tanks, etc.
- Number of component on walkdown list
  - CS 379 components
  - KS 321 components
  - MS 348 components

CS SMA RESULTS (1.67SSE)

- component
  11 items needed reinforcement

- Relay
  15 items needed reinforcement

Microsoft Excel
97-2003 工作表

KS SMA RESULTS (1.67SSE)

- component
  25 items needed reinforcement
  32 items needed clarification

- Relay
  128 items needed reinforcement

Microsoft Excel
工作表

MS SMA RESULTS (1.67SSE)

- component
  36 items needed reevaluation/clarification

- Relay
  no item needed reinforcement

Microsoft Excel
工作表

SMA Peer Reviewed by NCREE

(National Center of Research on Earthquake Engineering)

plant	date
CS	2013.4.17
CS	2013.5.15
CS	2013.6.25
CS	2013.9.12
KS MS	2013.9.12

NCREE will finish the peer review process by the end of 2013.

NTTF2.1
(March12 2012)

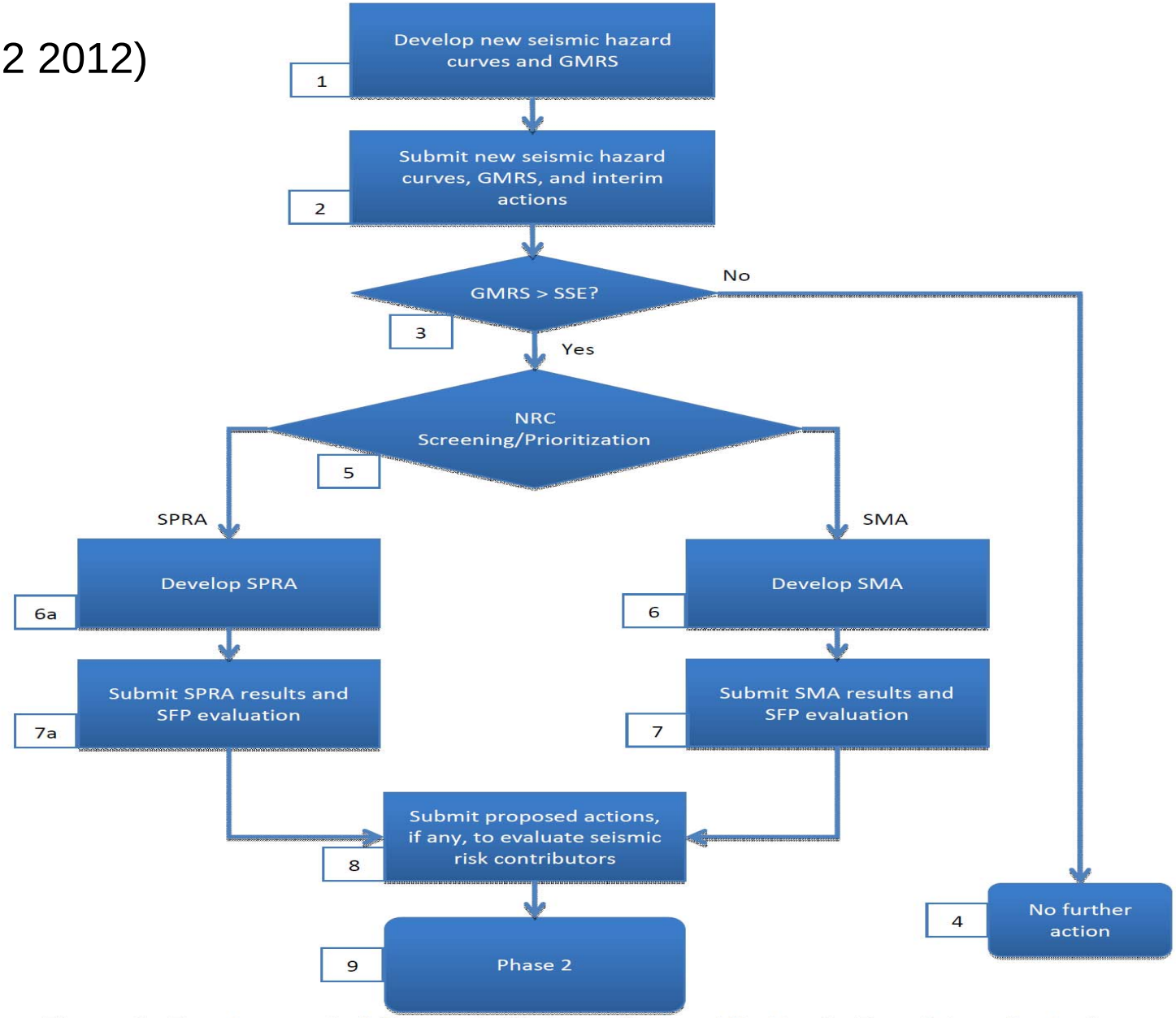

Figure 1. Development of Requested Information and Its Use in Regulatory Analysis.

台灣電力公司

Review Level Earthquake

- Develop site specific Ground Motion Response Spectra (GMRS) following Regulatory Guide 1.208
- GMRS submitted to AEC for reviewing
- RLE = max (SSE, GMRS).
- TPC will revise SMA results later.

SPRA Tasks

- Hazard Selection
- Fragility Estimation
- Plant Walkdowns
- Relay Chatter
- Liquefaction
- HCLPF (Fragility) Calculations

SPRA work will start when PSHA results are approved by AEC.

THANKS FOR YOUR ATTENTION