Overview of Comprehensive Assessment for the Safety of Nuclear Power Reactors

November, 2011

Nuclear and Industrial Safety Agency

Objectives and Overview of Comprehensive Safety Assessment

Objectives

Carry out safety assessment to ensure public/residents relief and confidence in improved safety of nuclear power plants, according to new procedure/rule and referring to stress tests conducted in European countries as references.

Overview

- **Primary assessment: (Decision on whether to restart operations at nuclear power stations currently suspended for the purpose of regularly scheduled checks)**

  Evaluate safety margins of structures, systems and components important to safety to endure the events beyond design bases, for nuclear power plants under periodic inspection and ready for start-up.

- **Secondary assessment: (Decision on whether to continue or halt operations of nuclear power stations that are currently in operation.)**

  Conduct comprehensive safety assessment for all nuclear power plants including those in operation and those subject to primary assessment, considering the status of stress tests in European countries and progress in investigation by the Investigation and Verification Committee on the Accident.

"Regarding the Confirmation of Safety of Nuclear Power Plants in Japan" (July 11)

Facilities Subject to Assessment and Implementation Plan

Facilities subject to assessment

All existing nuclear power reactor facilities, including those under construction except for TEPCO's Fukushima Dai-ichi and Dai-ni Nuclear Power Station and those under decommissioning without fuel in the site.

Implementation plan

- **Primary assessment:** (Decision on whether to restart operations at nuclear power stations currently suspended for the purpose of regularly scheduled checks)
  Sequentially for nuclear power plants under periodic inspection and ready for start-up
- **Secondary assessment:**
  Conduct for all power reactor facilities subject to assessment. Licensees' reports are expected basically within this year, but reconsidered, as appropriate, on the basis of the status of stress tests in European countries and progress in investigation by the Investigation and Verification Committee on the Accident.

Events to be Assessed and Safety Margin Assessment Process

Assess the safety margins (overall system margins) from the occurrence of events beyond design bases (earthquake and tsunami), through functional loss of individual component and damages to redundant safety measures, finally to core damage.

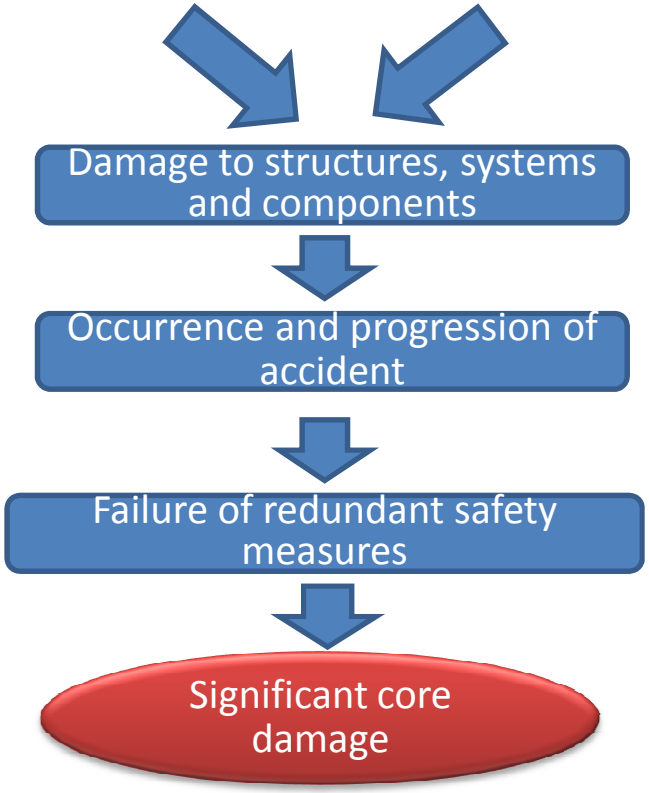
Events to be assessed

Beyond design bases

Earthquake

Tsunami

Event progression



Assessment methods

Assessment of what structures, systems and components will be damaged due to earthquake/tsunami.

Assessment of the scenarios to prevent core damage, on the basis of the above assessment.

Identification of earthquake/tsunami level above which there is no reliable measure to prevent core damage, on the basis of the above assessment.

Image of Safety Margin to be verified by Stress Test (for Ohi Unit 3)

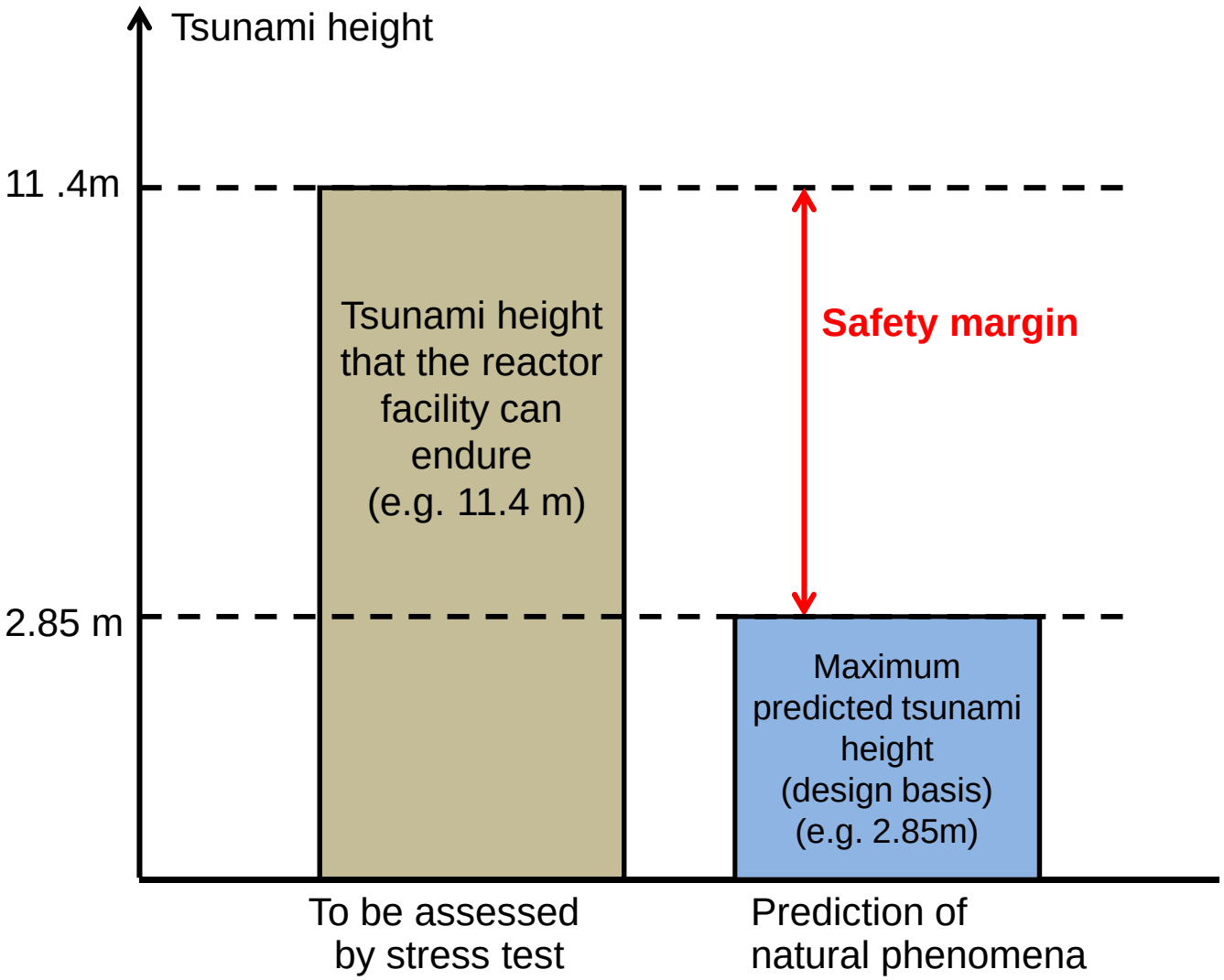
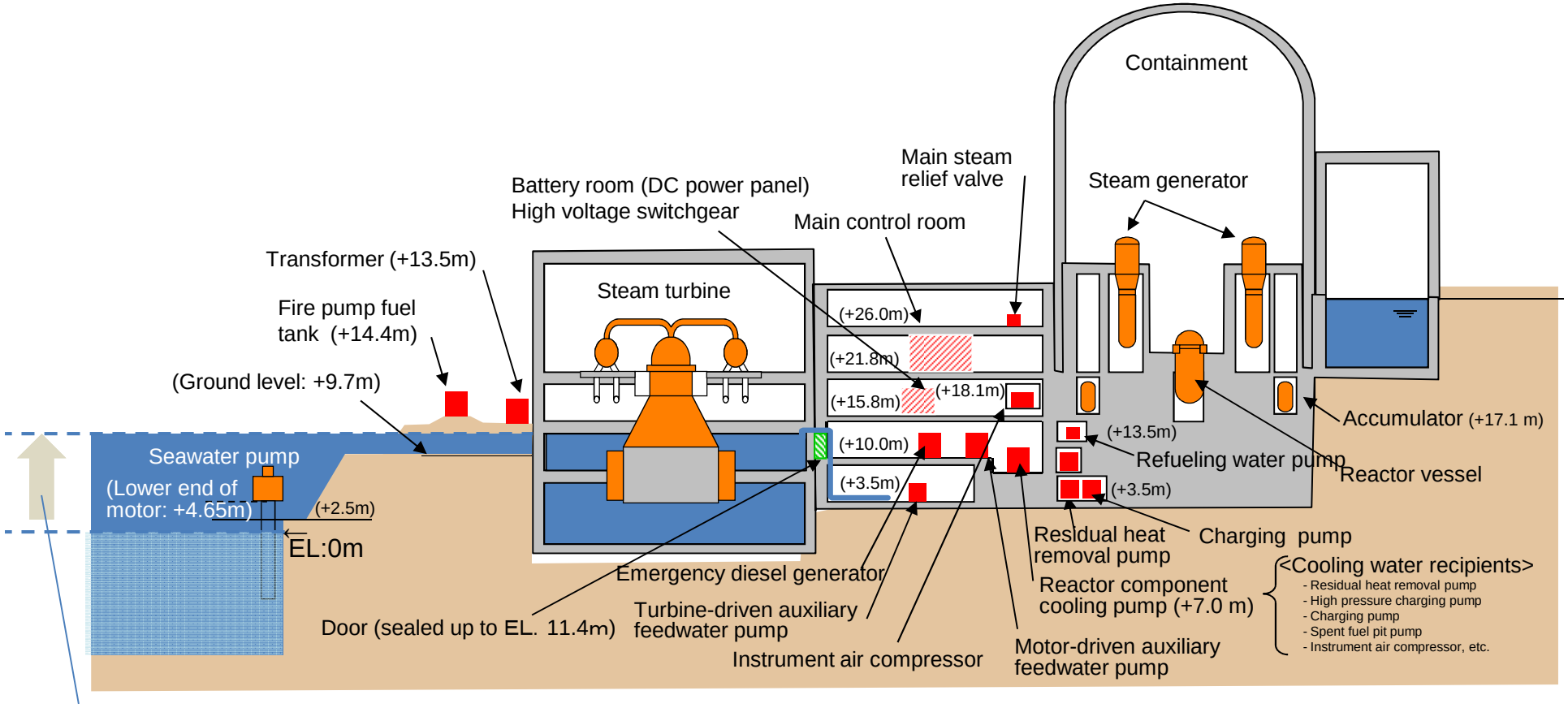


Image of Tsunami Assessment (for Ohi Unit 3)

What structures, systems and components will be flooded and/or lose functions due to tsunami



Postulated tsunami

Results of Tsunami Assessment for Ohi 3 (not assessed by NISA yet)

After the tsunami height that makes individual components inoperable is determined in advance, a possible scenario to prevent core damage is evaluated and the tsunami height that will exclude the measures to ensure prevention of core damage is identified.

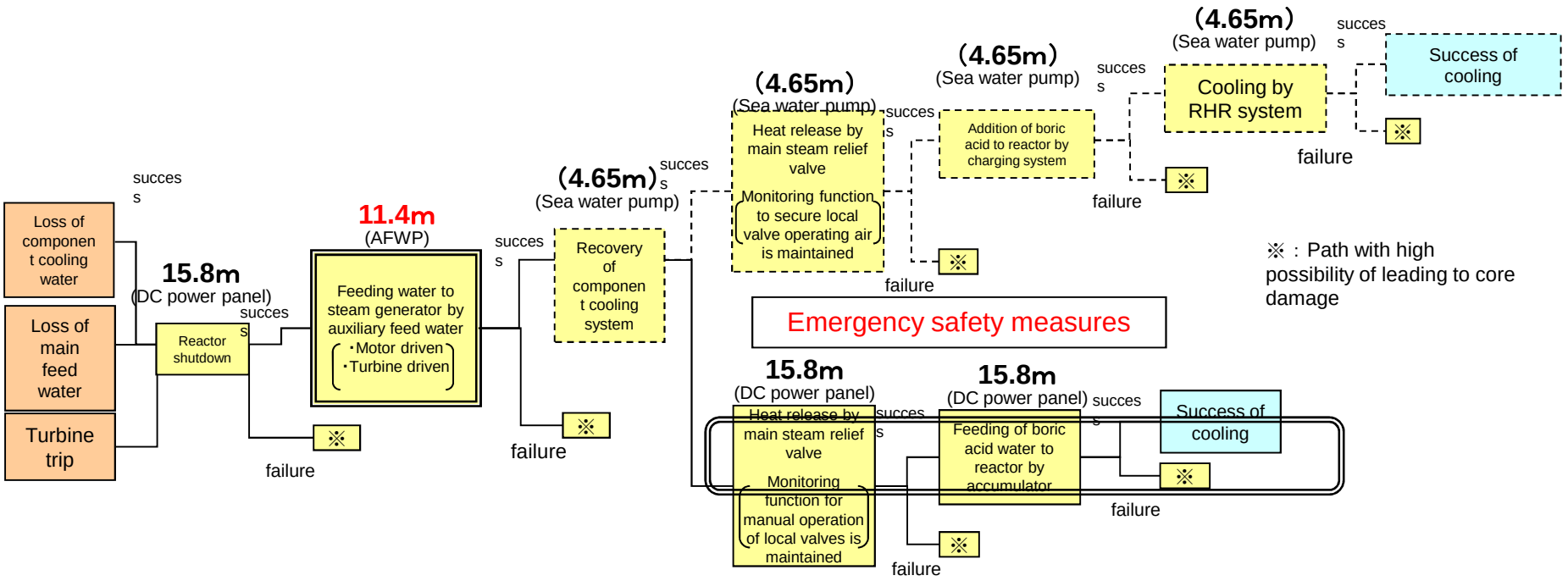


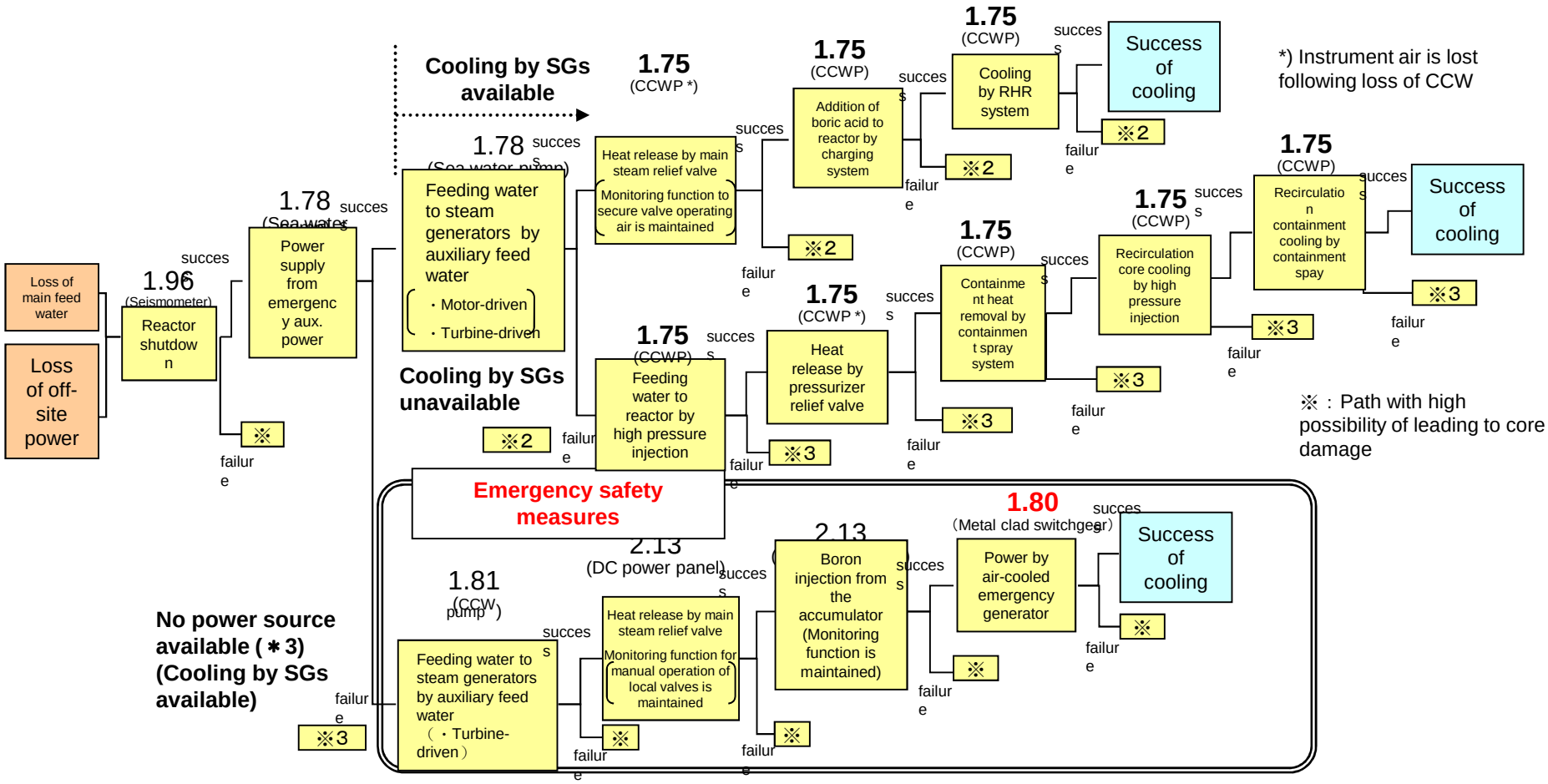
Image of Seismic Assessment (example of Ohi 3)

Evaluate which components (those affect the core damage) will lose their functions depending on the seismic intensity (expressed in multiples of basic seismic motion)

Part or Equipment Possibly To Be Damaged	Multiples of Basic Seismic Motion (Ss)
Main feed water pump, etc.	Less than 1.0
Transformer, etc.	Less than 1.0
Component cooling water pump	1.75
RHR hot leg suction piping	1.99
Reactor building, etc.	2.00
Small-bore piping connecting reactor coolant pressure boundary	2.03
Main feed water system piping	2.13
Steam generator (internals)	2.21
Pressurizer spray line piping, etc.	2.58

Results of Seismic Assessment for Ohi 3 (not assessed by NISA yet)

After the seismic intensity (represented in multiplications of basic seismic motion) that makes individual components unavailable for operation is determined in advance, a possible scenario to prevent core damage is evaluated and the seismic intensity that will eliminate the measures to ensure prevention of core damage is identified.



Summary of Assessment Results of Ohi 3
(not assessed by NISA yet)

	Guideline for cliff edge assessment	Cliff edge and facility subject to assessment		Before implementation of emergency safety measures and facility subject to assessment	Effects of safety assurance measures*1
Earthquake (Same in the case of combination with tsunami)	Comparison with design basis seismic ground motion Ss (700 gal)	1.80 times (Equivalent to 1260 gal) Metal clad switchgear		1.75 times (Equivalent to 1225 gal) Reactor component cooling water pump	Improved by about 3%
Tsunami (Same in the case of combination with tsunami)	Comparison with design tsunami height (2.85 m)	About 4 times (11.4 m) Turbine-driven auxiliary feedwater pump		About 1.6 times (4.65 m) Seawater pump	Improved by about 145%
Station blackout (SBO)	Period until the means for cooling fuel are not secured under the condition of no external support	Core	About 16 days*2 Gasoline for fire pumps supplying water to the water sources	About 5 hours*1 Battery	Improved by a factor of about 76
		Spent fuel	About 10 days (in shutdown)*2 Gasoline for fire pumps supplying water to the pit	About 12 hours*1 (in shutdown) (When the water temperature reaches 100℃)	Improved by a factor of about 20
Loss of ultimate heat sink (LUHS)		Core	About 16 days*2 Gasoline for fire pumps supplying water to the water sources	About 6 days Water source for steam generators	Improved by a factor of about 2.6
		Spent fuel	About 10 days (in shutdown)*2 Gasoline for fire pumps supplying water to the pit	About 12 hours*1 (in shutdown) (When the water temperature reaches 100℃)	Improved by a factor of about 20

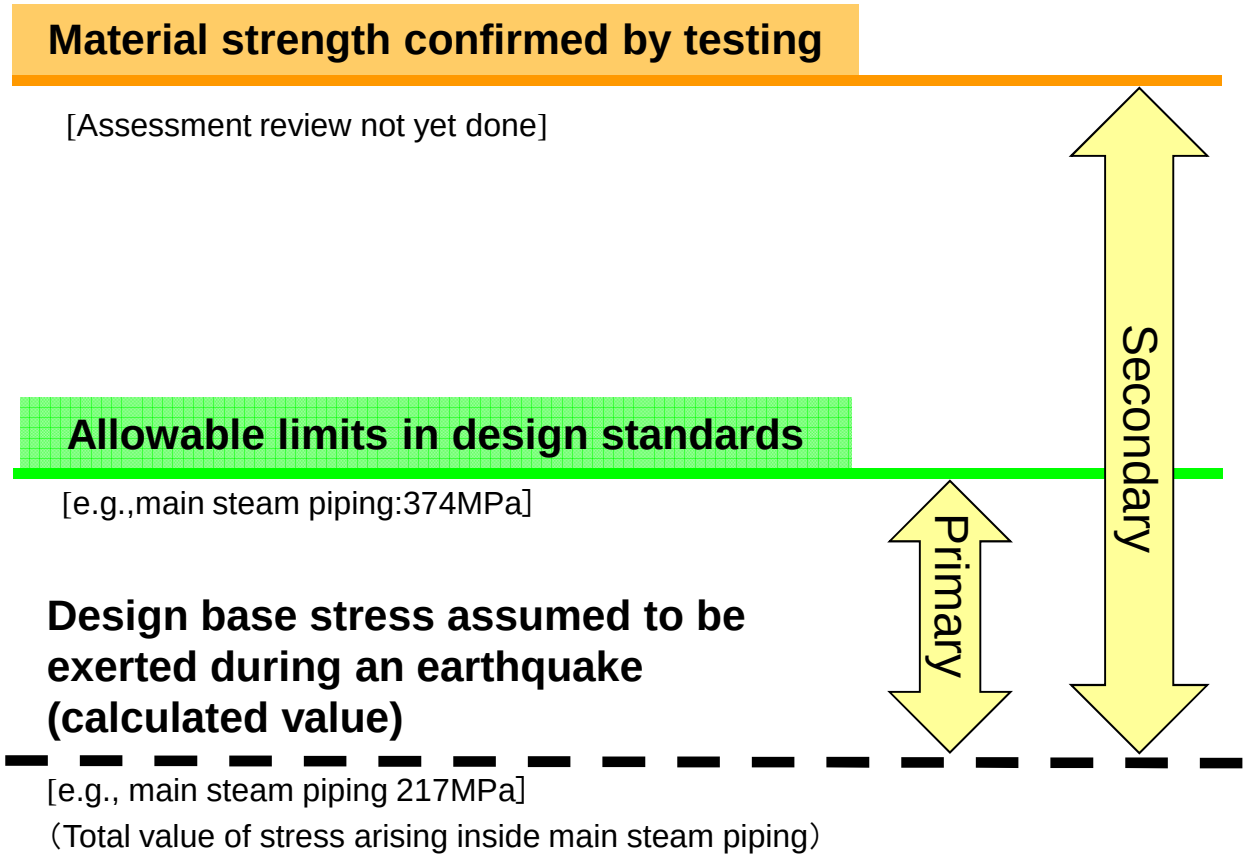
*1: The measures whose procedures have not been prepared yet were excluded from the assessment, even if they might be viable. The assessment was performed under the extremely conservative conditions.

*2: Assessment results without considering external support. As they have sufficient time to expect external support, the cliff edge can be avoided.

Primary and Secondary Assessment Method (Seismic Assessment)

Both Primary/Secondary Assessment asses the margins of the system as a whole, the difference the assessment method is on the concept about the threshold value against the function loss of individual component. In primary assessment, threshold is the allowable limits that is applied in the design standards. In secondary assessment, it is the realistic values regarding the loss of structural integrity or functions.

Basic approach for margins of structural integrity of components and piping (summary)



Plant Restart and Continuation of Plant Operation

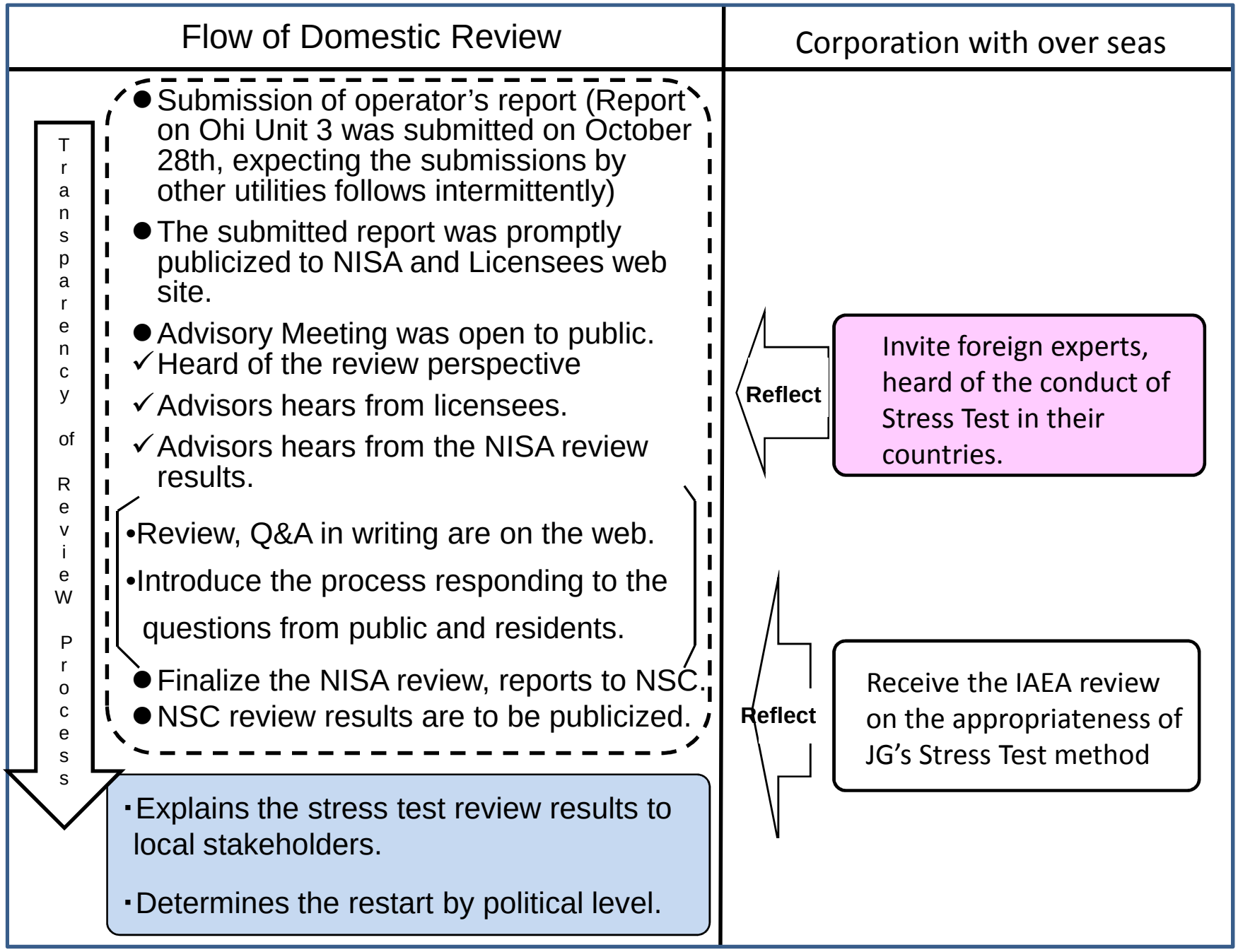
Primary Assessment

- ✓ Restart criteria for the NPPs under Periodic Inspection
- ✓ Margins compared to the allowable limits in design standards (Complete date base available to conservative assessment)

Secondary Assessment

- ✓ Criteria for continuation or suspension of operating NPPs
- ✓ Margins compared to the realistic limit for structural integrity and functions(Additional data may be necessary for confirmation)

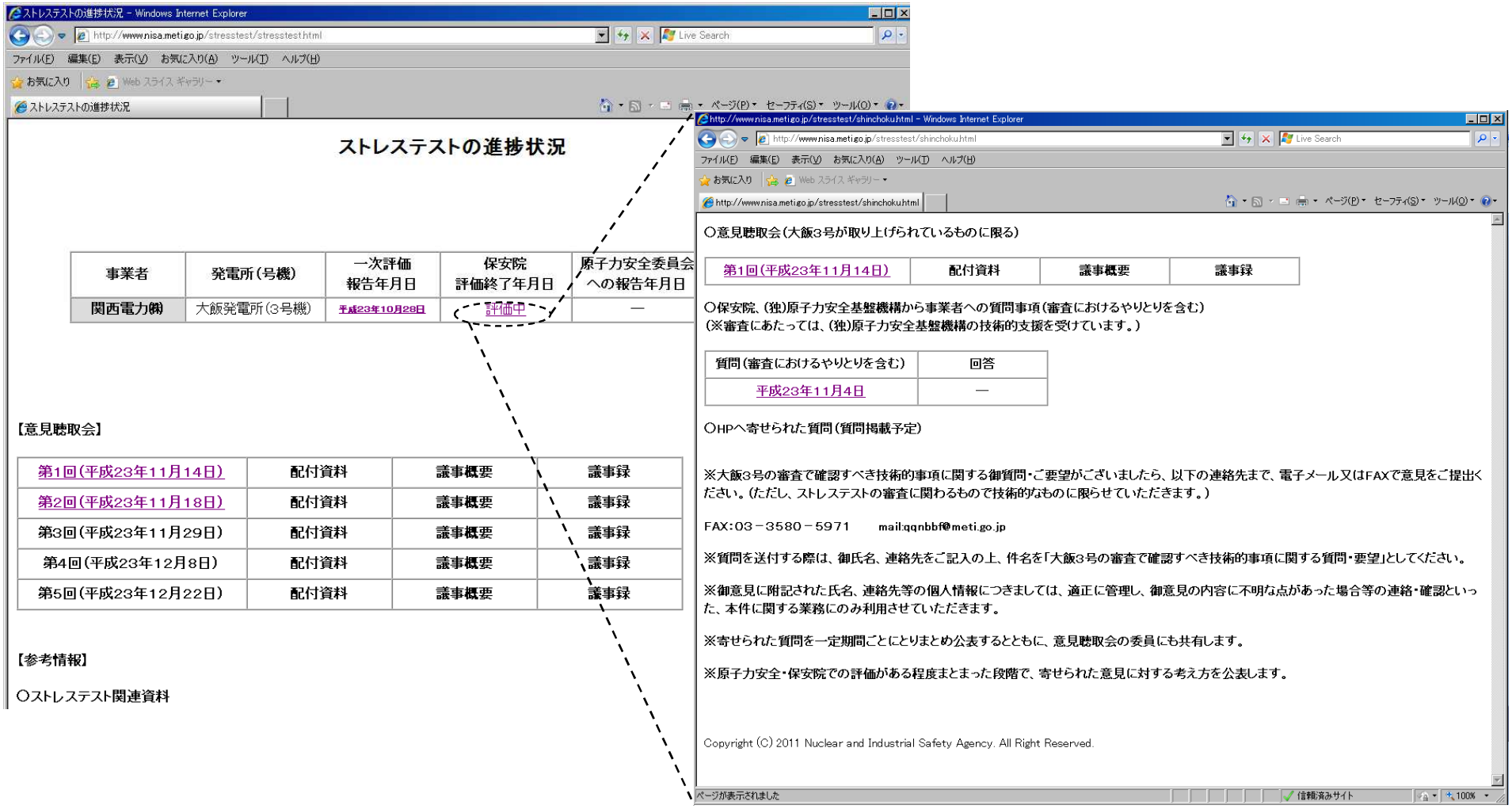
Review Process for Stress Test (Primary Assessment)



NISA conducts Advisory meetings open to the public and hears Experts' Opinions

Publicize Review Progress in Stress Test

- Web site of NISA, publicize review progress in stress test and receive public questions and requests for technical items to be confirmed by review.



ストレステストの進捗状況

事業者	発電所(号機)	一次評価 報告年月日	保安院 評価終了年月日	原子力安全委員会 への報告年月日
関西電力㈱	大飯発電所(3号機)	平成23年10月28日	評価中	—

【意見聴取会】

第1回(平成23年11月14日)	配付資料	議事概要	議事録
第2回(平成23年11月18日)	配付資料	議事概要	議事録
第3回(平成23年11月29日)	配付資料	議事概要	議事録
第4回(平成23年12月8日)	配付資料	議事概要	議事録
第5回(平成23年12月22日)	配付資料	議事概要	議事録

【参考情報】

○ストレステスト関連資料

○意見聴取会(大飯3号が取り上げられているものに限る)

第1回(平成23年11月14日)	配付資料	議事概要	議事録

○保安院、(独)原子力安全基盤機構から事業者への質問事項(審査におけるやりとりを含む)
(※審査にあたっては、(独)原子力安全基盤機構の技術的支援を受けています。)

質問(審査におけるやりとりを含む)	回答
平成23年11月4日	—

○HPへ寄せられた質問(質問掲載予定)

※大飯3号の審査で確認すべき技術的事項に関する御質問・ご要望がございましたら、以下の連絡先まで、電子メール又はFAXで意見をご提出ください。(ただし、ストレステストの審査に関わるもので技術的なものに限らせていただきます。)

FAX:03－3580－5971　　mail:qqnbbf@meti.go.jp

※質問を送付する際は、御氏名、連絡先をご記入の上、件名を「大飯3号の審査で確認すべき技術的事項に関する質問・要望」としてください。

※御意見に附記された氏名、連絡先等の個人情報につきましては、適正に管理し、御意見の内容に不明な点があった場合等の連絡・確認といった、本件に関する業務にのみ利用させていただきます。

※寄せられた質問を一定期間ごとにとりまとめ公表するとともに、意見聴取会の委員にも共有します。

※原子力安全・保安院での評価がある程度まとまった段階で、寄せられた意見に対する考え方を公表します。

Summary

- **Safety margins for each nuclear facility against beyond design basis earthquake and tsunami can be assessed quantitatively.**

Provides enhanced assurance of safety for nuclear facilities.

- **By clarifying the process of events that lead to significant damage to fuel, and specifying which systems and components have potential weakness, areas for improvement can be identified.**

Continue to improve safety by effective safety assurance measures.