

Executive Summary

Evaluation of shatter zones at Tsuruga NPP site

***Interim Report of
the Joint International Experts' Meeting
(TRM/IRG)***

May 21, 2013

TRM : Third-party Review Meeting

IRG : International Review Group

General Approach and Adequacy (1/2)

- *The JAPC Report presents a comprehensive approach.*
- *The methods already used by JAPC are appropriate.*
- *The data, in general, presented support JAPC's preliminary conclusions.*
- *But, there is a need to look at a wider area, to be supplemented by seismological data.*
- *The analysis of fault kinematics and microstructures seems reasonable, but further investigation is required.*

General Approach and Adequacy (2/2)

- *NRA has connected features in a way that JAPC disagrees with, which can only be resolved by additional field observations.*
- *Both JAPC and NRA reports need to provide a lot more information, and be evaluated by independent experts to see that the issues are addressed comprehensively.*
- *JAPC's investigation is on-going and they will present the results to NRA as they become available probably by the end of June.*

Interim Appraisal of the Geological Issues

- **The continuity of D-1 shatter zone**

- ✓ **G fault and D-1 shatter zone** are identical for their macroscopic structural characteristics (fault gouge, strike and dip), and their displacement senses are also the same.
- ✓ On the other hand, **K fault and D-1 shatter zone** are different to each other for their macroscopic structural characteristics, and their displacement senses are opposite.
- ✓ **A more comprehensive suite of data need to be collected and evaluated by more experts including structural geologists and seismologists.**

- **The activity of D-1 shatter zone, G fault and K fault**

- ✓ **D-1 shatter zone - G fault with probable continuity to D-1 shatter zone**, have not displaced and deformed the sedimentary layer including Mihama-tephra deposited 120,000 to 130,000 years ago.
- ✓ **K fault** also has not displaced and deformed that layer.
- ✓ **However, the age of Mihama-tephra needs to be defined by more information. Here, analytical results will support the chronology.**

- **Effects of displacement on Urasoko fault**

- ✓ Neither G fault nor K fault have sympathetic rupture in any rupture of Urasoko fault since at least **120,000 to 130,000** years ago.
- ✓ **Mechanical and kinematic analyses of induced rupture and deformation under the facilities by Urasoko faulting are important.**



Recommendations

- *An effective process of full and open-minded communication between JAPC and the NRA is essential.*
- *Joint geological investigations and discussion are recommended to be held by the members of JAPC, the NRA and independent experts.*
- *Application of international best practices such as the IAEA's risk approach and the experience of the Diablo Canyon NPP safety case, is recommended to come to a reasonable judgment by the regulator.*

May 21, 2013

External review of survey on the shatter zones in the site of Tsuruga power station

1. External review organization

(1) Third-party Review Meeting (TRM)

TRM is organized by Scandpower, a member of the Lloyd's Register Group of Companies, head quartered in Norway.

(2) International Review Group (IRG)

IRG is a group of experts in geology and risk at nuclear facilities led by Professor Neil Chapman of the University of Sheffield, who is an international expert in the field of geological waste disposal.

[Attachment 1]

2. Experts in attendance of today's press conference

(1) TRM

- Mr. Woody Epstein (Scandpower, PSA)
- Professor Koji Okumura (Hiroshima University, geology)

(2) IRG

- Dr. Kelvin Berryman (GNS Sciences, geology)

[Attachment 2]

3. About Scandpower

Scandpower is a risk management company in providing consulting services and software to the international market for oil companies, nuclear power entities, companies in the transport industries and so on.

In 1971, Scandpower was established at the urging of the then Norwegian Minister of Industry. The objective was to form an engineering company to target the growing nuclear power and petroleum industries.

For the nuclear power business, Scandpower provides consulting services of wide range field to nuclear power entities and regulatory authorities based on the risk management, such as aging management, licensing renewal, human factor and probabilistic safety analysis. The probabilistic safety analysis software "RiskSpectrum" developed by Scandpower is used at many nuclear power plants.

From 2009 Scandpower became part of the Lloyd's Register Group. Nuclear division is based in Sweden.

TRM/IRG joint expert meeting

External review members

TRM (Third-party Review Meeting)

Name	Specialty	Organization/ Title
Mr. Woody Epstein	PSA	Senior Principal Consultant, Scandpower,
Dr. Koji Okumura	Geology	Professor, Department of Geography, Graduate School of Letters, Hiroshima University
Dr. Peter Yanev	Geotechnology	Yanev Associates Council of Department of Civil and Environmental Engineering, University of California
Dr. Lloyd Cluff	Geology	Former researcher of PG&E (Diablo Canyon) Former associate professor, Department of geology and geophysics, University of Nevada
Dr. Hirokazu Kato	Geology	Emeritus researcher, the National Institute of Advanced Industrial Science and Technology

IRG (International Review Group)

Name	Specialty	Organization/ Title
Prof. Neil Chapman	Environmental Geology	MCM Consulting, Switzerland (Project Manager & Report Compiler) Professor of Environmental Geology, University of Sheffield, UK
Dr. Kelvin Berryman	Geology	GNS Sciences, New Zealand
Dr. Aybars Gurbinar	Civil and Geological Engineering	Independent Consultant, Austria, Former member of IAEA
Dr. William Aspinall	Geology	Aspinall & Associates, UK
Mr. David Mallard	Civil engineering	D. Mallard Associates, UK
Dr. Mark Stirling	Geology	GNS Sciences, New Zealand
Dr. Pilar Villamor	Geology	GNS Sciences, New Zealand

Experts in attendance of today's press conference is marked by bold square

Experts in attendance of today's press conference

Mr. Woody Epstein



- Specialty: Probabilistic Safety Analysis (Software development, Project Management, Modeling, Analysis)
- Organization: Scandpower (Risk Management Company, member of the Lloyd's Register Group)
- Notes: Mr. Epstein was a member of NASA's Probabilistic Risk Assessment team on the Space Shuttle accident.

Professor Okumura



- Specialty: Geology, Earthquake and active fault studies, Tephrostratigraphy, Radiocarbon chronometry
- Organization: Professor, Department of Geography, Graduate School of Letters, Hiroshima University
- Notes: Prof. Okumura is a committee member, the Science Committee of the IAEA International Seismic Safety Center.
- Vice president of INQUA, International Union for Quaternary Research
- Associate member of the Science Council of Japan
- He was an expert member, Nuclear Safety Commission.
- He was an expert panel member, the Headquarters for Earthquake Research Promotion.

Dr. Kelvin Berryman



- Specialty: Coastal neotectonics, Plaeo-earthquake studies and fault behavior, Seismic hazard assessment
- Organization: GNS science (Principal Scientist & Manager, Natural Hazards Research Platform)
- GNS science (NZ) is a provider of scientific research and consultancy of geoscience (Natural hazard such as Earthquake, Landslide, Tsunami and Volcano).
- Notes: Dr. Berryman was an international expert member of International Tectonics Meeting (A meeting on developing high-level radioactive waste repository site). He has many experiences to be invited to international meeting on Earthquakes such as the Hyogoken nanbu earthquake and the Niigataken chuetsu-oki earthquake.

Mr. Peter Rickwood (Coordinator)



Mr. Peter Rickwood is a former journalist who worked as a press officer in the IAEA from 2001 to 2009, a period during which it received the Nobel Peace Prize. Currently he works as a media consultant and has founded Atomic Reporters, a non profit Canadian organization, to offer impartial support to journalistic cover in a nuclear related issues internationally. He has accompanied international missions to the Kashiwazaki and Onagawa NPPs.