

June, 5, 2014

Teams of external review of survey on the shatter zone in the site of Tsuruga power station

1. Purpose of the external review

The purpose is to review the survey and its evaluation on the shatter zone in the site of Tsuruga Power Station, which was conducted by the Japan Atomic Power Company, by teams that consists of domestic and international experts from scientific point of view.

The review teams started evaluation and its own investigation in March of 2013 and expressed its view that the shatterzone in question did not move, at least, over the past 120,000-130,000 years.

After that, the nuclear regulation authority (NRA) held its additional evaluation meeting on April, 4, 2014. Considering this situation and the significance of continuous activity to be done based on the updated investigation status, the review teams will do evaluation and its own investigation again and summarize their views on this issue.

2. External review teams

(1) Third-party Review Meeting (TRM)

TRM is organized by Lloyd's Register Consulting, which is the company specialized in risk management, under the contract. Its headquarters is in Norway.

(2) International Review Group (IRG)

IRG consists of experts in geology. It is led by Professor Neil Chapman of the University of Sheffield, who is an international expert in the field of geological waste disposal. The other members are Dr. Kevin Berryman, Dr. Pilar Villamor, and Dr. Nicola Lichfield, all of them are from GNS science of New Zealand, and others.

[Attachment 1]

3. Experts who attend today's briefing session

(1) TRM

- Mr. Woody Epstein (Lloyd's Register Consulting, PSA),
- Professor Koji Okumura (Hiroshima University, Geology),
- Dr. Hirokazu Kato (The National Institute of Advanced Industrial Science and Technology (AIST), Geology),

(2) IRG

- Professor Neil Chapman, (University of Sheffield, UK, Environmental Geology)
- Dr. Kelvin Berryman (GNS Science, New Zealand, Geology)
- Dr. Nicola Litchfield (GNS Science, New Zealand, Geology)

[Attachment 2]

4. Past record: Meetings and Investigations

March, 2013	Conclusion of contract between TRM/IRG and JAPC
3/29-30	TRM meeting and site survey
4/24	TRM/IRG joint meeting
5/20-21	TRM/IRG joint site survey, joint meeting, summarizing interim report, press conference
7/29	TRM/IRG joint site survey
7/30-31	TRM/IRG joint meeting, finalizing report
8/1	Briefing session
May, 2014	Conclusion of contract between TRM/IRG and JAPC
5/26-31	IRG confirm updated information, discussion
June, 3-5	TRM/IRG joint site survey, joint meeting, Summarizing the report, Briefing session

5. Outline of the organizations

(1) TRM

Lloyd's Register Consulting, which coordinates TRM, is a risk management company that supplies consulting services in international market and develops / supplies software for using in oil, nuclear power, and transport industries.

In 1971, Scandpower, the precursor of Lloyd's Register Consulting, was established at the urging of the then Norwegian Minister of Industry. Since then, the company has been doing business in international market.

In the field of nuclear power, the company is providing wide range of consulting services such as aging management, licensing renewal, human factor and

probabilistic safety analysis to plant owners, vendors and regulatory authorities. The probabilistic safety analysis software “RiskSpectrum” developed by the company is major analysis tool that is used at many nuclear power plants.

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

(2) IRG

Professor Chapman, who coordinates IRG, has the experience of more than 35 years of undertaking work of government agencies, implementing organizations and regulatory authorities worldwide as a geologist in the field of radioactive waste management.

GNS science that Dr. Kelvin Berryman and others belongs to is the organization that conducts research and providing consulting service in the field of earth science including natural disaster (such as earth quake, land slide, seismic sea wave, volcano activity) and other field.

External review members

TRM (Third-party Review Meeting)

Name	Specialty	Organization/ Title
Mr. Woody Epstein	PSA	Senior Principal Consultant, Lloyd's Register Consulting
Prof. Koji Okumura	Geology	Professor, Department of Geography, Graduate School of Letters, Hiroshima University
Dr. Hirokazu Kato	Geology	Emeritus researcher, the National Institute of Advanced Industrial Science and Technology
Dr. Lloyd Cluff	Geology	Former researcher of PG&E (Diablo Canyon) Former associate professor, Department of geology and geophysics, University of Nevada
Dr. Peter Yanev	Earthquake Engineering and Risk Management	Senior consultant, The World Bank Earthquake engineering and Risk management, Yanev Associates Council of Department of Civil and Environmental Engineering, University of California
Prof. Koji Okamoto	Nuclear Engineering	Professor, Nuclear Professional School Graduate School of Engineering, The University of Tokyo

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 Science, New Zealand
Dr. Pilar Villamor	Geology	GNS Science, New Zealand
Dr. Nicola Litchfield	Geology	GNS Science, 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 Science, New Zealand

Experts who attends today's briefing session are highlighted with bold squares.

Experts who attend today's briefing session

Mr. Woody Epstein



- Specialty:** Probabilistic Safety Analysis (mathematics of risk assessment, natural hazards, and Black Swan risks)
- Organization:** Lloyd's Register Consulting
- Notes:** Mr. Epstein was a member of NASA's Probabilistic Risk Assessment team set up after the Space Shuttle accident. He, as a expert of risk analysis, involved in many projects such as safety analysis of Mitsubishi Aircraft, risk analysis for the Abandoned Chemical Weapons in China, risk analysis for more than 30 nuclear power units in Japan, the US and Europe. Also he was team member on the IAEA mission to Onagawa.

Professor Koji Okumura



- Specialty:** Geology, Earthquake and active fault studies, Tephrastratigraphy, 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 of Nuclear Safety Commission.
He was an expert panel member of the Headquarters for Earthquake Research Promotion.

Dr. Hirokazu Kato



Specialty: Geology

Organization: Emeritus researcher, the National Institute of Advanced Industrial Science and Technology

Notes: Japan Society for Natural Disaster Science, International Award of Hazards 2000 (received in 2005),
Hanamaki City, Iwate Prefecture, 17th Miyazawa Kenji Award (received in 2007)

Analysis of geologic structures: Analysis of the method for field analysis of faults and folds

Development of the method for analyzing mechanics of forming faults and folds using model tests.

Elucidation of geology in the Tertiary and Quaternary Period, diastrophism and neotectonics of the northern Fossa Magna

Making geological maps with a scales of 1/50,000 through 1/5,000,000

Research into the relationship between active faults/active folds and the occurrence of earthquakes using geological and earth scientific method in Japan and abroad. Editing a number of neotectonics maps.

Research into geological disasters (earthquakes, landslides and others), leading editorial plan for Eastern Asia geological hazards maps with international cooperation, and editing them.

Others: Participated in International Year of Planet Earth (IYPE) under the United Nations, engaged in building awareness of geology through being involved in the related geopark activity and geotourism. Studying Kenji Miyazawa from geological point of view.

Professor Neil A. Chapman



Specialty: Geologist with 35 years experience in radioactive waste management, working for government agencies, implementing organizations and regulatory authorities worldwide.

Organizations: Partner in MCM Consulting (Switzerland) and affiliate Professor in the Department of Materials Science and Engineering at the University of Sheffield, UK.

Notes: Member of the International Technical Advisory Committee for the Japanese implementing agency NUMO/Manages of NUMO's scientific program on tectonic stability and repository siting. /Chief geosciences evaluator for Swedish and Finnish nuclear regulatory authorities (SSM and STUK) for the national spent fuel repository construction license applications. /Chairman of the Technical Advisory Panel for UK Nuclear Decommissioning Authority's Radioactive Waste Management Directorate. He involved in numerous international overview groups since the 1980s. He wrote more than 180 papers and 8 books on radioactive waste management.

Dr. Kelvin Berryman



Speciality: Coastal neotectonics, Paleo-earthquake and fault behavior studies. Earthquake and tsunami hazard and risk assessment throughout New Zealand and in many circum-Pacific countries

- Organization: GNS Science (Principal Scientist & Manager, Natural Hazards Research Platform)
GNS Science (NZ) is New Zealand's principal provider of scientific research and consultancy of geosciences (including natural hazards such as Earthquake, Landslide, Tsunami and Volcano).
- Notes: Dr. Berryman has been an international expert member of International Tectonics Meeting (the meeting for developing methods for siting a high-level radioactive waste repository). He has about 30 years of experience in the fault studies of Japan. He was invited to the international meetings on the Hyogoken nanbu earthquake and the Niigataken chuetsu-oki earthquake.

Dr. Nicola Litchfield



- Specialty: Tectonic geomorphology, Earthquake Geology, Landscape Evolution, Seismic hazard assessment
- Organization: GNS Science (Senior Scientist)
GNS Science is New Zealand's leading provider of Earth, geoscience and isotope research and consultancy service. This includes natural hazards such as Earthquakes, Landslides, Tsunamis and Volcanoes.
- Notes: Dr. Litchfield has 13 years of experience in research and consulting projects including the development of a global active fault database, which includes active faults in Japan, for the Global Earthquake Modeling. She was an international expert member of the International Tectonics Meetings (meetings for developing high-level radioactive waste repository site).