

Long-Term Knowledge and Information Management Following Severe Accidents



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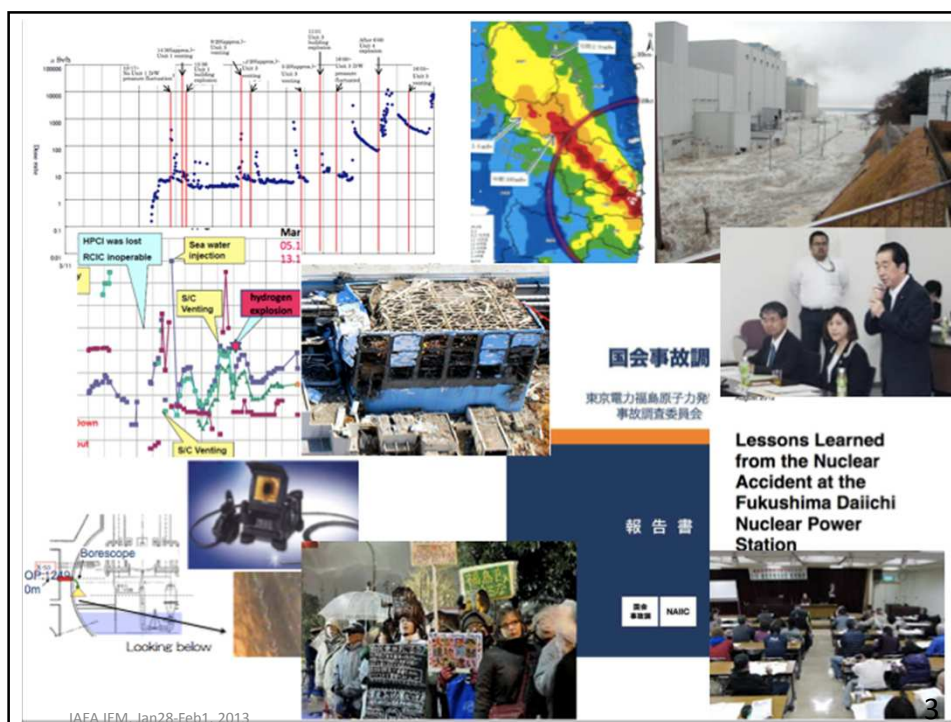
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Outline

- Archiving accident-generated information
 - ✓ Accident-generated information
 - ✓ Objective of archiving
 - ✓ Classification of information and taxonomy
 - ✓ Accessibility
- Currently-ongoing archiving activities in Japan

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Accident-generated information

Document type

- Technical information (design, plant response, environmental consequence), relevant analysis (seismic response, SA analysis, atmospheric dispersion, event tree, RCA...), crisis management records (meeting records, action records)
- Interviews (TEPCO, NSC, NISA, Cabinet members, other Government officials, Politicians, nuclear experts, evacuees, other stakeholders)
- Accident Investigation Committee's record and reports (Japanese (Diet, Government, NPO, AESJ etc) , ANS, US Academy, INPO..), IAEA etc
- Technical papers from conferences, workshops, seminars....
- Policy papers (regulatory bodies, AEC, Industry, Utility) and proposals for changes
- Published papers/books /papers to magazine & journals...)
- Media reports (newspaper, TV, film, [You-tube](#), [social media](#))

Accident Investigation Committee's record & reports (Some with videotapes, transcript...)

Government: <http://icanps.go.jp/eng/final-report.html>

Diet: <http://warp.da.ndl.go.jp/info:ndljp/pid/3856371/naiic.go.jp/en/index.html>

TEPCO: <http://www.tepco.co.jp/en/nu/fukushima-np/interim/index-e.html>

NPO-1: <http://rebuildjpn.org>

NPO-2: <http://pr.bbt757.com/2011/1028.html>

JANTI: http://www.gengikyo.jp/english/shokai/Tohoku_Jishin/summary.pdf

etc.



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Diet



福島第一原子力発電所事故から何を学ぶか (詳細解説)

NPO-2

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Objective of archiving

- To **prevent loss** of information/knowledge
- To **enable easy access, later retrieval and the use** of information, knowledge and LL for prevention of accident and better risk management (resilience, liability arrangement, crisis management, regulation, Emergency Plan...)
- To **disseminate** accurate accident information (IAEA Action Plan #11)

In the process of archiving

- Also, to help translate information into knowledge in appropriate hierarchy (Data/Information/Knowledge & Wisdom)

Need to establish coherent Accident Information Archiving System with taxonomy

Human brain can store three terabytes of information. One millionth of information is produced in the world everyday. We have to be selective about information we choose to remember.

- Nate Silver "The signal and the noise"

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THREE MILE ISLAND 2

Engineering Library
323 Hammond
University Park, PA 16802
814.863.3431
814.863.3288 (fax)

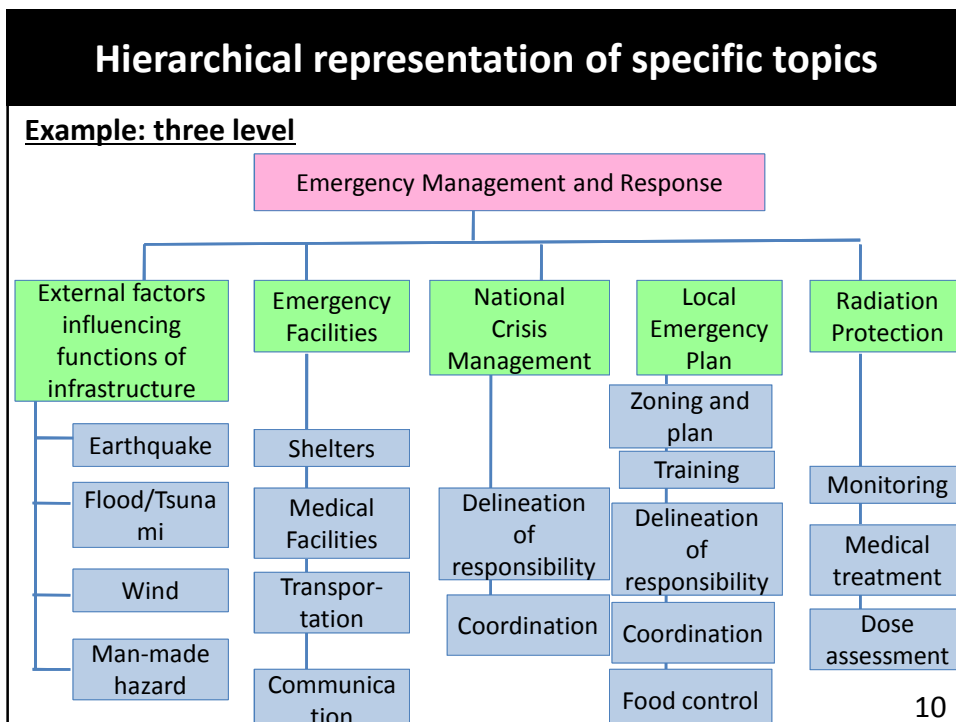
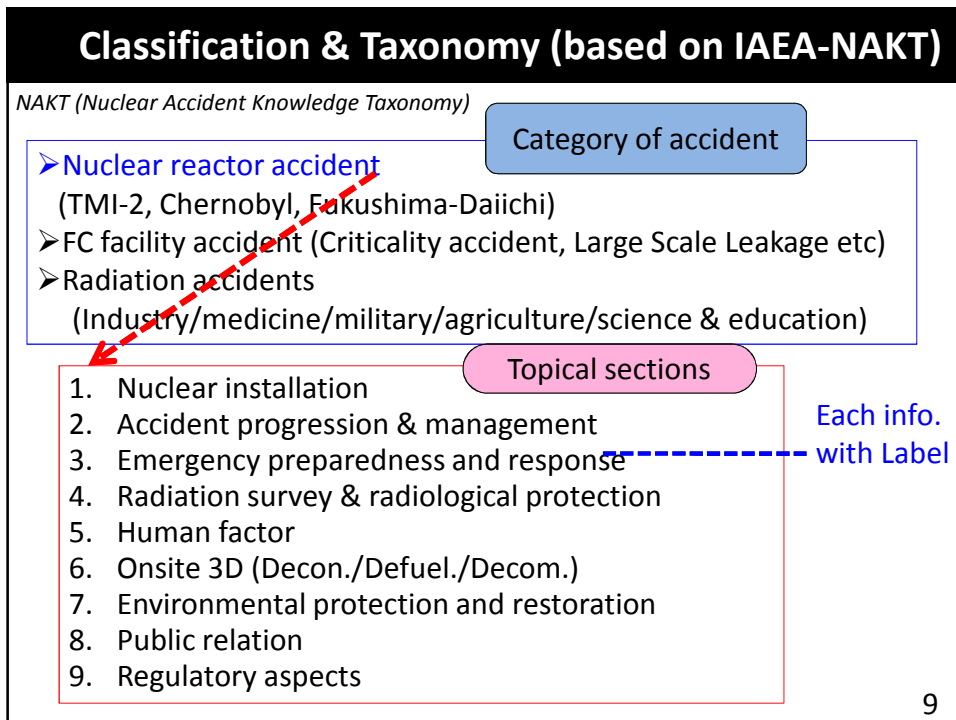
Books On
websites
Email the Engineering Library

Three Mile Island Reports

The TMI-2 reports collection consists of several hundred technical reports, conference papers, and documents that relate to the ongoing project. A number of the reports have been scanned and are available on this page in chronological order. All of the reports in the collection are indexed and searchable in the reports database.

Find out how to obtain copies of reports

Three Mile Island Reports (of 30)			
Title	Date	Report No.	Accession No.
Summary Technical Plan for TMI-2 Decommission and Dechlorination	December 12, 1979	1981	8
Early Decommission of TMI-2 Reactor Building	February 1, 1981	190781-005	190781-005



Possible standard keywords (label)

“Emergency response”, “Emergency plan”,
 “Emergency preparedness”,
 “Radiation protection”, “Exposure”,
 “Food control”,
 “Iodine tablet”
 “Shelter”,
 “Transportation”,
 “Evacuation”,
 “lessons learned” ,
 “Emergency Response Center”, “ERC”, “etc.

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IAEA Action Plan to prepare NAKT

Activities\Time	2/2 2012	½ 2013	2/2 2013	½ 2014	2/2 2014	½ 2015	2/2 2015
1. To create a “Glossary” of terms for the MNAKP Project	X	X		X			
2. To identify subject matter experts and create a roster of these interested to participate in the project	X	X	X				
3. To develop a Taxonomy for (Major) Nuclear Accidents Knowledge Preservation							
• Development of the Taxonomy Structure, incl. description	X	X					
• Review (consistently) and benchmarking of the Taxonomy Structure		X	X				
• Programming of the Taxonomy		X					

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IAEA Action Plan to prepare NAKT							
• Testing of the Taxonomy			X	X			
• Extension and Modification of the Taxonomy			X	X	X		
4. To identify sources of credible scientific and technical information	X	X	X	X	X	X	X
5. Collect and archive (or link) existing information into a repository within and outside the IAEA	X	X	X	X	X	X	X
6. To develop a Multimedia Archive of expert presentations, interviews etc		X	X	X	X	X	X
7. Develop an IAEA publication on (Major) Nuclear Accidents knowledge organizational System			X	X	X		
8. To develop a Multimedia Training Module to preserve tacit knowledge on Major Nuclear Accidents			X	X	X	X	X
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Accessibility
<p>Who to use and who to contribute</p> <ul style="list-style-type: none"> ✓ Public web site accessible to anyone ✓ Why/How query ✓ Contribution from <ul style="list-style-type: none"> Those who create & possess data/information Experts (knowledge and wisdom) Librarian Researchers in knowledge management IT specialist
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NAKT to help Why/How query

NAKT (Nuclear Accident Knowledge Taxonomy) should help to the users to find information and recommendation relevant to any nuclear accidents:

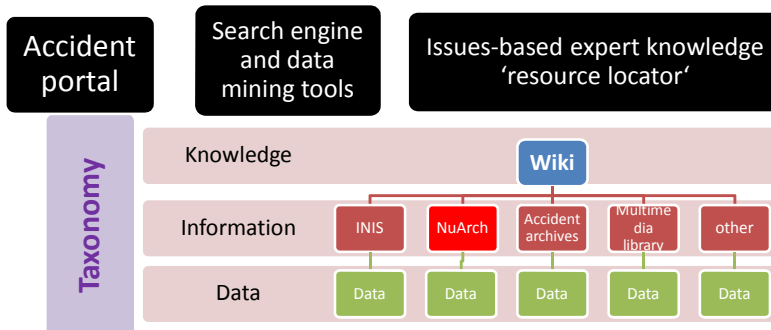
- ✓ Historical background (accident rooted in history)
- ✓ Pre-accident condition
- ✓ What caused the accident?
- ✓ How it could have been prevented?
- ✓ What are the consequences?
- ✓ What are the Lessons Learned?
- ✓ Changes in the aftermath of the Accident
- ✓ Long-term actions

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Example of ideas of contribution by experts

- a) technical experts: filling in gap of information and validation of information
- b) IT experts : “Search engine” & “resources locator”



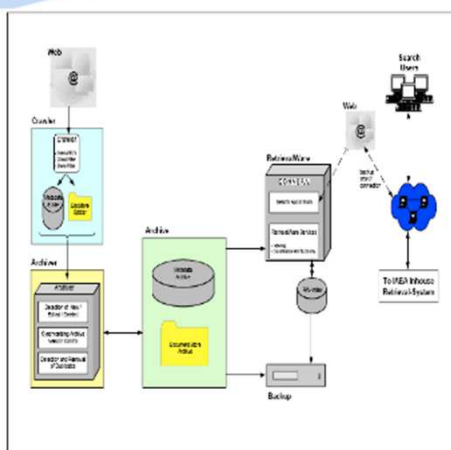
[SOURCE] H. Böck, Vienna technical University

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NuArch Project : IAEA archive of freely accessible web-based nuclear information

Archiving the “Nuclear Internet”



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1. A web crawler will identify and download (harvest) nuclear information resources from the Internet.
2. The harvested materials will be automatically indexed and stored in a high-volume archive with version control.
3. A customised version of an advanced search engine will index all contents and make them accessible to the user.
4. Specialised analysis tools are being developed.

[SOURCE] A. Pryakhin, IAEA-NKM

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- **Currently-ongoing archiving activities in Japan**

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Digital Archive of Japan's 2011 Disasters

<http://jdarchive.org/ja/about>
<http://www.archive-it.org>
<http://all311.ecom-plat.jp> etc.

jdarchive.org supported by many organs

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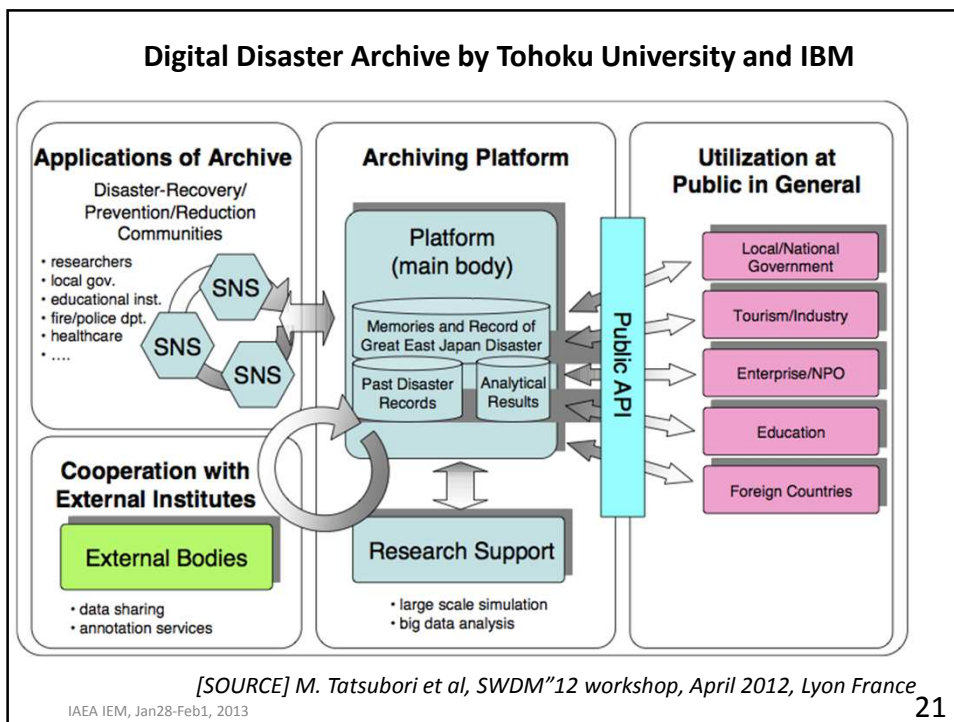
Tohoku University's archive project

http://www.bureau.tohoku.ac.jp/president/open/idrrr/idrrr_ppe.pdf

Creation of the action-oriented Disaster Science

Research Division	Research Fields	Partner organizations
1) Hazard and Risk Evaluation Research Division	<ul style="list-style-type: none"> • Earthquake Engineering • Disaster Potential Study • Science and technology for low-frequency Risk Evaluation • Tsunami Engineering • Remote Sensing and Geoinformatics for Disaster Management • Technology for Optimum Mitigation • Technology for Global Disaster Risk 	<ul style="list-style-type: none"> ● Overseas <ul style="list-style-type: none"> Harvard University(USA) The University of California, Los Angeles(USA) The University of Hawaii(USA) George Washington University(USA) United States Geological Survey(USA) Tsinghua University(China) The Chinese Academy of Sciences(China) National Cheng Kung University(Taiwan) The University of London(UK) German Aerospace Center(Germany) The University of New South Wales(Australia) Istanbul Technical University(Turkey) Università degli Studi di Firenze(Italy) Delft University of Technology(Netherlands) Asian Institute of Technology(Thailand) Institut Teknologi Bandung (Indonesia) The Russian Academy of Science(Russia) ● Japan <ul style="list-style-type: none"> Kobe University Fukushima University Iwate University Yamagata University Ibaraki University Tohoku Gakuin University Tohoku University of Art & Design Earthquake Research Institute, The University of Tokyo Disaster Prevention Research Institute, Kyoto University Research Institute for Natural Hazard and Disaster Recovery, Niigata University Disaster Mitigation Research Center, Nagoya University Japanese Association for Disaster Medicine Disaster Reduction and Human Renovation Institution The Japanese Society of Psychiatry and Neurology Japan Aerospace Exploration Agency Japan Agency for Marine-Earth Science and Technology
2) Human and Social Response Research Division	<ul style="list-style-type: none"> • Disaster-related Cognitive Science • Preservation of Historical Materials • Disaster Legislation • Affected Area Supportology • Social Systems for Disaster Mitigation • Japanese Disaster Culture • Comparative Mitigation Society 	
3) Regional and Urban Reconstruction Research Division	<ul style="list-style-type: none"> • Technology for Urban Resuscitation • Regional Safety Engineering • International Strategy for Disaster Mitigation • Radiational Decontamination Science • Disaster Robotics 	
4) Disaster Science Division	<ul style="list-style-type: none"> • Marine Geodesy Research • Volcanic Hazard Research • Atmospheric and Oceanic Disaster Research • Seismic Hazard Research • Geologic Hazard Research • Space Environment Disaster Research • Natural Disaster Research 	
5) Disaster Medical Science Division	<ul style="list-style-type: none"> • International Cooperation for Disaster Medicine • Radiation Disaster Medicine • Disaster Obstetrics and Gynecology • Disaster-related infectious Disease • Disaster Psychiatry • Disaster-related Public Health • Disaster Medical Informatics 	
6) Disaster Information Management and Public Collaboration Division	<ul style="list-style-type: none"> • Disaster Digital Archive • Disaster Reconstruction design & Management • International and Regional Cooperation Office 	

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Archiving nuclear accident information in the context of Gov't programme

➤ **Disaster Management Programme (2012 December):** Government and local community to archive Facts and LL for later generations

© Kō Saegaki

Prophetic: The stone tablet on the edge of the village of Aneyoshi, which the town's population credits with saving their lives

[SOURCE] http://www.ce.gunma-u.ac.jp/kamaishi_tool/pic/pic_13.pdf 22

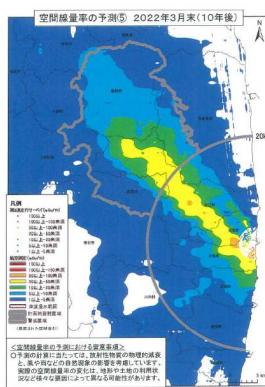
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Archiving nuclear accident information in the context of Gov't programme

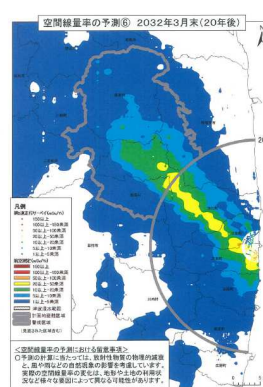
- **Remediation Programme** (2012 September): to archive scientific facts on remedial actions and health effect for later generations



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10 years later w/o decon.



20 years later w/o decon. 23

Currently ongoing nuclear archive activities in Japan

- Archive activities in respective organization;
 - Government
 - ✓ NRA (safety regulation)
 - ✓ METI-ANRE (code benchmarking)
 - ✓ MoE (offsite, environment and health effect)
 - TEPCO
 - JAEA (Scientific and Technical publications)
 - NDL (National Diet Library)
 - etc.

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Conceived network of repositories

- Central repository (also gateway to network): NDL
- Networking of distributed digital repository by a WG by Government agencies and Industry/Utility
 - Coordination
 - Common taxonomy and keywords
 - Structure (Data/Information/Knowledge)
- Cooperation with the IAEA for NAKT including definition of topical areas, taxonomy, keywords and validation using Fukushima information

Conceived network of repositories

- Holder/Creator of primary information to consider
 - ✓ Clarification of the scope of archived information, to avoid areas not covered by anyone
 - ✓ Mindful of creating useful information/knowledge for international community and for later generation
 - ✓ Digital information + experts' knowledge/wisdom (even listing of resourceful experts for contact)
- Further linkage with ICSU (International Council for Science)/CODATA (Committee on Data for Science and Technology)- WDS (World Data System) by Japanese initiatives?

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JAEA Library

http://jolifukyu.tokai-sc.jaea.go.jp/ird/english/sanko/fukushima_sanko-top-en.html

• JAEA_Library [Twitter](#)

Japan Atomic Energy Agency (JAEA) Library is one of the largest nuclear information center in Japan. JAEA Library maintains a circulating collection of books in physics, chemistry, computer science and engineering. JAEA Library supports the scientific research and development activities. We hope that JAEA Library contributes to your R&D activities.

Reference Information

[Fukushima Daiichi nuclear power station accident \(UPDATE\)](#)
Reference information about the Fukushima Daiichi nuclear power station accident.

- Over 15,000 nuclear accident related bibliographic records and full-text articles, such as JAEA research results, journal or conference papers, technical reports and web information.
- The reference information is arranged by the subject according to the INIS methods.

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JAEA Library

Accident

Fukushima-Daiichi accident

TMI-2 accident

Chernobyl accident

Blayais NPS Flood

LOCA

Various nuclear accident

Facility

NPS and earthquake

Defueling

Decommissioning

Treatment of accident-generated water

Emergency plan

Emergency Plan & Response

Radiation & Radioactivity

Radiation exposure & measurement

LL Radiation exposure

Mobility of radioactivity and soil decontamination

Radioactivity in food

Behavior of Sr90

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JAEA Library

List of JAEA R & D results related to Fukushima Dai-ichi NPP accident (80 articles, update monthly)

No.	Author	Title	Journal/Book Title/Meeting Information	Publication Date	Vol. No. Page	Link	Attachment
1	Sato, Kimiaki et al.	Effective dose conversion coefficients for radionuclides exponentially distributed in the ground	Radiation and Environmental Biophysics	2012.11	vol.51, no.4 p.411-423	http://dx.doi.org/10.1007/s00411-012-0432-y	
2	Nease, Jambihar et al.	Examinations of fuel debris samples from Three Mile Island Unit 2	Energy To Densoku	2012.11	no.779, p.1-7	http://cdlib.org/urn:nbn:jp:riken:14850032	
3	Nakajima, Hiromitsu et al.	Study for development of the Fukushima Dai-ichi Nuclear Power Station accident archive	Joho Choshiki Gakkai-Shi / Dai 17 Kai Jyoho Choshikigaku Forumu2011/12 (Tokyo, Japan)	2012.11	vol.22, no.4 p.344-353	http://cdlib.org/urn:nbn:jp:riken:14850032	
4	Izawa, Kazuhiko et al.	Infinis multiplication factor of low-enriched UO ₂ concrete system	Journal of Nuclear Science and Technology	2012.11	vol.49, no.11 p.1043-1047	http://dx.doi.org/10.1080/00223131.2012.730893	
5	Kawatsuma, Shoji et al.	Emergency response by robots to Fukushima-Daiichi accident: Summary and lessons learned	Industrial Robot	2012	vol.38, no.5, p.429-435	http://www.enrjournal.org/journals/iro/abstract/1347944	
6	Ramos, Keiichi et al.	Decontamination technology	Funtai Qiyutau	2012.10	vol.4, no.10, p.971-980	http://cdlib.org/urn:nbn:jp:riken:14850032	
7	Terada, Hiroaki et al.	Atmospheric discharge and dispersion of radionuclides during the Fukushima Dai-ichi Nuclear Power Plant accident. 2: Verification of the source term and analysis of regional-scale atmospheric dispersion	Journal of Environmental Radioactivity	2012.10	vol.112, p.141-154	http://dx.doi.org/10.1016/j.jenvrad.2012.05.002	
8	Kawatsuma, Shoji et al.	Overview and issues to be solved on emergency response of robots to Fukushima NPP accidents	Decontamination: Gho	2012.9	no.48, p.14-26	http://cdlib.org/urn:nbn:jp:riken:14850032	
9	Nishihara, Kenji et al.	Estimation of fuel compositions in Fukushima-Daiichi Nuclear Power Plant	JAEA-Data/Code 2012-018	2012.9	190p.	http://cdlib.org/urn:nbn:jp:riken:14850032	
10	Sato, Daiki et al.	Decontamination planning based on computer simulation code ODE	REST News	2012.9	no.53, p.12-23	http://www.rest.or.jp/rest/news/53_S32.pdf	
11	Kobayashi, Yasuhiko	Health effects of the radioactive contaminated foods	Nippon Kikai Gakkai-Shi	2012.9	vol.115, no.1128	http://www.sanso.or.jp/nkai/shi/kasai_120901a.pdf	
12	Nagai, Hanyasu	Analysis on the atmospheric dispersion by POPSED for the Fukushima Dai-ichi Nuclear Power Plant accident	Shunrishu Nyusu	2012.9	no.18, p.63-64		

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2012.12.10

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JAEA Library

Posts pdf and link to other web sites

- 1) JAEA R&D relevant to Fukushima-Daiichi Accident
- 2) [Nuclear Accident information](#) (Fukushima-Daiichi, TMI, Chernobyl)
[Fukushima: Plant behavior, Emergency plan, Radiation exposure, onsite 3D \(decontamination, Defueling and Decommissioning\) etc.](#)
- 3) Major reports (Investigation Committees, TEPCO, IAEA, ANS...)

Coarse taxonomy
 No keyword or label
 With strong linkage with IAEA-INIS

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MOE (Ministry of Environment)-1

Off-site decontamination

(1) Policy, plan and monitoring results for the basis of planning

- Policy and technical information on decontamination and management of generated radioactive waste
- Laws and Regulations, Basic Policy, Roadmap, Technical guidance/guidelines
- Implementation plan for decontamination and disposal of generated radioactive waste by each municipality
- Monitoring Results (Radioactive material concentration in the environment, dose rates, in areas to be decontaminated etc.)
- Documents and minutes of expert meetings etc.

<http://www.env.go.jp/jishin/rmp.html>

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MOE (Ministry of Environment)

Off-site decontamination

(2) Decontamination Information website

- Information for general public such as basic knowledge and brochures about decontamination, etc.
- Information on the progress of decontamination by each municipality and effectiveness of decontamination

<http://josen.env.go.jp/index.html>

MOE (Ministry of Environment)-2

Public health (Fukushima Health Survey)

- Long-term public health survey programme* and its results (operated by Fukushima prefecture under the financial support of the Japanese government)
 - *Exposure Estimation, Thyroid Ultrasound Examination, Comprehensive Health Check, Mental Health and Lifestyle Survey, Pregnancy and Birth Survey

http://wwwcms.pref.fukushima.jp/pcp_portal/PortalServlet?DISPLAY_ID=DIRECT&NEXT_DISPLAY_ID=U000004&CONTENTS_ID=24287
- Fukushima Medical University's web site

<http://www.fmu.ac.jp/radiationhealth/>

NRA (Nuclear Regulatory Authority)

Scope

Causal relationship of the accident, onsite/offsite monitoring and emergency actions taken, modeling and analysis, regulations...

Roadmap

Collection of primary information
 Classification and labeling
 System for public access

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TEPCO

- Data on the Fukushima nuclear accident are opened to the public on TEPCO's web site.
- Those data are shared among many projects inside and outside Japan.
- Preservation and arrangement activities are underway in TEPCO.

<The main data on the web site>

- ① Current situation and data on Fukushima daiichi and daini nuclear power station
<http://www.tepco.co.jp/en/nu/fukushima-np/index-e.html>

The screenshot shows the TEPCO website interface. At the top, there are language options: 日本語, English, 中文, and 한국어. Below this is a navigation bar with 'Contact Us' and 'Site Map'. The main heading is 'Current situation of Fukushima Daiichi and Daini nuclear power station'. Underneath, there are two main sections: 'Status of Fukushima Daiichi Nuclear Power' and 'Data'. The 'Data' section is expanded, showing a list of links for monitoring and analysis data, categorized by 'Fukushima daiichi' and 'Fukushima daini'.

Category	Data Links
Fukushima daiichi	<ul style="list-style-type: none"> Monitoring post (original/temporary/monitoring car) measurement data - Exhaust Stack Monitor - The Monitoring Results at a time Airlock is Opened at the Reactor Building - Monitoring results related to the nitrogen injection to Primary Containment Vessel of Unit 3 Survey map (Area around buildings, entire power station site) Result of Radioactive Nuclide Analysis around Fukushima Daiichi Nuclear Power Station (Air, Seawater, in the ocean soil off the coast etc) The parameters related to the plants in Fukushima Daiichi Nuclear Power Station Situation of water level, transfer and treatment of the accumulated water
Fukushima daini	<ul style="list-style-type: none"> Monitoring post (original) measurement data Monitoring at the exhaust stack Monitoring at the discharge channel

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TEPCO

② Plant data (submitted to NISA) - Japanese only -

<http://www.tepco.co.jp/nu/fukushima-np/index10-j.html>

東北地方太平洋沖地震発生当時の福島第一原子力発電所プラントデータ集

① 提出データ範囲説明書 ② チャート ③ 警報発生記録等データ ④ 運転日誌等 ⑤ プロセス計算機データ ⑥ 遠端観測記録等データ ⑦ 各種操作記録等データ ⑧ プラント関連ドキュメント

1. 提出データ範囲説明書

● 提出データ範囲説明書

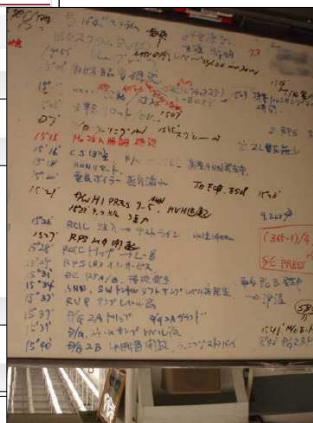
2. チャート

● 1系機 ● 2系機 ● 3系機 ● 4系機 ● 5号機 (1号機 2号機 3号機 4号機 5号機 6号機 7号機 8号機) ● 6号機 (1号機 2号機 3号機 4号機 5号機 6号機 7号機 8号機) ● 主変圧機

3. 警報発生記録等データ

● 1系機 2系機 3系機 4系機 5系機 6系機

4. 運転日誌等



Whiteboard in the unit 1 and 2 main control room

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TEPCO

③ Photos and Videos Library

<http://photo.tepco.co.jp/en/index-e.html>

Photos and Videos Library

“Photos and Videos Library” shows the status of the Fukushima nuclear accident and progress of the restoration, with photos and videos.

Photos / Videos search

- Search by key words
- Search by upload dates
- Search by dates (Photos were taken / Videos were shot)
- Search by status/measures
- Search by locations
- Pickup

New Topics

Upload date	Title
2013.1.9	Progress
2013.1.8	Steel Frame
2012.12.29	Prime Minister's Meeting
2012.12.28	Cause and Effect
2012.12.26	Water Level
2012.12.26	Water Level



Footage of TEPCO's TV conference

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NDL (National Diet Library)

The goal of NDL 3.11 Disaster Archive Project

1. Working to collecting, preserving and providing the records of the Great East Japan Earthquake as a nation
2. Aiming at the distributed collection and preservation by public and private institutions involved
3. Sharing collected data domestically and internationally and passed down to posterity

Using for various activities :

- Recovery and reconstruction of the disaster-afflicted areas
- Measures for disaster prevention, disaster reduction
- Academic research and study on the disaster
- Disaster prevention, disaster reduction education



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NDL (National Diet Library)

Collecting records

- NDL is building the archive topic of “Disaster and Earthquake”
- NDL is collecting various format of records topic of 3.11 earthquake
 - Books, journals, reports, government publications : by legal deposit system
 - Websites : by legal deposit system and consent
 - Movies, Sounds, Photos, and so on : by consent
 - ⇒NDL will continue to collect for the long term.
- including the records before 3.11 (Topic of Kobe Earthquake, Japan, 1995, nuclear accident, etc.)

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NDL (National Diet Library)**Schedule**

Time	Event
05 Nov 2012	First prototype release (Simple search, Advanced search, etc.)
10 Jan 2013	Second prototype release (Image search, Movie search, etc.)
Beginning of March 2013	Formal version release (Map search, Timeline search, API, other languages version, ASP service, etc.)
After April 2013	<ul style="list-style-type: none"> ➤ Improve system ➤ Continue to collect records ➤ Expand

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Concluding remarks

1. Archive, while preventing loss of information/knowledge, to learn lessons and to better prepared
2. Japanese digital archive of accident information in progress:
 - Networking of repositories
 - Yet to establish structured system with taxonomy and coherent labeling system in cooperation with the IAEA NAKT

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Thank you for your attention

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