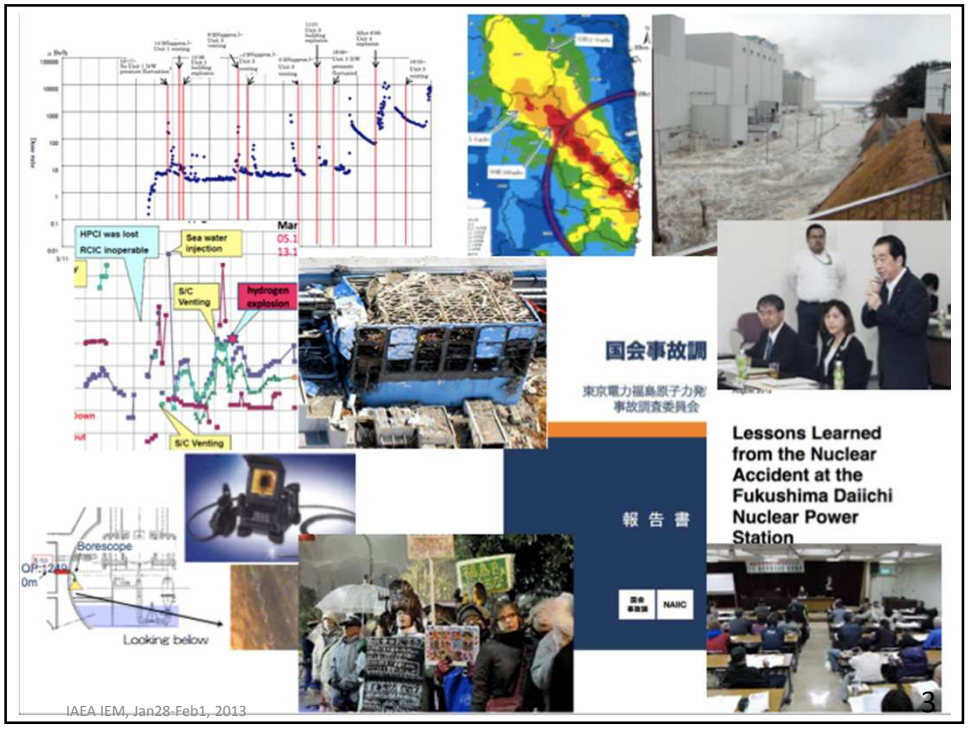
Long-Term Knowledge and Information Management Following Severe Accidents

A. Omoto (Tokyo Institute of Technology and AEC of Japan)
F. Adachi, T. Karseka (IAEA)
S. Iwata (The Graduate School of Project Design)
K. Itabashi, H. Nakajima (Japan Atomic Energy Agency)
T. Ohba (National Diet Library)
S. Takizawa. T. Anayama (TEPCO)

Outline

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



Accident-generated information

Document type

a) 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)

b) Interviews (TEPCO, NSC, NISA, Cabinet members, other Government officials, Politicians, nuclear experts, evacuees, other stakeholders)

c) Accident Investigation Committee's record and reports (Japanese (Diet, Government, NPO, AESJ etc) , ANS, US Academy, INPO..), IAEA etc

d) Technical papers from conferences, workshops, seminars….

e) Policy papers (regulatory bodies, AEC, Industry, Utility) and proposals for changes

f) Published papers/books /papers to magazine & journals…)

g) 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.

Diet

NPO-2

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"

Classification & Taxonomy (based on IAEA-NAKT)

NAKT (Nuclear Accident Knowledge Taxonomy)

Category of accident

- Nuclear reactor accident
  (TMI-2, Chernobyl, Fukushima-Daiichi)
- FC facility accident (Criticality accident, Large Scale Leakage etc)
- Radiation accidents
  (Industry/medicine/military/agriculture/science & education)

Topical sections

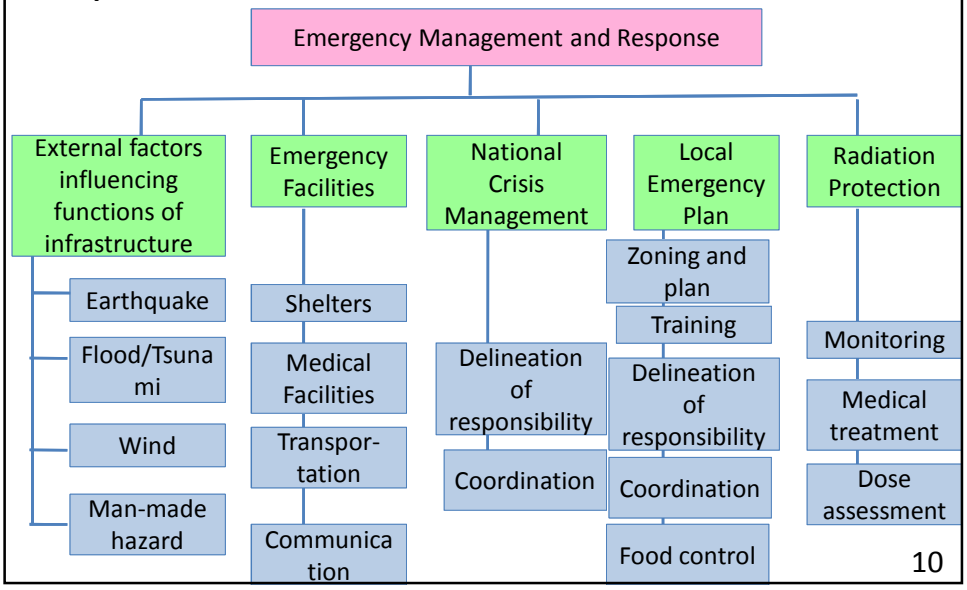
1. Nuclear installation
2. Accident progression & management
3. Emergency preparedness and response
4. Radiation survey & radiological protection
5. Human factor
6. Onsite 3D (Decon./Defuel./Decom.)
7. Environmental protection and restoration
8. Public relation
9. Regulatory aspects

Each info. with Label

9

Hierarchical representation of specific topics

Example: three level



10

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.

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					

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

Accessibility

Who to use and who to contribute

- ✓Public web site accessible to anyone
- ✓Why/How query
- ✓Contribution from
  - Those who create & possess data/information
  - Experts (knowledge and wisdom)
  - Librarian
  - Researchers in knowledge management
  - IT specialist

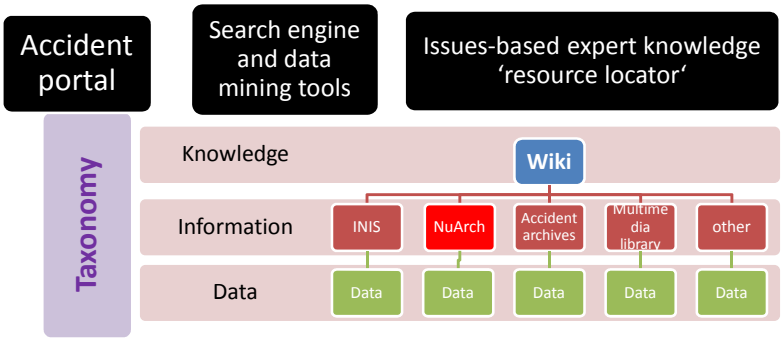
NAKT to help Why/How query

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

Example of ideas of contribution by experts

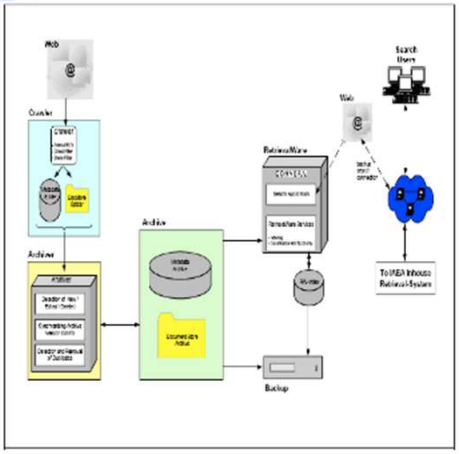
a) technical experts: filling in gap of information and validation of information
b) IT experts : “Search engine” & “resources locator”



[SOURCE] H. Böck, Vienna technical University

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

Archiving the "Nuclear Internet"



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

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

Digital Archive of Japan's 2011 Disasters

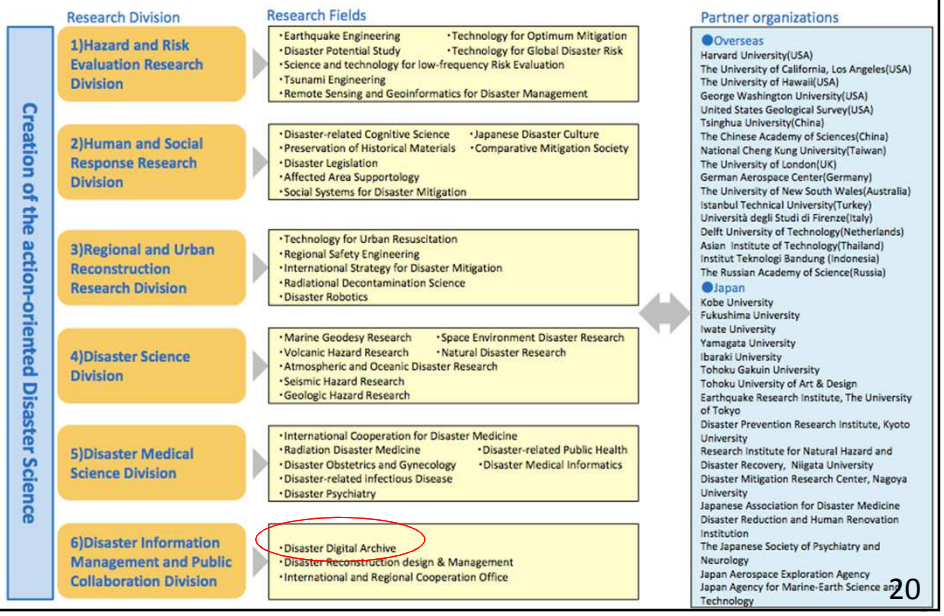
http://jdarchive.org/ja/about
http://www.archive-it.org
http://all311.ecom-plat.jp etc.

jdarchive.org supported by many organs

19

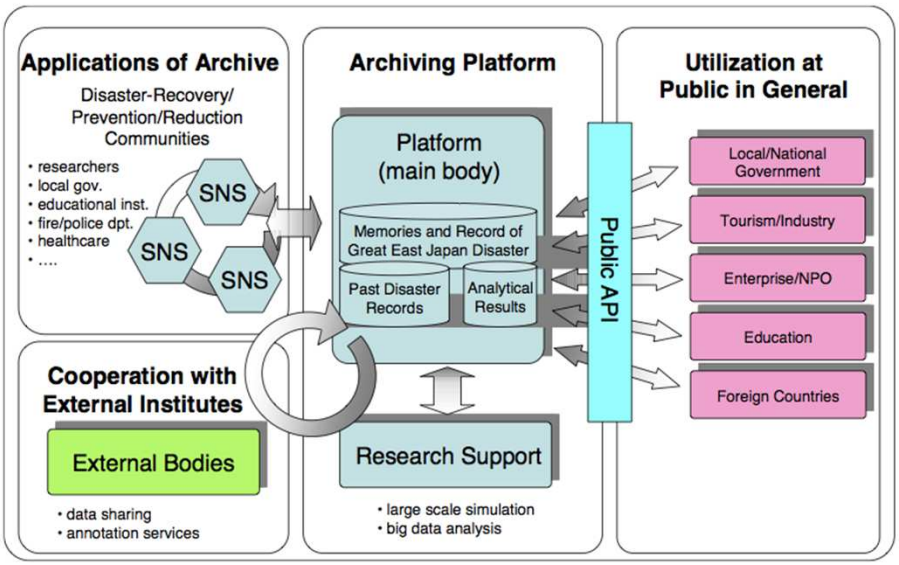
Tohoku University's archive project

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



20

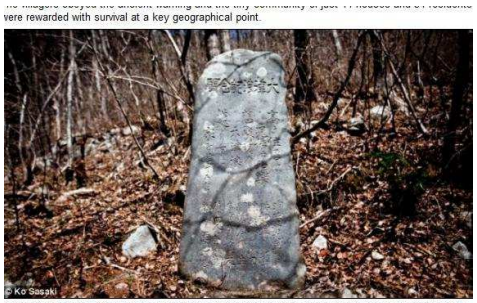
Digital Disaster Archive by Tohoku University and IBM



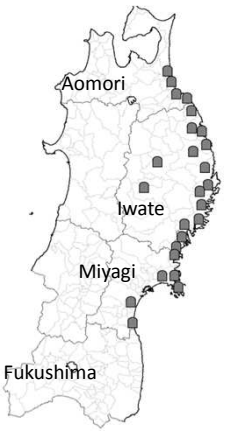
[SOURCE] M. Tatsubori et al, SWDM"12 workshop, April 2012, Lyon France

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



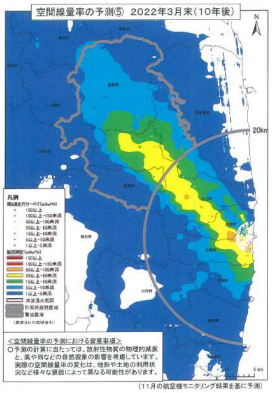
Prophetic: The stone tablet on the edge of the village of Aneyoshi, which the town's population credits with saving their lives



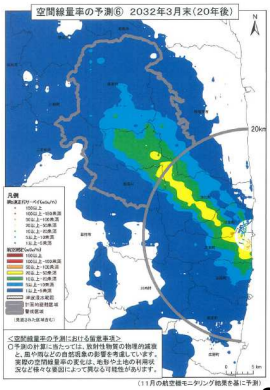
[SOURCE] http://www.ce.gunma-u.ac.jp/kamaishi_tool/pic/pic_13.pdf

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



10 years later w/o decon.



20 years later w/o decon.

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.

The daydreams of cat herders

Conceived network of repositories

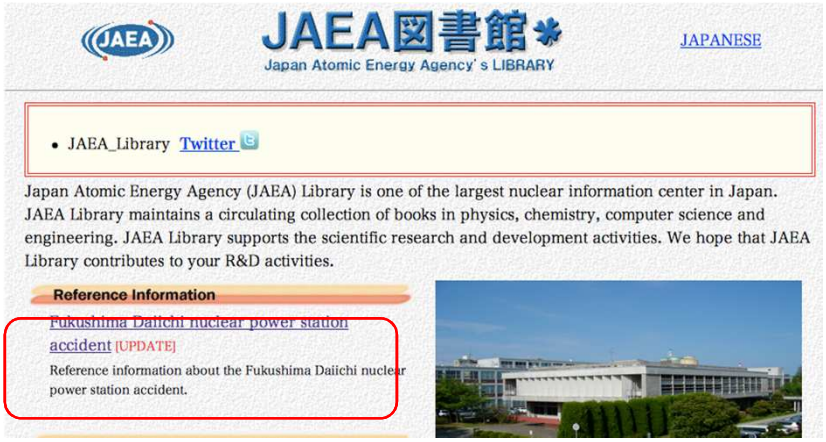
- Central repository (also gateway to network): NDL
- Networking of distributed digital repository by a WG by Government agencies and Industry/Utility
  - Coordination
  - Common taxonomy and keywords
  - Structure (Data/Information/Knowledge)
- Cooperation with the IAEA for NAKT including definition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

JAEA Library

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



- 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.

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

JAEA Library

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

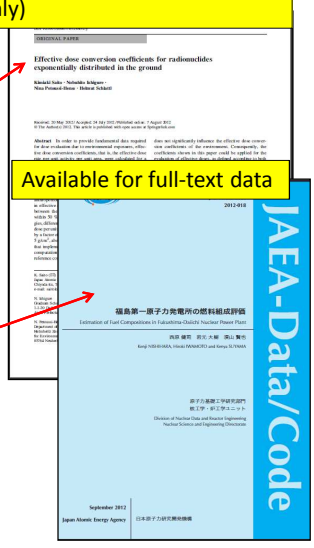
List of the R&D results done by JAEA(Fukushima Daiichi Nuclear Power Station)【Nov.2012】 *JAEA Reports:

*Retrieval service for JAEA-OPAC Database on World Wide Web: http://library-documents.jaea.go.jp/opac/eng/br_search.asp

No.	Author	Title	Journal·Book Title/Meeting Information	Publication Date	Vol. No. Page	Link	JAEA(Free)
1	Saito, 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	Nagase, Fumihisa; et al.	Examinations of fuel debris samples from Three Mile Island Unit 2	Enerugi To Doryoku	2012.11	vol.62, no.279, p.1-7	http://ci.nii.ac.jp/naid/40019486362	
3	Nakajima, Hidemitsu; et al.	Study for development of the Fukushima Dai-ichi Nuclear Power Station accident archive	Joho Chishiki Gakkai-Shi / Dai 17 Kai Jyoho Chishikigaku Foramu/2011/12 Tokyo,Japan)	2012.11	vol.22, no.4, p.344-353	http://ci.nii.ac.jp/naid/40019490032	
4	Izawa, Kazuhiko; et al.	Infinite 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, Shinji; et al.	Emergency response by robots to Fukushima-Daiichi accident: Summary and lessons learned	Industrial Robot	2012	vol.39, no.5 p.428-435	http://www.emeraldinsight.com/journals.htm?articleid=17047604	
6	Kawase, Keiichi; et al.	Decontamination technology	Funtai Gijutsu	2012.10	vol.4, no.10, p.971-980	http://ci.nii.ac.jp/naid/40019463218	
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.2012.05.023	
8	Kawatsuma, Shinji; et al.	Overview and issues to be solved on emergency response of robots to Fukushima NPP accidents	Dekomisshoningu Giho	2012.9	no.46, p.14-26	http://ci.nii.ac.jp/naid/40019449803	
9	Nishihara, Kenji; et al.	Estimation of fuel compositions in Fukushima-Daiichi Nuclear Power Plant	JAEA-Data/Code 2012-018	2012.9	190p.	http://jolisearch-inter.tokai-sc.jaea.go.jp/search/servlet/search?5052464	○
10	Satoh, Daiki; et al.	Decontamination planning based on computer simulation code CDE	RIST News	2012.9	no.53, p.12-23	http://www.rist.or.jp/rist/rnews/53-53c3.pdf	
11	Kobayashi, Yasuhiko	Health effects of the radioactive contaminated foods	Nippon Kikai Gakkai-Shi	2012.9	vol.115, no.1126,	http://www.jsme.or.jp/publish/kaisi/120902t.pdf	○
12	Nagai, Haruyasu	Analysis on the atmospheric dispersion by WSPEEDI for the Fukushima Dai-ichi Nuclear Power Plant accident	Shuninsha Nyusu	2012.9	no.18,p.63-64		

1 / 9 ページ 2012.12.10

Available for full-text data



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

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

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…

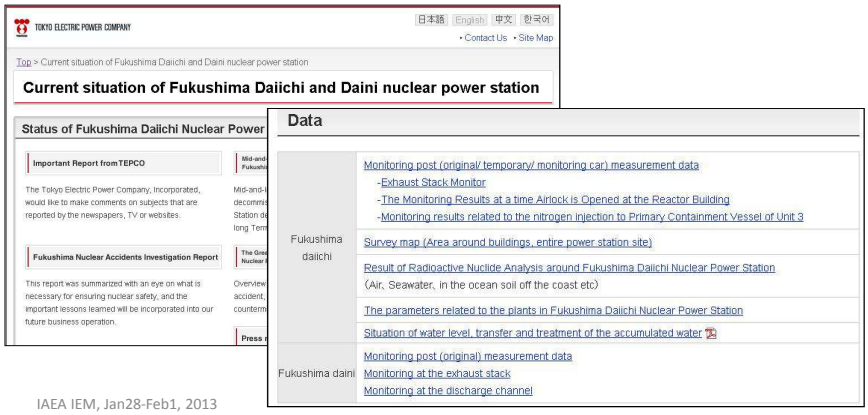
Roadmap
Collection of primary information
Classification and labeling
System for public access

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＞

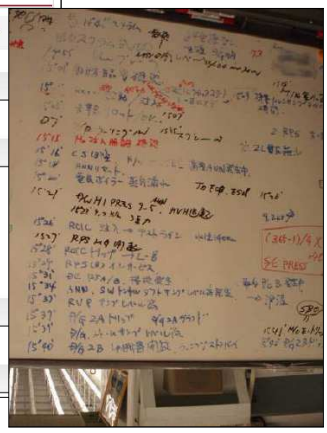
①Current situation and data on Fukushima daiichi and daini nulear power station
http://www.tepco.co.jp/en/nu/fukushima-np/index-e.html



TEPCO

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

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

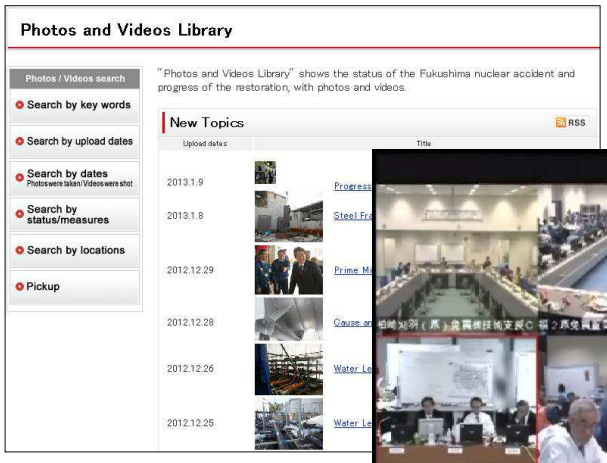


Whiteboard in the unit 1 and 2 main control room

TEPCO

③Photos and Videos Library

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



Footage of TEPCO's TV conference

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

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.)

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	➢Improve system ➢Continue to collect records ➢Expand

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

Thank you for your attention