

International Forum "Chornobyl's Legacy for the Nuclear Safety of the World"

30th anniversary of the Chernobyl NPP accident

5th anniversary of the Fukushima Daiichi NPS accident

International Community in Search for International Guarantees of the World Nuclear Safety



Japan Atomic Energy Agency
Special Advisor to the President

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National Technical University of Ukraine KPI, Kyiv, Ukraine, 21-23 April, 2016.

- Thank you, Mr. Chairman, for kind introduction for me.
- I would like to express my special thanks to the organizers of this Forum for inviting me and I am honored to have a chance to make this presentation.
- As I stayed in Kyiv as Ambassador of Japan to Ukraine for about three years until October 2014, I'm very happy to be back to Kyiv for the first time in about one and a half years.
- I believe this Forum is very important in memory of 30th anniversary of the Chernobyl NPP accident, and this year also marks the fifth anniversary of the Fukushima Daiichi Nuclear Power Station (NPS) Accident.
- So this Forum is a timely and important step toward enhancing world nuclear safety, and I would like to congratulate you for the successful organization of this Forum.
- The title of my presentation is "International Community in Search for International Guarantees of the World Nuclear Safety."
- In early this month, President Poroshenko was invited to visit Japan to meet with Japanese Prime Minister Abe. Mr. Abe expressed continuous support to the peaceful resolution and domestic reforms in Ukraine. It has also been confirmed to promote further enhancement of Ukraine-Japan relationship, including the Fukushima-Chernobyl collaboration.
- The present forum plays an important role to enhance the Ukraine-Japan collaboration on nuclear safety.

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1. Support/cooperation for the Chernobyl NPP Accident
2. Situation of and response to the Fukushima Daiichi NPS Accident
 - Environmental restoration/ Lifting of evacuation order/ Return of residents/ Reconstruction and revitalization of Fukushima
 - Decommissioning of the Fukushima Daiichi NPS and related R&D activities
3. Circumstances on nuclear energy after the Fukushima Daiichi NPS Accident
 - Activities for enhanced safety regulation and nuclear safety
 - Global situation and future prospects of nuclear energy
4. Ukraine-Japan cooperation to advance aftermath response to accidents at NPS and contribute to the enhancement of world nuclear safety

- The contents of my presentation are listed here. I will start with an overview of Japanese support and cooperation for the Chernobyl NPP accident.
- Then, I will explain about the Fukushima Daiichi NPS accident, followed by the circumstances on nuclear energy in both Japan and the world after the Fukushima Accident.
- And lastly, I will stress the importance and significance of cooperative contributions by Ukraine and Japan to the enhancement of world nuclear safety.

1. Support/cooperation for the Chernobyl NPP Accident

- Two international conventions on nuclear accidents: came into effect in 1987 following negotiation at the IAEA
 - Convention on Early Notification of a Nuclear Accident
 - Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency
- <== Special statement on the Chernobyl Nuclear Accident at Tokyo G7 summit (May 4-5, 1986):
- Various types of support
 - Nuclear safety assistance:
Assistance to Nuclear Safety Account and Chernobyl Shelter Fund
 - Humanitarian aid:
Provision of medical supplies, Contribution through the WHO
 - Assistance for denuclearization (completed in May, 2015):
Support for establishment of a nuclear material control system, provision of medical equipment and materials for personnel for disposition of nuclear weapons, etc.

http://www.clearing.mod.go.jp/hakusho_data/1986/w1986_02003.html

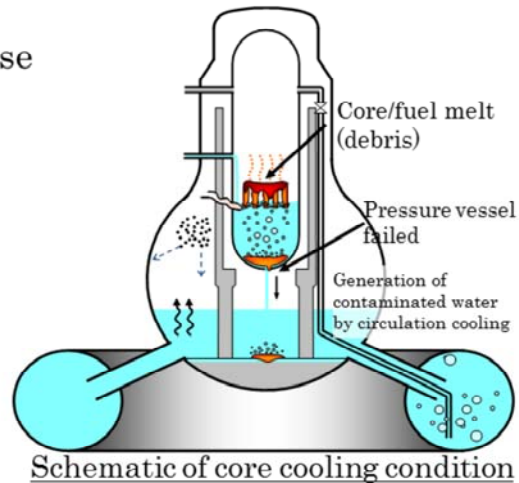
- Immediately after the accident, under the initiative of the then Japanese Prime Minister Yasuhiro Nakasone, the Special Statement on Chernobyl accident was adopted and officially announced at the Tokyo G7 summit that was held on May 4-5, 1986.
- In response to this statement, member countries had a series of negotiations under the auspices of the IAEA, to conclude two Conventions. One is convention on Early Notification of a Nuclear Accident, and the other is Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency.
- Both conventions came into effect in the next year, 1987.
- Moreover, in cooperation with the G7 and other countries, Japan has provided Ukraine with various types of support such as nuclear safety assistance and humanitarian aid and so on.
- The total contribution has been approximately 190 million US dollars for restoration and recovery from the Chernobyl accident. We expect the new shelter which I visited yesterday to be completed in construction in the fall of 2017.

[Supporting information: Breakdown] Chernobyl Shelter Fund: 116 million US dollars (M\$), Nuclear Safety Account: 46 M\$, Humanitarian aid: 27 M\$, Assistance for denuclearization: 21 M\$

2-1 Overview of the Fukushima Daiichi NPS Accident (March 11, 2011)

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- Reactors were safely shut down by earthquake.
- Station blackout: off-site power (by earthquake), emergency power (by tsunami)
- Loss of core cooling functions -> Core damage/melt
-> Hydrogen explosion,
Radioactive material release



- Five years ago, on March 11, 2011, the Great East Japan Earthquake struck at the north-eastern part of Japan with a magnitude of 9. Like other nuclear power reactors in Japan, all 6 units at the Fukushima Daiichi NPS were safely shut down.
- However, 50 minutes after the earthquake, the Fukushima Daiichi NPS was hit by a huge tsunami with a height of more than 15m. The tsunami inundated many facilities, which led to the station blackout.
- The loss of cooling functions caused core damage, fuel melt occurred and debris were formed.
- In addition, the hydrogen generated during the accident exploded and destroyed the reactor buildings of Units 1, 3 and 4, scattering rubble over the site.
- This accident caused the release of radioactive cesium and iodine into the environment. Their radioactive amounts were estimated to be less than one sixth and one tenth, respectively for cesium and iodine, of those released by the Chernobyl accident.

2-2 Response to the Fukushima Daiichi NPS Accident and Efforts toward Reconstruction/Revitalization of Fukushima

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[Emergency response measures]

For 1 month from immediately after the accident

- Measures to stabilize the reactor
- Measures to minimize radiation exposure: Setting up of evacuation zones (20km radius), Restriction on ingestion of food and drink

[Aimed at environmental restoration, the lifting of evacuation order, and the return of residents]

For 1 year from after the accident

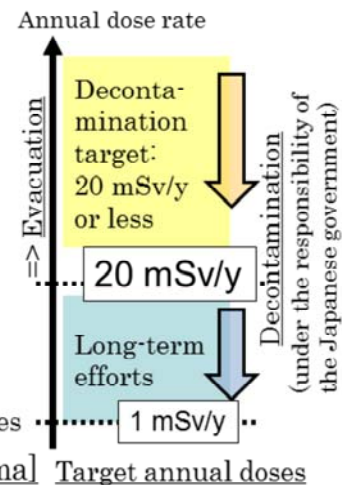
- Start of decontamination, temporary access of evacuees to home, etc.
- Monitoring and measurement of radiation

=>Lifting and successive update of evacuation order zones

[Toward Reconstruction/Revitalization of Fukushima]

Beyond 1 year or more after the accident

- Measures for early returnees: Continued decontamination, Infrastructure reconstruction, etc.
- Measures for long-term evacuees: Establishment of evacuee housing
- Support for new lives: Preparation for new living environment, Creation of new industry.



• Japanese government has been doing various efforts towards restoration and reconstruction of Fukushima.

• As emergency response to the accident, an area comprising a 20-km radius from the Fukushima Daiichi NPS was designated as an evacuation order zone to protect the public from radiation exposure.

• During this period, Japan received great support from many countries, including 2000 radiation measurement devices and 1000 sets of protective masks and iodine absorbent cans from Ukraine. Again, we are especially grateful for all the support from Ukraine.

(• For approximately 1 year following the accident, a short-term strategy was developed to restore the environment, lift the order for evacuation and allow the residents return to their regions. Under this strategy, decontamination was initiated, and other activities, such as temporary access to their homes for evacuees, monitoring and measurement of radiation status, were conducted.)

• Beyond 1 year or more from the accident, special laws on the reconstruction and revitalization of Fukushima were put into force, and major efforts were initiated, such as continued decontamination, the reconstruction of local infrastructure, the creation of new industry and the support for new lives of sufferers.

• It should be noted that the criterion to designate the evacuation order zone was set at 20 mSv/y or more. It is the most conservative value based on the fundamental concept of the ICRP on the annual exposure dose limit.

2-3 Update of Evacuation Order Zones with the Progress of Decontamination 5

- 3 Zones after the accident (April 22, 2011):
 - The evacuation order zone, the emergency evacuation-ready zone and the planned evacuation zone
- April 2012: The zoning has been updated according to radiation dose level:
 - Zone 1 (< 20 mSv/y), to which evacuation orders were ready to be lifted
 - Zone 2 (> 20 mSv/y), in which the residents are not permitted to live
 - Zone 3 (> 50 mSv/y), where it is expected that the residents will have difficulties in returning for a long time
- The evacuation order has been lifted in series since April 2014 for 3 municipalities located in the Zone 1.

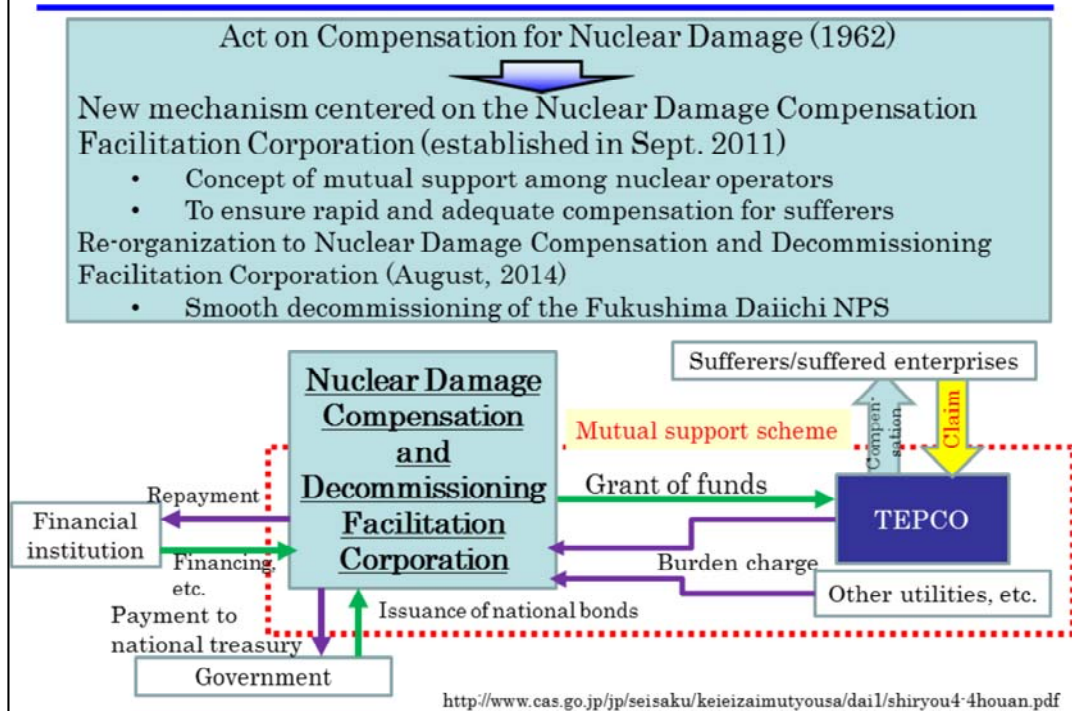
•As a result of these efforts since April 2012, one year after the accident, the zoning has been updated according to radiation dose level. •Specifically, the zone indicated in green is where evacuation orders were ready to be lifted, yellow-colored zone where the residents are not permitted to live, and red-colored zone where it is expected that the residents have difficulties in returning for a long time.

•The evacuation order has been lifted in series since April 2014 for 3 municipalities located in the green-colored zone.

•As of March 2016, the number of evacuees decreased to 97,000 from 160,000 immediately after the accident. Still now, activities are underway for environment recovery and the return of residents.

2-4 Nuclear Liability Scheme

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- Next topic is the liability for damage caused by the Fukushima Daiichi NPS accident
- The existing scheme of liability for damage caused by nuclear accidents in Japan, which was introduced in 1962, is not sufficient for the Fukushima NPS accident because of its maximum compensation of about 1 billion US dollars, in comparison to that needed for the Fukushima NPS case, more than 60 billion US dollars.
- The newly established scheme centered on Nuclear Damage Compensation and Decommissioning Facilitation Corporation allows for TEPCO and the Japanese government to enable rapid and adequate compensation for sufferers and support steady progress of TEPCO's decommissioning work over several decades. This scheme fits well into the Japanese social and business climate.

(• Under this scheme, the government finances the NDF, the NDF loans out TEPCO using the government funds, and then TEPCO uses the funds for compensation.)

[Supporting information]

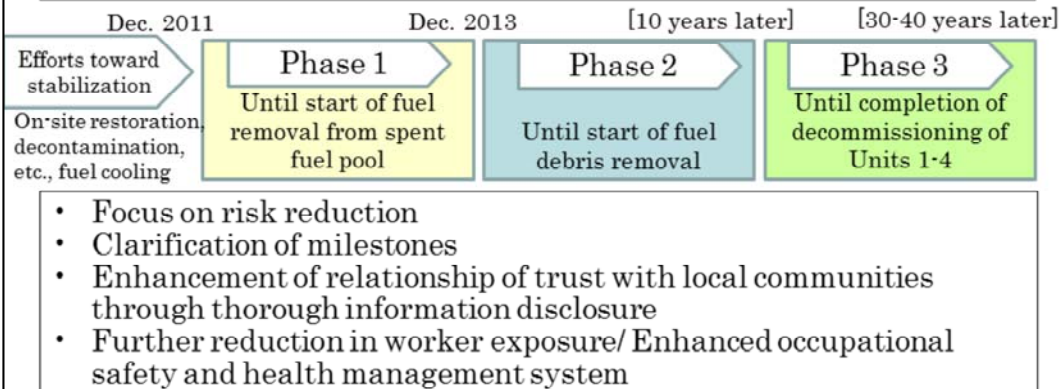
Total amount of burden charges paid by utilities from 2011 to 2014: 620 billion yen, including the general burden charge of 510 billion yen (TEPCO's share: 180 billion yen, approximately 35%)

2-5 Decommissioning of Fukushima Daiichi NPS

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Mid-and-long-Term Roadmap towards the Decommissioning of TEPCO's Fukushima Daiichi NPS (revised in June 2015)

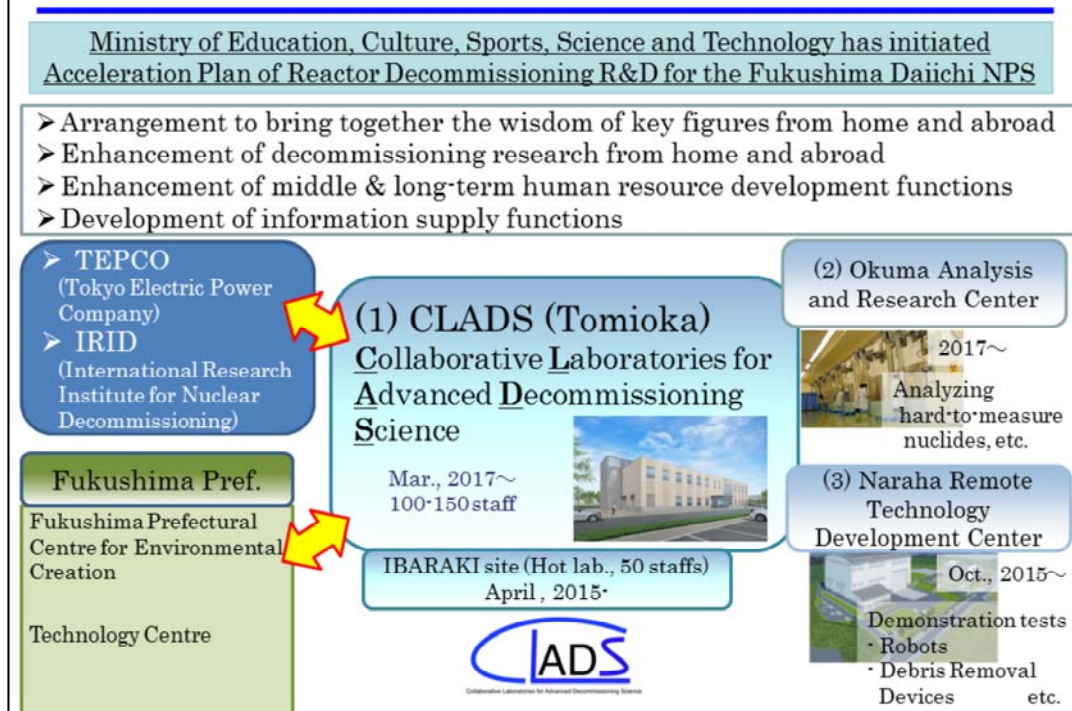
1. Removal of fuel from spent fuel pool
2. Treatment of contaminated water
3. Removal and disposition of fuel debris
4. Treatment of solid waste



https://www.kantei.go.jp/jp/singi/hairo_osensui/dai2/siryoul.pdf

- Next, I'll talk about the work on decommissioning of Fukushima Daiichi NPS. There are four main tasks as shown here, for example, the treatment of contaminated water generated by fuel debris cooling, the removal and disposition of fuel debris, and so on.
- In June 2015, the latest version of the decommissioning roadmap was developed with the aim of safe completion of all decommissioning activities within next 30 to 40 years.
- There are three phases in the roadmap. Now in Phase 2, and various R&D efforts are underway for difficult technology development for fuel debris removal.

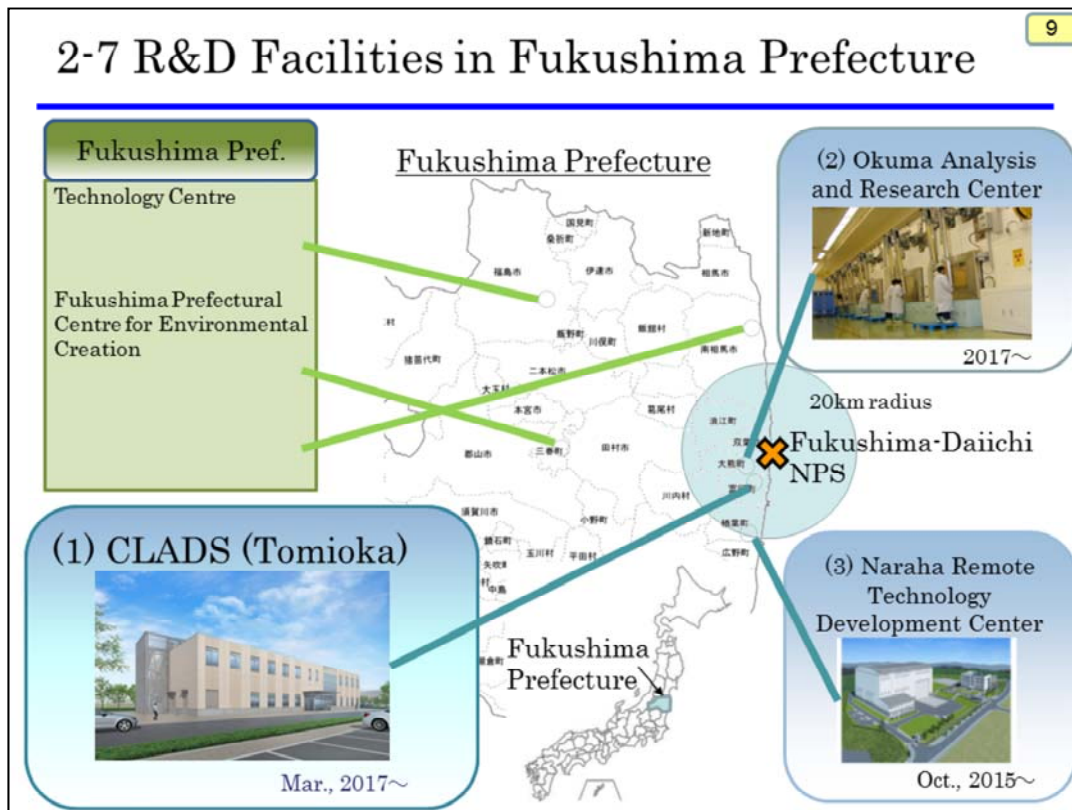
2-6 R&D Efforts for Decommissioning Centered on the JAEA 8



• Ministry of Education, Culture, Sports, Science and Technology has initiated Acceleration Plan of Reactor Decommissioning R&D for the Fukushima Daiichi NPS. Based on the plan, the Collaborative Laboratories for Advanced Decommissioning Science (CLADS) was established in JAEA as the central base for the R&D.

• The main role of CLADS is to enhance fundamental research on decommissioning in cooperation with domestic and overseas organizations, to develop human resources by inviting participation of young staff in collaborative research efforts, and so on.

• For this purpose, three JAEA research facilities will be built around Fukushima NPS.



• This slide shows the geographical relation between the Fukushima Daiichi NPS and 3 JAEA newly-built research facilities which are all located in the area of a 20 km radius from the Fukushima site.

[Supporting information]

- Well-known researchers and engineers from home and abroad will be invited to (1) the main building of CLADS.
- At (2) the Okuma Analysis and Research Center, analysis of debris removed from the NPS will be performed.
- (3) the Naraha Remote Technology Development Center will be built to develop remote-handling components and equipment, including robots, and to conduct demonstration testing.
- Effective promotion of R&D and collaboration are expected utilizing these facilities, including those built by Fukushima prefecture.

2-8 Promotion of International R&D at JAEA-CLADS

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1st CLADS International Workshop

- Held Nov. 2015, at Tokai, Japan
- 130 participants, 6 overseas countries



Possible Collaboration Items between Ukraine - Japan

1. Collaborative research: Institute for Safety Problem of NPP of the National Academy of Sciences of Ukraine and JAEA have started an information exchange on technology regarding the fuel containing material of Chernobyl and debris of Fukushima NPS.
2. Collaborative work in the frame of OECD/NEA: e.g. Databasing for severe accident-related materials (debris, fission products, etc.)
3. Researcher invitation: Invitation to the 2nd CLADS international workshop (next autumn)

<http://fukushima.jaea.go.jp/initiatives/cat05/haishi02002.html>

• In order to promote international collaborative research, an international workshop was held in Japan last November with the sponsorship of CLADS. There were 6 overseas participated countries and Ukraine was one of them.

• We are now considering specific research cooperation with Ukraine under the Ukraine-Japan agreement, which I'll describe later.

• One of these is a collaborative research on the treatment for fuel containing materials of Chernobyl NPP and debris of Fukushima Daiichi NPS between Institute for Safety Problem of NPP of the National Academy of Sciences of Ukraine and JAEA.

• Another possible cooperative research activity on environmental restoration is under consideration between several Ukrainian research institutes and two Japanese universities.

• We believe there would be more potential in cooperation between our two countries in this field.

2-9 Responses to the Fukushima Daiichi NPS Accident (Summary)

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IAEA report (published on August 31, 2015)

Prepared by approximately 180 experts from 42 countries in an international advisory committee organized with the participation of OECD/NEA, the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and other institutions.

Foreword written by Yukiya Amano, Director General, IAEA:

- Since nuclear safety in Japan was based on a "myth about the safety," preparation for major nuclear accidents was not sufficient.
- Distributed regulatory responsibilities among a number of organizations/ Lack of measures against the coincidence of large natural disasters and nuclear accident
=> improved after the Fukushima Accident

Chapter 1: Introduction: Significance and configuration of the report

Chapter 2: Description and evaluation of the accident (consideration of nuclear safety):

Several important aspects did not sufficiently follow international practice. Consideration of tsunami and other external events was insufficient.

Chapter 3: Emergency preparedness and response: Lack of a system to respond to the coincidence of nuclear emergency and natural disasters

Chapter 4: Radiation effects: consistent with the conclusion of the UNSCEAR report

Chapter 5: Restoration after the accident: External exposure from cesium deposited on the ground surface is dominant (focused on decontamination work)/ Need for sustainable solutions for contaminated water

<http://www.aec.go.jp/jicst/NC/iinkai/teirei/siryo2015/siryo32/siryo2-1.pdf>

• As a summary of the responses to the Fukushima Daiichi NPS accident, I refer to the contents of the IAEA report that was prepared by approximately 180 experts and published at the end of last August.

• In the foreword, Yukiya Amano, Director General summarized the accidents, as caused by insufficient preparation for major nuclear accidents, that is, insufficient countermeasures against the coincidence of large natural disasters such as tsunami and nuclear accident, as well as distributed regulatory responsibilities.

• However, as is shown in the next slide, these issues have been well addressed and improved in Japan.

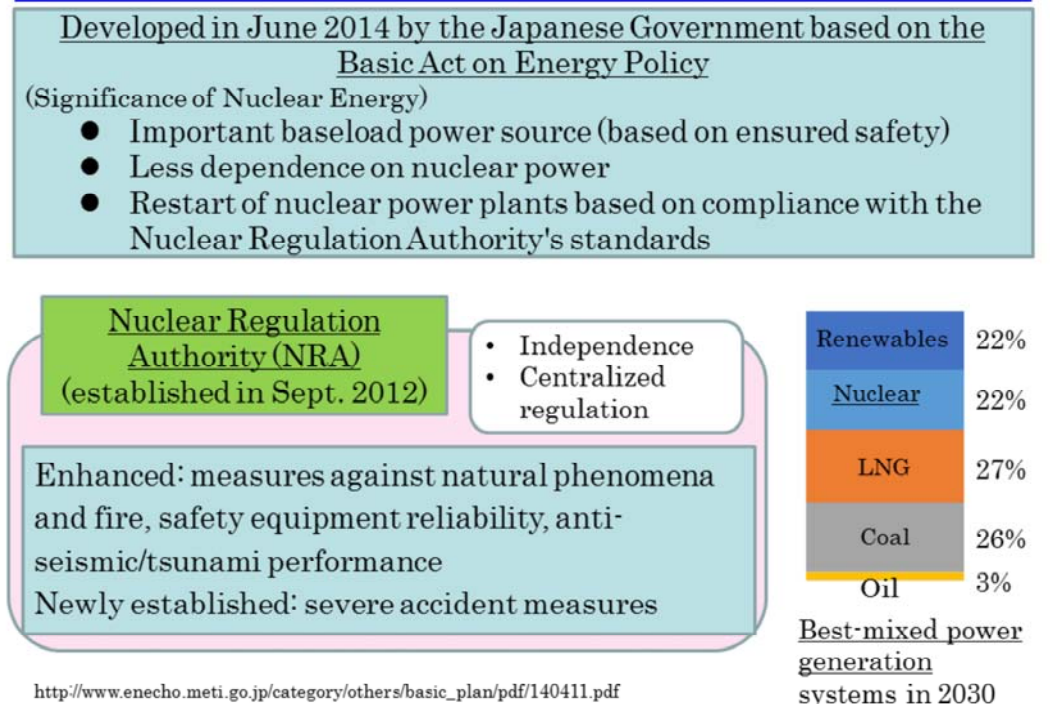
[Supplement]

• A UNSCEAR report noted that no discernible increase in the incidence of radiation-related health effects are expected among exposed members of the public and their descendants.

• As of now, no opinion or announcement on this report was given by government of Japan or other Japanese institutes.

3. Development of Basic Energy Plan -Significance of Nuclear Energy-

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- In June 2014, the Japanese government authorized the Basic Energy Plan, which provides a basic strategy for the national energy policy.
- This Plan specifies nuclear power as an important baseload power source, and promotes the restart of domestic nuclear power plants on the premise of compliance with the new regulatory standards, set up by the newly established Nuclear Regulation Authority, while reducing the dependence on nuclear power to the possible extent.
- Since 2014, 5 nuclear power reactors of 43 units in Japan have been authorized to comply with the new regulatory standards, and so those reactors have been planned to start operation one after another since last August (*At present, two reactors are in operation (Sendai-1,2).).
- In addition, as a future prospect, the goal of best-mixed power generation systems in 2030 was established based on this Basic Plan. The share of nuclear power in total power generation would decrease to at most 22 percent-from about 30% before Fukushima nuclear accident, nevertheless the nuclear would still remain one of the most important baseload power sources.
- On the other hand, total number of world nuclear power reactors would almost double, approximately maximum 700 units of 1GWe class by the year 2030 according to the IAEA estimation. I understand that in Ukraine the share of nuclear power in total power generation is about 55% at present.
- These facts suggest that the enhancement of nuclear safety will become an increasingly important global issue and that Ukraine and Japan, which have experienced severe accidents, have a responsibility to contribute to the enhancement of world nuclear safety.

4-1 Ukraine-Japan Cooperation to Advance Aftermath Response to Accidents at Nuclear Power Stations

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- Ukraine-Japan cooperation:
"Agreement concerning Cooperation to Advance Aftermath Response to Accidents at Nuclear Power Stations":
concluded in April 2012, and came into effect in May 2012
- Meeting of the intergovernmental cooperation joint committee based on this Agreement:
 - ✓ 1st Mtg. (July 2012), 2nd Mtg. (July 2013): Support for responses to the Fukushima NPS accident, possible cooperation for addressing NPS accidents
 - ✓ 3rd. Mtg. (Nov. 2015): Further promotion of information sharing between two countries, etc.
- Cooperation results:
 - ✓ 6 Japanese ultra-small earth observation satellites were launched by Ukrainian rockets to observe regions surrounding the both Chernobyl and Fukushima NPSs (June and Nov. 2014).
 - ✓ Nearly 80 Chernobyl NPS accident investigation teams from Japan visited the Chernobyl site.
 - ✓ Many exchanges between experts of both countries.

http://www.mofa.go.jp/mofaj/press/release/24/7/0726_04.html

- Now, please let me add a few words about the bilateral cooperation between Ukraine and Japan on global nuclear safety.
- Following the Fukushima accident, the "Agreement concerning Cooperation to Advance Aftermath Response to Accidents at Nuclear Power Stations" came into effect in May 2012.
- To date, our two countries' intergovernmental joint committee based on this Agreement has met three times.
- In particular, in the third committee meeting that was held last November, both countries showed interest in research cooperation between the JAEA and Ukrainian institutes concerning the decommissioning of the Fukushima Daiichi NPS.
- Further, under this agreement, 6 Japanese ultra-small earth observation satellites were launched by Ukrainian rockets to observe regions surrounding the both Chernobyl and Fukushima NPSs, and nearly 80 Japanese accident investigation teams successfully visited the Chernobyl site.
- I would like to express my special thanks for such excellent cooperation extended from the Ukrainian side.

4-2 Conclusion (1):

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Contribution to the Enhancement of the World Nuclear Safety (1/2)

Contribution to international community by Ukraine and Japan

It is a responsibility of Ukraine and Japan as countries that have experienced severe nuclear reactor accidents to contribute to enhancement of world nuclear safety in a positive and leading way.

- Systematization and sharing among countries concerned of lessons, findings and technologies obtained from the responses to Chernobyl and Fukushima NPS accidents
 - Accident cause investigation; Reflection of the results into severe accident management technology and regulation
 - Environmental restoration technology
 - Damage liability scheme for nuclear accidents
 - Various responses and measures against nuclear accidents (development of emergency evacuation plans, emergency support, life reconstruction, etc.)
 - Technology to decommission a reactor that caused accident

• In conclusion, I would like to point out how important it is for Ukraine and Japan to cooperate for the enhancement of contribution to world nuclear safety.

• Since Ukraine and Japan provided mutual support for the Chernobyl and Fukushima Daiichi NPS accidents, both countries have a common mission to contribute to the enhancement of the world nuclear safety in a positive and leading way.

• For this purpose, it is necessary for us to systematize the lessons, findings and technologies obtained from the responses to Chernobyl and Fukushima NPS accidents and share such information with the world through various opportunities, including the meetings or reports of IAEA.

• Possible themes include accident cause investigation, the reflection of the results into severe accident management measures, environmental restoration and etc.

4-2 Conclusion (2):

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Contribution to the Enhancement of the World Nuclear Safety (2/2)

- My personal idea for nuclear emergency response measures
 - Establishment of an international nuclear emergency support team:
 - ✓ Establishment of national nuclear emergency support teams
 - ✓ International cooperation among national teams for nuclear accidents in any countries
(cooperation for the team of the country with an accident, or for establishment, training and guidance of teams for countries that newly introduce nuclear reactors)
 - ✓ Coordination of the roles of respective countries' teams by the IAEA, if needed
 - Succession of lessons and findings of nuclear accidents, human resource development for nuclear emergency response

<http://energie.edf.com/fichiers/fckeditor/Civaux/FARN2015.pdf>
<http://www.japc.co.jp/news/press/2015/pdf/270918.pdf>

• In addition, concerning the nuclear emergency measures, personally I think it is desirable to establish an international nuclear emergency support team like a sort of a UN-PKO team for nuclear emergency when an accident happens.

• National nuclear emergency support teams, such as the French Nuclear Rapid Action Force (FARN) or Japanese Emergency Countermeasure Support Team, should be established in the countries with NPPs.

• In case of a nuclear accident in any country, the dispatch of each national team to the country concerned should be discussed and negotiated among the countries concerned to cooperatively give emergency support measures as needed.

• I believe that, if needed, the IAEA can help coordinate the roles of these national teams, which would form an international nuclear emergency support team.

• In addition, it is important for capable countries to contribute to the human resource development for nuclear emergency response.

• Finally, I would like to emphasize the importance to enhance the collaborative relationship in the field of nuclear safety between Ukraine and Japan.

• We welcome the cooperation and collaboration with Ukraine on R&D of the decommissioning technology.

• Let's work together for the world nuclear safety!



Thank you for your kind attention.

- Thank you for your kind attention.
- Слава Україні ! (スラーヴァ・ウクライニ)