Provisional Translation

Technical Subcommittee on Nuclear Power, Nuclear Fuel Cycle, etc. Data Sheet 2

Estimation of Accident Risk Cost in Nuclear Power Plants

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Edited by Atomic Energy Commission Bureau

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Requests from the Cost Review Committee※

- Future risk costs in nuclear power generation
  The costs in nuclear power generation, invisible at present but potentially coming to light in the future, are estimated in consideration of three chief areas: 1) the nuclear accident at the Fukushima Dai-ichi NPS of TEPCO, 2) the costs required for the compensation of damages and decontamination, and 3) additional costs for decommissioning, among others.

※ the Energy and Environment Council's Cost Review Committee, http://www.npu.go.jp/

Concepts of Accident Risk Cost Estimation

- The accident risk cost is estimated based on the following concepts:

1) $$\frac{\text{Damage cost (yen)} \times \text{Accident frequency (per reactor year)}}{\text{Gross output (kWh)}}$$

2) The damage cost is the sum of additional decommissioning costs and amount of damages.

3) The damage cost is standardized in consideration of the following:
   - Output capacity of model plants
     Output: 1.2 million kWe, Operation rate: 60%, 70%, 80%
   - Site characteristics
     GDP/person, income/person employed, regional difference price
   - Population around the site
     within 30 km radius

Calculation of Damage Costs

- Assuming nuclear hazards following a severe accident , prospective damage costs are estimated using the model plant (a plant which started operation in the last seven years).
- The following may be included in nuclear hazards:
  - Physical damage (loss of assets, decontamination costs to restore property values, etc.)
  - Human damage (death, injuries, evacuation, emigration, etc.)
  - Economic and social losses (production loss, damage due to joblessness, harmful rumors, etc.)
- The figures publicly announced are used for estimating the damages.
- It should be noted that future risks depend on the site location and the generation of plant.

Estimation of Damage Costs (1)

Estimates by the TEPCO Management and Finance Investigation Committee

- TEPCO Management and Finance Investigation Committee Report (Published on October 3, 2011)
  - Costs of decommissioning the reactors at the Fukushima Dai-ichi NPS
    - Units 1 to 4 (additional costs) 964.3 billion yen
  - Amount of damages
    - Onetime damages 2,618.4 billion yen
    - Damages on a yearly basis
      - 1st year 1,024.6 billion yen
      - Second year (and thereafter) 897.2 billion yen

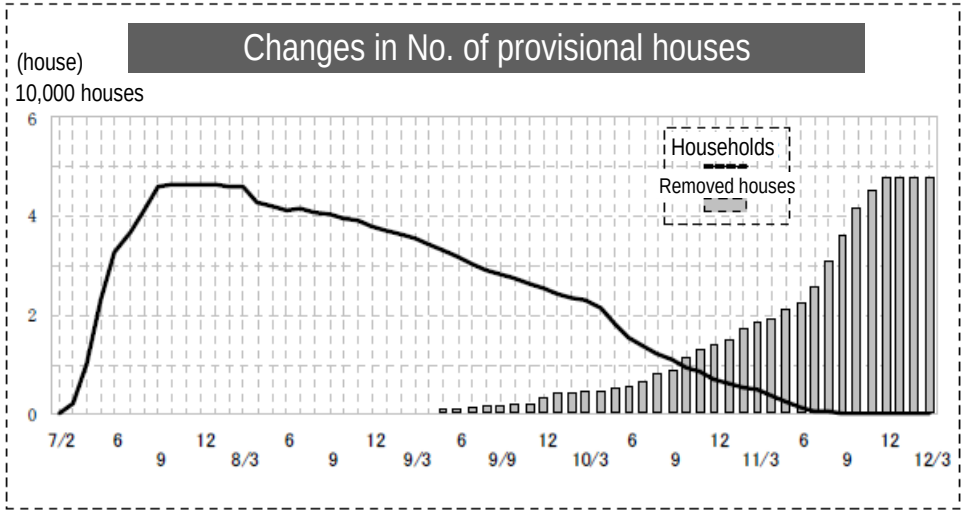
Total: 5,504.5 billion yen

Estimation of Damage Costs (2)

Presumed Damages in the Second Year and Thereafter

- For the amount of damages in the second year and thereafter, the payment up to the fifth year is considered in light of the decontamination plan under discussion now.
- In reference to the changes in the number of evacuees in large-scale disasters in the past, a linear decline of the amount of damages is assumed.

（Remarks) Changes in number of people who lived in provisional housing in the Great Hanshin-Awaji Earthquake.



⇒Addition of 1,345.8 billion yen (years 3 to 5)

Moves of the people who were forced to evacuate and live in provisional houses for a prolonged time in a large-scale disaster.

Source) "Recovery and Reconstruction Following the Great Hanshin-Awaji Earthquake" Hyogo pref., December 2010

Estimation of Damage Costs (3)

On-site Damage Costs

- Additional costs for decommissioning Units 1 to 4 of the Fukushima Dai-ichi NPS in the TEPCO Management and Finance Investigation Committee Report: 964.3 billion yen
- Decommissioning of reactors contaminated by the nuclear accident is assumed to be independent from the output capacity.
- Considering a lower level of contamination at Unit 4 compared with Units 1 to 3, the additional decommissioning costs may be small.
- The estimation of additional decommissioning costs for three reactors is conservative.
- Additional decommissioning costs for the model plant: **321.4 billion yen**

Estimation of Damage Costs (4)

Decontamination Costs

- TEPCO Management and Finance Investigation Committee Report
  - While restoration using a low-cost decontamination method is possible, the damage costs may be ballooning if the decontamination costs exceeds the value of the property. It will take some time to make the estimation realistic.
- Interim guidelines to determine the scope of nuclear damages caused by the accident at the Fukushima Dai-ichi and Dai-ni NPSs of TEPCO (August 5, 2011)
  - The costs exceeding the value of relevant properties are excluded from the scope of compensation for damage in principle (except for particular cultural assets).

In this estimation, decontamination actions within the scope of the value of property are assumed to be included in the damage cost. As for the decontamination which is likely to exceed the aforementioned scope (mainly woods of low air dose rates), or the construction of interim storage facilities, etc., data should be kept up to date based on the determination and future actions of the Government.

Estimation of Damage Costs (5)

Conversion of Compensation for Damages (1)

- The damage costs for the model plant are calculated in reference to the following and according to the estimates of damages for the accident at the Fukushima plant:
  - Ratio of Fukushima Prefecture ("Fukushima") to the mean of other prefectures where nuclear power plants are located ("Mean").
    - Ratio of GDP/person (Mean/Fukushima): **0.97**
      - Business loss (1st year, 2nd year and thereafter)
      - Indirect damage resulting from business loss (1st year, 2nd year and thereafter)
    - Ratio of income/person employed (Mean/Fukushima): **1.03**
      - Damage due to joblessness (1st year, 2nd year and thereafter)
    - Ratio of consumer price regional difference index (National/Tohoku): **1.02**
      - Temporary visit cost (1st year, 2nd year and thereafter)
      - Homecoming cost (1st year, 2nd year and thereafter)

References: Statistics and Investigation Results, Cabinet Office, Calculation of Prefectural Economy: http://www.esri.cao.go.jp/
Outline of average consumer price regional difference index in 2011, MIC: http://www.stat.go.jp/

Estimation of Damage Costs (6)

Conversion of Compensation for Damages (2)

Conversion of compensation for damages

CF: Conversion factor

Item	Damage (100 million yen)[1]	CF	After conversion (100 million yen)	Remarks
Onetime damage	26,184		26,184	
Damage resulting in evacuation or other government orders				
Inspection (material)	67	1.00	67	
Loss or decrease, etc. of property value	5,707	1.00	5,707	
So-called harmful rumor	13,040	1.00	13,040	
So-called indirect damage	7,370	1.00	7,370	
1st year	10,246		10,208	
Damage resulting in evacuation or other government orders				
Inspection (human)	315	1.00	315	
Temporary visit	79	1.02	81	Ratio of consumer price regional difference index
Homecoming	1,139	1.02	1,162	Ratio of consumer price regional difference index
Mental distress	1,276	1.00	1,276	
Business loss	1,915	0.97	1,858	Ratio of GDP/person
Damage due to joblessness	2,649	1.03	2,728	Ratio of income/person employed
So-called indirect damage	2,874	0.97	2,788	Ratio of GDP/person
2nd year and thereafter (yearly)	8,972		8,918	
Inspection (human)	293	1.00	293	
Temporary visit	105	1.02	107	Ratio of consumer price regional difference index
Homecoming	447	1.02	456	Ratio of consumer price regional difference index
Mental distress	688	1.00	688	
Business loss	1,915	0.97	1,858	Ratio of GDP/person
Damage due to joblessness	2,649	1.03	2,728	Ratio of income/person employed
So-called indirect damage	2,874	0.97	2,788	Ratio of GDP/person

[1] TEPCO Management and Finance Investigation Committee Report, Oct. 3, 2011

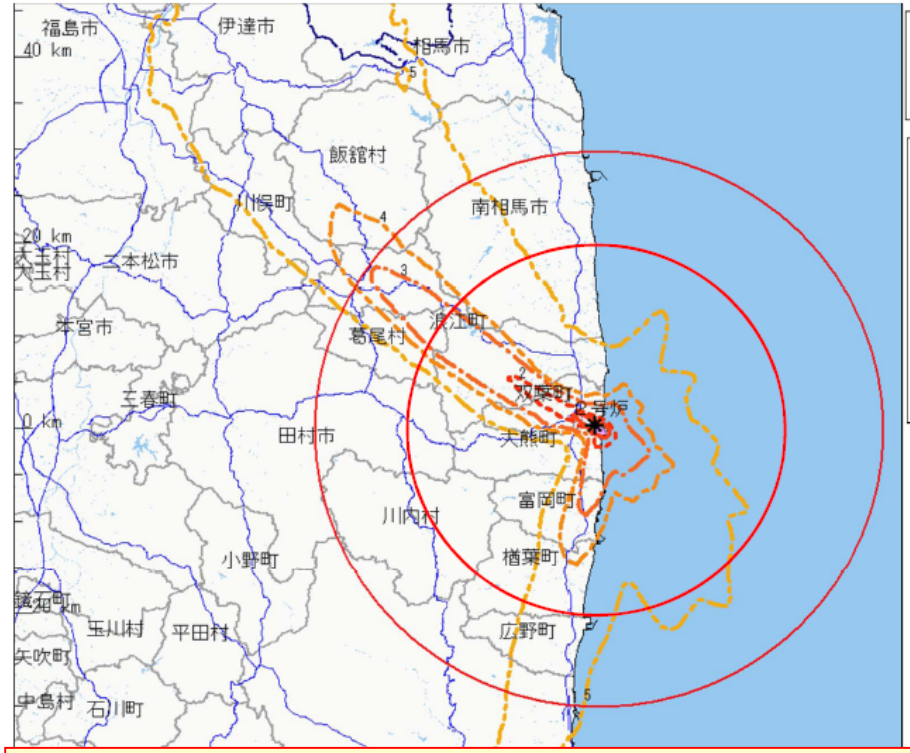
Estimation of Damage Costs (7)

Correction of Compensation for Damage with Reactor Output

- Amount of radioactive materials released in the air
  - Radioactive materials are produced in the reactor in proportion to the reactor output.
  - If the ratio of radioactive materials released in the air in the accident is constant, the amount of radioactive materials released into the air is proportional to the amount of radioactive materials present in the core, namely, the reactor output.
- Effects of Accident on Economy
  - At the beginning of the accident, the evacuation areas were determined from the physical distance from the power plant regardless of the amount of radiation released. After that, the evacuation areas were determined according to the distribution of radioactive materials.
    - ✓ Onetime damage (harmful rumor, inspection cost, etc.) is assumed not to be proportional to the amount of released radiation.
    - ✓ In contract, yearly damage (the 1st, 2nd and subsequent years) is assumed to be proportional to the amount of released radiation (area of diffusion of radioactive materials).

Estimation of Damage Costs (8)

Released Amount of Radiation and Area of diffusion area



I Integrated dose of external exposure (estimates based on SPEEDI from March 12, 6:00 to April 6, 0:00)

Effective dose of external exposure
Date: Integrated dose from 03/12/2011, 06:00 to 04/06/2011, 00:00
Area: 92 km x 92 km
Nuclide: I-131,I-132,Cs-137,Cs-134
Age: Grownup

[explanatory note]
Effective dose, etc. value line (mSv)
1= 100
2= 50
3= 10
4= 5
5= 1
← Indoor evacuation level

Created by the Cabinet Office based on the data provided by JAEA.

Dose level	Contamination area	Ratio to the area of 10mSv
1mSv	2246km^2	10.3
5mSv	468km^2	2.14
10mSv	218km^2	1.0

In the accident at the Fukushima plant, a constant relation is also true between the released amount of radiation (proportional to the effective dose) and the area of diffusion of radiation.

Example: If the amount of released radiation is decoupled, the effective dose is also decoupled, namely, the area of dose level 1mSv becomes 10mSv area. In this regard, the contamination area is 10.3 times as large as the previous 10mSv area.

Estimation of Damage Costs (9)

Compensation for Damage Corrected with Reactor Output - Model Plant

Damages (corrected with regional characteristics and proportion of population)[1] 6,044.8 billion yen

- Onetime damage 2,697 billion yen
- Yearly damage 3,347.8 billion yen
  - (1st year: 1,020.8 billion yen, 2nd year: 891.8 billion yen, 3rd - 5th year: 1,337.7 billion yen)

Additional decommissioning costs[1] 321.4 billion yen

Part of damages is corrected with reactor output.

2,697 billion yen + 3,347.8 billion yen x 0.59 + 321.4 billion yen

= 4,993.6 billion yen

[1] Estimated by the Cabinet Office based on the TEPCO Management and Finance Investigation Committee Report (Oct. 3 2011)

Concepts of Accident Frequency (1)

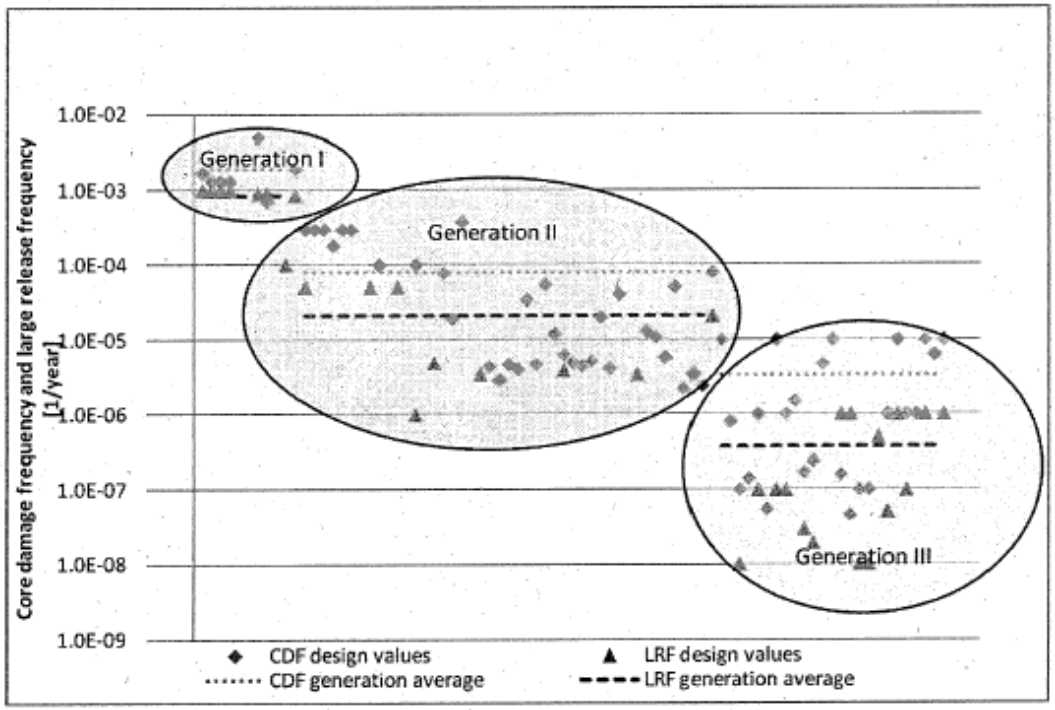
Accident Frequency of Model Plant

The frequency of accident at the model plant constructed in the future is estimated in the following time frame based on the latest knowledge:

Frequency	Description
1.0×10^{-5} /reactor year	Frequency is based on the IAEA safety standard for early large release frequency of existing reactors. Taking in account the lessons learned from the accident at the Fukushima plant, the frequency of severe accident in the reactors built in the future is assumed to meet at least the IAEA safety standard.
2.1×10^{-4} / reactor year	Frequency is calculated based on the operation years of commercial reactors in the world and three accidents at TMI-2, Chernobyl-4 and Fukushima Dai-ichi NPS by regarding the incidents in units 1 to 3 as a single event because damage to all three units was caused by the great tsunami following the Great East Japan Earthquake. It is synonymous with a continuous use of old type reactors as those at the Fukushima plant without any safety measures in reference to the Fukushima accident.
3.5×10^{-4} / reactor year	Frequency is calculated based on the operation years of commercial reactors in the world and five accidents at TMI-2, Chernobyl-4 and Fukushima Dai-ichi NPS by regarding the incidents in units 1 to 3 as three separate events. It is synonymous with a continuous use of old type reactors as those at the Fukushima plant without any safety measures in reference to the Fukushima accident.
6.7×10^{-4} / reactor year	Frequency is calculated based on the operation years of commercial reactors in Japan and one event by regarding the incidents in units 1 to 3 at the Fukushima Dai-ichi NPS as one event because damage to all three units was caused by the great tsunami following the Great East Japan Earthquake. It is synonymous with a continuous use of old type reactors as those at the Fukushima plant without any safety measures in reference to the Fukushima accident.
2.0×10^{-3} / reactor year	Frequency is calculated based on the operation years of commercial reactors in Japan and by regarding the incidents in units 1 to 3 at the Fukushima Dai-ichi NPS as three separate events. It is synonymous with a continuous use of old type reactors as those at the Fukushima plant without any safety measures in reference to the Fukushima accident.

Difference in Accident Frequency in Different Reactor Generations

- The accident frequency (core damage, early large release) is deemed to have lowered as the technology changed from the 1st to 3rd generation reactors.



Generation I reactor: Early prototype reactors developed in the 1950s and 60s.

Generation II reactor: Commercial reactors introduced in the 1970s to 90s.

Generation III reactor: Evolutionary reactors introduced in the 1990s.

Source: “Comparing Nuclear Accident Risks with Those from Other Energy Sources” 2010, OECD/NEA

Accident Frequency of Model Plant

Measures and actions to raise nuclear safety to the world's highest standard

- Measures in reference to the accident in the Fukushima plant have been implemented in domestic nuclear power plants.
  - Improvements of power supply (e.g., power supply vehicles, etc.)
  - Improvements of water injection
  - Protection from tsunami (tide walls, watertight installation), etc.
- Lessons learned from the Fukushima accident will be reflected in the design of nuclear plants in the future.

At a minimum, the frequency of severe accident meets IAEA safety standards.

Estimation of Accident Risk Cost based on Accident Frequency

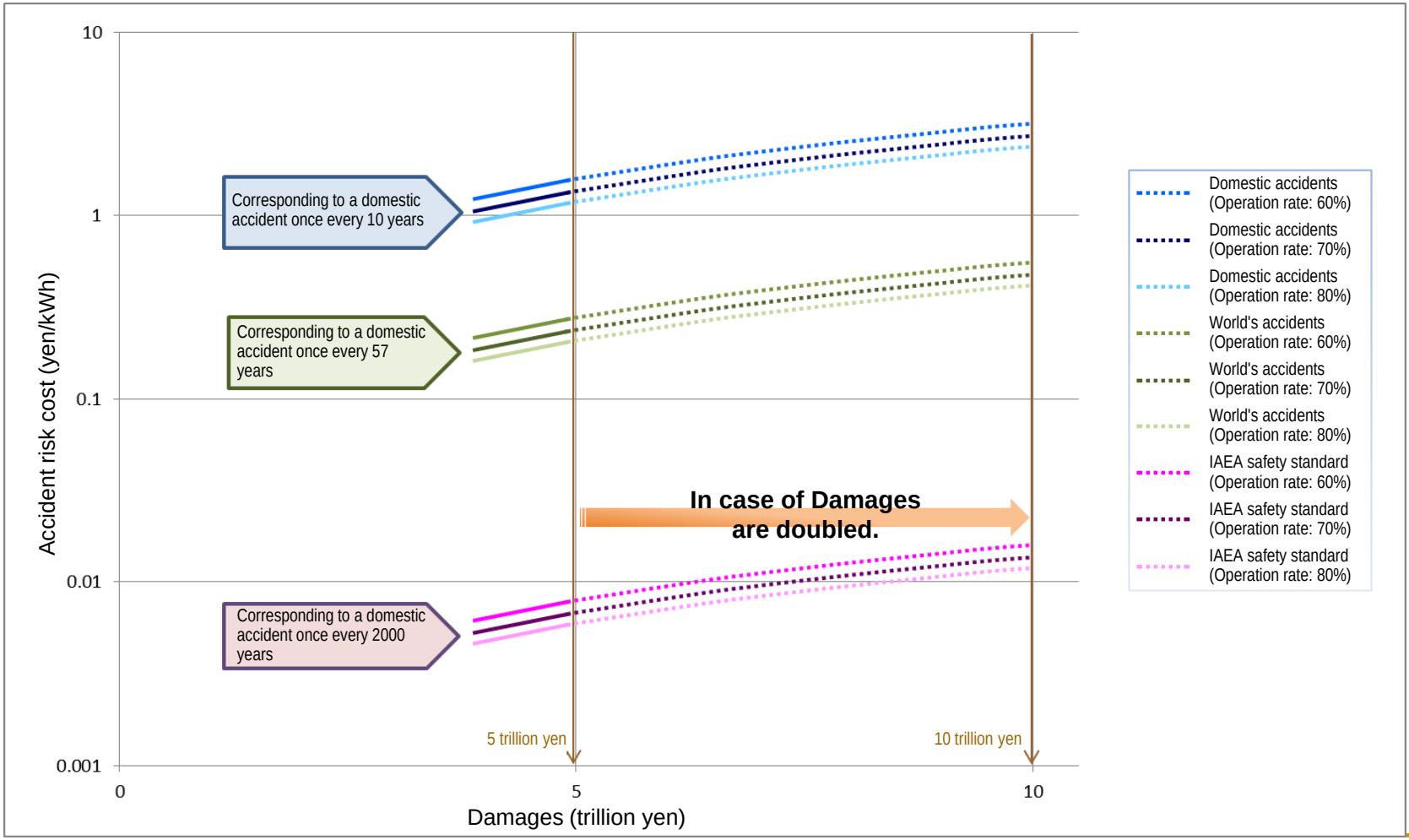
Frequency (/reactor year)	Accident risk cost per model plant operation rate (yen/kWh)			Cost added in case of an increase of damages by 1 trillion yen (yen/kWh)		
	Operation rate 60%	Operation rate 70%	Operation rate 80%	Operation rate 60%	Operation rate 70%	Operation rate 80%
1.0×10^{-5} (IAEA safety standard for early large release from existing reactor)	0.008	0.007	0.006	0.002	0.001	0.001
3.5×10^{-4} (Severe accident frequency of world's commercial reactors, equivalent to once every 57 years[1])	0.28	0.24	0.21	0.06	0.05	0.04
2.0×10^{-3} (Severe accident frequency of domestic commercial reactors, equivalent to once every 10 years[1])	1.6	1.4	1.2	0.32	0.27	0.24

[1] Accident frequency for 50 reactors in operation

Accident Risk Cost Based on Accident Frequency (2)

Sensitivity Analysis of Accident Risk Cost

- Changes in accident risk cost when damages are doubled



Estimation of Accident Risk Cost based on the Aid System in the U.S.

- The estimation of damages including decommissioning costs for the model plant by this Technical Subcommittee: 4, 993.6 billion yen
- Based on the estimation, 5,000 billion yen is estimated on the assumption of the availability of a mutual insurance scheme among the operators in reference to the Price-Anderson Act, or twice the damages, 10,000 billion yen as a result of sensitivity analysis.

Damages	Payment term	Total nuclear generation[1]	Accident risk cost
5 trillion yen	40 years	280 billion kWh	0.45 yen/kWh
10 trillion yen			0.89 yen/kWh

[1] Data of the Results and Energy Environment Committee, 2010

  - If the nuclear operators in the world share the payment, the damages will be further decreased.

Accident Risk Cost of Reprocessing Plants

- Severe accidents (serious damage to reactors) are not assumed in reprocessing.
  - Unlike nuclear power plants, the reprocessing plant does not have reactors that have a latent risk such as meltdown due to a high output of fission chain reaction, or water and zircaloy reactions causing a large amount of hydrogen to be generated for a short period of time.
  - The decay heat of spent fuel stored at the reprocessing plant is not high, and there is no high temperature or high pressure system in nuclear power plants that potentially blows down the coolant.
  - According to a study by the Science and Technology Agency, the accident at Tomsk was caused by a high-temperature contact of concentrated nitric acid with a large amount of organic matter (including highly reactive aromatic hydrocarbon), while the same event is not likely to occur at the Rokkasho plant where stable aliphatic saturated hydrocarbon with less impurity is used, and organic solvents are separated and cleaned prior to the heating process, with an interlock stop heating steam at high temperatures to prevent further pressurization.
- However, to evaluate the unexpected risks exceeding the design basis accidents, the same accident frequency and damage costs as those used at nuclear power plants are hypothesized for estimating the effects on generation costs.
  - The IAEA safety standard is used for the frequency as in nuclear power plants: 1.0×10^{-5}/year
  - Damage costs is set in reference to the sensitivity analysis of nuclear accident risk: 10 trillion yen
  - Electric energy equivalent to 800 ton/year is used for conversion to generation coat: Approx. 288 billion kWh/year

    10 trillion yen $\times 1.0 \times 10^{-5} \div$ 288 billion kWh $=$ 0.0003 yen/kWh
- Spent fuel transported from dozens of reactors is handled at a large-scale commercial reprocessing plant, and the conversion of accident risk to generation cost may result in **a value with one digit smaller** than the value for the nuclear reactor, not a significant value for considering the future risks of nuclear generation.
  - To participate in the mutual aid scheme for utilities, an idea to handle it as one unit of reactor can be considered.

Source: Japan Nuclear Fuel Ltd. (Data No. 2 at the 4th meeting)

Reference

Concepts of Liability Insurance

- The rate of liability insurance is generally set in the following basis:

$$F = \frac{C \times P + M}{N}$$

C: Damage costs
P: Frequency
M: Interest and other Charges by insurance companies ,agencies, etc.
N: No. of insurers

  - If upper limits are not set on *C*, the rate cannot be calculated in principle. Like automotive accidents, upper limits may be set if statistically significant samples are provided, and upper limits can be predicted, and insurance designed with upper limits for payment is also available.)
  - If *C* is enormous, reassurance is made to avoid risks, but in some cases, if even reassurance cannot entirely prevent risks, the government will then guarantee the insurance (earthquake insurance, system of liability for shipping or oil pollution damage, etc.)
  - If the law of great numbers is not applicable because *N* is not large enough, the insurance rate is basically difficult to set.

Estimates in TMI and Chernobyl Accidents

Date	Location	Radiation released in the air (Bq)	Dead (workers)	Estimated latent dead	Injured	Contaminated area (km^2)	No. of evacuees	Amount of damage (10^6 $)
April 26, 1986	Chernobyl	1.2×10^{19} - 1.5×10^{19}	31	Workers: 2,200 - 2,700 General public: 7,000 - 30,000	370	- 154,620 (>37kBq/m^2 Cs-137) [1] - 7,200 (555-1,480kBq/m^2) - 3,100 (1,480 kBq/m^2or more) [3]	115,000 - 135,000	20×10^3～320×10^3 (1.6 to 25.6 trillion yen)
March 28, 1979	Three Mile Island	3.7×10^{17}	0	General public: 1	0	0	144,000	～5×10^3 (400 billion yen)

Created by the Cabinet Office based on “Severe Accidents in the Energy Sector” by Herschberg et al.,Paul Sherrer Institute (1998), and JAEA-Review 2008-029 (2008) by Yoshio Matsuki, et al. (1$=80 yen)

March 11, 2011	Fukushima Dai-ichi	I-131: 1 - 2×10^{17}Bq Cs-137: 1 - 2×10^{16}Bq [2]	0	—	15	- 700 (555-1,480kBq/m^2) - 600 (1,480 kBq/m^2or more) [2]	146,500 people, + 245 households [1]	—

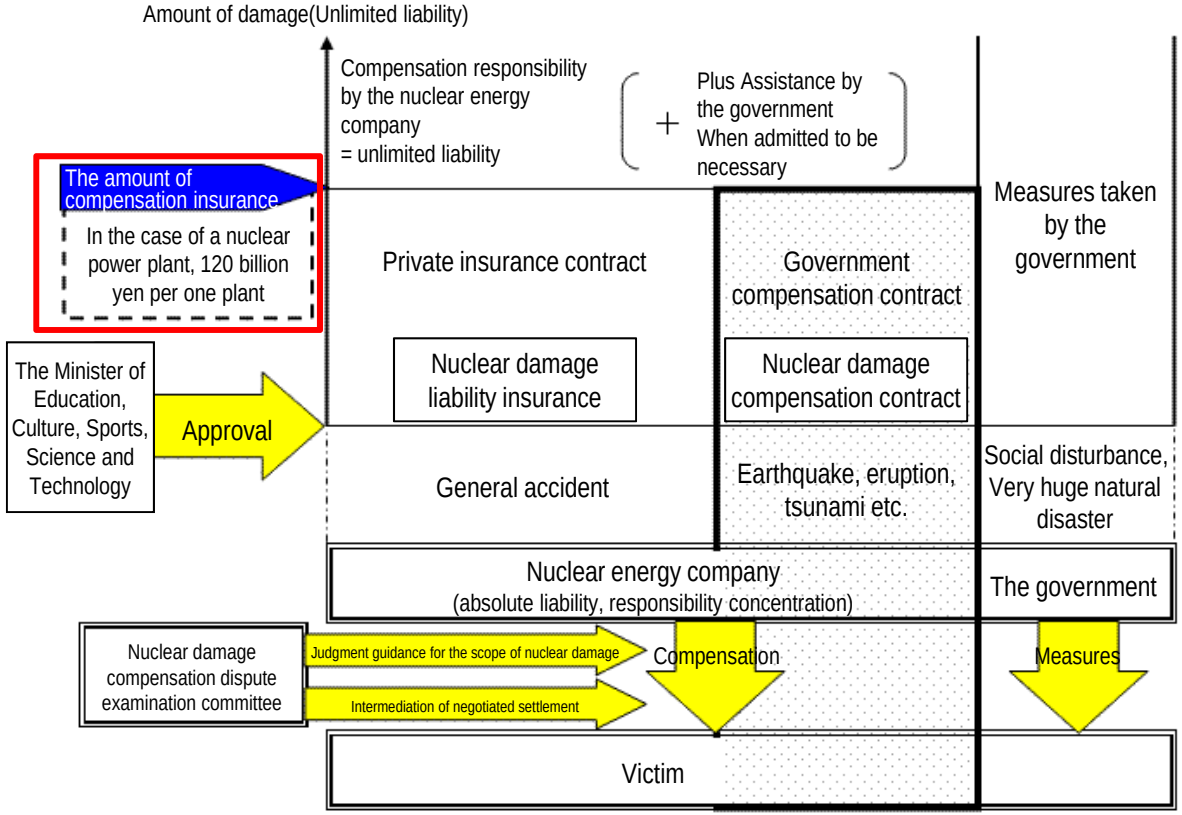
[1] Nuclear Emergency Response Headquarter, "Additional report by the government of Japan to IAEA" Sep. 2011
[2]"Soil Contamination and Measures" K. Kawada, Data No. 2 for the 16th Atomic Energy Committee, May 2011

Estimated Damages in Chernobyl Accident by the Presidential Council in the U.S.

Item	In the case when the same work is conducted by U.S.A. (1 billion dollars)
Alternative power supply including alternative power plant	4
Sarcophagus construction	4
Equipment	0.05
Collection work laborer	3
Damages by house use restriction	2.25
Damages by farmland use restriction	4
Evacuees	3
Total	20.3

Prepared by Cabinet Office based on Wilson, R., “The Cost of Catastrophic Nuclear Accidents: The Experience at Chernobyl,” paper written for the President’s Commission on Catastrophic Nuclear Accidents,” Presented in Washington, DC (1989)a and Yoshio Matsuki et al., JAEA-Review 2008-029(2008)

Outline of Nuclear Energy Liability Insurance

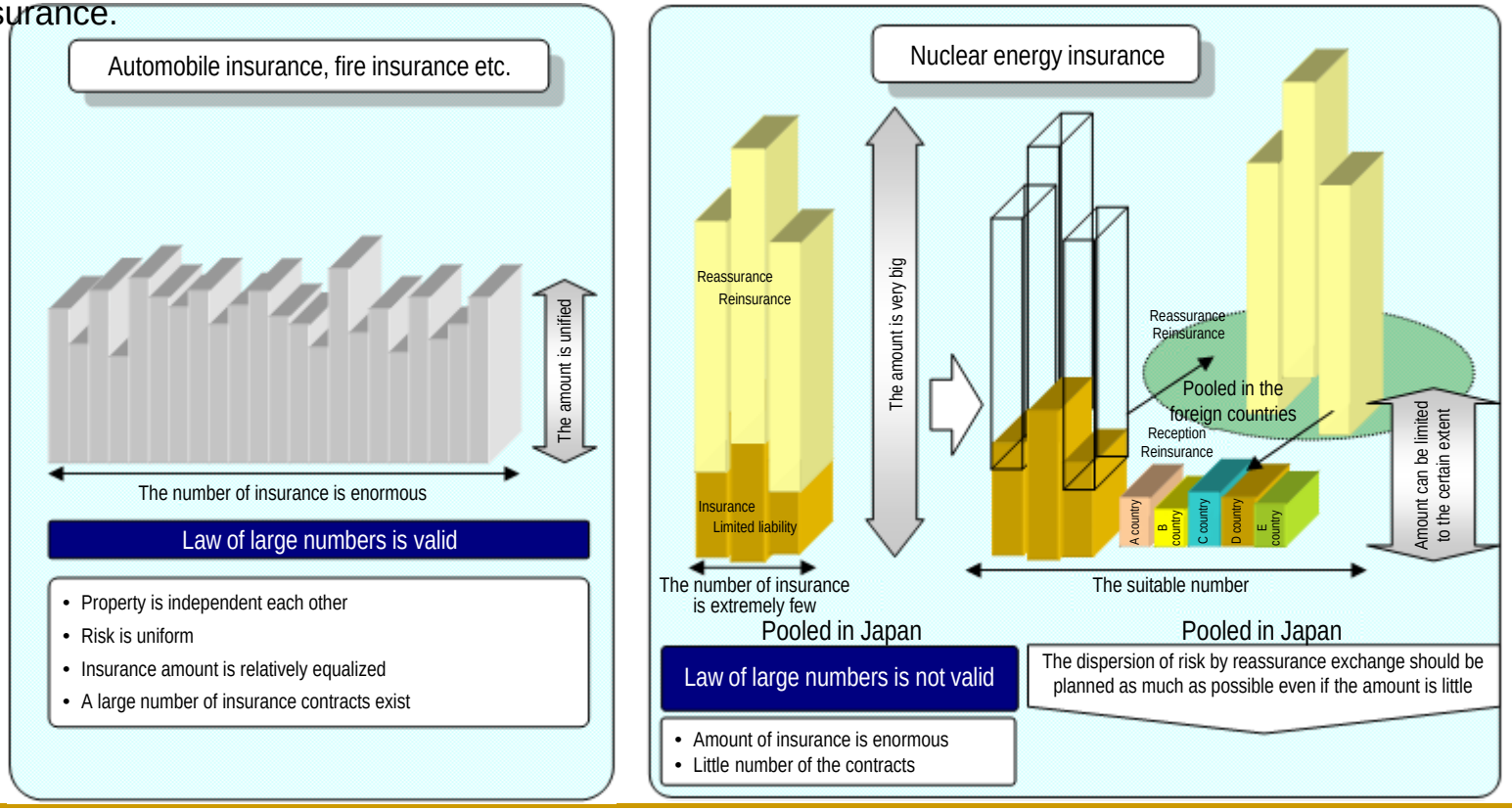


- The nuclear damage compensation system is a system of compensation for damages when nuclear damage is caused by the operation of the nuclear reactor. etc. It is intended to protect the people who suffer from nuclear damage and to contribute to healthy development of the nuclear energy industry.
- The amount of compensation of the government compensation contract is 36 million yen / year for one plant, in the case of a nuclear power plant.
- In the case of this accident, damage occurred which greatly exceeds the compensation amount (120 billion yen per one plant)

Source: Prepared by Cabinet Office based on the website of Ministry of the Education, Culture, Sports, Science and Technology, among others.

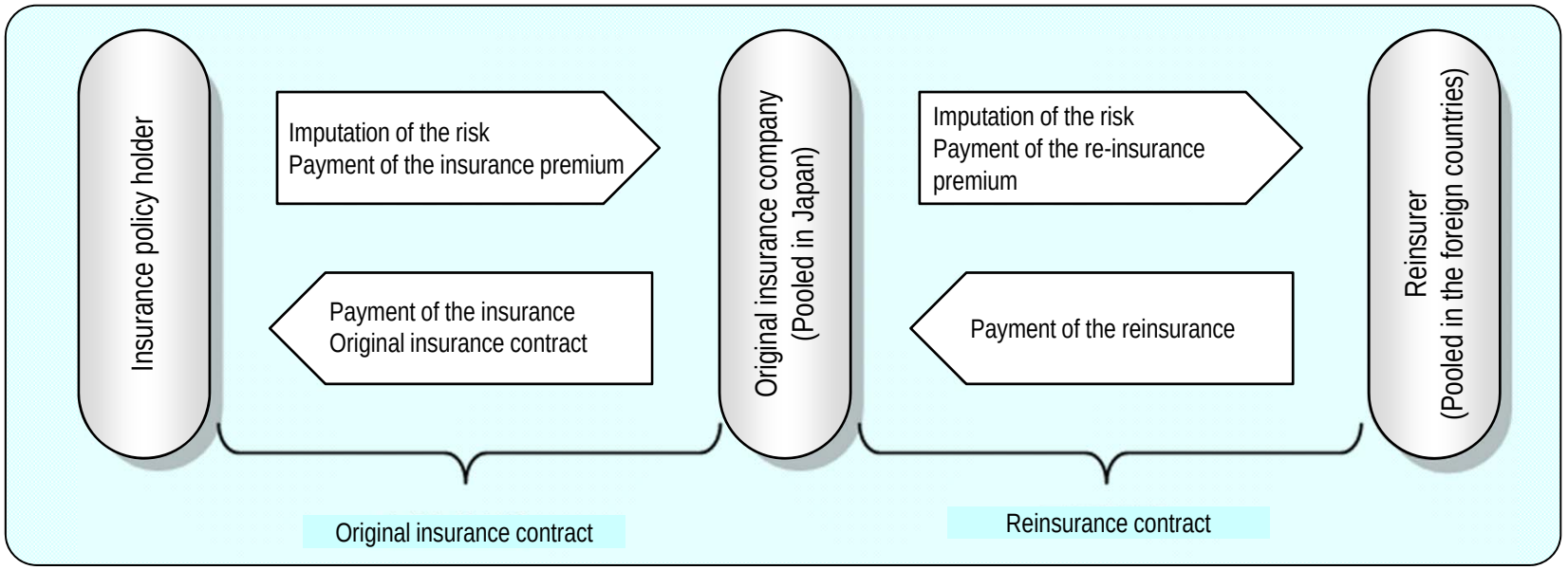
Japan Atomic Energy Insurance Pool (1)

- Differences between general insurance and nuclear energy insurance (compensation / property)
  - The target facilities of the nuclear energy insurance are limitative, and there is no specific example for colossal damage; the “law of large numbers,“ therefore does not function.
  - Examples of accidents in nuclear installations are limited. Therefore insurance rate is calculated considering international levels, referring to the accident example of foreign countries, including property insurance.



Japan Atomic Energy Insurance Pool (2)

- Capacity of nuclear insurance
  - The undertaking amount is too big for Japan's domestic nonlife insurance companies to accept. The amount greatly exceeds their capacity .
  - It is necessary to supplement the deficit by utilizing the capacity of overseas reinsurers, but the capacity has a definite limit even if all the capacity of the worldused.



Outline of World's Nuclear Compensation Scheme (1)

* Exchange rates on Nov. 1, 2011

	Japan	ROK	U.S.	Germany
Operator's liability (liability)	Unlimited	Limited （300 million SDR） （Approx. 39 billion yen)	Limited (Same amount with legal damages)	Unlimited
Legal damages	120 billion yen	50 billion won （Approx. 3.5 billion yen）	Approx. $12.594 billion （Approx. 984.4 billion yen） * Liability insurance（$375 million) ＋Operator's mutual aid scheme (Approx. $12.219 billion）	2.5 billion euro （270.1 billion yen） * Liability insurance（approx. 256 million euro) + Fund assurance by the parent company (utility) of the operating company (approx. 2.24 billion euro)
Government max. liability	If the payment exceeds the legal damages, aid is given (as needed)	If the payment exceeds the legal damages, aid is given (as needed)	If the payment exceeds the legal damages, the President submits a compensation plan to the Congress for the Congress to take necessary action.	If the above measures fail to work, the government compensates up to 2.5 billion euro.
Immunity	・Social convulsion ・Unusual, gigantic natural disasters	・International armed conflict, acts of hostility, civil war, rioting	・Act of war	・None
International treaty	Non-member	Non-member	CSC（not effective)	Paris Convention Brussels Sup. Treat Joint Protocol

Source:"1st Report of Investigative Commission on Nuclear Energy Liability Insurance" Dec. 2008, MECSST
"Let's Know Nuclear Damage Liability System 2010" Oct. 2010, JAEIA

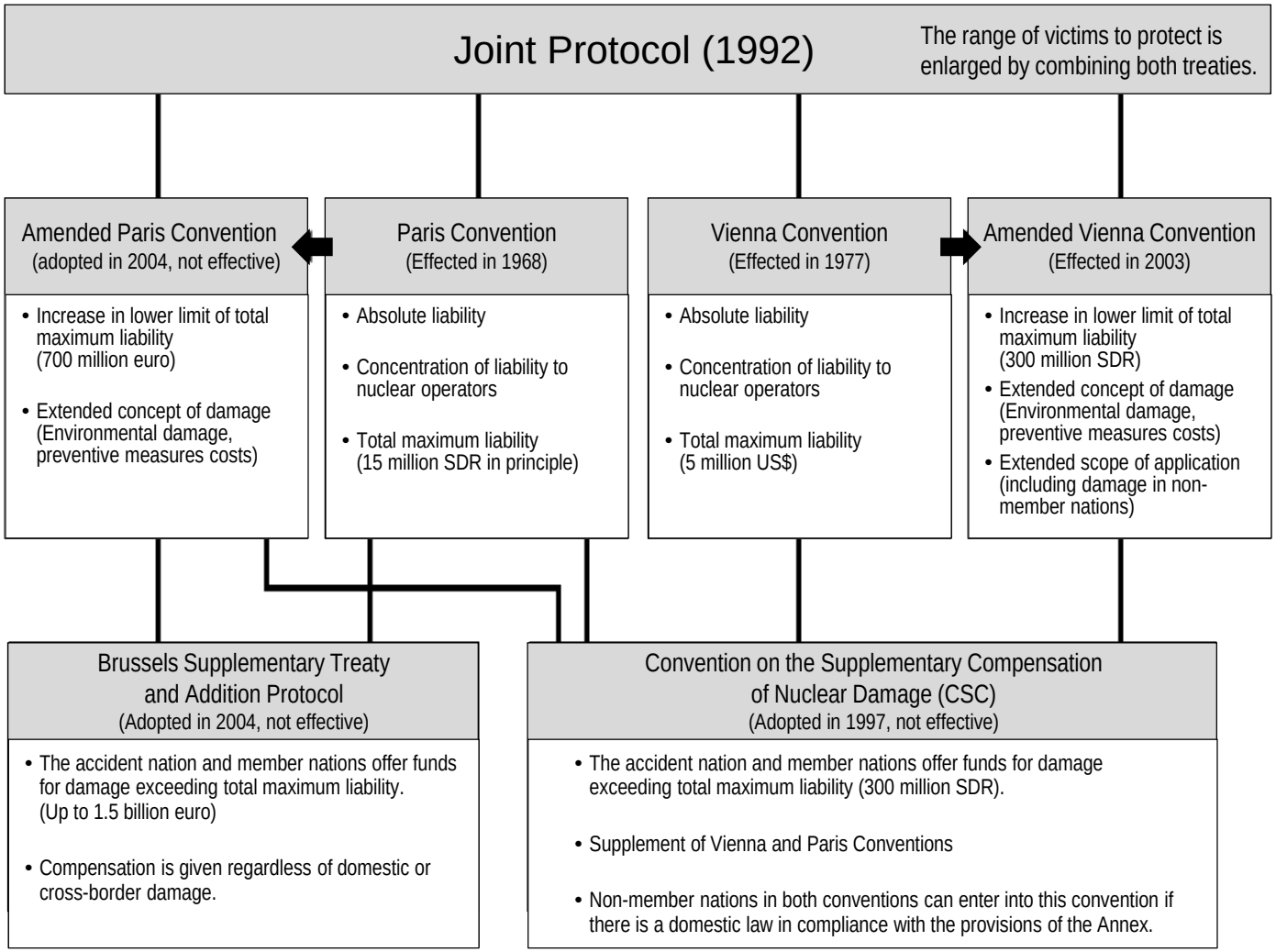
Outline of World's Nuclear Compensation Scheme (2)

* Exchange rates on Nov. 1, 2011

	U.K	France	Switzerland
Operator's liability (liability)	Limited	Limited	Unlimited
Legal damages	140 million SP (Approx. 17.6 billion yen)	600 million F (91,469,410.34 euro) (Approx. 9.8 million yen)	1.1 billion SF (Approx. 97.8 billion yen)
Government compensation limit	If payment exceeds the legal damages, the amount up to 300 million SDR (approx .37.1 billion yen) including overseas contribution is guaranteed based on the Brussels Treaty.	If payment exceeds the legal damages, amount up to 300 million SDR (approx. 37.1 billion yen) including overseas contribution is guaranteed based on the Brussels Treaty.	If payment exceeds the legal damages, or the operator's provision does not work, amount up to 1.1 billion SF is guaranteed.
Immunity	・Act of hostility in the process of armed conflict.	・Act of combat, act of hostility, civil war, riot ・Unusual, gigantic natural disasters	・Deliberation or gross negligence of victim
International treaty	Paris Convention Brussels Supplementary Treaty	Paris Convention Brussels Supplementary Treaty	Paris Convention Amended Paris Convention (not effective) Amended Brussels Supplementary Treaty (not effective)

Source: "1st Report of Investigative Commission on Nuclear Energy Liability Insurance" Dec. 2008, MECSST
"Let's Know Nuclear Damage Liability System 2010" Oct. 2010, JAEIA

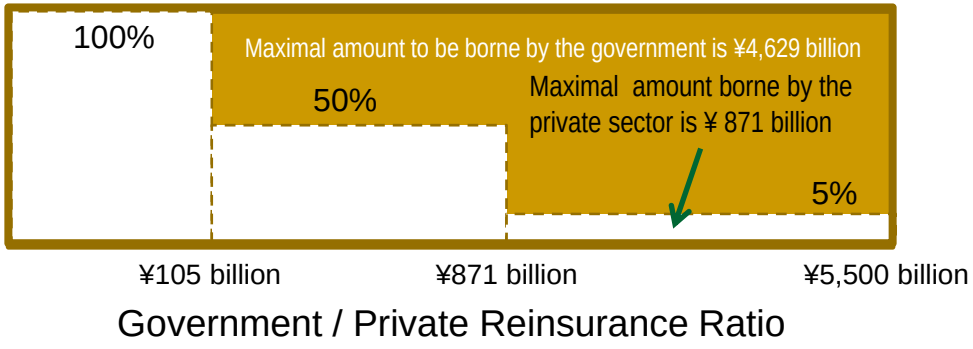
Outline of International Treaties on Compensation for Nuclear Damage



Source: "Let's Known Nuclear Damage Liability System 2010" Oct. 2010, JAEIA

Outline of Earthquake Insurance

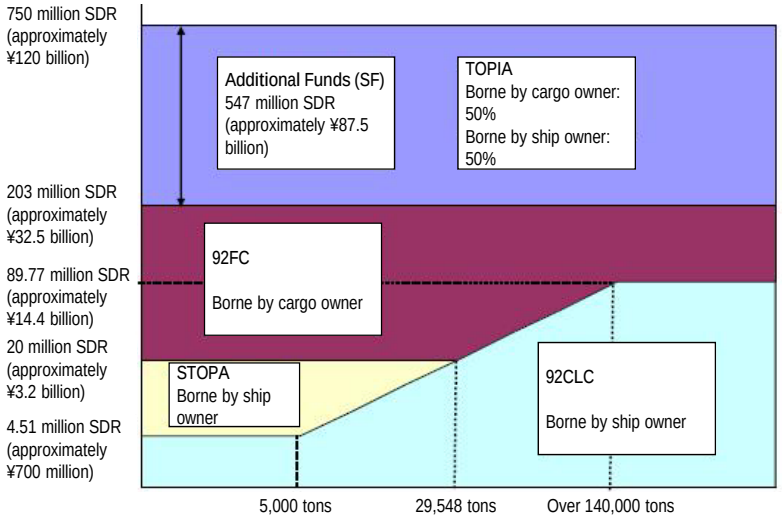
- Compensating damage of fire, destruction, burial on land and washing away of property caused by earthquake, eruptions, and tsunami
- The government and private casualty insurance company jointly operate the insurance industry, based on laws. The government will pay a part of insurance when the payment exceeds a certain amount
- The objectives are limited to dwelling houses and movable assets for living
- The system can be effected by being backed by the Government for the insurance company due to the following reasons :
  - Damage by disaster may largely exceed the guarantee capacity of the insurance company
  - Difficult to be subject to the law of large numbers due in difficulty to estimating the time the disaster occurs or frequency of the occurrence
- Because a large amount of damage derived from an earthquake or other natural disasters is impossible to estimate, the amount that the insurance company will pay for one earthquake damage is decided to limit up to ¥5,500 billion maximum
- The insurance company and government are reinsured with the excess of loss reinsurance system (At Government is responsible for is ¥4,629 billion)



Government / Private Reinsurance Ratio

Outline of Act on Liability for Ship Oil Pollution Damage

- In March 1967, Tory Canyon, the largest tanker at the time grounded on an offshore reef southwest of England, spilled approximately 8,000 tons of crude oil into the sea. This caused tremendous damage to the waters between Britain and France. The accident made the world aware of the importance of responsibility and compensation issues caused by spilled oil from tankers.
- In Japan, after ratification of the treaty, Oil Pollution Damage Compensation Indemnity Law (presently Ships and Vessels Oil Pollution Damage Compensation Indemnity Law) was enacted in 1975 and damage caused by oil spill from tankers has been safeguarded by the Law.
- Since then, some 20 cases of accidents have occurred; the current compensation amounts have been set up after several revisions of the treaty
- Outline of Ships and Vessels Oil Pollution Damage Compensation System
  - Owners of ships and vessels principally bear no-fault liability. Compensation liability can be limited to a certain amount depending on tonnage of the ships and vessels. Compensation policy covering liability amount must be compulsory (CLC Treaty).
  - Cargo owners are also responsible for relief of the victims, compensation system for cases that exceed the limit of CLC treaty has been also established (FC Treaty). Additional funds were established in 2003.
  - After establishment of additional funds, STOPIA and TOPIA have agreed to adjust the balances of amounts borne by cargo owners and ship owners
  - Scope of compensation: mainly removal of oil, clearing costs (labor costs, equipment and material costs), survey and research costs (measures to oil spill, damage survey), damage to fisheries, damage to hotel accommodations, adviser and lawyer fees to submit invoices and others



Sources: Ministry of Land, Infrastructure Transport and Tourism HP, JX Nikko, Nisseki Energy HP,