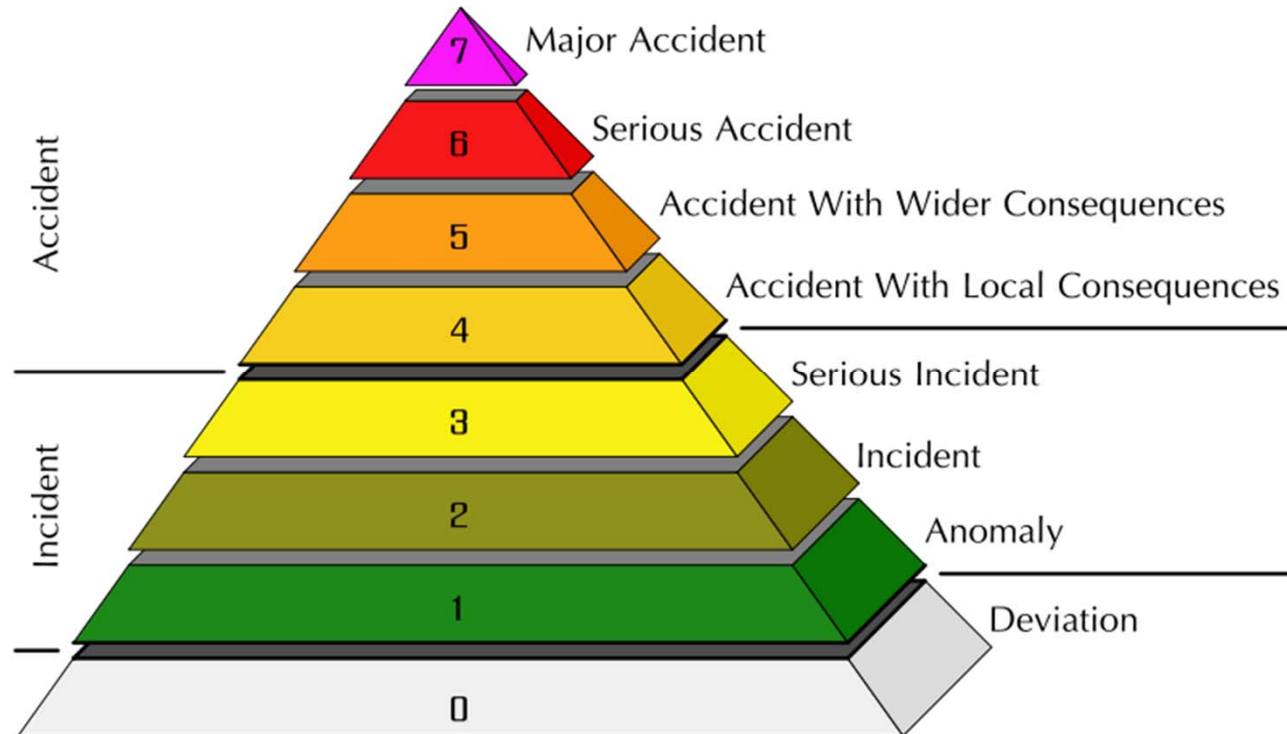


Nuclear Energy from viewpoint of Fukushima

S.Tsunoyama University of Aizu, Fukushima
October 2011



INES



With such a release, stochastic health effects over a wide area, perhaps involving more than one country, are expected, and there is a possibility of deterministic health effects.

These criteria relate to accidents where early estimates of the size of release can only be approximate. For this reason, it is inappropriate to use precise numerical values in the definitions of the levels. However, in order to help ensure consistent interpretation of these criteria internationally, it is suggested that the boundaries between the levels are about 500, 5000 and 50 000 TBq.

Level 7	Major Accident	5200PBq	Chernobyl disaster
		370PBq	Fukushima
Level 6	Serious Accident	74 ~ 185PBq	Mayak (plutonium production reactors)
Level 5	Accident with wider consequences		TMI etc

Surface deposition of Cesium by Chernobyl disaster

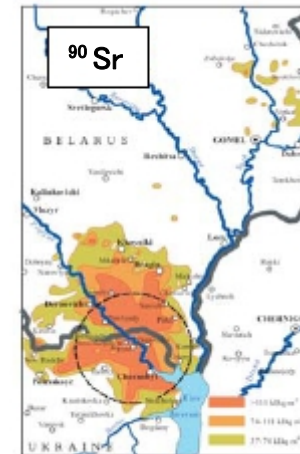
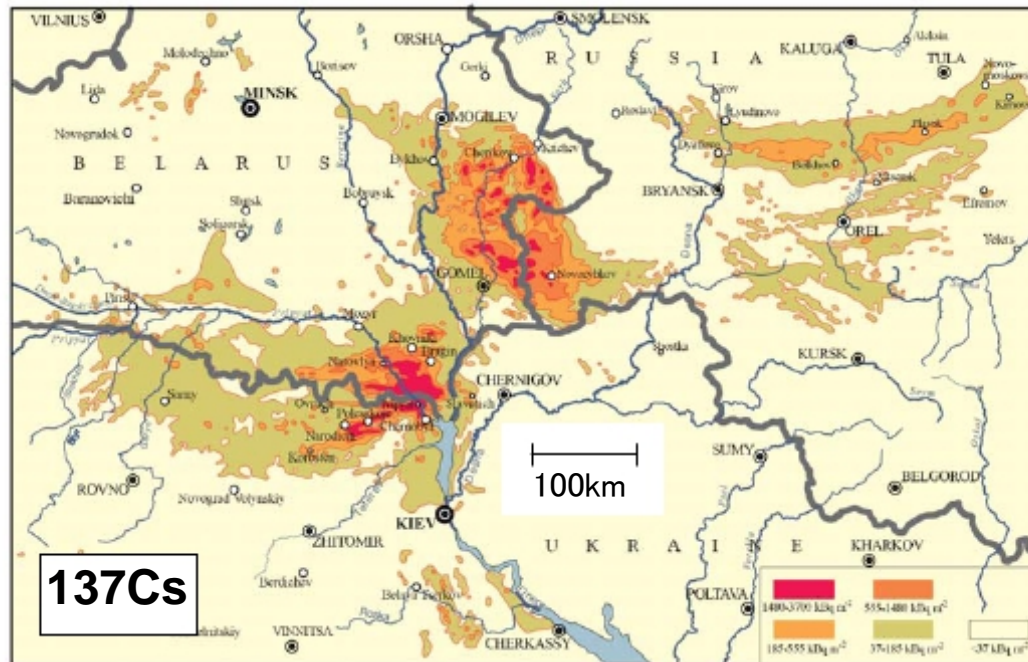


FIG. 3.8 Surface ground deposition of ⁹⁰Sr [54].



FIG. 3.9 Areas (orange) where the surface ground deposition of ^{239,240}Pu exceeds 3.7 kBq m⁻² [54].



Fukushima

Same Scale

Atomic Energy Society of Japan

Chernobyl Reactor



The reactor itself was covered with bags of sand, lead and boric acid dropped from helicopters during the week that followed the accident.

Concrete sarcophagus had been constructed to seal off the reactor and its contents.

TMI-2

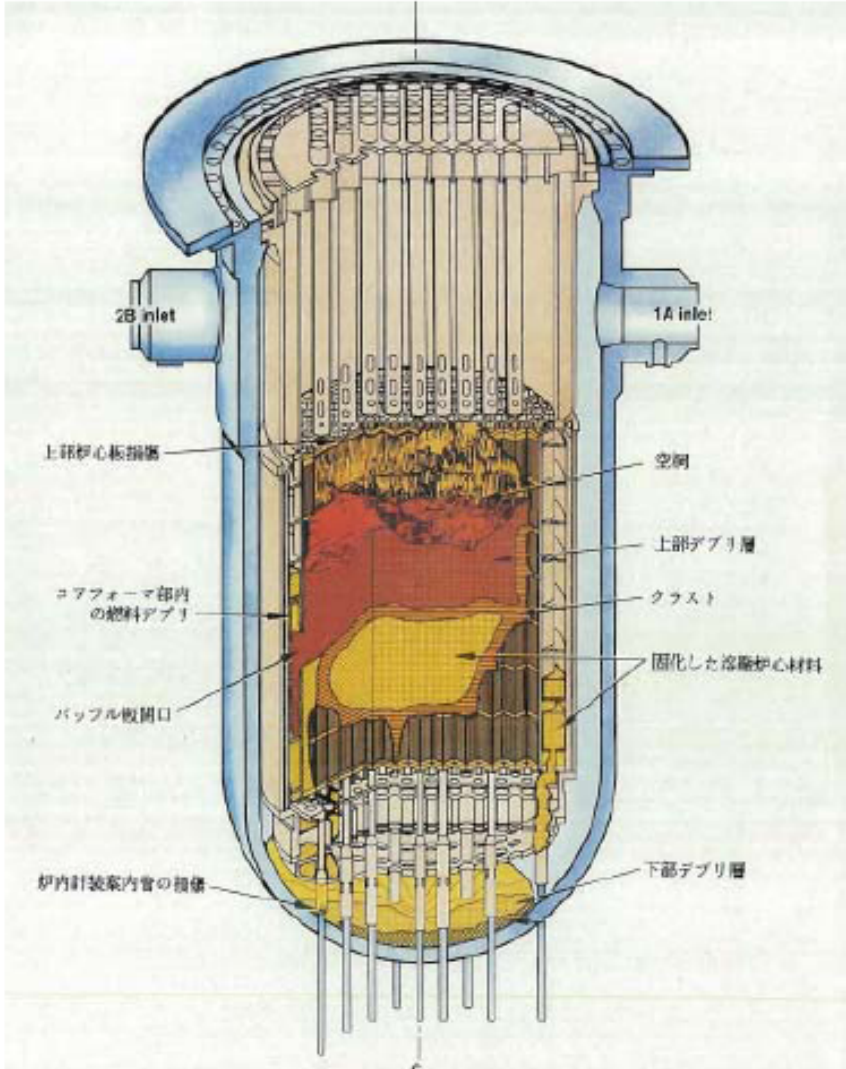
Integrity of Reactor Pressure Vessel and Primarily Containment Vessel are maintained.



Comparison of Fukushima with TMI

<参考>TMI-2 炉心の最終状態

TMI	Fukushima
<ul style="list-style-type: none"> No Damage to Reactor Building and utilities 	<ul style="list-style-type: none"> Extensive Damage to Building and most of utilities
<ul style="list-style-type: none"> No Debris outside RPV 	<ul style="list-style-type: none"> Lot of contaminated Debris
<ul style="list-style-type: none"> Defuel from RPV 	<ul style="list-style-type: none"> Remove 2800 fuels from Spent Fuel Pool of 4 plants Defuel from 3 plants
<ul style="list-style-type: none"> Clean Floor for defueling 	<ul style="list-style-type: none"> Contaminated Floor covered by Debris



New Safe Confinement construction process (continued)

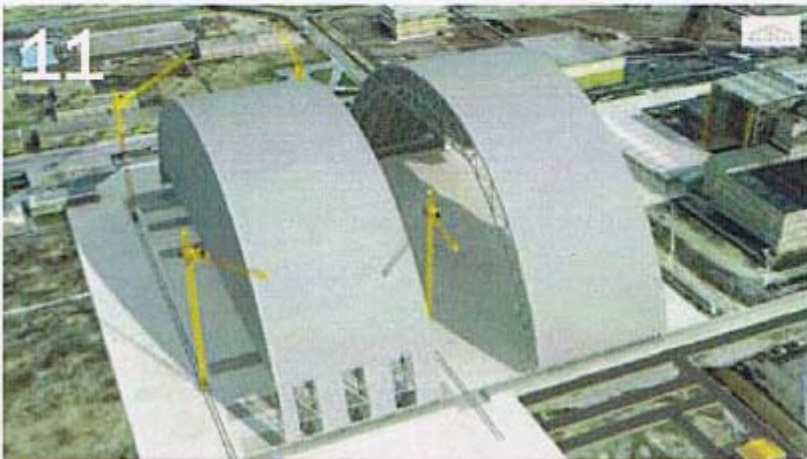
Chernobyl reactor will be preserved in 100 years.



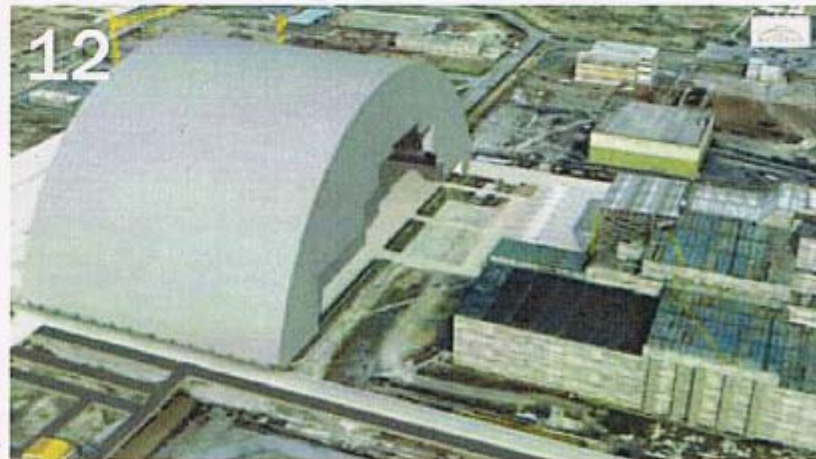
End wall installed and first section moved into holding area



Second section assembled



Two sections joined



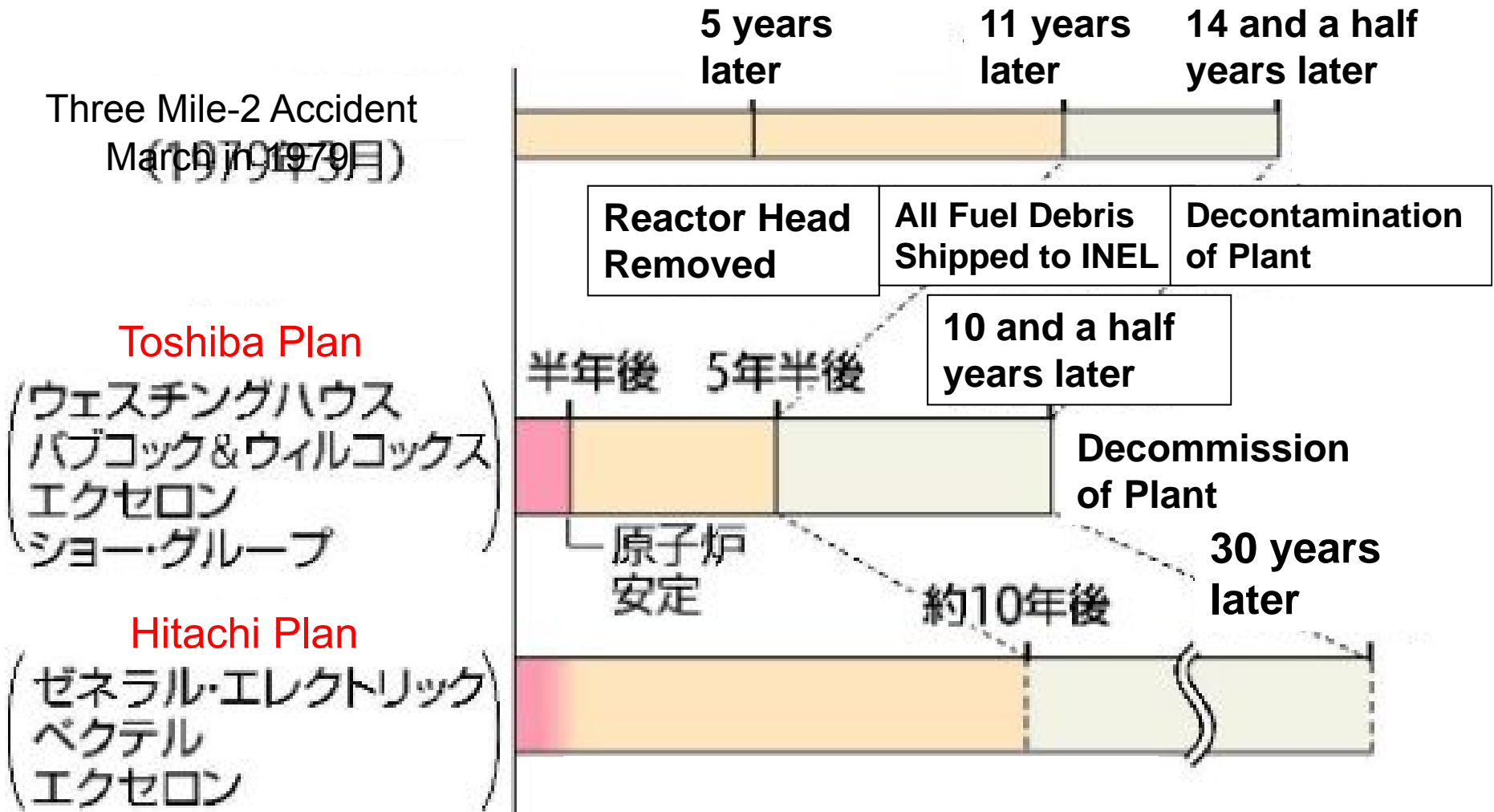
Whole structure slid into place over object shelter

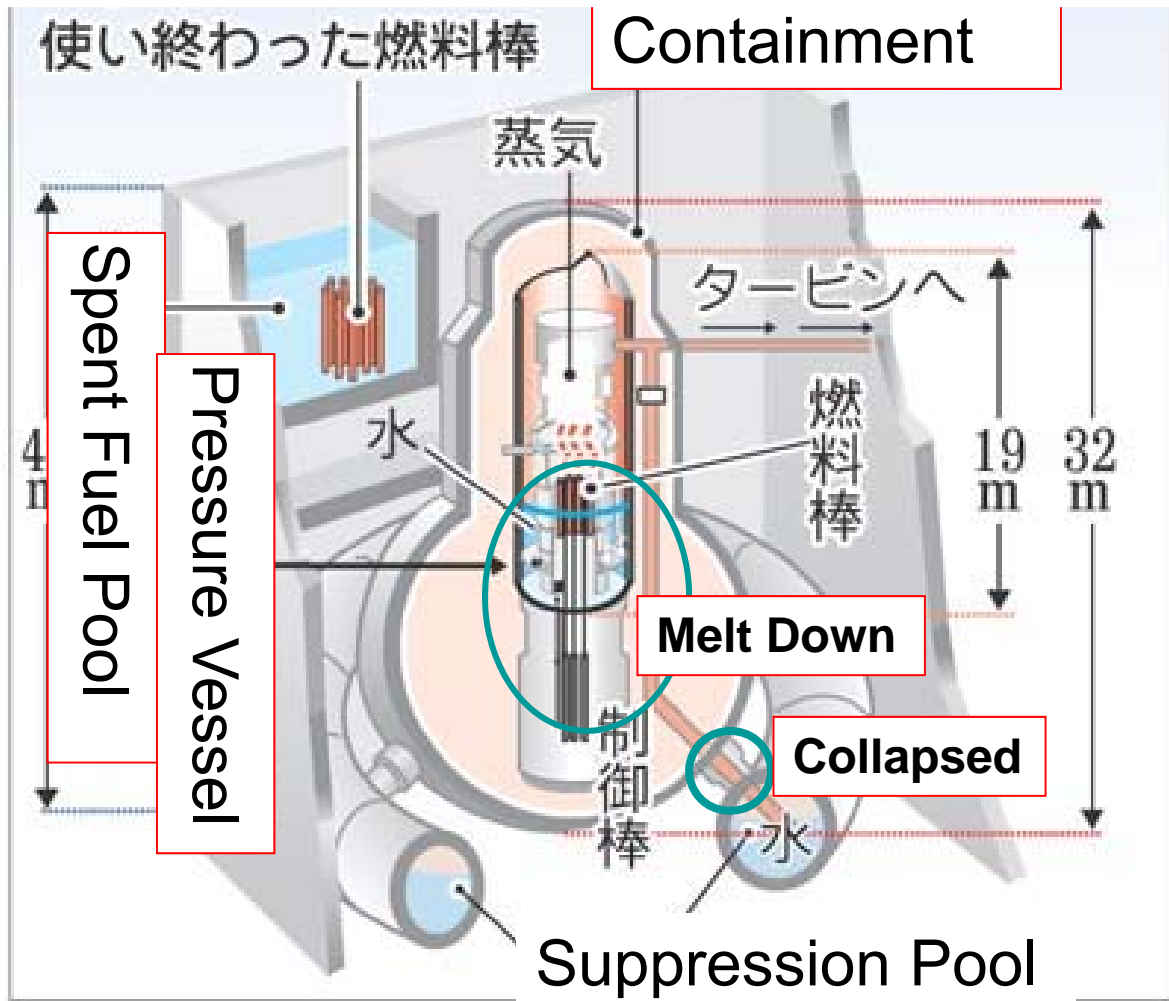
Fukushima plant :Covering by Textile

Difficult to control air flow in reactor building



TMI-2 Clean-up Time line and Fukushima's Time line



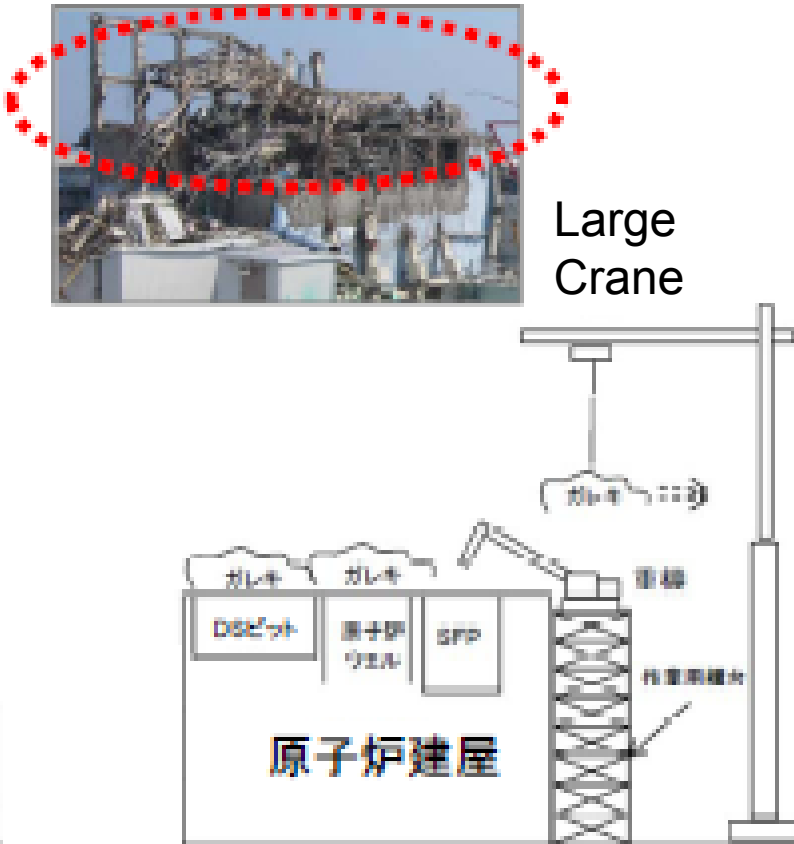


Contaminated Debris in the Upper Part of Reactor Building

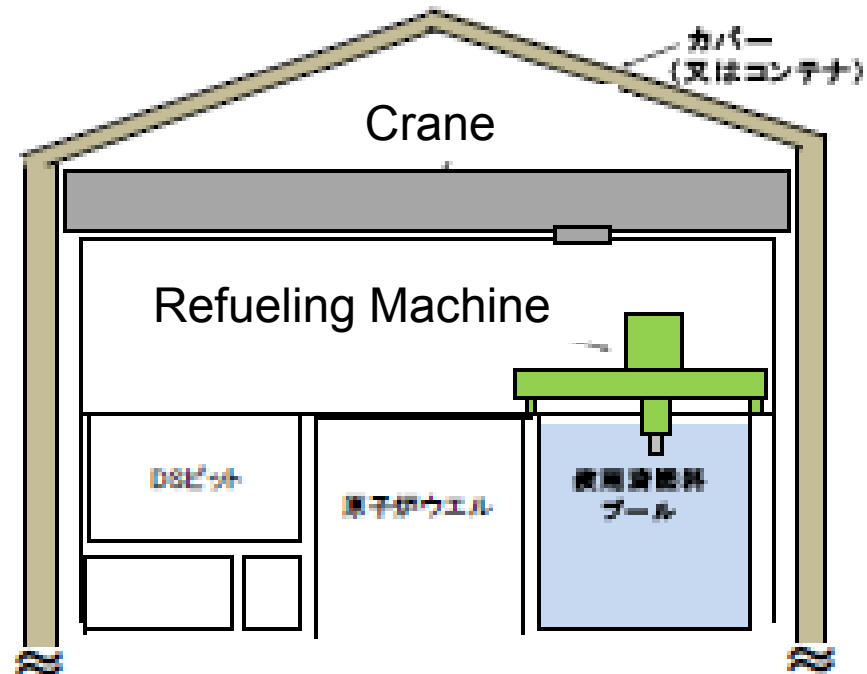


Schedule after Step2

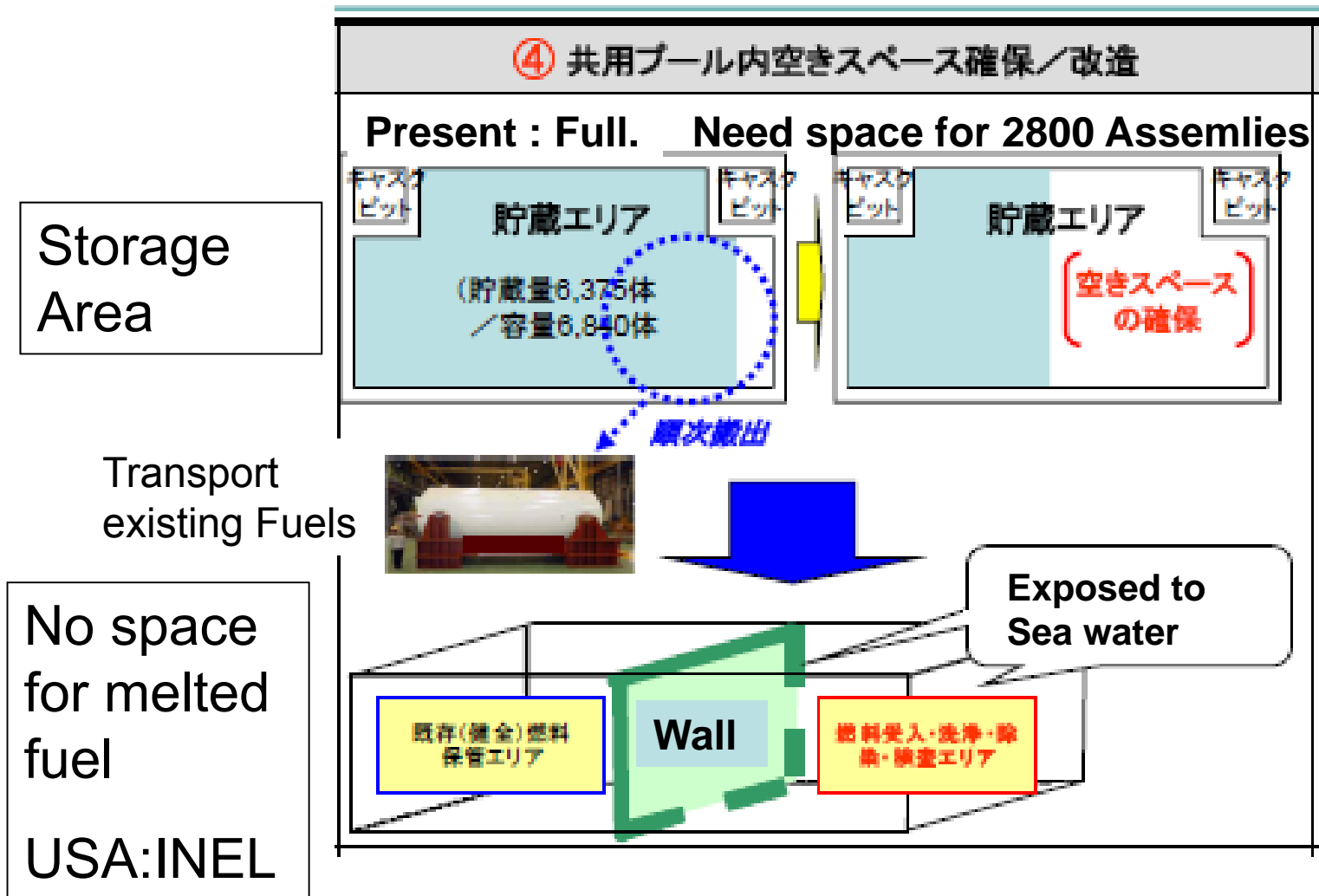
Remove Debris on Operation Floor



Install Covering/Containment and Refueling Machine



Storage Area for Spent fuel pool in Daiichi



Credibility Gap

Central Government

Higher rate of Operation 85%、90%、

Long Cycle Operation 12months →18months

On-line maintenance

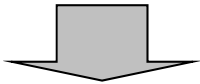
Local Government

Concern on daily safety

No concern on high performance

Metropolitan Area Receive merit based on higher performance

Fukushima Accept Risk related to nuclear accident. Reduce in Job opportunity due to long cycle operation



Gulf between Central government and Local government

Gulf between actual safety regulation and safety theory

A open hearing by Japan Atomic Energy Commission was held at Fukushima, 2006.

I talked about severe accident. PSA says maximum core damage probability is due to earthquake. But offsite center which is office of operations in emergency, is located at a building without earthquake-proof construction.

Two years later, Kashiwazaki site was attacked by big earthquake and TEPCO administration office lost the function of emergency operations.

In Tohoku disaster, Ohkuma and Onagawa offsite centers also lost their functions.

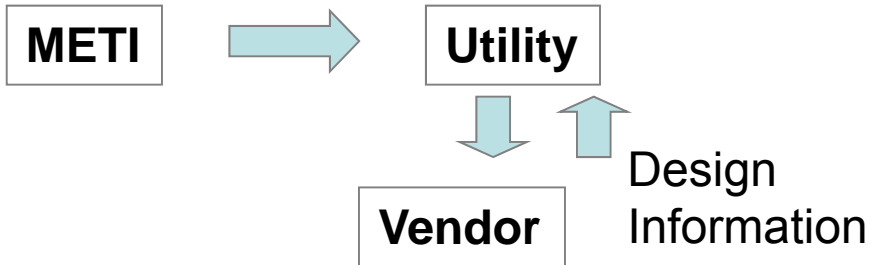
It means there is no consistency between actual safety regulation and prediction by safety theory, such as PSA.

Certification Process

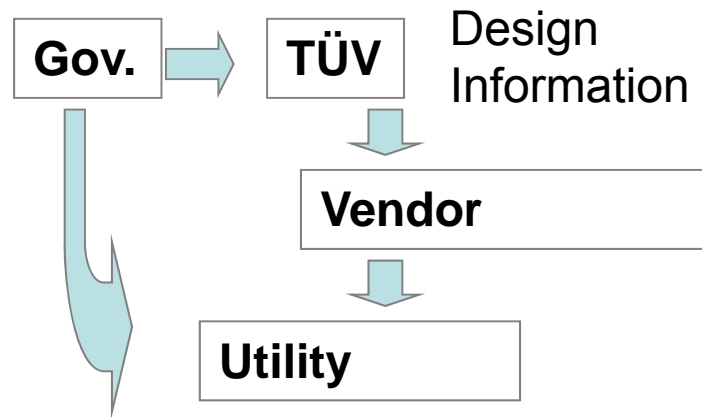
Japan : Vendor is not involved in certification process.

USA & Germany : Vendor is directly involved.

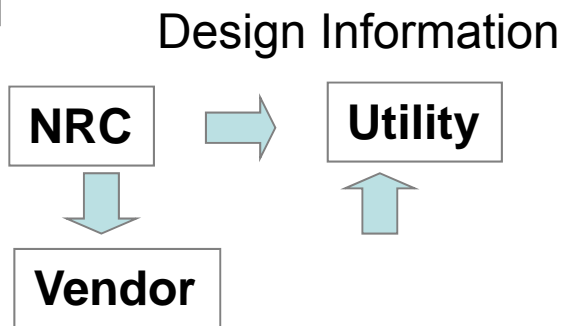
Japan



Germany



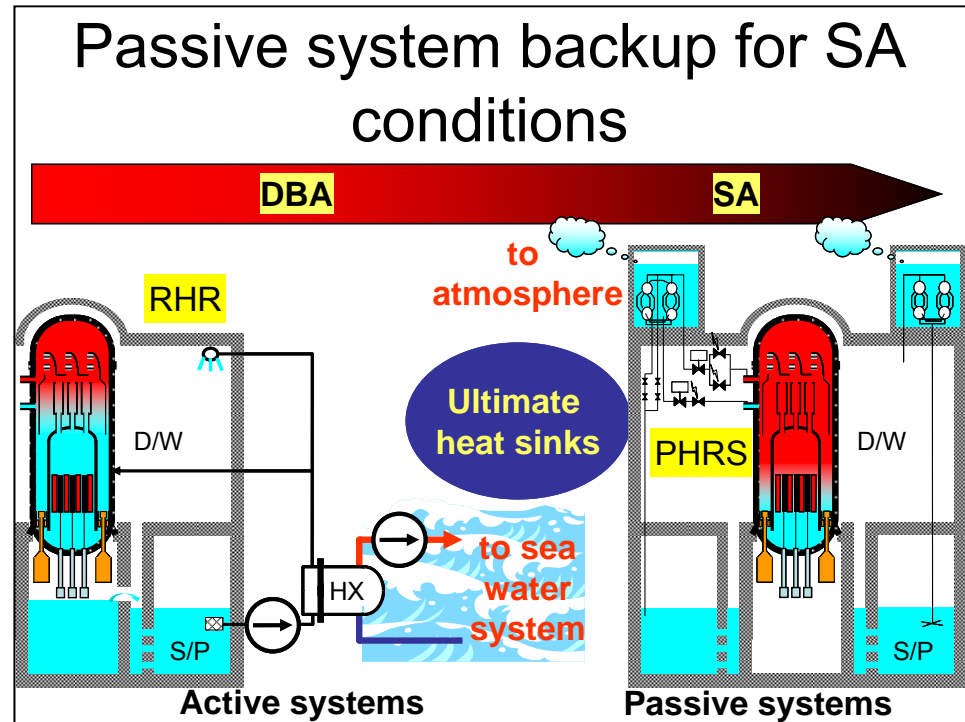
USA



Passive is safer than Active in Japan?

Passive is vertically long.

Japan should choose system more suitable for highly seismic country by ourselves.



遷宮 (Sen-Gu)

Construct a new shrine and transfer the god from the old to the new, in every 20 years.

Japanese tradition (Renewal and technology transfer to next generation)

GE reports Posted on May 25,2011

Venting Systems in Mark I Reactors

Although the reactors at Fukushima Daiichi originally were designed by GE or built under a license of GE technology, GE did not design or build the hardened vent system at Fukushima Daiichi or, for that matter, at any other nuclear power plant—whether in Japan, the United States, or elsewhere.

Original Design is same to GE plant Hatch1

in some cases, valves or other methods of operating the vent that are located outside the reactor building, enabling plant operators to control them manually, if necessary.

Under NRC regulation in the U.S., reactor operators in the control room have full authority to vent gases from the primary containment immediately, if needed. Licensed control room managers do not need additional authorization from either their company's management or government regulators to open vents when they determine this is needed to prevent damage to the primary containment system. Reactor operators also spend considerable time and resources training for possible contingencies, including emergency events.

Multi-plant nuclear emergency

Fukushima: 10 plants
 1-F and 2-F sites are near in place, 10km.

USA: Maximum number at one site is three.

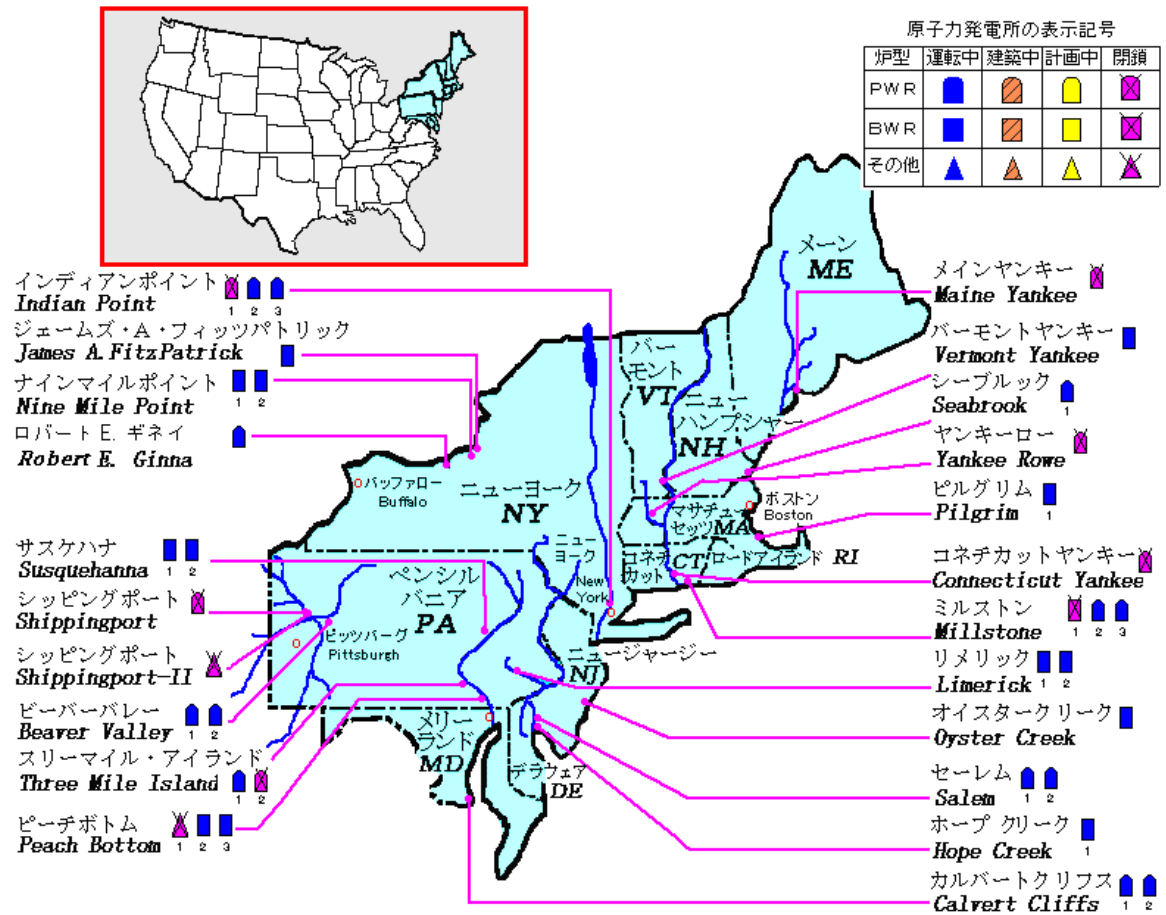


図1-2 米国北東部の原子力発電所立地点

[出典](社)日本原子力産業協会:世界の原子力発電開発の動向 2005年次報告、(2006年5月)、p.72

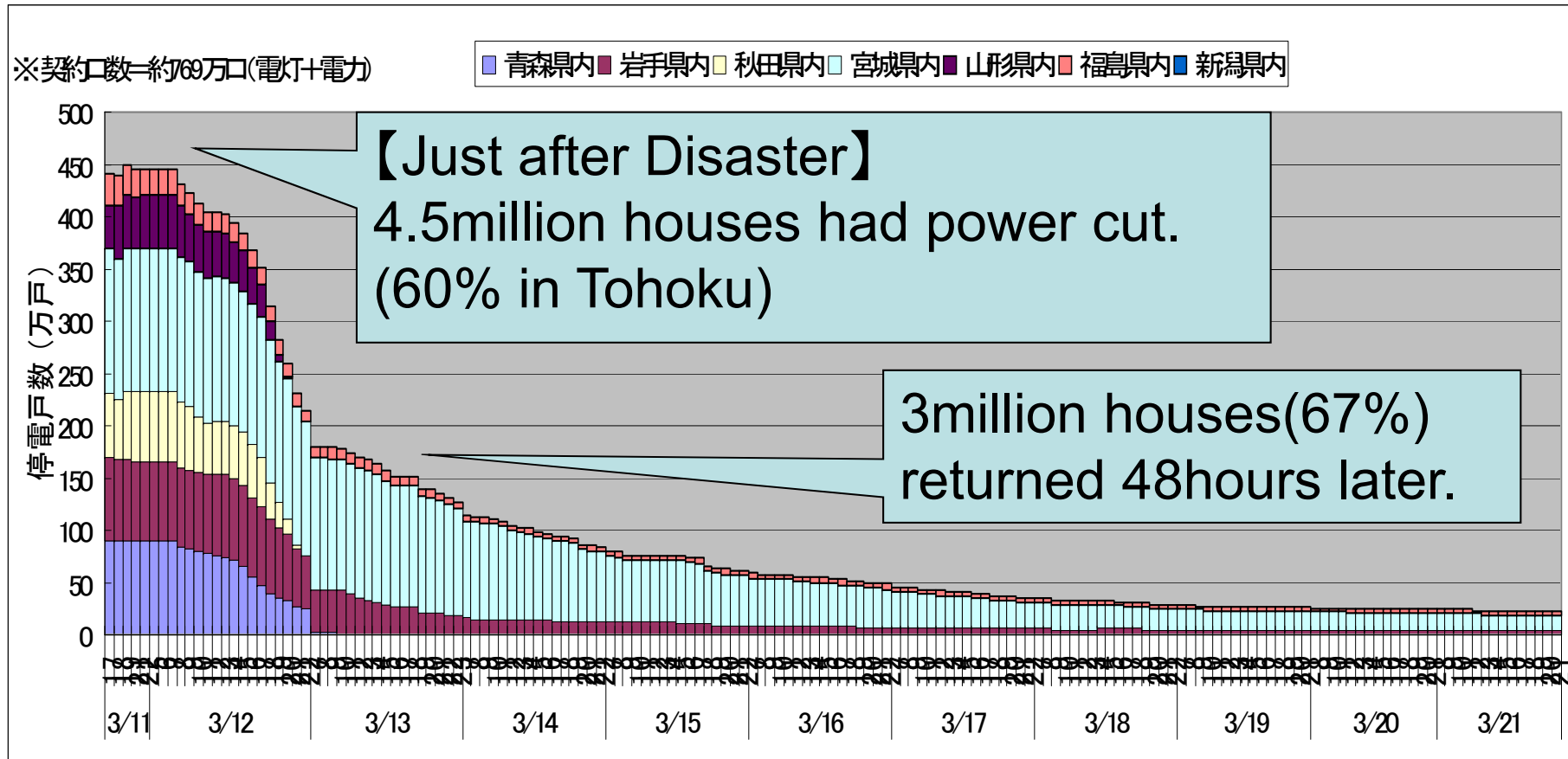
Blackout in Tohoku

○ Significant disruption in supply of Electricity.

4.5 million houses (60% of total houses in Tohoku) were left without electricity for up to 48 hours.

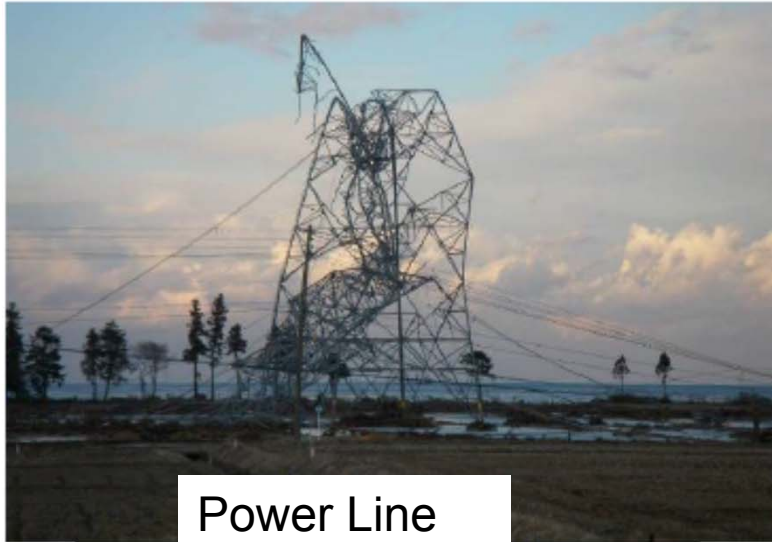
To resupply electricity, fossil, hydroelectric and geothermal plants along the Japan Sea and in mountain area were used.

It means importance of diversity of power generations.



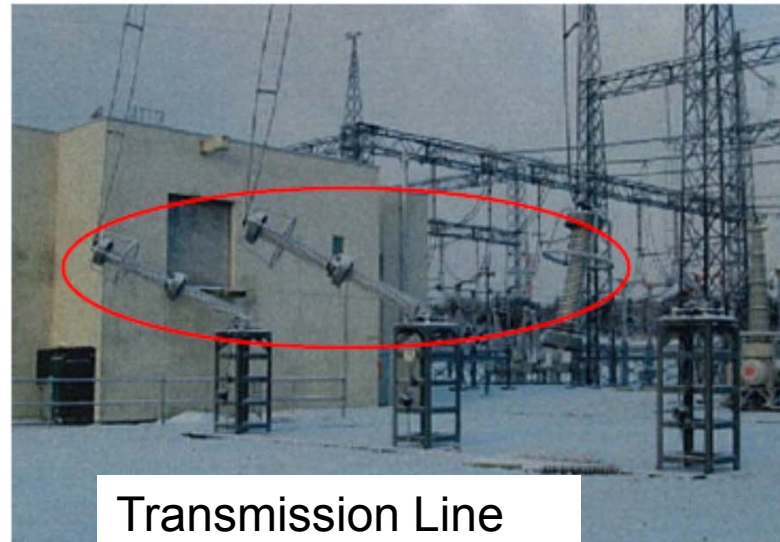
Destruction of Infrastructure

○Electric power transmission was significantly damaged.



Power Line

送電鉄塔の折損状況(福島県南相馬市)



Transmission Line

発電電設備の地震による設備被害(宮城県加美町)



送電設備の地震による設備被害(岩手県大槌町)

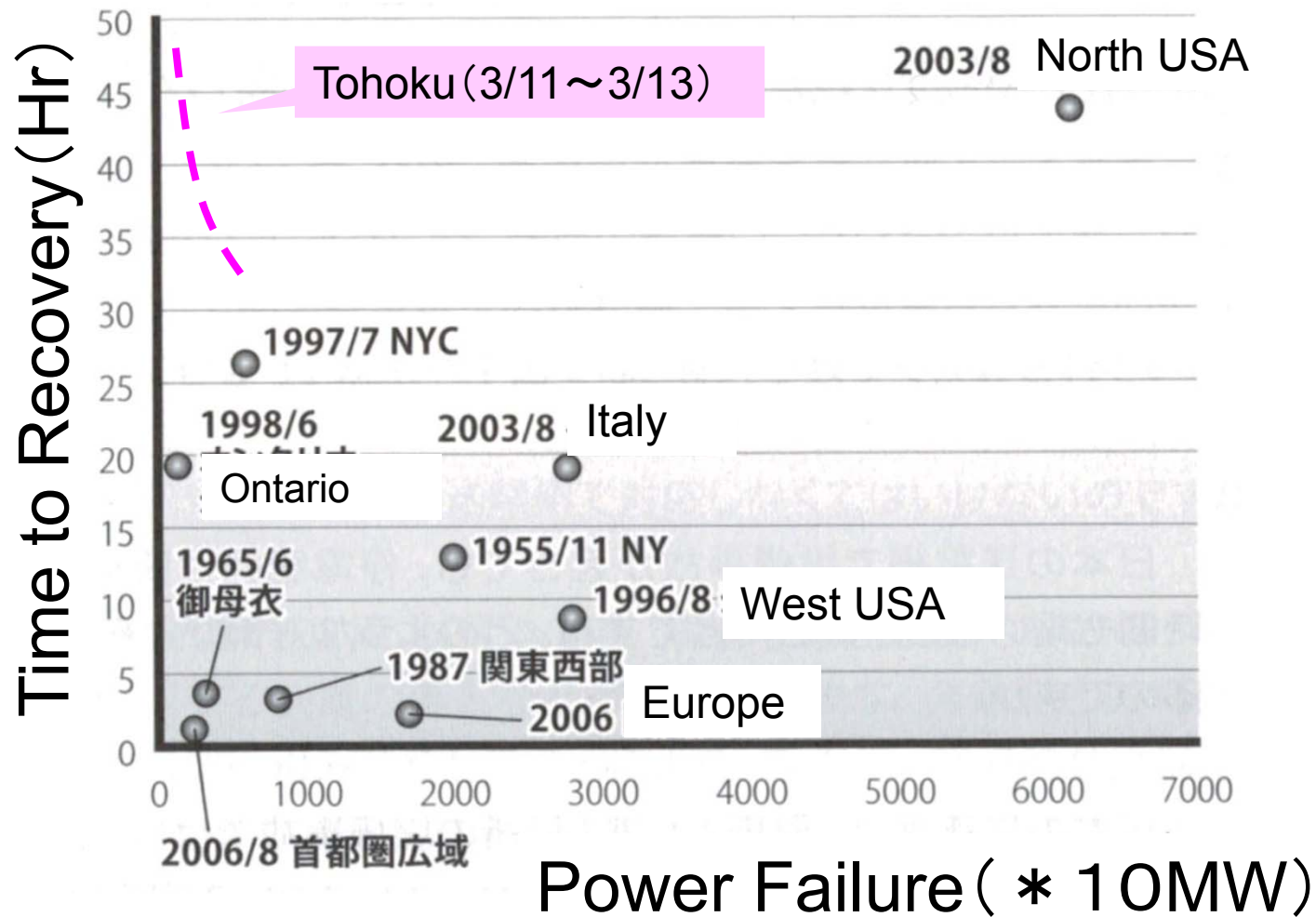


配電設備の被害状況(電柱の倒壊及び傾斜)(福島県南相馬市原町区)

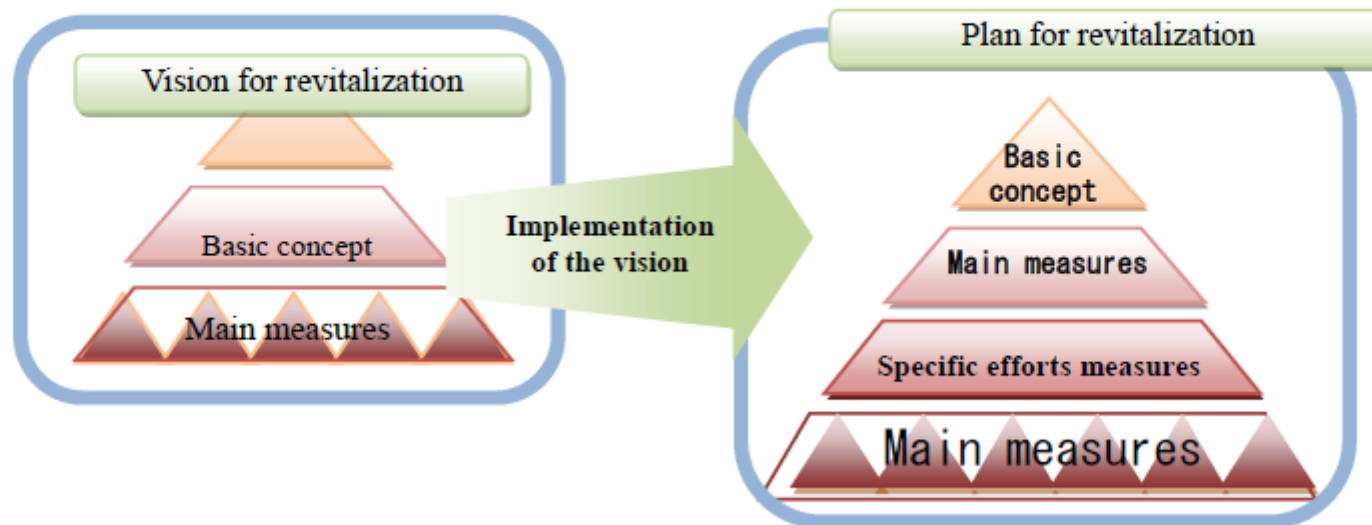
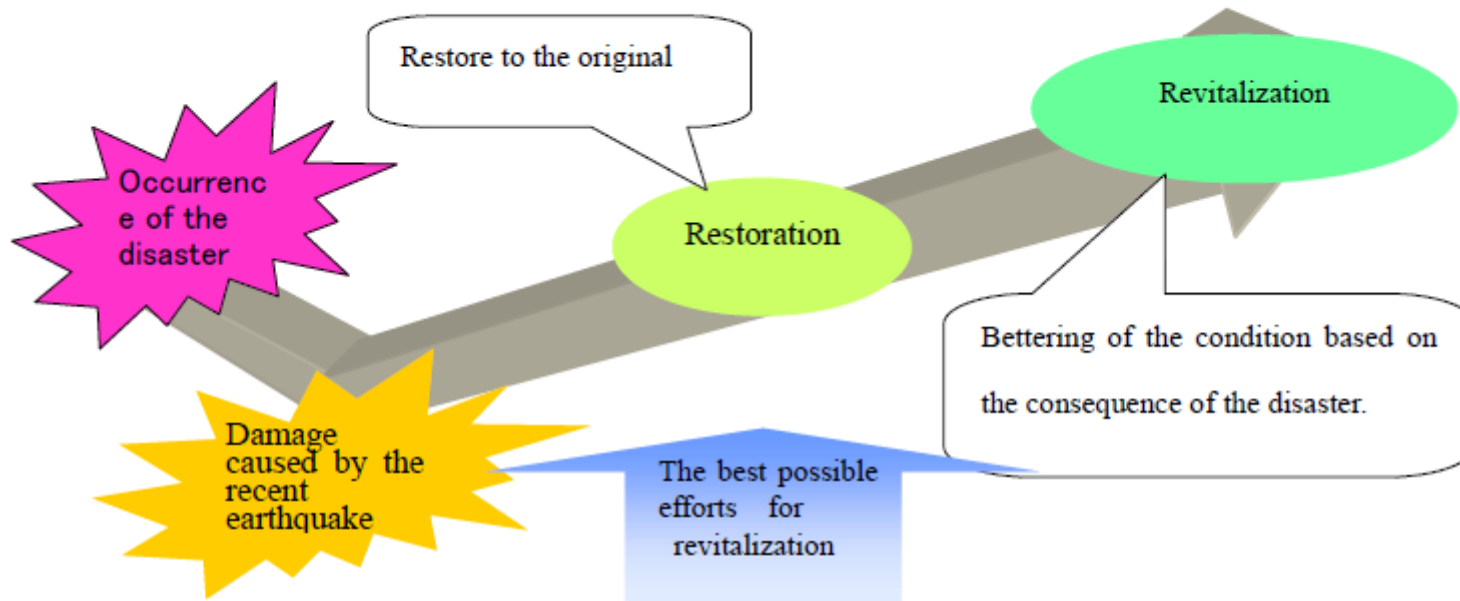
東北電力
2011年3
月15日プ
レス

Blackouts in the world

○Comparing to other events, Tohoku blackout was one of severest power cut in the world.
Unstable renewable energy could not contribute recovery of electrical grid.



Fukushima revitalization plan



Fukushima Revitalization Plan

The prefecture will set pillars of the **emergency measure and the nuclear disaster measure respectively,**

because **the damage** caused by the disaster **including the nuclear disaster** to the prefecture **is so huge,** and assumingly **the restoration** will significantly **take long time.**

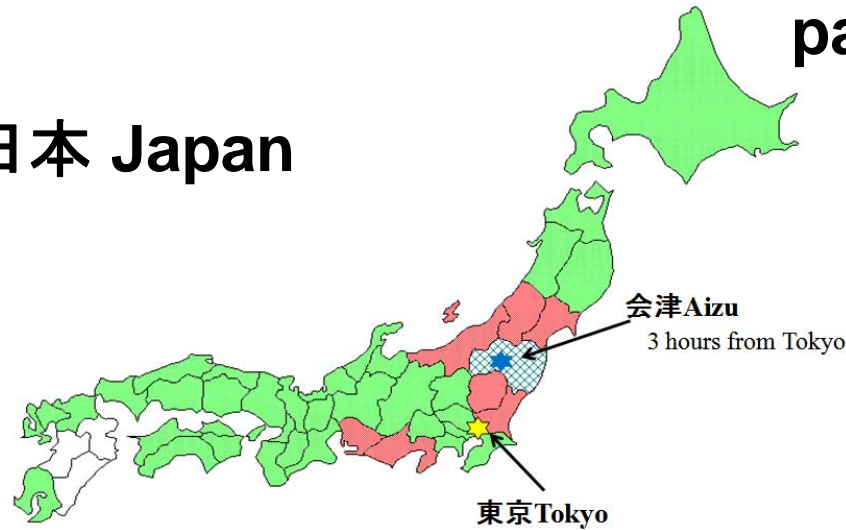
Basic concept

- Building of a safe and secure society which is not dependent on nuclear power and viable with sustainable development
- Revitalization by integrating the power of people who love and care for Fukushima
- Realization of a hometown in which we can take pride

Last week, Fukushima congress declared decommissioning of all ten plants.

会津 Aizu Region

日本 Japan



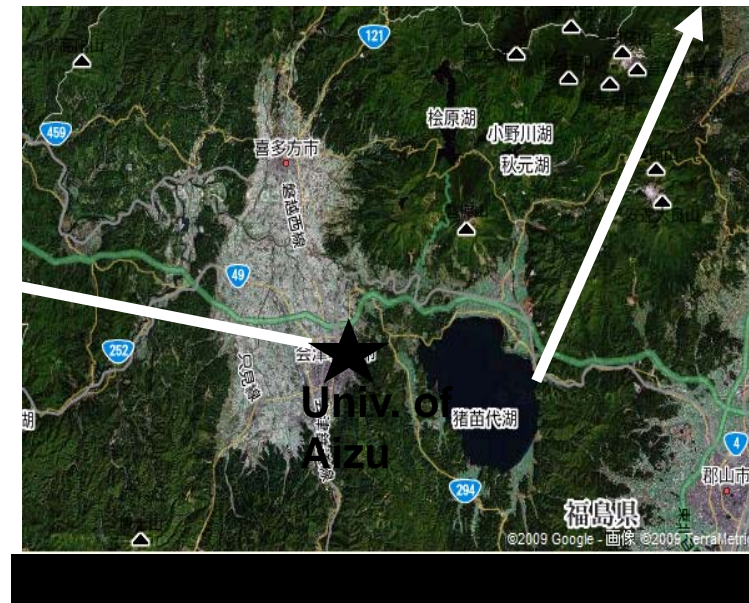
Mt. Bandai and Lake Inawashiro (National park)



会津大学 University of Aizu



会津盆地 Aizu basin



For Fukushima revitalization, Global IT Companies are coming to Aizu

ACCENTURE opened Innovation center in Aizu

産業振興と雇用創出にITで連携 一会津若松市、アクセントゥアと協定



会津大学は会津若松市、アクセントゥア（株）と共同で、福島県と会津若松市
 災復興に向けた産業の振興と雇用の創出に取り組んでいきます。
 コンサルティングやテクノロジー
 難された方々の雇用確保とその受
 発電所の事故から世界に広がる風
 若松市に「福島イノベーションセ
 ターは、会津地域の特性を活かし
 に、新しい製品やサービスの創出
 します。



India IT company, TATA, agreed to cooperate with UoA



TATA CONSULTANCY SERVICES

インド最大のITサービス会社タタ コンサルタンシー サービスズ(株)*
 (TCS日本 梶社長)は、震災復興への支援のため、会津大学とパート
 ナーシップ協定を結び種々の支援を行う。会津大学に特化した支援。
 10月3日調印式。

支援内容:IT秋フォーラムへ協賛、日本人学生(原発事故等の震災被災学生)への支援(支給型奨学金)、冠講義、寄付講座等研究・教育活動での協業

以上

長沙(Changsha)中聯重工

ZOOMLION decided to open maintenance center in Aizu.

UoA will have a cooperative agreement with Central south university(中南大学) at Changsha in November.



The screenshot shows the Zoomlion website homepage. At the top left is the Zoomlion logo. To the right, there is a language selector set to "ENGLISH [change]", a "Site Map" link, and a search bar with an "OK" button. Below the header is a navigation menu with links for "Home", "News", "About Us", "Products", "Service", and "Investor Relations". The main content area features a large banner with the text: "* We share value with global clients". Below this, it states: "With the most abundant product categories, fully product chain supply, we meet all requirements from clients, and aim to first choice partner of the most competitive corporation all around the world." The banner includes an image of a blue Volvo truck with a white trailer. At the bottom of the banner, there are three navigation buttons: "Zoomlion H-share Global Offering", "Product Research Institute", and "Industry Park Introduction".

Italian construction equipment maker Compagnia Italiana Forme Acciaio SpA and British construction equipment manufacturer Powermole are subsidiaries of the company.

歴史と伝統の街 会津Historical Town Aizu



Tsurugajoh castle
鶴ヶ城



Aizu cotton store
会津木綿



Canal from Lake Inawashiro



Lacquer plates 漆器



Soba(buckwheat noodles) 蕎麦



KURA (old Japanese storage) 蔵