

Countermeasure of Fukushima and Benchmark Visits

International ISOE ALARA Tokyo Symposium

Aug 27-28, 2013

Aug 29 Fukushima Site Visit

IAEA, OECD/NEA ISOE Committee 7th Chairman

Severe Accident Management (SAM) Chairman

Wataru MIZUMACHI

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Fort Calhoun, Peach Bottom, Vogtle, Zion,
Chelnobyl
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1. Japanese Ten Utilities prepared to restart their plants

- Countermeasure of Fukushima
 1. Diversity of Power Supply using Gas Turbine
 2. Cooling water supply system for the core
 3. Diversity of Instrumentation system
 4. Strengthen the refueling pooland so on
- Strengthen the Training and Drill

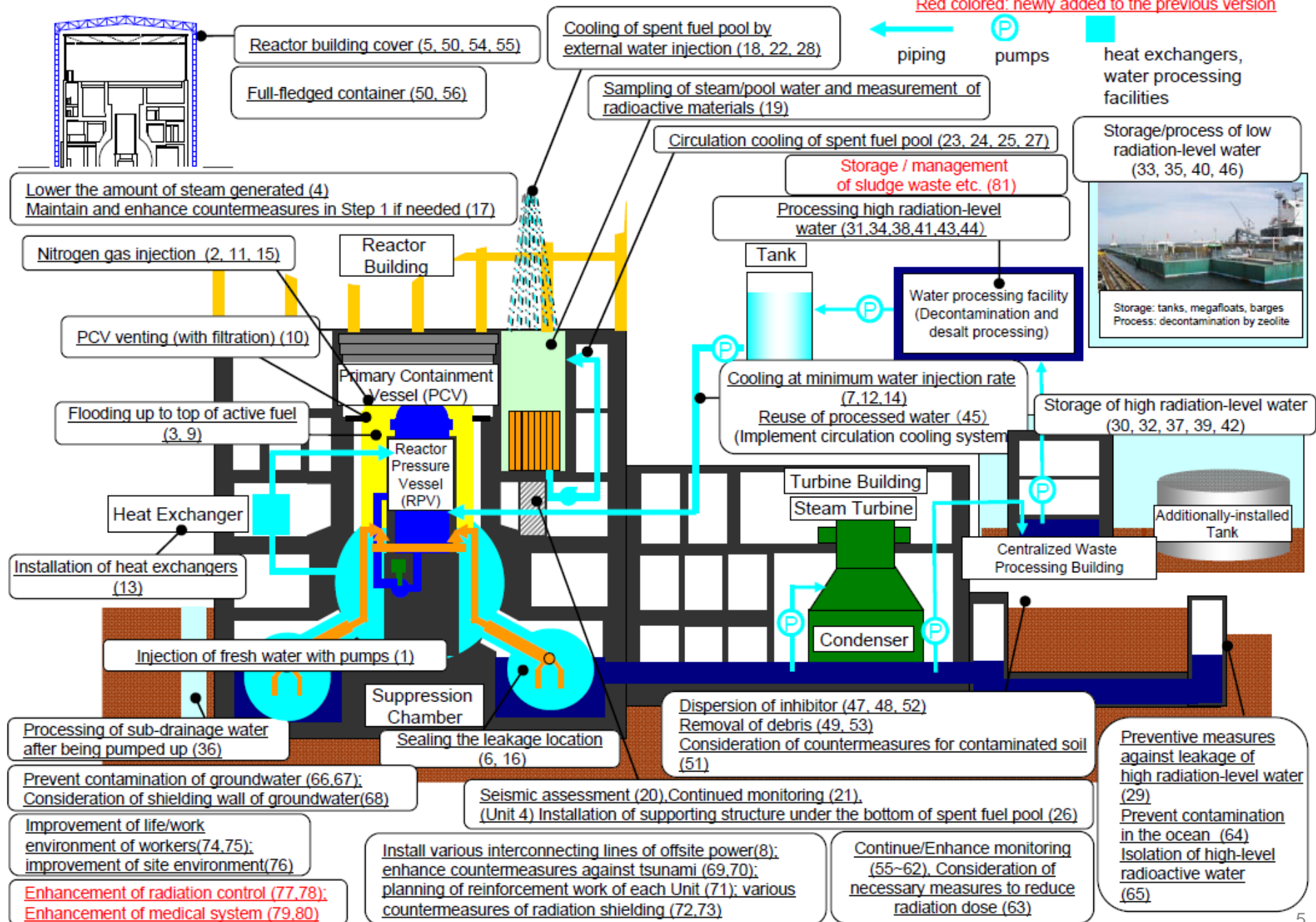
Efforts to restore the Accident

Red colored: newly added to the previous version. Blue colored: modified from the previous version

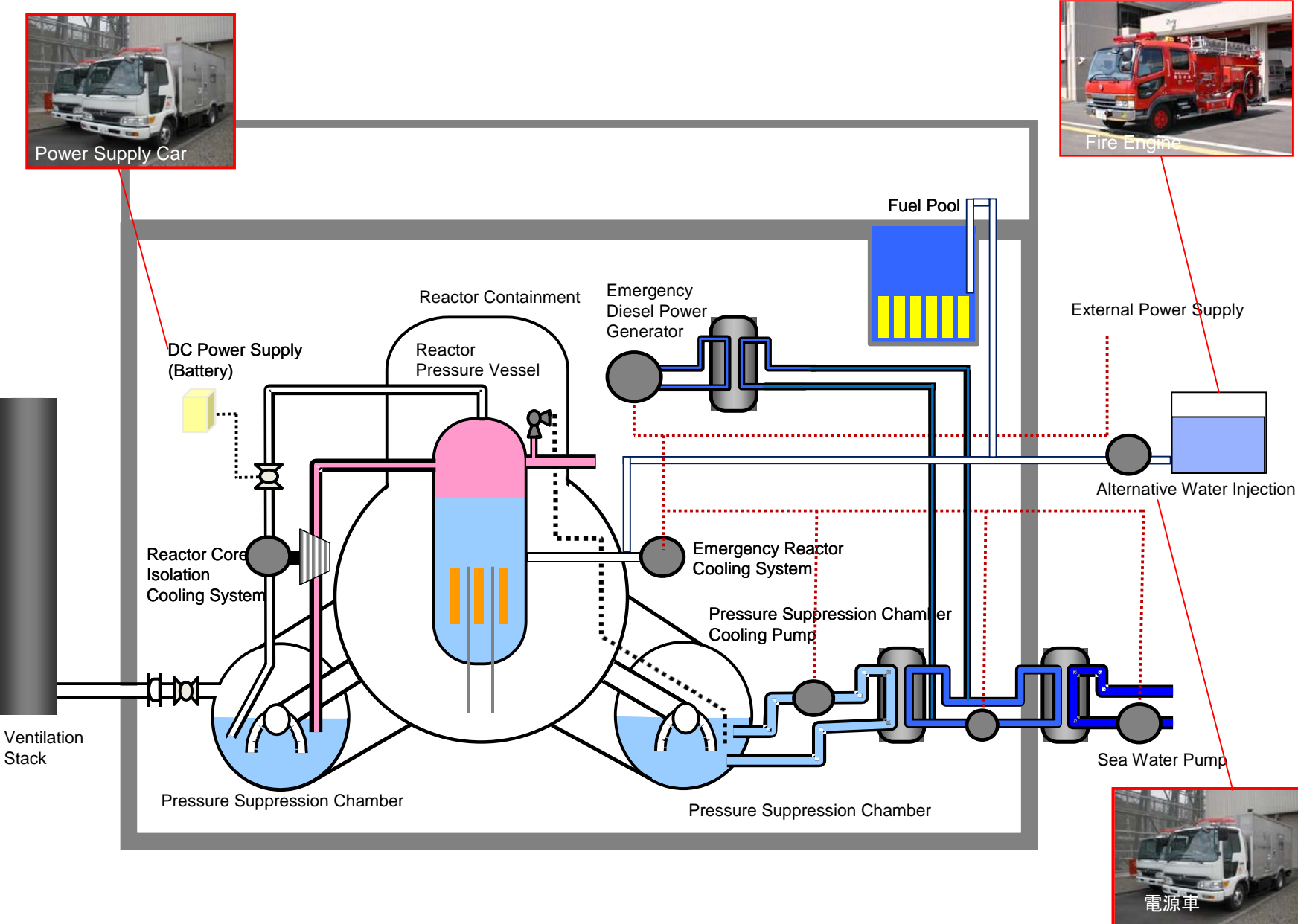
Issues	As of April 17	Step 1 (around 3 months) current status (as of June 17)	Step 2 (around 3 to 6 months after achieving Step 1)	Mid-term issues
I. Cooling	(1) Reactor	Fresh water Injection Cooling by minimum injection rate (injection cooling) Consideration and preparation of reuse of accumulated water Nitrogen gas injection Consideration and implementation of sealing measure at leaking points of PCV Improvement of work environment	Stable cooling Circulating Injection Cooling (start) Cold shutdown condition PCV flooding Securing heat exchange function	Protection against corrosion cracking of structural materials *to be partially implemented ahead of schedule
	(2) Spent Fuel Pool	Fresh water injection Reliability improvement in injection operation /remote-control operation *ahead of schedule Circulation cooling system (installation of heat exchanger) *partially ahead of schedule	Stable cooling Remote-controlled injection operation Consideration / installation of heat exchanging function More stable cooling	Removal of fuels
II. Mitigation	(3) Accumulated Water	Transferring water with high radiation level Storing water with low radiation level Installation of storage / processing facilities Installation of storage facilities / decontamination processing	Secure storage place Expansion of storage / processing facilities Decontamination / Desalt processing (reuse), etc Storage / management of sludge waste etc. Mitigation of contamination in the ocean	Reduction of total amount of contaminated water Installation of full-fledged water processing facilities Completion of processing of accumulated water in buildings Processing of sludge waste etc. Mitigation of contamination in the ocean (continued)
	(4) Ground water	Mitigation of contamination of groundwater	Mitigate ocean contamination (continued) (Sub-drainage management with expansion of storage / processing facilities) Consideration of shielding wall of groundwater	Solidification of contaminated soil, etc Establishment of shielding wall of groundwater
	(5) Atmosphere / Soil	Dispersion of inhibitor Removal of debris	Mitigate scattering (continued) Installing reactor building cover (with ventilation system) Consideration of reactor building container	Installation of reactor building container

Overview of Major Countermeasures in the Power Station as of June 17

Red colored: newly added to the previous version

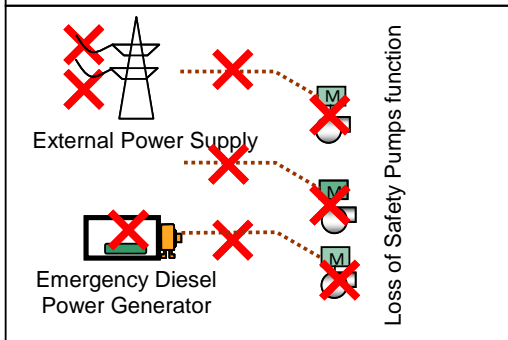


Series of Events and Countermeasures in case of tsunami, for BWR

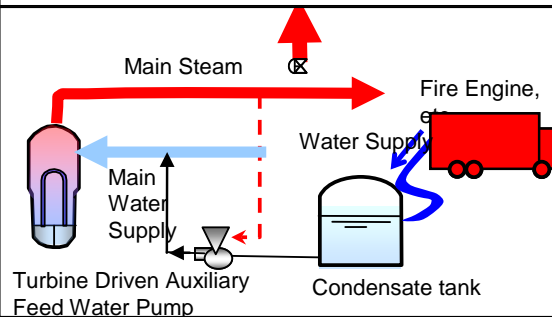


Series of Events and Countermeasures in case of tsunami, for PWR

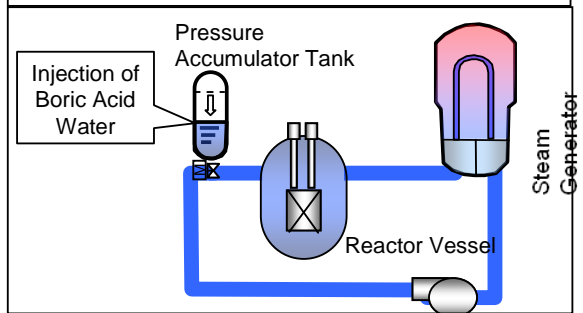
(1) Loss of External Power Supply



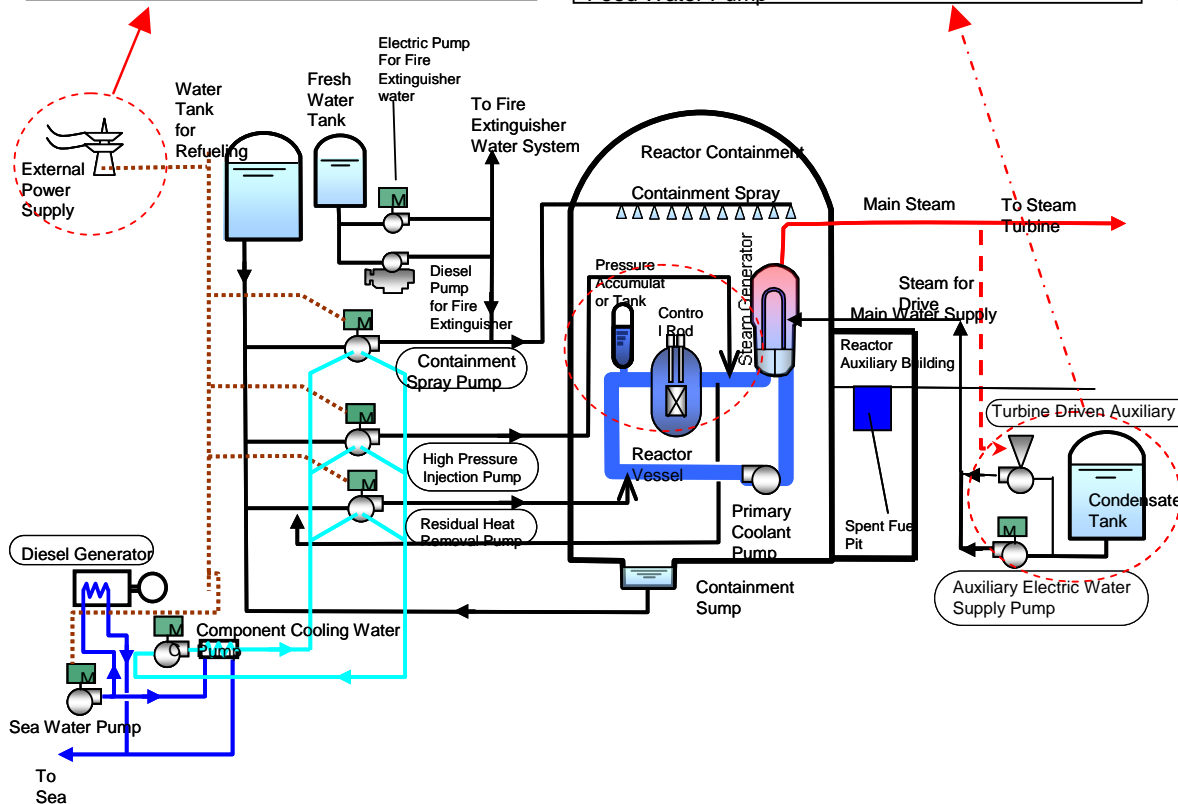
(2) & (5) Water supply / cooling of steam generator, supply water to condensate tank



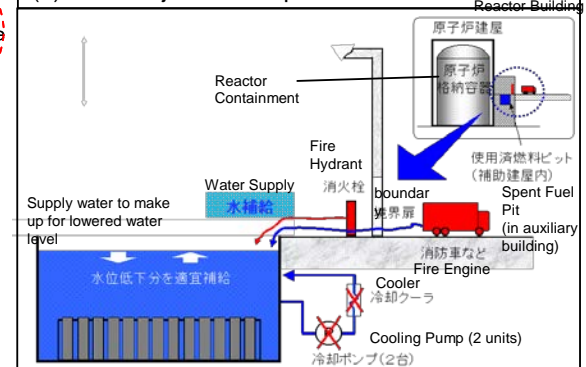
(3) & (4) Injection of Boric Acid Water from Pressure Accumulator tank, shut-off of the valve



(6) Connection of Power Supply Car



(7) Water Injection to Spent Fuel Pit





Electric Power Supply Car at Ikata NPS on Aug 2012



Portable Water Supply Pumps at Ikata NPS on Aug 2012



Under Water Pumps at Ikata NPS on Aug 2012



Anti-Seismic Rubbers under Main Office Building at Ikata NPS on Aug 2012

2. New Japanese Society just starts NUSU Society for Nuclear Safety and Utilization

NUSU : Society for NUclear Safety and Utilization

- **NUSU** starts this August headed by **Dr. Arima, the former Minister of Education, Technology and Science**
- **Main Activities**
 1. **Restore Fukushima Area**
 2. **Encourage the Nuclear Safety and Utilization to restore Japanese Economy**
 3. **Make the bridge between the Nuke Technology, People and Local Business**

NUSU : Society for NUclear Safety and Utilization

- Member (Manager to Worker)
All Stakeholders, Utility ,Bender, Professor, Journalist, Local Business, and so on
- Annual Fee
 - A Member : Free
 - B Member : 10 US Doller
- I was nominated as the Chairman of International Affairs.

3. Benchmark Visits

Fort Calhoun NPP

Zion NPP

Peach Bottom NPP

Vogtle NPP

Chelnobyl NPP

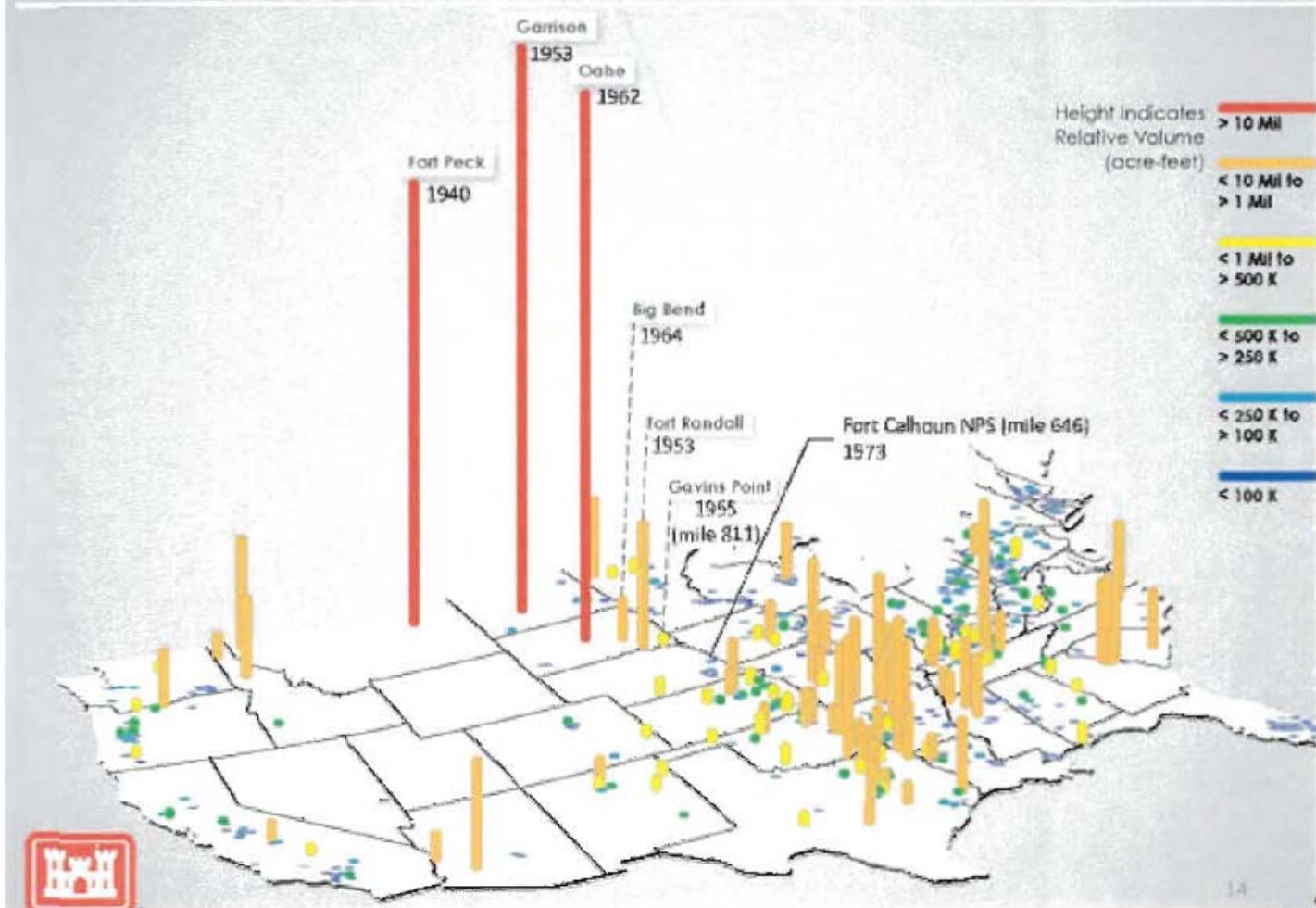
Fort Calhoun NPP Visit and Restart Process

2013.2.19

478Mw CE PWR

Commercial Operation Sep 1973

Storage Capacity of Corps Reservoirs



Missouri River Mainstem Reservoir System



Why are these initiatives important

- Heavy Snowfall in Montana: Photo Taken June 17, 2011
- Spring Snow Melt Flows to Missouri & Mississippi Rivers.



Why are these initiatives important

- Fort Calhoun PWR Station
Nebraska,
USA



Why are these initiatives important



Why are these initiatives important

- Cooper BWR Station on Mississippi River, Summer 2011







UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
1600 EAST LAMAR BLVD
ARLINGTON, TEXAS 76011-4511

June 11, 2012

CAL 4-12-002

David J. Bannister, Vice President
and Chief Nuclear Officer
Omaha Public Power District
Fort Calhoun Station FC-2-4
P.O. Box 550
Fort Calhoun, NE 68023-0550

SUBJECT: CONFIRMATORY ACTION LETTER – FORT CALHOUN STATION

Dear Mr. Bannister:

This letter confirms the actions Omaha Public Power District (OPPD) will take prior to the restart of Fort Calhoun Station. Enclosed is an NRC-developed list of actions that will be completed by the NRC prior to restart of Fort Calhoun Station. The purpose of the Restart Checklist is to verify that the issues that resulted in the prolonged performance decline at Fort Calhoun Station are resolved. The Restart Checklist includes an assessment of each of the key attributes described in NRC Inspection Procedure 95003, "Supplemental Inspection for Repetitive Degraded Cornerstones, Multiple Degraded Cornerstones, Multiple Yellow Inputs or One Red Input." The scope of the items in the Restart Checklist will ensure the facility can be safely operated if restart is approved. OPPD has committed to complete specific actions listed in the Restart Checklist.

On December 13, 2011, the NRC informed you via letter¹ that Fort Calhoun Station transitioned to IMC 0350, "Oversight of Reactor Facilities in a Shutdown Condition due to Significant Performance and/or Operational Concerns." The IMC 0350 process was implemented at Fort Calhoun Station when the entry conditions were met. These conditions included the plant being in an extended shutdown with significant performance problems, and a significant operational event involving a fire in safety-related electrical switchgear on June 7, 2011.

The NRC recognizes that OPPD initiated a comprehensive review at Fort Calhoun Station to identify the causes for performance issues, identify and review the extent of cause and extent of condition related to these performance issues to fully understand the breadth of performance issues at Fort Calhoun Station, and implement corrective actions to address these performance issues. In addition, OPPD continues to assess any long term flooding effects from the 2011 Missouri River flood on Fort Calhoun Station systems, structures, and components.

¹ Agencywide Document Access and Management System (ADAMS) Accession No. ML113470721

U.S. Nuclear Regulatory Commission
Manual Chapter 0350 Panel
Fort Calhoun Station Restart Checklist

**Check List
for Restart**

Item Number	Description	Closure Date
1	Causes of Significant Performance Deficiencies and Assessment of Organizational Effectiveness	
1.a	Flooding Issue – Yellow finding	
1.b	Reactor Protection System contact failure – White finding	
1.c	Electrical bus modification and maintenance – Red finding	
1.d	Security – Greater than green findings	
1.e	Third-Party Safety Culture Assessment	
1.f	Integrated Organizational Effectiveness Assessment	
2	Flood Restoration and Adequacy of Structures, Systems, and Components	
2.a	Flood Recovery Plan actions associated with facility and system restoration	
2.b	System readiness for restart following extended plant shutdown	

3	Adequacy of Significant Programs and Processes	
3.a	Corrective Action Program	
3.b	Equipment design qualifications	
3.c	Design changes and modifications	
3.d	Maintenance programs	
3.e	Operability process	
3.f	Quality assurance	
4	Review of Integrated Performance Improvement Plan	
5	Assesment of NRC Inspection Procedure 95003 Key Attributes	
5.a	Design	
5.b	Human performance	
5.c	Procedure quality	
5.d	Equipment performance	
5.e	Configuration control	
5.f	Emergency response	

5.g	Occupational radiation safety	
5.h	Public radiation safety	
5.i	Security	
6	Licensing Issue Resolution	
6.a	Review of necessary licensing amendments or actions	
6.b	Review of licensing commitments necessary for restart	
7	Readiness for Restart	
7.a	Operations organization ready for restart	
7.b	Systems ready for restart and Mode restraints properly addressed	
7.c	Final review of corrective actions program for restart items	
8	Confirmatory Action Letter Resolution	
8.a	Verification that all restart-related Confirmatory Action Letter items are appropriately resolved	
8.b	Conduct public meeting regarding plant readiness for restart	
9	Final Recommendation for Restart	

9.a	Manual Chapter 0350 Panel recommends restart to Region IV Administrator. Region IV Administrator obtains concurrence for restart from the Deputy Executive Director for Reactor and Preparedness Programs and the Director of the Office of Nuclear Reactor Regulation.	
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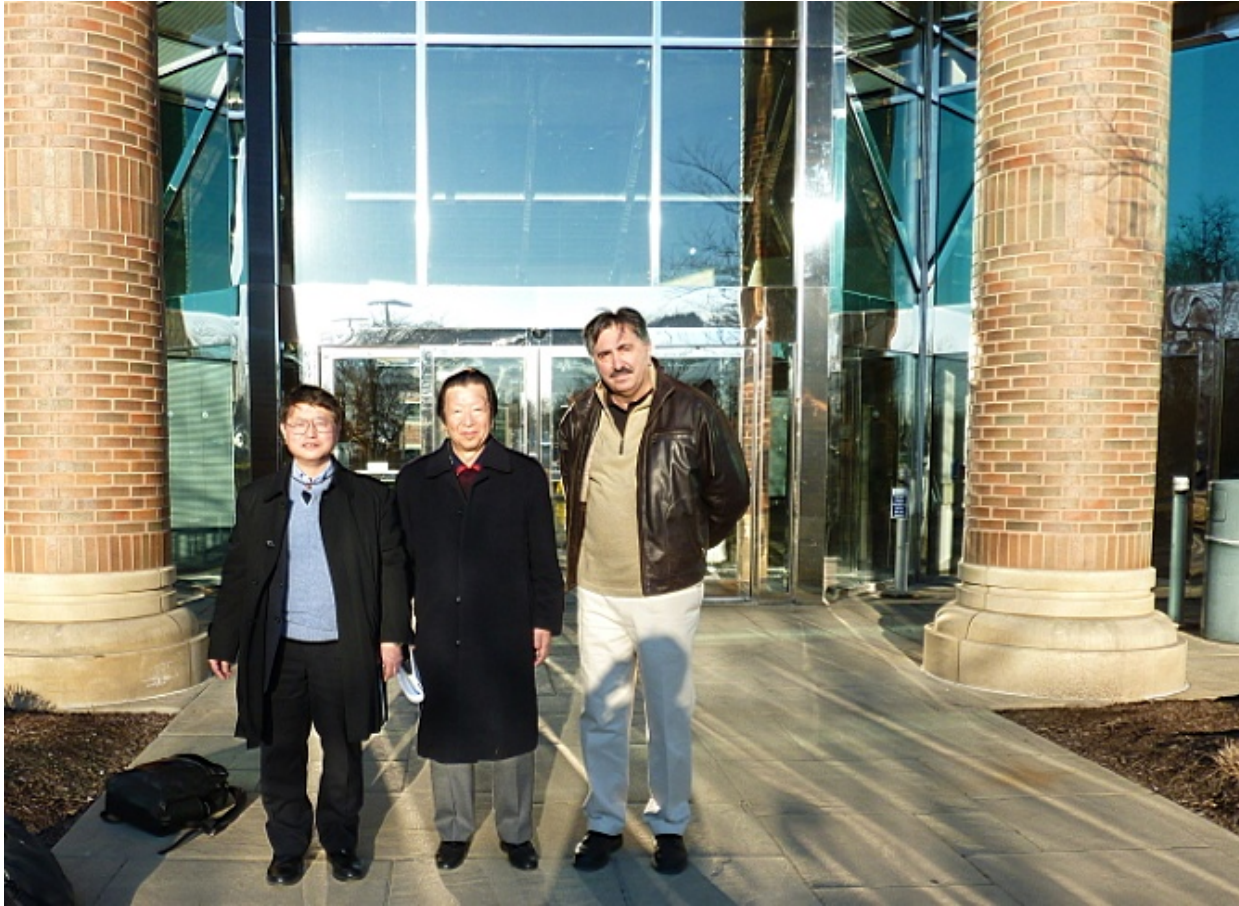
Peach Bottom Visit

2013. 2. 21

Peach Bottom 2, 3 1170Mw Mk-I BWR-4
1968 First Concrete、
1974 Commercial Operation

Peach Bottom NPP is the sister plant of
Fukushima 2 and 3 which were designed
by GE, MK-1 BWR-4
1969 First Concrete
1974 Commercial Operation。

EXELON Philadelphia



Peach Bottom NPP



EXELON Peach Bottom NPP



Susquehanna River







Emergency Diesel Generator Building



**Water proof doors were installed and
Loovers are above**



**PCV Vent Exhaust Piping is installed
on Reactor Building Wall**

Peach Bottom NPP



Alvin W Vogtle Visit

2013. 2. 22

Vogtle 1,2 1200Mw WH PWR

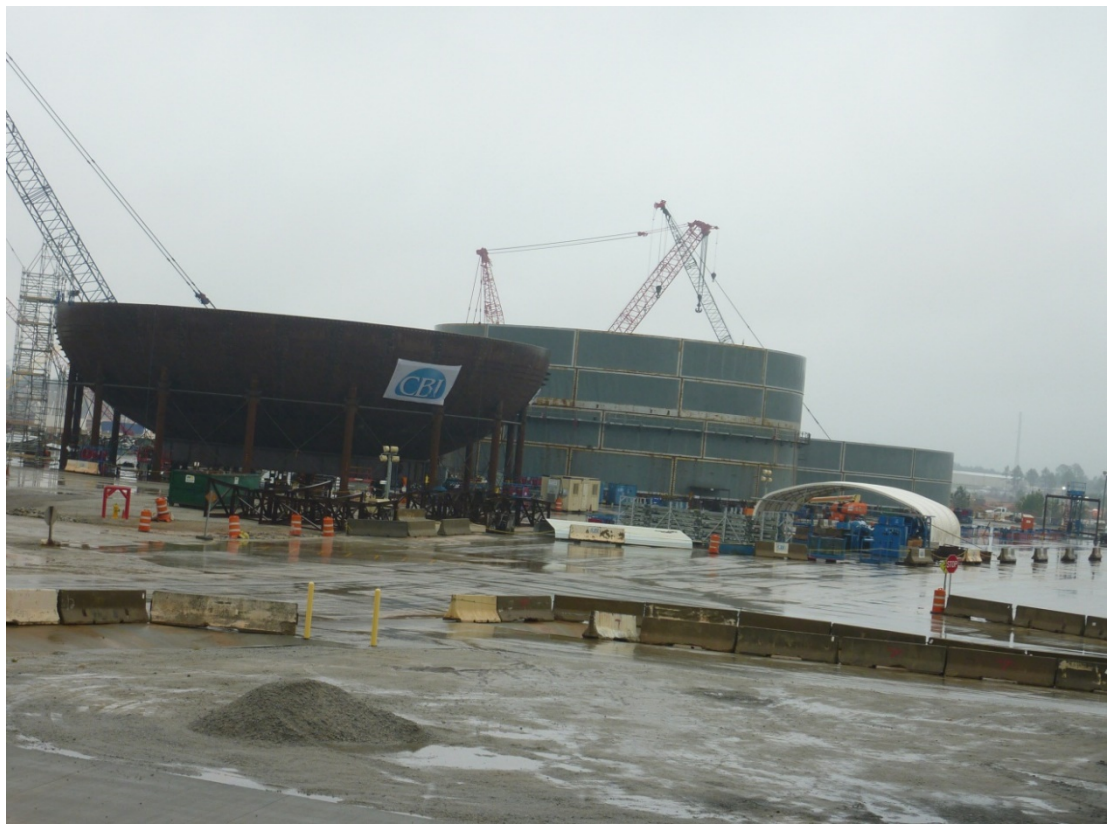
1987 ,1989 Commercial Operation

Vogtle 3,4 1117Mw AP1000

2016,2018 Commercial Operation

Passive Reactor



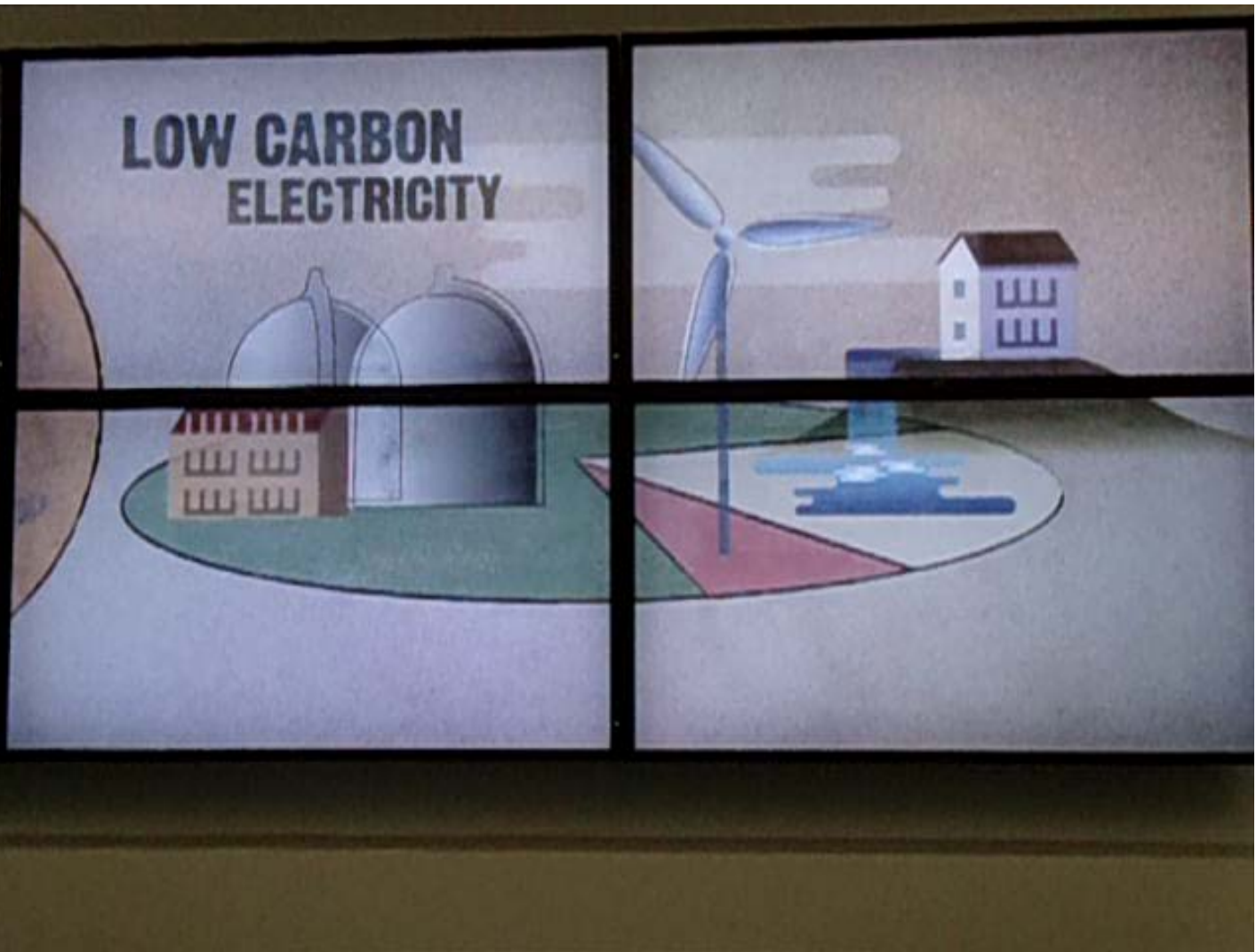




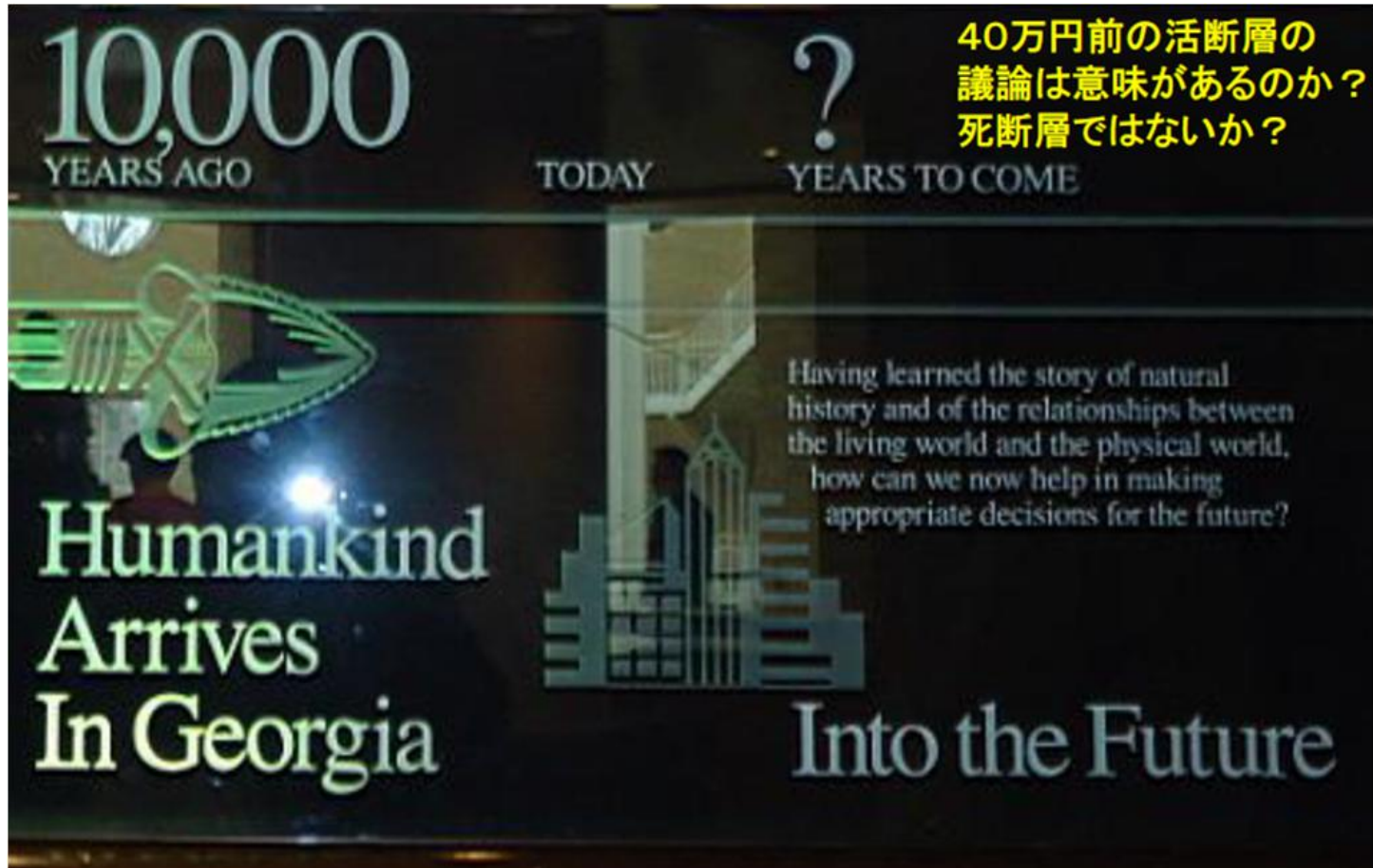




LOW CARBON ELECTRICITY



First Humankind arrives in Georgia 10,000 years ago



Zion NPP under decommissioning



Chicago: Zion NPP



Zion NPP



Total cost of the decommissioning
per one unit is 400 Million dollar

放射線量「評価は首相官邸に聞いて」…文科省

B!

4

おすすめ

6



おすすめ



チェック



携帯に送る



特集 福島原発

文部科学省は16日、事故を起こした福島第一原子力発電所の周辺で屋内退避の指示が出ている地域で、事故後初めて放射線量を観測した結果を発表した。

約20キロの地点では、最大で毎時330マイクロ・シーベルトだった。同省は「一般的には高い数値だが、健康への影響があるかどうかなどの評価は首相官邸に聞いてほしい」としている。

胃のX線検診を受けると600マイクロ・シーベルトを浴びるとされ、今回の結果は、その半分程度にあたることになる。同省はすでに首相官邸に報告したとしている。

同省は15日に福島第一原発周辺から半径20～30キロ内で放射線量の測定を始めることを決定。観測車両6台のうち、先着した車両が同日午後8時40分から約10分間、発電所から北西約20キロの福島県浪江町周辺の3地点で観測し、車外で毎時240～330マイクロ・シーベルト、車内で同195～300マイクロ・シーベルトとなった。16日以降、観測地点を変えて引き続き調査を行う。

(2011年3月16日10時48分 読売新聞)

Dr. ElBaradei and I made the speech at Sep 11th memorial by International Security Society at Philadelphia Convention Center



ElBaradei Calls for Global Dialogue

Sept 11, 2012 Memorial Speech at Philadelphia Convention Center

- One of the most important elements of maintaining any close relationship is **healthy, open communication**.
- If you want **Iran** to change their behavior, then you better talk to them and the **Islamic world**.
 - Addressing the root of the problem would be finding out if and **why Iran** would feel like it would need **nuclear weapons in the first place**.
 - **US and Russia have 19,000 nuclear weapons which can break the world 10 times. Crazy!**



2012. 10. 12
Best Alumni
Award from
Univ of Michigan

Congratulated by
Governor of
Michigan State,
Mr. Rick Snyder

Chelnobyl Benchmark Visit on December, 2012





Sarcophagus of unit 4
was piled up by
the concrete blocks.

The first stage of the new confinement steel structure was completed on last november. The total structure will complete In 2015 and the buget is 1.5 Billion dollar. This structure will be jacked up and slide on the rail.



There were holes on
the steel roof.





Detail model inside the
reactor building.



НАЦІОНАЛЬНИЙ ІНСТИТУТ СТРАТЕГІЧНИХ ДОСЛІДЖЕНЬ

The Strategic Solution Research Center
directly under Ukraine President
Dr Olg NASVIT, Dr Volodymyr RYABTSE



Slavutych City
Model and photo

24,720 people
are living



Створи свій стиль



Embroidered Drawings from
computerized photos

デ
Painting on
glasses





Judo, Sacker and
Boxing players



С.М.Яновська з ученицями Дитячої школи мистецтв на уроці з класу фортепіанного ансамблю. 2007 р.



Інструментальне тріо Дитячої школи мистецтв (зліва направо): Д.Константинова, В.Павлюкова, Р.Саксаренко, лауреати конкурсу "Дебют-2005" і дипломанти міжнародного конкурсу камерних ансамблів у Болоньї (2006 р.) 2007 р.



Н.Ф.Соловйчикова, викладачка фортепіанним відділом Дитячої школи мистецтв, перемагачка конкурсу "Симфонічний рік - 2005". 2007 р.



О.Д.Абраменко, викладачка Дитячої школи мистецтв, нагороджена знаком "За особистий внесок у розвиток міста". 2007 р.



Ансамбль струнників Дитячої школи мистецтв. I-й з'їзд - В.А.Ілляшов, викладач. 2007 р.



В.А.Галущак, викладачка по класу струнно-щипкових інструментів дитячої школи мистецтв за В.Б. Гравоткіна, конкурсистка з ученицями. 2007 р.



Л.Ю.Розенберг, викладачка по класу музиканти, викладачка відділом народно-вокального інструменту Дитячої школи мистецтв. 2007 р.



Л.А.Ткаченко з ученицями Л.Б.Соловйчикова, викладачка обласного конкурсу "Дебют".

Music
activities



Painting
activities

Hospital Complex







Heaven for children



Radiological and Medical
Research Center

Clinic and 600 in hospital

23,370 people are registered
who received the radiation from
Chelnobyl in Ukraine and should
have the examination here
once in two years.

We have 23,370 people's database. The ratio of their sickness is same as the normal hospital. The ratio of cancer is same.



National Agricultural Radiation Research Center
Director General Dr. Kashparov

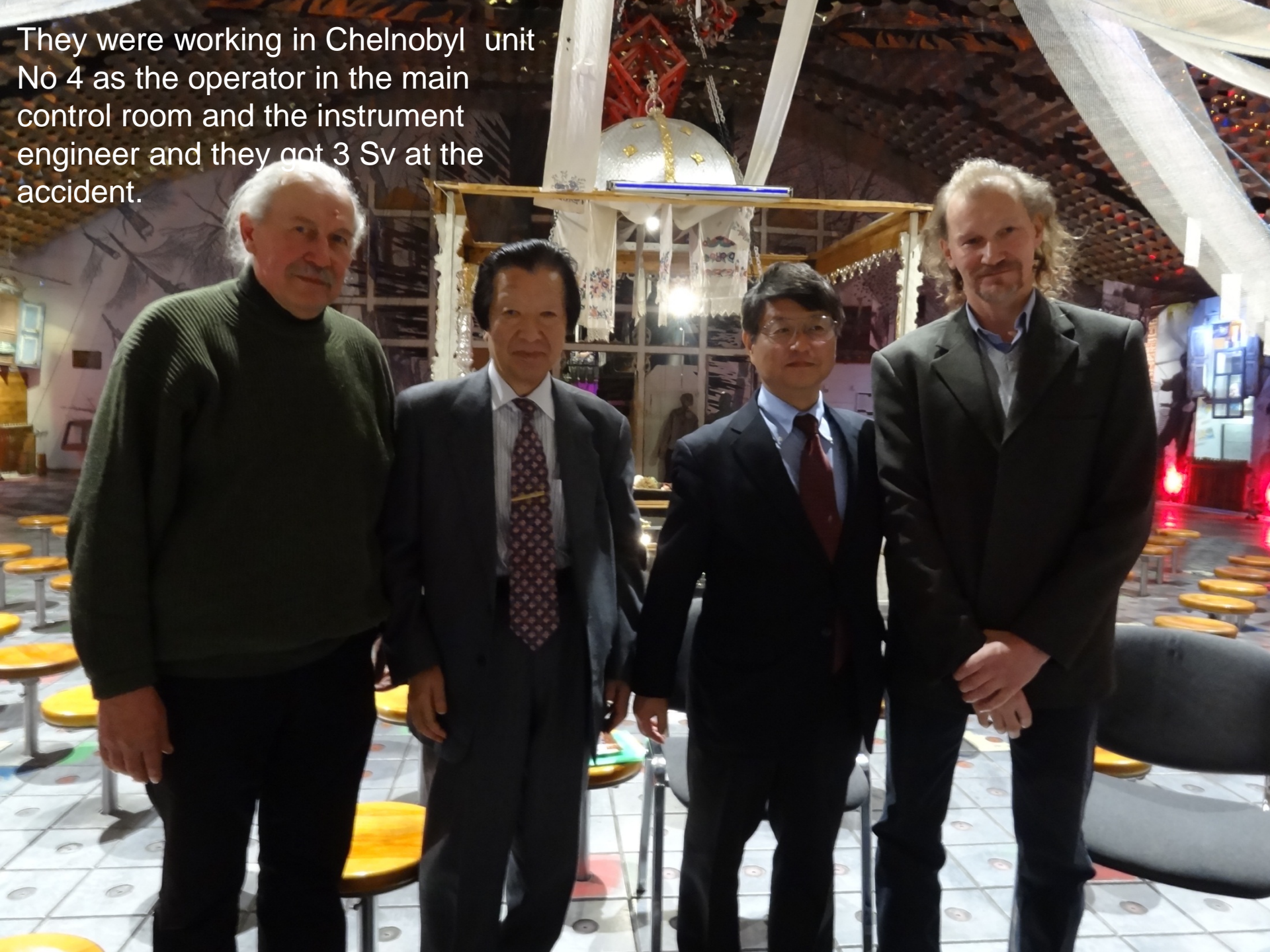




Powdered Prussian Blue which
can exhaust the caesium from
the saw to the ratio of 1/17 by
eating them for 2 months



They were working in Chelnobyl unit No 4 as the operator in the main control room and the instrument engineer and they got 3 Sv at the accident.



4. IAEA Expert Group

IAEA Expert Group conclusion on Fukushima



IAEA
International Atomic Energy Agency

IAEA
Original English

- This June, IAEA expert group visited Fukushima.
- This group is composed by **18 experts from 12 countries** headed by Mr **Weightman** from HSE, UK.
- There is Jennifer **Uhle** from **USNRC**.
- They summarized **15 conclusion** and **16 recommendation**.

MISSION REPORT

THE GREAT EAST JAPAN EARTHQUAKE EXPERT MISSION

IAEA INTERNATIONAL FACT FINDING EXPERT MISSION OF THE FUKUSHIMA DAI-ICHI NPP ACCIDENT FOLLOWING THE GREAT EAST JAPAN EARTHQUAKE AND TSUNAMI

Tokyo, Fukushima Dai-ichi NPP, Fukushima Dai-ni NPP and
Tokai Dai-ni NPP, Japan

24 May – 2 June 2011

IAEA MISSION REPORT

DIVISION OF NUCLEAR INSTALLATION SAFETY

DEPARTMENT OF NUCLEAR SAFETY AND SECURITY

IAEA Expert Group conclusion on Fukushima

1. There is a need to consider the **periodic alignment** of national regulations in particular of the impact of external hazards.

(**every ten years**)

For Fukushima, the original design condition of the tsunami was **3.1m high** and **in 2002** they revised to **5.7m** and ACRS member indicated there is the evidence of **15m tsunami** at **Jorgan Earthquake in 869**.

The **actual tsunami** was **14.5m** this time .

List of earthquakes in Japan

From Wikipedia, the free encyclopedia

This is a **list of earthquakes in Japan** with a magnitude of 7.0 or above or which caused significant damage or casualties. As indicated below, magnitude is measured on the Richter magnitude scale (M_L) or the moment magnitude scale (M_w), or the surface wave magnitude scale (M_s) for very old earthquakes. The present list is not exhaustive and reliable and precise magnitude data is scarce for earthquakes that occurred prior to the development of modern measuring instruments.

*This list is incomplete; you can help by expanding it
([http://en.wikipedia.org/w/index.php?
title=List_of_earthquakes_in_Japan&action=edit](http://en.wikipedia.org/w/index.php?title=List_of_earthquakes_in_Japan&action=edit)).*

~BC 200 Year
Yayoi Earthquake

Date ☐	Magnitude ☐	Name of quake	Japanese name	Rōmaj
November 29, 684	8.0–8.4 (unknown scale)	Hakuko Nankai earthquake	白鳳南海地震	Hakuko Nankai
June 5, 745	7.9 M_s	occurred at Minoh		
July13, 869	8.3 M	869 Sanriku earthquake and tsunami	貞観三陸地震	Jōgan s jishin

56th Emperor Seiwa

Present Emperor is 125th.

All victims by the Tsunami have no responsibilities.

I have all responsibility because the god punished my activities as the emperor.

Do not take any tax from these areas attacked by the tsunami.

I will pray at Ise Temple and the officers should go there and help all victims.

Clean up the mass of rubble.



858~876 as Emperor

Jorkan Earthquake and Tsunami attacked the same area in 869.

IAEA Expert Group conclusion on Fukushima

2. Strengthen the management in the case of the severe accident.

The training and education are very important.

In Japan, there is the special training on the severe accident at the job site including the prime minister once a year. But it is a kind of ceremony which means that they do not believe the severe accident really happens.

The complicated structures and organizations can result in delay in urgent decision making.

Who is the boss in the case of SA?

- The site manager called the **president** and the **chairman of TEPCO** by phone.
- The **prime minister** said “I am the expert on the nuke.”
- IAEA representative from Slovenia pointed out Japan is such a country where they need the permission from the prime minister to make PCV Vent and insert the water into the core.

We should determine the captain in the case of SA like **Mr. Harold Denton at TMI** accident and so I invited him to Tokyo last November

IAEA Expert Group conclusion on Fukushima

3. 2007 IRRS (Integrated Regulatory Review Service) indicated the complicated regulatory organizations.

There is no answer on this issue from Japanese Government .

JNESで津波事故、解析済み

2007年度 原子力安全基盤機構年報

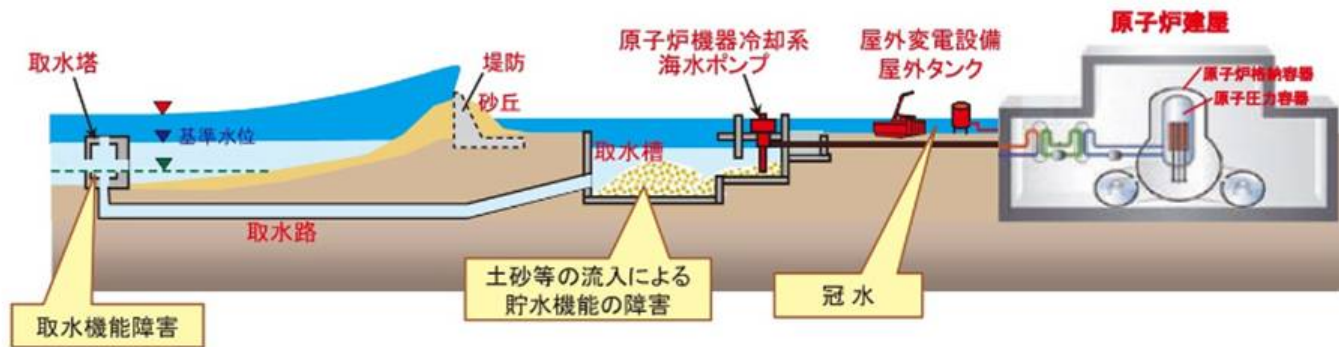
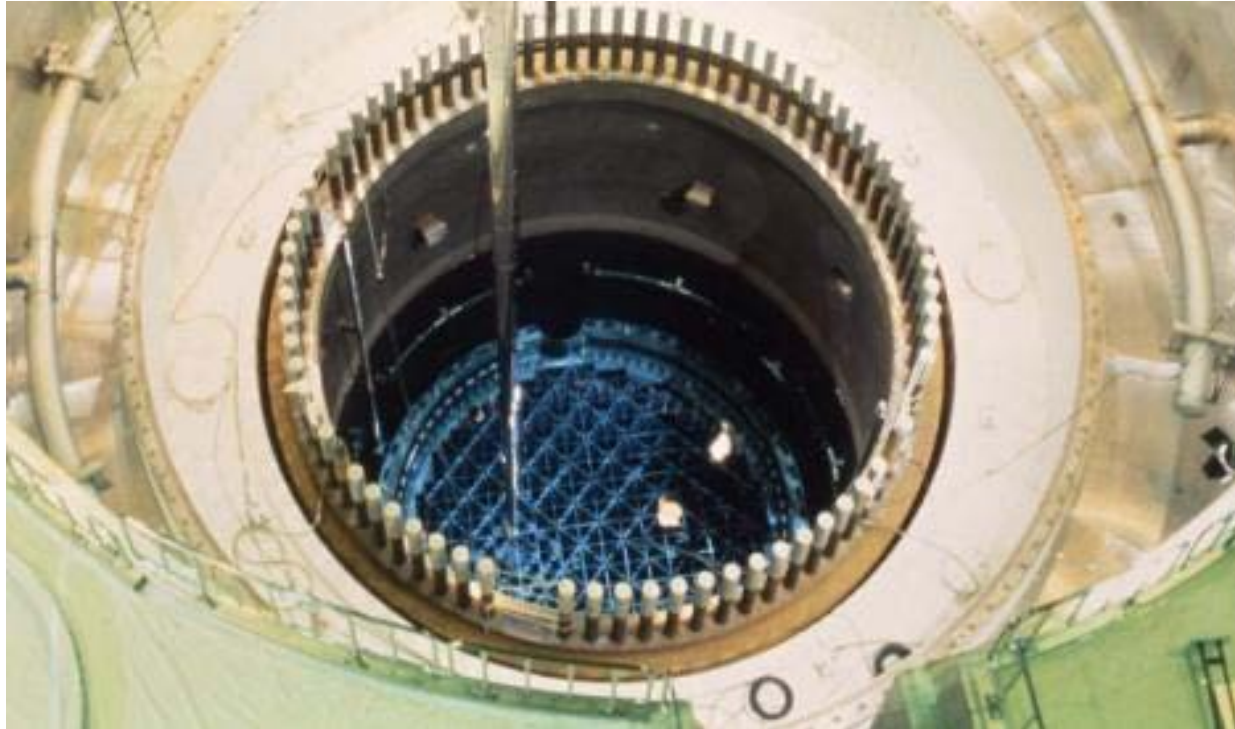


図1 津波遡上が原子炉施設へ与える影響を表す概念図

原子炉格納容器フランジ



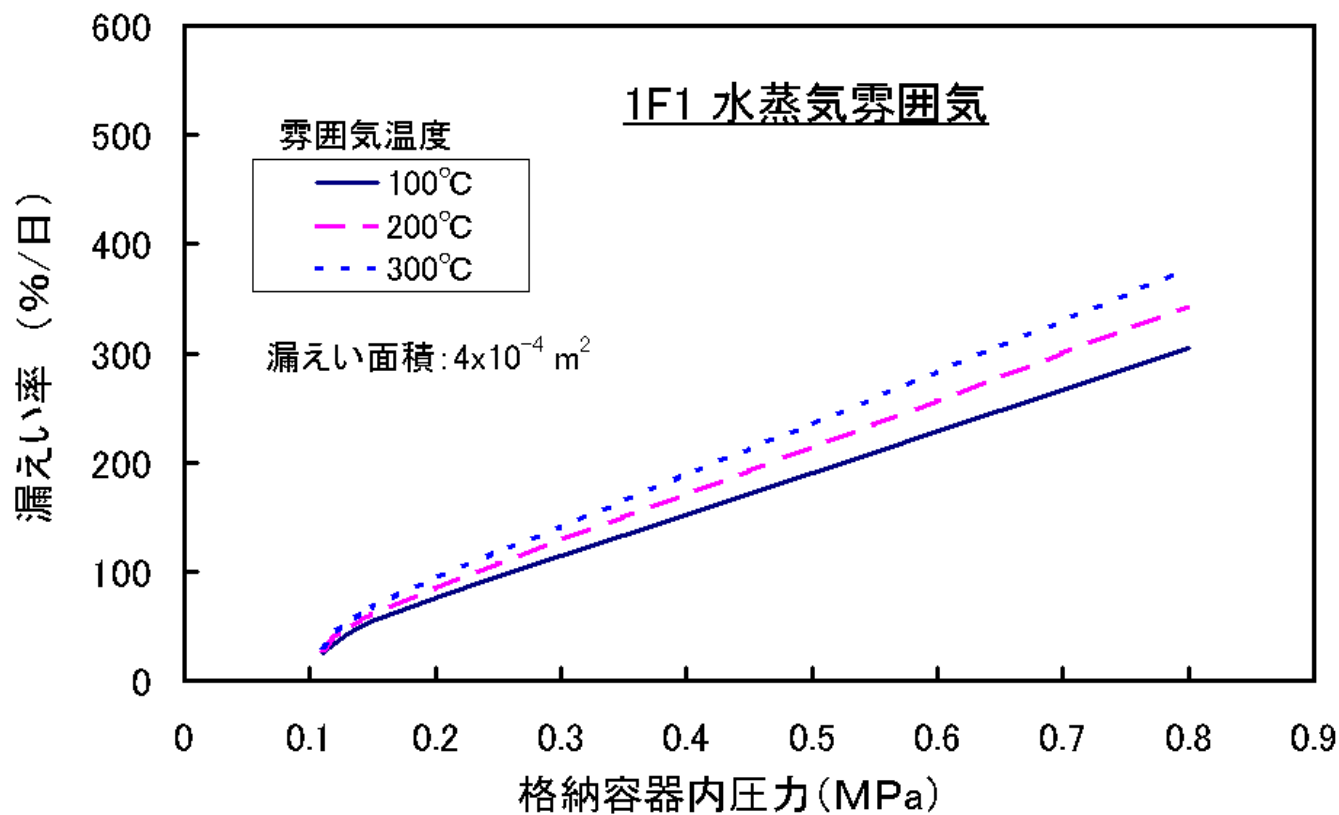
PCVフランジ部ガスケットの高温劣化



NUPECの実験で、278度で漏洩

PCVフランジからの漏洩

2009年JNES発表





Mr Andre Lacoste, Chairman of France ASN

ラコステASN長官退任、シュベ氏就任

- ASNを設立し初代の長官として、世界の原子力界をリードした旧友ラコステ氏が、11月12日退任した。当日パリでは会えなかったが今後は福島^の教訓^の反映で国際貢献するそうである。
- 彼は退任に当たり、次のように述べた。原子力規制は、継続性が必要である。私が退任して、規制の基本が変わってはいらないし、変わらないと確信している。
- 原子力の規制は国際的なものに準拠しており、常に国際的な視野に立つべきである。
- シュベ新長官は、名門のエコール・ポリテクニークを5番以内に卒業したエリートで、ラコステ長官のすぐ下の副長官を勤めており、順当な人事といわれている51歳の若手である。
- 就任の談話がすばらしく、羨ましい限りである。

シュベ新長官の談話(2012. 11)

- 後継者に与えられる優先課題は、
①長期性の認識、②国際的開放性、及び③組織体制である。
- 私の考えでは、長期的な意識を持つこと、国際情報に通じること、及び組織上の事項を考慮に入れることである。
- 長官が交代するから改革が行われるわけではない。切れ目があるわけではない、それが長期性を持つ問題についての基本事項である。原子力施設の認可は60年から100年に及ぶ約束である。
- 第2の国際性について、ASNは、1つの問題を扱う時、それが海外で知られているか、またどのように扱われているか自問するようにしている。
- 第3点は極めて難しい。我々は、組織がどのように構想(設計)されているかという編成方法について判断を求められている。福島以後、我々は、社会的、組織的及び人的要因に関する考察を深めるよう決意した。

2013年4月25日 シュベ新長官と100分懇談
(ASN新庁舎にて)



シュベ新長官の意見(2013. 4)

- 「原子力の規制は、国の約束であり、長期的なもので、継続性が重要である。朝令暮改は先進国のものではない。」
- 私から「地図を見ると国境が存在するが、チェルノビル事故を見ても、原子力には国境はなく、国際的な取り決めが重要である。」との発言
に対し、「水町さんの意見に賛成であり、原子力は、一国の技術ではなく、特に規制は国際的なものでなくてはならない。」と同意された。
- 「福島事故に対し、我々もストレス・テストを行い、クリフ・エッジ（最も弱い場所）を見つけ、対策を講じている。しかし、福島事故は日本の独特な文化と組織的なものが、関与していると思われる。」

Future Benchmark Visits

- Sep 21 to 26

Chelnobyl Revisit with Fukushima people to help them to restore Fukushima area.

- October

Taiwan is going to have the public election on nuke existence.

Taiwan President Mr Ma asked to make the presentation to support nuke.

Dr Arima ,former Minister of Education,

Mr Akimoto, former President tMitsubishi Material and I will be invited to Taiwan.

Future Benchmark Visits

- Nov 10 to 23

Germany to visit PIJ on PCV Vent System

England to discuss with HSE on Severe
Accident

France to discuss with ASN and EDF on
countermeasure of Fukushima

Population Increase in the World

- On October, 2011 the total population became 7 Billion in the world.
- In 1970 there were 3.5 Billion.
- The total population became double in 40 years.
- In 2050, 9 Billion people are expected.
- The most serious issues are energy and food.
- The development of the natural energy are absolutely essential ,but they lack the quantity and quality.
- The solar energy is only 2% even in Germany.

Conclusions

- Japanese utilities completed countermeasure of Fukushima to prepare to restart their plants which installed the equipment against severe accident.
- Every country needs **safe, clean and economical electricity by nuke.**
- USNRC made the **transparent check list to restart** the plant which every country should follow.
- Ukraine created the **dreamy city called Slavutych** near Chelnobyl before two years after the accident.
- As for **the regulation, long term and continuous** one is required and **international aspect is also important.**
- EGSAM should issue the bible how to avoid SA.

