Approach for dose reduction in Sendai NPS

August 30-31,2010

Kyushu Electric Power Co.,Inc.
Nuclear Power Operation Dept.

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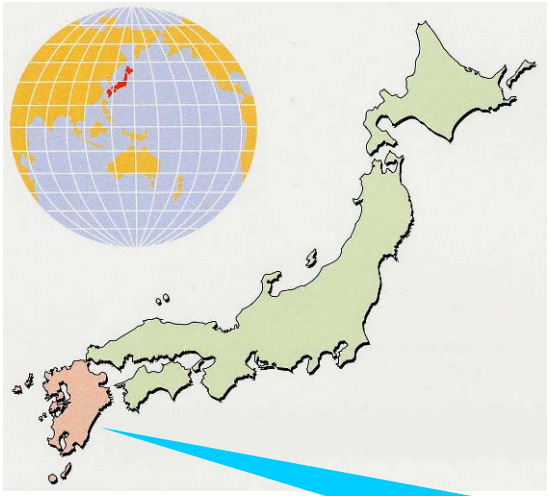
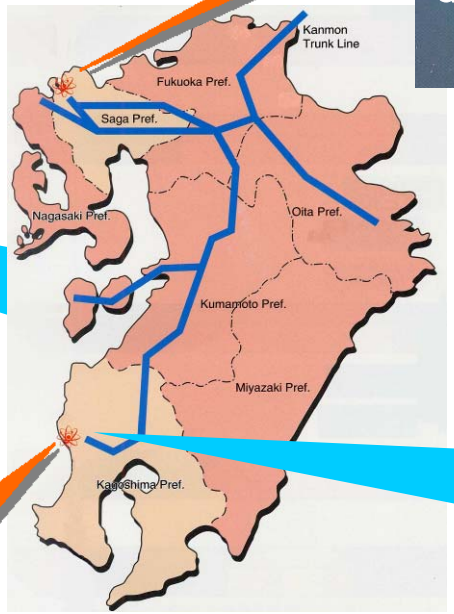
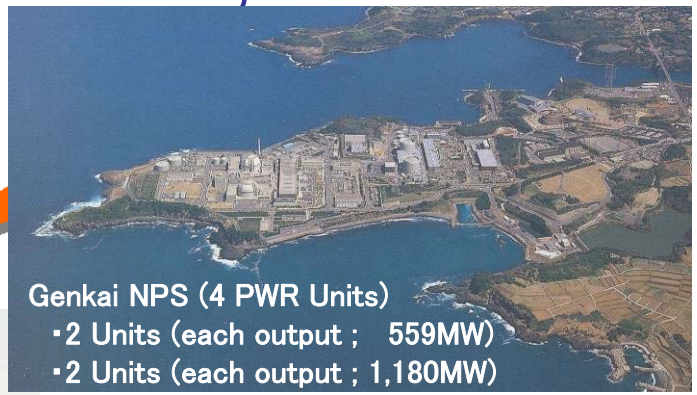
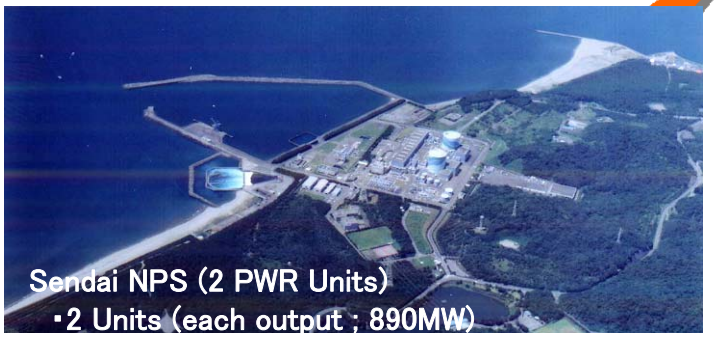
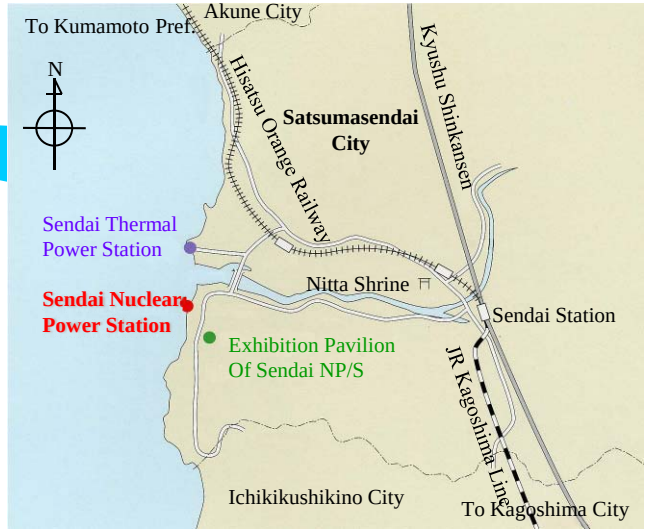










Summary for Sendai NPS

Item \ Unit		No.1	No.2
Location		Gumizaki-cho, Satsumasendai City, Kagoshima Pref.	
Site Area		About 1,450,000 m^2	
Electric Output		890 MW	890 MW
Reactor Type		Pressurized Water Reactor (PWR)	
Fuel	Type	Low enriched UO2 (About 4%)	
	Core Loading	About 72 tons	About 72 tons
Start of Commercial Operation		July 4, 1984	November 28, 1985

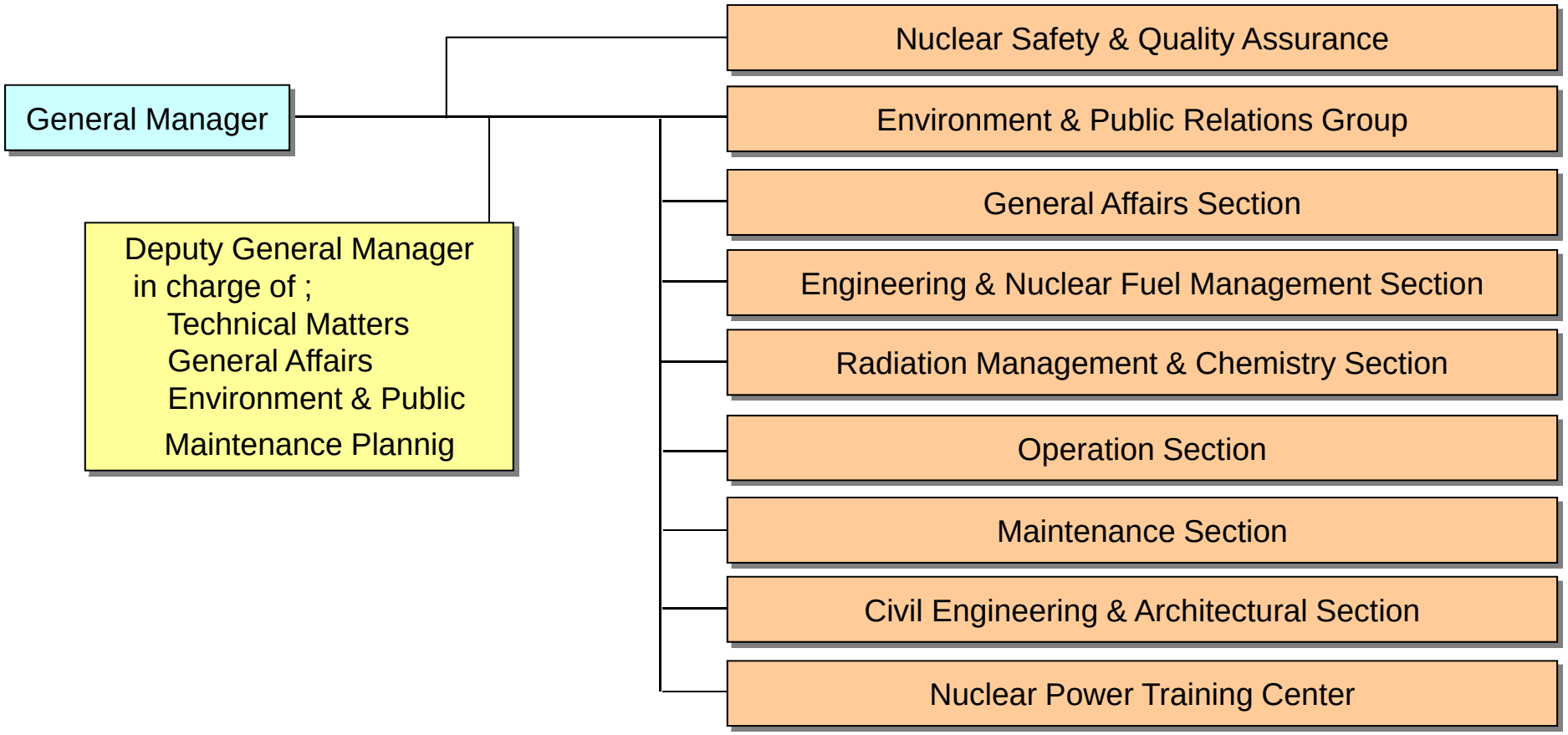
Capacity factor

(as of March , 2010)

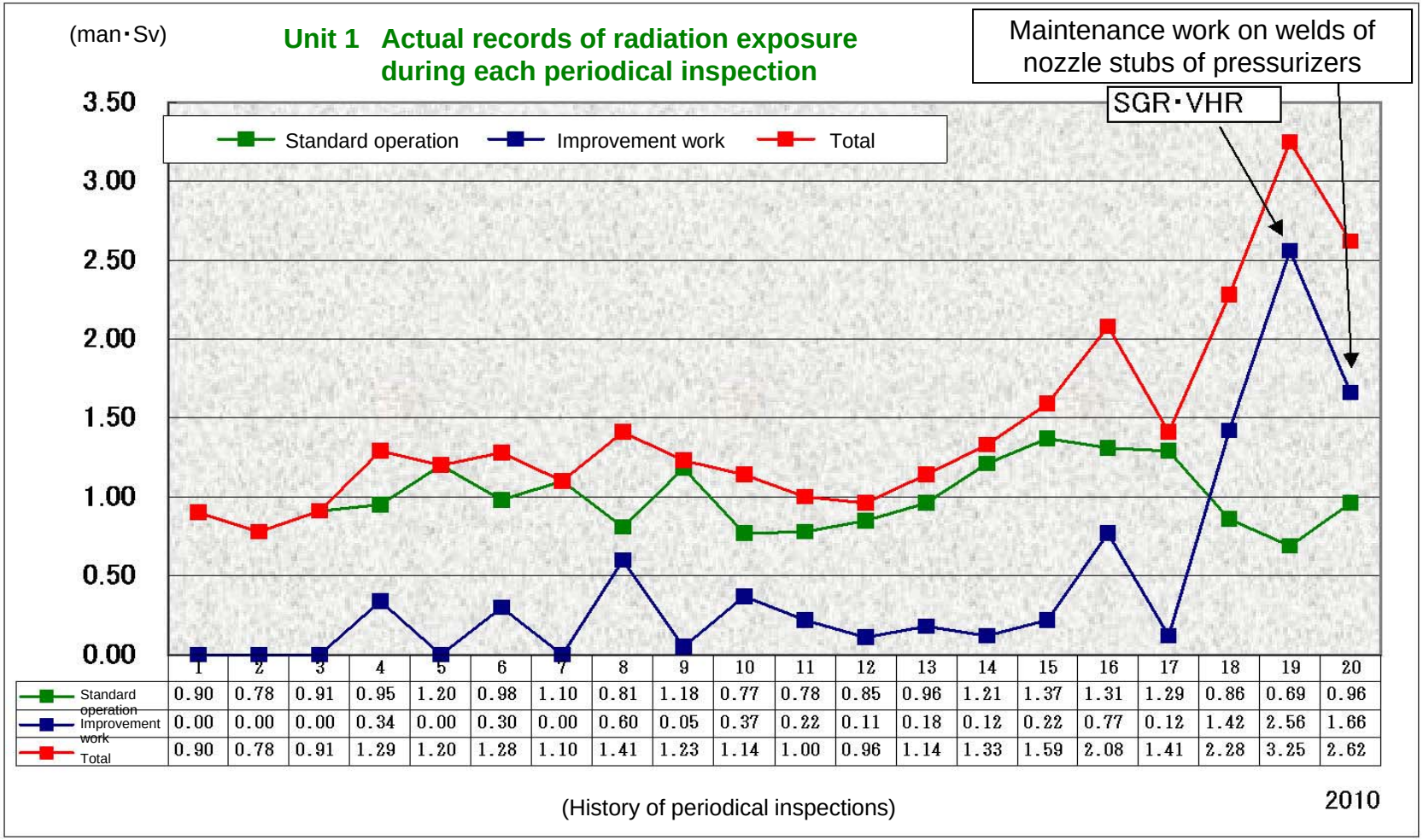
Unit No.1 : 82.4%

Unit No.2 : 84.1%

Organization Chart in Sendai NPS



Sendai Unit 1 Changes in Exposure Doses during Periodical Inspection



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Standard operation	0.90	0.78	0.91	0.95	1.20	0.98	1.10	0.81	1.18	0.77	0.78	0.85	0.96	1.21	1.37	1.31	1.29	0.86	0.69	0.96
Improvement work	0.00	0.00	0.00	0.34	0.00	0.30	0.00	0.60	0.05	0.37	0.22	0.11	0.18	0.12	0.22	0.77	0.12	1.42	2.56	1.66
Total	0.90	0.78	0.91	1.29	1.20	1.28	1.10	1.41	1.23	1.14	1.00	0.96	1.14	1.33	1.59	2.08	1.41	2.28	3.25	2.62

Sendai Unit 2 Changes in Exposure Doses during Periodical Inspection

(man・Sv)

Unit 2 Actual records of radiation exposure during each periodical inspection

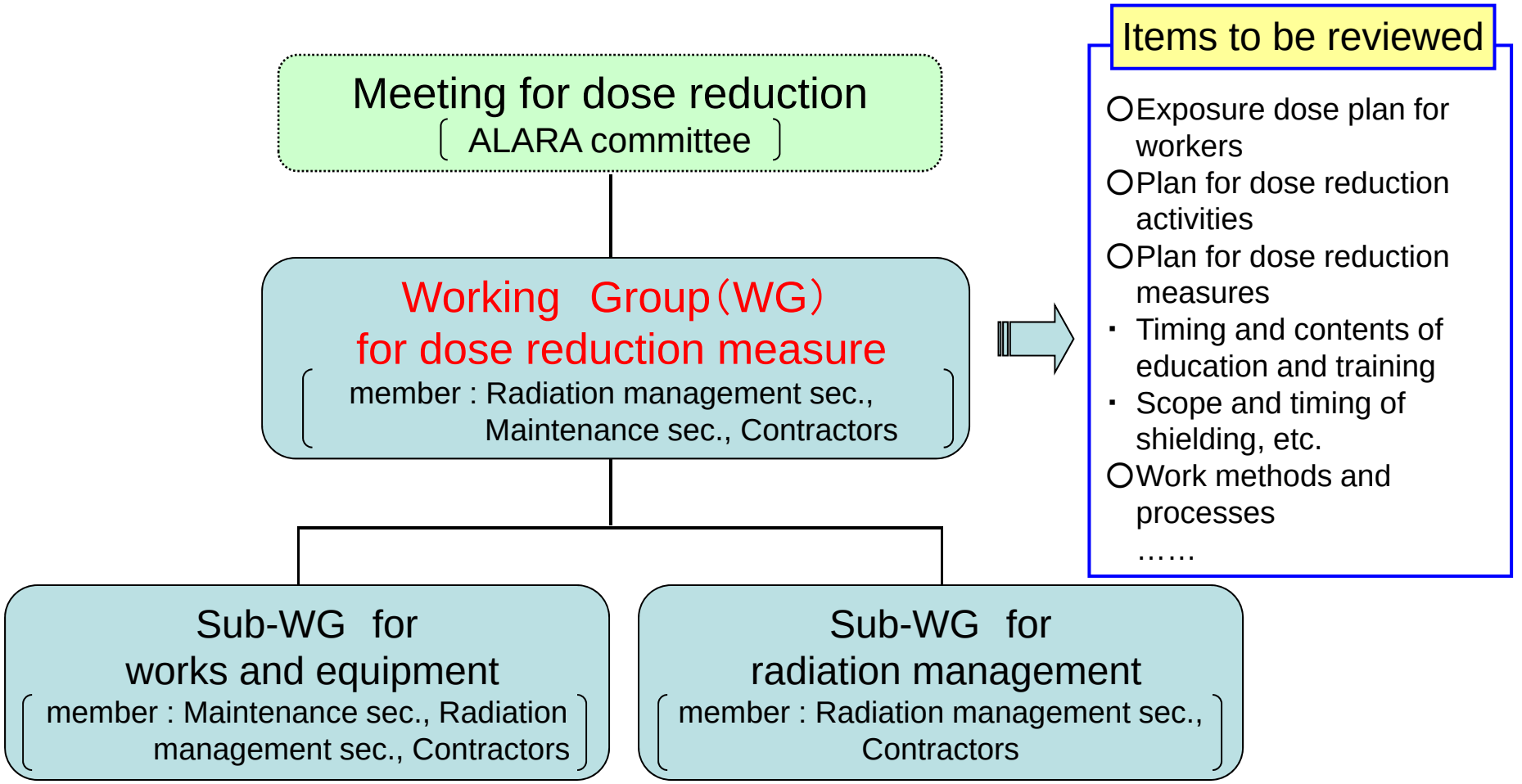
Maintenance work on welds of nozzle stubs of pressurizers

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Standard operation	0.51	0.70	0.72	0.73	0.89	1.06	0.84	0.90	0.99	0.79	0.98	1.12	1.09	1.38	1.29	1.04	0.95	0.89	0.98
Improvement work	0.00	0.00	0.42	0.00	0.20	0.78	0.00	0.01	0.23	0.10	0.14	0.00	0.13	0.38	0.67	0.01	1.15	1.87	1.86
Total	0.51	0.70	1.14	0.73	1.09	1.84	0.84	0.91	1.22	0.89	1.12	1.12	1.22	1.76	1.96	1.05	2.10	2.76	2.84

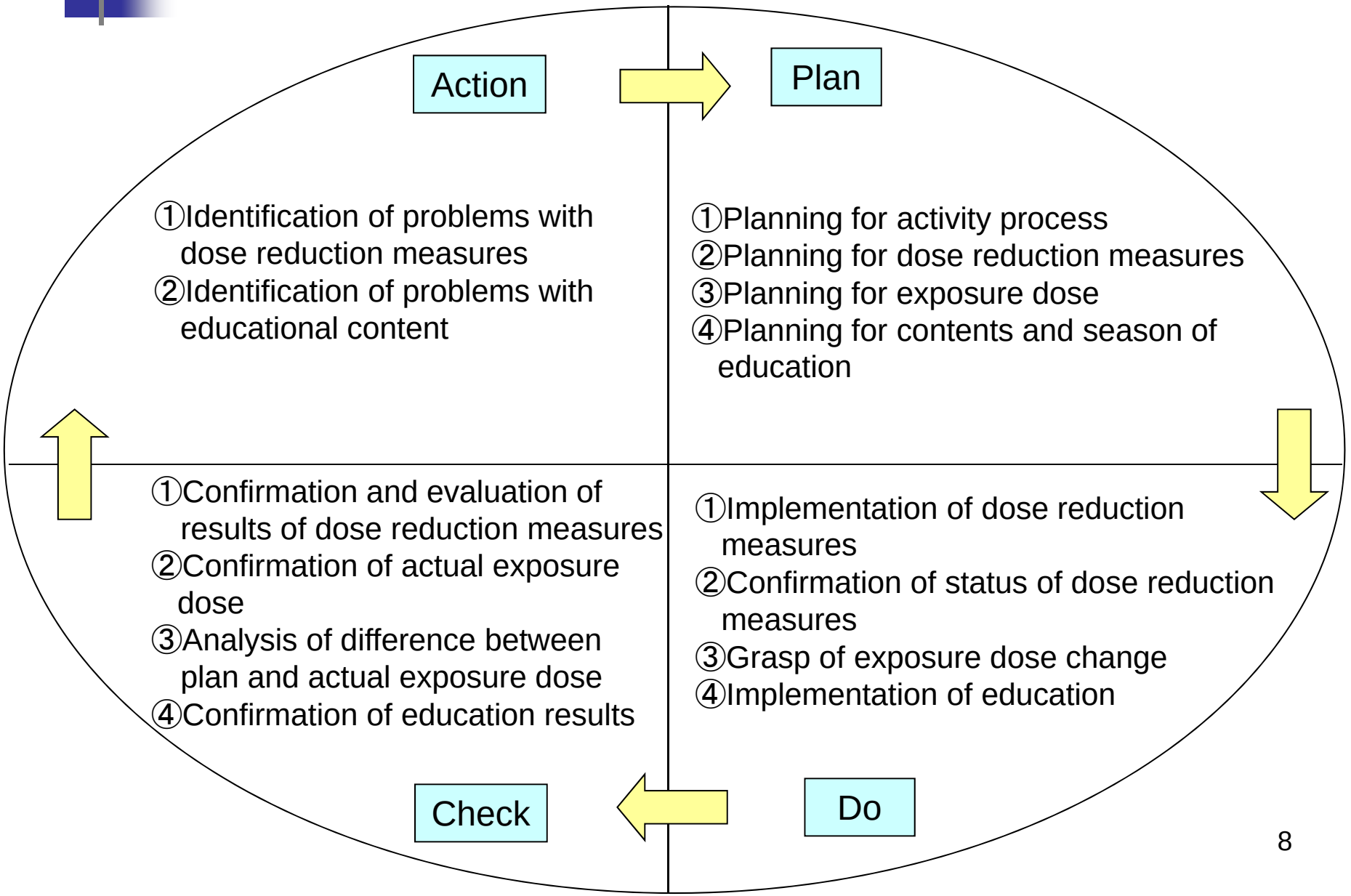
(History of periodical inspections)

2010

Review System for Measures for Dose Reduction and Others



Outline of activities



Plan for Dose Reduction Measures and Others

- Settings of environmental dose levels
  - Based on the previous records of environmental doses and conditions of water quality management, environmental dose levels are predicted before periodical inspection.
- Installation of temporary shields and calculation of planned doses
  - The scope of installation of temporary shields is decided in consideration of prediction of environmental dose levels, places of work and details of work. Moreover, the planned doses are calculated based on the environmental dose levels after shielding.
- Plan for dose reduction measures
  - Dose reduction measures are planned in consideration of matters reflected from the previous periodical inspection and dose reduction measures taken by other nuclear power plants during improvement works.

Results of dose reduction measures

(1) Work processes
(2) Temporary shields
(3) Calling workers' attention
(4) Improvement of awareness
(5) Education

(1) Work processes

- Limited access to areas with high dose equivalent rates
  - Access to the loop room and residual heat removal (RHR) system room where environmental doses increase at the time of plant shutdown is limited.

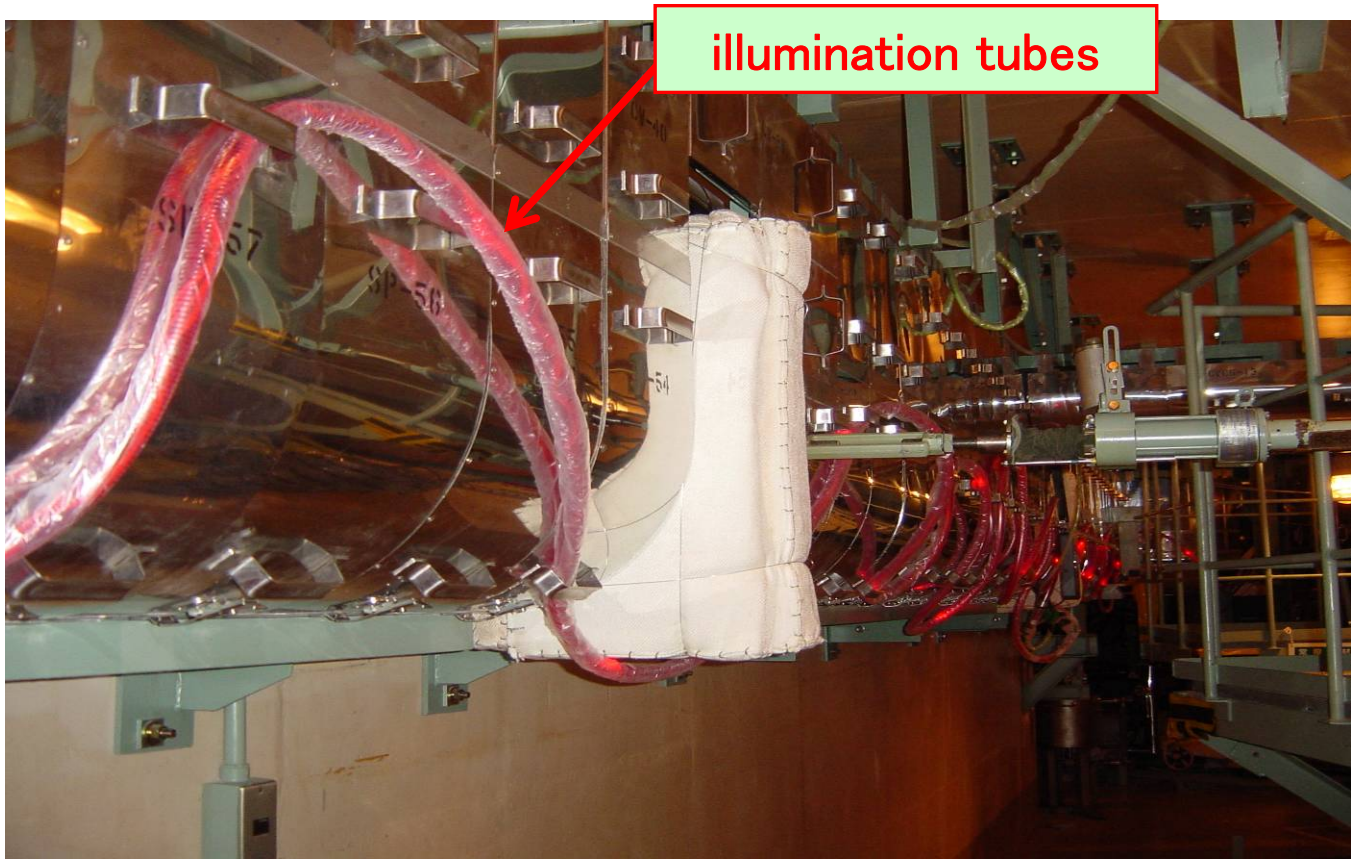
- Change in the timing of drain process on the secondary side of S/G
  - Adjustment is made to conduct the drain process during the night to reduce the effect of dose increase due to the process on the secondary side of S/G.

(2) Temporary shields

- Used temporary shields for major work locations

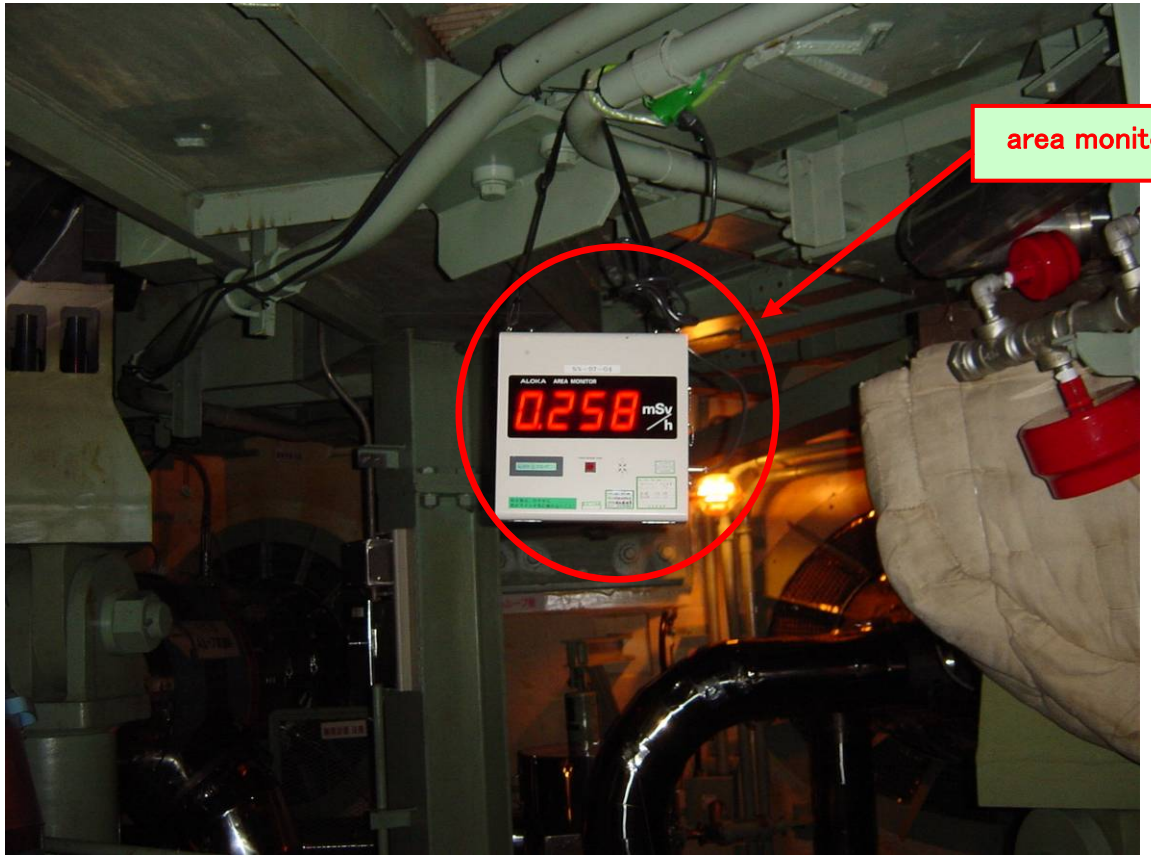
(3) Calling workers' attention(1/5)

a. Installation of illumination tubes



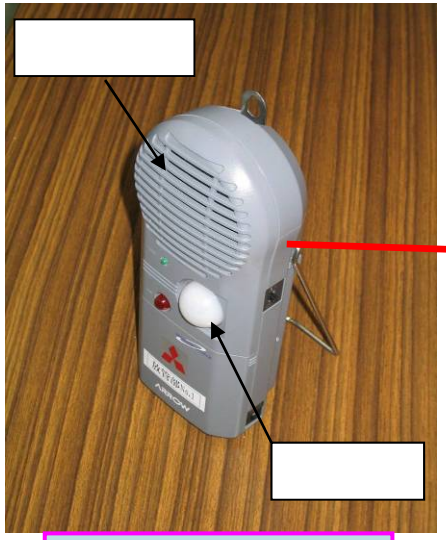
(3) Calling workers' attention(2/5)

b. Installation of area monitors

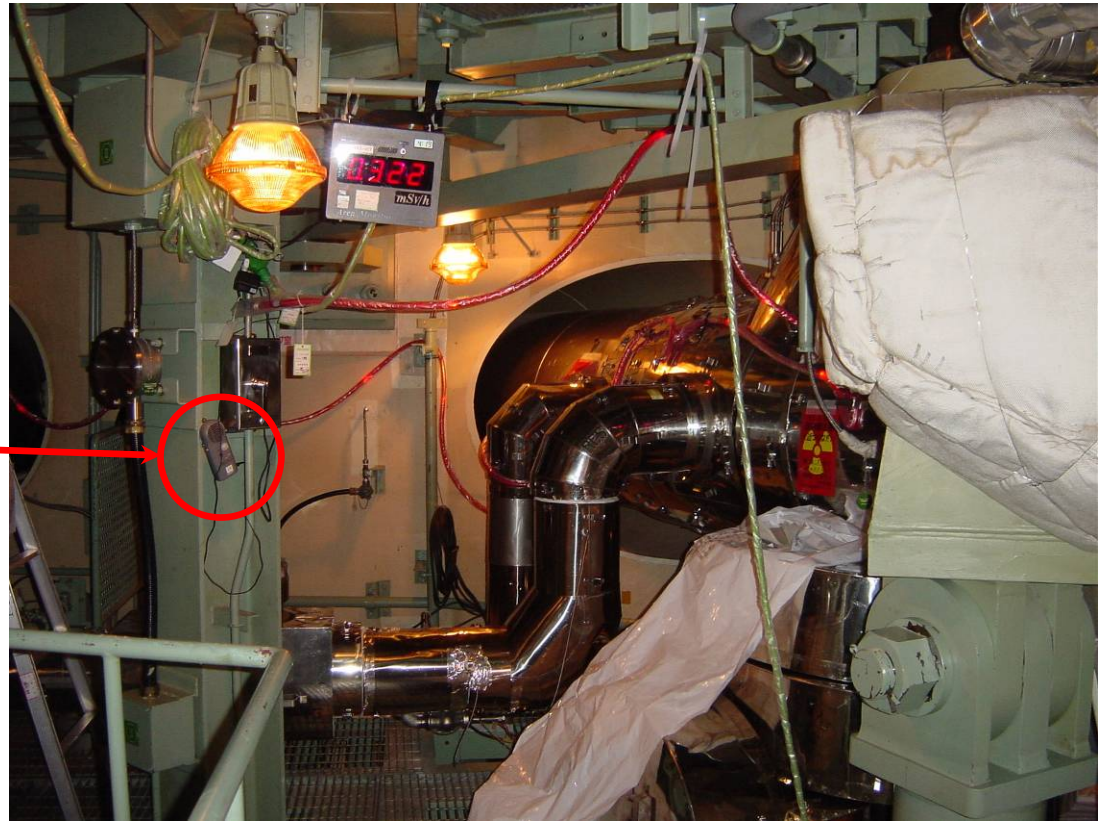


(3) Calling workers' attention(3/5)

c. Installation of voice sensors

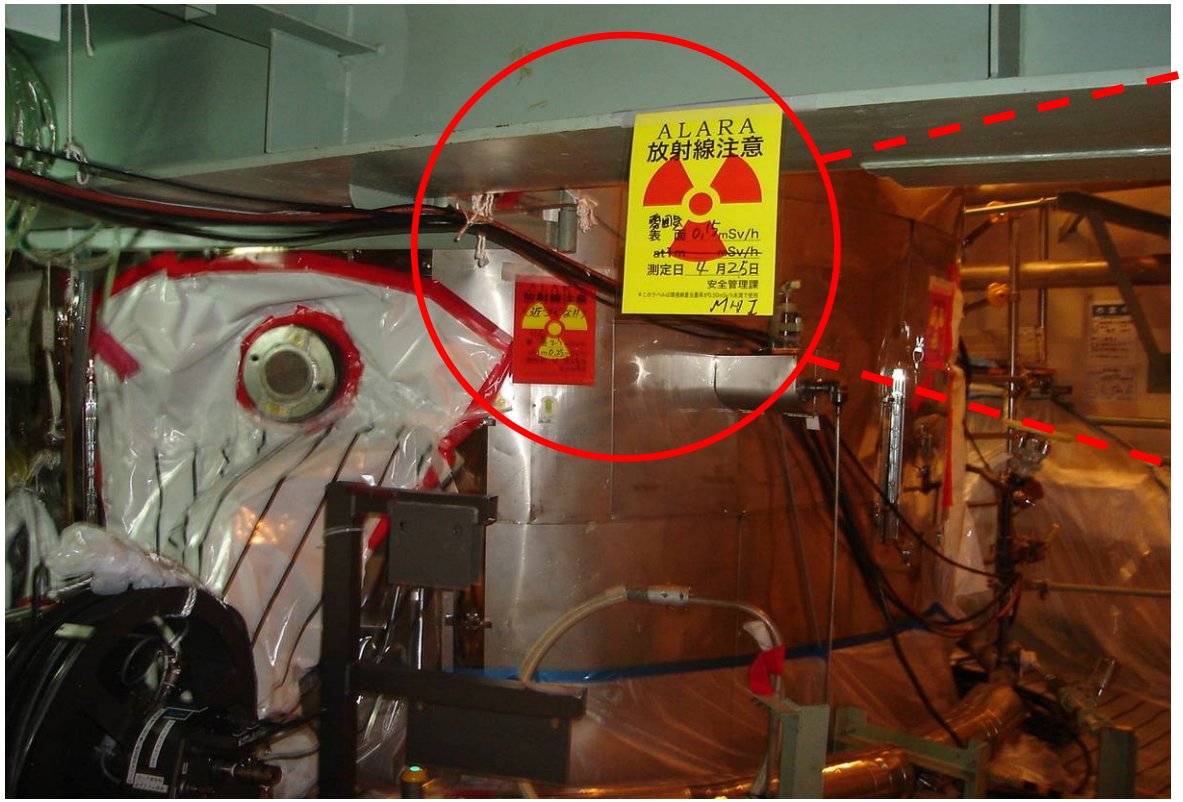


Voice sensor



(3) Calling workers' attention(4/5)

d. Installation of radiation warning signs



ALARA
放射線注意
〈近づくな!!〉

表　面＿＿＿mSv/h
at1m ＿＿＿mSv/h
測定日＿＿月＿＿日
安全管理課
＊このラベルは線量当量率が0.50mSv/h以上で使用

ALARA
放射線注意

表　面＿＿＿mSv/h
at1m ＿＿＿mSv/h
測定日＿＿月＿＿日
安全管理課
＊このラベルは線量当量率が0.50mSv/h未満で使用

(3) Calling workers' attention(5/5)

e. Clarification of signs for waiting areas

sign for waiting area

green sheet

(4) Improvement of awareness

Radiation management patrols

○ Implemented patrols together with radiation management officer from each company

○ Contents of principal activities

- Confirm status of dose reduction measures
- Give guidance and advice to workers on radiation dose management
- Ensure consistent use of waiting areas

（5）Education

Implemented education of radiation management on a periodical inspection

○ Objects：Staffs in NPS (including contractors)

○ Contents

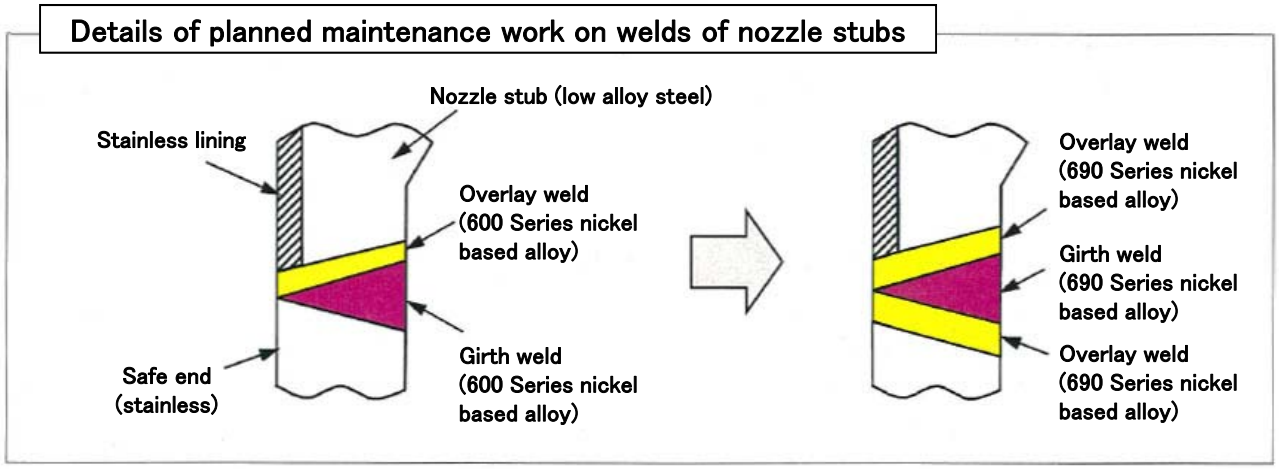
- The aim of ALARA
- Education related to radiation protection
- Essential items for radiation management
- Contents of dose reduction measures

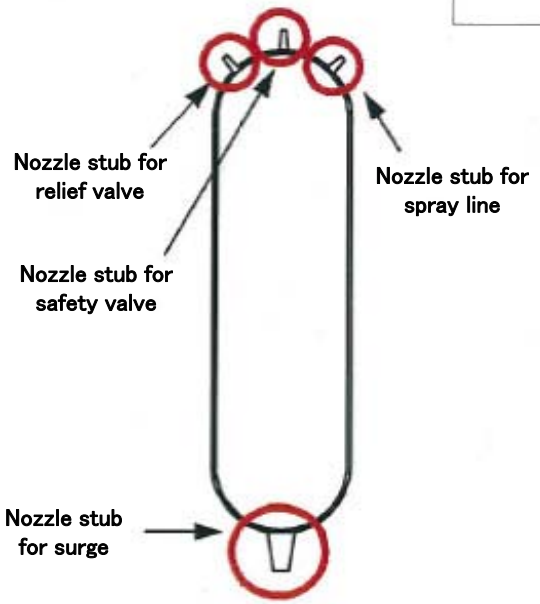
Evaluation of Dose Reduction Measures and Reflection in the Next Periodical Inspection

- The exposure dose plan for workers and actual records of exposure doses are compared with each other, the factors that may increase or decrease exposure doses are analyzed, and the results are reflected in the dose reduction measures to be taken in the next periodical inspection.

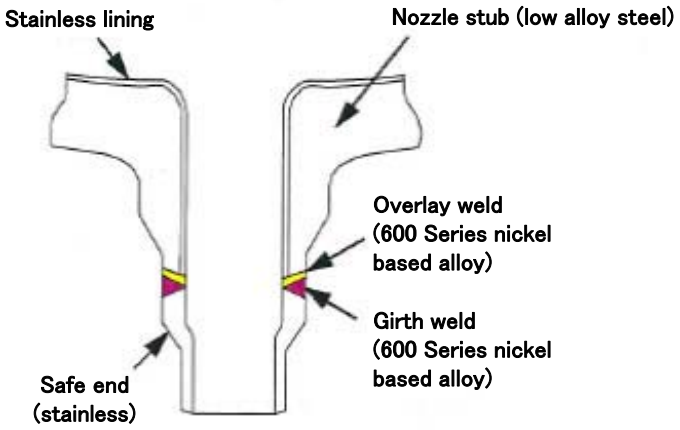
- The exposure doses of the latest periodical inspection decreased by 10-20% from the planned values.

Sendai Unit 1 Outline of Planned Maintenance Work on Welds of Nozzle Stubs of Pressurizers (20th Periodical Inspection)





Schematic diagram of pressurizer



Schematic diagram of nozzle stub

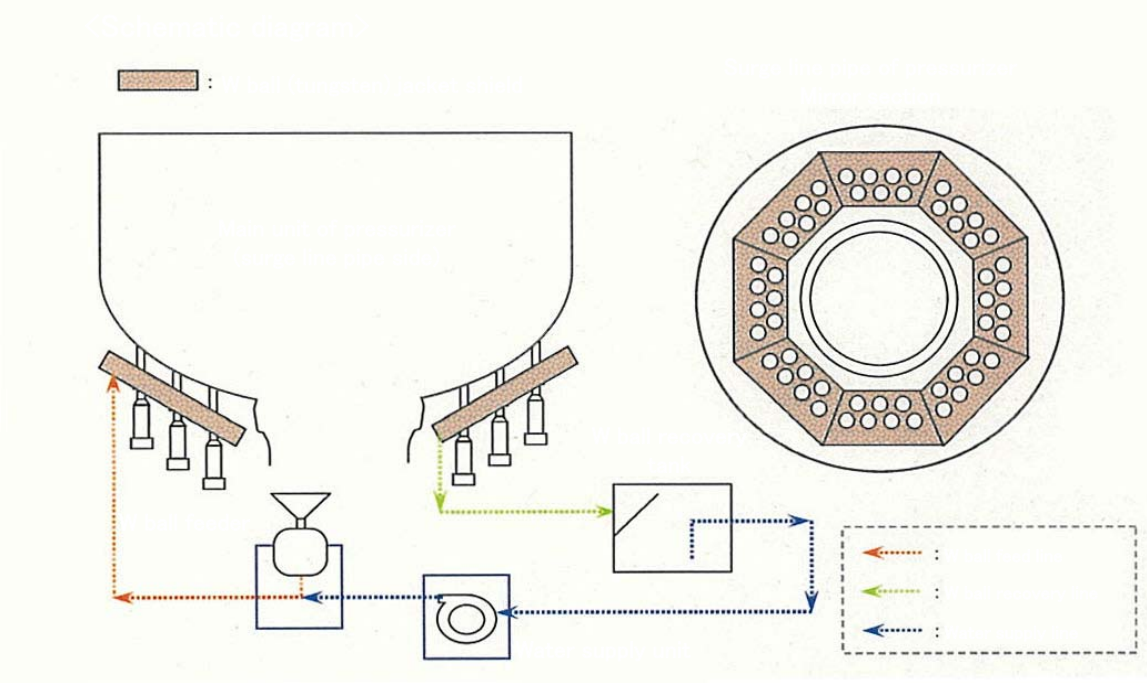
Dose Reduction Measures for Planned Maintenance Work on Welds of Nozzle Stubs of Pressurizers (20th Periodical Inspection)

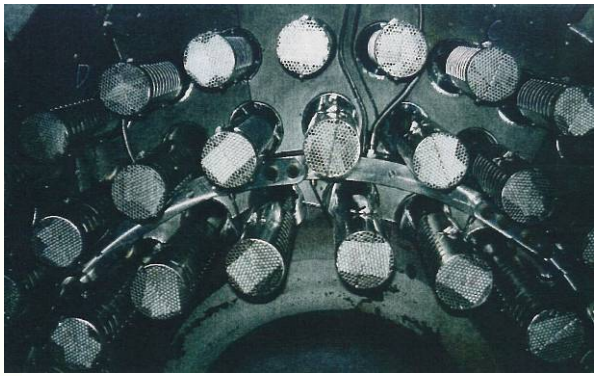
(1) Installation of tungsten ball jacket shield

(2) Installation of screen shield

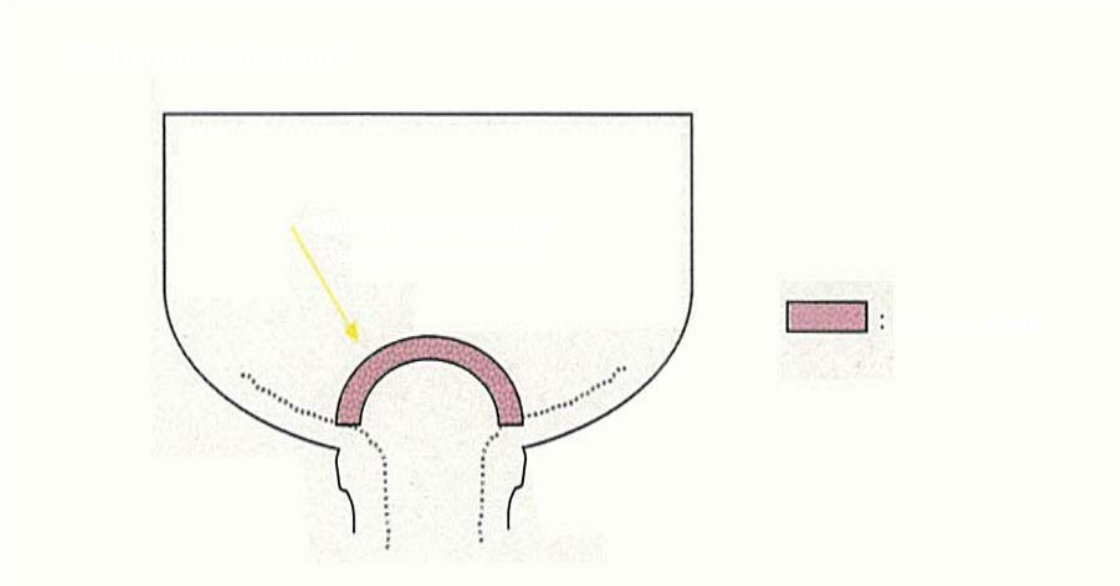
(3) Installation of temporary shield, etc.

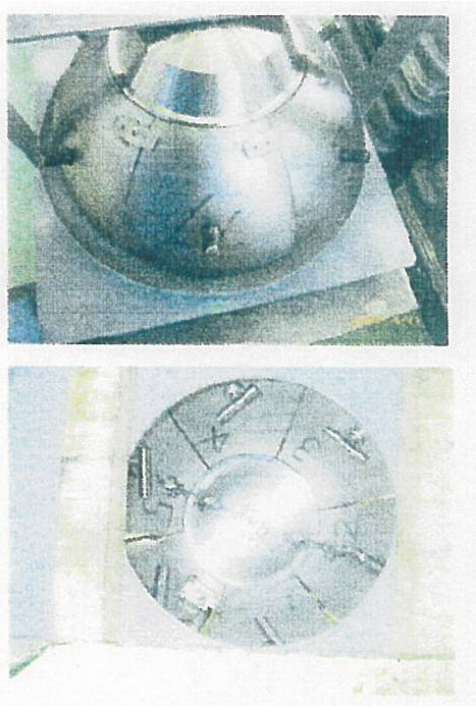
(1) Installation of Tungsten Ball Jacket Shield





(2) Installation of Screen Shield





Sendai Unit 1 Results of Dose Reduction Measures for Planned Maintenance Work on Welds of Nozzle Stubs of Pressurizers (as a whole)

	Measures not taken	Measures taken (actual record)
Exposure doses of planned maintenance work on welds of nozzle stubs of pressurizers	1,446	878

Measures for dose reduction	Reduction effect
Installation of tungsten ball jacket shield	85
Installation of screen shield	22

Conclusion

- The exposure doses during the latest periodical inspection decreased by 10-20% from the planned values as a result of dose reduction activities where PDCA was applied.

- Large-scale maintenance work is now underway, because of aging nuclear power plants which cause an increase in exposure doses during periodical inspection. But we take appropriate dose reduction measures for each work and try to reduce radiation exposure.