# Response to the accumulated water containing radioactive materials that was found in the trench at Fukushima Daiichi Nuclear Power Station (Interim report)

January 6, 2011
Tokyo Electric Power Company

In connection with the directive titled "Regarding the response to the accumulated water which contains radioactive materials (Direction)" (December 19, 2011 NISA No.6), the report mentioned above provides a progress update on the following items undertaken thus far that were instructed in the direction:
“1. Transfer the accumulated water in the trench to a facility so as to manage the water in an appropriate way”,
“2. Detect the incoming route of the water accumulated in the trench so that we will examine measures to shutoff the water”, and
“4. Organize a patrol/inspection plan to check whether there is accumulated water in other trenches that contain radioactive materials”

[The directions]
Considering the fact that the water containing radioactive materials was accumulated in the trench in large volumes, NISA has instructed that we respond to take the following steps and report to NISA in the order of the measures undertaken.

1. Transfer of the water accumulated in the trench

With regards to the accumulated water containing radioactive materials that we found on December 18, 2011, at the Common Pool Duct connected to the Process Main Building, after studying as safe a route as possible and by utilizing the existing transfer hoses, we have decided to transfer the water to the Miscellaneous Solid Waste Volume Reduction Treatment Building that stores high level radioactive contaminated water. The chronology before we transferred the water is as follows:

| | |
|---|---|
| December 19 | Select a route for transfer |
| | Start preparing a jig that connects the existing transfer hose |
| December 22 | Make sure the jig and hose has no omissions like delivery or installation |
| December 23 | Send out the water accumulated in the Common Pool Duct (10:19 am to 20:13 pm) |

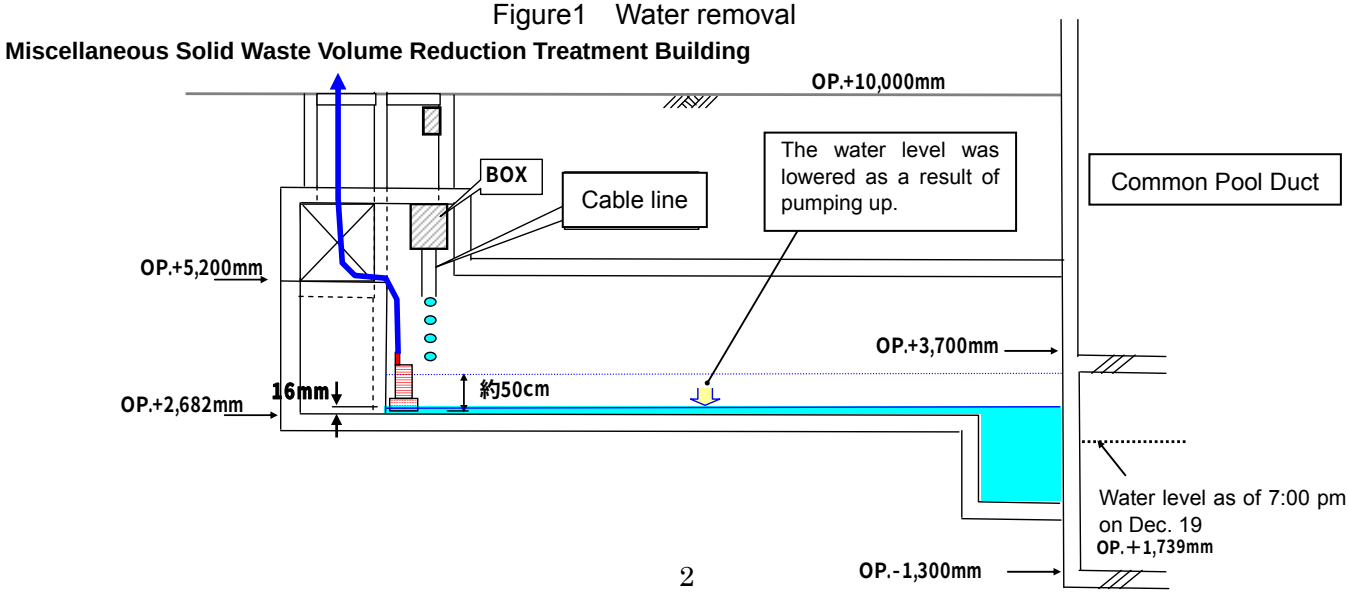
The transfer of the accumulated water was executed by setting an underwater pump near the opening hatches on the trench floor as the Diagram1 shows, since it was difficult to move farther into the trench due to the high concentration of radioactive materials in the accumulated water. Out of the accumulated water, 16mm (220 $m^3$) on the trench floor because of the pump capacity, approximately 120 $m^3$, have been transferred this time.

Meanwhile, we have finished the water proof treatment for the said part and the Process Main Building in April 2011 as the Annex1 shows. As the surrounding underground water level is higher than inside the trench, we do not suppose the accumulated water will leak out, minus any abnormalities regarding the radioactive density surrounding the sub-drain.

Table1　Trench water level and its amount before-and-after transfer of accumulated water

| | Water level in the trench | Transfer amount |
|---|---|---|
| Start of transfer | 504mm on the floor (OP +3,186mm) | Approx. 120$m^3$ |
| Suspension of transfer | 16mm on the floor (OP +2,698mm) | |

Figure1　Water removal



2. Incoming route detection and water penetration stop measures for the accumulated water in the trench

(1) Detecting an incoming route of the water accumulated in the trench

The water (3 tons/day) of relatively low concentration flows into the Common Pool Duct through the cable conduit line. The conduit line is buried directly under the soil, the diameter of which is around 20 mm.

As we could not check the drawings of the conduit line, we interviewed our affiliated companies. As a result, it was found that we had installed a similar conduit line at a power source work carried out about ten years ago to build a PHS relay station. As this conduit line diverges from the lighting power source, and as an opening mouth developed due to the damage incurred to a panel light the Figure 2 below illustrates, the water seems to have moved in through the opening. According to the radioactive concentration we analyzed on January 4 at a puddle on the damaged part of the light, the Cs concentration was almost the same as that which dripped down from the cable conduit line. (Diagram2)

January 4 10:00am The water accumulated in the south of the Process Main Building was collected
16:00pm Analysis results were found.
January 5 11:00am Work to stop the water started.
12:00am The water penetration stop work was finished
January 6 10:30am We confirmed stoppage of the water accumulated in the trench

Table2 Radioactive concentration of the puddle

| Investigation spot | | Radioactive concentration (Bq/cm$^3$) | | |
|---|---|---|---|---|
| | | I-131 | Cs-134 | Cs-137 |
| Puddle at the connected part of the lighting | | ND | $1.5\times10^{-1}$ | $2.1\times10^{-1}$ |
| Common Pool Duct (Between A-A) (Already announced) | Accumulated water in the trench | ND | $4.2\times10^{3}$ | $5.4\times10^{3}$ |
| | Water dripping down from cable conduit line | ND | $1.3\times10^{-1}$ | $1.2\times10^{-1}$ |

(2) Water penetration stop measures

We cut off the cable conduit line as the Figure2 below shows, and stopped the water leakage by using sealing materials at the intake and outlet of the conduit line. On January 6, we confirmed the result of no water incursion from the conduit line located at the trench.

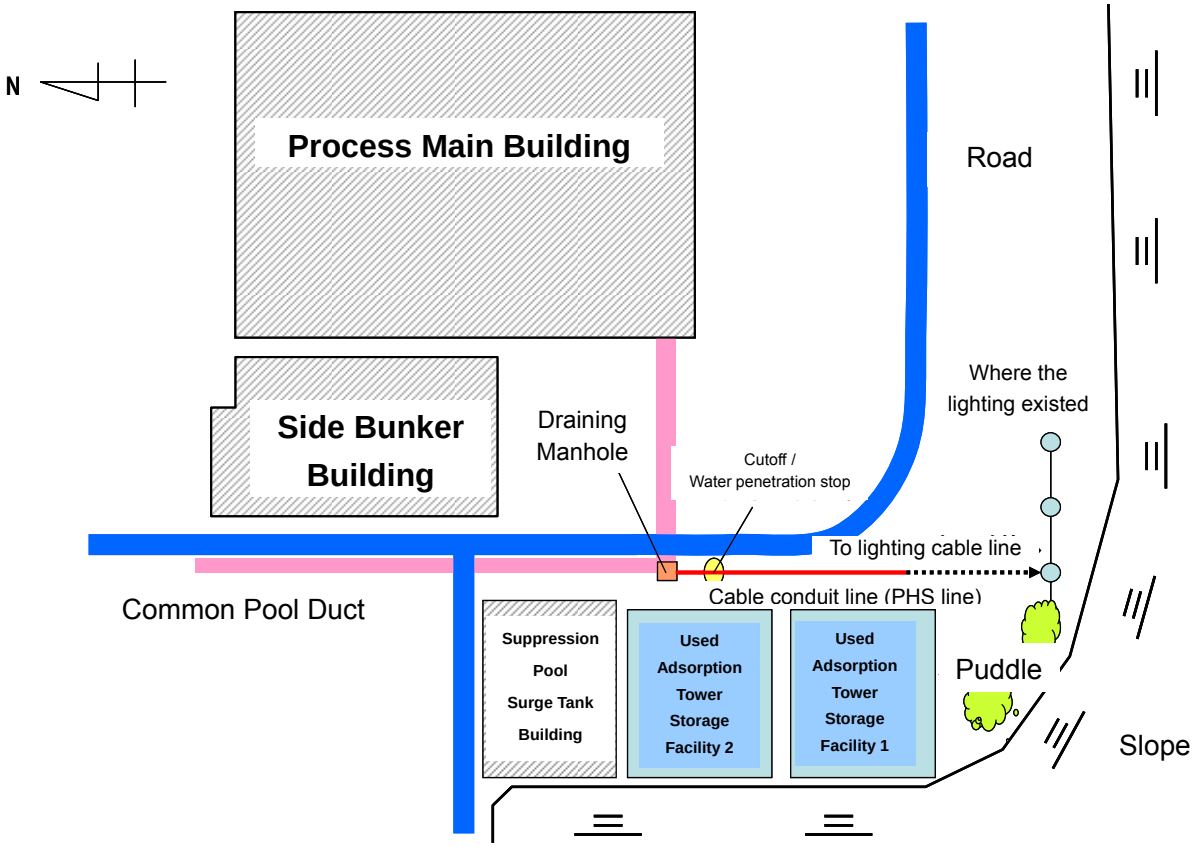



Figure2　Position of cable conduit line


Figure3　Water incursion to cable conduit line

Figure4　Before and after the cutting of cable conduit line

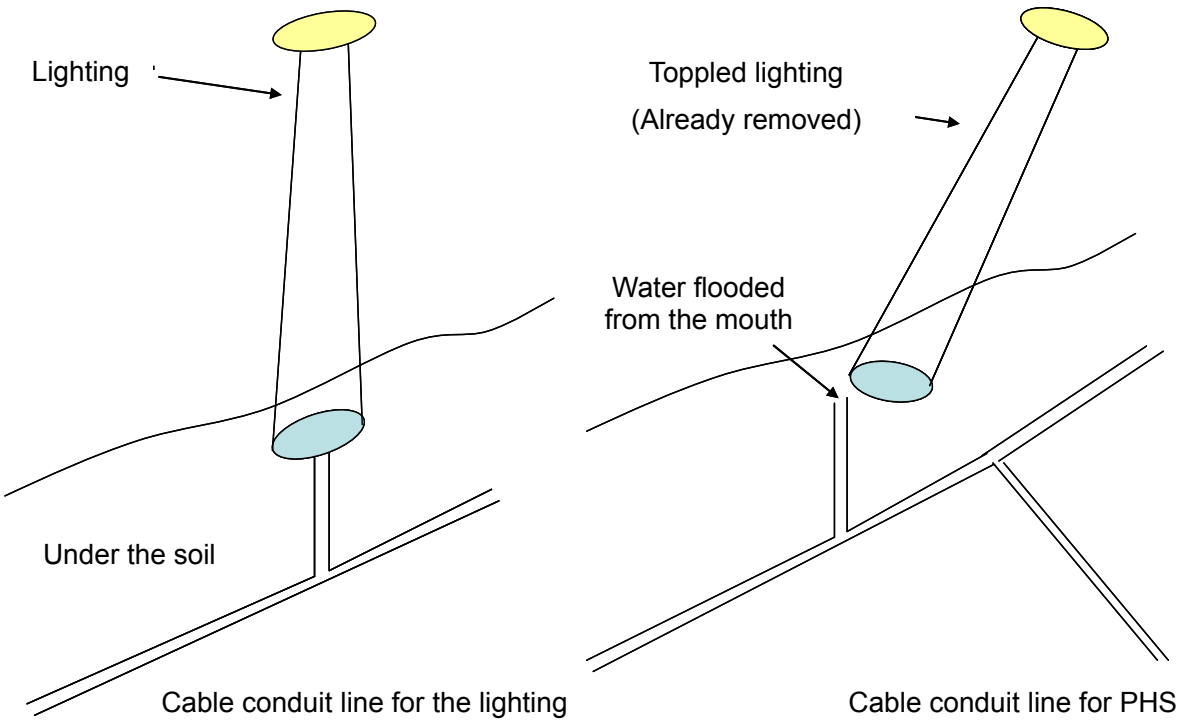



Figure5　Water incursion to cable conduit line (Sketch)

3. Inspection of the trench etc. connected to the Process Main Building and Miscellaneous Solid Waste Volume Reduction Treatment Building

(1) Inspection plan

In response to the accumulated water containing radioactive materials found at the Common Pool Duct that is connected to the Process Main Building, we will inspect the Common Pool Duct, Centralized RW Connecting duct, Regulated Zone Lane, all of which are connected to the Process Main Building and Miscellaneous Solid Waste Volume Reduction Treatment Building. (Figure6)

The inspection of the trench will be conducted by accessing from its opening hatch located on the ground. However, some part of the open hatches are blocked that resulted from filling cement per the countermeasures conducted to transfer the high level radioactive contaminated water to the Process Main Building (①-2,②-1, and ②-2). There also exist some open mouths into which we are unable to access due to the crushed stones and cement wall that we installed to cover up the Reactor Building (②-3, ②-4, ②-5). As the open mounts that we can access are ①-1, ①-3, ②-6 at this time, the trenches which we inspected visually this time are the Common Pool Duct (B-B section) and the Centralized RW Connecting duct ①. It is noted that the Common Pool Duct (A-A section) was already inspected on December 18.

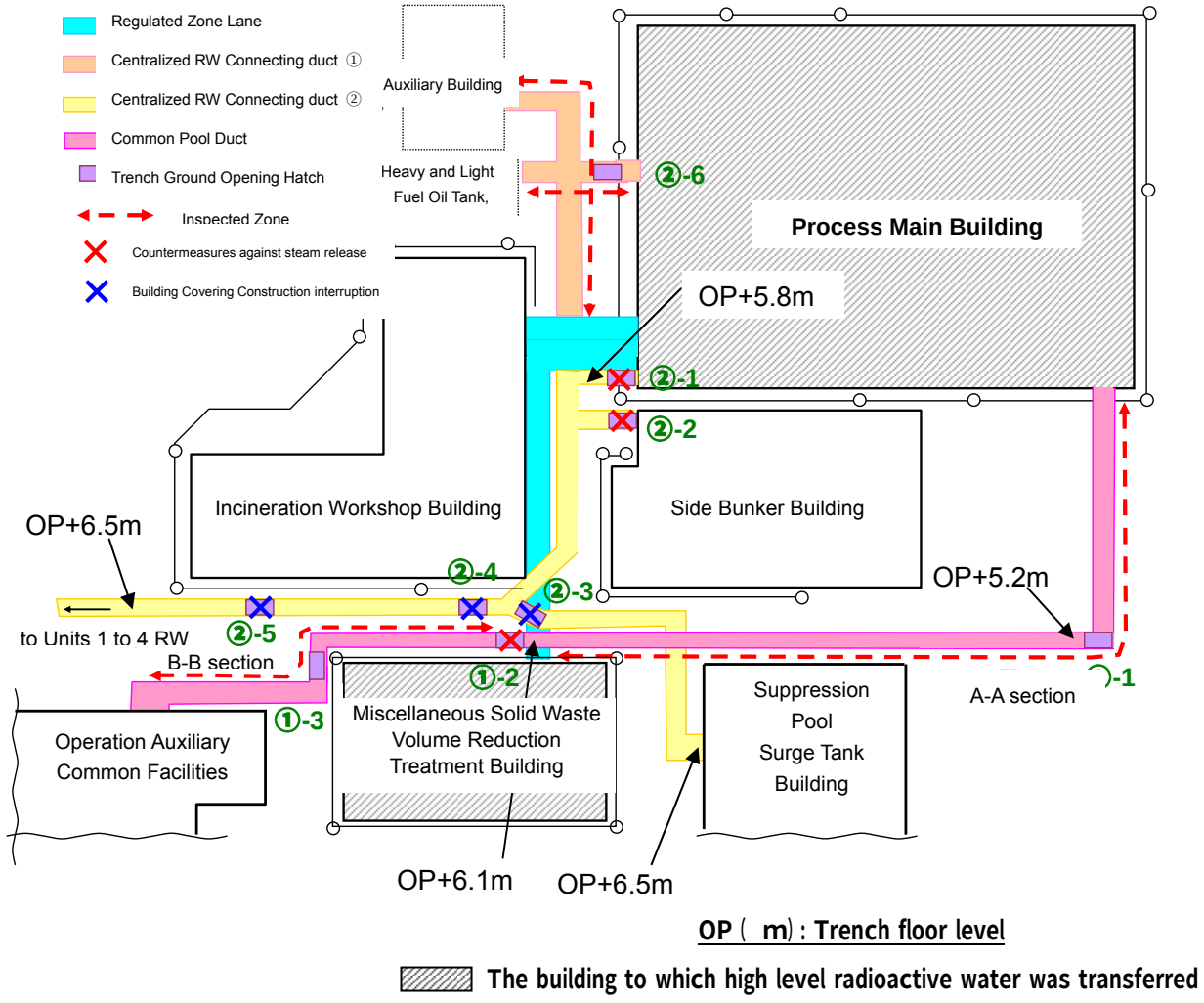



Figure6 Inspected area

(2) Inspection results

The inspection results of the trench etc. are shown in the table 3.

No accumulated water was found at the Common Pool Duct (B-B section). (Appendix-2)

On the other hand, the accumulated water of approx. 142m$^3$ was found at the Centralized RW Connecting Duct ① (Appendix-3). As shown in the table 4, the radioactive concentration of the accumulated water was low. Therefore, it is assumed that the accumulated water resulted from rain water etc., entering in from the opening hatch located at the upper trench rather from the leakage of the highly concentrated contaminated water that was transferred to the Process Main Building.

As previously announced on December 18, 2011, at the Common Pool Duct (A-A section), approx. 220m$^3$ of accumulated water in the south side part and the water dripping from the cable conduit line was found (Appendix-4).

Table3　Inspection Result of Trench, etc.

| Name of Trench/Duct | Confirmation of Accumulated Water | Amount of Accumulated Water（m$^3$） | Inspection Date |
|---|---|---|---|
| Common pool duct (B-B section) | None | — | 11:00 am, Dec. 20, 2011 |
| Centralized RW Connecting Duct ① | Yes | Approx. 142 | 11:00 am, Dec. 20, 2011 |
| Common pool duct (A-A section) | None | Approx. 220 | 1:00 pm, Dec. 18, 2011 （Already announced） |

Table 4　Result of Radioactivity Concentration Analysis on Accumulated Water

| Name of Trench/Duct | Location | Radioactivity Concentration（Bq/cm$^3$） | | |
|---|---|---|---|---|
| | | I-131 | Cs-134 | Cs-137 |
| Centralized RW Connecting Duct ① | Around hatch opening | ND | $1.5\times10^{-1}$ | $1.7\times10^{-1}$ |
| | Around process main building | ND | $7.8\times10^{-2}$ | $1.3\times10^{-1}$ |
| Common pool duct (A-A section) (Already announced) | Accumulated water inside trench | ND | $4.2\times10^{3}$ | $5.4\times10^{3}$ |
| | Water drop at cable conduit | ND | $1.3\times10^{-1}$ | $1.2\times10^{-1}$ |

(3) Possibility of highly concentrated contaminated water leakage at the uninspected area

As for the passages located in the controlled area that we were unable to inspect this time, the leakage of highly contaminated water was found on May 26, 2011, which worked with the water level of the accumulated water in the Miscellaneous Solid Waste Volume Reduction Treatment Building. Also, we assume that there was no leakage towards the outside area considering that there was no increase in the radioactive concentration of the surrounding sub-drains.

As for the Centralized RW Connecting Duct ②, construction to prevent leakage is being conducted by

injecting cement from the opening trench (②-1) near the Process Main Building in addition to the leakage prevention construction conducted in April, 2011. Also, the floor level of the trench is higher than the recorded water level (OP+5m) of highly concentrated contaminated water in the Process Main Building and that floor level got higher towards the RW Building of Units 1 to 4 as well as the Suppression Pool Surge Tank Building (Figure1). Moreover, the floor level is higher than the recorded water level (OP+4m) of highly concentrated contaminated water in RW Building of Unit 1 to 4. Based on the aforementioned facts, we assume the possibility of highly concentrated contaminated water in the Process Main Building and RW Building of Units 1 to 4 leaking inside the trench is low.

(4) Monitoring and Inspection plan

The water level of the accumulated water and radioactivity concentration of the Common Pool Duct (A-A section) and Centralized RW Connecting Duct ① will be checked periodically (tentatively once a week). As for the centralized RW connecting duct ①, we are planning to implement preventive measures for rain water at the opening hatch of the upper duct.

The monitoring and inspection for the common pool duct (B-B section), the section which no accumulated water was found, will not be conducted this time because the possibility of highly concentrated contaminated water from the Process Main Building entering the B-B section is low. This is due to the cement injected inside the trench from the opening trench (①-2) and the water level of the accumulated water in section A-A will be managed.

4. Schedule

(1) Inspection of the other trenches, etc.

As shown in the Figure7, there are many trenches etc. on the grounds of Fukushima Daiichi Nuclear Power Station. The inspection will be conducted on those trenches etc. regarding the items below in accordance with the schedule shown in Table 5.

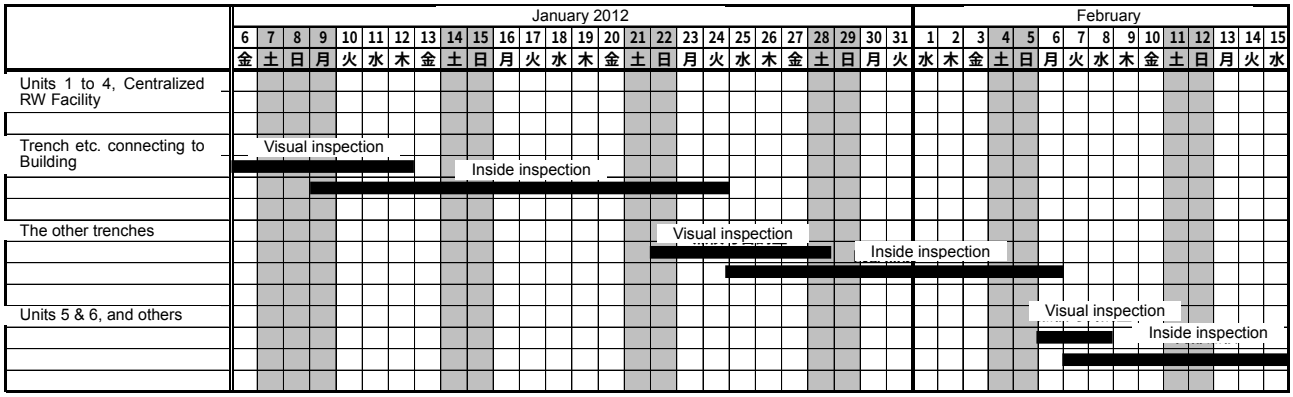
First, regarding the trenches etc. connected to the building (Unit 1 to 4, Process Main Building and Miscellaneous Solid Waste Volume Reduction Treatment Building) with highly concentrated contaminated water, we will inspect the possibility of accessing the inside trenches etc., followed by examining the availability of inner inspection. Meanwhile, no inspection will be conducted on already-inspected trenches etc. located around the Process Main Building and the ocean side of the Turbine Building of Unit 1 to 4 with highly concentrated contaminated water because they are well managed by implementation of preventive measures for water leakage and water level monitoring.

Second, we will subsequently conduct the investigation for the possible inspection and inner inspection of the other trenches etc. around Units 1 to 4 as well as trenches etc. in Units 5, 6 and others in the site. Based on this inspection result, we will continue to conduct the monitoring and inspection.

【Inspection Item】

- Confirmation of accumulated water
- Water level and radioactivity concentration measurement if confirmed.

Table 5　Inspection Schedule for Trench etc,




(2)Investigation of the cause of highly contaminated incoming water and the implementation of preventative measures

As for the Common Pool Duct (A-A section), we will continue identifying the location of the leakage of highly concentrated contaminated water and investigate the cause as well as consider and implement the preventative measures. Also, we will change the installation position of the pump according to the radiation dose in the trench and consider further the water draining from the trench.

End

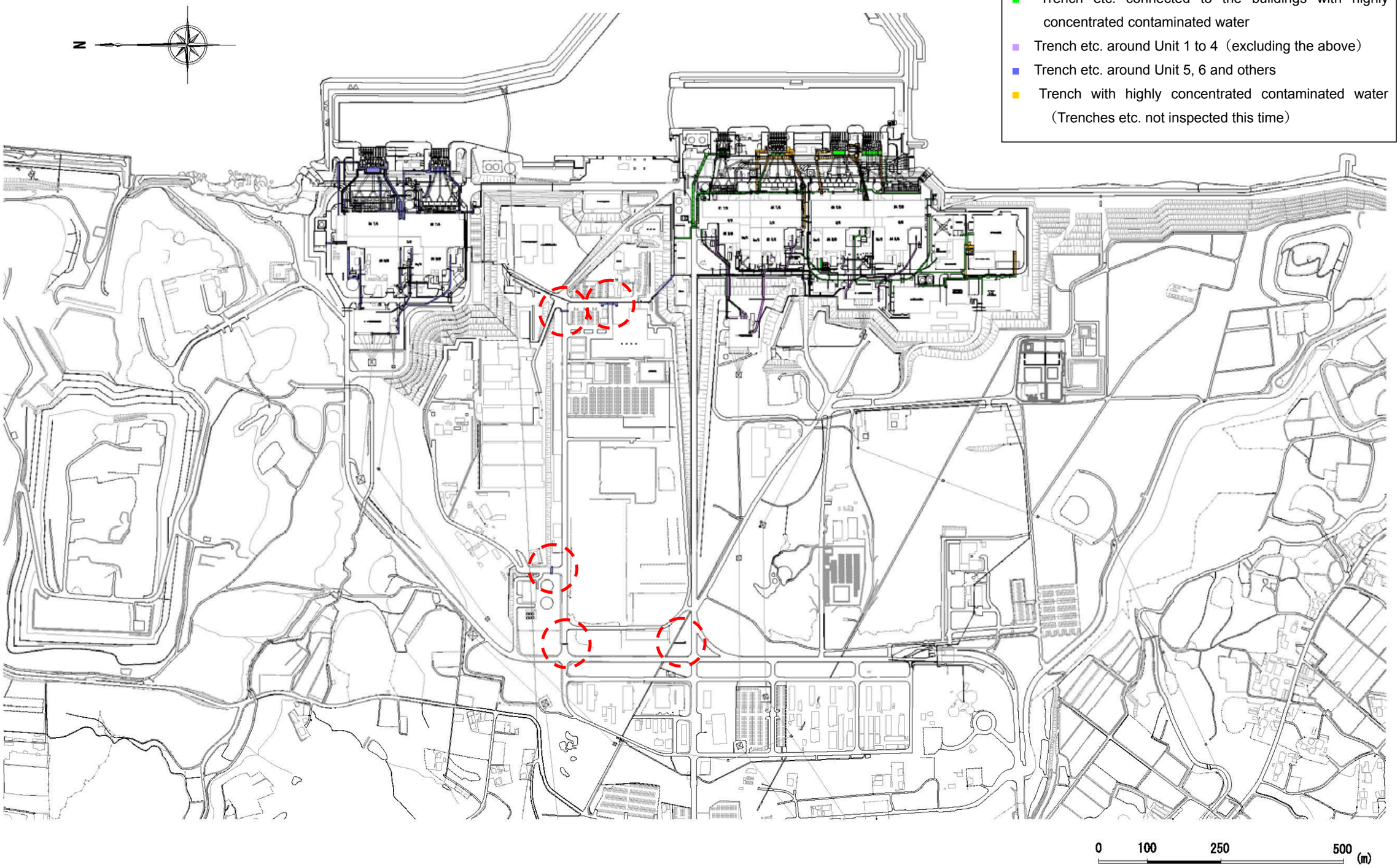



Figure7（1） Layout of Trenches etc.（Whole site）

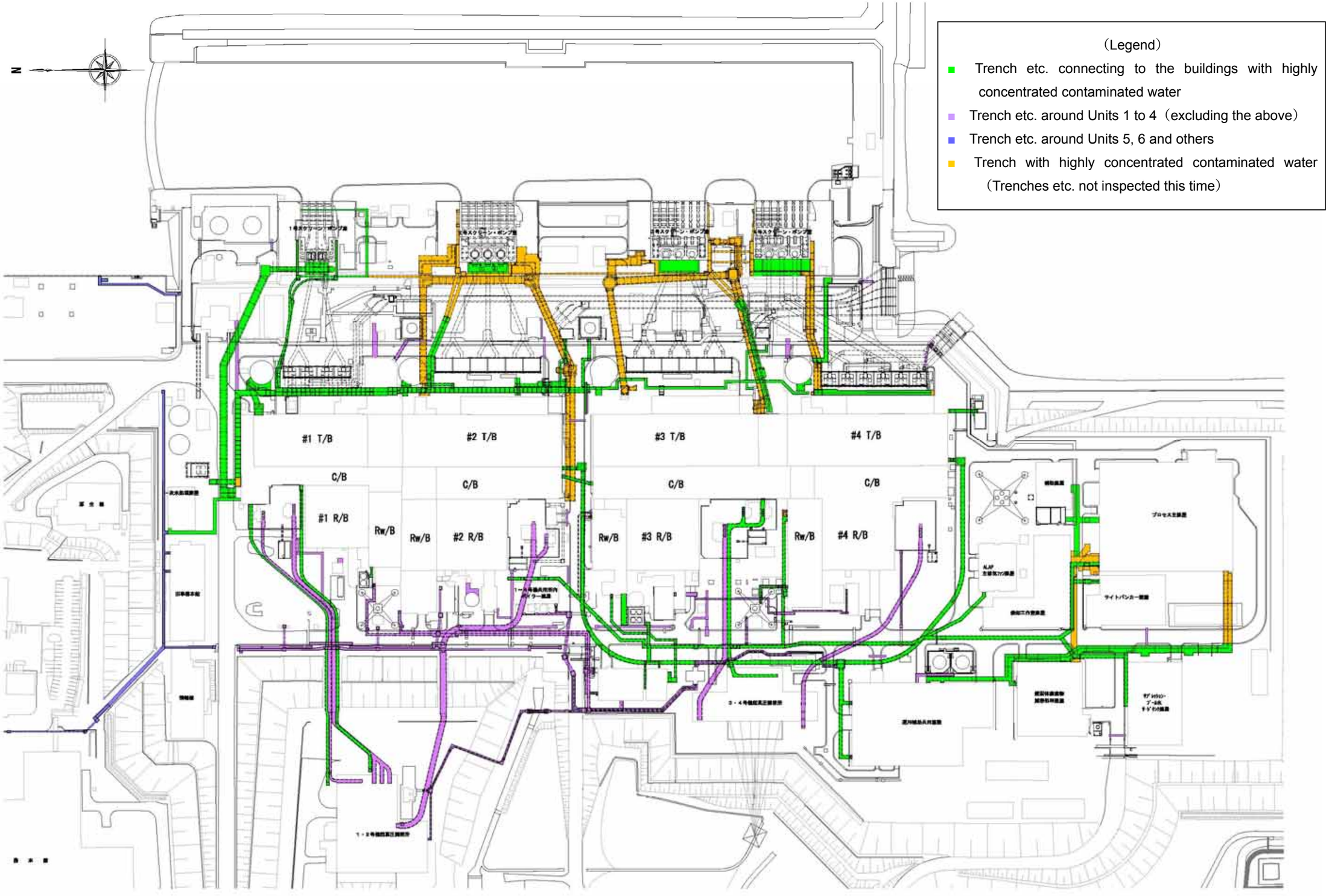



Figure.7（2） Layout of Trenches etc.（Around Units 1 to 4）

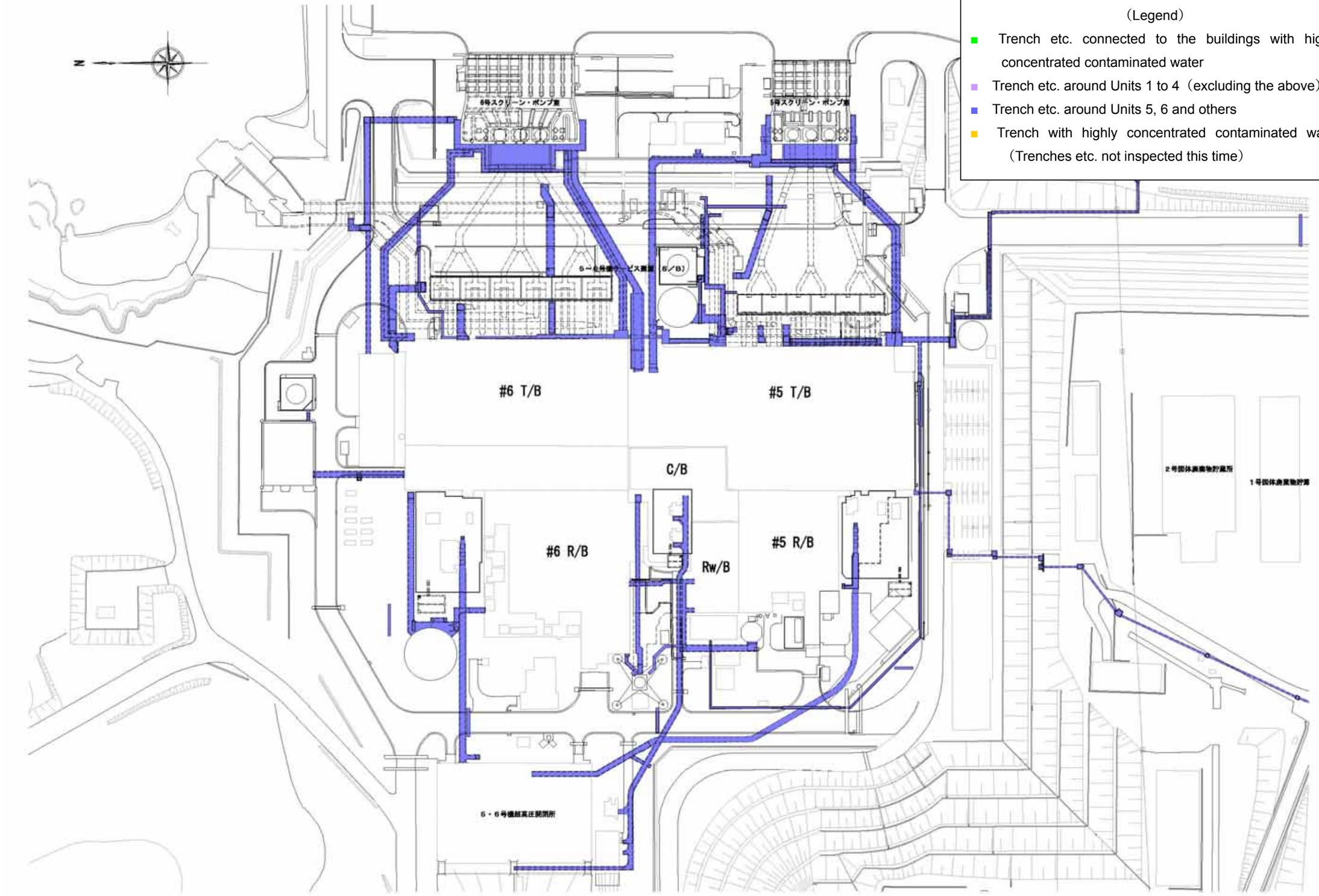
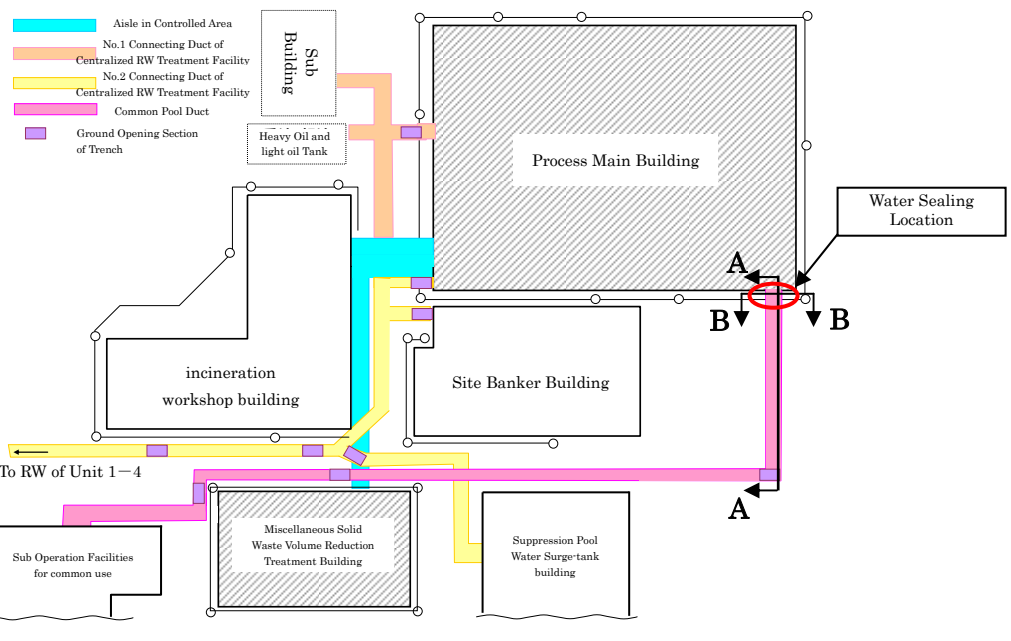



Figure.7（3） Layout of Trenches etc.（Around Units 5 and 6）

Water Penetration Stop Work of the penetration of the Process Main Building

The water penetration stop work at the process main building has been conducted at the location where the pipes penetrate the walls of the building per the following diagram. The water penetration stop work is shown in the table "Procedures to Stop Water at the Penetration". The work was completed on April, 2011. The details are as follows.

- In the case of the pipe penetration, close the valve near the penetration inside the building
- In the case of the penetration around the pipes, it is to be sealed using the blind plate
- In the case of the penetration of electricity conduits, the electricity conduit is cut off and, the cutting plane or the pull box is sealed.



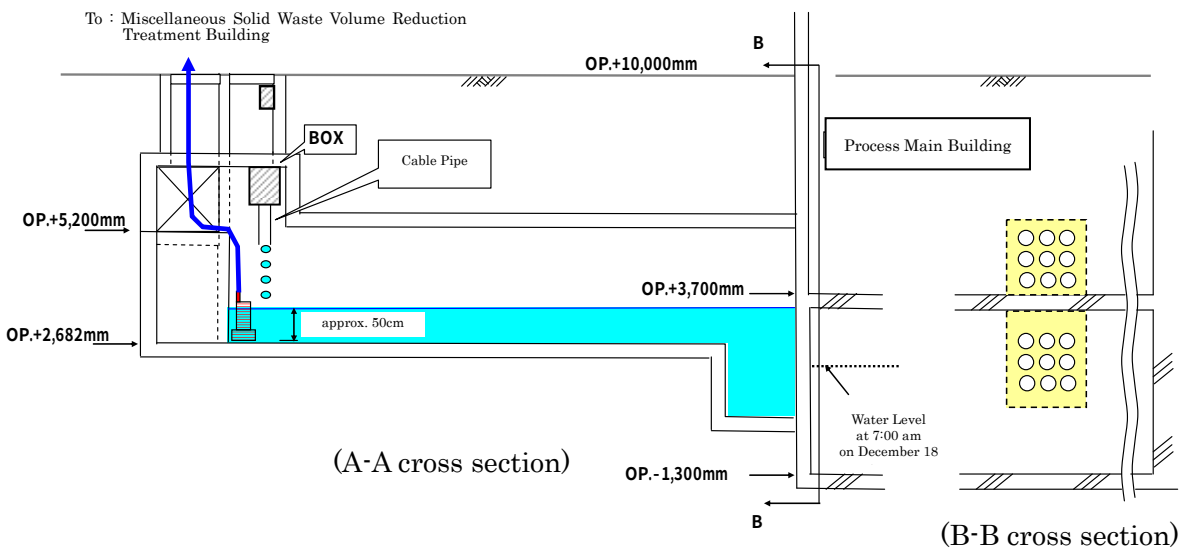
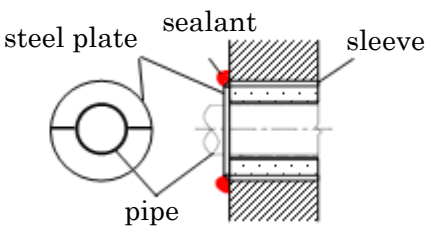
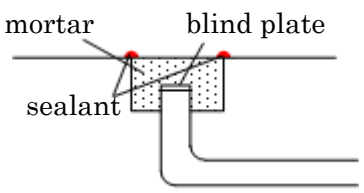
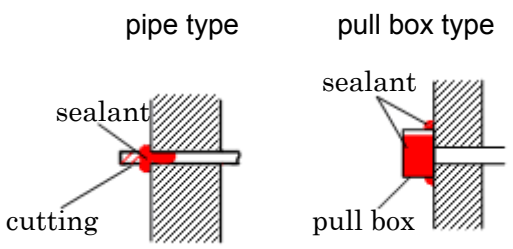



Chart. Procedures to Stop Water at the Penetration

| Type | Procedure to Stop Water | Schematic Diagram |
|---|---|---|
| Pipe Penetration | The steel plate is fixed to the pipe/sleeve per welding / with repair materials, and then the gap between the concrete and the sleeve is sealed with sealant. |  |
| | After covering the pipe opening in a funnel with a blind plate and filling up a funnel with mortar, the border between the floor and mortar is sealed with sealant. |  |
| Electricity Conduit Penetration | After cutting off the electricity conduits, the hole is filled up with sealant. |  |

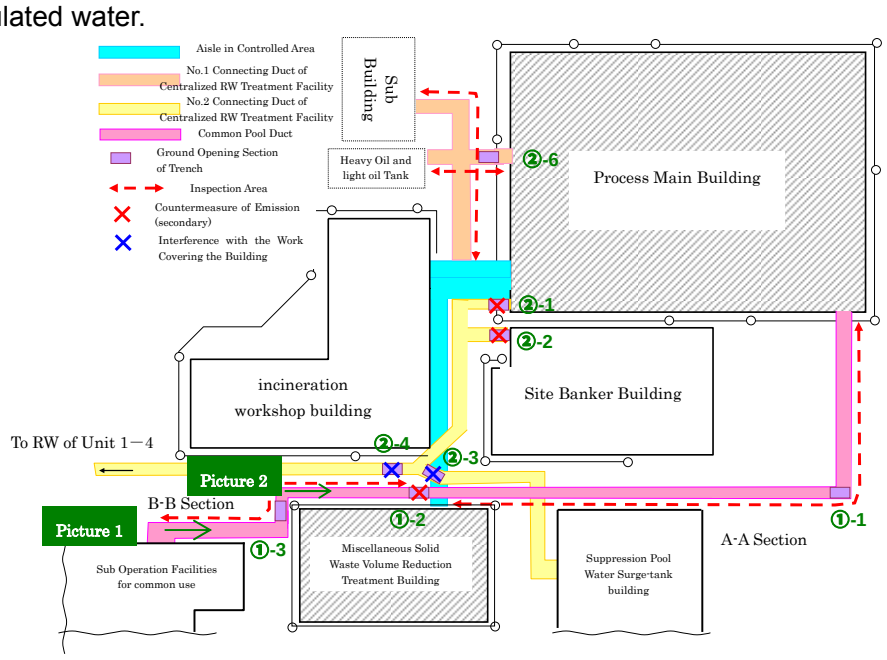
# The Inspection Result at B-B section of Common Pool Ducts

1. Date and Time of Inspection

From 10 am to 11 am on December 20, 2011, we inspected from □-3.

2. Result of Inspection

No accumulated water.




Date：December 20, 2011

Photo：Tokyo Electric Power Company

【Photo 1】Situation in the trench（No accumulated water）

Date：December 20, 2011

Photo：Tokyo Electric Power Company

【Photo 2】Situation in the trench（No accumulated water）

# Result of Inspection at No.1 Duct the Centralized Radiation Waste Treatment Facility

1. Date and Time of Inspection

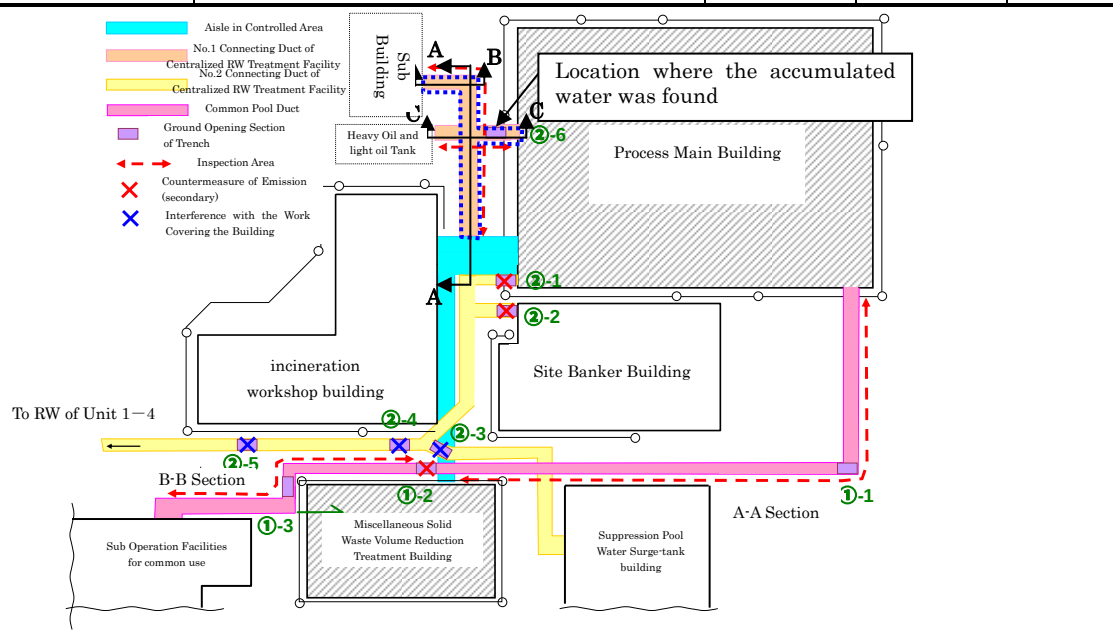
From 11 am to 12 noon on December 20, 2011, we inspected from □-6.

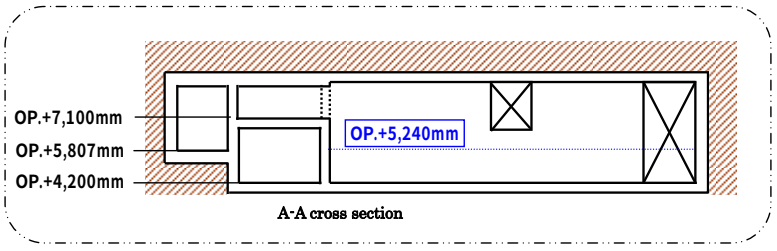
2. Result of Inspection

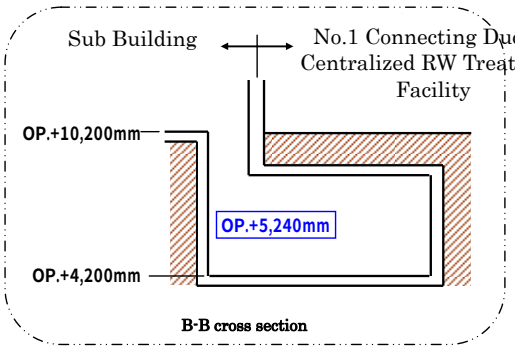
・There is accumulated water.　The amount of water was approx. 142m$^3$.

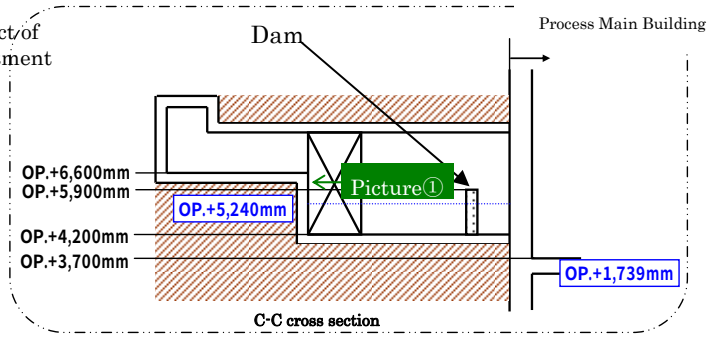
・Result of Nuclide Analysis：

| Name of Trench/Duct | Location of Inspection | Radio Active Density (Bq/cm$^3$) | | |
|---|---|---|---|---|
| | | I-131 | Cs-134 | Cs-137 |
| No.1 Connecting Duct of Centralized RW Treatment Facility | Around Opening Section for equipment hatch | ND | $1.5\times10^{-1}$ | $1.7\times10^{-1}$ |
| | Around the process main building | ND | $7.8\times10^{-2}$ | $1.3\times10^{-1}$ |



【Photo 1】Situation of accumulated water in the trench

Date：December 20, 2011

Photo：Tokyo Electric Power Company

# The Inspection Result at the A-A section of Common Pool Ducts

1. Date and Time of Inspection

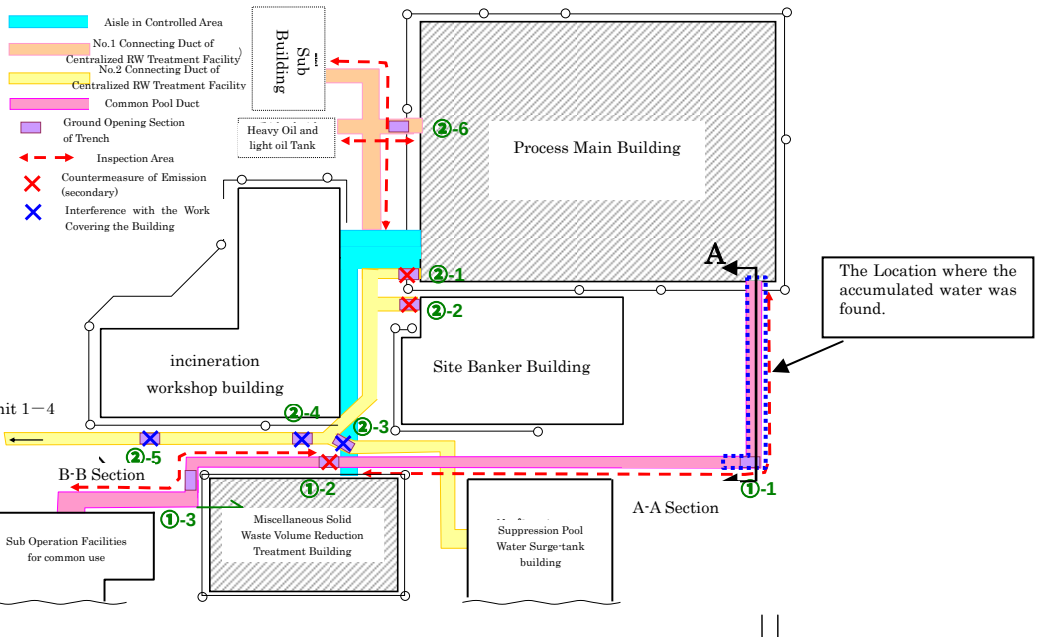
From noon to 3 pm on December 18, 2011, we inspected from □-1.

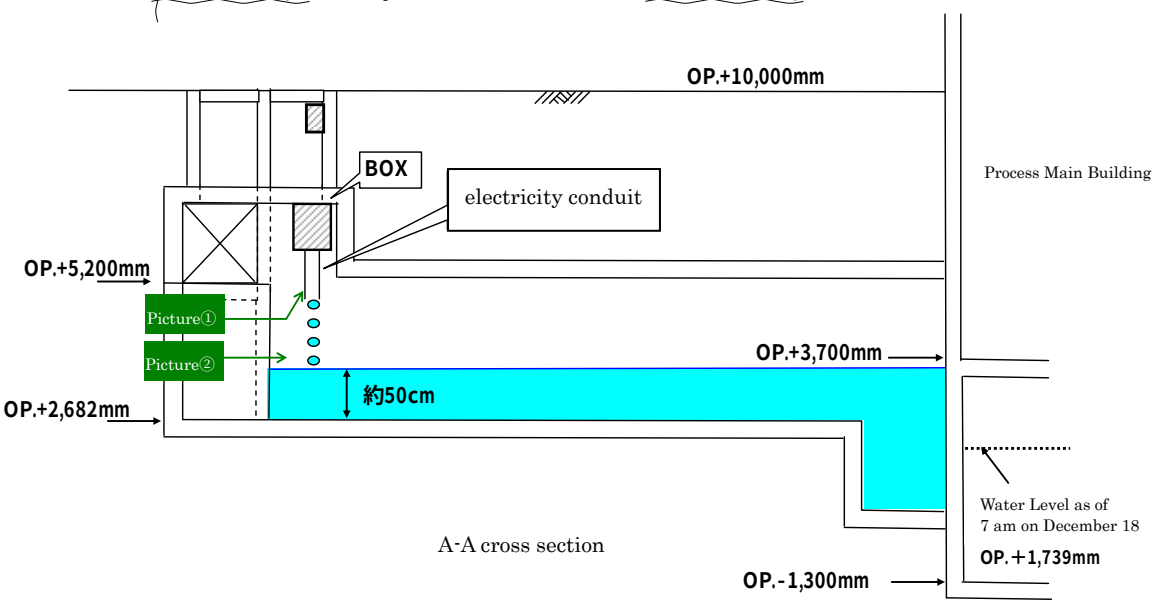
2. Result of Inspection

・There is accumulated water. The amount of water is approx. 220m$^3$

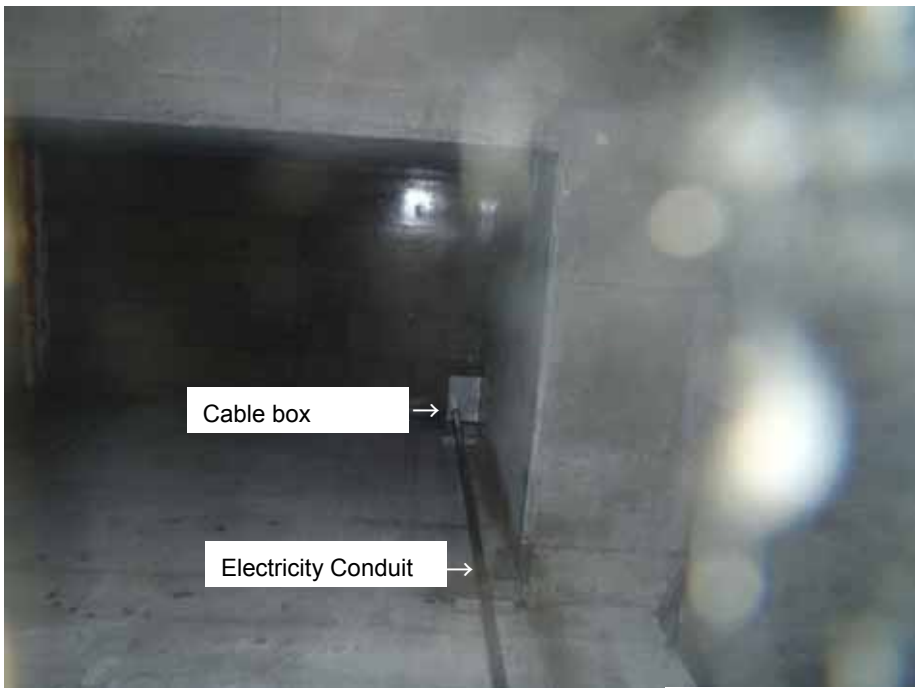
・Result of Nuclide Analysis：

| Name of Trench/Duct | Location of Inspection | Radio Active Density（Bq/cm$^3$） | | |
|---|---|---|---|---|
| | | I-131 | Cs-134 | Cs-137 |
| A-A section of Common Pool Ducts (press has been informed) | In the trench | ND | $4.2\times10^{3}$ | $5.4\times10^{3}$ |
| | Dripping from the electricity conduits | ND | $1.3\times10^{-1}$ | $1.2\times10^{-1}$ |




A-A cross section




【Photo 1】Situation of accumulated water in the trench

Date：December 18, 2011

Photo by Tokyo Electric Power Company

【Photo 2】Situation of accumulated water in the trench

Date：December 18, 2011

Photo by Tokyo Electric Power Company