

PROCESSING METHOD OF RADIATION-TAINTED WATER AND SEALING PROCESSING METHOD OF NUCLEAR PLANT

Technical Field

[0001]

The present invention relates to a processing method of radiation-tainted water in a nuclear power plant and a sealing processing method of a nuclear plant.

Background Art

[0002]

In the case that any trouble is generated in the nuclear power plant, as typified by the Great East Japan Earthquake, there invites a situation in which the radiation-tainted water keeps on standing in a primary containment vessel (PCV), a reactor pressure vessel (RPV) and a tank set on the land.

[0003]

However, the radiation-tainted water cannot be released in the sea as it is, and a technique of defusing the radiation-tainted water is under developing and is not sufficient. Accordingly, there has been strongly requested any effective countermeasure for processing the radiation-tainted water, however, the processing of the radiation-tainted water is made further difficult for the reason that it is difficult to easily approach the radiation-tainted water storage tank and nuclear power plant for the radiation-tainted water in the case that an amount of the radiation-tainted

water is large and the residual radioactivity density is high. Particularly, under an actual condition, it is difficult to map out a strategy for processing of the radiation-tainted water within the primary containment vessel and nuclear reactor in which the residual radioactivity density is extremely high.
[0004]

On the other hand, in recent years, a drilling technology in the sea has been rapidly developed, deep drilling by a riser drilling can be achieved as typified by a drilling method in the Japanese scientific drilling vessel (deep sea drilling vessel) "CHIKYU", and a bending drilling technology has also been developed.

Summary of Invention

Technical Problem

[0005]

Accordingly, a main object of the present invention is to provide a processing method which can smoothly process radiation-tainted water even in the case that it is difficult to approach due to radioactivity.

The other object is to provide a sealing processing method of a nuclear plant in a nuclear reactor, a primary containment vessel, or a reactor building.

Solution to Problem

[0006]

The present invention achieving the object is as follows.

[0007]

A processing method of radiation-tainted water according to the present invention comprises:

a drilling step of carrying on drilling from a drilling vessel anchored or drifting on the sea away from the land toward the land side through the sea, the seabed, and the seabed ground by drill pipes, carrying out the drilling through the below of a nuclear plant on the land reserving the radiation-tainted water while penetrating the nuclear plant, and bringing the drill pipe into contact with the radiation-tainted water; and

a radiation-tainted water transferring step of transferring the radiation-tainted water within the nuclear plant to a storage ship on the sea through the drill pipe or a transfer pipe which is communicated with the drill pipe.

[0008]

In the present invention, the radiation-tainted water is transferred to the storage ship on the sea via the communicated transfer pipe through the drill pipe by having access to the inner side of the nuclear plant (for example, reactor pressure vessel (RPV), primary containment vessel (PCV), the reactor containment vessel building, or the tainted water tank) on the land which reserves the radiation-tainted water on the basis of the drilling by the drill pipe from the drilling vessel anchoring or drifting on the sea away from the land.

It can be thought to have access to the inner side of the nuclear plant, for example the primary containment vessel, from the land. However, since the subject to be accessed is the radiation-tainted water, it is actually difficult, in securement of a space or the like, to install a drilling facility or a

storage facility of the radiation-tainted water on the land.

On the other hand, the difficult problem such as the securement of the space can be released by setting the drilling facility and the storage facility of the radiation-tainted water on the sea. Further, it is easy to move the storage ship on the sea after storing, and a degree of freedom of the storage ship is high.

[0009]

The present invention also proposes a processing method of radiation-tainted water comprises:

a drilling step of carrying on drilling from a drilling vessel anchored or drifting on the sea away from the land toward the land side through the sea, the seabed, and the seabed ground in a drill pipe, carrying out the drilling through the below of a nuclear plant on the land reserving the radiation-tainted water while penetrating the nuclear plant, and bringing the drill pipe into contact with the radiation-tainted water;

a radiation-tainted water transferring step of transferring the radiation-tainted water within the nuclear plant to a storage ship on the sea through the drill pipe or an outlet path of it; and

a gas injection step of sending inert gas or air into the nuclear plant in the process of transferring the radiation-tainted water to the storage ship or after the transfer.

[0010]

Total amount of the tainted water within the nuclear plant can be replaced by the inert gas by sending the inert gas into the nuclear plant in the process of transferring the radiation-tainted water to the storage ship or

after the transfer.

Further, since a head difference exists between the nuclear plant on the land and the offshore during transferring of the radiation-tainted water, the tainted water can be transferred to the storage ship on the sea through the drill pipe or the transfer pipe for discharging which is communicated with the inner portion of the drill pipe by utilizing the head difference. As a result, since a sending pressure is applied by sending the inert gas or the air into the nuclear plant, it becomes further easy to transfer the tainted water. Since the inner side of the nuclear plant can be finally replaced by the inert gas or the air, it is possible to prevent the tainted water from being left.

[0011]

Further, the present invention proposes a processing and sealing method of radiation-tainted water comprises:

a drilling step of carrying on drilling from a drilling vessel anchored or drifting on the sea away from the land toward the land side through the sea, the seabed, and the seabed ground in a drill pipe, carrying out the drilling through the below of a nuclear plant reserving the radiation-tainted water while penetrating the nuclear plant, and bringing the drill pipe into contact with the radiation-tainted water;

a radiation-tainted water transferring step of transferring the radiation-tainted water within the nuclear plant to a storage ship on the sea through the drill pipe or a transfer pipe which is communicated with an inner portion of the drill pipe; and

a solidifying material injection step of sending a solidifying material into the nuclear plant in the process of transferring the radiation-tainted

water to the storage ship or after the transfer.

[0012]

A safety of the inner side of the nuclear plant can be secured for a long time of period by sending the solidifying material such as cement and sealing the inner side of the nuclear plant.

[0013]

Here, in the case that lead Pb is included (mixed) into the solidifying material such as the cement, a shielding effect of the radioactivity is achieved.

[0014]

On the other hand, the drilling by the drill pipe can be achieved by the riser drilling.

In the case that the drilling by the drill pipe is achieved by the riser drilling, it is possible to achieve a long distance drilling.

[0015]

The drilling by the drill pipe in the drilling step is achieved by the riser drilling and the drill pipe is penetrated into the seabed through a blow-out preventing device (a blow-out preventer of well) provided on the seabed, and

a flow path of an undersea transfer pipe connected to a flow path of the drill pipe, which is connected to the storage tank from the blow-out preventing device, in the blow-out preventing device, during transferring of the radiation-tainted water to the storage ship in the radiation-tainted water transferring step, thereby transferring the radiation-tainted water to the storage ship on the sea through the undersea transfer pipe.

[0016]

It is possible to prevent the blow-out during the riser drilling by the provision on the seabed of a blow-out preventing device (a device attached onto a well head for carrying out a leakage and blow-out preventing work by sealing the well when any sign of blowout exists during the well drilling or the well finishing work, blowout preventer (BOP)) which is generally used in the searching of the oil field or the gas field or the scientific drilling.

Further, since the blow-out preventing device provided on the seabed is installed stably on the seabed, the undersea transfer pipe is stabilized when connecting the flow path of the undersea transfer pipe.

Advantageous Effects of Invention

[0017]

According to the present invention, it is possible to smoothly process the radiation-tainted water even in the case that it is difficult to approach due to the radioactivity.

Brief Description of Drawings

[0018]

Fig. 1 is an explanatory view of an outline of a drilling process to a seabed;

Fig. 2 is an explanatory view of an outline of the drilling process in which the drilling reaches an inner side of a primary containment vessel (PCV) after passing through a seabed ground and a land ground;

Fig. 3 is an explanatory view of an outline of a process of transferring radiation-tainted water to a storage ship; and

Fig. 4 is an explanatory view of an outline of a gas sealing process into a primary containment vessel (PCV).

Description of Embodiments

[0019]

Next, an embodiment of the present invention will be described.

[0020]

Fig. 1 is an explanatory view of an outline of a drilling process to the seabed. Fig. 1 shows an example which processes radiation-tainted water within a primary containment vessel (PCV) 10 of a reactor pressure vessel (RPV) 1 built on the land. Reference numeral 12 denotes a reactor building.

[0021]

A drilling vessel 20 is anchored in an offshore 3 which is away from the land 2, and drilling is started from the drilling vessel 20. The drilling vessel 20 is equipped on board with a derrick 20A, is provided in a bottom with elevating type or fixed type azimuth thrusters 20B, for example, six azimuth thrusters 20B as shown in Fig. 2, and can be retained at a target fixed position while utilizing GPS.

[0022]

A riser pipe, a drill pipe 4, and a leading end blow-out preventing device 5 are let down through a moon pool in the drilling vessel 20, and are grounded on the seabed 6.

[0023]

Subsequently, as shown in Fig. 2, the riser drilling is pressed forward toward the land side via a circular arc shaped bending drilling process or a

horizontal drilling process, or a V-shaped, U-shaped, or W-shaped drilling process through the seabed ground, by the drill pipe 4, the drilling process is carried out by passing through the containment vessel 10 from the below of the primary containment vessel 10 on the land which reserves the radiation-tainted water, and the drill pipe 4 is communicated with a radiation-tainted water D (a drilling step).

At the riser drilling, as is well known, the drilling process is carried out by feeding viscosity control mud through the drill pipe 4 which is arranged within a riser pipe, circulating the muddy water mud in a bit portion in a leading end, and returning the muddy water through a portion between the riser pipe and the drill pipe 4, and get back mud control and feeder system.

The bending drilling can utilize, well known the bending drilling. As well as the drill pipe 4 itself can be utilized for passing through the primary containment vessel 10, the primary containment vessel 10 can be passed through by switching to the other cutting device.

Further, the subject to be passed through (a nuclear plant) may be a reactor pressure vessel (RPV) 1 or may be a reactor building 12 as shown in Fig. 4 in addition to the primary containment vessel 10.

[0024]

The drilling position is desirably determined by locating a position of the drilling vessel 20 by a known position of the primary containment vessel 10 or a known position of the reactor building 12, and the azimuth thrusters 20B after searching a state of the seabed and a state of the seabed ground, and a position of the drill bit is desirably controlled by utilizing the GPS.

[0025]

Next, as shown in Fig. 3, the radiation-tainted water D within the primary containment vessel 10 is transferred to a storage ship 30 on the sea via an undersea transfer pipe 7 which is connected thereto in a blow-out preventing device 5, through a drill pipe 4 within the ground (a radiation-tainted water transferring step).

[0026]

Storage vessels 31, 31, ... obtained by covering a vessel which is constructed, for example, by a metal plate with a lead concrete are set in the storage ship 30, and the radiation-tainted water is transferred into the storage vessel 31 sequentially through an external turret 32 and is completely sealed.

[0027]

The storage ship 30 is anchored on the sea or is operated at an appropriate place so as to wait for decay of radioactivity for a long period of time while being anchored in the seashore.

[0028]

Since a head difference H (refer to Fig. 3) exists between the primary containment vessel 10 on the land 2 and the storage ship 30 in the offshore 3, it is possible to transfer the tainted water to the storage ship on the sea by utilizing the head difference H.

Further, a suction force can be applied by a pump or the like in the storage ship 30 side as occasion demands. However, in the case that the force for transferring the tainted water to the storage ship 30 side still comes short (for example, the head difference H to the primary containment vessel

10 is not great due to locational reason or the pressure loss of the transfer force is great), a sending pressure of the gas G is applied by sending the gas G such as inert gas or air into the primary containment vessel (the storage tank) 10 from the storage ship 30 side, for example, while utilizing the undersea transfer pipe 7, as shown in Fig. 4. As a result, the transfer of the tainted water can be more easily carried out. Finally, since the inner side of the storage tank can be replaced by the inert gas or the air, it is possible to prevent the tainted water from being left (a gas injection step).

[0029]

In this case, a high safety can be achieved by replacing the inner side of the primary containment vessel (the storage tank) 10 by the inert gas such as nitrogen.

[0030]

The safety over a long period of time can be secured by injecting a solidifying material such as a cement, for example, a cement slurry mixed with lead into the nuclear plant 1, 10, 12, or 11 in the process of transferring the radiation-tainted water to the storage ship or after the transfer, and sealing the nuclear plant.

[0031]

Fine particles of the lead Pb can be dispersed and included in the solidifying material.

The lead mixed solidifying material slurry obtained by mixing the solidifying material such as the cement with the lead powder can be used, for example, particularly when forming the base for installing the blow-out preventing device (BOP) 5, when drilling the ground, and when penetrating

the nuclear plant.

[0032]

In the present invention, as well as the primary containment vessel 10 is employed as the nuclear plant, the tainted water tank 11 may be employed as the storage tank. Further, the primary containment vessel 10 or the tainted water tank 11 is desirably penetrated from its bottom portion in the respect that it is possible to prevent the tainted water from being left. However, for example, in the case of being difficult due to a locational reason, it is possible to penetrate into the inner portion of the nuclear plant, for example, the primary containment vessel 10 or the tainted water tank 11 from the side part thereof.

[0033]

On the other hand, in the case that the inner side of the r primary containment vessel (the storage tank) 10 is replaced by the gas G such as the inert gas, for example, the nitrogen, an exclusive blow-out preventing device 50 can be installed and an injection flow path 40 can be formed in the same manner as the drilling mentioned above.

As well as the gas G is sent into the nuclear plant, water or heavy water can be sent and the nuclear plant can be sealed by the water or the heavy water.

Reference Signs List

[0034]

- 1 Reactor pressure vessel (RPV)
- 2 Land

3	Offshore
4	Riser pipe, Drill pipe
5, 50	Blow-out preventing device
6	Seabed
7	Undersea transfer pipe
10	Primary containment vessel (PCV)
11	Tainted water tank
20	Drilling vessel
30	Storage ship
31	Storage vessel
40	Injection flow path
D	Radiation-tainted water
G	Gas
H	Head difference

CLAIMS

1. A processing method of radiation-tainted water comprising:

a drilling step of carrying on drilling from a drilling vessel anchored or drifting on the sea away from the land toward the land side through the sea, the seabed, and the seabed ground in a drill pipe, carrying out the drilling through the below of a nuclear plant on the land reserving the radiation-tainted water while penetrating the nuclear plant, and bringing the drill pipe into contact with the radiation-tainted water, wherein the drilling by the drill pipe in the drilling step is achieved by a riser drilling and the drill pipe is penetrated into the seabed through a blow-out preventing device provided on the seabed; and

a radiation-tainted water transferring step of transferring the radiation-tainted water within the nuclear plant to a storage ship on the sea through the drill pipe and/or a transfer pipe which is communicated with the drill pipe, under a condition where a head difference exists between the nuclear plant on the land and the sea, wherein the transfer pipe includes a riser pipe between the nuclear plant and a blow-out preventing device provided on the seabed, connected through the below of a nuclear plant and the seabed ground, and an undersea transfer pipe between the blow-out preventing device and an external turret of the storage ship on the sea.

2. A processing method of radiation-tainted water comprising:

a drilling step of carrying on drilling from a drilling vessel anchored or drifting on the sea away from the land toward the land side through the sea, the seabed, and the seabed ground in a drill pipe, carrying out the

drilling through the below of a nuclear plant on the land reserving the radiation-tainted water while penetrating the nuclear plant, and bringing the drill pipe into contact with the radiation-tainted water, wherein the drilling by the drill pipe in the drilling step is achieved by a riser drilling and the drill pipe is penetrated into the seabed through a blow-out preventing device provided on the seabed;

a radiation-tainted water transferring step of transferring the radiation-tainted water within the nuclear plant to a storage ship on the sea through the drill pipe and/or a transfer pipe which is communicated with the drill pipe, under a condition where a head difference exists between the nuclear plant on the land and the sea, wherein the transfer pipe includes a riser pipe between the nuclear plant and a blow-out preventing device provided on the seabed, connected through the below of a nuclear plant and the seabed ground, and an undersea transfer pipe between the blow-out preventing device and an external turret of the storage ship on the sea; and

a gas injection step of sending inert gas or air into the nuclear plant through the drill pipe and/or the undersea transfer pipe which is communicated with the drill pipe in the process of transferring the radiation-tainted water to the storage ship or after the transfer.

3. A processing and sealing method of radiation-tainted water comprising:

a drilling step of carrying on drilling from a drilling vessel anchored or drifting on the sea away from the land toward the land side through the sea, the seabed, and the seabed ground in a drill pipe, carrying out the drilling through the below of a nuclear plant reserving the radiation-tainted water while penetrating the nuclear plant, and bringing the drill pipe into

contact with the radiation-tainted water, wherein the drilling by the drill pipe in the drilling step is achieved by a riser drilling and the drill pipe is penetrated into the seabed through a blow-out preventing device provided on the seabed;

a radiation-tainted water transferring step of transferring the radiation-tainted water within the nuclear plant to a storage ship on the sea through the drill pipe and/or a transfer pipe which is communicated with the drill pipe, under a condition where a head difference exists between the nuclear plant on the land and the sea, wherein the transfer pipe includes a riser pipe between the nuclear plant and a blow-out preventing device provided on the seabed, connected through the below of a nuclear plant and the seabed ground, and an undersea transfer pipe between the blow-out preventing device and an external turret of the storage ship on the sea; and

a solidifying material injection step of sending a solidifying material into the nuclear plant through the drill pipe and/or the undersea transfer pipe which is communicated with the drill pipe after the radiation-tainted water is transferred to the storage ship.

4. The processing and sealing method of the radiation-tainted water according to claim 3, wherein lead Pb is included into the solidifying material.