September 30, 2022
Nippon Steel Corporation

Submission of the Report on the Effluent Incidents at Kimitsu Area of East Nippon Works

We sincerely apologize to local residents, the municipal authorities and all other stakeholders regarding a series of effluent incidents to occur in the Kimitsu Area of our East Nippon Works. The incidents involved, specifically, the draining of colored effluent flowed, the draining of exceeding the effluent standards at Outlets Nos. 7 and 16, and our handling of water quality measurement results for effluent outlets and drainage channels.

In this connection, on August 25, 2022, we received a request from Chiba Prefecture for reporting and inspection based on paragraph 1, Article 22 of the Water Pollution Prevention Act and an instruction for improvement based on the Agreement Concerning Environmental Preservation from Chiba Prefecture and Kisarazu, Kimitsu and Futtsu Cities. In response, we have submitted a report to Chiba Prefecture and Kisarazu, Kimitsu and Futtsu Cities today. The report includes information on the incidents, their causes, and the corresponding countermeasures. For details, please see the appendix.

We fully recognize the seriousness of this matter. We will do the utmost to regain the trust that the local residents, the municipal authorities and all other stakeholders have in us by implementing thorough, corporate-wide measures to ensure that such incidents do not occur again.

Appendix: Contents of the Report Submitted to Chiba Prefecture and Kisarazu, Kimitsu and Futtsu Cities

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(Appendix)

Content of the Report Submitted to Chiba Prefecture and Kisarazu, Kimitsu, Futtsu Cities

I. Outline of the Incidents

1. Incidents at Effluent Outlet (meaning the place of Effluent being discharged; the same applies hereinafter) Nos. 11 and 14 (coke gas desulfurization liquid)

A. Draining of colored effluent exceeding the effluent standards for cyanide, etc. via Effluent Outlet Nos. 11 and 14

Around 13:00 on June 19, 2022, we confirmed red effluent flowing outside from our sites via Outlet No. 14, and at around 12:00 on June 20, we confirmed red effluent flowing outside from our sites via Outlet No. 11. Although we immediately stopped draining effluent from the relevant outlets, during the period until June 25, samples collected from these outlets showed values exceeding applicable effluent standards.

The following describes the timeline of the incidents and the actions taken in response.

- At around 17:00 on June 18, 2022, we identified leakage of desulfurization liquid from the manhole section in the lower part of the desulfurization liquid primary storage tank (hereafter referred to as "Tank T941"), which stores the desulfurization liquid generated when cleaning the gas produced in the coke oven.
- At around 21:00 on the same day, after determining that red effluent containing desulfurization liquid had flowed into the drainage system of Outlet No. 10, we closed the shut-off gate at Outlet No. 10 to prevent effluent from flowing outside the sites. Thereafter, we did not observe any effluent outflow via Outlet No. 10.
- At around 13:00 on June 19, 2022, confirming red effluent flowing outside via Outlet No. 14, which was connected to the drainage system of Outlet No. 10, we closed the shut-off gate at Outlet No. 14. We then notified Kisarazu Coast Guard Station to that effect and reported to Chiba Prefecture and Kisarazu, Kimitsu and Futtsu Cities (hereafter referred to as the "Prefecture and Three Cities"). We also closed the shut-off gate at Outlet No. 11, which was connected to the drainage system of Outlet No. 14.
- At around 15:00 on the same day, we confirmed dead fish in the Kisarazu-Ko Yoko Channel.
- At around 12:00 on June 20, we confirmed red effluent flowing outside via Outlet No. 11. We notified Kisarazu Coast Guard Station to that effect and then reported to the relevant administrative agencies.

<Table 1: Water quality test results at the relevant outlets>

	Measurement item	Effluent standard	June 21	June 22	June 23	June 24	June 25
Outlet No. 10	COD[*1] (mg/L)	25	98	10	8	51	10
	Total nitrogen (mg/L)	20	53	7	7	48	7
	Cyanide (mg/L)	Not detected (<0.1)	Not detected	Not detected	Not detected	Not detected	Not detected
	Ammonia, etc.[2] (mg/L)	100	14	<1	1	13	<1
Outlet No. 11	COD[*1] (mg/L)	25	210	150	90	69	30
	Total nitrogen (mg/L)	20	440	270	86	49	26
	Cyanide (mg/L)	Not detected (<0.1)	0.6	0.3	Not detected	Not detected	Not detected
	Ammonia, etc.[2] (mg/L)	100	160	70	22	7	6

Outlet No. 14	COD*1 (mg/L)	25	170	71	36	29	No stagnant water
	Total nitrogen (mg/L)	20	230	52	32	23	No stagnant water
	Cyanide (mg/L)	Not detected (<0.1)	0.3	Not detected	Not detected	Not detected	No stagnant water
	Ammonia, etc.2 (mg/L)	100	63	14	8	—	No stagnant water

Shaded boxes indicate values exceeding the applicable effluent standards. Where measurements were taken on multiple occasions on the same day, the table indicate the highest values measured within the same day.

*1 COD (Chemical Oxygen Demand): Also called "oxygen consumption", an index of water pollution.

*2 Ammonia, etc.: Ammonia, ammonium, nitrous acid, and nitric acid compound.

2. Effluent incident at Effluent Outlet No. 7 (Blast Furnace No. 2)

A. Draining of effluent exceeding the effluent standards for cyanide, etc. via Effluent Outlet No. 7

In response to the incidents described in Section 1 above, we conducted daily water quality measurement at all effluent outlets, and then we became to determine that the effluent at Outlet No. 7 indicated measured values of cyanide and total nitrogen exceeding the effluent standards from June 30 to July 2.

The following describes the timeline of the incidents and the actions taken in response.

- At 16:02 on July 1, 2022, we confirmed that the preliminary water quality test results we received from the water quality analysis company for the sample taken at Outlet No. 7 on June 30 (0.24 mg/L for cyanide and 25 mg/L for total nitrogen) exceeded the effluent standards.
- As a result of an investigation, looking into the causes and effects of the leak of desulfurization liquid on June 18, we confirmed, at around 13:00 on July 2, that the dust collection water for Blast Furnace No. 2 caused the effluent to exceed the effluent standards for cyanide and for total nitrogen at Outlet No. 7.
- After this confirmation, we conducted a detailed investigation of the drainage system referring Outlet No. 7 and, at 23:39 on the same day, we notified Kisarazu Coast Guard Station to that effect and reported to the Prefecture and Three Cities.
- For effluent samples collected on and after July 3, no measurements for cyanide or for total nitrogen exceeded the effluent standards.

B. Inappropriate notifications under the Water Pollution Prevention Act

During the investigation into the causes of the effluent incidents, we found non-compliance with the notification requirements including the following.

i) Effluent discharge via the incorrect outlet
- The notification stated that effluent referring this incident to be flowed outside our site via Outlet No. 8.
- In contrast, the effluent method actually implemented was to transfer redundant water to a different drainage system (the drainage system of Outlet No. 7) utilizing a temporary pump, and to discharge it together with other treated water.

ii) Existence of facilities not described in the notification (multiple temporary pumps, cyanide treatment facility)
- We identified that multiple temporary pumps and the cyanide treatment facility were not described in the notification to the authorities as required by the Water Pollution Prevention Act.

3. Other incidents additionally identified through the follow-up inspection

In response to the above incidents, we conducted a comprehensive follow-up inspection of drainage statuses, including exhaustive data collection and inspection of water quality at the outlets and drainage channels from August 2017 to August 2022 as well as interviews with persons concerned. As a result of this inspection, we identified the following facts.

A. Incidents of unreported measurement data at the outlets related to the incidents described in Sections 1 and 2 above

i) Incident of unreported measurement data related to the effluent incidents at Effluent Outlet Nos. 11 and 14 (coke gas desulfurization liquid)

- After identification of the effluent incidents at Outlet Nos. 11 and 14, we conducted water quality measurement at each outlet, reported the measurement results to the administrative agencies concerned, and made official announcements. However, we identified that the measurement results for COD and total nitrogen obtained from June 23 to 26 at Outlet Nos. 9, 11 and 14 did not contain certain figures indicating higher values than those we reported and announced.
- After our announcement on August 18, we additionally identified eight unreported measurement data items.

ii) Incident of unreported measurement data obtained on July 1 and 2 related to the effluent incident at Outlet No. 7 (Blast Furnace No. 2)

- We conducted an investigation into the drainage system and water quality related to the incident at Outlet No. 7 (Blast Furnace No. 2), reported the measurement results to the administrative agencies concerned, and made official announcements. However, we identified that the measurement results for cyanide and total nitrogen obtained on July 1 and 2 did not contain certain figures indicating higher values than those we reported and announced.

B. Effluent incident at Outlet No. 16 (Blast Furnace No. 4)

i) Incident of unreported measurement data exceeding the effluent standards

- Regarding past statutory required measurements of water quality at Outlet No. 16 (the water quality measurement conducted at each outlet once every three months based on the Water Pollution Prevention Act and the Chiba Prefectural "Measurement Frequency Ordinance (stipulating the number of contamination measurements)"; the same applies hereafter), we identified that although measurement results had exceeded the effluent standards three times for cyanide and six times for total nitrogen, these measurement results were not reported to the administrative agencies concerned. Instead, additional sample collection was conducted, and measurement results were replaced with values within the effluent standards when recording and storing the statutory required measurement results.
- After our announcement on August 18 that the measurement results exceeded the effluent standards twice for cyanide and five times for total nitrogen, we identified an additional case each for cyanide and total nitrogen.
- In addition to statutory required measurements, we have voluntarily conducted measurement of cyanide and total nitrogen since February 2018. Regarding such voluntary measurement, we identified that measurement results exceeded the effluent standards 39 times for cyanide and 195 times for total nitrogen, but such measurement results were not reported to the administrative agencies concerned.
- After our announcement on August 18 that the measurement results exceeded the effluent standard 37 times for cyanide and 168 times for total nitrogen, we identified an additional two cases for cyanide and an additional 27 cases for total nitrogen.

ii) Inflow of overflow water into the rainwater drainage system

- In the course of investigating the cause of effluent exceeding the effluent standards, we found that redundant water (containing cyanide and nitrogen) generated in the dust collection system of Blast Furnace No. 4 unintentionally overflowed from some tanks and flowed into the rainwater drainage system connected to Outlet No. 16 via a side ditch. We thus concluded that the above overflow of redundant water was the cause of the effluent exceeding the effluent standards for cyanide and total nitrogen at Outlet No. 16.
- The water treatment system was designed to have the redundant water generated in the dust collection system of Blast Furnace No. 4 be recycled in on-site processes since the initial stage of construction of Blast Furnace No. 4. For this reason, the notification of specified facilities under the Water Pollution Prevention Act was not made for the dust collection facility for Blast Furnace No. 4.

C. Incidents of unreported measurement data other than those described above

i) Incident of unreported measurement data at outlets subject to statutory required measurement

- Regarding past statutory required measurements at Outlet No. 7, although measurement results exceeded the effluent standards for zinc, cyanide, and total nitrogen, such measurement results were not reported to the administrative agencies concerned. Instead, additional sample collection was conducted, and the measurement results were replaced with items having values lower than the effluent standards when recording and storing the statutory required measurement results.
- For those data exceeding the effluent standards for cyanide and total nitrogen were additionally identified after our announcement on August 18.

ii) Incident of unreported measurement data at outlets other than those subject to statutory required measurement

- Regarding past measurements, not statutory required but were conducted as a part of voluntary management at Outlet Nos. 6, 7, 8, and 15, we additionally identified after our announcement on August 18, that measurement results exceeding the effluent standards for SS, n-Hex, and pH were not reported to the administrative agencies concerned.

iii) Incident of unreported measurement data at drainage channels required by the Agreement Concerning Environmental Preservation

- Regarding measurement of water quality at drainage channels required by the Agreement Concerning Environmental Preservation with the Prefecture and Three Cities (hereafter referred as the "Agreement"), measurement results exceeding the agreement values were not reported to the Prefecture and Three Cities, or additional sample collection was conducted and replaced with additional items having values lower than the Agreement values when recording and storing measurement results based on the Agreement.
- After our announcement on August 18, we additionally identified that measurement results exceeding the Agreement values were not reported three times for the ammonia water from secondary processing plant drainage channel and nine times for the oil-containing effluent drainage channel.

II. Causes

1. Effluent incidents at Outlet Nos. 11 and 14 (coke gas desulfurization liquid)

A. Causes of the discharge of desulfurization liquid via the outlets and the relation between the desulfurization liquid and fish deaths

i) Causes of the series of events from damage to the tank and leakage from the tank to discharge via the outlets

- On December 4, 2020, a manhole cover on the side face of Tank T941 underwent repair for an oozing leak, and was covered and sealed by a stainless box. This time, sulfurization liquid leaked through the stainless box (estimated leakage volume: 1,800 m^3). It is planned that the leak mechanism will be investigated after removing the content of Tank T941.
- Although Tank T941 was surrounded with a dike to contain the leaked desulfurization liquid inside, the desulfurization liquid overflowed.
- The leaked desulfurization liquid flowed into the rainwater collection side ditch, which was regarded as a drainage facility exclusively for the coke by-product area to which Tank T941 was located, but actually, the side ditch was connected to the drainage system of Outlet No. 10 via an underground passage, so eventually we came to close the gate of Outlet No. 10.
- Although the drainage systems of Outlet Nos. 10 and 14 were connected to each other, it was understood that in normal cases effluent shall not overflow from the connected piping between the two systems, because of the drainage gradient. However, shutting down the gate of Outlet No. 10 generated an effluent flow from a branch line of the drainage system of Outlet No. 10 to the drainage system of Outlet No. 14. As a result, colored effluent flowed outside from the sites via Outlet No. 14, and Outlet No. 11 which had also been connected to the drainage system of Outlet No. 14.

ii) Relation between the desulfurization liquid components and the fish deaths

- The reason for the effluent samples collected from the Kisarazu-Ko Yoko Channel on June 20 showing measurement values exceeding the effluent standards was due to ammonium thiocyanate*, which is the main component of the desulfurization liquid, and the residual ammonium cyanide that remained unreacted in the production reaction of ammonium thiocyanate in the effluent. Also, in the detailed follow-up investigation, we found that cyanide could be detected in the desulfurization liquid due to residual ammonium cyanide that remained unreacted in the liquid.

  * Ammonium thiocyanate exists as cyanic acid, ammonium ions, and ammonia in water solution.

- According to our investigation and the opinion from a specialist, as a result of a comparative analysis of the water quality measurement results of effluent in the Kisarazu-Ko Yoko Channel conducted by the prefecture and the acute toxicity values (96-hour median lethal concentrations) for fish from the literature analysis, ammonia, ammonium thiocyanate, and cyanide may all be a cause of fish deaths, and the ratios of measurement values to the acute toxicity values in descending order are ammonia, ammonium thiocyanate, and cyanide, and eventually ammonia had the highest ratio.

<Table 2: Acute toxicity values of suggested causative substances, measurement values from the prefecture, and ratios of the measurement values to the acute toxicity values>

Compound	Acute toxicity value[*1] (mg/L)	Bridge over the Koito River on June 20		Area close to Outlet No. 14 on June 20	
		Measurement value (mg/L)	Measurement value/Acute toxicity value	Measurement value (mg/L)	Measurement value/Acute toxicity value
Ammonia	11.1 mg N/L	450	40.5	310	27.9
Ammonium thiocyanate	47～87 mg SCN/L	710[*2]	8.16 to 15.1	310[*2]	3.56 to 6.60
Cyanide	0.026 mg CN/L[*3] 0.1 mg CN/L	0.2	7.69[*3] 2.0	Not detected (<0.1)	<3.8[*3] <1

*1 The following domestic and overseas databases were referred to when collecting information on acute toxicity values:
ECOTOX Knowledgebase: https://cfpub.epa.gov/ecotox/
NITE-CHRIP: https://www.nite.go.jp/chem/chrip/chrip_search/systemTop
Information on Chemicals ECHA: https://echa.europa.eu/information-on-chemicals
CERI Chemical Substance Hazard Assessment Reports:
https://www.cerij.or.jp/evaluation_document/hazard_assessment_report_03.html
Initial Environmental Risk Assessment of Chemicals: https://www.env.go.jp/chemi/risk/chemi_list/index.html
*2 It was assumed that the COD component was mostly cyanic acid (1 mg/L of cyanic acid ≒ 1 mg/L of COD).
*3 The acute toxicity values and the ratios of measurement values to acute toxicity values for rainbow trout, which has a high sensitivity.

B. Causes related to business operations

i) Implementation statuses of inspections and tank tests

- Tank T941 has undergone daily and monthly inspections, overhaul inspections, and non-destructive tests depending on the situation (wall thickness measurement). Defects identified through these inspections and tests have been repaired accordingly.

ii) Recognition of the degree of aging and implementation of the replacement plan

- Tank T941 has been in operation for 47 years since its construction and undergone repairs of pinhole defects due to aging of the wall and manhole, and it was being used while being repaired. Recognizing that the tank experienced an oozing leak, we started to consider replacing the tank. We then measured the wall thicknesses through non-destructive tests, calculated the remaining service life, and established a replacement plan to be implemented before the tank was to reach the end of its service life. Specifically, the renewal work for one of the two desulfurization liquid tanks, the one with a shorter remaining service life, has been underway with expected completion in August 2023. Tank T941 was planned to be fully repaired after the completion of such work.
- Tank T941, which had the desulfurization liquid leak this time, underwent repair of the manhole section on the side face with a stainless box in December 2020. However, this repair could not prevent the leakage of a large quantity of desulfurization liquid that occurred at this time.

2. Physical causes related to the effluent incidents at Effluent Outlet No. 7 (Blast Furnace No. 2) and Effluent Outlet No. 16 (Blast Furnace No. 4)

A. Effluent incident at Effluent Outlet No. 7 (Blast Furnace No. 2)

i) Response to the total nitrogen issue in consistent drainage capacity

- When implementing dredging and work for the respective tanks, effluent was drained through a drainage route

different from those notified by using temporary pumps as a temporary measure.
- Because the existing facilities of the drainage system of Outlet No. 8 had insufficient capacity to treat nitrogen, the above temporary measure to drain effluent via a route different from those submitted by utilizing temporary pumps was implemented in order to comply the effluent standards at the outlets and drainage channels specified by law and in the Agreement.

ii) Operation changes and measures taken to handle cyanide
- Along with the changes in the operation of the blast furnaces oriented to reducing energy use and achieving low-carbon emissions, there has been an increase in the ratio of cyanide compounds formed in the lower part of the blast furnaces to be remained decomposed in the upper part of the blast furnaces.
- Against this backdrop, we have progressively installed cyanide treatment equipment since 2015 in the dust collection system of Blast Furnace No. 2, where regarding water quality control of collected water generated during wet treatment of dust and other substances contained in gas produced in blast furnaces, it was confirmed that there was a risk of cyanide in excess of the Agreement values in drains.
- Regarding the volume and changes in water quality in the dust collection system of Blast Furnace No. 2 and the change in inflow volume of recycled water from other systems, we reinforced the cyanide treatment equipment capacity. However, the lack of treatment capacity left unsolved, thus we came to continue temporary measures to comply with the effluent standards at the outlets and drainage channels specified by law and in the Agreement via a route different from those notified utilizing temporary pumps even after taking countermeasures to control total nitrogen.

iii) Falling of the temporary pump into the tank
- Of the two temporary pumps (with delivery port diameters of 6 inches and 4 inches), among the equipment for transferring redundant water in the tanks in the dust collection system of Blast Furnace No. 2, the pump with the port diameter of 6 inches fell into the tank and pumped out redundant water while agitating and dispersing sludge with a high concentration of cyanide deposited at the bottom of the tank. It is thought that the other pump continuously transferred redundant water containing the agitated, dispersed sludge.

<u>B. Effluent incident at Outlet No. 16 (Blast Furnace No. 4)</u>

i) Recycling of the dust collection water of Blast Furnace No. 4 inside the sites
- The water treatment system was designed to have the redundant water generated in the dust collection system of Blast Furnace No. 4 recycled in on-site processes since the initial stage of construction of Blast Furnace No. 4.

ii) Operation changes and measures taken to handle cyanide
- Along with the changes in the operation of the blast furnaces oriented to reducing energy use and achieving low-carbon emissions, the has been an increase in the ratio of cyanide compounds formed in the lower part of the blast furnaces to be remained decomposed in the upper part of the blast furnaces.
- However, according to the design concept explained in i) above, assuming the redundant water generated in the dust collection system of Blast Furnace No. 4 was not to be drained outside the sites, the dust collection system was not provided with cyanide treatment equipment despite the changes in water volume and quality.

iii) Generation of effluent overflow due to an imbalance of water in the dust collection system of Blast Furnace No. 4
- The redundant water generated in the dust collection system of Blast Furnace No. 4 contains nitrogen, cyanide, and other substances. There have been cases in which the temporary increase in volume of redundant water was

observed, for instance when the operation to blow air into the furnace was stopped or resumed, to a level causing an imbalance of water in the dust collection system, thereby allowing the redundant water to overflow from the recycling system into the rainwater drainage system connected to Outlet No. 16.

- Also, an imbalance of water occurred when recycled water consumption was reduced, thereby allowing the recycled water to overflow from the recycling system into the rainwater drainage system connected to Outlet No. 16. The frequency of such occurrences has been increasing since 2016, for instance due to the commencement of receiving redundant water from other drainage treatment systems.
- Although some persons concerned recognized water overflowing from the recycling system to be drained via Outlet No. 16, no fundamental measures were taken to resolve the matter (detailed explanation follows below).

C. Incidents of unreported measurement data other than those described above

The relevant incidents include unreported measurement results exceeding the effluent standards and Agreement values were due to temporary factors and other issues.

3. Problems with business operations and mindset related to the effluent incidents at Effluent Outlet No. 7 (Blast Furnace No. 2) and Effluent Outlet No. 16 (Blast Furnace No. 4)

A. Problems with mindset that caused the effluent incident at Effluent Outlet No. 7 (Blast Furnace No. 2)

i) Insufficient risk sharing with other departments

- The employees concerned recognized that, regarding cyanide treatment, the problem with water quality exceeding the Agreement values at the drainage channel in the drainage system of Outlet No. 8 could not be solved without taking fundamental measures for the facilities. However, although they were complying the Agreement values at the channel of the drainage system of Outlet No. 8 by transferring the redundant water to another drainage route using temporary pumps, and when they informed other departments of the situation, they merely communicated that "there is a risk". As a result, they failed to create a plan to take fundamental measures for the facilities.

ii) Misconception about the necessity of submission according to the Water Pollution Prevention Act

- The employees concerned had the misconception that the temporarily installed facilities and the drainage routes were not subject to notification according to the Water Pollution Prevention Act.

iii) Insufficient dissemination of awareness regarding environmental compliance

- The employees in the Kimitsu Area received training concerning the company-wide environmental management system, but ultimately the employees in charge of water treatment operations in the Kimitsu Area did not have sufficient awareness regarding environmental compliance.

B. Problems with mindset that caused the effluent incident at Outlet No. 16 (Blast Furnace No. 4)

i) Misconceptions about statutory required measurement

- The employees concerned had the misconception that even if the measurement results exceeded the effluent standards for statutory required measurement, it was unnecessary to report to the administrative agencies concerned if the results of additional sampling and measurements were within the effluent standards, and that only the data of such additional measurements that satisfy the effluent standards needed to be recorded and stored as statutory required measurement results.
- Concerning the risk that the imbalance of water in the dust collection system of Blast Furnace No. 4 may cause effluent containing nitrogen to overflow from the system and to flow outside the sites via Outlet No. 16 through

the side ditch and rainwater drainage system, the employees concerned decided to measure the quality of water treated by the rainwater treatment facility flowing into Outlet No. 16 for the purpose of obtaining the data necessary to deliberate countermeasures. However, considering that the above measurement was conducted voluntarily and thus was not a case of statutory required measurement, the employees concerned did not recognize the necessity of reporting the measurement results to the administrative agencies concerned even when such results exceeded the effluent standards.

- Also, the fact that the measurement results for total nitrogen and cyanide exceeded the effluent standards was shared only by relevant employees in the workplace, and were not reported to their superiors. Thus, the fact was not shared widely among the persons concerned.

ii) Insufficient sharing of risks with superiors and other departments

- The employees concerned recognized that the problem with the water quality exceeding the effluent standards at Outlet No. 16 could not be solved without taking facility measures. However, they did not issue a clear report to their superiors or other departments stating that the risk of overflow occurrence may cause the water quality at Outlet No. 16 to exceed the effluent standards; instead, they informed them merely that there was a risk. In addition, they did not share with their superiors nor other departments the facts that the measurement results exceeding the effluent standards had been replaced with the results of additional sampling and measurement that satisfy the effluent standards, and that voluntary measurement results conducted outside those required by statute also exceeded the effluent standards. Actually, information on these facts were limited to the relevant employees in the workplace. As a result, they failed to create a plan to take fundamental measures for the facilities.

iii) Insufficient dissemination of awareness regarding environmental compliance

- The employees in the Kimitsu Area received training concerning the company-wide environmental management system, but ultimately the employees in charge of water treatment operations in the Kimitsu Area did not have sufficient awareness regarding environmental compliance.

C. Probable causes related to organizational and business operation structures

In the Kimitsu Area, there is a strong necessity to utilize water resources thoroughly due to the geological conditions imposed by having a limited water source. Based on this necessity, the Kimitsu Area has adopted an organizational and management structure whereby many roles and functions related to water treatment have been centralized and are integrally managed by the Energy Management Division. This organizational and management structure is considered as one of the causes of the effluent incidents that occurred this time.

i) Structure related to blast furnace operation and blast furnace dust collection water treatment

- In the Kimitsu Area, the Energy Management Division has been in charge of operations to treat dust collection water that was generated by the operation of the blast furnaces (by the Ironmaking Division). In contrast, in other plants and areas in Nippon Steel, the Ironmaking Division has been in charge of such operations.
- Although there were changes in the characteristics of the blast furnace dust collection water and the overall water balance, the separation of operational roles described above inhibited collaborative effluent and water quality control, as well as the appropriate deliberation and implementation of measures necessary for the water treatment facilities by both departments.

ii) Business operations related to water quality measurement

- The Kimitsu Area had adopted a business flow in which only the Energy Management Division was in charge of receiving information on water quality measurement results exceeding the effluent standards and Agreement values except for those pertaining to a small portion of the drainage channels, in contrast to other plants and areas

of Nippon Steel, where the Environment Divisions are in charge of such operations. Thus, this business flow prevented the Environment Division from checking the content of water quality measurement operations and allowed inappropriate treatment such as additional sampling and omission of reports on measurement results that exceeded the effluent standards and Agreement values to go undetected and uncorrected.

- Also, almost all operations from water treatment to water quality measurement were outsourced to Nippon Steel Eco-Tech Corporation. This arrangement had the tendency of reducing the effectiveness of checking operations.

III. Measures Taken in the Kimitsu Area

1. Tangible measures

A. Effluent incidents at Effluent Outlet Nos. 11 and 14 (coke gas desulfurization liquid)

We will implement three countermeasures to prevent recurrence: "no leaks," "no inflow into drainage systems even if a leak occurs," and "shutting-off of leaks within drainage systems."

i) Renewal of the desulfurization liquid tanks

- Based on the effects of desulfurization liquid leakage this time, we reviewed the renewal plan for the desulfurization liquid tanks, including their installation locations. As a result of this review, we rescheduled the expected completion of renewal of one of the two desulfurization tanks to December 2023 and will renew the remaining tank without delay.
- We will utilize alternative tanks until the renewal of these tanks.

ii) Installation of dikes

- New desulfurization liquid tanks will be installed with dikes having a storage capacity equivalent to 110% of the tanks' total capacity.
- The alternative tanks to be tentatively used until the renewal of the desulfurization liquid tanks will also be installed with dikes having the necessary storage capacity by the end of September.

iii) Isolation of drainage systems

- The drainage route from the rainwater side ditch in the chemical conversion area to the drainage system of Outlet No. 10, had already been sealed with concrete. We also confirmed that the drainage system is not connected to any other drainage routes.
- We have already standardized the operation procedures for isolating drainage systems in the event of an emergency, and will also install a function capable of instantaneously isolating a drainage system without using sandbags.

<Measures to store colored water>

Colored water, flowed into the drainage system, has been recovered and is appropriately managed in a concrete tank or similar facility.

- Each outlet has been provided with a double-closing mechanism. Also, each drainage system has been modified to be an individual system isolated from the other drainage systems.
- The colored water in the piping of the drainage systems has been pumped out and the piping has been cleaned. We have confirmed that the water quality of the drainage systems has improved so that if is now within the effluent standards except for the drainage system of Outlet No. 10, which is near the leakage point.
- Colored water that has been pumped out from the piping is appropriately managed in steel and concrete tanks.

B. Effluent incidents at Outlet No. 7 (Blast Furnace No. 2) and Outlet No. 16 (Blast Furnace No. 4)

i) Effluent incident at Outlet No. 7 (Blast Furnace No. 2)

We have already removed all temporary pumps that had been used for transferring effluent from the drainage system of Outlet No. 8 to the drainage system of Outlet No. 7, which were not submitted to the administrative agencies. In addition, we installed the following dual measures for cyanide treatment, and now the effluent is drained outside the site via Outlet No. 8 as submitted to the administrative agencies.

a) Installation of a gutter-type chemical injection equipment to the thickener (meaning chemical sedimentation equipment; the same applies hereinafter) of Blast Furnace No. 2

- To ensure sufficient cyanide treatment capacity in the drainage system of Outlet No. 8, to which the effluent of Blast Furnace No. 2 was originally designed to be drained, we have implemented primary cyanide treatment with a gutter-type chemical injection equipment installed onto the thickener of Blast Furnace No. 2.

b) Reinforcement of the cyanide treatment equipment and installation of a back-up equipment

- We have implemented secondary cyanide treatment by reinforcing the capacity of the existing two cyanide treatment equipment and installing a back-up equipment for use in case of emergency.
- During the repair of the thickener of Blast Furnace No. 2, it was unable to use the existing cyanide treatment equipment, so we used to treat cyanide with temporary equipment. We will additionally install a drainage route that will enable to utilize the three existing cyanide treatment equipment even if the thickener of Blast Furnace No. 2 is undergoing repair.
- Furthermore, we have already installed continuous cyanide analyzers in the drainage system for early detection of changes in the cyanide concentration in the upstream drainage channel.

ii) Effluent incident at Outlet No. 16 (Blast Furnace No. 4)

As described below, we will implement redundant cyanide treatment and submit notifications as required by the Water Pollution Prevention Act in addition to taking measures for preventing overflow even in the event of an imbalance of water.

a) Overflow prevention measures

- The water balance has been stabilized by introducing a circulating water cooling tower as a device for redundant water consumption.
- We have installed level gauges in each tank to prevent overflow by automatic water level control.
- We have also installed a steel tank with a capacity of 1,000 m^3 to hold redundant water in the event an abrupt imbalance of water.

b) Installation of a gutter-type chemical injection equipment to the thickener of Blast Furnace No. 4

- We have implemented primary cyanide treatment with a gutter-type chemical injection equipment installed onto the thickener of Blast Furnace No. 4.

c) Installation of cyanide treatment equipment

- We will implement secondary cyanide treatment by installing a cyanide treatment equipment together with a back-up device for use in case of emergency.
- In addition, we will install continuous cyanide analyzers for early detection of changes in cyanide concentrations.

iii) Incidents of unreported measurement data other than those described above

The relevant incidents include unreported measurement results exceeding the effluent standards and Agreement values due to temporary factors and troubles. We have already taken measures to address these incidents.

2. Managerial measures

A. Revision of the organizational structure

To strengthen the organizational structure for environmental and disaster prevention management in the Kimitsu Area, the "Safety, Environment, and Plant Safety Division" of East Nippon Works will be separated into the "Safety and Health Division" and the "Environmental and Plant Safety Division" (scheduled to commence on October 1). The "Environment and Disaster Prevention Division" will be solely in charge of planning, promotion, control, and assistance of environmental and disaster prevention activities as well as reinforcing such activities.

B. Strengthening of environmental management in East Nippon Works

i) Change in consciousness to prioritize legal compliance and preservation of the regional environment

We will take the following measures to thoroughly promote understanding and dissemination of the importance of complying laws and the Agreement, including legal and voluntary measurement as well as the water quality control rules with respect to the outlets and drainage channels.

- We will hold an ad hoc meeting that is compulsory for all employees in the Kimitsu Area as a first step toward implementing the emergency measures (scheduled to be held in October).

(The Head and the Vice Head of East Nippon Works will explain to all managers the details of the effluent incidents and again order them to thoroughly comply with laws and regulations related to the environment that pertain to their workplaces. Then, general managers and/or plant managers will do the same to all other employees.)

- We will continuously implement the following measures.

a) Training and clearly indicating the regulations, etc. based on laws and the Agreement (creation of an easy-to-understand list of items subject to regulations, effluent standards, Agreement values, and measurement frequencies for each outlet and drainage channel; clear display of these lists in workplaces (visualization of regulations); and utilization of the list in employee training)

b) Implementation of regular environmental patrols by the Head and Vice Head of East Nippon Works (including confirmation of the status of submissions related to facilities to the administrative agencies concerned)

ii) Placing higher priority on water quality control among senior management of East Nippon Works

- The Environment and Disaster Prevention Division will issue monthly reports on water quality measurement data in the committees of the senior management at East Nippon Works (to promote KPI management while maintaining the completeness of environmental and disaster prevention management — for example, regular reports on measurement results exceeding the effluent standards and Agreement values as well as trend values).
- Establish a "meeting to enhance water quality preservation" headed by the Head of East Nippon Works and hosted by the Environment and Disaster Prevention Division. This conference will be attended by the main general managers and will deliberate the direction of sharing information on water quality issues and implementing measures to address such issues.

iii) Intensive training of personnel in charge of water quality control

- We will intensively retrain the personnel in charge of water quality control, including compulsory implementation of training upon assignment and regular training (including, for example, the introduction of the practice of signing pledges, an internal certification system, and distribution of emblems to certification holders).

iv) Revision of the roles of the division in charge of water quality measurement and subcontractors

- To ensure objectivity and transparency in water quality measurement operations, we will transfer the roles of sampling water from the outlets and drainage channels as well as measuring water quality, which directly relate to complying the Water Pollution Prevention Act and Agreement, from the Energy Management Division to the Environment and Disaster Prevention Division.
- Also, we will change the outsourcing structure in order to divide the water treatment/ sampling operations and water quality management operations to different subcontractors. We will assign a specialist company (Nippon Steel Technology Co., Ltd.) as the subcontractor in charge of water quality measurement operations.

v) Restructuring of water quality measurement work

a) Fundamental revision of the workflow from sampling to measurement and data receipt

- Along with the revision of the roles of the related departments explained in ④ above, we will change the contact department for the water quality analysis company, for ordering measurement of samples at the outlets and drainage channels and receiving reports on the measurement results, from each plant to the Environment and Disaster Prevention Division. (Already implemented on August 16 for outlets, and scheduled to be completed in November for drainage channels).
- In addition to statutory required measurements, we will designate the following year as a period for intensive management focusing on monitoring items (specified measurement items at specified outlets) to be measured and stored every week.
- The Environment and Disaster Prevention Division will set the dates for sampling without notifying the plants in advance.
- Standardize the format for reporting water quality measurement results related to the outlets and drainage channels.
- Toward the next step, we will deliberate functional improvements (to provide an alert function, for monitoring effluent standards, and for preventing input errors (for instance, by eliminating manual input operations)) to the system for controlling the water quality measurement results (a system enabling the water quality analysis company to input the results and for us to browse the data)

b) Establishment of a reporting structure to administrative agencies concerned

- Establish a new rule for the water quality analysis company to directly report to the administrative agencies concerned regarding water quality issues, exceeding the effluent standards and Agreement values, via the Security Center, automatically (implemented on August 16).

vi) Reinforcement of internal audits along with the changes to the water quality measurement operation

In addition to the reinforcement of environmental audits of the Kimitsu Area by the Nippon Steel headquarter, a third-party division (for example, the general administration division) will regularly audit both the Environment and Disaster Prevention Division and the water quality analysis company, with regard to the measurement results of samples at the outlets and drainage channels, as well as the measurement results exceeding the effluent standards and Agreement values. The audit results will then be subjected to a follow-up investigation by the headquarters.

vii) Establishment of a structure for preventing and checking inadequate notifications of facilities to the administrative agencies

- First, we will conduct inspections of the implementation of notifications for all facilities subject to notification on the sites.

- Next, we will deliberate a system to ensure submission of installation and changes to facilities subject to notification.
- As a supplemental measure to the above structure, we will implement regular environmental patrols by the Head and Vice Head of East Nippon Works as well as regular on-site confirmation by the Environment and Disaster Prevention Division (as to correspond notified documents to actual facility conditions).

C. Managerial measures regarding the effluent incidents at Outlet Nos. 11 and 14 (coke gas desulfurization liquid)

- We will take specific managerial measures to repair the desulfurization liquid tanks in order to ensure safety during the period until completion of the renewal of the tanks. This will be done based on a deliberation of the department in charge and cross-divisional risk identification in the Kimitsu Area.

D. Managerial measures regarding the effluent incidents at Outlet No. 7 (Blast Furnace No. 2) and Outlet No. 16 (Blast Furnace No. 4)

- We will transfer cyanide treatment and cyanide concentration control of blast furnace dust collection water from the Energy Management Division to the Ironmaking Division to enable the Ironmaking Division to continuously confirm all changes in the characteristics and flow rates of blast furnace dust collection water, thereby ensuring drainage and water quality control of the blast furnace dust collection water associated with blast furnace operations.
- Also, we will establish a committee and business rules to enable the Ironmaking Division and the Energy Management Division to promptly and appropriately deliberate and implement facility measures necessary for water quality control.

3. Enhancement of communication with the local communities

A. Disclosure of water quality measurement data

- To enhance the transparency of our drainage operations, we will disclose water quality measurement data via an East Nippon Works webpage on the Nippon Steel website.

B. Enhancement of dialogue with the local communities

i) Explanation of the effluent incidents occurred this time

- We will explain the causes of the effluent incidents that occurred this time and the countermeasures we implemented in response to the residents of 14 community associations in the three cities as well as people in four fisheries associations and the Chiba Prefectural Federation of Fisheries Cooperative Associations.

ii) Enhancement of dialogues

- In the information exchange meetings, we have been holding twice a year with the community associations and fishermen's associations, we will report on our efforts in the Kimitsu Area focusing on environmental management, including water quality control.
- Also, we will improve the content of the plant tours that we have been holding annually to enable residents in the community associations to observe the implementation statuses of our environmental measures on-sites as well as to utilize the tours as an opportunity for sharing information on these measures and facilitating dialogue with local residents.

IV. Company-wide Measures

1. Tangible measures

A. Installation of dikes

- We will provide desulfurization liquid tanks in the necessary locations with dikes having a storage capacity equivalent to 110% of the tanks' total capacity.

B. Standardization of cyanide treatment devices

- We will install cyanide treatment devices with capacity sufficient for treating blast furnace dust collection water according to the standards in the necessary locations.

2. Managerial measures

A. Revision of the organization within the headquarters

To strengthen the company-wide organizational structure with respect to environmental risk management, the Environment Division will be divided into the Environmental Planning Division and the Environmental Technology and Management Division (scheduled to commence on October 1). The Environment Technology and Management Division will fulfill and reinforce the functions of planning, promotion, implementation of company-wide controls, and provision of assistance in environmental technologies for and management of water and air quality.

B. Reinforcement of the company-wide environmental management function

We will reinforce existing company-wide environmental management by supplementing it with additional measures and revising it based on an analysis of the effluent incidents in the Kimitsu Area that occurred this time.

i) Reinforcement and restructuring of company-wide committees

- We will divide the Environment Committee, which is one of the company-wide committees*, into the Environmental Planning Committee and the Environmental Technology and Management Committee.

  * These committees have been established to jointly review company-wide and cross-sectional issues.
- The Environment Technology and Management Committee will be comprised of board members of the headquarter and Head of works, and it shall review issues and measures related to environmental technologies for and management of water and air quality.
- The content reviewed by this committee will be regularly reported at management meetings and board meetings.
- We will promptly implement transmission and sharing of information on as well as discussion of environmental management in other committees and liaison conferences attended by the Head of works.

ii) Reinforcement and review of the content of environmental audits and internal factory audits

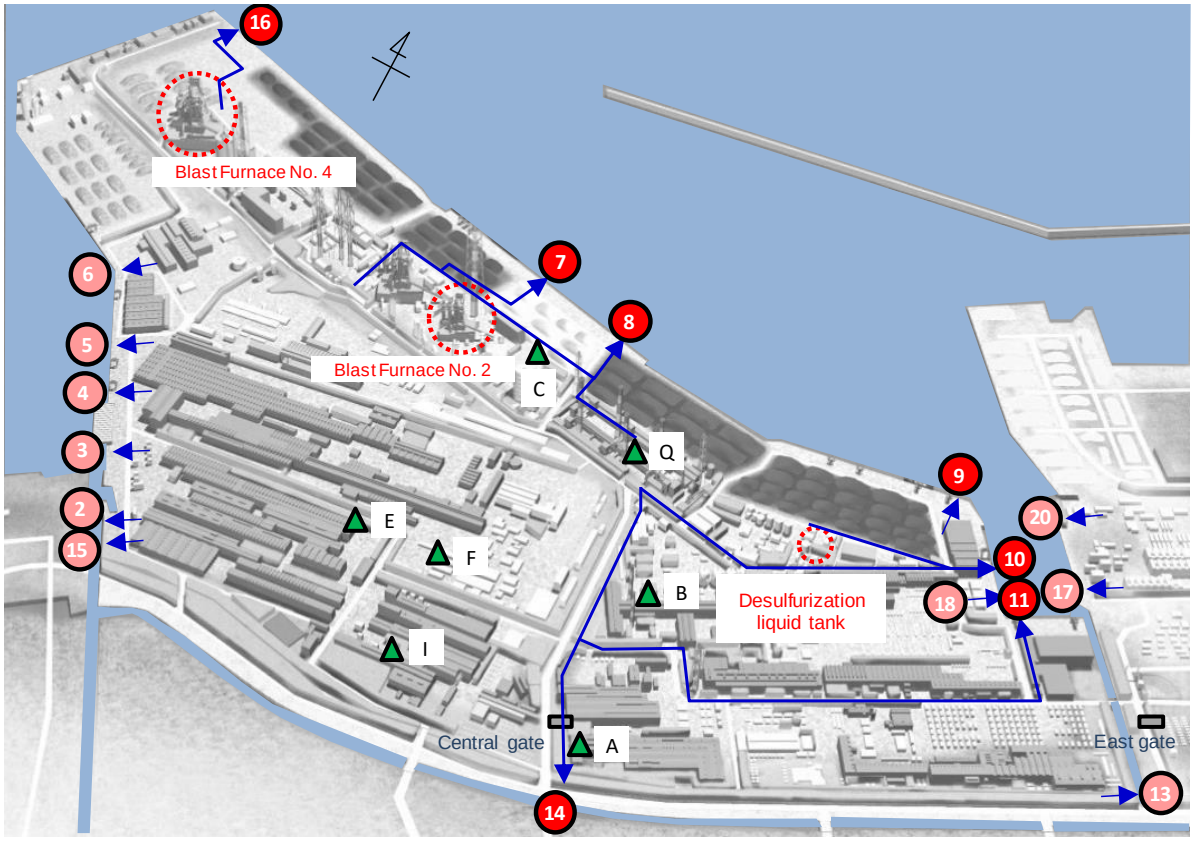
- To further enhance the effectiveness of environmental audits by the headquarters, we will conduct audits without prior notice focusing on document inspections, hearings with persons concerned, and field inspections. Also, in management hearings, we will implement on-site sample checks with respect to water quality measurement and report content as an immediate measure.
- We will confirm the priority environment risks, including those related to water quality control and the implementation statuses of countermeasures, through dialogues with the directors and executives of the works in the environmental audits by the headquarter.
- As an immediate measure, we will conduct "internal plant audits," which are conducted by dispatching

personnel in charge of environmental technology and management at the headquarter and persons in charge of environment at the respective plants to the plants in each area as auditors, exclusively for divisions related to water quality.

iii) Company-wide deployment of portions of intangible measures deemed necessary for other works and areas, implemented in the Kimitsu Area

We will proactively implement company-wide deployment of intangible measures deemed necessary for other works and areas, implemented in the Kimitsu Area, described in III. 2. The details of the specific content of such intangible measures to be implemented will be determined by the Environment Technology and Management Division of the headquarter.

<Figure:1> Outline of effluent outlets and drainage channels at Kimitsu Area of East Nippon Works



○ Outlets at 17 points (Nos. 1, 12, and 19 have been closed.)
➔ The Water Pollution Prevention Act applies to these outlets. (Effluent standards)

△ Drainage channels at 7 points
➔ Subject to the Agreement Concerning Environmental Preservation among the Prefecture and Three Cities (Agreement values)

Symbol	Drainage channel name	Outlet
A	Small diameter pipe return w ater drainage channel	⑪
B	Bar steel return w ater drainage channel	⑩
C	Dust collection secondary treatment drainage channel	⑧
E	Cold rolling-1 w eak acid treatment drainage channel	⑮
F	Oil-containing w astew ater treatment drainage channel	⑮
I	EGL process drainage channel	⑮
Q	Ammoniacal liquor secondary treatment drainage channel	⑧

Locations which Effluent standards/Agreement values apply to drainage system (concept)