Port of Kaohsiung Environmental Report

▶ 2018

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Port of Kaohsiung Environmental Report

This environmental report presents Kaohsiung Port's achievements in environmental protection from 2016 to 2017 as well as the environmental policy, commitments and action plans of the Kaohsiung Branch, Taiwan International Ports Corporation, Ltd.

If you have any inquiries regarding this report, please contact us.

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Environmental Policy

Ports are the core of international trades and essential for Taiwan's economic development. The Port of Kaohsiung recognizes the importance of ensuring sustainable development while keeping the balance between port prosperity and local ecology. In order to sustain the beauty and prosperity of the bay area, Port of Kaohsiung thereby established the following environmental policy to ensure consistent environmental performance.

- Fully apply the environmental management system; promote sustainable development of the green port
- Follow environmental laws and regulations; endeavor to fulfill corporate social responsibility initiatives
- Provide appropriate environmental education and training; enhance the environmental awareness and skills of our employees
- Continue environmental monitoring and pollution control; reduce energy consumption, carbon emissions, and environmental load
- Disclose environmental information regularly; establish a bridge of communication between the inner and outer port

Chen, Shao Liang
President of Port of Kaohsiung, TIPC

PORT OF KAOHSIUNG, TAIWAN INTERNATIONAL PORTS CORPORATION

– Environmental Objectives –

Improve port air quality:

To encourage speed reductions for vessels in proximity to the port, reduce air pollution emissions from cargo handling operations, and continuously monitor air quality at the port

Abate vessel emissions:

To manage vessel pollution effectively by promoting environmental friendly practices and conducting long-term port water quality monitoring.

Reduce waste:

To fully implement waste recycling at the port, and manage river debris efficaciously.

Manage hazardous cargo:

To value disaster prevention and prevent accidents at all cost.

Practice good port development strategies:

To minimize impacts of port development by coordinating with city development and monitoring marine environment.

Monitor marine sediment:

To protect port ecology by monitoring the dredged-sediment disposal area.

Continue brownfield remediation:

To continuously monitor and remedy the contaminated sites in the port and revitalize the brown fields.

Strengthen relationships with local communities:

To enhance port friendliness by making port information transparent, encouraging public participation, and increasing opportunities to interact with the local communities.

Restore habitats:

To restore local ecology by reducing impacts from port development and implementing compensation measures.

Tighten resource usage:

To reduce port impact by managing resource consumption and greenhouse gas emissions.

Chen, Shao Liang

President of Port of Kaohsiung, TIPC

PORT OF KAOHSIUNG, TAIWAN INTERATIONAL PORTS CORPORATION

Message from the President

01/

Message from the President of Port of Kaohsiung Taiwan International Ports Corporation ,Ltd

To achieve sustainable development, the Port of Kaohsiung (hereinafter the Port) has employed environmentally friendly practices in its operational development. Since 2010, the Taiwan International Port Corporation's "Greening the Ports Action Plan" has been gradually implemented among ports in Taiwan. In 2014, the Port became the first in the Asia-Pacific region to obtain European EcoPort certification. Since then, it has continued to strive toward sustainable development and has set the following objectives: to increase its business competitiveness, to enhance its social image, to improve its visibility and reputation, and to obtain the experience of international ports.

The Port has continually improved its infrastructure under the joint efforts of various shipping sectors and agencies, promoting the port as the center for Asia-Pacific transshipment and global logistics. With the business goals of "breakthrough, innovation, and variation" and "safety, efficiency, and sustainability," the Port aspires to develop its logistics and transshipment and to become a free port, cultivating a safe, economical, and highly efficient operating environment.

Considering the compatibility of port–city development, the Port will expand southward and adhere to the principles of sustainable development in production, life, and ecology by adjusting the function of the old port area. As a green port, the Port is transitioning into the role of a hub port, LOHAS port (i.e., a port that features lifestyles of health and sustainability), and eco-port (i.e., a port that is environmentally friendly). The Port will be built to function as a modern commercial harbor that is informative, automated, and complies with green transportation, while meeting shipping and urban development demands. Combining the business culture of "integrity, sincere service, and business innovation," the Port provides clients with attentive and thoughtful services, creating a win-win business outcome for the Port, shipping sectors, and clients.

Chen, Shao Liang

President of Port of Kaohsiung
Taiwan International Ports Corporation, Ltd.


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Port Profile

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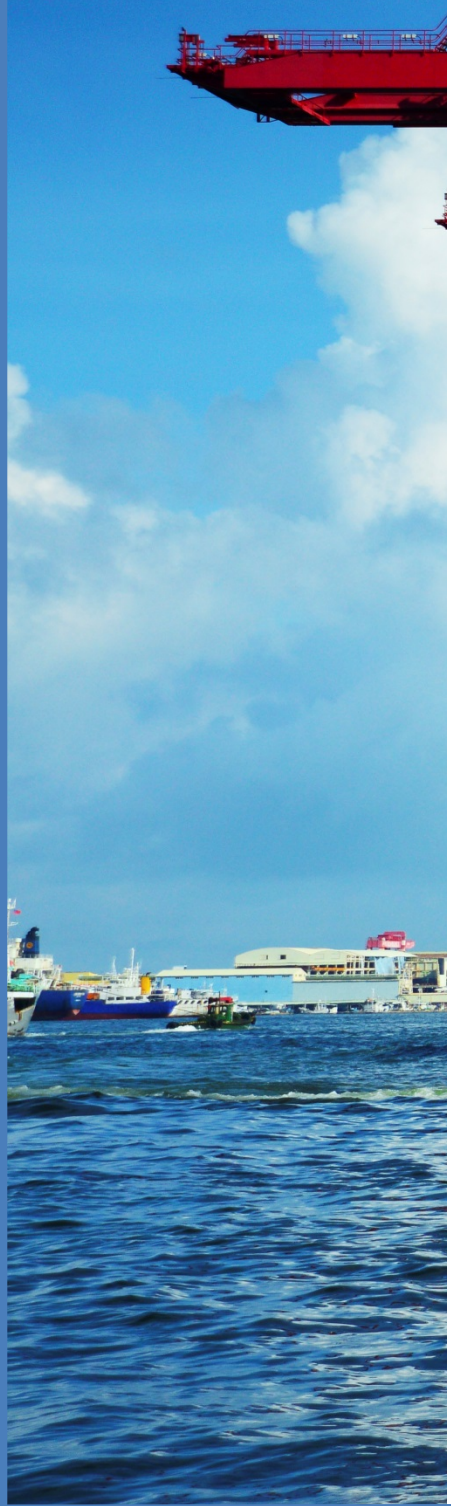
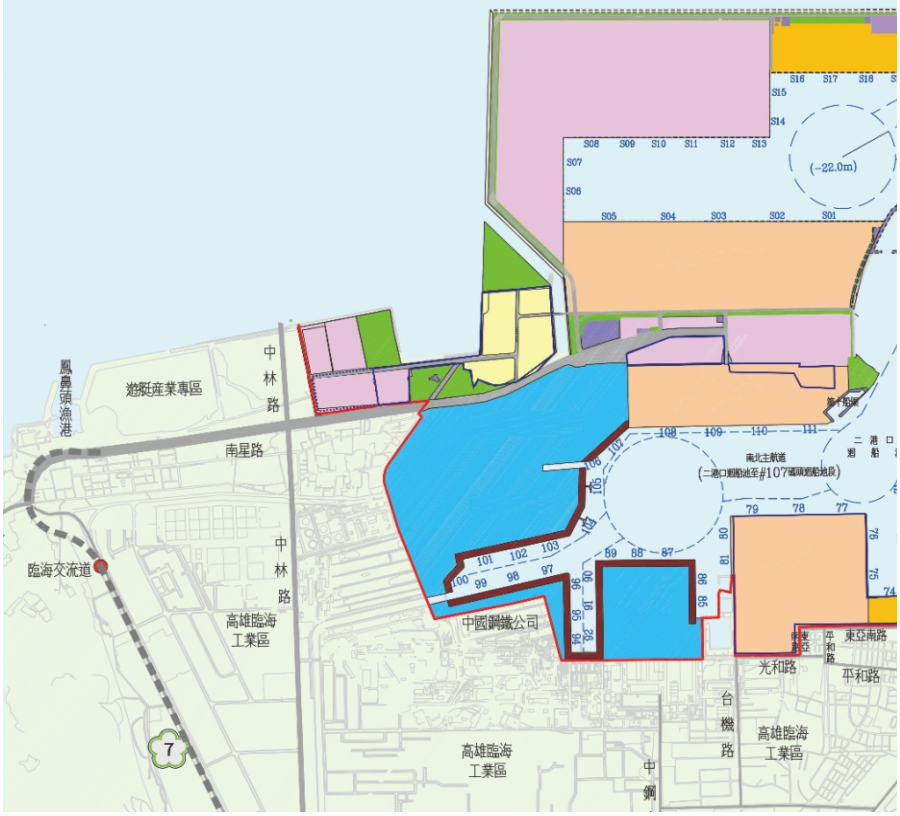


2.1 Port Location and Port Area

The Port of Kaohsiung is located on the southwest coast of Taiwan (22°27 north latitude and 120°10' East longitude) at the intersection of Taiwan Strait and Bashi Channel. The Port enjoys a geographic position at the hub of shipping routes, and serves as an essential point for American, European, Australian and Asian shipping routes. With a vast hinterland, the port occupies 18.71 km² of land, and the water area of the Port reaches 158.65km². The maximum draft of its inner port is 17.6 meters. Mean tide is 0.74 meters. The Port has two entrances: No. 1 and No.2. Geographically speaking, the Port was a natural lagoon before it became a port (Takao Bay). The Port is situated on a plain area, and the coastal area of the Port includes: rocky foreshore, tidal flats, sea walls, offshore island (Cijin Peninsula), offshore banks and sandy beach. The Port neighbors the downtown area of Kaohsiung City, industrial parks (Linhai Industrial Park, Export Processing Zone) and waterfront recreational area (Cijin Seashore). In addition, the Love River, Qianzhen River, Canal No. 5 and Yanshui Stream all flow into the ocean through the Port.

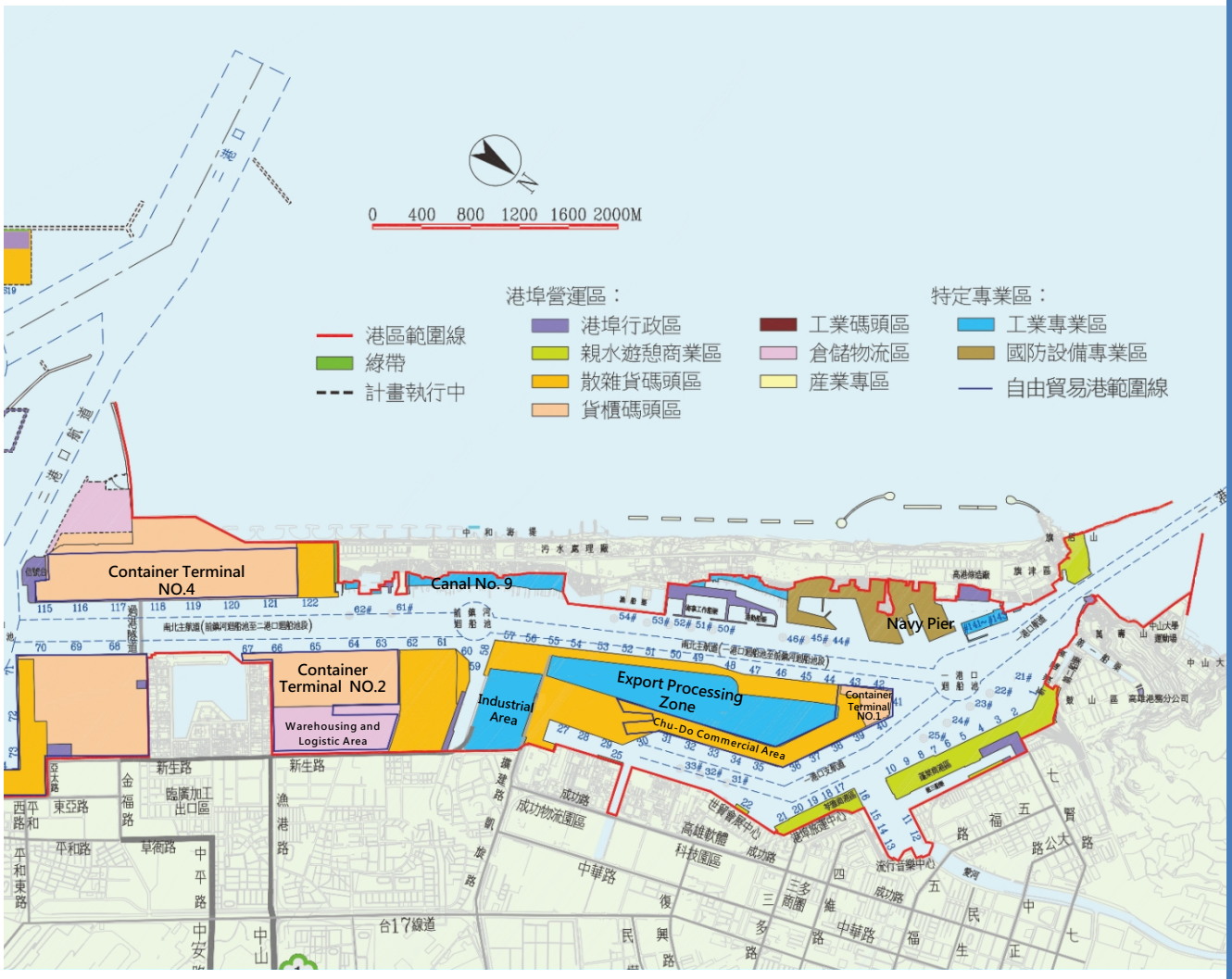
Master Plan of Port of Kaohsiung



Source: Kaohsiung Branch of TIPC

2.2 Legal Status and Port Operators

To modernize the management of commercial ports in Taiwan, the country passed the amendment of Commercial Port Law on December 28, 2011. It was then decided in March 2012 that the government should be separated from the enterprise for management of the ports. Public entities that used to manage the ports, including: Kaohsiung Harbor Bureau, Taichung Harbor Bureau, Keelung Harbor Bureau and Hualien Harbor Bureau, are integrated into a corporation (Taiwan International Ports Corporation, TIPC) to reduce legal and institutional restrictions on commercial port operations, enhance the ability of ports to respond to market changes, and increase their competitiveness. After the transformation, management of the Port of Kaohsiung is now the responsibility of the Kaohsiung Branch of TIPC. The Southern Taiwan Service Center of Maritime and Port Bureau (MPB), Ministry of Transportation and Communications (MOTC) will be in charge of navigation and management of issues related to public authority.



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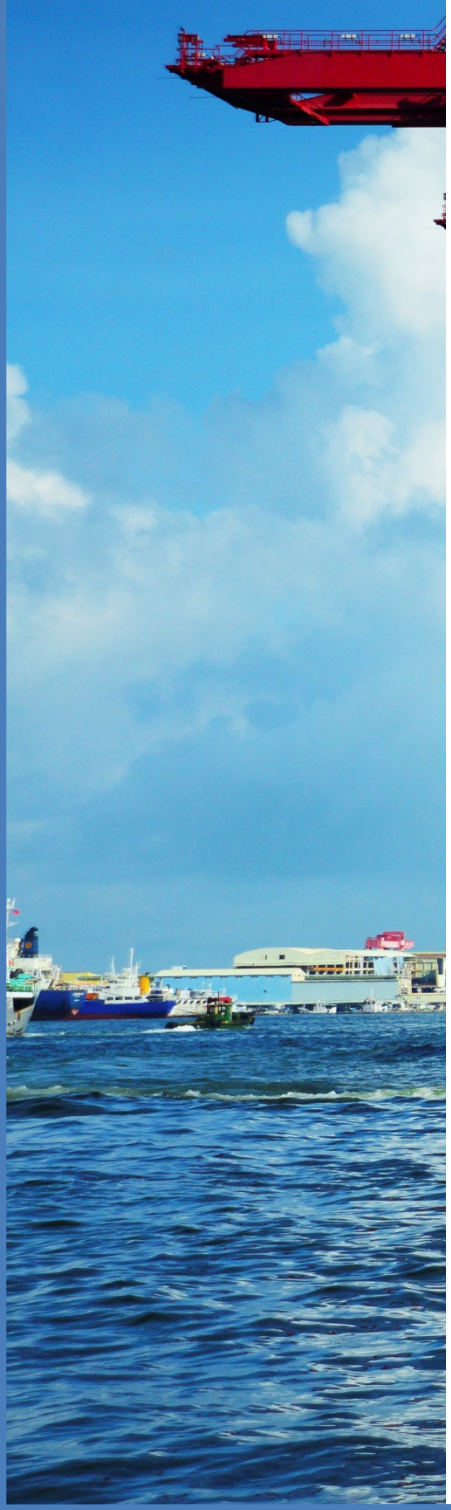

2.3 Commercial Activities

At present, the commercial section of the port include 124 operating docks, whose full length is 28,853 m, including: bulk and sundry goods dock, container dock and industrial dock. Commercial activities within the port include: ship building and repair, petroleum product processing, marinas / leisure, chemical industry, general manufacturing, storage and packaging and refrigerated cargo.

2.4 Main Cargoes

In 2016 and 2017, the inbound cargo of the Port of Kaohsiung mainly includes mineral products (60.28%), base metals and articles therefore (13.22%), vegetable products (7.58%), and products of chemical or allied industries (6.12%). The outbound cargo primarily includes base metals and their products (35.67%), plastics, rubber, and articles thereof (20.84%), mineral products (10.42%), and products of chemical or allied industries (10.26%).

Main Commercial Activities and Cargo Handling of Port of Kaohsiung

Petroleum	**Pyrites minerals**
Crude oil Refined products LNG (liquefied natural gas)	Aluminum Cement Phosphates Sulphur
Dry bulk	**Liquid bulk (non-oil)**
Animal feed Chemicals Grains Scrap Timber Wood products	Liquid chemicals Liquefied gases
Ores	**Other**
Coal Iron ore	Vehicles Fish Fruit

Source: Kaohsiung Branch of TIPC

2.5 Port Business

2016-2017 Business of Port of Kaohsiung

Item		2016	2017	Difference	%
Incoming & Outgoing Ships	V.	36,525	37,546	1,021	2.8
	G.T.	900,275,872	915,594,148	15,318,276	1.7
Volume of Cargo Handled	Cargo (Revenue ton)	374,785,560	367,561,080	-7,224,480	-1.9
	Dry bulk and Groceries (Revenue ton)	51,789,568	50,937,814	-851,754	-1.6
	Pipeline cargo (Revenue ton)	29,801,464	31,544,006	1,742,542	5.8
	Total (Revenue ton)	456,376,592	450,042,900	-6,333,692	-1.4
Number of Cargo Handle	Incoming Cargo(TEU)	5,229,312	5,126,820	-102,492	-2.0
	Outgoing Cargo(TEU)	5,235,548	5,144,198	-91,350	-1.7
	Total (TEU)	10,464,860.00	10,271,018.00	-193,842	-1.9
Volume of Imports & Exports	Incoming Cargo(TEU)	78,172,862	79,438,675	1,265,813	1.6
	Outgoing Cargo(TEU)	32,297,031	32,116,744	-180,287	-0.6
	Total (TEU)	6,150,923	4,515,553	-1,635,370	-26.6
	Imports (ton)	116,620,816	116,070,972	-549,844	-0.5
Incoming & Outgoing Passenger	Domestic	76,523	79,057	2,534	3.3
	International	42,998	117,559	74,561	173.4
	Total	119,521	196,616	77,095	64.5

Source: TIPC, 2016-2017 Statistical Report

Environmental Management

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Environmental Management

3.1 Organizational Structure

The Kaohsiung TIPC is responsible for addressing environmental concerns involved in port operation and management, as indicated by the attribution of responsibilities specified in the Commercial Port Law and the Marine Pollution Prevention Act. The South Maritime Affairs Center is in charge of coping with environmental issues related to public authority. The Marine Bureau is in charge of handling environmental issues associated with the Marine Pollution Prevention Act.

In the Kaohsiung Branch of TIPC, the department responsible for the operation and management of the environment is the Occupational Safety Division that consists of the Safety and Hygiene Management Section, Hygiene and Pollution Control Section and Environmental Management Section. The Safety and Hygiene Management Section is in charge of management of occupational safety and hygiene; the Hygiene and Pollution Control Section deals with pollution control, environmental laws, environmental impact assessment, environmental monitoring, oil pollution, chemical accidents, emergency management and environmental education in the port; the Environmental Management Section manages conservation, plant conservation, waste treatment and recycling. Among the staff members, 50 are involved in environmental protection issues.

Figure of Organization involved in environmental issues of Port of Kaohsiung

Port of Kaohsiung

Management

- Kaohsiung Branch of TIPC
- Environmental Protection Bureau, Kaohsiung City Government
- South Taiwan Maritime Affairs Center, Maritime and Port Bureau, MOTC

Supervise

- Kaohsiung Branch of TIPC
- Marine Bureau, Kaohsiung City Government
- Environmental Protection Administration
- Ocean Affairs Council
- Environmental Protection Bureau, Kaohsiung City Government
- South Taiwan Maritime Affairs Center Maritime and Port Bureau, MOTC

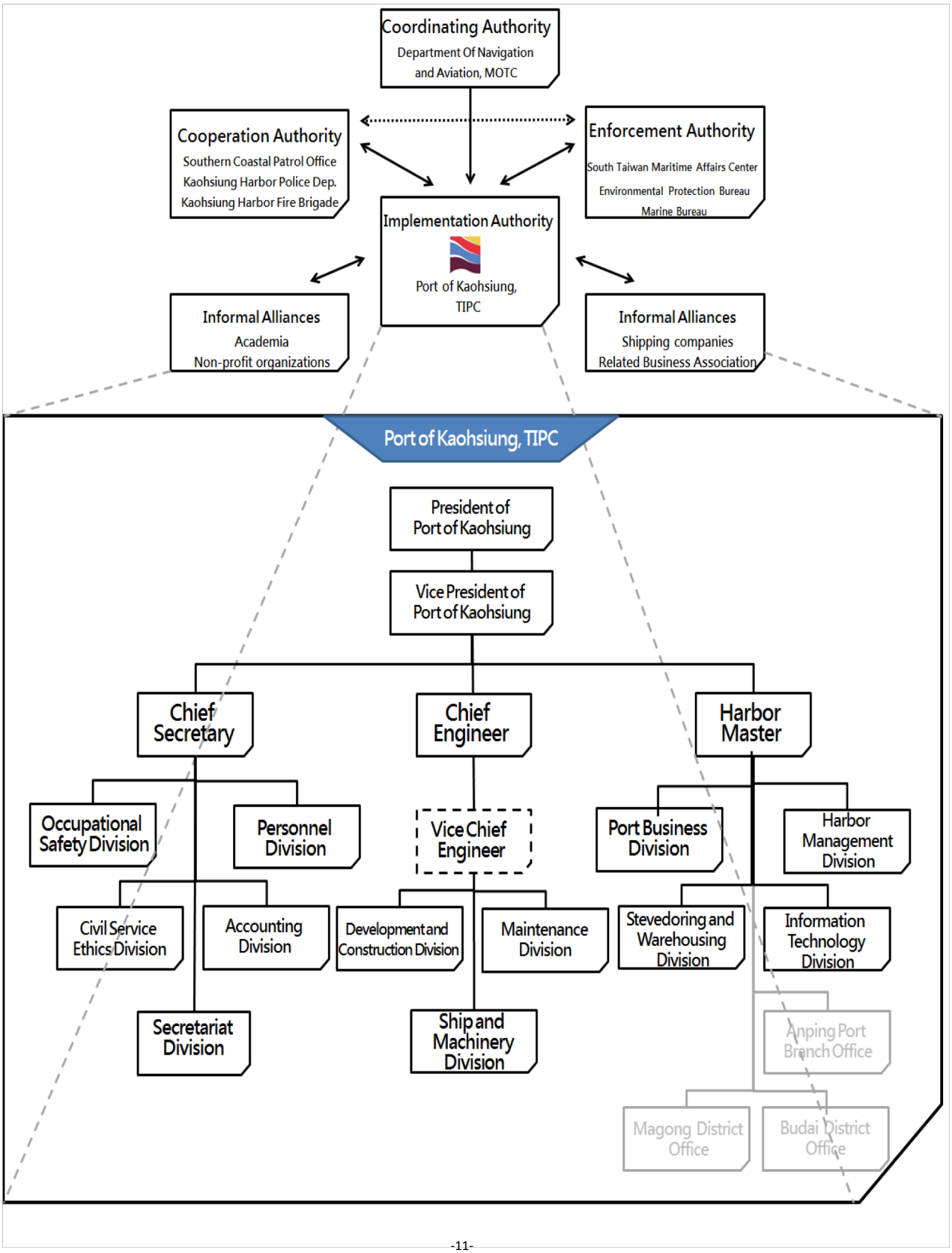
Perform Interdiction, Collection of evidence or Enforcement Referral

- Kaohsiung Branch of TIPC
- Kaohsiung Harbor Police Dep. , National Police Agency, Ministry of the interior
- Southern Coastal Patrol Office, Coast Guard Administration
- South Taiwan Maritime Affairs Center, Maritime and Port Bureau, MOTC
- Environmental Protection Bureau, Kaohsiung City Government

Sanction

- South Taiwan Maritime Affairs Center, Maritime and Port Bureau, MOTC
- Kaohsiung Harbor Police Dep. , National Police Agency, Ministry of the interior
- Environmental Protection Administration
- Ocean Affairs Council
- Environmental Protection Bureau, Kaohsiung City Government

Figure of Organization chart of Kaohsiung Branch of TIPC



03/ Environmental Management

3.2.1 Relevant international regulations

The Kaohsiung Branch of TIPC follows relevant international specifications, such as International Convention for the Prevention of Pollution From Ships(MARPOL 73 / 78), London Dumping Convention, International Convention on the Control of Harmful Anti-fouling Systems on Ships etc..

Relevant Environmental Laws and Regulations Related to Ports in Taiwan

Competent Authorities	Laws Title
Sectors in the Ministry of transportation and communications	The Commercial Port Law
	The Law Of Ships
	The Shipping Act
	Act for the Establishment and Management of Free Trade Zones
Sectors in the Ministry of the Interior	Fire Services Act
Sectors related to agricultural	Wildlife Conservation Act
Sectors related to environmental protection	Marine Pollution Control Act
	Basic Environment Act
	Air Pollution Control Act
	Water Pollution Control Act
	Waste Disposal Act
	Environmental Impact Assessment Act
	Environmental Education Act
	Noise Control Act
	Indoor Air Quality Act
	Toxic Chemical Substances Control Act
	Soil and Groundwater Pollution Remediation Act
	Environmental Agents Control Act
	Greenhouse Gas Reduction and Management Act
	Public Nuisance Dispute Mediation Act
Intersectoral	Disaster Prevention and Protection Act

Source: Kaohsiung Branch of TIPC

3.2.2 Relevant Environmental Laws and Regulations in Taiwan

In addition to the international environmental specifications and conventions, The Kaohsiung Branch of TIPC collaborates with local authorities to manage the environment in the Port in compliance with relevant environmental laws and regulations in Taiwan. The follow table lists the relevant environmental laws and regulations related to ports in Taiwan.

		Central Competent Authority	Local Law Enforcement Agencies
	2011/12/28	Ministry of Transportation and Communications	South Maritime Affairs Center, Maritime and Port Bureau, MOTC
	2010/12/08		
	2014/01/22		
	2012/12/28		
	2011/12/21	Ministry of the Interior	Fire Bureau, Kaohsiung City Government
	2013/01/23	Council of Agriculture	Marine Bureau/ Agriculture Bureau, Kaohsiung City Government
	2014/06/04	Ocean Affair Council	Marine Bureau, Kaohsiung City Government
	2002/12/11	Environmental Protection Administration	Environmental Protection Bureau, Kaohsiung City Government
	2018/08/01		
	2018/06/13		
	2017/06/14		
	2003/01/08		
	2017/11/29		
	2008/12/03		
	2011/11/23		
	2013/12/11		
	2010/02/03		
	2016/12/07		
	2015/07/01		
	2009/06/17		Public Nuisance Disputes Mediation Committee, Kaohsiung City Government
	2017/11/22	Ministry of the Interior	Kaohsiung City Government

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高雄港
Environmental
環境管理系統
Management

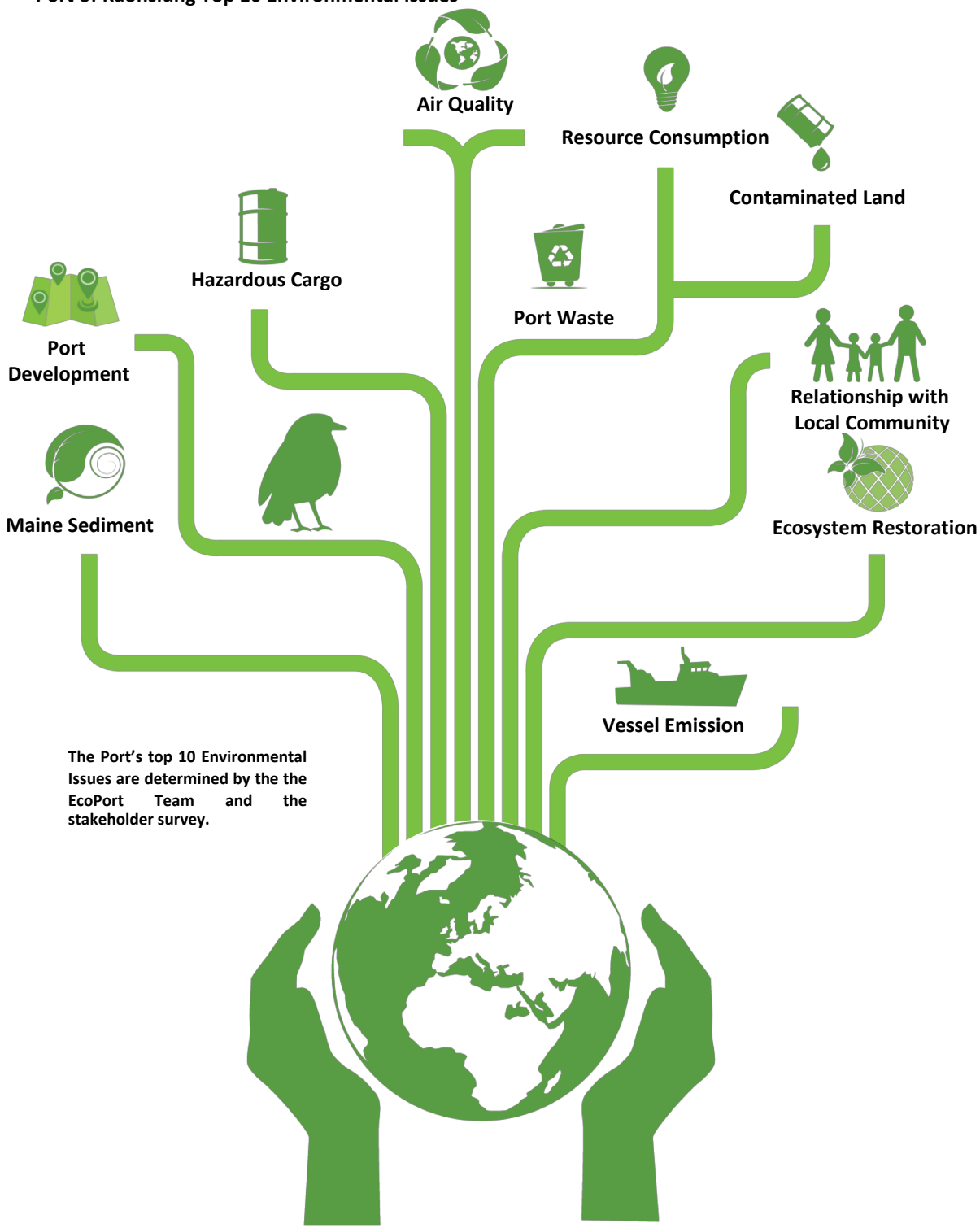
3.3 Stakeholder Analysis

As an important enterprise in the Kaohsiung City bay area, the Kaohsiung Branch of TIPC uses a variety of methods to communicate with stakeholders. Their needs and expectations are gathered and incorporated into the company's policy.

The Port of Kaohsiung believes that good communications with the stakeholders help identify key environmental issues and create value. Therefore, it collected surveys to help formulate the Port's Environmental Objectives.

Sector	Environmental Concerns	Relevant Environmental Objectives
Government	Dust, Emissions from Heavy Duty Vehicles and Vessels, Emissions from Port Industry, Hazardous Cargo	I. Air Quality II. Vessel Emissions III. Port Waste IV. Hazardous Cargo
Employee	Living Quality near the Ports, Port Ecology, Resource Usages	V. Port Development VIII. Relationship with Local Community IX. Ecosystem Restoration X. Resource Consumption
Clients	Air Quality, Emissions from Port industry, Cargo Leakage, Port Safety, Soil Pollution	I. Air Quality II. Vessel Emissions IV. Hazardous Cargo VII. Contaminated Land
Community	Dust, Emissions from Heavy Duty Vehicles and Vessels, Pollution from Riverain, Dredge Disposal, Marine Sediment, Port Development, Port Safety	I. Air Quality II. Vessel Emissions III. Port Waste IV. Hazardous Cargo V. Port Development Vi. Marine Sediment

Port of Kaohsiung Top 10 Environmental Issues



The Port's top 10 Environmental Issues are determined by the the EcoPort Team and the stakeholder survey.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State of the Environment

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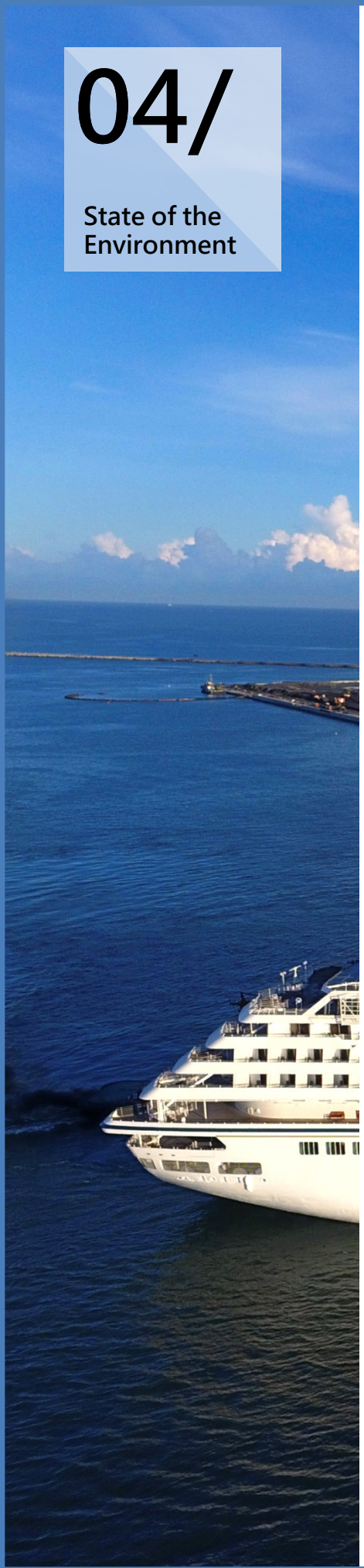

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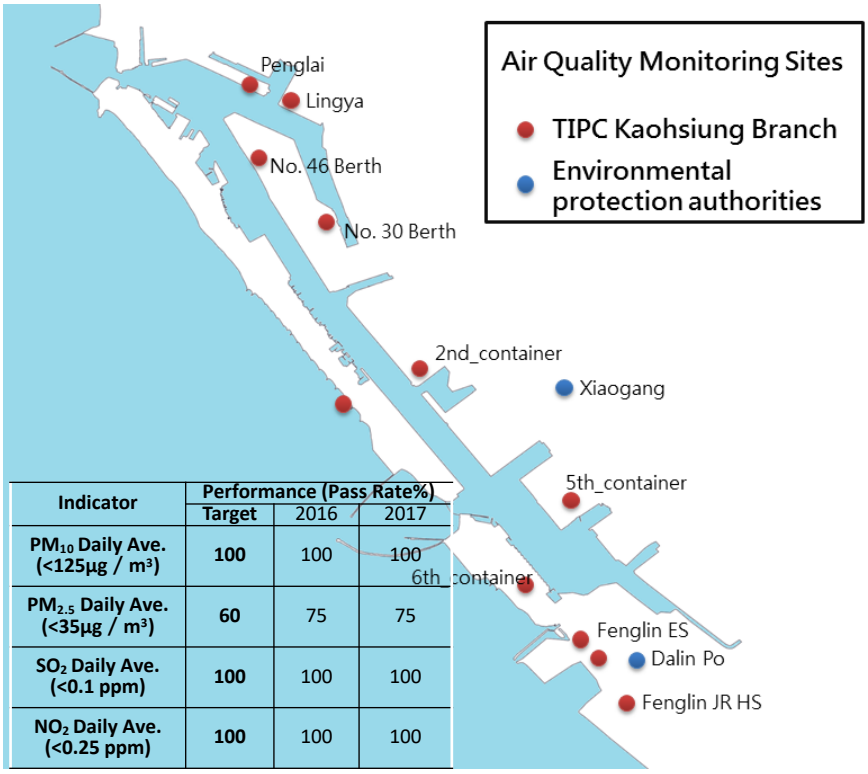
State of the Environment

4.1 Air Quality

The air pollutants in the Port of Kaohsiung mainly include nitrogen oxides (NO_x), sulfur dioxides (SO_x), and suspended particulates. Ocean-going vessels are the greatest contributor of pollutant emission, followed by in-port ships, heavy-duty vehicles, and steve-doring equipment. Pollutants from ocean-going vessels are mainly derived from emissions caused by the fuel combustion of auxiliary boilers and engines when such ships approach and berth in a port, thereby generating SO_x as the primary pollutant. Pollution released from heavy-duty trucks is mainly caused by engine idling during freight handling. Therefore, to reduce pollution and green-house gas (GHG) emissions, the Kaohsiung Branch of TIPC has focused on promoting eco-friendly practices among incoming ships and freight forwarders, improving handling equipment, decreasing fugitive substances produced during handling, and controlling transportation vehicles.

4.1.1 Air Quality Monitoring

Currently, 10 air quality monitoring stations are set up in the Port of Kaohsiung, among which 3 are located in the construction development district and 7 in the operation district. The monitoring items include total suspended particles (TSP), particulate matters (PM_{10}), fine suspended particles ($PM_{2.5}$), SO_2, NOx, and ozone (O_3). These indicators are monitored quarterly. In addition, two monitoring stations are established in the neighboring areas of the Port of Kaohsiung, namely the Xiaogang Monitoring Station and the Dalin Po Monitoring Station, respectively set up by the EPA and EPB.



Indicator	Performance (Pass Rate%)		
	Target	2016	2017
PM_{10} Daily Ave. (<125μg / m³)	100	100	100
$PM_{2.5}$ Daily Ave. (<35μg / m³)	60	75	75
SO_2 Daily Ave. (<0.1 ppm)	100	100	100
NO_2 Daily Ave. (<0.25 ppm)	100	100	100

4.1.2 Preventing Emissions from Cargo Handling Operations

Port of Kaohsiung effectively manages dust generated from bulk cargo handling operations at Bulk and General Cargo Terminals No. 48–56 by implementing dust net, swiping and cleaning the streets, and deploying mist cannon vehicles. At Wharf No. 49, a covered warehouse is installed to control stevedoring-induced suspended coal particles. The amount of coal handled at Wharf No. 49 was about 960,000 tons in 2016 and 1,000,000 tons in 2017. In addition, Wharves No. 50, 52, 54, and 55 have been individually equipped with a vehicle-washing pond, and a camera is installed at the inspection and registration checkpoint of Wharf No. 55 to calculate the ratio of outgoing vehicles that have been washed.

Dust prevention nets

High water pressure car wash lane

Automatic spraying system

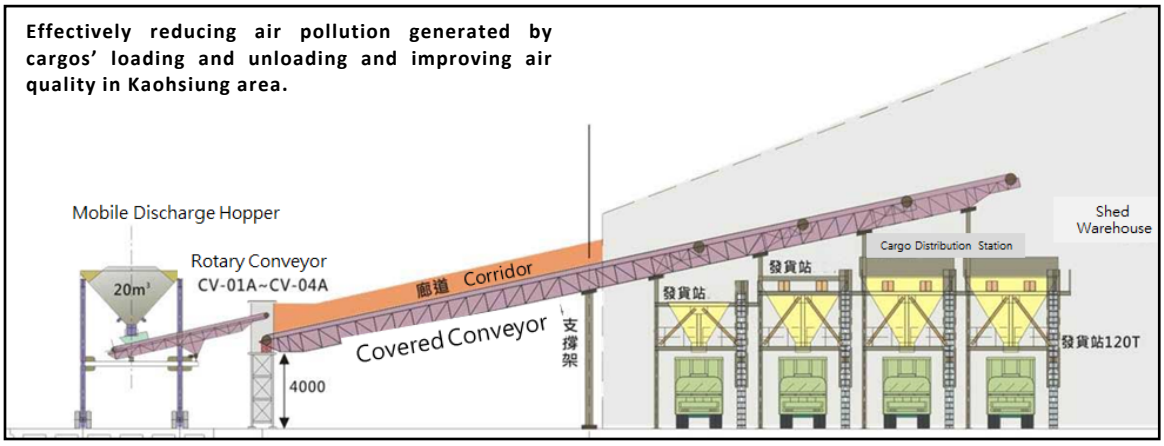
Number of Vehicles washed and inspected

Year	Vehicles	Inspections	Pass rate
2016	107,408	25,345	99%
2017	96,299	30,331	99%

◀ The amount of coal handled at Wharf No. 49 was about 960,000 tons in 2016 and 1,000,000 tons in 2017.

Figure of the covered warehouse facility

Effectively reducing air pollution generated by cargos' loading and unloading and improving air quality in Kaohsiung area.



4.1.3 Land Mobile Pollution Source Control

Vehicles traveling on land in the Port of Kaohsiung are another source of air pollution. The Kaohsiung Branch of TIPC conducts inspection jointly with the Environmental Protection Bureau of Kaohsiung City Government. At the quarterly Port Affairs Meeting, the branch also advises shipping lines to have their trucks join the diesel vehicle self-management program, and encourages stevedoring companies to shift to electric or hybrid machinery. Currently, 63 of the 69 roadways in and out of the Port of Kaohsiung are installed with an automatic gate sentry post. The automatic gate sentry post control system is not comprehensively installed because ordinary roadways are required for the passage of goods with particular specifications. However, all newly built roadways are installed with the system.

The carbon reduction of heavy trucks through automatic gate lanes

Year	No. of Passing Container Trucks	Fuel Consumption Reduction	Carbon Emission Reduction(Kg)	Total Fuel Reduction (L)	Total Carbon Reduction(Kg)
2013	7,858,423	24.6 g/ per passing (1)	0.152Kg/per passing (2)	227,432	1,194,480
2014	8,581,882			248,370	1,304,446
2015	8,860,126			256,422	1,346,739
2016	8,588,795			248,570	1,305,497
2017	8,698,290			251,739	1,322,140

1. Automotive Research & Testing Center
2. EPA “Eco Life” Website(ecolife.epa.gov.tw)

Automatic gates

4.2 Vessel (Water) Mobile Pollution Source Control

Regarding the management of ships emissions, there are mainly two types of pollutions: air and wastewater. The Kaohsiung Branch of TIPC has endeavored to promote the use of low-pollution practices. Currently, there are 17 dwarfs installed with low-voltage shore power and 7 dwarfs installed with high-voltage shore power. To lead by example, all the harbor crafts in the Port of Kaohsiung have started to use shore power to reduce air pollution at berth. And the accumulated usages of low-voltage shore power were 321,932 kWh in 2016 and 269,318 kWh in 2017.

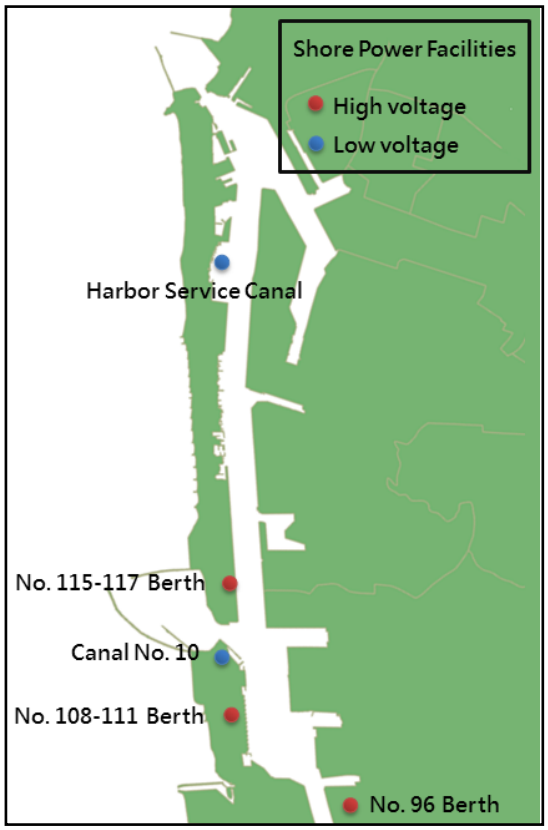
Shore Power Systems at Port of Kaohsiung

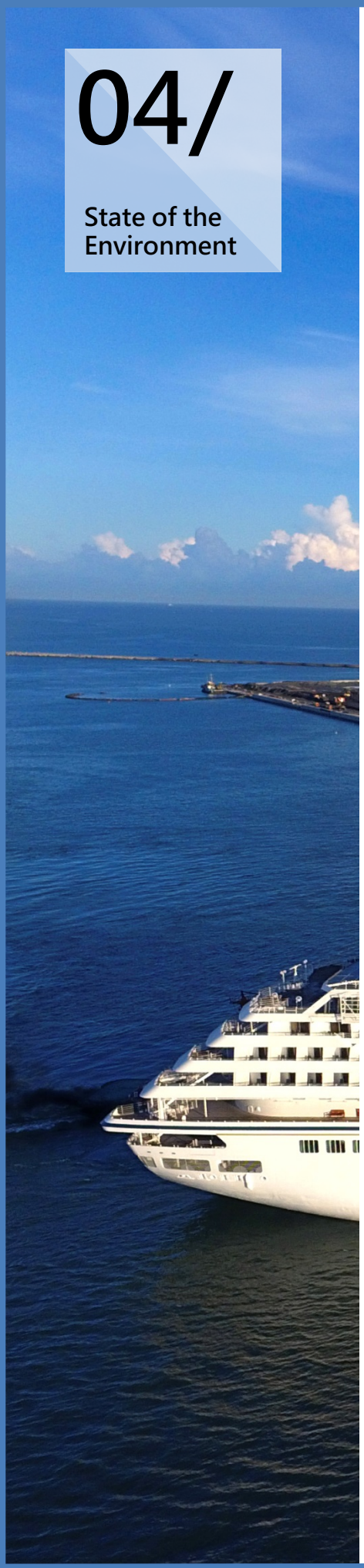
High Voltage Shore Power

Location	Voltage	#
Base Wharf	220V、110V	15
Wharf No. 115	6.6kV	1
Wharf No. 116	6.6kV	3
Wharf No. 96	11.4kV	1
Wharf No. 108	6.6kV	1
Wharf No. 109	6.6kV	1
Wharf No. 110	6.6kV	2
Wharf No. 111	6.6kV	2
Security Check	220V	1
Ship Channel 10	220V	3


High Voltage Shore Power at Wharf No. 96


High Voltage Shore Power at Wharf No. 96





4.2.1 Promote Vessel Speed Reduction

In addition, the port encourages Vessel Speed Reduction (VSR), which is to ask incoming and outgoing ships to decelerate to less than 12 knots within 20 nm from the port. The speed reduction attainment rate target was set to be 40% in 2016 and 50% in 2017. Although the actual attainment rate was only 36.46% in 2016 and 35.30%. To improve the VSR, the Kaohsiung Branch of TIPC has sent an official letter to major shipping lines, providing speed reduction information specific to their ship types and promoting the compliance with the branch's speed reduction program.

Furthermore, beginning Jan 1st of 2018, the Port gives bonus to lower the costs for clients who are willing to help improve the air quality by joining the VSR program.

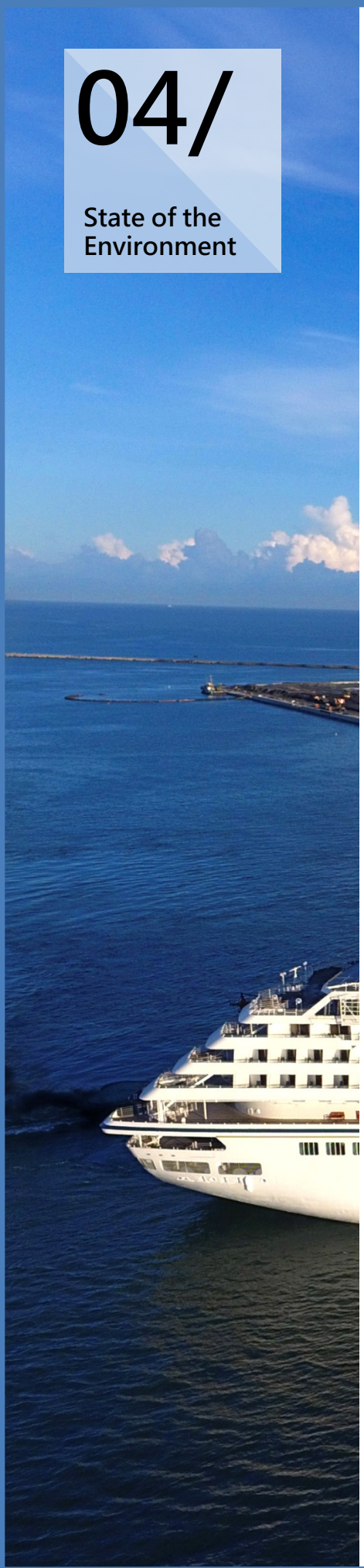
Nevertheless, the Port respects the schedule of each ship liner, does not wish to see any client penalized for late shipping, and only asks those who are not in a hurry to help promote VSR.

Month	(A)Vessels meeting the criteria	(B)Vessels with measured average speed	(C)Total number of vessel count	(D)VSR achievement rate (D=A/B)(%)
1	935	2185	2900	42.8
2	693	1599	2324	43.3
3	999	2279	2908	43.8
4	926	2231	2786	41.5
5	953	2322	2754	41.0
6	1017	2206	2706	46.1
7	831	1,793	2,780	46.3
Total	6,354	14,615	19,158	43.5

4.2.2 Low Pollution Fuel

All harbor vessels in the Port uses clean fuel in 2016 and 2017. Request ships to switch to fuel C from A upon receiving the notification from VTC tower after getting to within 5 nautical miles from the port.

In order to meet the new national fuel sulfur content standard, the Port has reached an agreement with CPC reduce the sulfur content of all MGO and MDO supplies to less than 0.5wt% from March 2018.



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4.3 Port Waste

Because the Port of Kaohsiung is located close to the city of Kaohsiung, it pays special attention to maintaining the cleanliness of the port environment and the quality of life of Kaohsiung citizens. It follows the General Waste Recycling Management Procedure to reduce port resource consumption and waste generation. Furthermore, it requires that international ocean liners separate garbage properly to increase the efficiency of onshore waste disposal.

To diminish the environmental impact of ships berthing at the port, the Port of Kaohsiung, Taiwan International Ports Corporation (TIPC) also requires that such ships entrust legal environmental protection vendors to collect and transport waste (oil) water. Ship waste treatment is handled by vendors commissioned by the Port of Kaohsiung, TIPC. In addition to fully managing ship waste, the Port of Kaohsiung entrusts vendors to clear drift waste brought into the port area by rainfall and rivers daily and record the amount of marine waste cleared. The total amount of waste collected from vessels and from the water surface was about 879.12 tons in 2016 and 636.4 in 2017.

Waste recycling statistics

Item	2015	2016	2017
Total (Ton)	2,286.22	195.23	133.57
Recycled (Ton)	490.20	51.16	43.29
Rate (%)	21.44	26.2	32.4

As of ship waste and wastewater, the Kaohsiung Branch of TIPC has properly managed the disposal of ship oily wastewater, waste oil, and waste currently. The disposal of general waste derived from port waters and land is outsourced according to wharf locations and types of operations required. Shipping lines, terminal tenants, and operators are responsible for contacting qualified waste disposal companies to clean up their industrial waste (including waste oil and water).

Considering that ship emissions and upstream debris are the mainly sources of port water pollution, the Kaohsiung Branch of TIPC has committed to facilitating the establishment of rainwater treatment facilities and ship emission control measures. For example, domestic sewage is discharged to sewage systems, and wastewater (sewage) treatment plants are built to effectively treat port wastewater (sewage) and prevent pollution caused by direct discharge. To improve upstream pollution that affects the port, the Kaohsiung Branch of TIPC has communicated effectively with other responsible authorities (e.g., Water Resources Bureau and Environmental Protection Bureau of Kaohsiung City Government), as well as coordinated continuously with local governments and actively requested them to reduce the upstream pollution sources.

Collected vessel waste and waste oil

Year	2015	2016	2017
# vessel	3,952	3,892	4,049
Waste (ton)	922.95	879.12	636.40
Waste oil (ton)	47,540	12,174	5,376

Waste water treatment facilities

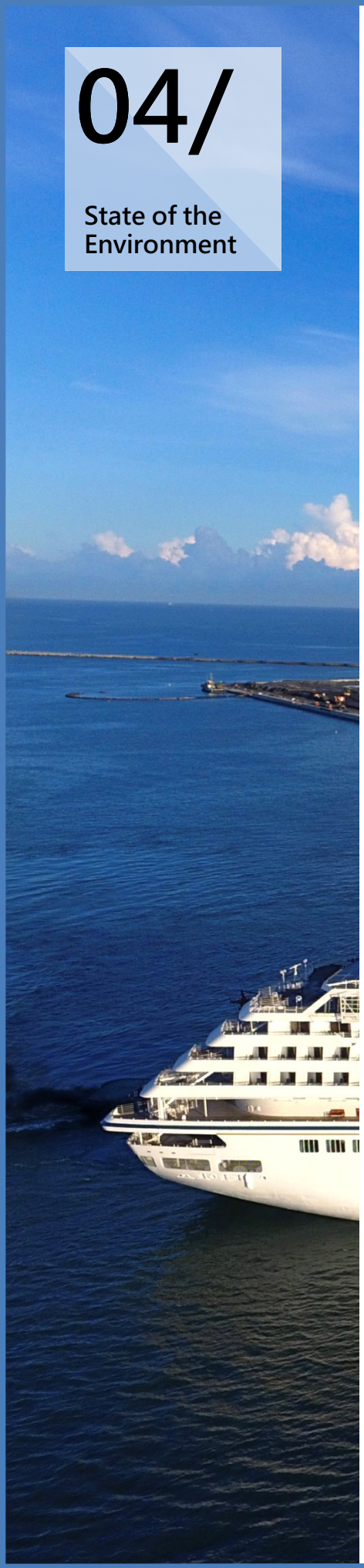
4.4 Manage Hazardous Cargo

Promoting disaster prevention awareness and implementing disaster management guidelines are essential for hazardous cargo management. To ensure port safety, Port of Kaohsiung set conducting a minimum of 2 disaster drill together with port tenants as its cargo management target. The number of drills was 3 times in 2016 and 2 times in 2017.

On top of setting response plans in case of disaster, Port of Kaohsiung also set inspection targets, which it will perform at least 6 joint inspections with the competent authority and conduct at least 12 joint patrols with other port units and the port fire brigade. Serious violators will be reported to competent authorities. There were 0 cases reported to the competent authority in 2016 and 3 in 2017. The 3 cases were all reported for keeping hazardous cargo longer than the permitted time period.

Hazardous Cargo Management Related Activities

Year	Name of Event (Training Conference)	Date
2016	Laws and Regulations on Tugboat and Sea Disaster Rescue	2-23
	2016 Marine Bureau Rescue Alliance Meeting	3-03
	CPC 2016 3D Compounded Disaster Drill	3-25
	2016 Toxic Chemical Disaster Prevention Seminar	4-26
	National Key Infrastructure Protection Plan Conference	6-17
	Marine Oil Pollution Emergency Response Seminar	7-11~12
	Dredging Disposal Training	9-09、12-15
	CPC 2016 3D Compounded Disaster Drill at Dalin Refinery	11-02
	Lecture on Marine Dispute Litigation Experience Sharing and Storm Damage Compensation	11-08
	National Key Infrastructure Protection Evaluation	11-21
2017	Chemical Cloud--Cross Department “Chemical Substance Information Platform Training”	6-15
	2017 Marine Pollution Prevention Expert Training	8-16~17
	2017 Marine Pollution Inspection Sampling Training	9-08
	2017 Lifetime Learning Program Training Report	9-01
	Marine Pollution Prevention System Operation Meeting	12-08
	IMO Level 2 Marine Oil Pollution Cleanup Training	12-13~15
	2017 Toxic Chemical Emergency Response Team Seminars	5-08、10-18
	Using Drone with Aerial Photography for Emergency Response	7-17
	Marine Chemical Substance Leakage Emergency Response Seminar	8-24~25
	2017 Marine 3D Compounded Oil Pollution Emergency Response Drill	9-28~29
	Marine Oil Pollution Emergency Response Drill at Wharf No. 8	10-20
	Marine Oil Pollution Emergency Response Drill at CPC Dalin Refinery	11-04



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4.5 Practice good port development strategies

The port development policies of the Kaohsiung Branch of TIPC are aimed at creating a sustainable green port. Therefore, the compatibility with the environment and the urban area of Kaohsiung City is considered during development.

Port of Kaohsiung has two emphases on port development: first is to cultivate a pedestrian friendly waterfront, and second is to bring good living quality and images to the public. Good water front requires proper spatial planning and clean water bodies. Currently, the accumulated waterfront space such as fishing area is as high as 31.5 hectares, and Port of Kaohsiung strives to maintain and increase the waterfront area.

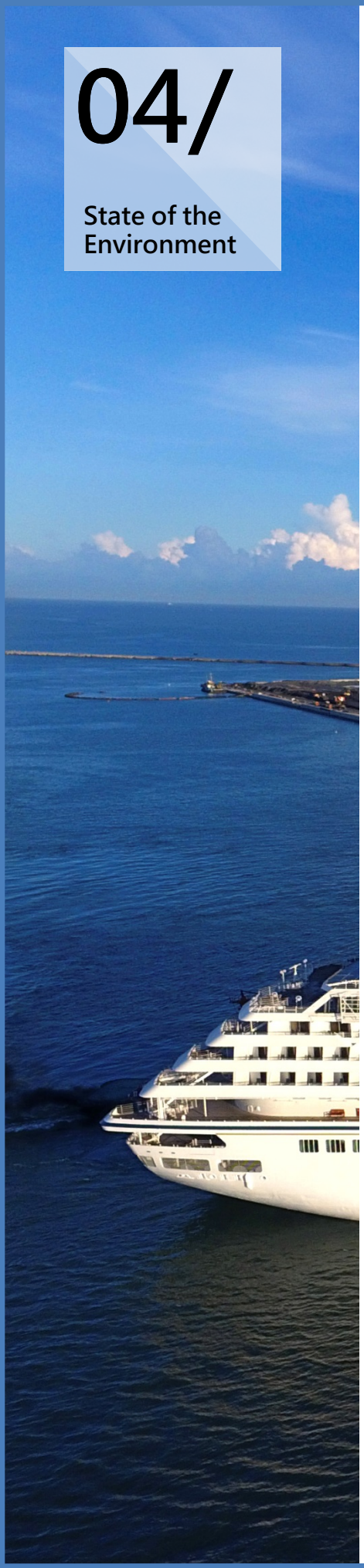
Considering that ship emissions and upstream debris are the mainly sources of port water pollution, the Kaohsiung Branch of TIPC has committed to facilitating the establishment of rainwater treatment facilities and ship emission control measures. For example, domestic sewage is discharged to sewage systems, and wastewater (sewage) treatment plants are built to effectively treat port wastewater (sewage) and prevent pollution caused by direct discharge. To improve upstream pollution that affects the port, the Kaohsiung Branch of TIPC has communicated effectively with other responsible authorities (e.g., Water Resources Bureau and Environmental Protection Bureau of Kaohsiung City Government), as well as coordinated continuously with local governments and actively requested them to reduce the upstream pollution sources.

On top of pollution prevention measures, the Port of Kaohsiung also monitors water quality to understand the effectiveness of water quality control in the port area. At present, the Port of Kaohsiung has 14 water quality monitoring stations in the port area; the monitoring stations conduct surveys every quarter. Moreover, pursuant to the Marine Pollution Control Act , the Marine Bureau, Kaohsiung City Government has set up sea area monitoring stations to monitor water quality since 2004; seven of these stations are located in the commercial port area of the Port of Kaohsiung. The monitoring results of 2016 and 2017 show that the Port of Kaohsiung met the water quality standards of a Class C sea area.

In the past, the Port of Kaohsiung and the Kaohsiung City were developed to meet different goals. Consequently, the distinct modes of management and operation have resulted in a huge gap both in the relationship and spaces between the port and the city.

Moreover, the locations of the industrial districts and container terminals imperceptibly separate the port from the city. To reshape port views and the urban image of Kaohsiung City, the Kaohsiung Branch of TIPC collaborates with Kaohsiung City Government in releasing the Penglai, Yancheng, and Lingya Commercial Port Districts and the nearby warehouse district of Taiwan Sugar Corporation for the renovation of old port areas and the repurposing of idle spaces, providing public access to the port and improving city image.

In response to the growing demand for container traffic, the first phase of the Intercontinental Container Center Project of the Port of Kaohsiung has been completed, and the land reclamation efforts will be continued to increase port hinterland in the second phase of the project. During land reclamation, the Port of Kaohsiung has actively sought alternative material sources, including the remaining earth works from major public works in Southern Taiwan and mud dredged from the port. By doing so, the port has effectively reduced the amount of gravel extracted from offshore waters, controlled pollution caused by dredging and filling, and protected bare land created after land reclamation to mitigate environmental impacts.



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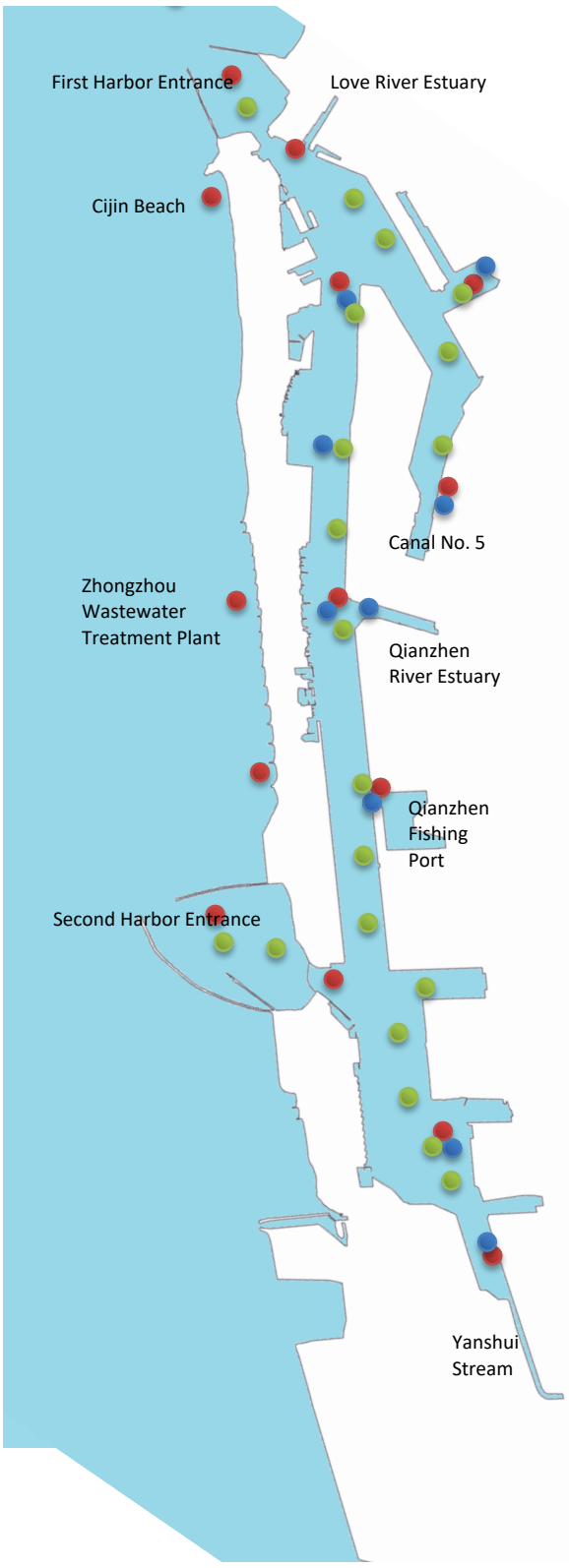
4.6 Monitor and Reduce Sediment Pollution

To ensure effective management, the Kaohsiung Branch of TIPC conducts sediment monitoring every quarter. In addition to monitoring port sediments, ocean disposal of dredging, and determining sediment monitoring sites for environmental assessment, the branch monitors measures the 32 pollutants that include total nitrogen, total phosphorus, total oils, cyanide, and heavy metals. Particularly, heavy metal pollution is more serious than other types of solution; however, such pollution Is majorly found in rivers and canal conjunctions, indicating that it is mainly caused by upstream industrial wastewater discharge by factories. In the ocean disposal area for port dredging, the Kaohsiung Branch of TIPC also conducts long-term monitoring on the environmental impacts on the area's marine ecology according to the "Application and Permission for Ocean Disposal of Port Dredging." Monitoring reports are presented to the Environmental Protection Administration every quarter.

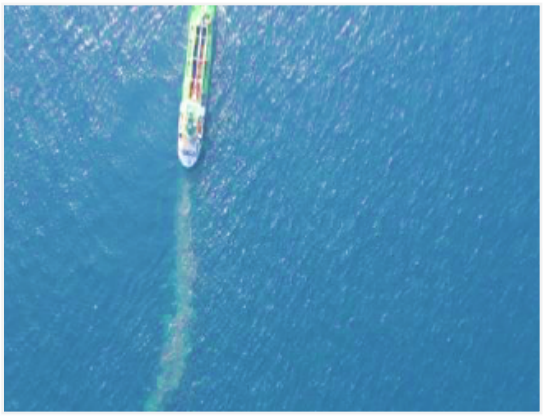
Amount of Sedimentation Disposing at Port of Kaohsiung Unit: Ten Thousand M³

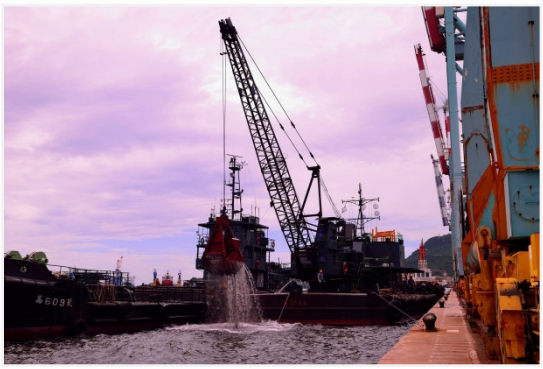
Year	Actual dredging volume	Actual amount of dredging sludge disposal	Actual amount of alternative's dredging mud	Dredging mud reuse rate %
2009	59.4	42.6	16.8	28.3
2010	96.7	30.7	66.0	68.3
2011	88.0	16.0	72.0	81.8
2012	70.9	18.9	52.2	73.3
2013	51.7	25.7	26.0	50.3
2014	60.0	11.4	48.6	81.0
2015	97.4	9.3	88.1	90.5
2016	51.7	0.2	51.5	99.6
2017	31.4	8.6	22.8	72.6

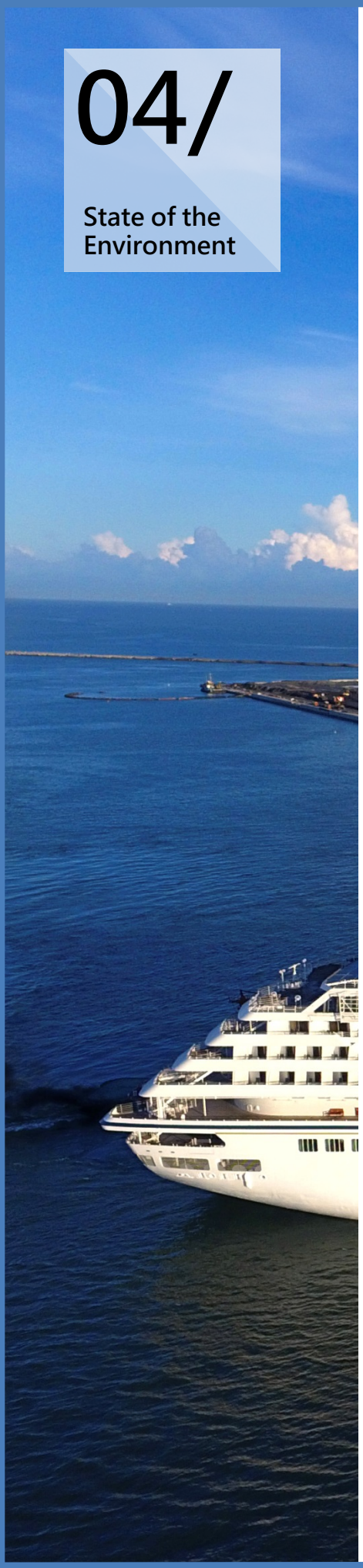


Sediment Monitoring Sites

- TIPC Kaohsiung Branch Sediment Monitoring Project
- TIPC Kaohsiung Branch Dredging Management Monitoring
- Marine Bureau







4.7 Brownfield Remediation

In the past, the heavy industry, oil storage facilities, and shipbuilding surrounding the Port of Kaohsiung may have contributed to the accumulation of heavy metals and toxic substances in port soil and water. The brownfields left after environmental remediation become the greatest challenge to the port.

The site of the Kaohsiung Port Terminal in the Passenger Transportation District used to be where the old Lingyaliao Storage Station of the Refinery under the Refining Business Division of CPC Corporation (Taiwan) was located. The storage station has been completely out of service since 1996, and the oil storage tanks and delivery lines have been removed. Currently, it is the base for the construction of Kaohsiung Port Terminal. During construction, oil pollution was determined at the site. Since the site was classified by the EPA in 2013, the CPC Corporation (Taiwan) remediated and removed oil-contaminated soil from the base. The site was eventually declassified on April 12th, 2018.

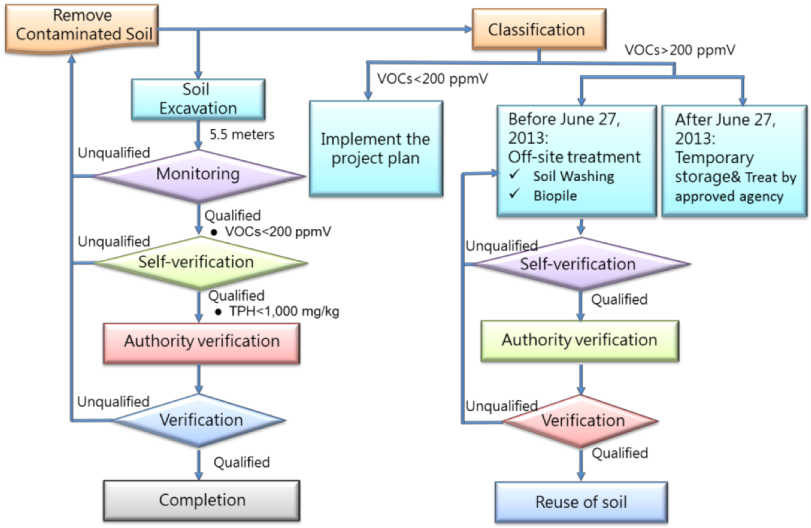
Oil Contaminated Site

Timeline of the oil pollution at the Old Lingyaliao Storage Station

1947-1997	Lingzhan oil delivery and storage operations
1997	CPC Corporation handed the site back to the TIPC.
2005	The Environmental Protection Bureau announced the original site as partially polluted.
2010-2013	Decided to build the Kaohsiung Port Terminal on the original site during planning and design.
Sep. 2013	Soil contamination was spotted during construction.
Mar. 2014	The Kaohsiung Branch of TIPC conducted an additional survey on the site, and professionals from the Environmental Protection Bureau arrived at the site to verify the survey results.
June 2014	Continued to execute the Plan of Necessary Response Measures, and the Environmental Protection Bureau announced this site to be a site under pollution control.
Jan. 2016	Presented the Application for Land Use in the Kaohsiung Port Terminal.
April 2016	Removed all the contaminated soil at the site and completed self-verification.
May 2016	Resumed the construction of the basement structure and the new building of the Kaohsiung Port Terminal.
April 2018	Declassified

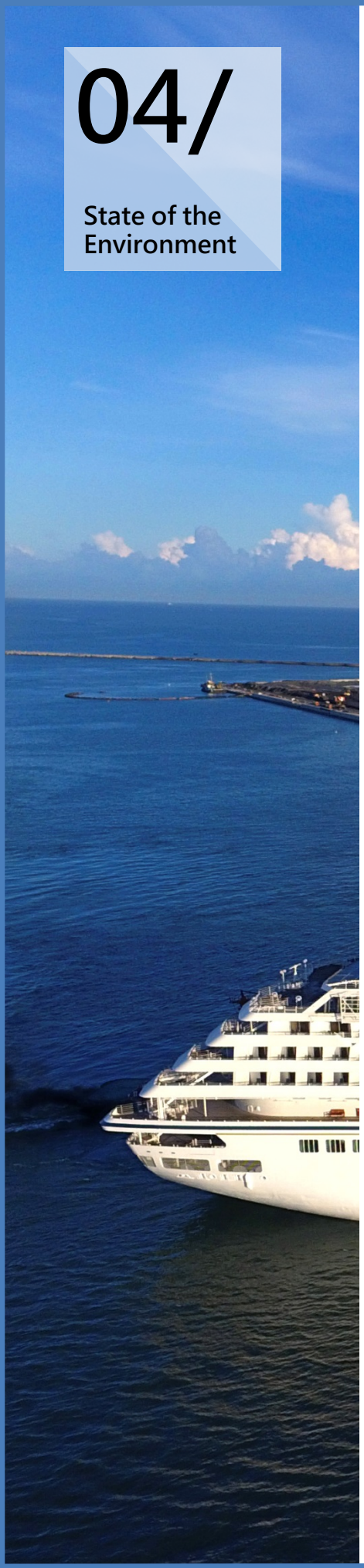
Pier 121 of the Port of Kaohsiung was once monitored by the Environmental Protection Administration because of soil pollution. The pier contains a fuel adding and storage facility that provides fuel for container hauling vehicles and equipment operation within the pier; the facility is for internal use only and is not open to the public. In Nov. 2015, the Environmental Protection Administration performed an onsite investigation and found that the total petroleum hydrocarbons (TPH) exceeded soil control standards stipulated by the latest relevant environmental protection laws and regulations. Port of Kaohsiung began the improvement process since 2016 and completed in March 2018. The site was declassified on June 15th, 2018.

Contaminated Soil Treatment Processes



Timeline of oil pollution at Wharf No. 121

1990	Planning and design of Wharf No. 121
1994	Contracted to NYK
2014	NYK terminated the contract
July 2015	The Port operates the wharf for container handling and public docks
Nov. 2015	EPA discovered one sample with TPH level above the soil standard
2016	The Port outsourced the “Emergency Response Plan”
2017	The “Emergency Response Plan” approved by the EPB and the Port proceeded the remediation
Jan. 2018	Oil storage removed
Feb. 2018	Conducted the soil and storage tank sampling and testing autonomously
Mar. 2018	Site Improvement Completion Report sent to the EPB for verification
June 2018	EPB approved and declassified the site



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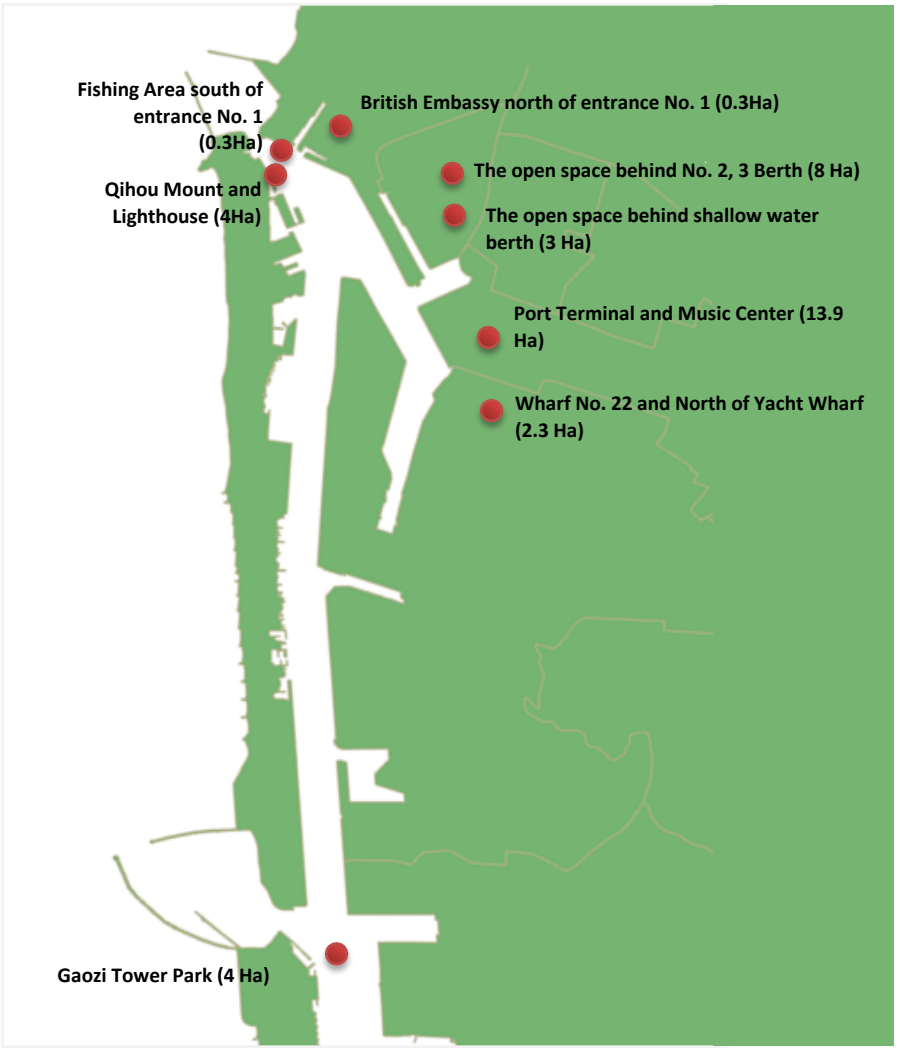
4.8 Enhance Community Relations

The neighboring communities of the Port of Kaohsiung bear the brunt of possible environmental impacts from the port and face high environmental risks. Therefore, the branch maintains waterside recreational spaces and green belts (or buffer zones) to restore the environment and create a sustainable water–land interface. The green belts close the gap between the port and the city, improving local residents' quality of living and reducing the impact of port pollution on them. In addition, the green belts can increase habitats and thus improve the biodiversity of environments surrounding the port. The Kaohsiung Branch of TIPC will gradually open the old port areas to the public, providing recreational spaces such as parks, activity venues, and bicycle routes. In addition, the branch will occasion-ally organize ocean carnivals and volunteer visits and seminars with local governments, inviting citizens to participate in the activities, maintaining public identification with the port, and engaging in favorable interaction with nearby communities.

Waterside recreational areas at Port of Kaohsiung



Visiting Traditional Tribes

Giving New Years Gifts

Participating Local School Graduations

Accessible Space Walkthrough

Anti-drug Campaign

Beach Cleanup

The Port Concert

4.9 Habitat Restoration

The natural coast where the Port of Kaohsiung is located at was originally the habitat of mangroves. The coast was later reclaimed to develop the Port of Kaohsiung, and the increase of artificial coasts reduces the ecological and species diversity of the coast.

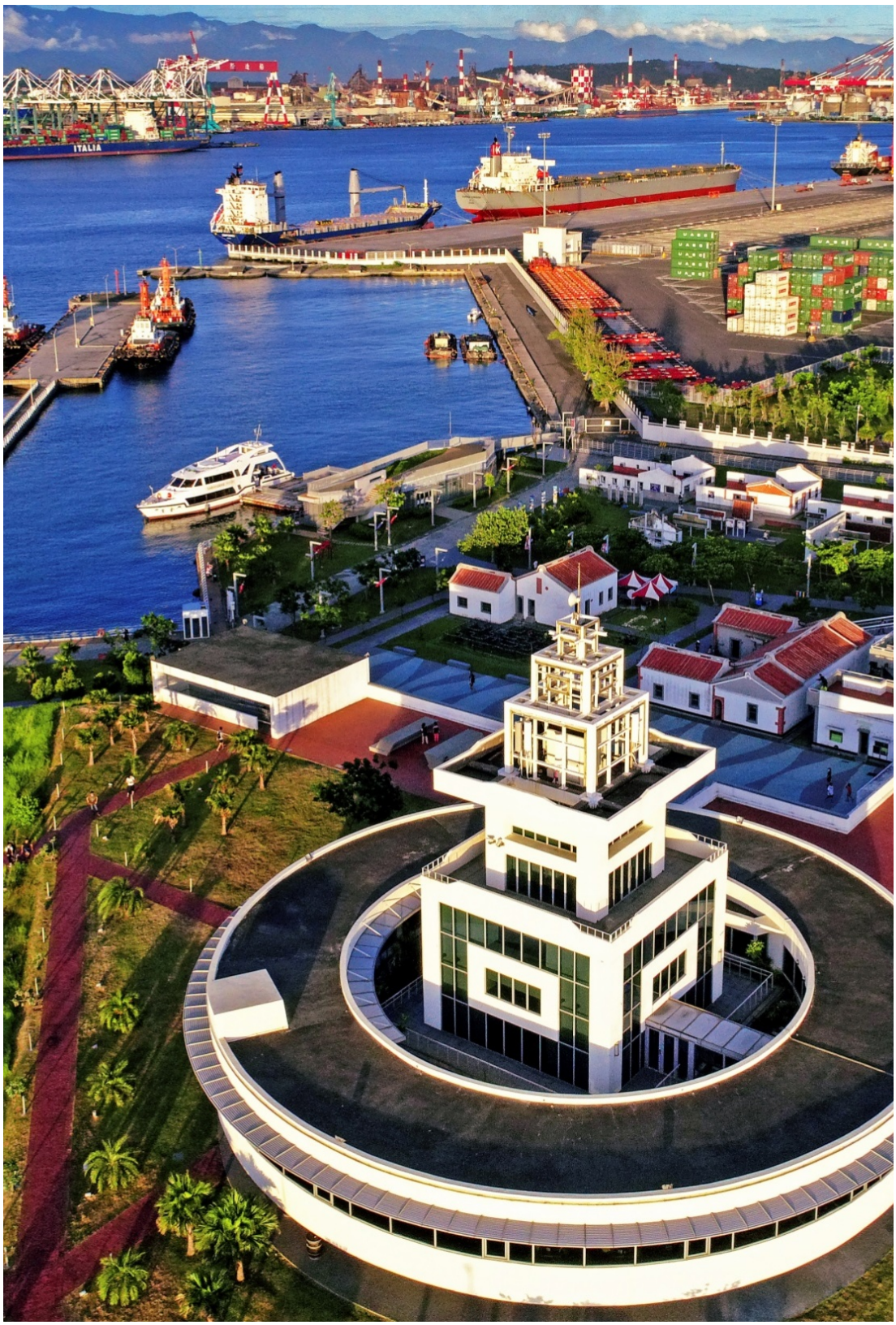
Therefore, when developing the Port of Kaohsiung, the Kaohsiung Branch of TIPC is also committed to maintaining the ecology and habitats in the port and actively protecting the existing green belts (or buffer zones) to reduce the environmental stress.

The South Star Green-Building Center

For example, the South Star Free Trade (SSFT) District is located in a remote area that is relatively free from human disturbances. According to the environmental assessment conducted on the first and second phases of this land development project, a total 68 bird species have been observed and recorded. According to the Kaohsiung Wild Brid Society, more than 210 species of migratory birds stop by the SSFT District during autumn and winter. The district is also habitat to 8 species of mammals, 6 species of amphibians, 10 species of reptiles, and 40 species of butterflies.

In addition, the society found 5 species endemic to Taiwan, 19 subspecies endemic to Taiwan, 2 rare and protected species, and 3 other species that should be protected.

Therefore, during construction and operation processes, the SSFT District plans to preserve the existing windbreaks, protect indigenous species to green the area, set up green belts as buffer zones, and restrict the speed of incoming and outgoing vehicles to reduce the impact incurred by development. Currently, approximately 10 ha of land in the development area of the first phase of the SSFT District has been preserved as a wild bird habitat.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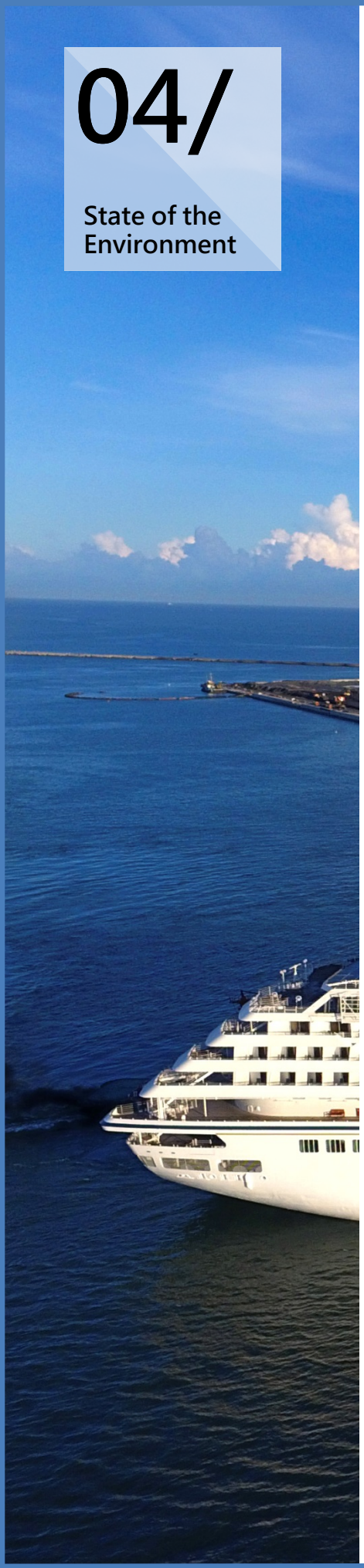

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4.10 Port Resource

To practice environmental protection and reduce the environmental impact of port operations, the Port of Kaohsiung sets increasing energy use efficiency as one of its top ten environment objectives. The port continues to promote resource usage reduction control in the port area by reducing resource consumption and greenhouse gas generation. In addition, the office building is the first wharf the receives green building certification.

In the new port area (Container Terminal No. 6) of the Intercontinental Container Center Project, all wharves are equipped with shore power systems that provide electricity required by ships during berthing, reduce their oil consumption, and mitigate port air pollution. In addition, electric vehicles are used throughout the area, and all containers are operated using one electronic system to enhance operational efficiency and reduce energy consumption in the area.

Resource Managements

The Four-Saving Program, promulgated by the Executive Yuan, entails a negative growth in annual electricity, fuel, water, and paper consumption to lower port resource consumption and waste generation.

Even though the gas reduction target was not met in 2017, overall trend is decreasing. The savings in 2016 and 2017 were 14.8% and 3.5% for electricity, 3.5% and 1.8 % for gas, 27.5% and 9.1% for water, and 12.9% and 30.1% for paper.

Port of Kaohsiung 2014-2017 Four Savings

Item	Target	2014	2015	2016	2017
Electricity	1	0.6	-1.2	14.8	3.5
Gas	3	6.9	-12.4	3.5	1.8
Water	2	-7.1	1.7	27.5	9.1
Paper	1	17.3	13.0	12.9	30.1

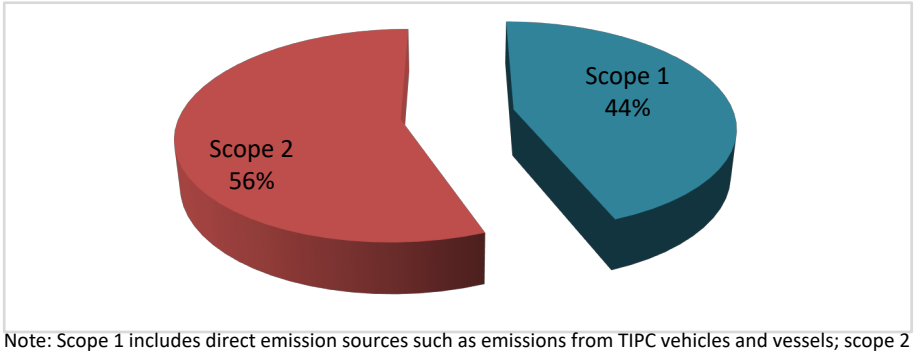
Unit: Percentage

Greenhouse Gas Management

In 2016, the Port of Kaohsiung complied with ISO14064 and inspected its 2013–2015 greenhouse gas emissions, where it found that the main causes of its greenhouse gas emissions were port area management operations and office administration operations. Concerning the methods for setting organizational boundaries for greenhouse gases, all emission sources within organizational boundaries are identified in accordance to Operational Control Laws.

The organizational boundary of Port of Kaohsiung, TIPC is the areas that it owns and controls. Thus, greenhouse gas emissions of the Port of Anping, the TIPC Marine Corporation, Ltd. (TIPC Marine), and tenants are not included in the calculation. The total Greenhouse Gases Emissions of Kaohsiung Port from 2013 to 2015 are 18,710.497 tons CO_2e, 16,791.840 tons CO_2e and 12,512.032 tons CO_2e respectively.

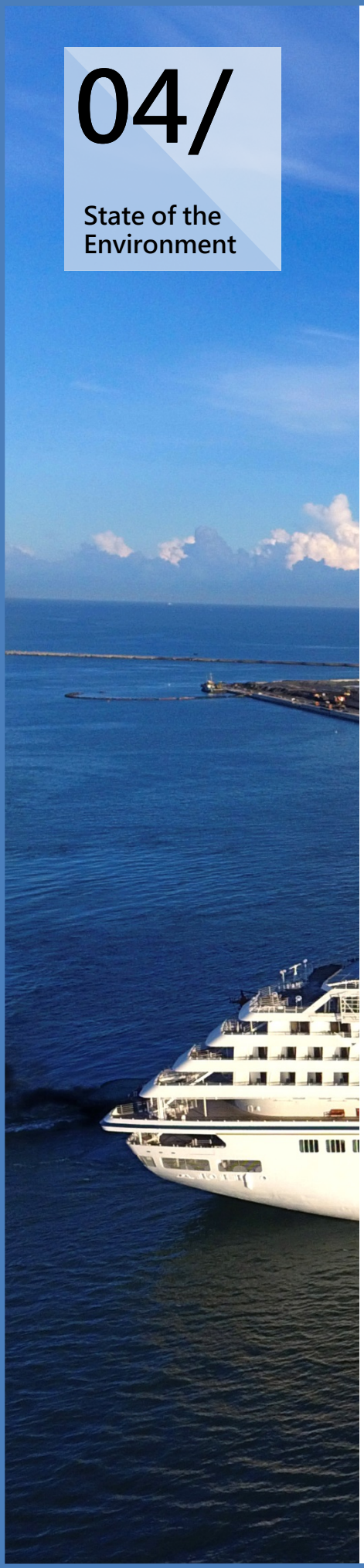
Port of Kaohsiung Emission Source 2015



Note: Scope 1 includes direct emission sources such as emissions from TIPC vehicles and vessels; scope 2 includes indirect emissions from purchased energy usage

Electricity used by the Port of Kaohsiung, TIPC is mainly for providing transportation for port-related operations, public area operations, and office administration operations. Between 2013 and the first half of 2014, the main sources of emissions were TIPC Marine ships. Since the addition of the TIPC Marine in October 2014, tugboating-related operations of the Port of Kaohsiung, TIPC are no longer included in inspection checks. Therefore, the main GHG emission was from electricity usages (more than 50%). The GHG inventory for 2016 and 2017 is scheduled to be complete by the end of this year (2018).

According to the environmental impact assessment of the South Star Free Trade Zone in the Port of Kaohsiung, the competent agency promises to provide guidance for individual companies to conduct annual greenhouse gas inventorying and verification starting from the March of the year following their entry into and official launch in the zone, and register the resultant greenhouse gas inventories 6 months after completing the inventorying procedure. Therefore, guidance will be provided this year (2016) to determine the companies' carbon emissions during operation.



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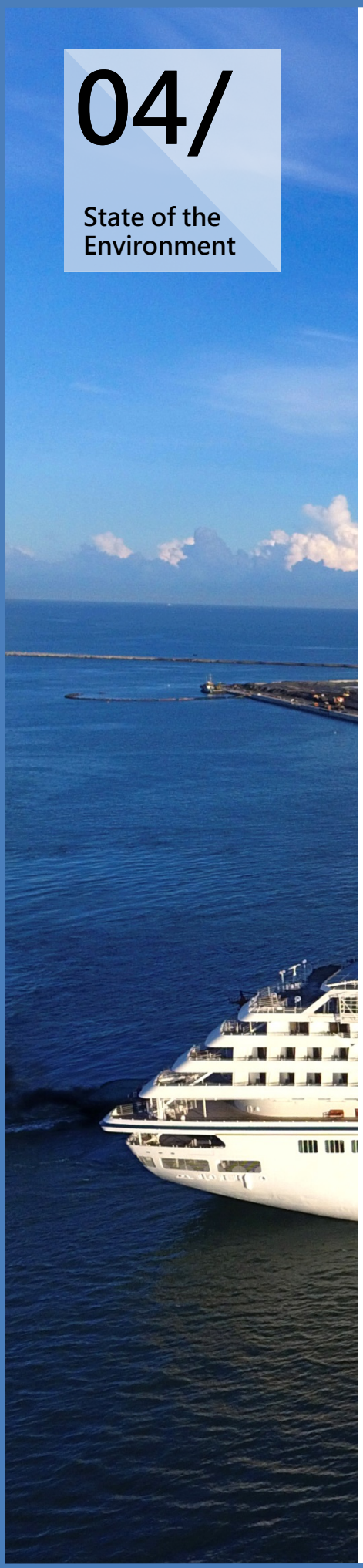
Environmental Performance Indicators of Kaohsiung Port

	Index item	Calculation method	
Air Quality	Air quality pass rate (PM_{10}、$PM_{2.5}$、SO_2、NO_2)	The ratio of the measurements in the air quality monitoring station of the port that meet the "Air Quality Standards"	
	The ratio of using low-pollution fuel or biodiesel and the consumption of low-pollution fuel among harbor crafts	• Number of harbor crafts using low-pollution fuel (marine diesel oil or super diesel) ÷ Total number of harbor crafts × 100% • Consumption of low-pollution fuel among harbor crafts	
	Promotion of a comprehensive use of the Automatic Gate Sentry Post Control System among shipping lines	• The ratio of incoming and outgoing roadways installed with an automatic gate sentry post control system • Number of passes	
	Car wash	• Percent washed • Vehicle washed • Promotion	
	Air pollution inspection	• Number of land area inspections	
Vessel emission	Vessel waste oil management	• Processed by qualified collectors÷ Total number of vessels collected×100% • Amount of waste oil collected	
	Vessel exhaust • Usage of clean fuel by harbor vessels	• Number of harbor vessel using clean fuel÷Total number of harbor vessel×100% • Total amount of clean fuel used	
	The ratio of using shore power among harbor crafts	Number of harbor crafts using shore power ÷ Total number of harbor crafts × 100%	
	Ships deceleration target completion rate	The automatic identification system for ship deceleration is applied to determine the deceleration of ships within 20 sea miles from the port	
	Vessel pollution inspection and notifications	• Water area inspections • Smoke emission notifications	
Garbage/ port waste	Port waste recycle rate	Amount of recycled waste÷Waste generation×100%	
	Port water area garbage	• Cleaning frequency • Amount of waste collected	
Hazardous cargo	Drill	Number of drills	
	Hazardous cargo inspection	Number of inspections	
	Number of patrols, vessels inspected, and number of cases sent to the authorities	• Number of patrols • Number of cases sent to the authorities	

	Target value	Indicator presentation (calculation details)	
		2016	2017
	• PM10 daily mean <125μg /m3: 100% • PM2.5 daily mean <35μg/m3: 60% • SO2 daily mean <0.1 ppm: 100% • NO2 daily mean <0.25 ppm: 100%	• PM10 daily mean <125μg /m3: 100% • PM2.5 daily mean <35μg/m3: 75% • SO2 daily mean <0.1 ppm: 100% • NO2 daily mean <0.25 ppm: 100%	• PM_{10} daily mean <125μg /m^3: 100% • $PM_{2.5}$ daily mean <35μg/m^3: 75% • SO_2 daily mean <0.1 ppm: 100% • NO_2 daily mean <0.25 ppm: 100%
	The ratio of using low-pollution fuel or biodiesel reaches 100% among harbor crafts	52 ÷ 59 × 100% = 88.1% Among the 59 harbor crafts, 52 use low-pollution fuel. Low-pollution fuel for work vessels: Consumption of marine gas oil: 5 KL Consumption of marine diesel oil: 255 KL 52÷59×100%=88.1%	52 ÷ 59 × 100% = 88.1% Among the 59 harbor crafts, 52 use low-pollution fuel. Low-pollution fuel for work vessels: Consumption of marine gas oil: 20 KL Consumption of marine diesel oil: 236 KL 52÷59×100%=88.1%
	• All newly built gates of roadway are automatic. • Number of passes	The ratio of incoming roadways installed with an automatic gate sentry post control system: 18 ÷ 35 × 100% = 51.4% The ratio of outgoing roadways installed with an automatic gate sentry post control system: 18 ÷ 34 × 100% = 52.9% Number of passes: 8,588,795	The ratio of incoming roadways installed with an automatic gate sentry post control system: 18 ÷ 35 × 100% = 51.4% The ratio of outgoing roadways installed with an automatic gate sentry post control system: 18 ÷ 34 × 100% = 52.9% Number of passes: 8,698,290
	• 90% • Total number washed • Number of times promoted	• 99.0% washed • Total of 107,408 vehicles • Promoted 25,345 times	• 99.0% washed • Total of 96,299 vehicles • Promoted 30,331 times
	• 300 inspections annually	• 462 times	• 320 times
	• 100%	• 100%; total of 475 vessels • Vessel waste oil collected: 12,174.26 tons	• 100%, total of 441 vessels • Vessel waste oil collected: 5376.38 tons
	• 100%	13÷13x100%=100% • Clean fuel: 45 KL Marine Gas Oil: 49 KL Marine Diesel Oil: 88.3 KL	13÷13x100%=100% • Clean fuel: 30 KL Marine Gas Oil: 45 KL Marine Diesel Oil: 52.8 KL
	The ratio of using shore power reaches 100% among harbor crafts	13 ÷ 13 × 100% = 100% All the 13 harbor crafts use shore power during berthing operations. 59÷59×100%=100%	59 ÷ 59 × 100% = 100% All the 59 harbor crafts use shore power during berthing operations. 59÷59×100%=100%
	• 2016: 40% • 2017: 50%	36.46%	35.30%
	• Inspect 150 times annually • Number of some emission notifications	• 164 times • 52 notifications made	• 159 times • 16 notifications made
	Port recycling rate reaches 20%.	51.16÷195.23=26.2%	43.29÷133.57=32.4%
	Clean daily	• Cleaned daily • 879.12 tons (including garbage from 3,892 vessels)	• Cleaned daily • 636.4 tons (including garbage from 4,049 vessels)
	2 drills each year	3 drills	2 drills
	6 inspections	12 inspections	12 inspections
	• 12 patrols each year, 12 vessels • Number of cases decrease over year	• 12 patrols, 24 vessels • 0 case	• 12 patrols, 23 vessels • 3 cases



04/

State of the Environment

Environmental Performance Indicators of Kaohsiung Port

	Index item	Calculation method	
Port development	Public waterside recreational space	The area of waterside recreational space	
	Marine water quality pass rate (pH, DO, BOD_5, TP, cyanide, phenols, mineral oils)	The ratio of port water quality measurements (obtained at the water quality monitoring station in the port) satisfying the Marine Environment Classification and Quality Criteria	
Marine sediment	Sediment monitoring	Quarterly means and maximums of port sediment monitoring measurements	
Contaminated Land	Control rate of soil contaminated sites	Number of regulated sites in the port ÷ Total number of sites with soil pollution in the port × 100%	
Relationship with Local Communities	Neighborhood and community welfare activities	Number of activities and events	
Terrestrial habitats / ecosystems loss	Ecological habitats	Area of ecological habitats	
Resource consumption	Outcomes of implementing the Four-Saving Project (saving energy, oil, water , and paper)	Power, oil, paper, and water conservation rates for offices and operation sites	
	Greenhouse Gas Management	GHG Inventory	

	Target value	Indicator presentation (calculation details)	
		2016	2017
	Increasing and maintenance the area of waterside recreational space	Total waterside recreational area is 30.2 Ha, which includes: (1)The open space behind No. 2, 3 Berth (3.7 Ha) (2)The open space behind shallow water berth(3 Ha) (3)Gaozi Tower Park(4 Ha) (4)Port Terminal, Music Center (under construction, 13. 9 Ha) (5)Wharf No. 22 and North Shore Yacht Area (1.3 Ha) (6)Fishing area at North Shore Exit 1 (0.3 Ha) (7)Qihou Mountain and Lighthouse (4 Ha)	Total waterside recreational area is 31.2 Ha, 1 Ha increase at Wharf No. 22 and North Shore Yacht Area
	Marine water quality: 100% of the quarterly pH, DO, cyanide, metal oils, and BOD_5 measurements satisfy the criteria.	Marine water quality criteria for Category C pH 100% DO 100% BOD_5 96.43% Cyanide 98.21% Phenols 100% Metal oils 100%	Marine water quality criteria for Category C pH 100% DO 100% BOD_5 100% Cyanide 100% Phenols 100% Metal oils 100%
	Upper limits of heavy metal content in domestic sediments (mg/kg per unit): Arsenic 33 Mercury 0.87 Copper 157 Lead 161 Chromium 233 Zinc 384 Cadmium 2.49	Meeting sediment standards Arsenic: mean = 1.75 Mercury: mean = 0.24 Copper: mean = 131 Lead: mean = 34.4 Chromium: mean =138 Zinc: mean = 322 Cadmium: mean ND	Meeting sediment standards Arsenic: mean ND Mercury: mean ND Copper: mean =1.3 Lead: mean ND Chromium: mean ND Zinc: mean =5.65 Cadmium: mean ND
	Control over all sites with soil pollution (100%)	Number of regulated sites in the port: 12 Control rate of soil contaminated sites: 100%	Number of regulated sites in the port: 12 Control rate of soil contaminated sites: 100%
		The 12 sites that were regulated since July 2nd 2013 had been delisted on April 12th 2018.	
	12 activities held	Types of activity: Events Environmental: 18 Energy saving: 6 Cultural: 11 Total: 35	Types of activity: Events Environmental: 9 Energy saving: 10 Cultural: 15 Total: 34
	• Area of reserved wide bird habitat • Area of grassland • Area of woods	• Reserved wide bird habitat: 8 ha • Grassland: 3.6 ha • Woods: 18.3 ha	• Reserved wide bird habitat: 8 ha • Grassland: 4.2 ha • Woods: 18.3 ha
	• Power consumption reduction: 1% • Oil consumption reduction: 3% • Water consumption reduction: 2% • Paper consumption reduction: 1% • (Index calculation: Resource consumption of the previous year – Resource consumption of the present year) / Resource consumption of the previous year × 100%	• Power consumption reduction: 1.4% • Oil consumption reduction: 3.5% • Water consumption reduction: 27.5% • Paper consumption reduction: 12.9% (Note: Negative value means not reached the index)	• Power consumption reduction: 3.5% • Oil consumption reduction: 1.8% • Water consumption reduction:9.1% • Paper consumption reduction: 30.1% (Note: Negative value means not reached the index)
	• GHG emissions	The 2016-2017 GHG inventory report is expected to complete by the end of 2018 with 3rd party verification.	

Emergency Response

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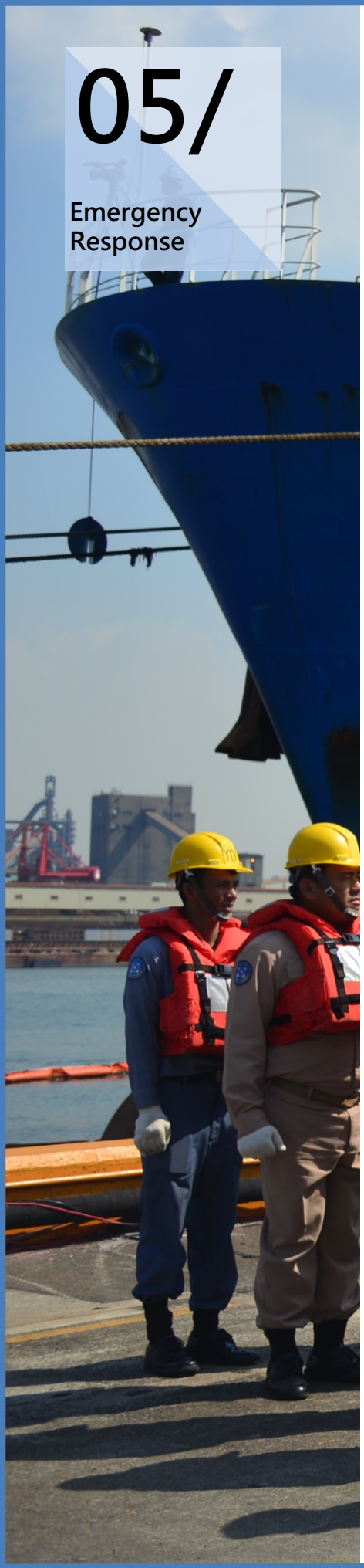

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Emergency Response

5. Emergency Response

One of the main tasks of the Kaohsiung Branch of TIPC is to maintain the safety of the Port area. Every month, the Pollution Control Section of Occupational Safety Division of the Kaohsiung Branch regularly assigns personnel to investigate land and water area of the Port. When they discover any act of pollution, they will ask the perpetrators to stop immediately and start an emergency response. They may also notify competent public authorities for penalty.

During 2016 and 2017, within the Kaohsiung Port area, the major accidents include fishing vessels blocking the navigation routes, followed by small scale fuel spill, garbage and fire, ship collision, fire, explosion, fuel spill, chemical spill and ship breakdown and tilt that did not affect the safety. For pollution and accidents within the port area, the Kaohsiung Branch of TIPC, the EPB of Kaohsiung City Government and the Marine Bureau of Kaohsiung City Government have hotline services for the public or terminal operators to notify the relevant units.

Kaohsiung Branch of TIPC has also established 14 standard emergency response procedures for accidents and disasters, including: shipwreck, fire and explosion, fuel spill, major accidents, spill of announced controlled toxic chemicals, disease and natural disasters.

Environmental Inspection and Punishment in Port of Kaohsiung

Item\Year	2012	2013	2014	2015	2016	2017
Number of patrols	463	508	461	496	545	407
Notification	96	97	117	76	159	164
Exhaust emission	66	44	42	57	47	16
Environment and hygiene inspection in ship making plants	62	105	52	64	55	39
Oil fence (vessels)	114	133	120	122	147	126
Joint inspection	7	11	16	24	24	23
Admonishment for improvement	1296	1895	1895	1851	2110	1510
Admonishing ticket	12	49	49	36	30	36
Penalty (MPB)	3	2	9	12	9	2

Source: TIPC Kaohsiung Branch

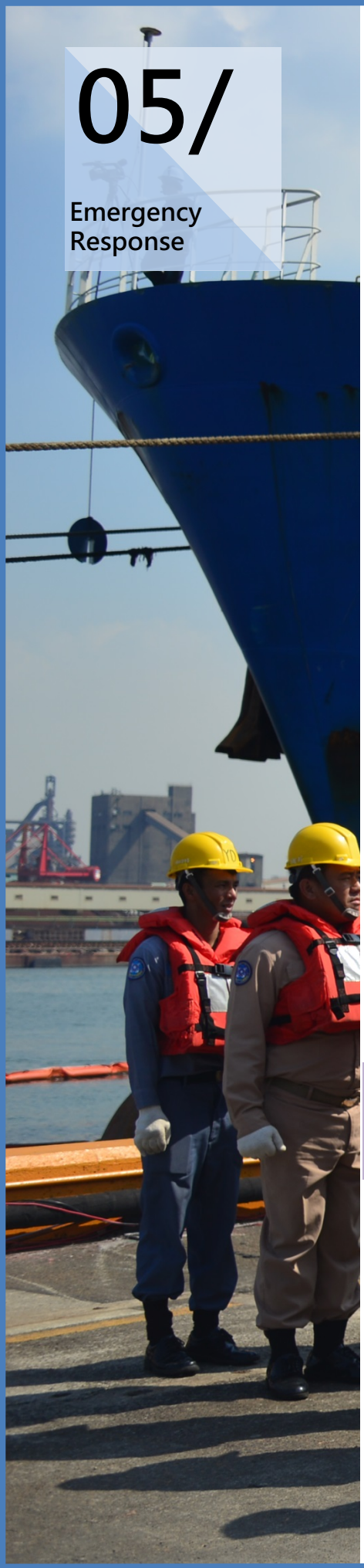
In addition to hotlines and emergency responses, the Kaohsiung Branch of TIPC also works to improve labor safety, Environmental education and training, in order to reduce the number of accidents in the Port area. Joint exercises are conducted every year with other units related to port management. The exercises focus on marine oil pollution, civilian protests, connected pathway flooding, typhoons, International Ship and Port Facility Security (ISPS).

The main collaborators of these exercises includes Kaohsiung Branch of TIPC, Kaohsiung Harbor Police Department, Kaohsiung Harbor Fire Brigade, National Fire Agency, MOI, Southern Coastal Patrol Office, Coast Guard Administration, Executive Yuan, Southern Taiwan Service Center of MPB, MOTC, and Marine Bureau of Kaohsiung City Government. The joint exercises aim to maintain port safety and security through inter-agency collaboration.

Number of Accidents in Kaohsiung Port

Accidents\Year	2012	2013	2014	2015	2016	2017
Ship collision, fire, explosion, fuel spill, chemical spill	28	31	28	19	24	26
Ship breakdown, tilt (no affecting safety)	19	32	10	12	28	16
Safety and health accident (cause injuries or deaths)	-	-	21	15	11	12
Fire and/or explosion of warehouse or fuel tank	2	0	0	0	0	1
(Small) fuel spill, garbage and fire in the port area	60	78	117	87	96	110
Others	170	123	206	211	119	84

Source: TIPC Kaohsiung Branch



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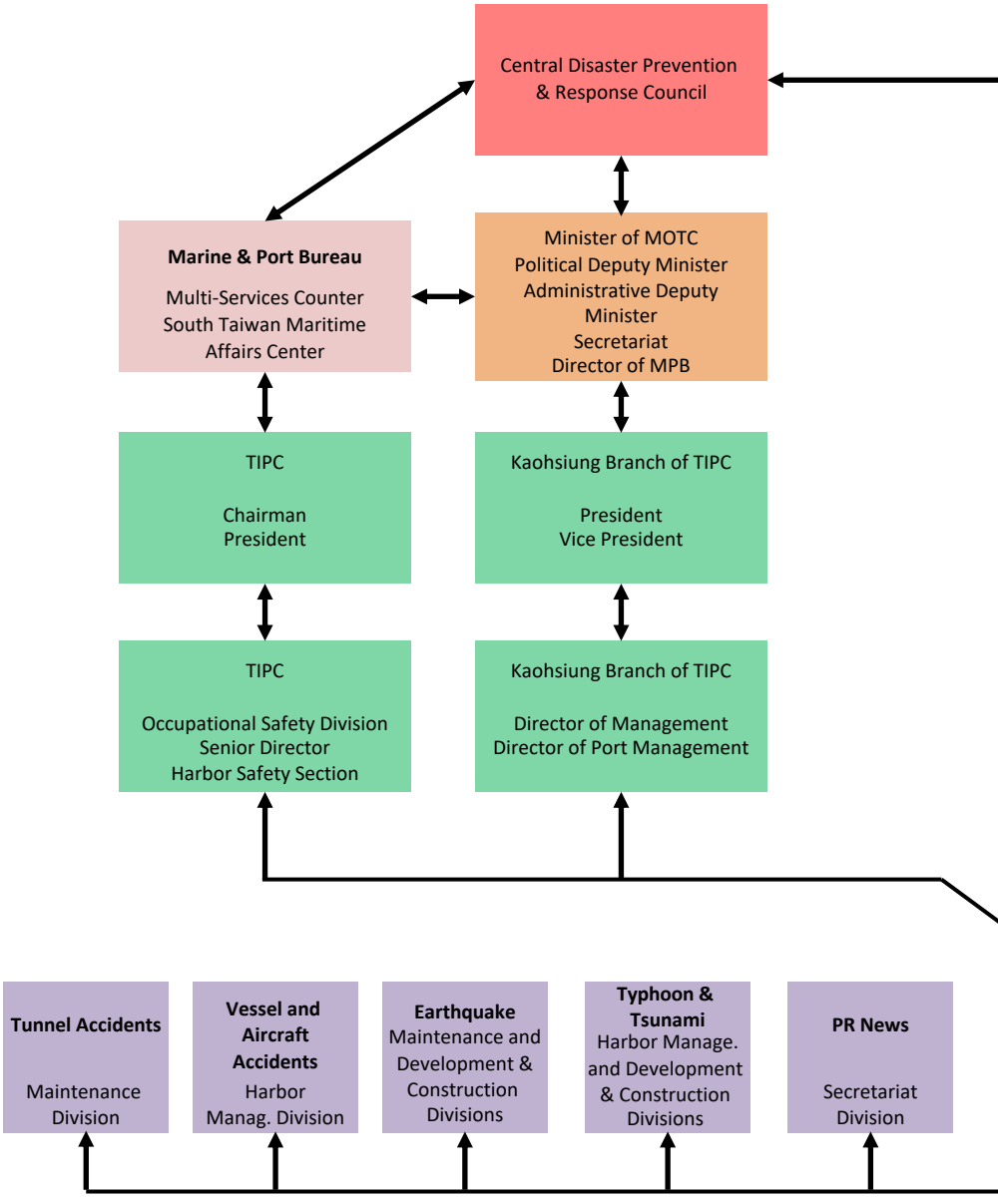
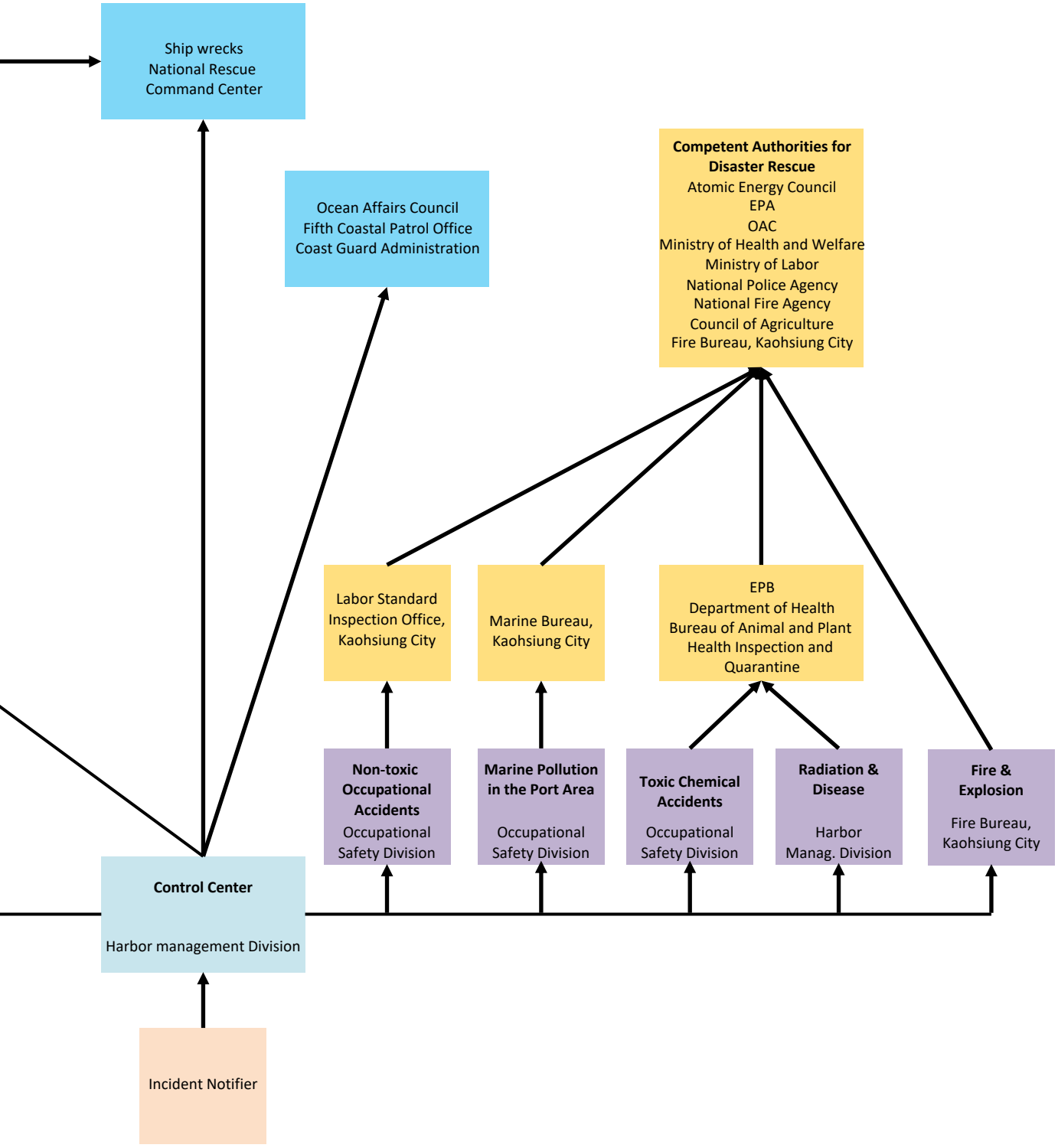
Emergency Response

Disaster and Accident Notification in Port of Kaohsiung



Source: Kaohsiung Branch of TIPC


Ship wrecks
National Rescue
Command Center
Ocean Affairs Council
Fifth Coastal Patrol Office
Coast Guard Administration
Competent Authorities for Disaster Rescue
Atomic Energy Council
EPA
OAC
Ministry of Health and Welfare
Ministry of Labor
National Police Agency
National Fire Agency
Council of Agriculture
Fire Bureau, Kaohsiung City
Labor Standard Inspection Office, Kaohsiung City
Marine Bureau, Kaohsiung City
EPB
Department of Health
Bureau of Animal and Plant Health Inspection and Quarantine
Non-toxic Occupational Accidents
Occupational Safety Division
Marine Pollution in the Port Area
Occupational Safety Division
Toxic Chemical Accidents
Occupational Safety Division
Radiation & Disease
Harbor Manag. Division
Fire & Explosion
Fire Bureau, Kaohsiung City
Control Center
Harbor management Division
Incident Notifier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Innovation and Cooperation

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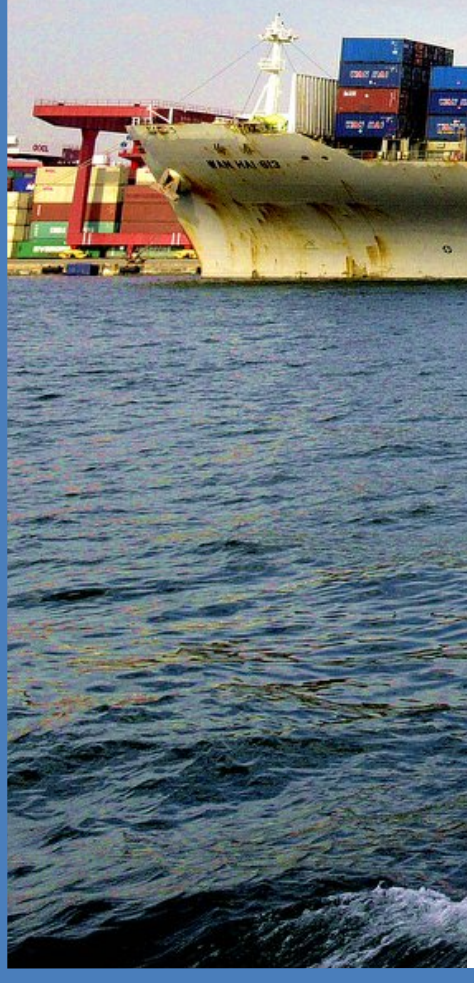
Innovation and Cooperation



6.1 Solar Power System

Environmental issue: Climate Change, Energy Consumption

Strategies: Exemplifying, Encouraging, Enforcing

Attention/Motives

With the completion of the environmental management system at the Port of Kaohsiung, promotion of the development of renewable energy has matured. However, despite the sufficient sunlight in southern Taiwan that makes the region suitable for solar photovoltaic development, the high installation and maintenance costs and the large area of land required for the solar equipment mean careful consideration and evaluation are required for such investment.

Solutions

To solve problems regarding money management and spatial resources, the Port of Kaohsiung recruits investment from the solar industry by leasing building roof spaces, which solve the problem of insufficient space. Additionally, the rent from roofs is used to replace self-investment costs, and a proportion of electricity sales revenue is collected for the Port of Kaohsiung.

The Port of Kaohsiung allows solar photovoltaic equipment companies to assess suitable roof spaces in the port area and negotiates with building tenants to install relevant equipment. The solar panels are installed through noninvasive methods to avoid destroying the original roof structure, which could result in problems such as leakage.

Investment amount

Direct investment is unavailable because the Port of Kaohsiung only provides building roofs for leasing.

The electricity sales rate is NT$4.7 per kWh of electricity, and the Port of Kaohsiung receives part of the revenue.

Effect/Benefits

- **Roof spaces in the port area are leased to collect rent and increase the revenue of the Port of Kaohsiung.**
- **Installing 6.4 m2 of solar panels can yield a power generation capacity of 1000 W, producing a total of 1320 kWh per year.**
- **Through promotion of the development of solar photovoltaic industry in Taiwan, photovoltaic energy companies produced 880,000 kWh and 3,120,000 kWh of electricity in 2016 and 2017, respectively, amounting to NT$4.16 million and NT$14.7 million. Approximately 4,870,000 kWh of electricity is anticipated to be produced in 2018.**

Solar Power Systems at the Port of Kaohsiung

Location	Building	Date of Completion	Area (M^2)	Capacity (kW)	Power Generated (kWh)	
					2016	2017
Penglai Commercial	Office No.1	2016/03/24	91	14	15,657	19,752
Zhongdao Commercial	Transit Shed (TS) 34-1	2016/08/22	3,706	580	215,440	698,189
	TS 35-1		3,485	546	216,056	694,627
	TS 37-1		2,613	410	183,299	583,867
	TS 38-1		2,613	410	184,950	593,765
	TS 39-1	2016/11/09	2,613	410	63,099	534,221
Container Terminal No.4	Warehouse No. 118	2017/12/26	2,330	365	-	
	Warehouse No. 119		1,425	223	-	
	Warehouse No. 120		1,650	259	-	
Qienzhen Commercial	MCC	2017/12/29	3,037	476	-	
Total			23,562	3,693	878,501	3,124,421

Participating Units and Stakeholders

Kaohsiung Branch of TIPC, Port Tenant, Solar Power Companies/Developers

Port of Kaohsiung
Port Business Division
Contact: David Chen

Phone: 07-562-2153
Fax: 07-533-4481
Email: davidchen@twport.com.tw

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Innovation and Cooperation

6.2 Land Reclamation at the Intercontinental Terminal #2

Environmental issue: Dredging: Operation and Disposal, Hazardous Cargo: Handling/storage

Strategies: Exemplifying, Encouraging, Enforcing

Attention/Motives

More than 300 petrochemical fuel storage tanks and operating facilities are scattered in Zhongdao and other neighboring areas in old harbor areas at the Port of Kaohsiung, which is close to the crucial zones in Kaohsiung City. In consideration of the citizens' safety, petrochemical and other operating facilities should be relocated to the outer section of the Port of Kaohsiung, and the functions of the port should be readjusted to manage the facilities in a professional and centralized manner.

Solutions

In conjunction with the developments of the government such as the Asia–Pacific Regional Operations Center and Multifunctional Commerce and Trade Park, the Port of Kaohsiung has used land reclamation technology together with more than 41.09 million m3 of sand to expand the port, producing approximately 232 ha of land area. Sensitive goods such as refinery storage tanks from the Chinese Petroleum Corporation in Kaohsiung are then moved to the new harbor area.

Additionally, chemical pipelines that originally passed through Kaohsiung City will be abolished, with the transferred chemicals being directed on other routes. The port area adjacent to the urban area will be transformed into a sightseeing dock with less environmental effect. In addition to adjusting dock positions, the land reclamation area at the Intercontinental Container Center Phase 2 Project at the Port of Kaohsiung also provides a deep water pier more than 16 m in depth in which large container ships of 8,000 to 10,000 TEU and above (please confirm with the Design Section) can anchor, thereby stabilizing the international shipping status of the Port of Kaohsiung.

Effect/Benefits

Through the Shoreline, Filling, and Harbor Craft Basin of the Intercontinental Container Terminal Phase 2 Project at Port of Kaohsiung and New Land Fill Construction Project of the Intercontinental Container Terminal Phase 2 Project at Port of Kaohsiung, the Port of Kaohsiung receives the following additions: ten petrochemical liquid storage terminals, four bulk cargo terminals, and five 15,000 TEU. In addition to improving the safety of cargo storage at the port area and expanding its future development, these construction projects adopt several environmental protection methods to overcome a number of engineering problems. The Shoreline, Filling, and Harbor Craft Basin project won the outstanding 16th Public Construction Golden Quality Award, whereas the New Land Fill Construction Project won honorable mention for the 17th Public Construction Golden Quality Award.

Environmental Protection Construction Method

- **Natural ecology construction method:**
  - **Constructing fish ladders can help fish avoid the construction area.**
  - **Using dynamic self-propelling and self-loading features, the dredger actively circumvents ecologically sensitive areas and avoids pumping sand at a fixed spot that results in potholes in the seabed.**
- **Sand monitoring: monitor the direction of ocean current to avoid sand loss and reduce the ecological effect on the sea area**
- **Dredge-based backfilling: ocean-dumped soil from the channel dredging is used as the source of sand for the Intercontinental Container Terminal Phase 2 Project to save the costs of ocean dumping and offshore sand pumping and reduce the ecological effect on the ocean.**

Construction Difficulties:

- **Proximity to fishing rights areas: maintain favorable relations with the neighboring fishermen's associations, and reach agreement through six coordination meetings with the fishermen's associations.**
- **Unexploded sea mines:**
  - **Formulate relevant SOP and Management mechanisms**
  - **Proactive detection to avoid risk**

Implementation/Timeline

Began Nov 23rd 2015
Completed Nov 22nd 2017

Investment amount

Approximately 115.6 million Euro

Participating Units and Stakeholders

Shipliners, Cargo handling operators,

Port tenants, EPA, EPB

Port of Kaohsiung
New Construction Section,
Development & Construction Division
Contact: Ching-Hung Lin

Phone: 07-562-2259
Fax: 07-521-3115
E-mail: T02667@twport.com.tw

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Innovation and Cooperation

6.3 Cooperation

The Kaohsiung Branch of TIPC has been very active in collaborating with the private sector, public sector and academia in Taiwan and abroad on issues related to the environment. In addition to understanding environmental development trends in the international arena, the Port of Kaohsiung also works to achieve the goal of becoming a sustainable green port through technological cooperation, joint venture, joint investigation and seminars.

Participation organizations

Association

Association of Pacific Ports(APP)

The APP is aimed to gather the authorities of ports along the Pacific coast to discuss the development of Pacific marine transportation, seek solutions for problems. The Kaohsiung Branch regularly attends APP conferences and served as the organizer in 2015, adopting the theme of "Ecology, LOHAS, and Greening in the Port of Kaohsiung" to exchange innovative technology, knowledge, and professional management experiences with other members.

The International Association of Ports and Harbors(IAPH)

The IAPH is a NGO with a tremendous influence on global port authorities, IAPH also provide the advisory to the main bodies of UN (eg. ECOSOC, IMO , UNCTAD , UNEP , ILO, WCO). The IAPH holds biennial conferences alternately in America, Asian Pacific, and European and African regions. The Port of Kaohsiung regularly attends the conference to keep abreast of the development and latest topics of ports worldwide.

Terminal operators

Kao Ming Container Terminal Corp. (KMCT)

Kaohsiung Branch of TIPC and KMCT collaborated through BOT to invest in the first world class green terminal in Terminal No. 6 of Kaohsiung Port, to offering high-quality and highly efficient service with the principle of safety, efficiency, and energy saving .

Yes Logistics Corp.

The Kaohsiung Branch of TIPC cooperated with Yes Logistics in 2013 to install a solar photovoltaic system on the rooftop of the warehouse (KLC2). The system can generate 411.72kWp of electricity.

Cooperation

South Star Free Trade Port Zone (SSFT)

South Star Free Trade Port Zone will be the hinterland for the Kaohsiung Free Trade Port Zone in the future. The existing windbreak forest within the Zone will be kept. An insulation green belt will be added around the Zone with multi-layered endemic vegetation. The administrative center and other public buildings (such as transforming substation and checkpoint) will all be green buildings to reduce carbon emission.

Kaohsiung Port Land Development Company

The branch facilitates the cooperation between the Port of Kaohsiung and Kaohsiung City Government, adaptively reuses old land and buildings, and integrates the resources and strengths of the port and the city to improve local economic development.

Academic institution

National Sun Yat-sen University

NSYU signs a memorandum of cooperation with the TIPC to cooperate in terms of personnel training, student internships, and the management of seminars and lectures.

Ports

APEC-Antwerp/ Flanders Port Training Center

The Port of Kaohsiung signed a letter of intent with the Antwerp/Flanders Port Training Center to provide various port operation-related courses on engineering, wharf management, logistics, and docker training.

Port of Gdansk Authority

The Port of Kaohsiung signed a sister port agreement with the Port of Gdansk to facilitate mutual operational developme-nt and exchanges in port management and technologies.

Shanghai International Port (Group) Co. Ltd.

With an aim to improve the level of port engineering technology, the Port of Gdansk and the Port of Kaohsiung actively engage in exchanges regarding equipment maintenance, energy conservati-on and environmental protection, and the application of new technologies.

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Innovation and Cooperation

Public sector

Institute of Transportation (IOT), MOTC

The Institute of Transportation at the MOTC has served as a think tank that assists the ministry with formulating policies, integrating and coordinating transportation-related decisions, and establishing a communication network for industrial, governmental, and academic transportation organizations. The Kaohsiung Branch of TIPC has collaborated with the Harbor and Marine Technology Center of the institute in multiple projects regarding topics such as the establishment of green ports, innovative container management, and port operation strategies.

Marine Bureau, Kaohsiung City Government

Kaohsiung Branch of TIPC works with the Marine Bureau of Kaohsiung City Government, and forms an ocean protection alliance with 30 entities from private sector, public sector, academia and the military to cooperate in controlling port pollution and sharing marine environmental monitoring data and information to achieve the goal of marine pollution control.

Bureau of Cultural Affairs, Kaohsiung City Government

The Kaohsiung Branch of TIPC has signed a contract with the Bureau of Cultural Affairs (BCA), Kaohsiung City Government, to provide some of its warehouses for art exhibition, and to promote the cultural and creative industry with the BCA. Functions of the warehouses near The Pier 2 Art Center have changed accordingly.

Ministry of Economic Affairs, Executive Yuan

The Kaohsiung Branch of TIPC works with the Export Processing Zone Administration of the Ministry of Economic Affairs in Kaohsiung, South Taiwan Maritime Affairs Center, and Kaohsiung EPB monthly to conduct joint inspections of the public bulk cargo dock of Zhongdao Commercial Port to prevent pollution in the Port area.

Southern Taiwan Service Center of MPB, MOTC

The South Taiwan Maritime Affairs Center of the MPB under the MOTC is in charge of the affairs related to port security, disaster relief, and pollution control in the Port of Kaohsiung, as well as the implementation of laws and regulations, gathering of evidence, and penalty consideration. The Kaohsiung Branch of TIPC cooperates with the South Taiwan Maritime Affairs Center to conduct land–water inspection in the port.

Environmental Protection Administration, Executive Yuan

The EPA of the Executive Yuan and the USEPA cooperate according to an "Agreement between the American Institute in Taiwan and the Taipei Economic and Cultural Representative Office in the United States for Technical Cooperation in the Field of Environmental Protection" (1993). The agreement also covers a series of cooperation strategies for the port environment, so American experts are regularly invited to Taiwan for seminars, offering technical assistance and sharing information (such as regional partnership for "Port Air Quality Improvement Strategies and US-Taiwan Sustainability Forum").

Environmental groups

Environmental Protection Bureau, Kaohsiung City Government

The Kaohsiung Branch of TIPC works with EPB of the Kaohsiung City Government to encourage diesel vehicles entering the Port area to join Kaohsiung City's autonomous management project to set up a vehicle license plate recognition system at Checkpoint No. 55 for joint inspection.

Kaohsiung Wild Bird Society

The Kaohsiung Branch of TIPC consulted ecological protection in SSFT Port Zone with the Kaohsiung Wild Bird Society. Existing habitats will be kept and a multi-layered microhabitat environment will be created for migratory birds and birds of passage. Members from Kaohsiung Wild Bird Society are invited to lecture our staff about ecology in the SSFT Port Zone.

Training

07/

07/ Training

7. Training

In compliance with its environmental policies, the Kaohsiung Branch of TIPC provides suitable environmental education and training programs to improve staff's environmental awareness, enhance their environmental protection knowledge and improve the competitiveness of the Port of Kaohsiung.

Each year, the Kaohsiung Branch of TIPC organized dozens of environmental education courses for internal staff members, with approximately 2,000 participants. The courses included: pollution prevention, natural disaster, environmental impact assessment and ecological education.

Posture training

Health Seminar

Corporate Culture

Company Leadership Training

Civil Defense Training

Employee Consultation Training

Leaders Consensus Building

AED and CPR Training

Communication and Publication

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Communication & Publication

8. Communication & Publication

The Kaohsiung Branch of TIPC works to provide information related to the Port through activities, seminars, workshops, publications, websites and exhibitions to ensure that the general public, terminal operators, academic institutions and competent authorities can have a better understanding of the Port.

Publication

Seasonal Magazines

TIPC Environmental Monitoring Report

TIPC Green Policy Website

Kaohsiung Port Facebook

Eco Mobility 2017

2017 Green Port and Port Safety Conference

Exhibition on Green Port

Marine Environmental Workshop

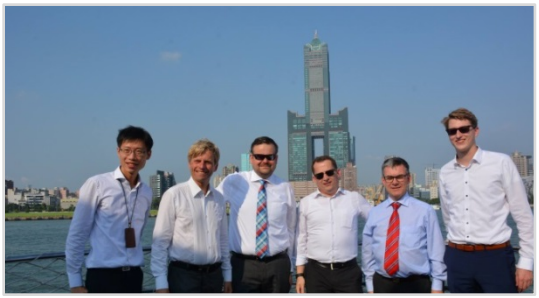
Green Port Awards Ceremony

Occupation Safety Week Event

Visitors from Universities

Visitors from the Marine Academy

Visitors from Overseas



Visitors from Elementary Schools

Green Accounting

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09/ Green Accounting

9.1 Environmental costs

Regarding the environmental issues, the Kaohsiung Branch of TIPC has spent funds on their employees, environmental maintenance, management, environment-al monitoring, publications, emergency response and communication, with the aim of enhancing employees' environmental awareness and environmental maintenance , to improve environmental quality and ability of emergency response, and to increase the public's understanding of the port.

The total amounts that Kaohsiung Branch of TIPC invested in the environmental issues are NT$287,357 thousand (€8,027 thousand) in 2016 and NT$153,369 thousand (€4,283 thousand) in 2017.

Environmental investments in the Kaohsiung Branch

- **Employees: Personnel costs of environmental control, and environmental educationand training**
- **Environmental maintenance and management: Port green landscaping, waste disposal and dredging**
- **Environmental Monitoring: Monitoring the air, noise, water, sediment, dredging as well as environmental patrol**
- **Emergency Response: The costs of accident management, laboratory test fees for materials and dangerous goods that pollute the Port, and so on**
- **Communication and Publications: Website maintenance, promotional activities and environmental publications**

Costs related to Environmental Issues, Kaohsiung Branch of TIPC (Unit: NTD thousands)

Expenses/ Year	2013	2014	2015	2016	2017
Employees	67,710	74,878	41,227	59,666	53,363
Environmental Maintenance & Management	67,907	179,211	116,311	179,842	64,222
Environmental Monitoring	27,774	37,035	26,502	26,583	28,360
Emergency Response	3,853	14,740	13,720	17,073	7,201
Communication & Publication	5,519	1,230	2,214	4,193	223
Total	172,763	307,094	199,974	287,357	153,369

9.2 Environmental Assets

In order to develop Kaohsiung Port into a trans-shipment hub in the Asia-Pacific Region, the Kaohsiung Branch of TIPC has promoted a series of port development projects, some of them involve environmental issues. For example, new buildings are designed and constructed as green buildings, and also in a way to increase opportunities for the public to get close to the Port; the wharfs are reconstructed with shore power systems; old vessels and vehicles are removed or replaced to increase the effectiveness and reduce pollutant emissions. The total amounts that the Kaohsiung Branch of TIPC invested in the fixed assets regarding environmental issues are NT$1,371,617 thousand (€38,111 thousand) in 2016 and NT$1,353,470 thousand (€37,804 thousand) in 2017.

Assets invested in Environmental Issues in 2016 (Unit: NTD thousands)

Item / Fixed assets		Land Improvement	Buildings	Machinery and Equipment	Transportation Facilities	Miscellaneous Equipment	Investment property	Total
Development Plan	Follow-up Projects	1,142,665	208,721	843	0	0	0	1,352,229
	New Projects							
General Building and Equipment Plan		1,652	0	0	15,479	2,257	0	19,388
Total		1,144,317	208,721	843	15,479	2,257	0	1,371,617

Assets invested in Environmental Issues in 2016 (Unit: NTD thousands)

Item / Fixed assets		Land Improvement	Buildings	Machinery and Equipment	Transportation Facilities	Miscellaneous Equipment	Investment property	Total
Development Plan	Follow-up Projects	1,127,766	0	0	0	0	0	1,127,766
	New Projects							
General Building and Equipment Plan		13,400	177,333	24,131	9,840	1,000	0	225,704
Total		1,141,166	177,333	24,131	9,840	1,000	0	1,353,470

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