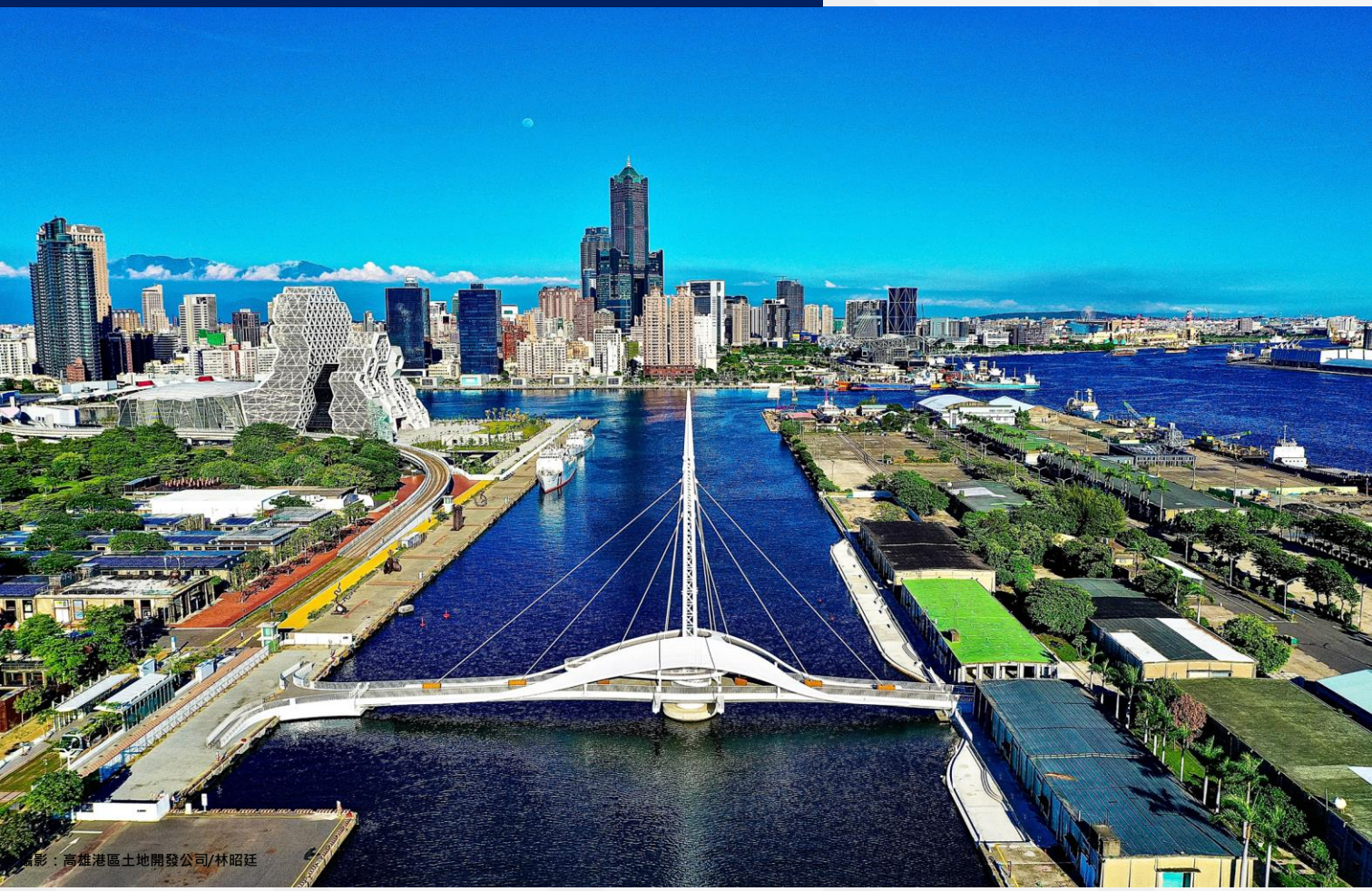
Port of Kaohsiung Environmental Report

▶ 2020



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Port of Kaohsiung
Environmental Report

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This environmental report presents Kaohsiung Port's achievements in environmental protection from 2018 to 2019 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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Photographer: Kaohsiung Port Land Development Company/Lin Zhao-ting

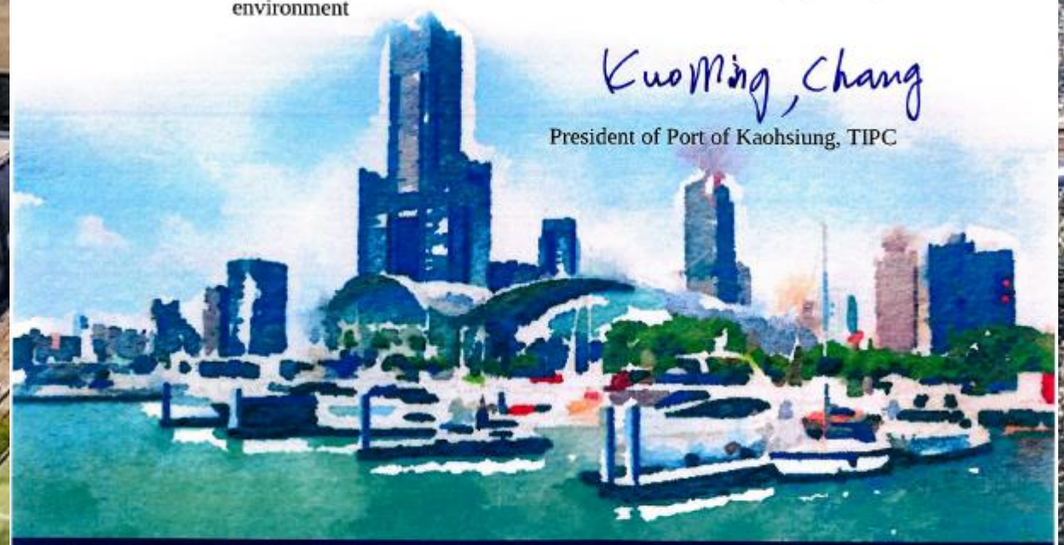
Environmental Policy

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
- Promote community participation ; co-create a friendly port-city environment

Kuo Ming, Chang

President of Port of Kaohsiung, TIPC



PORT OF KAOHSIUNG, TAIWAN INTERATIONAL PORTS CORPORATION

Environmental Objectives

Improve port air quality:
Continue to monitor port air quality, enhance environmental inspection and trace pollution sources

Abate vessel emissions:
Continue to promote vessel speed reduction, manage vessel emissions and conduct long-term port water quality monitoring

Reduce waste:
Manage port wastes effectively through full implementation of waste stream recycling

Prevent Dust in the Port Area:
Provide better dust prevention practice guides to fugitive dust-prone operations

Practice good port development strategies:
Minimize impacts of port development by coordinating with city development and environment monitoring

Strengthen transportation vehicle control:
Install RFID automatic-gates and assist the competent authority to manage old heavy vehicles

Manage hazardous cargo:
Emphasize disaster prevention and ensure accident prevention practices

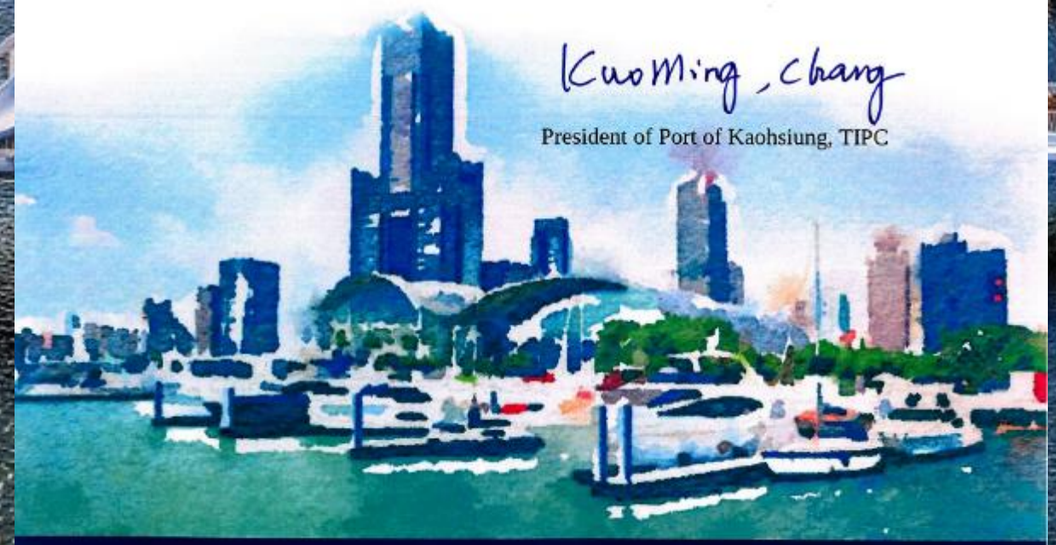
Monitor marine sediment:
Protect port ecology by monitoring the disposal area for dredged sediment

Strengthen relationships with local communities:
Increase port friendliness by making port information transparent, encouraging public participation, and encouraging local communities interaction

Tighten resource usage:
Reduce port impact by streamlining resource consumption and reducing greenhouse gas emissions

Kuo Ming, Chang

President of Port of Kaohsiung, TIPC



PORT OF KAOHSIUNG, TAIWAN INTERATIONAL PORTS CORPORATION

Photographer: Kaohsiung Port Land Development Company/Lin Zhao-ting

Message from TIPC

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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.

To implement industrial and diverse operation concepts, Port of Kaohsiung adopted development strategies based on cooperation, innovation, and sustainability. By adopting a customer-oriented corporation core value, the Port has created an environment conducive to favorable operation and has cooperated with manufacturers to generate benefits. The Port will implement various construction projects to build port facilities and develop solutions to expand on its core operation. Through this approach, the Port will continue to develop diverse operation models to expand its scope of business associated with port industry, transcend the conventional management framework of ports, and apply smart technologies in port operation. Finally, we will optimize the operation safety of all ports in Taiwan and provide convenient transportation and efficient services to realize the vision of "focus on innovation to enter the world market and become the best port operation group worldwide."

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.

Kuo Ming, Chang

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

Port Profile

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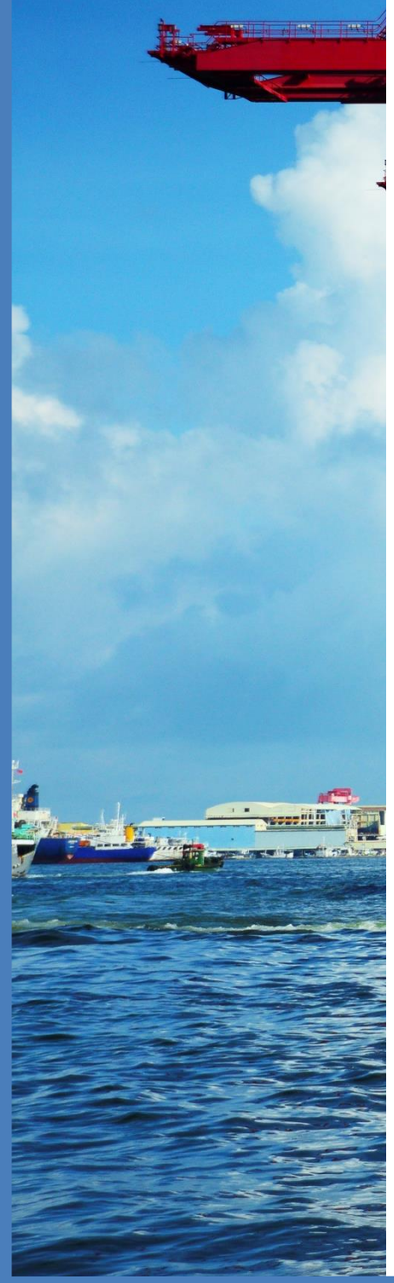
02/ Port Profile



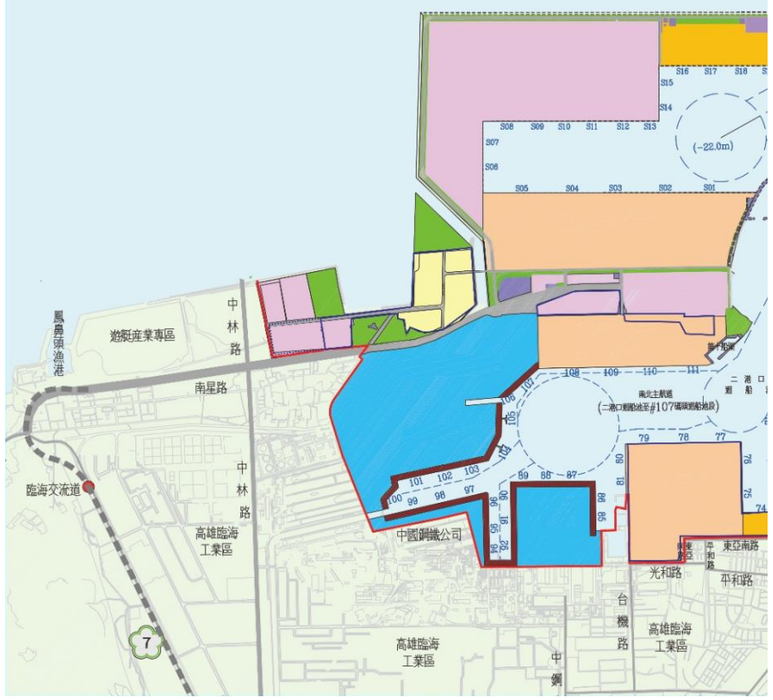
2.1 Port Location and Port Area

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 km^2 of land, and the water area of the Port reaches 158.65km^2. 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, Canal No. 5, Qianzhen River and Yanshui Stream all flow into the ocean through the Port.

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.

Master Plan of Port of Kaohsiung



Source: Kaohsiung Branch of TIPC

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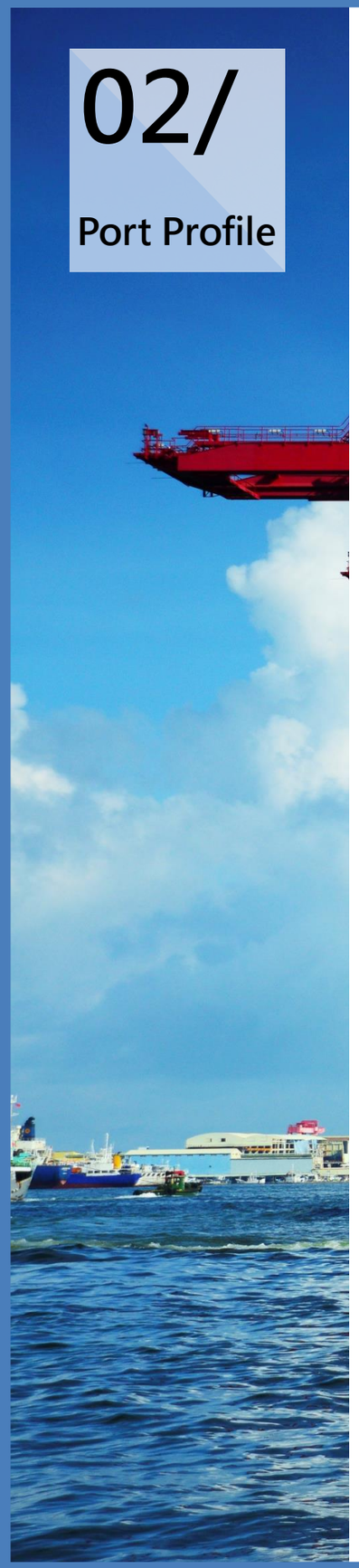

2.3 Commercial Activities

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 2018 and 2019, the inbound cargo of the Port of Kaohsiung mainly includes mineral products (61.4%), base metals and articles therefore (13.6%), vegetable products (7.7%), and products of chemical or allied industries (5.9%). The outbound cargo primarily includes base metals and their products (37.9%), plastics, rubber, and articles thereof (22.9%), products of chemical or allied industries (11.6%), and mineral products (11.3%).

Main Commercial Activities and Cargo Handling of Port of Kaohsiung

Petroleum	Pyrites minerals
Crude oil Refined products	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	Fish Fruit

Source: Kaohsiung Branch of TIPC

2.5 Port Business

2018-2019 Business of Port of Kaohsiung

Item		2018	2019	Difference	%
Incoming & Outgoing Ships	V.	35,513	34,608	-905	-2.55
	G.T.	910,307,404	929,291,816	18,984,412	2.09
Volume of Cargo Handled	Cargo (Revenue ton)	373,528,683	372,626,001	-902,682	-0.24
	Dry bulk and Groceries (Revenue ton)	54,294,805	53,771,280	-523,525	-0.96
	Pipeline cargo (Revenue ton)	31,101,969	30,770,023	-331,946	-1.07
	Total (Revenue ton)	458,925,457	457,167,304	-1,758,153	-0.38
Number of Cargo Handle	Incoming Cargo(TEU)	5,230,400.25	5,235,470.00	5,069.75	0.10
	Outgoing Cargo(TEU)	5,215,325.50	5,193,164.25	-22,161.25	-0.42
	Total (TEU)	10,445,725.75	10,428,634.25	-17,091.50	-0.16
Volume of Imports & Exports	Imports (ton)	81,976,719	76,162,267	-5,814,452	-7.09
	Exports (ton)	32,315,267	31,767,557	-547,710	-1.69
	Domestic (ton)	4,505,584	6,095,005	1,589,421	35.28
	Total (ton)	118,797,570	114,024,829	-4,772,741	-4.02
Incoming & Outgoing Passenger	Domestic Line (number)	60,577	58,769	-1,808	-2.98
	International Line (number)	56,553	93,110	36,557	64.64
	Total (number)	117,130	151,879	34,749	29.67

Source: TIPC, 2016-2017 Statistical Report

Environmental Management

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03/ 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, hygiene and chemical accidents; the Hygiene and Pollution Control Section deals with pollution control, environmental laws, environmental impact assessment, environmental monitoring, oil pollution, emergency management and environmental education in the port; the Environmental Management Section manages conservation, plant conservation, waste treatment and recycling. Among the staff members, 45 are involved in environmental protection issues.

Figure of Organization involved in environmental issues of Port of Kaohsiung

Port of Kaohsiung

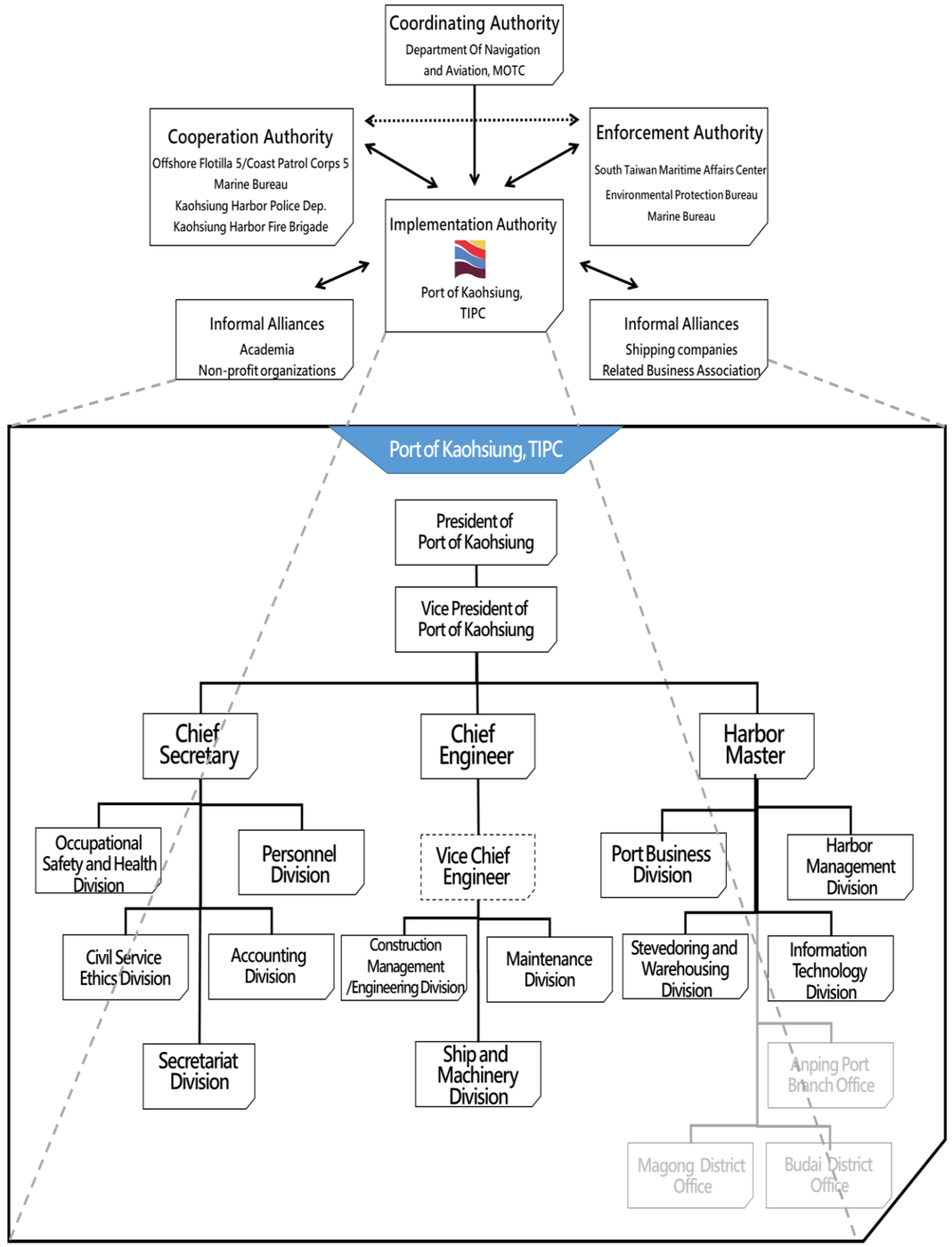
Management
- Kaohsiung Branch of TIPC
- Ocean Affairs Council
- South Taiwan Maritime Affairs Center, Maritime and Port Bureau, MOTC

Supervise
- Kaohsiung Branch of TIPC
- Marine Bureau
- Ocean Affairs Council
- Environmental Protection Administration
- 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
- Offshore Flotilla 5
- Kaohsiung Harbor Police Dep.
- South Taiwan Maritime Affairs Center, Maritime and Port Bureau, MOTC
- Environmental Protection Bureau, Kaohsiung City Government

Sanction
- Ocean Conservation Administration
- Marine Bureau
- South Taiwan Maritime Affairs Center, Maritime and Port Bureau, MOTC
- Environmental Protection Administration
- Environmental Protection Bureau, Kaohsiung City Government
- Kaohsiung Harbor Police Dep.

Figure of Organization chart of Kaohsiung Branch of TIPC



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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..

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

Competent Authorities	Laws Title			Central Competent Authority	Local Law Enforcement Agencies
Sectors in the Ministry of transportation and communications	The Commercial Port Law		2011/12/28	Ministry of Transportation and Communications	South Maritime Affairs Center, Maritime and Port Bureau, MOTC
	The Law Of Ships		2010/12/08		
	The Shipping Act		2014/01/22		
	Act for the Establishment and Management of Free Trade Zones		2012/12/28		
Sectors in the Ministry of the Interior	Fire Services Act		2019/01/07	Ministry of the Interior	Fire Bureau, Kaohsiung City Government
Sectors related to agricultural	Wildlife Conservation Act		2013/01/23	Council of Agriculture	Marine Bureau/ Agriculture Bureau, Kaohsiung City Government
Sectors related to environmental protection	Marine Pollution Control Act		2014/06/04	Ocean Affair Council	Marine Bureau, Kaohsiung City Government
	Basic Environment Act		2002/12/11	Environmental Protection Administration	Environmental Protection Bureau, Kaohsiung City Government
	Air Pollution Control Act		2018/08/01		
	Water Pollution Control Act		2018/06/13		
	Waste Disposal Act		2017/06/14		
	Environmental Impact Assessment Act		2003/01/08		
	Environmental Education Act		2017/11/29		
	Noise Control Act		2008/12/03		
	Indoor Air Quality Act		2011/11/23		
	Toxic and Concerned Chemical Substances Control Act		2019/01/16		
	Soil and Groundwater Pollution Remediation Act		2010/02/03		
	Environmental Agents Control Act		2016/12/07		
	Greenhouse Gas Reduction and Management Act		2015/07/01		
	Public Nuisance Dispute Mediation Act		2009/06/17		Public Nuisance Disputes Mediation Committee, Kaohsiung City Government
Intersectoral	Disaster Prevention and Protection Act		2019/05/22	Ministry of the Interior	Kaohsiung City Government

Source: Kaohsiung Branch of TIPC

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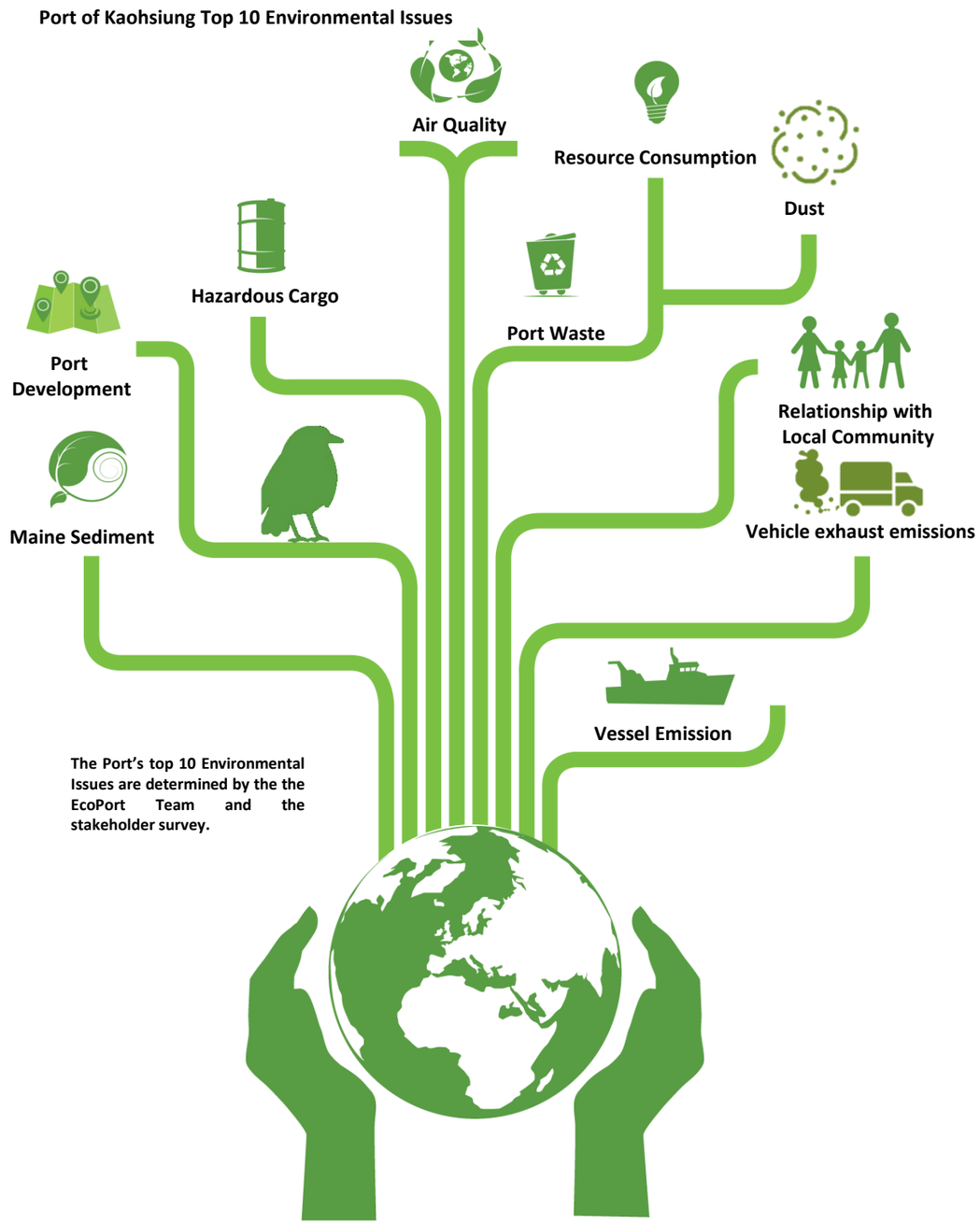
3.3 Stakeholder Analysis

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 VI. Vehicle exhaust emissions VII. Hazardous Cargo
Employee	Air Quality, Living Quality near the Ports, Resource Usages	I. Air Quality V. Port Development IX. Relationship with Local Community X. Resource Consumption
Clients	Air Quality, Emissions from Port industry, Cargo Leakage, Port Safety, Dust	I. Air Quality II. Vessel Emissions IV. Dust VII. Hazardous Cargo
Community	Air Quality, Emissions from Heavy Duty Vehicles and Vessels, Pollution from Riverain,Noise, Dredge Disposal, Marine Sediment, Port Development, Port Safety	I. Air Quality II. Vessel Emissions III. Port Waste V. Port Development VII. Hazardous Cargo VIII. Marine Sediment



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

State of the Environment

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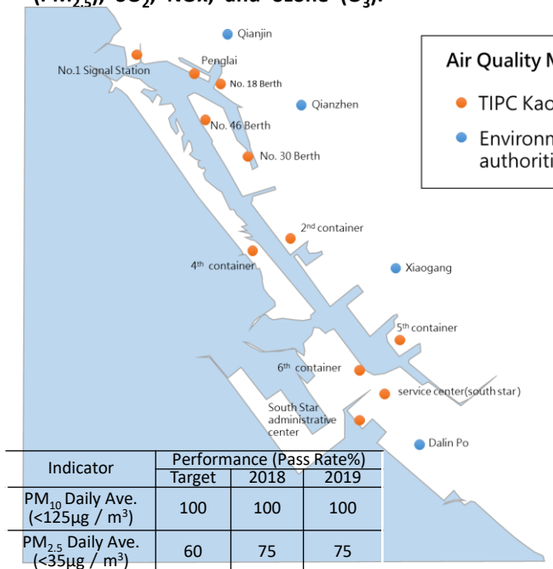
State of the Environment

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.

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.



Air Quality Monitoring Sites

- TIPC Kaohsiung Branch
- Environmental protection authorities

Indicator	Performance (Pass Rate%)		
	Target	2018	2019
PM_{10} Daily Ave. (<125μg / m^3)	100	100	100
$PM_{2.5}$ Daily Ave. (<35μg / m^3)	60	75	75
SO_2 Daily Ave. (<0.1 ppm)	100	100	100
NO_2 Daily Ave. (<0.25 ppm)	100	100	100

Preventing Emissions from Cargo Handling Operations

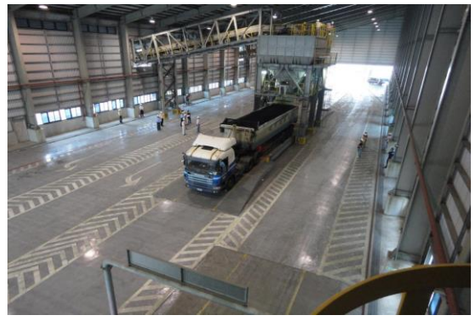
Port of Kaohsiung effectively manages dust generated from bulk cargo handling operations at Bulk and General Cargo Terminals No. 48–56 by implementing dust net, swiping and cleaning the streets, and deploying mist cannon vehicles.


Dust prevention nets

In addition, Wharves No. 50, 52, 54, and 55 have been individually equipped with a vehicle-washing pondis installed at the inspection and registration checkpoint of Wharf No. 55,58 to calculate the ratio of outgoing vehicles that have been washed.


High water pressure car wash lane

Shelter type coal unloading operation



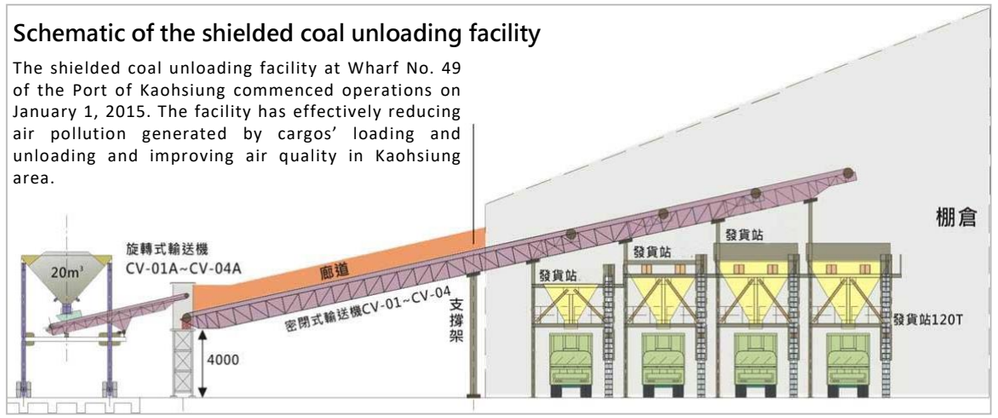
Number of times and utilization rate of car wash pool

Year	Washing times	Utilization rate
2018	Around 120,000	98%
2019	Around 80,000	98%

Wharf No. 49 is equipped with a shielded coal unloading facility to prevent dust pollution caused during coal loading and unloading . The amount of coal handled was about 1,090,000 tons in 2018 and 1,000,000 tons in 2019.

Schematic of the shielded coal unloading facility

The shielded coal unloading facility at Wharf No. 49 of the Port of Kaohsiung commenced operations on January 1, 2015. The facility has effectively reducing air pollution generated by cargos' loading and unloading and improving air quality in Kaohsiung area.



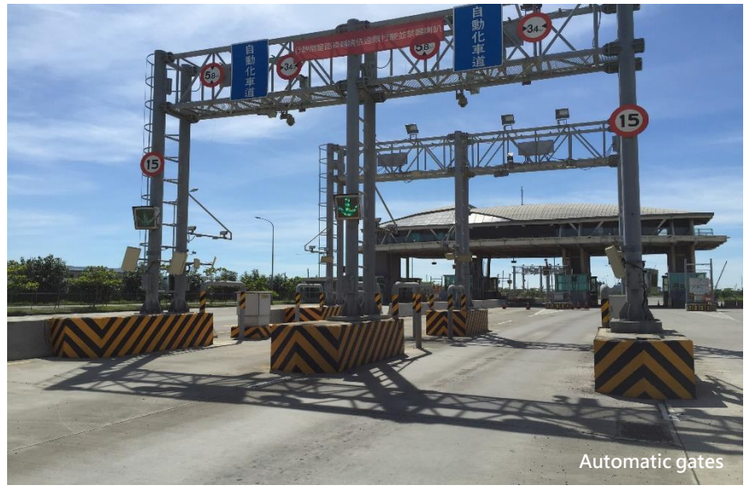
Land Mobile Pollution Source Control

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, 36 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
2018	9,898,116			286,463	1,504,514
2019	10,876,734			314,785	1,653,264

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



Automatic gates

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 21 dwarfs installed with low-voltage shore power and 11 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 384,759 kWh in 2018 and 486,526 kWh in 2019.

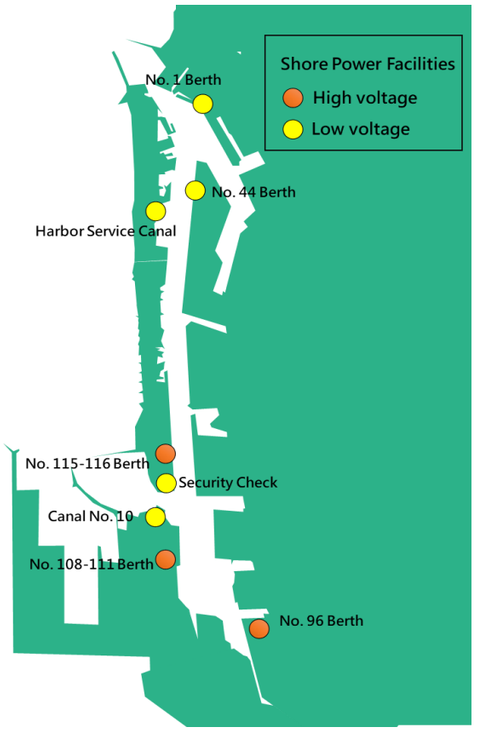
Shore Power Systems at Port of Kaohsiung

High Voltage Shore Power


High Voltage Shore Power


High voltage shore power facility

Location	Voltage	Number
Base Wharf	220V · 110V	15
Security Check	220V	1
Ship Channel 10	220V	3
Wharf No. 1	220V	1
Wharf No. 44	220V	1
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
Wharf No. 115	6.6kV	1
Wharf No. 116	6.6kV	3



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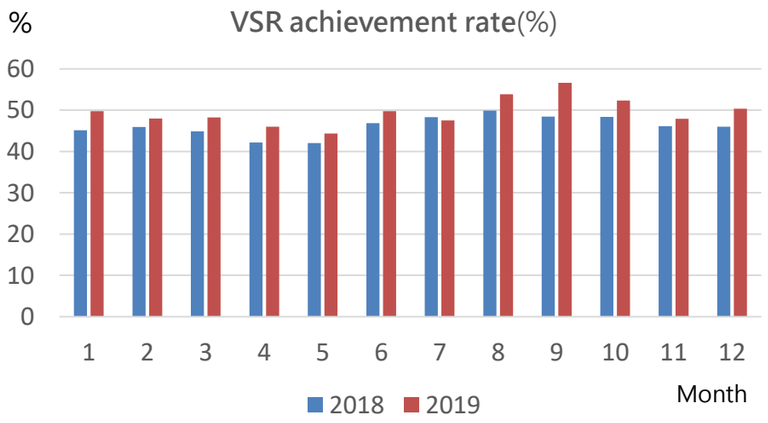
State of the Environment

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 50%. The achievement rates in 2018 and 2019 were respectively 46 % and 50%.

Moreover, since January 1, 2018, vessels achieving speed reduction have been granted with bonuses. Compared with 2017, the achievement rate of vessel speed reduction in 2018 significantly increased, with a rise by approximately 30%.

Year	(A)Vessels meeting the criteria	(B)Vessels with measured average speed	(C) VSR achievement rate (C=A/B) (%)
2018	11,941	25,953	46
2019	11,136	22,667	50



Low Pollution Fuel

All harbor vessels in the Port uses clean fuel in 2016 and 2019. 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.

At present, low-sulfur fuel with sulfur content below 0.5% has been fully used in the port area, and an agreement with CPC reduce the sulfur content of all MGO and MDO supplies to less than 0.5wt% from March 2018.

04/

State of the Environment

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 671.89 tons in 2018 and 549.96 in 2019.

Waste recycling statistics

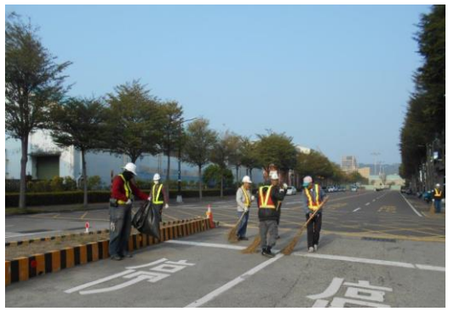
Item	2014	2015	2016	2017	2018	2019
Total (Ton)	2,193.27	2,286.22	1,833.09	1,437.58	1536.20	1414.87
Recycled (Ton)	496.65	490.20	455.29	217.17	185.29	133.94
Rate (%)	22.64	21.44	24.84	15.11	12.06	9.47

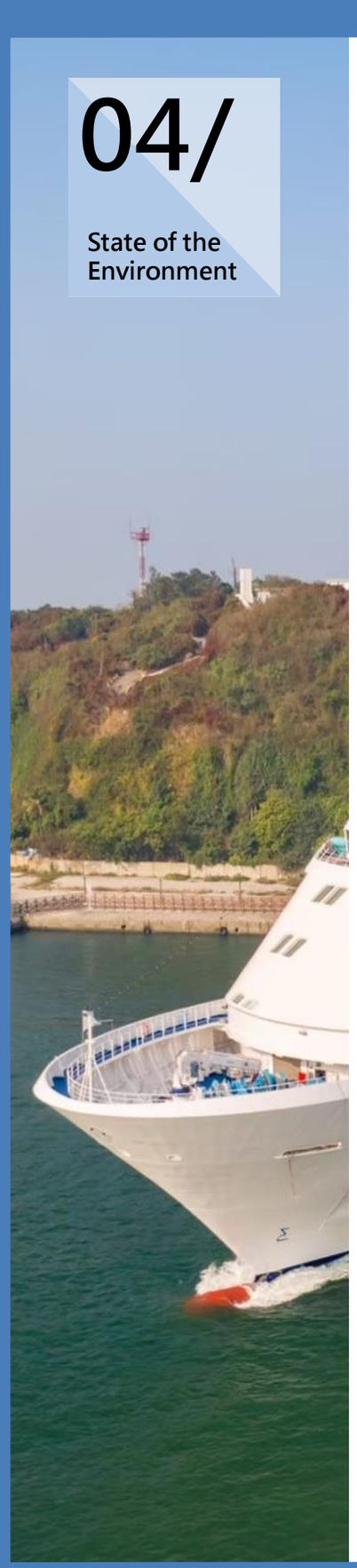
As of ship waste and wastewater, the Kaohsiung Branch of TIPC has properly managed the disposal of ship oily wastewater, waste oil, and waste currently. The disposal of general waste derived from port waters and land is outsourced according to wharf locations and types of operations required. Shipping 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	2013	2014	2015	2016	2017	2018	2019
# vessel	1,580	3,691	3,952	3,892	4,049	4,310	2,812
Waste (ton)	883.65	856.29	922.95	879.12	636.40	671.89	549.96
Waste oil (ton)	-	-	47,540	12,174	5,376	6,043	5,661





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 establishes goals for inspecting dangerous goods at least twice a year and cooperates with the Maritime Port Bureau to jointly implement relevant inspections. The numbers of inspections in 2018 and 2019 were 3 times each.

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. For instance, one case in 2018 and another in 2019 were reported concerning the excessive retention of highly dangerous goods in the port area. To implement the management of dangerous goods containers, the port of Kaohsiung Port constructed the "Port Area Dangerous Goods Safety Management Information System" in January, 2017. The system serves to strengthen the control of dynamic information and inspections concerning the storage of dangerous goods.

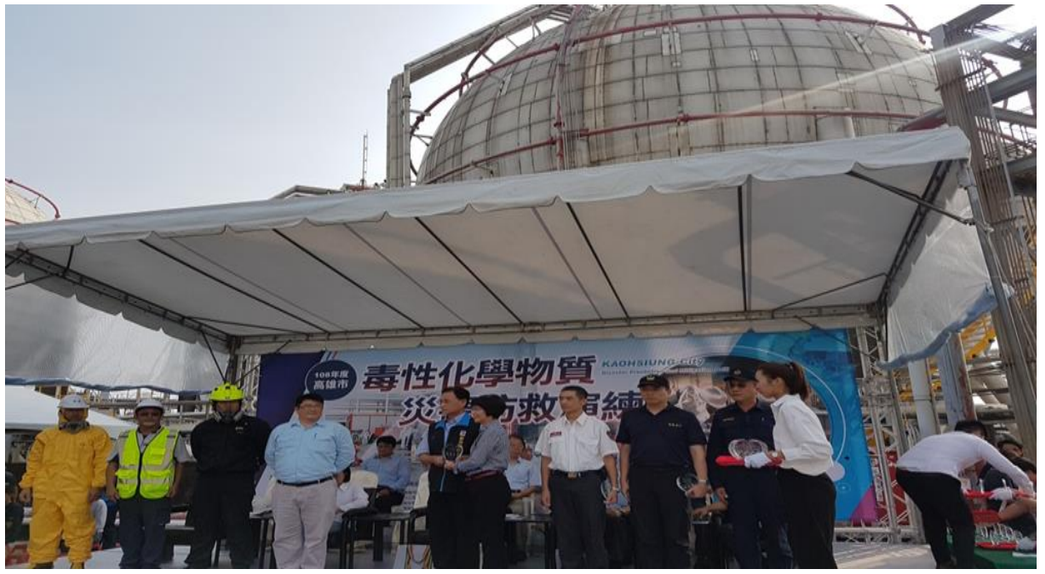
Inspection of hazardous materials in 2018

Safety Supervision for the Handling of Hazardous Materials for Petrochemical Storage and Transportation Operators

The poison disaster prevention and protection drill in 2019

Hazardous Cargo Management Related Activities

Year	Name of Event (Training Conference)	people
2018	"Kaohsiung Port and Anping Port Safety Supervision for the Storage and Transportation of Petrochemical Products and Hazardous Materials " meeting	19
	Self-inspection of the loading, unloading, and warehouse management of hazardous materials (inspection conducted on petrochemical operators in Kaohsiung Port from December 4, 2018, to December 13, 2018	12
	2018 Kaohsiung Port Scenario Simulation of Typhoon Disaster Prevention and Response	30
	2018 Kaohsiung Port Response Simulation of International Ship and Port Facility Security, Port Hijack, Oil Spill Contamination, and Influenza Testing for Port Visitors	170
2019	"Kaohsiung Port Safety Supervision for the Storage and Transportation of Petrochemical Products and Hazardous Materials" meeting	16
	Self-inspection of loading, unloading, and warehouse management of hazardous materials (inspection conducted on petrochemical operators in Kaohsiung Port from December 10, 2019, to December 19, 2019)	13
	Joint inspection for places involving the manufacturing, storage, and handling of public hazardous materials at a quantity not less than 30 folds of theregulated volume	9
	2019 Kaohsiung Port Drill of Typhoon Disaster Prevention and Response	42
	2019 Kaohsiung Port Tactical Drill of International Ship and Port Facility Security Incidents	179



04/

State of the Environment

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 open and planned waterfront space as high as 58.7 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.

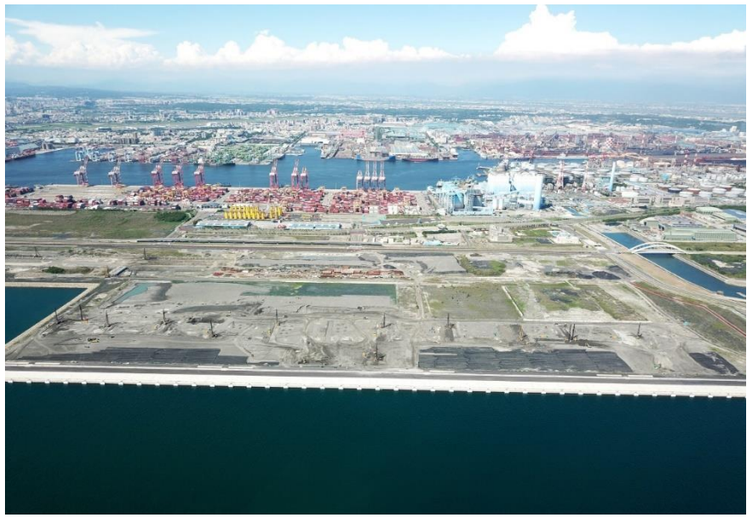
To integrate accesses to the Port of Kaohsiung, effectively separate passenger and freight traffic flows, improve passenger and freight transportation efficiency and service quality, enhance the traffic system of the port and the surrounding areas, and increase the quality of living in Kaohsiung City, the Construction Project of Elevated Accesses to the Port of Kaohsiung was launched to build a traffic corridor (length = 3.4 km) in commercial port districts and a traffic corridor (length = 1.13 km) extending from the Freeway 1.

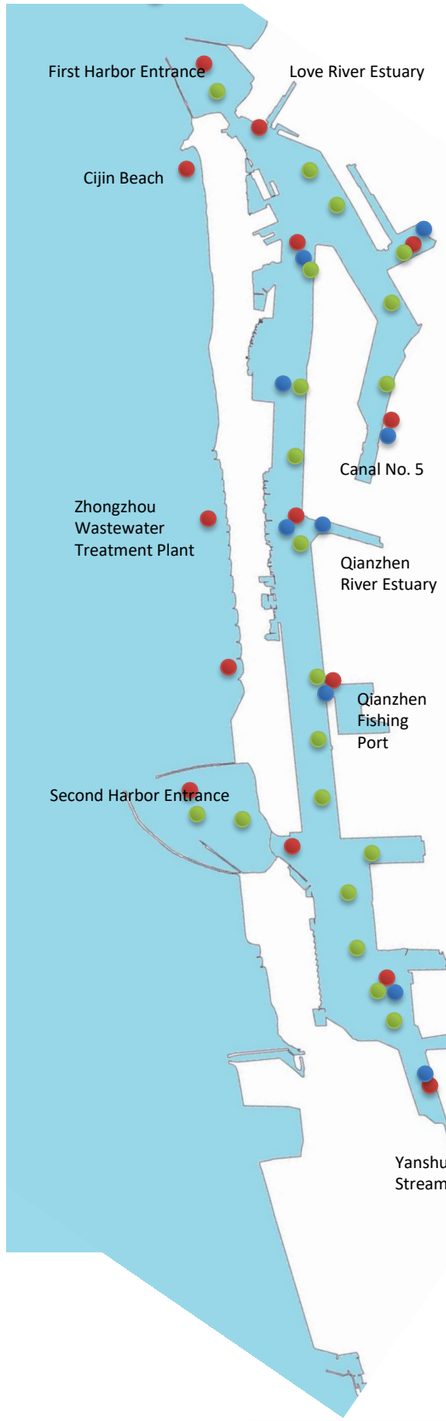
Monitor and Reduce Sediment Pollution

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 M^3

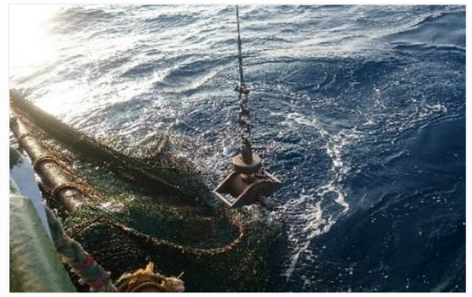
Year	Actual dredging volume	Actual amount of dredging sludge disposal	Actual amount of alternative's dredging mud	Dredging mud reuse rate %
2009	59.4	42.6	16.8	28.3
2010	96.7	30.7	66.0	68.3
2011	88.0	16.0	72.0	81.8
2012	70.9	18.9	52.2	73.3
2013	51.7	25.7	26.0	50.3
2014	60.0	11.4	48.6	81.0
2015	97.4	9.3	88.1	90.5
2016	51.7	0.2	51.5	99.6
2017	31.4	8.6	22.8	72.6
2018	22.1	18.5	3.6	16.4
2019	19.6	16.6	3.0	15.2





Sediment Monitoring Sites

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



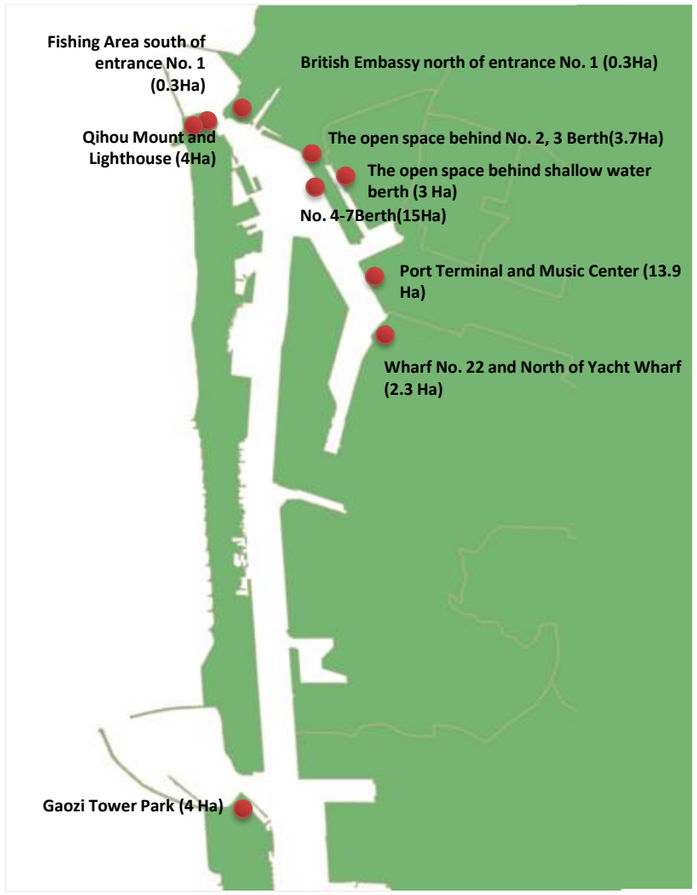
04/

State of the Environment

Strengthen Relationships with Local Communities

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

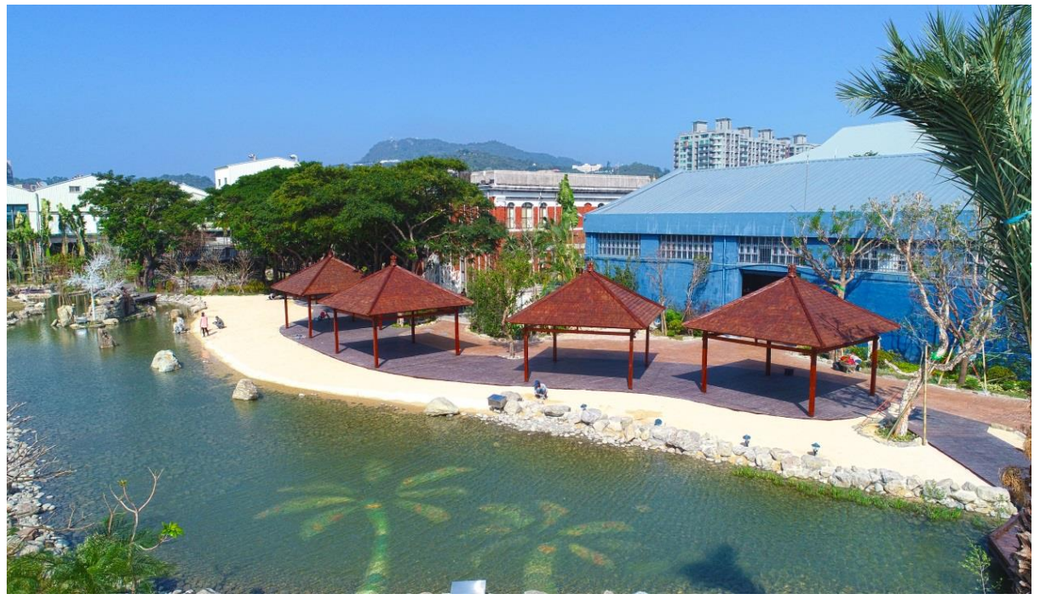


Parent–child reading

The Port of Kaohsiung cohosted the "423 World Book Day: parent–child reading" event in collaboration with Kaohsiung Chang Gung Hospital in 2019. This event enabled child patients to celebrate World Book Day through various engaging reading.

The 111th anniversary of the Port of Kaohsiung

The TIPC holds "Appreciation, Dream Building, and Lighting up Kaohsiung" walks as well as collaborates with operators and citizens to hold charity walks. For each attendance, the corporation donates a pair of warm socks to older adults living alone. To date, a total of 1,368 pairs of socks have been donated, keeping many older adults warm in the winter.



The Penglai Commercial Port area of Kaohsiung Port is open to the public for the first time in a century. Starting from December 22, 2018, the Kaohsiung Water Garden is an ecological landscape adjacent to the old Port area of Kaohsiung Port. It covers an area of about 4,300 pings and is located around the docks no. 3-5 of Kaohsiung Port.

Strengthen Relationships with Local Communities

In 2018, there were 40 neighborhood and social charity activities were held, among which four environmental education events were attended by about 120 people. In 2019, 54 activities were held, among which 5 environmental education events was 64 people.

The marathon celebrating the 110th anniversary of the Port of Kaohsiung
Invite citizens with visual impairments to participate in the event and spread love to them; enable all participants to run freely, healthily, and joyfully.

New Southbound Policy—Spreading warmth and sharing delicacies with new immigrants on International Woman's Day
Through sharing information, female employees at the Taiwan International Ports Corporation, LTD. can invite mothers in new immigrant families to participate in the event with their children.

The "2018 Ocean Education–Guardian of the Coastline" event

2018 Coloring Paper Lanterns for the Lantern Festival—Fulfillment at Kaohsiung Port

Charity The Double Ninth Festival Activity

Charity Dragon Boat Festival Activity

Paying visits to and showing concern for community older adults living alone and families of the port' s employees in 2019

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.



Ecological conservation

The wave chamber dissipates wave energy and increases biodiversity in its vicinity

1. Establish a wave chamber to receive waves through exterior wall openings. By using the openings of the wave chamber and the phase differences of waves to dissipate wave energy, the wave chamber can increase the loading efficiency of the port.
2. The openings of the wave chamber provide an environment for marine animals to attach to, facilitating the habitation of fish and shrimp and maintaining the marine ecosystem.

04/

State of the Environment

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.

Compound energy street light

Combining solar and wind energy to generate power for lighting

Automated control point operations

Resource Managements

The main approach for reducing resource consumption is to report the amount of power consumption and oil consumption through the “Energy Conservation Reporting Website for Government Agencies and Schools.” This website was established by the Bureau of Energy, Ministry of Economic Affairs to reduce port resource consumption and waste generation. The amounts of power saved in 2018 and 2019 were 1.62% and − 0.28% respectively, and the amounts of oil saved in 2018 and 2019 were 1.06% and 5.59% respectively.

Greenhouse Gas Management

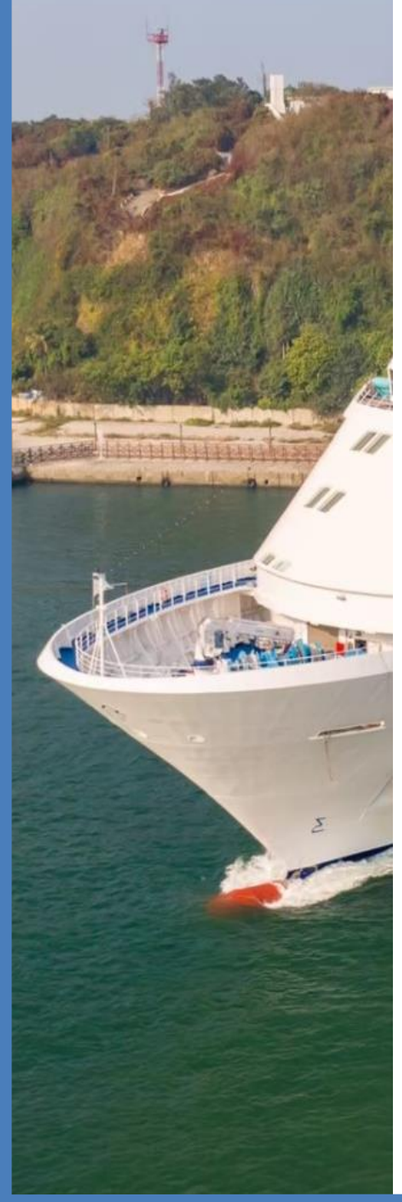
In 2020, the Port of Kaohsiung complied with ISO14064-1 and inspected its 2018–2019 greenhouse gas emissions, where it found that the main causes of its greenhouse gas emissions were port area management operations and office administration operations. Concerning the methods for setting organizational 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 2018-2019 greenhouse gas emission inventory is expected to be completed by the end of this year (2020).
Additionally, a comparison table was devised that indicate the revised contents of the third amendment (greenhouse gas inventory) in October 2019 to the environmental impact report of “The Phase I Nanxing Land Development Project: Free Trade Zone.” The table was submitted to the Environmental Protection Administration. The main change involved the stipulation that the Port of Kaohsiung shall guide port businesses to conduct greenhouse gas evaluation and report their findings for future reference.

External audit meeting

Orientation for port businesses

The ample sunshine in the region of the Port of Kaohsiung is favorable for developing solar energy. Therefore, parts of the building roofs in the port are leased to an energy company to install solar photovoltaic power generation equipment. The company renting the roofs pays part of its revenue from selling power as management fees to the Port of Kaohsiung. By doing so, the space is effectively utilized to increase revenue, and the solar energy equipment on the roofs can block sunlight, thus reducing indoor temperature and power consumption. As a result, solar power is the dominate form of renewable energy in the Port of Kaohsiung. The amounts of power generation in 2018 and 2019 were respectively 5.09 million kW-h and 6.71 million kW-h.



Environmental Performance Indicators of Kaohsiung Port

	Index item	Calculation method		Target value	Indicator presentation (calculation details) 2018	Indicator presentation (calculation details) 2019
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"		• 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%	• PM_{10} daily mean <125μg /m3: 100% • $PM_{2.5}$ daily mean <35μg/m3: 75% • SO_2 daily mean <0.1 ppm: 100% • NO_2 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%
	Number of air pollution patrols	• Frequency of land patrol		• 300 inspections annually	• 319times	• 450 times
Vessel emission	Vessel waste oil management	• Processed by qualified collectors÷ Total number of vessels collected×100% • Amount of waste oil collected		• The implementation of entrusting qualified operators to clean up waste oil and sewage from ships • The pass rate reaches 100%	• 100%; total of 325 vessels • Vessel waste oil collected: 6043.4tons	• 100%, total of 302 vessels • Vessel waste oil collected: 5,661.1 tons
	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		• 100%	15÷15×100%=100% • Clean fuel: 45 KL Marine Gas Oil: 108.9 KL Marine Diesel Oil: 716 KL	15÷15×100%=100% • Clean fuel: 30 KL Marine Gas Oil: 118.1 KL Marine Diesel Oil: 602 KL
	• The ratio of using shore power among harbor crafts • Shore power usage	• Number of harbor crafts using shore power ÷ Total number of harbor crafts × 100% • Shore power usage		The ratio of using shore power reaches 100% among harbor crafts	15 ÷ 15 × 100% = 100% • All the 15 harbor crafts use shore power during berthing operations. • Shore power usage: 384,759kWh	15 ÷ 15 × 100% = 100% • All the 15 harbor crafts use shore power during berthing operations. • Shore power usage: 486,526kWh
	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		• The ratio of deceleration among all the incoming and outgoing ships reaches 40% 50%. • Growth rate of the ratio of Ships deceleration	• The achieved speed reduction rate was approximately46%. • Growth rate of the ratio of Ships deceleration : (46-35.3)/35.3×100% =30.3%	• The achieved speed reduction rate was approximately50%. • Growth rate of the ratio of Ships deceleration:(50-46)/46×100% =8.7%
Garbage/ port waste	Port recycling rate(land)	Amount of recycled waste ÷ Waste generation×100%		Port recycling rate reaches 20%.	64.31÷864.31×100%=7.4%	43.29÷133.57=32.4%
	Waste from the waters	• Cleaning frequency • Amount of waste collected		Clean daily	• Cleaned daily • 671.89 tons	• Cleaned daily • 549.96 tons
Dust	The percentage of concealed/covered transportation for bulk cargo (e.g., cement and coal) during loading and unloading operations in the port area	Amount of bulk cargo handled indoor÷total bulk cargo×100% (Cement and coal are calculated separately)		The percentage of cement loaded and unloaded using concealed transportation: 100% The percentage of coal loaded and unloaded using covered transportation: 80%	The amount of break bulk general cargo handled using the enclosed storage method ÷ (cement /coal) * 100% • cement : 1,153,753÷1,153,753×100%=100% • coal : 1,090,000÷1,090,000×100%=100%	The amount of break bulk general cargo handled using the enclosed storage method ÷ (cement /coal) * 100% • cement : 1,220,931÷1,220,931×100%=100% • coal : 1,000,000÷1,000,000×100%=100%
	Car wash	• Percent washed • Vehicle washed		• 90% • Total number washed	• 99.0% washed • Total of 28,933 vehicles	• 99.0% washed • Total of 29,719 vehicles
Port development	Public waterside recreational space	• Area of reserved wide bird habitat • Area of greenbelt • Area of grassland		Increasing and maintenance the area of waterside recreational space	• Reserved wide bird habitat: 8 ha • Area of greenbelt:4.5 • Area of grassland :18.3ha • The area of green space in Kao Port Park: 1.4 ha	• Reserved wide bird habitat: 8 ha • Area of greenbelt:4.5 • Area of grassland :18.3ha • The area of green space in Kao Port Park: 1.4 ha
	The percentage of automated container terminals	The number of automated container terminals ÷ the total number of container terminals ×100%		The percentage of automated container terminals:10%	• 4 ÷26 ×100%=15%	• 4 ÷26 ×100%=15%

Environmental Performance Indicators of Kaohsiung Port

	Index item	Calculation method		Target value	Indicator presentation (calculation details)	
					2018	2019
Vehicle exhaust emissions (including cargo handling)	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 • Carbon reduction		All new lanes are to be organized as automated lanes.	• 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: 9,898,116 • Carbon reduction:1,504.51 tons	• 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: 10,876,734 • Carbon reduction:1,653.26 tons
Hazardous cargo	Hazardous cargo inspection	Number of inspections		6 inspections	12 inspections	12 inspections
	Number of patrols, vessels inspected, and number of cases sent to the authorities	• Number of patrols • Number of cases sent to the authorities		• 12 patrols each year, 12 vessels • Number of cases decrease over year	• 12 patrols • 1 case	• 12 patrols • 1 case
Marine sediment quality	Sediment monitoring	Quarterly means and maximums of port sediment monitoring measurements		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	• Arsenic: mean = 1.3 • Mercury: mean = 0.88 • Copper: mean = 113 • Lead: mean = 38.5 • Chromium: mean = 112 • Zinc: mean = 298 • Cadmium: mean = 0.19	• Arsenic: mean = 2.0 • Mercury: mean = 0.6 • Copper: mean = 119 • Lead: mean =38 • Chromium: mean = 134 • Zinc: mean = 333 • Cadmium: mean = 0.15
Relationship with Local Communities	Neighborhood and community welfare activities	Number of activites and events		12 activities held	40 activities held(Four environmental events)	54 activities held(Five environmental events)
Energy consumption	Power and oil saving efficiency	Power, oil, conservation rates for offices and operation sites. Index calculation equation: (the amount of resources consumed in the preceding year – the amount of resources consumed in the current year) ÷ the amount of resources consumed in the preceding year × 100%		The total power consumption (kW-h) and oil consumption (L) did not exceed those of the preceding year.	• Power consumption reduction: 1.62% • Oil consumption reduction:1.06% (Note: Negative value means not reached the index)	• Power consumption reduction: -0.28% • Oil consumption reduction:5.59% (Note: Negative value means not reached the index)
	The amount of solar power generation	• The 2018 power discharge coefficient announced by the Bureau of Energy: discharging approximately 0.533 kg of CO_2 per kW-h		• The amount of solar power generation • Reduce carbon emissions	The amount of power generation in 2018 was 5,094,975 kW-h, and the reduction of carbon emissions was 2,716 t	• The amount of power generation in 2019 was 6,706,833kW-h, and the reduction of carbon emissions was 3,571 t
	Greenhouse Gas Management	• GHG Inventory		GHG emissions	The 2018–2019 greenhouse gas inventory is expected to be completed by the end of this year (2020).	

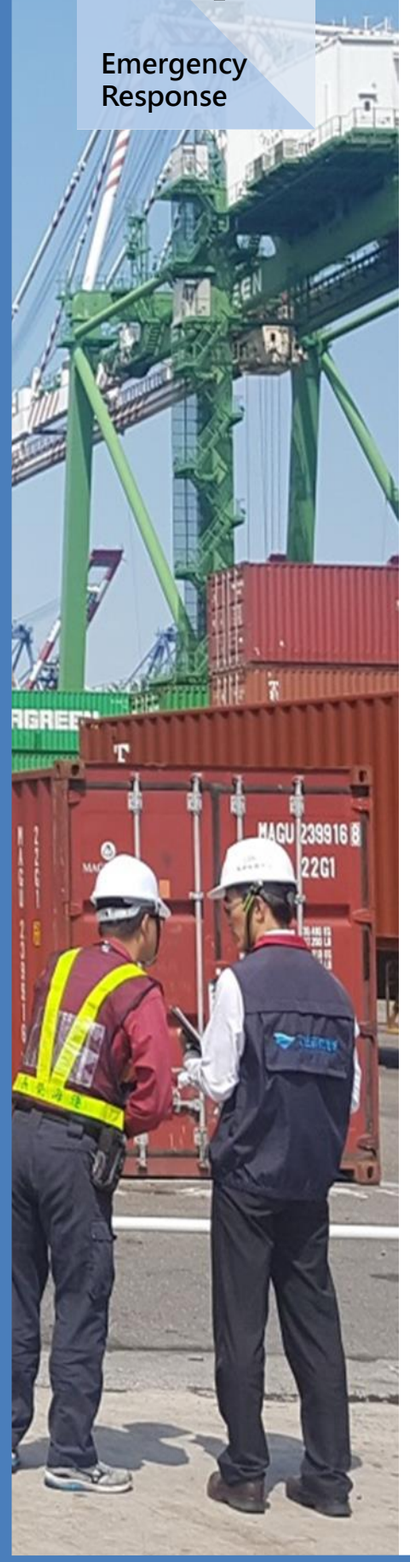
Emergency Response

05/

高雄港「107年度港口設施保全（ISPS）、防制劫持海洋油汙染暨港區旅客疑似流感檢疫措施」應變演習

05/

Emergency Response



Emergency Response

One of the main tasks of the Kaohsiung Branch of TIPC is to maintain the safety of the Port area. Every day, the Hygine and Pollution Control Section of Occupational Safety and Health 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 2018 and 2019, 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 18 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	2014	2015	2016	2017	2018	2019
Number of patrols	461	496	545	407	376	503
Notification	117	76	159	164	120	130
Exhaust emission	42	57	47	16	16	91
Environment and hygiene inspection in ship making plants	52	64	55	39	30	35
Oil fence (vessels)	120	122	147	126	80	164
Joint inspection	16	24	24	23	20	19
Admonishment for improvement	1895	1851	2110	1510	1577	1621
Admonishing ticket	49	36	30	36	32	31
Penalty (MPB)	9	12	9	2	9	9

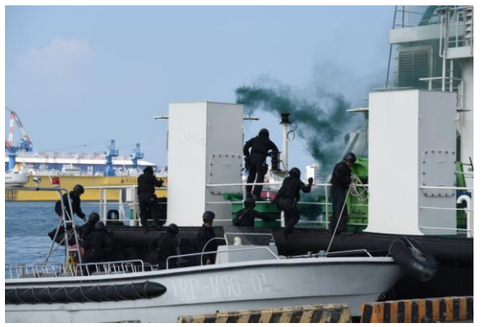
Source: TIPC Kaohsiung Branch

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, Offshore Flotilla 5, Coast Guard Administration, Ocean Affairs Council, 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	2014	2015	2016	2017	2018	2019
Ship collision, fire, explosion, fuel spill, chemical spill	28	19	24	26	26	8
Ship breakdown, tilt (no affecting safety)	10	12	28	16	2	12
Safety and health accident (cause injuries or deaths)	21	15	11	12	16	9
Fire and/or explosion of warehouse or fuel tank	0	0	0	1	0	0
(Small) fuel spill, garbage and fire in the port area	117	87	96	110	149	58
Others	206	211	119	84	126	85



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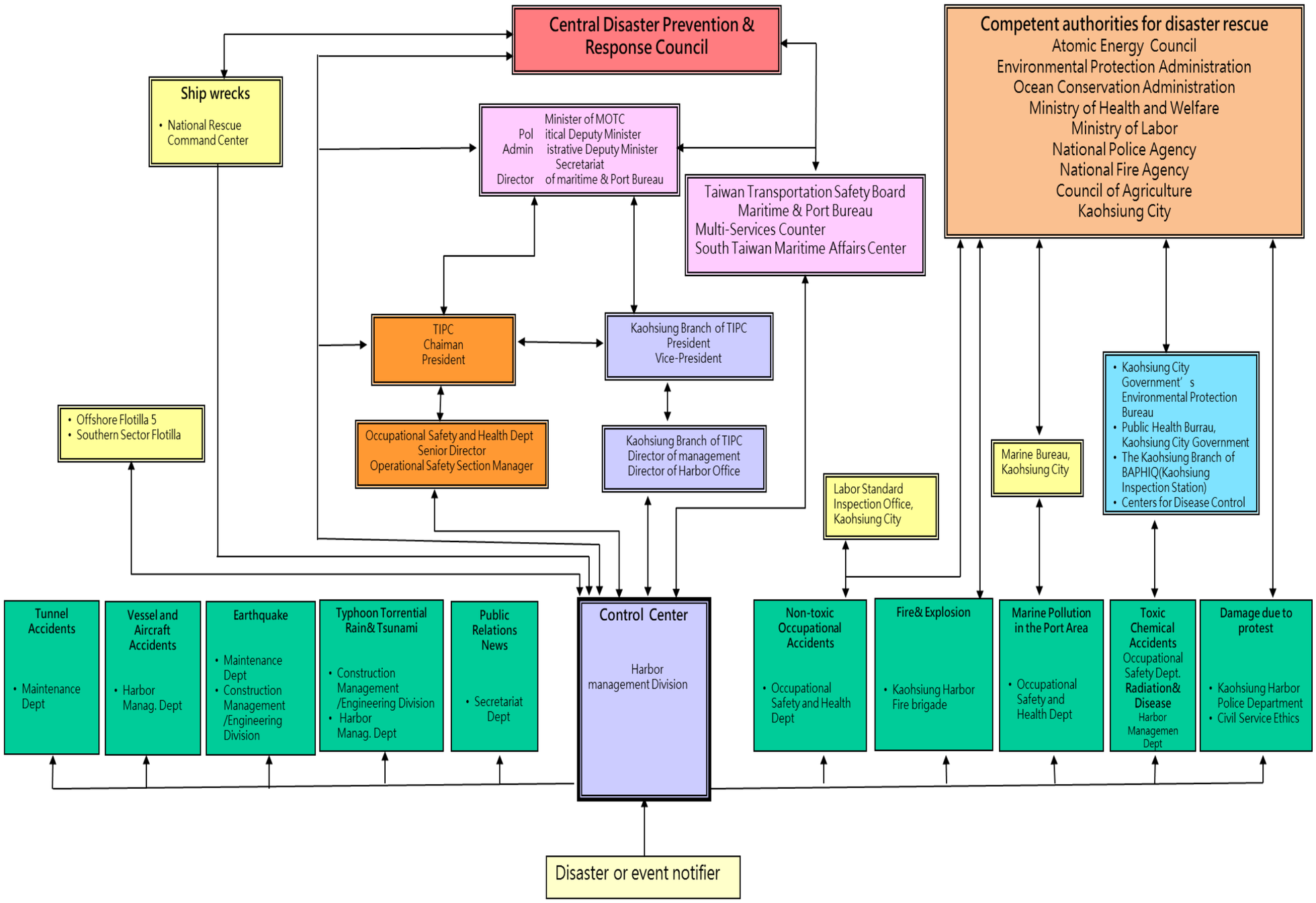
Emergency Response

Disaster and Accident Notification in Port of Kaohsiung



Innovation and Cooperation

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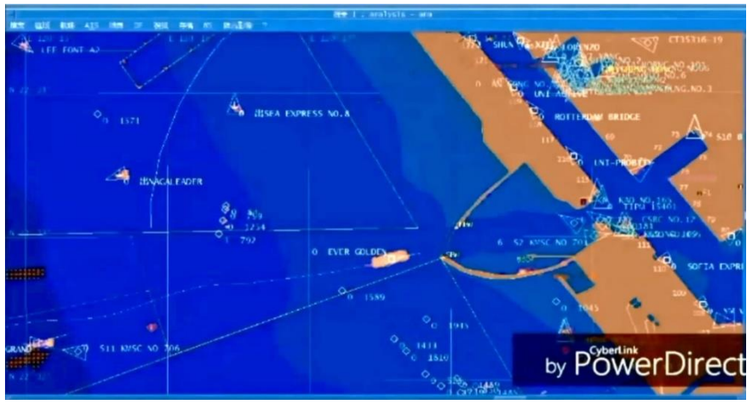
Innovation and Cooperation

6.1The Intelligent Vessel Operation Auxiliary System

Environmental issue: Climate Change, ship exhaust emissions



Strategies: Exemplifying, Enabling

Content

To promote the concept of smart ports, reduce human errors, enhance port operation efficiency and service quality, strengthen navigation safety, and lower the risks of marine traffic accidents, digital technologies were incorporated with Big Data analytics, AI, and innovative services. The Kaohsiung office of this corporation upgraded the existing vessel traffic system to develop the Vessel Operation Intelligent Auxiliary System so as to improve its function and operation efficiency under a low-cost and high-efficiency framework. The Kaohsiung Port is an international, comprehensive port for business, military, fishery, and industrial use. Approximately 70,000 vessels enter and exit the port annually; such voluminous sea traffic poses great burdens on traffic controllers and increases risks to navigation safety.

Solutions

The design of the vessel operation intelligent auxiliary system: The Smart Port—Vessel Operation Intelligent Auxiliary System is an upgrade to a vessel traffic system. The data of vessel entering into and exiting navigation paths, berthing trajectories, angles, and vessel speeds are analyzed through Big Data to identify the risk factors. The safety range (value) is preset accordingly. Smart electronic nautical charts establish smart navigation routes with warning zones (lines) for offcourse navigations and speeding. Furthermore, sensor systems, such as radar, the Automatic Identification System, and CCTVs, gather and integrate navigation data. Real-time images of vessel arrivals, departures, and berthing are further obtained using computer AI and automatic surveillance management. When identifying vessels with abnormal conditions (e.g., being off course or speeding), the system actively alerts traffic controllers and uses intelligent monitoring technology to enhance navigation safety and reduce the occurrence of port accidents.

Effect/Benefits

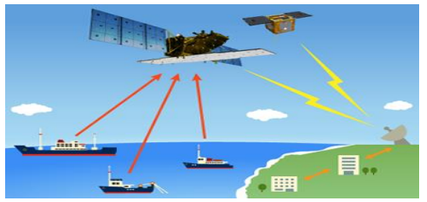
■ **The smart auxiliary monitoring system effectively enhances vessel navigation safety and reduces port accidents (collisions at ports) and also marine pollution events caused by accidents in waters.**

■ **This low-cost and high-efficiency upgrade to the original system reduces costs for replacement, extends service life, and improves planning efficiency.**

■ **Computer AI and automated monitoring management can monitor ship movements, reduce waiting time (by approximately 6 minutes per vessel), increase the efficiency of port traffic operations, and lessen vessel exhaust emissions..**

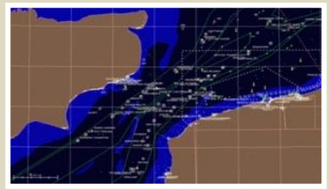
Participating Units and Stakeholders

Kaohsiung Branch of TIPC, The operators of the port area, The developers



AIS

Vessel database



VTC Vessel Traffic Service Center

Marine meteorology equipment

CCTV

Port of Kaohsiung
Habor Management Division
Contact Person: Mr. Ru-Lung Ma

Phone: ：07-571-1369
Fax: 07-572-0307
E-mail： T01625@twport.com.tw

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Innovation and Cooperation

6.2The Smart Environment Network

Environmental issue :Air Quality

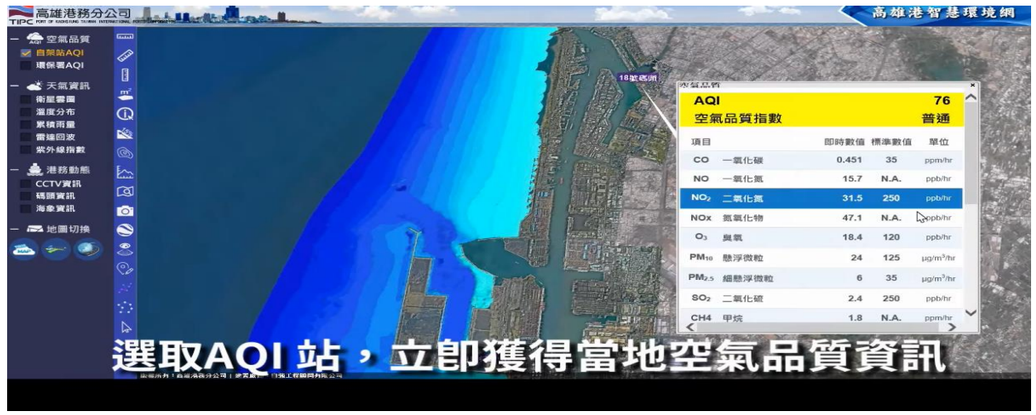
Strategies: Exemplifying, Enabling

Content

Recently, numerous major international ports have gradually incorporated smart technologies. The Port of Kaohsiung, TIPC expects to refer to the smart technology development experience of international benchmark ports, to use 3D terrain and 3D scene models as base maps for integrating environmental medium data and images obtained by this corporation and other agencies, and to enable relevant stakeholders in the port area to browse the real-time environmental information of the Kaohsiung port through interactive operations. Users' immersive operation experiences effectively inform them of the current situation in the port area and improves operation efficiency.

Solutions

The Kaohsiung Port established the Kaohsiung Smart Environment Network in the second quarter of 2019. This system can connect the monitoring data of each unit and display the following four environmental information: air quality, weather information, port affairs, and port maps and is supported by auxiliary tools to assist users during system operation. Regarding air quality, the system provides real-time air quality data (e.g., the amount of $PM_{2.5}$) gathered from the 3 monitoring stations in the port area and from stations of the Environmental Protection Administration . Concerning weather information, the real-time weather information includes satellite cloud images, temperature distributions, accumulated rainfall data, radar echoes, and ultraviolet index data from the Central Weather Bureau, the Ministry of Transportation and Communication. For port affairs, this system presents basic information about terminals managed by the Port of Kaohsiung Taiwan International Ports Corporation, CCTV images of the Kaohsiung Port, images from the road surveillance system of the Kaohsiung City Government, and real-time sea state information obtained from the Harbor and Marine Technology Center and this corporation.



Effect/Benefits

- **Reducing the response time of pollution notifications.**
- **Management personnel can be informed of the current situation in the port area through the real-world system on the website, which avoids textual and graphical misjudgments.**
- **Cooperating with the Emergency Operation Center when vessel accidents and climate disasters occur and providing rescue information (e.g., the planned rescue scope and route).**
- **Enhancing self-management ability of environment in the port area, which can serve as a reference for accident identification and analyses when disputes occur.**
- **Providing port environment information (e.g., environmental information regarding water and land areas) for vessels to enter or exit the port, for navigation, and for handling cargo so as to ensure the safety of piloting and cargo handling.**

Implementation/Timeline

2018	**Initiating the development**
2019	**Completing the construction**

Investment amount

The investment in this facility is approximately NT$790,000

Participating Units and Stakeholders

Kaohsiung Branch of TIPC, Shipliners, Cargo handling operators, Port tenants, EPA, EPB

Port of Kaohsiung
Occupational Safety and Health Division
Contact Person: Mr. Chia-Yu Li
Phone: 07-562-2413
Fax: 07-532-1361
E-mail：cylee@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

Academic institution

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.

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

Participation organizations

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.

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").

Ocean Affairs Council

Co-implementation of operations related to ocean environment protection, biodiversity conservation, and pollution prevention. For example, radar monitoring and the handling of stray events in the young killer whales, Marine pollution aspects are all cooperating.

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.

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.

Environmental groups

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 184 participants in 2018-2019. The courses included: pollution prevention, natural disaster, environmental impact assessment and ecological education.

Experiencing internal company culture

Internal education and training

Environmental education statistics table

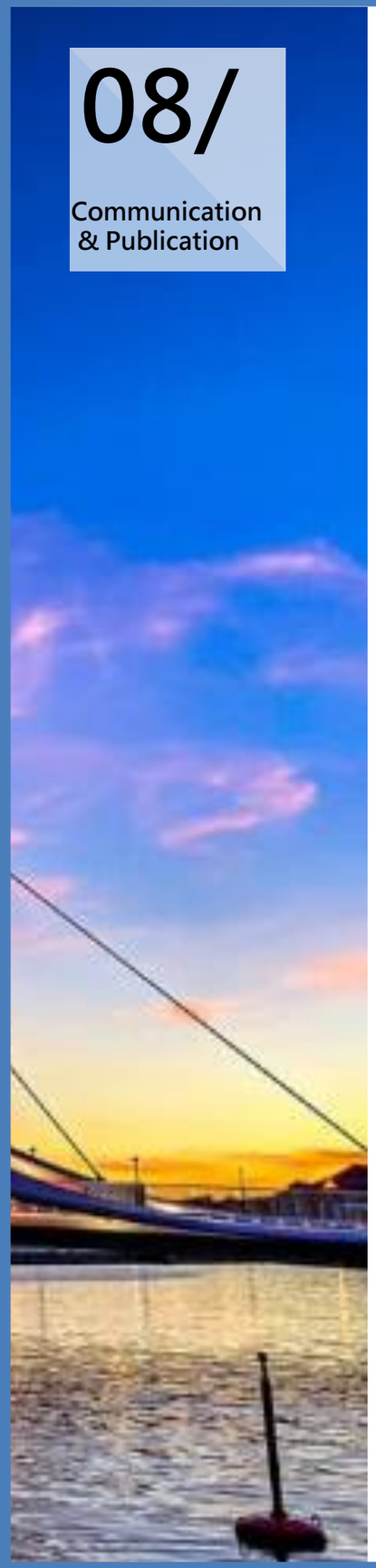
Year	Date	Content	Participants
2018	April 9, 2018	Understanding port-related ecological environment	69
2018	June 29, 2018	Knowledge related to the oil spill removal process and how oil spill removal machinery is operated in Kaohsiung Port	20
2018	November 21, 2018	Face-to-face class: 2018 Kaohsiung Port Internal Training of Environmental Supervision-related Tasks	16
2018	December 13, 2018	Conservation education and wildlife protection regulations	15
2019	June 19, 2019	Implementation of the 2019 Training for Ocean Dredged Material Disposal Operators (current situation and expectations for future ocean dredged material disposal and reuse)	10
2019	August 30, 2019	Courses on conservation education and wildlife protection regulations	14
2019	September 6, 2019	Education training courses on the Kaohsiung Port Offshore Topography and Water Depth Database as well as the Kaohsiung Port Smart Environment Network	11
2019	November 13, 2019	Digital learning	15
2019	December 31, 2019	Implementation of the 2019 Training for Ocean Dredged Material Disposal Operators	14
total			184

Freight Transport Elite Lecture Hall

Training in dredged mud disposal

Communication and Publication

08/



08/ 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

Brochure

Seasonal Magazines

TIPC Green Policy Website

Kaohsiung Port Facebook

Family members of new recruit visit the working environment of the port area

Dragon Boat Festival

Exchange activities for new recruit

110th Anniversary

111th Anniversary Exercisewalking Event

Harbor Engineering Camp

Double Ninth Festival

Dagang Bridge Opening Ceremony

Receiving preschool visits to Dagang Bridge

Green Accounting

09/

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$113,776 thousand (€3,302 thousand) in 2018 and NT$131,473 thousand (€3,816 thousand) in 2019.

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	2016	2017	2018	2019
Employees	59,666	53,363	51,551	62,870
Environmental Maintenance & Management	179,842	64,222	21,510	21,116
Environmental Monitoring	26,583	28,360	38,918	45,531
Emergency Response	17,073	7,201	824	746
Communication & Publication	4,193	223	973	1,210
Total	287,357	153,369	113,776	131,473

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 tend to be built green to facilitate public access; terminals are reconstructed and equipped with shore power systems, and old vessels and vehicles are replaced to enhance project implementation effectiveness and reduce pollution emissions. The Kaohsiung Branch of TIPC invested in fixed assets for approximately €43,432,939.44 and approximately €34,876,104.22 in 2018 and 2019, respectively.

Assets invested in Environmental Issues in 2018 (Unit: NTD thousands)

Item / Fixed assets		Land Improvement	Buildings	Machinery and Equipment	Transportation Facilities	Miscellaneous Equipment	Total
Development Plan	Follow-up Projects	619,113	552,961	187,965	1,000	1,000	1,362,039
	New Projects						
General Building and Equipment Plan		16,204	10,492	25,941	92,628	3,697	148,961
Total		635,317	563,453	213,906	93,628	4,697	1,511,000

Assets invested in Environmental Issues in 2019 (Unit: NTD thousands)

Item / Fixed assets		Land Improvement	Buildings	Machinery and Equipment	Transportation Facilities	Miscellaneous Equipment
Development Plan	Follow-up Projects	358,327	438,310	197,772	0	0	994,409
	New Projects						
General Building and Equipment Plan		61,169	85,783	7,382	55,615	8,955	218,905
Total		419,496	524,093	205,154	55,615	8,955	1,213,314

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PORT OF KAOHSUNG TAIWAN INTERNATIONAL PORTS CORPORATION, LTD

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Environmental Science Technology Consultants corporation