

我國海洋污染防治之反思

The Reconsidering for Taiwan's Marine Pollution Prevention

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摘要

隨著我國科技進步的發展，海洋資源愈受重視，海洋資源開發雖可帶來巨大經濟效益，卻也令海洋生態面臨重大衝擊。為減少海洋污染事件對臺灣海洋生態環境的影響，積極推動海洋污染防治作為及提昇海洋污染事件防處及應變能力顯得相當重要。目前國內海洋油污染事件發生時，無法有效達成分工，且應變資源包含應變人力、設備及人才教育缺乏；另目前海巡署負責海洋污染應變處理人員，大多未具備專業背景，使油污染事件發生時第一時間未能有效的降低污染擴散。尤其海巡署因未享有裁量權而是被動取締。

作者建議「工欲善其事、必先利其器」，無論是「藍色革命」還是「海洋興國」，再多口號，也比不上設立一賦有實權的海洋專責機關來得有幫助，希望未來成立海洋委員會時能讓臺灣成為真正的海洋國家。

關鍵字：海洋委員會、海洋污染防治、海洋專責機構

Abstract

Taiwan's economic development depends hugely on its marine environment. Therefore, it is particularly important for protection of the marine environment.

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The more booming of development of technology in Taiwan, the more attention is given to marine resources. The exploitation of marine resources brings outstanding benefits for local economy, but it also causes a huge impact on the marine ecosystem. In order to mitigate the impact of marine pollution incidents on Taiwan's marine ecosystem, much more importance should be attached to implementing aggressive ways of the prevention and control of marine pollution and enhancing the prevention of marine pollution incident handling and response capabilities. In Taiwan's response mechanism for dealing with domestic marine oil pollution incident is difficult to reach an effective way of collaboration, the competent authority has insufficient response resources (i.e. personnel, equipment and professional education); in Taiwan's competent authority, personnel who in charge of managing marine oil pollution are mostly short of qualified experience, may further impact the operations for spilt oil recovery and mitigation of pollution spreading. Particularly, because the Coast Guard Administration has no discretion so the crackdown is passive behavior.

I recommend that "Power for good work, must first sharpen his tool", whether it is making slogans as "blue revolution" or "seeking prosperity from the ocean", no matter how many slogans can't compare with the establishment of a real ocean dedicated authority. Hope that Taiwan becomes a true maritime nation when establishing Ocean Affairs Council in the future.

Keywords: Ocean Affairs Council, Marine pollution prevention, Ocean dedicated authority

1. INTRODUCTION

As an island nation, Taiwan began its industrial development in the 1960's, but due to its lack in petrochemical energy sources, the crude oil needed by oil-refining and petrochemical industries inevitably had to be imported from oil producing regions. Thus,

maritime transport activities were flourishing. Taiwan Strait and Pacific coastline along eastern Taiwanese seaboard are marine regions via which merchandise is shipped to Mainland China, Japan and Korea, and hence the blooming maritime traffic (Figure 1), mainly because of a large number of import and export of various goods, import



Source: Adapted by the researcher from ‘The marine pollution and protection’ (Yang, 2002)

Figure 1 The maritime transport routes near Taiwan

and export of petrochemical products are important factors that promote industrial development, as well as the frequent reports of stranded ships, or even collision and sinking that cause pollution to seaboards.

In the other hand, due to its special geographical environment, Taiwan owns an abundant bio-resource meaning that the economic activity of its people is closely connected with the marine environment. The narrow landscape, dense population, urbanisation and industrialisation of Taiwan

result in massive discharge of point source pollution such as urban sewage, industrial wastewater, animal husbandry wastewater, as well as non-point source pollution such as agricultural recycled water or surface erosion that carries large amounts of pollutants into rivers which subsequently flow into oceans causing the water increasingly deteriorated quality of ocean water and in the main sources of pollution will affect Taiwan’s sea area comes from the land of industrial wastewater (EPA, 2009).

However, Taiwan's government emphasized "seek prosperity from the ocean", paying attention to the marine environment and to develop relevant policies after 2000. Thence, "Marine Pollution Prevention Law", after years of revision, finally promulgated on November 1, 2000. Yet, the 'Amorgos' oil spill began on 14 January 2001 near Kenting National Park, off the southern coast of Taiwan. After this marine pollution incident, arrive one after another in rapid succession before the Environment Protection Administration has not developed "Marine Pollution Control Act Enforcement Rules", and Environment Protection Administration set the January 14, 2002 as the "Taiwan waters of Good Friday". However, Taiwan still emerging marine pollution, there have been numerous ship-related oil-spill incidents in the last decade (Table 1).

Ours sea shipping's frequent degree will be increased in the future. As a result, faced the work on marine pollution prevention, especially for oil pollution discharge section, we have to develop solutions early. How to do it in an effective, fast, accurate, appropriate treatment to avoid secondary pollution, will be the task of our government units must face now. In addition, marine education must be strengthened, as a result, people can cultivate a love for the ocean, and then care for and

protect our marine environment.

To be brief in the main sources of pollution will affect Taiwan's sea area comes from the land of industrial wastewater and contaminated with oil and chemical spills at sea at present. However, the most serious impacts on Taiwan's sea area are oil and chemical pollution of the leakage. Consequently, the scope of discussion in the chapter shall be limited to the pollution pertaining to the leakage of oil-related and chemical products for the reason that the major sources of marine pollution at Taiwan marine areas are oil-related and chemical products.

2. OBSTACLES

The reasons why Taiwan government is still unable to deal with oil pollution incidents as below:

2.1 Human resources

2.1.1 Education and training insignificance

Education on the marine environment is one of the most fundamental methods in marine environmental management. However, there are no colleges, universities in the country that offer academic departments

Table 1 Ship-related pollution incidents of the last decade in Taiwan

Date	Case	Location
19/02/2012	Fuel oil leakage of Thailand registered 'M/T OBERON'.	Mudouyu of Penghu Island North Sea
03/10/2011	312.5 tons oil leakage of gravel dredge Panama registered 'M/V JUI HSING'.	Waimushan of Keelung
10/11/2008	100 tones heavy oil leakage of Panama registered 'Morning Sun'.	Shimen offshore of Taipei
24/12/2006	100 tons oil leakage of Malta registered 'TJINI'.	Grounding in the coast of Suao, Ilan.
15/07/2006	The turnover of Indonesian registered 'DEWIBUNYU' chemical freighter	51 nautical miles at high sea off of Keelung
10/10/2005	Korean registered freighter 'SAMHO BROTHER' sunk out of collision	N25.01, E120.50 (approximately 10 nautical miles at high sea off of Sinjhu)
18/07/2005	Stranded sand and gravel ship 'Yungchang' registered in Anping, Tainan resulting in oil leakage	N22.45, E120.14 (0.3 nautical miles off of the seaboard of Erkeng, Mitouu Township, Kaohsiung County)
11/07/2005	Mongolian registered freighter 'Lucky city' discharging waste oil at the marine area near Green Island	Marine area 13 nautical miles southwest of Green Island
30/06/2005	Turnover of cruise ship 'Royal Pacific' at the Port of Kaohsiung resulting in oil spill	Turnover at Dock 54 of Port of Kaohsiung
18/02/2005	Oil leakage of Suau registered 'Hemancheng' at port	In front of the dock of Suau Labor Union
21/10/2004	Oil overflow of oil storage tank(s) at Kingmen Power Plant	Oil spill discovered at the seaboard near Tashan Power Plant at Kingmen
15/07/2004	Oil leakage of China Petroleum Corp (CPC). 'Hsuanyuen II'.	Suspected oil leakage at CPC operational platform
15/06/2004	Turnover and sinking of oil spill processing platform 'Hsiehchin VI'.	Turnover and sinking of oil spill processing platform 'Hsiehchin VI' in the fishing port at Linhai New Village of Kaohsiung
18/03/2004	Stranded freighter, Panamanian registered 'Shuentung'.	3.5 nautical miles northwest of Port of Keelung; water entering cabins
28/02/2004	Oil leakage from the oil transport pipes of China Petroleum Corp.	0.5 nautical mile at high sea off of Linkou Fossil Fuel Power Plant
27/06/2001	96 tons paraxylene leakage of 'Golden Chemical'.	Kaohsiung offshore
14/01/2001	Oil leakage of Greek registered 'Amorgos'.	Stranded and leaking oil near the marine area of Eluanbi
01/11/2000	Marine Pollution Prevention Act promulgated.	

Source: Researcher's own compilation from multiple sources.

dedicated to the control and management of marine pollution. Therefore, there is a general

deficiency amongst the citizens of the country concerning the knowledge of marine pollution

and after the destruction of the sensitivity of the environment.

In the other hand, the mainly reason of education and training insignificancy, because we don't have any specific market of employment and the large demand for talented person in Taiwan. However, there still are many universities giving the marine pollution courses, such as: (1) the Department of Marine Environment and Engineering at National Sun Yat-sen University has set up the core required course of marine pollution prevention engineering technology, and marine pollution simulation theory and practice course. (2) the Department of Marine Environmental Engineering at National Kaohsiung Marine University has set up the compulsory course of marine pollution prevention, marine pollution transport and diffusion internship program

As above, Taiwan still has professional personnel training institutions. After establishing Ocean Affairs Council as Environmental Protection Administration in the future, we can create lots of job opportunity and department of personnel training.

2.1.2 Education and training insignificancy of the government

To seek a solution for the issue of severe pollution on this marine area, the Executive Yuan allocated a total of 260 million New Taiwan Dollars in two consecutive years, as well as made substantial investments in both hardware, software facilities and emergency response training of personnel, with the expectation to provide maximum results for the handling of marine pollution events in the future. The immaturity of handling marine pollution by the government in recent years is causing the gradual deterioration of marine ecology (Zhong, 2007). In order to be able to control the marine pollution, requires the establishment of marine environmental monitoring network, ensure the quality of monitoring data, establish a complete system, to prevent, mitigate and control of marine discard waste and other pollution of the marine environment because other offshore activities. Therefore, the government should develop a policy framework and establish the necessary mechanisms (Yang, 2014). Because the execution of marine pollution control in the country include international affairs in areas of environmental protection, resources, legal system, vessel administration, insurance and vessels, and relevant authorities include governing, executive, assisting port management authorities, as well as governing authorities for target businesses,

the integration of departmental personnel and resources is needed for the implementation of promoting the task of marine pollution control.

Environmental Protection Administration and Coast Guard Administration (above will be abbreviated as EPA and CGA) in order to strengthen the professional capability of marine pollution control, personnel is sent to domestic and international trainings to improve on the prevention and response capabilities regarding marine pollution events (CGA, 2012). However, half of the aforementioned trainees were CGA employees; those who were sent to EPA sponsored training sessions on marine pollution have no employment relationship with EPA, so training instructors are not able to demand trainees' learning attitude. In addition, Coastal and Maritime Patrol Directorates General have separate personnel training and study centers hosting respective education and training courses, thus causing the scattering and waste of resources (Kao and Liu, 2013).

Moreover, according to the article of "Marine environmental protection: an application of the nanometer photo catalyst method on decomposition of benzene" talked about a new methodology has been proposed for the treatment of oil pollution (Lin and

Kao, 2016). If we can add this new method to human resources training course of on job training which will enable the development of training more solid.

2.2 Pollution management unable to predominate the opportunity

Oil pollution was hard to clean up because the government of Taiwan lacked the first opportunity to remove oil, resulting in the rapid spread of oil pollution to ecologically sensitive coastal areas. In addition, Taiwan's government lack of a well-trained team and the proper removal of oil degreasing machinery equipment, which can be handled well at once while the pollution happened.

2.3 CGA is not a "dedicated authority" of marine environmental protection

Once upon the CGA going to be reformed will be more difficult than the average executive. From marine oil pollution prevention point of view, CGA is not a "dedicated authority", just the unit assist the environmental authorities, the implementation of laws and regulations. Its functions only limited implementation of relevant laws, the ban against illegal, collection of evidence and so on. Until pollution incidents, and then

through the “coordination” between units, consisting of common “event management team” or “Joint Inspection Unit” to coordinate the personnel, material and so on.

However, in addition to the implementation of ban, gathering evidence and transfer, when the oil pollution incidents involve legal proceedings of discretion and professional sampling evidence of oil pollution, all have to rely on the Environmental Protection Agency and Shipping Administration Authority to support, thus, CGA handle general oil pollution incidents still needed to strengthen the capacity and expertise in the future.

There are six government agencies in charge of the management of marine pollution in Taiwan currently, including Environmental Protection Administration, Coast Guard Administration, Council of Agriculture, Ministry of Transportation and Communications, Ministry of National Defense, Environmental Protection Bureau of local government. Thus, for the most part, is that the division of labor is not well done, so there is no centralized coordination mechanism with regards to the scattered utilization of manpower and materials, resulting it is difficult to clean up once and loss of ability to solve oil pollution problems easily.

Once marine oil pollution discharge occurred, the most important work is to use the most cost-effective and the least harming of impact on the environment engineering, in the shortest time for achieving degradation to safe levels, and removed the oily pollutant quickly. In other words, oil removal technology chosen should minimize the harm to the environment and ecology. Because of the biodegradation indicated that to be a cheap, safe and reliable way compared to the mechanical and physical method and chemical treatment. Consequently, this study used “A New method for treating Coastal Oil Pollution” which had been published by scholars to manage the problems of oil pollution (Lin, 2010).

3. SOLUTION

Currently, cleaned up the oil pollution has become a major environmental problem of high costs and materials waste for the remediation of oil pollution. And we must take into account about sustainable development as a result. Nevertheless, a method which we want to introduce has already resolved on cost considerations.

Basically, the coasts are mainly formed with rock and beach. Land-based spill

pollution and floating offshore oil pollution are both cause a hazard to coastal. Land-based oil pollution characteristics is easy attachment to the rock, it is difficult to clean up to the beach or shore wind tolerant plants, causing the death of animals and plants of the shore. Experiencing the difficult time for fishermen's livelihood and enduring heavy financial losses for tourism industry also is included by knowing no bounds for ecological damage which is even incalculable. Despite of how hard we try to prevent oil leakage occurred, but there are still a lot of oil spill polluting on the coastline, sometimes even we guiding the oil floating toward the direction of coastline deliberately for easily clean up, but there are limited by utilization of manpower.

However, there are two main methods of dealing oil pollution in Taiwan:

1. Physical methods: With oil fence, oil header, oil skimmers and other recycling for oil spill. However, this method constrained by environmental conditions (such as storms, wave etc.) Oil pollution cannot be completely clean up and leave the problem of residual oil.
2. Chemical methods: Chemical methods are using the oil thickener and oil dispersant clean up the oil. But the oil thickener is still required to use the physical recycling,

cannot solve the problem of residual oil as the same. Chemical methods not only would produce secondary pollution, but also produce an unknown substance easily, resulting in pollution sources transferred.

A quick treatment method — central treatment plant processing oil spill is completely different from the above two methods. This present method can generally applied to the prevention of oil pollution and without of secondary pollution. It can not only reduce the difficulty in treating oil pollution, dramatic the cost of employees, transportation, and cost reduction, but also sharply reduced time for achieving degradation at the same time.

4. TREATMENT BY POLLUTANT CLEANING PLANT

4.1 The quick treatment method

The authors combined the ideas of scraping the polluted oil layer with off-site biodegradation and developed a method for a central treatment plant. The plant, set up with a multistage washing line, degradation ponds, filtering mechanisms, a furnace and degradation system, can intensively degrade the oily pollutant to safely levels relatively

quickly. The process as below:

1. Send excavators to the polluted beach to scrape the polluted oil layer off.
2. Transport the oily pollutant to a central treatment plant.
3. With the oily sand removed, make good and reinstate the now unpolluted beach immediately.
4. Wash out the oily pollutant by multistage line, and then carry back the cleaned sand to the beach.
5. Filter the oily waste water by multiple layers of oil absorbent sheets.
6. Dry the oil absorbent sheets and incinerate them.
7. Degrade the residual oil.

4.2 The quick treatment for rocky coast oil pollution

The characteristics of coastal rock pollution and beach pollution are quite different. Governments suggested spraying dispersant onto the polluted rocks to clean them up. It seemed that the oil stains on the rocks were disappearing but part of the oil-water mixture simply drifted to sea as fish food to enter the food chain. Part of the mixture sunk down into the sea as a pollution source. Nonetheless, in practice the treatment of beach pollution can be extended to coastal

rock pollution. In other words, by utilization of a central treatment plant we can treat coastal rock pollution the same way as we treat beach pollution. The system for a central treatment plant is shown as figure 2. The treatment is as follows.

First, people recover the floating oil on the water where coastal rock pollution has occurred. Second, clean the heavy oil from the rocks by oil absorbent sheets. Third, brush away the dry oil stain standing on the underside of a rock by electric brush. Finally, gather the oily dust and transport it to central treatment plant to be degraded just like the oily sand mentioned above. In this manner, the reinstatement work of a rock coast could be completed much faster.

In short, the treatment of beach and rocky coast oil pollution can be united by the method of a central treatment plant.

4.3 The advantages of central treatment plant

The present scheme of central treatment plant has many advantages:

1. Elimination of adverse conditions. Degradation is made quite simple and stable.
2. Dramatic cost reduction with respect to employees, transportation, material and utilities.

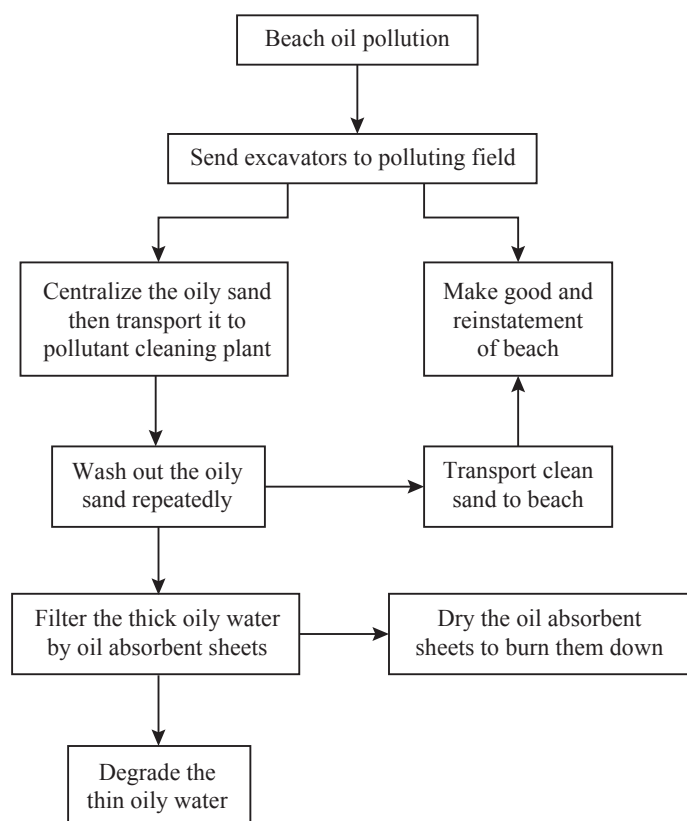


Figure 2 A central treatment plant system

3. Managerial control. The workers focus their attention on the tasks at hand within the plant, minimizing the likelihood of mistakes.
4. Rapid beach recovery.
5. Sharply reduced time for achieving degradation to safe levels.
6. Elimination of secondary pollution.

5. CONCLUSION

Effective and successful marine oil

pollution emergency response strategy depends on the first line of duty officer control judge the crisis immediately. The governing authority of emergency response to oil spills of the country is EPA, and maritime execution authority is CGA. According to all the marine pollution control affairs and existing personnel organization, there exist an excessive number of involved missions and amount of regular business affairs, meanwhile also lacking professionals with maritime background. By contrast, professionals

dealing with marine oil pollution incidents not easy training, and the cost of oil spills special equipment is still high. Therefore, the ability to dispose of marine oil pollution, only spoke of the manpower use, manpower schedule, but did not focus on the education and training.

Teaching energy CGA is not sufficient now. Since the Coast Guard set up, most of the personnel and material resources in against illegal immigration and smuggling, protect fishing and fishery resources energy, marine pollution prevention and control work is seems not to be more attention.

However, according to relevant laws and regulations, whether face of general marine pollution or major marine pollution, CGA plays a very important role in post-processing or mobilization.

But in Manpower training, only with the Act or with the EPA's education and training, obviously, this is insufficient. How to increase on knowledge and to train education teacher is Coast Guard units has to be thinking when faced with the expansion of marine pollution prevention energy.

Speaking about the current educational training according to Coast Guard Administration guided by July 6, 2012 the results of the second session of the Division for

Ocean Affairs Forum report content, must be thinking about how to improve the education and training of human resources allocation in the future, discussed the problems on the planning and management training.

As a matter of fact, If we can implement on job training of professional and technical, such as school education combined with the needs of government departments, and use a new method of remove oil pollution presented in this paper as the basis for education and training connotation, would be able to improve the current predicament of oil pollution response capabilities in Taiwan. This study made several recommendations as below:

1. Add this new method to human resources training course of on job training which will enable the development of training more solid. We recommended establish a competent authority of professional and technical personnel training centre, making experience accumulated, response rapidly, and to strengthen international cooperation to enhance the positive image of Taiwan.
2. Marine oil pollution prevention, research development issues, including the quality inspection and assessment of oil pollution-related facilities and equipment, magazines and other relevant journal publications of

Marine Pollution Prevention, regularly participate in relevant international organizations and promote international cooperation. Apart from that, research and development related to pollution prevention techniques and standards can collaborate with academic institutions, learn the latest oil pollution control technology and new knowledge in the future.

3. Eventually, the issue of protecting the marine environment cannot be ignored, combined with the personnel exercises continuously, reduce disaster losses when disaster strikes, continued efforts for sustainable development of marine. Thus, conservation of the marine environment of Taiwan can be synchronized with the international standards.

REFERENCES

Coast Guard Administration (CGA), 2012. Coast Guard Annual Report, 51.

Environment Protection Administration (EPA), 2009. The Environmental White paper in 2008, Taipei.

Kao, J.C. and Liu, W.H., 2013. Coast guard personnel training policy. *Chinese Law*, 15, 273-297.

Lin, M.C. and Kao, J.C., 2016. Marine environmental protection: an application of the nanometer photo catalyst method on decomposition of benzene. *Marine Pollution Bulletin*, 105 (1), 139-142.

Lin, M.C., 2010. The physical model of marine oil pollution and its solution. In *Proceedings of the Underwater Technology Conference*, Tainan.

Yang, L., 2002. The marine pollution and protection. In: W.Y. Qin, Eds. *New Trend of Navigation Trade, Ocean and Taiwan, Past-Now-Future Series*, Fourth Edition, Hu-Shi Book Publisher: Taipei (in Chinese).

Yang, L.T., 2014. On the Sustainable Development Strategy of Marine Resources. Available at: <http://www.npf.org.tw/2/13973> (Accessed 10 December, 2015)

Zhong, D.M., 2007. The pollution of marine and the protection of marine. In *Proceedings of the Council of Taiwan Ecology Institute*, Taipei.

