Hong Kong

Acute Plastic Pellet Loss Case Study

Key Facts

Incident Date:	24 July 2012
Location:	Hong Kong islands, China, Asia Pacific
Cause:	6 containers of polypropylene pellet lost overboard during a storm
Quantity lost:	150 tonnes (~7.5 billion pellets)
Quantity removed:	~105 tonnes (~5.25 billion pellets)

Incident summary

Between 20 and 24 July 2012, originating over the western North Pacific northeast of the Philippines, the category 4 Typhoon Vicente swept across Hong Kong, China and Vietnam[1]. This was the culmination of three tropical storms which rapidly strengthened near the coast of Hong Kong[2].

As the storm passed southwest of Hong Kong on the evening on 23 July 2012, the 128m long container ship Yong Xin Jie 1[3], owned by China Petroleum and Chemical Corp (SINOPEC), was traveling east to moor in the open waters of Ninepin Group islands, approximately 2 km off the coast of Hong Kong. Due to the high winds and sea conditions, a total of seven 40-foot-long cast steel containers were lost overboard, six of these contained polypropylene pre-production plastic pellets. Each container was thought to carry ~1,000 bags (25 kg each) resulting in **150 tonnes (an estimated 7.5 billion pellets) being lost to the marine environment[4].** According to the Marine Department and the Food and Environmental Hygiene Department (FEHD), five of the containers were recovered. However, four were completely damaged, and most of the pellets had been released into the sea. The incident was not released to the public at the time[4].

Extent of plastic pellet impact

On 25 July 2012, Plastic Free Seas (PFS), a Hong Kong-based environmental charity, found plastic pellets on Hong Kong's Lantau Island and notified the government[5]. A deep layer of pellets covering the length of the beach and 30 SINOPEC branded plastic bags containing pellets were found (Figure 1). Cleanup was undertaken by PFS on 26 July 2012 with over five tonnes of loose pellets removed and a further 170 branded bags were identified in varying conditions, some being damaged and completely empty[5].

Figure 1: SINOPEC bags recovered from the beach by Plastic Free Seas and other NGOs and individuals[5]

Figure 2: Location of Yong Xin Jie container loss and extent of Hong Kong Administrative Areas

Six days later, more pellets were found in some areas of Hong Kong's southern island's, Beaufort Island and Lamma Island, with further impact to the Chi Ma Wan peninsula. Mui Wo on Lantau Island was seen to be knee-deep with pellets in some areas[5]. The scale of the spilled pellets is likely to be underreported due to the geographical spread of Hong Kong's 250 islands[6] and 1189 km of coastline[7] (Figure 2).

Response to plastic pellet pollution – Clean-up

Thousands of citizens and non-governmental groups (NGOs)[5,8,9] were involved in the cleanup efforts across Hong Kong after the pellet spill. The government and SINOPEC were heavily criticized by the public and NGOs for their lack of responsibility, slow response to the incident and for the delay in announcing the spill to the public. Although SINOPEC were responsible for the cargo, it had not admitted liability and China Shipping Container Lines reportedly leased the cargo vessel, however, they did state SINOPEC would "pay for the necessary costs and expenses"[10]. Seventeen days after the spillage, SINOPEC initially set aside 1.28 million USD to help with the cleanup effort and sent staff to join local volunteers in picking up pellets by hand[11]. In addition to this, a comprehensive cleanup strategy[5] was agreed between the government's Marine Department, Environmental Protection Department (EPD), FEHD, NGOs and SINOPEC.

Figure 3: SINOPEC bags filled with plastic pellets piled up on the shoreline, floating and sunken near the shore. Concentrations of white plastic pellets are visible on the strandline and on rocks on the shore. A washed-up damaged container is visible too[5]

This led to a widescale clean-up operation covered by the media and promoted on social media, resulting in over 1000 resourceful volunteers participating in removing pellets from the beaches of Tung o Wan (East Lamma)[5]. During the clean-up, some plastic bags were seen to float, but others were seen sinking to the seabed (Figure 3). The scale of lost pellets had the potential to affect marine ecosystems including coral reefs and IUCN Vulnerable Finless porpoises *Neophocaena sp.*[12] that hunt nearby[13,14].

In the following days, smaller volumes of pellets were found on the Special Administrative (SA) mainland China by Macau, on Hac Sa and Zhuwan Beach approximately 80 km west of the container loss. The Port Authority, the EPB, and Macau Cleaning Specialty Co. Ltd conducted clean ups in the area and organised ships to patrol the beaches for floating particles to tackle the pellet pollution[15].

In Hong Kong, in response to the public's criticism of the government's slow response, the Secretary for Food and Health defended the government's actions stating that they were also responsible for clearing fallen trees and debris following the typhoon. Consequently, this took people away from responding to the plastic incident[16]. They stated lessons needed to be learned from the incident, including response time and making the public aware[17]. Issues began to arise with recycling the recovered pellets due to the mixed material obtained contaminated with sand and other waste[17]. Further to this, NGOs noted the interspersal of pellets with other marine debris including household items, which highlighted the scale of the background plastic pollution problem in the area[18] (Figure 4).

Figure 4: Plastic polypropylene pellets spread across the surface of the beach along with varying macroplastic pollution, such as domestic plastic bottles and other unidentifiable plastics[8]

Environmental, social and economic affects

Health and access

The government advised public swimmers to contact beach lifeguards, or their Environmental Protection Hotline if they found pellets on the beach[16], and due to the unknown health impact at the time, the **government advised caution when bringing children to the beach[19].** This was in parallel while the EPD continued to monitor the water quality and for any "ecological changes"[16].

Toxicity

From the start, SINOPEC stated that the pellets were not toxic or hazardous on their own[20]. However, research had identified **plastic pellets are able to adsorb toxins and other chemicals within the surrounding waters,** which could then lead to further contamination of the environment and risk to human health[21,22]. An associate professor[13] and other researchers,[23,24] have stated that the pellets may have already been exposed to plasticizers or flame retardants to give them certain characteristics that could be toxic to marine life over many years as the pellets degrade. Another study highlighted that just 6 days was sufficient for the microplastic particles to adsorb carcinogenic chemicals in seawater, such as Polychlorinated biphenyl (PCB) and Dichlorodiphenyldichloroethylene (DDE)[12]. The ingestion of these pollutants could result in accumulation within food webs and could result in ingestion into human consumption[25], thus **sparking concerns about the safety of consuming locally produced seafood in the waters surrounding Hong Kong.**

Fishing

Fishers reported appetite loss in farmed fish due to their stomachs being occupied by the microplastic pellets or blocking their digestive systems[26].The Hong Kong Fisheries Federation received reports from fishers of a small amount of abnormal dead fish were found in south Hong Kong, and it was confirmed these fish had ingested plastic pellets[4]. The white, transparent pellets spilled are similar to fish eggs and small fish ingest them by mistake[27]. Despite reported fish mortalities, the Hong Kong government made a statement, saying the fishing industry of the bay would not be strongly impacted by the plastic contamination, and would not have a negative impact on the quality of the fish[28]. However, this event was later credited **to the crash in fishery stocks, impacting the natural food resource and warnings were issued** that the 'fish had eaten the gelatinous particles, and (the public) should not eat them and any **fish showing signs of being affected should not be sold'**[17].

Protected areas and species

Within the Hong Kong and the SA China region, there are 103 National designations including the Terrestrial and Inland Waters Protected Areas (Figure 5), and one International designated Ramsar Site Marine Protected Area (Mai Po Marsher & Inner Deep Bay to the north)[28]. Sham Wan on Lamma Island is a spawning area for IUCN Red List Endangered green sea turtles, *Chelonia mydas*[29], where tourists are prohibited during the spawning season. The pellet spill occurred during the turtles' spawning months meaning hatchlings were likely exposed to large quantities of pellets from birth, potentially ingesting them. Additionally, Sham Wan, Tung O Wan of Lamma, Po Toi, Beaufort Island and South Ninepin Island have **coral reef sites**[30]**, that were likely not only impacted by the typhoon itself, but at risk from plastic pellets and covering the corals and the introduction of potential toxins and pathogens into the environment.**

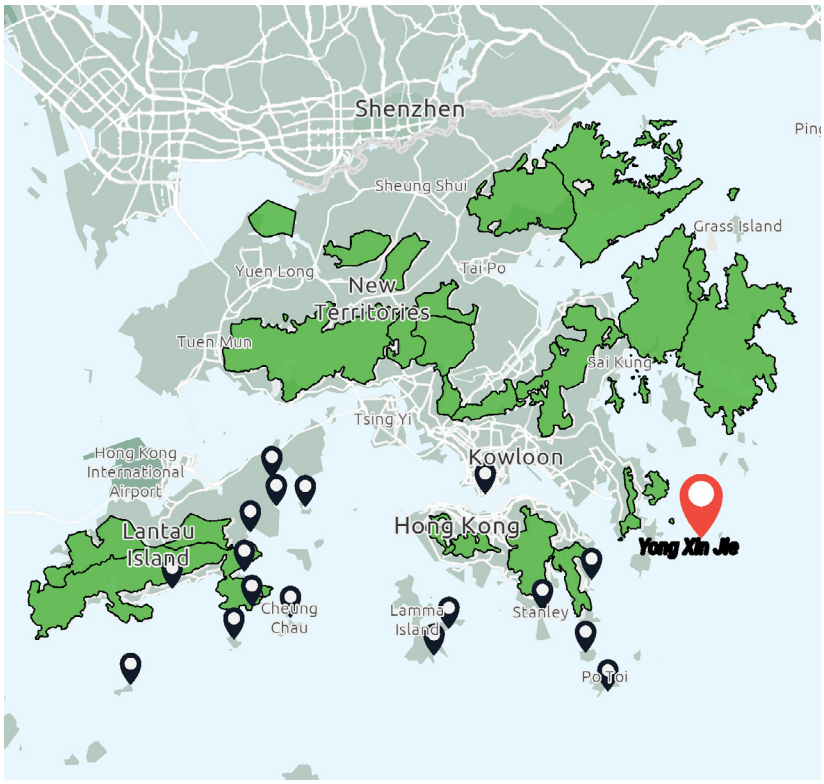

Figure 5: Location of Yong Xin Jie container loss, environmental designated areas (green) and recorded pellets (black markers) identified following the incident

Legacy pollution

Due to the dynamic nature of the three dominant ocean currents in the Hong Kong area[7], **pellets were found newly deposited on beaches months after the container spill event.** Six months after the incident plastic pellets were found at Ngong Chong Beach on Po Toi Island and six years later in 2019, mounds of pellets were still found on some of the Hong Kong islands[31]. It is unclear if the pellets found are legacy pollution from the 2012 incident (e.g. sunken bags releasing pellets over time), new acute or chronic spills due to mismanagement within the supply chain.

The Hong Kong government reported that 70% of the pellets had been recovered totalling an estimated 105 tonnes (~5.25 billion pellets). As a result of the incident, funding of a two-year Coastal Watch programme was initiated to promote marine conservation and protect Hong Hong's ecologically valuable habitats[6]. This promoted the development of the first inter-Departmental Working Group on Marine Environmental Management 'Clean Shorelines', comprising of nine government departments with a focus on marine plastic pollution[5].

Lack of regulation and compensation

The areas impacted by the acute incidents not only have to deal with the potential damage to the environment, community space and livelihoods but also the financial fallout associated with it. The International Maritime Organisation (IMO) have put in place measures to ensure strict liability to those affected by an oil spill as a result of oil spills leading back to the Amoco Cadiz spill in 1978[32], and since 2003 it has been possible to hold multiple entities liable, including the individuals who hire a ship, not just the ship owner. However, **there are no specific regulations in place to address the consequences of container loss and therefore enforcing compensation for damage made to both a community impacted, or the environment is difficult[33].** Hong Kong did announce almost two years after the event a private deal had been struck to cover costs associated with the clean-up of the spill[34]. Due to the confidentiality clause in the agreement it is unclear, the type of compensation received (e.g. equipment, resources, financial). Further to this it was not disclosed who was compensated, how local communities could apply for this, if the compensation supported the local economy, or if compensation would only be for clean-up.

Overall, despite the long term negative impact of the acute spill on Hong Kong's government resources, the public perception of the government, and the increase in container traffic on the route where the spill occurred in 2012, there has been no additional regulation or spill protocols that have been put in place that is accessible to the public following the incident. Further measures need to be in place to ensure if acute pellet incidents do occur, the countries and communities most likely to be affected will be sufficiently protected from the associated impacts and will also be appropriately compensated.

Summary & Conclusions

- The **plastic pellet spill had significant impacts on the fauna and flora of the surrounding Hong Kong islands, the health of local communities, and financial losses to fisheries and businesses** including the polluter SINOPEC. The true extent and impacts of the spill is likely to have been underreported based on the remoteness of some of the island communities, and low value placed on plastics.
- The 2012 Hong Kong incident was caused by a severe storm event that was rare at the time, however, **with ever-increasing sea temperature and climate change these storm events are likely to become more frequent and have greater intensity[35].**
- Classification of pellets by the IMO as environmentally hazardous would have allowed more accurate and timely information on the containers lost which could have helped improve response. Safer stowage may also prevent containers with pellets from being lost in the future and secure packaging may also aid in pellet recovery in the event of containers being lost overboard.

Acute pellet pollution sites around the world

- 41 acute pellet losses have been identified in this study globally to date, with 34 of these occurring after the Hong Kong incident. The largest from a container ship was the fire on the X-Press Pearl off the west coast of Sri Lanka which resulted in the release of 1,680 tonnes of pellets into the environment. This value is likely underreported but similar impacts to those listed here could be found at other acute pellet loss sites.
- Local NGOs are vital in spreading awareness of these issues to the general public and being custodians of the environment. However, **dedicated national and international spill response is needed, particularly near major ports, shipping routes and nations that are at risk of these pollution events.**

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