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Massive Container Explosion Was Caused By Self-Heating Chemical Cargo

Courtesy CMSA

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The dramatic container explosion aboard the boxship *YM Mobility* at Ningbo last year was caused by thermal runaway in a cargo of organic peroxides, according to China's Maritime Safety Administration (CMSA). It is the latest in a long string of container accidents involving this class of dangerous chemicals, notorious for self-heating, decomposition, fires and explosions.

The container in question was a reefer box filled with tert-butyl perbenzoate (TBPB), a common activator for making plastics like polyethylene and polyester. It is unstable at high temperatures, and has a thermal tipping point of about 140 degrees Fahrenheit, above which its self-heating tendency accelerates until combustion or explosion. This particular shipment was headed for Jebel Ali, where the terminal requires refrigerated storage for TBPB, so the manufacturer packed it in a reefer box in order that it could be plugged in on arrival.

YM Mobility's operator did not require the box to be plugged in while under way. When the container was loaded aboard *YM Mobility* in Shanghai on August 6, it was stowed as deck cargo on the starboard bow, packed in a reefer but unplugged and unrefrigerated. Ambient summertime temperatures were about 95 degrees Fahrenheit.

Courtesy CMSA

YM Mobility left Shanghai August 7 and transited to Ningbo. On August 9, a crewmember on duty smelled an "irritating odor" while up on the bow. At about 1331, he inspected the container involved and noticed a hissing noise, white smoke and a yellow liquid dripping from the door - characteristic of TPBP decomposition. Over the next six minutes, the smoke increased. The crewmembers up on the bow realized the danger and evacuated the area, and the captain sounded the fire alarm to muster the crew.

By 1338, white smoke obscured most of the starboard bow, and within minutes, it was billowing all over the foredeck. At 1346:30, the reefer box exploded violently, blowing six containers over the side and disintegrating three more. No injuries were reported, and all crewmembers safely evacuated onto the dock a few minutes later.

First responders from shore took over firefighting efforts, and the blaze was under control by the next morning. It took another day to fully put out the last hot spots in adjacent containers.

A post-accident inspection found that the force and heat from the blast were enough to warp the hatch coaming, hatch cover and adjacent structures. More than a dozen containers were burned, blown up or had their contents ruined.

Courtesy CMSA

CMSA noted that reefer boxes are airtight and thermally insulated, and any heat from a self-heating substance like TBPB would accumulate inside the container, particularly in hot weather. Under these conditions, the cargo could get hotter and hotter until it went into thermal runaway and exploded.

"No attention was paid to the temperature changes in the box during transportation," CMSA concluded, calling the arrangement negligent. "The transportation plan of transporting TBPB in unplugged refrigerated containers during the hot season is inappropriate. . . . TBPB shippers failed to take into account the thermal insulation and airtightness of unplugged reefers in hot weather."