The Nautical Institute
Marine Accident Reporting Scheme
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MARS 200901

Fire in palm seed cake cargo

Official report: Adapted from Australian Transport Safety Bureau (ATSB) Transport safety investigation report - Marine occurrence investigation no. 250

A dry bulk carrier was chartered to load a cargo of palm kernel expeller (PKE: see Editor's note, p 19) in bulk from a far eastern port for Australia. Before arrival at the load port, the master received by email the analysis report for the proposed cargo, declaring an oil content of 8.89 per cent and a moisture content of 7.93 per cent.

After consulting the Bulk Cargo (BC) Code, the master determined that the cargo was non-hazardous seed cake and therefore could be carried on board the ship. (The shipper had also provided the master with a certificate similarly stating that the cargo was 'non-hazardous seed cake'.)

Cargoes such as PKE are routinely fumigated en route to their destination port in order to destroy any pests that may be present in, or introduced, to the cargo. The fumigant used on board this vessel was aluminium phosphide, which produces phosphine gas when it reacts with the moisture in the cargo hold atmosphere.

Before the loading was completed a fumigation contractor added fumigant to each cargo hold at a rate of two grams of phosphine per cubic metre of cargo. The plan was to place socks containing aluminium phosphide tablets on the surface of each cargo hold. However, as it was raining at the time, the socks were buried in the cargo in an attempt to protect the fumigant from the rain.

The contractor who carried out the fumigation of the cargo provided the master with documentation that named the fumigant, defined the dosage rate, outlined the fumigation plan and the safety precautions to be followed during the voyage including when the cargo holds were to be ventilated. However, the correct method of application was not properly communicated.

The cargo hold hatch covers and ventilators were then closed. The ventilators were also wrapped in plastic and taped to ensure that the fumigant did not escape.

The day after sailing, the crew observed black smoke coming from no. 3 cargo hold, between the hatch coaming and the hatch cover. The master was informed and he instructed the crew to seal the cargo hold hatch covers with duct tape. He also reported the suspected cargo fire to the ship's manager and charterer.

The manager and the master discussed contingency plans that included diverting the ship to a place of refuge but, under advice from a contracted expert, it was decided to continue the voyage, with the ship sending regular reports of cargo temperatures at varying depths, concentration of carbon monoxide and oxygen for each hold.

The maximum cargo temperature measured was 44°C at a depth of 7.5 m in no. 3 cargo hold. As the temperatures were not increasing significantly, the consultant advised the master that it was safe for the ship to continue its voyage. The authorities at the port of destination were also advised about the suspected fire in the particular cargo hold.

On arrival off the port, an expert and two firefighters boarded the vessel along with the pilot. Observations confirmed the possible existence of a fire and, on berthing, more firefighters boarded the ship and rigged fires hoses. When the no. 3 hatch cover was opened, only two small areas of the cargo's surface, each less than two m in diameter, were smouldering. A small amount of water was sprayed on to each of the smouldering areas and the hold was thoroughly inspected to make sure there were no other hot spots. Soon afterwards, the two pockets of smouldering cargo were removed from the hold with a grab and placed on the wharf. The cargo was then spread out and hosed down to ensure that the smouldering material was extinguished. After the fire was declared extinguished, the ship proceeded to discharge the remainder of the cargo.

Both fire-affected areas had burned in a circular pattern that was centred on the location of a fumigation sock. However, the fires had not grown in size over the ensuing days because, as they developed, they had consumed the available oxygen in the vicinity. It is likely that the amount of oxygen in the cargo hold atmosphere quickly fell to a level that would not support flame (below 15 per cent). The fires then slowly smouldered until the cargo hold hatch covers were opened, when they were extinguished with water.

▲ Circular pattern of burned cargo

When the fumigation socks were removed from the cargo, many of them were observed to have become charred.

During its reaction the fumigant, aluminium phosphide, releases phosphine gas, heat and diphosphine gas. Localised

high concentrations of phosphine and diphosphine gases are likely if the reaction occurs too quickly; if too much fumigant is placed in the packaging; or if the packaging does not allow the gases to escape quickly enough. Furthermore, there will be localised 'hot spots' if the heat produced as a result of the reaction is slow to dissipate. As the socks containing the fumigant were buried in the cargo, the surrounding cargo would have slowed the dissipation of heat from the reacting fumigant tablets.

Pure phosphine gas has an auto-ignition temperature greater than 100°C. However, diphosphine gas has an auto-ignition temperature of about 90 to 100°C. As a result, it is likely that the local temperature rose to a level above the auto-ignition temperature of the diphosphine gas and that the gas subsequently ignited.

Root cause/contributory factors

1. The fumigation contractor buried the socks containing the fumigant in the cargo in an attempt to protect them from the rain;

2. The fumigation contractor and ship's crew did not sufficiently consider the risks associated with burying the aluminium phosphide fumigant in the cargo, especially that of heat build-up around each sock and auto-ignition of diphosphine.

Lessons learned

1. Shipowners, operators, masters and fumigation contractors should consider the safety implications of using aluminium phosphide;

2. The vessel must be given sufficient information to enable the ship's crew to effectively supervise the application of the aluminium phosphide fumigant.

MARS 200902
Seed cake loading violation

A bulk consignment of hazardous palm kernel expeller (PKE) was shipped on a vessel in violation of regulations, and despite being specifically excluded in the charter party, due to a combination of negligence on the part of the master, an ambiguous agreement between owner and charterer and a misleading certificate provided by the shipper. The ship was not designed or fitted for the carriage of this dangerous commodity; did not possess the required certificates and proper documentation; and the ship's crew failed to observe the necessary safety procedures for the cargo properly. The matter came to light only at the discharge port when the port state control inspector requested to see all the relevant documents and records.

Even though PKE was excluded in the charter party, owners agreed to load, subject to the shipper supporting his claim that the cargo was 'non-hazardous' seed cake listed in group C of the BC code, by providing a certificate from the competent authority. An independent surveyor was appointed by the owners to supervise the operation. The master was informed of these intentions and arrangements.

As per the laboratory analysis results provided onboard, the consignment conformed to UN 1386 seed cake (b) UN Class 4.2, and the attending owner's surveyor confirmed this. However, despite clear evidence that the cargo was dangerous, the shipper misdeclared it on his certificate by simply stating that it was 'non-hazardous'.

The master failed to note the different categories of seed cake as listed in the BC Code. He also failed to appreciate that ship's certificate of fitness did not permit the vessel to load the cargo being shipped. It was further observed that the crew had not properly documented hold temperature records, having written them on scrap pads and not in the deck logbooks.

It is the master's responsibility to verify that the vessel is properly certified and equipped for carrying any intended cargo as soon as he is told about it by the charterers or owners. The BC Code, IMDG Code, BLU Code (for loading/unloading bulk cargoes), the ship's certificate of fitness and the charter party must be referred to every time a cargo loading is planned and the company informed of any doubts or commercial pressure from charterers.

Editor's note: The Bulk Cargo (BC) Code lists palm kernel along with some 30 other commodities under the generic term 'seed cake', which is the byproduct after the removal of oil from any oil-bearing seed or cereal by mechanical crushing or by a process known as solvent extraction. Regardless of the manufacturing process used, seed cake contains residual oil and moisture and tends to oxidise and self-heat. The product obtained from solvent extraction, while containing relatively less oil and moisture, is also prone to self-heat, and has an additional hazard arising from residual flammable solvent mixed in the cargo.

Depending on its extraction process, oil and moisture content, seed cake is categorised under three types in the BC Code:

1. Seed cake containing vegetable oil UN no. 1386 – group B, IMDG class 4.2 **a)** mechanically expelled, containing more than 10 per cent oil or more than 20 per cent oil and moisture combined; and **b)** solvent extracted seeds, containing not more than 10 per cent oil and when the amount of moisture is higher than 10 per cent, not more than 20 per cent of oil and moisture combined.

2. Seed cake UN no. 2217 – group B, IMDG class 4.2, residue after solvent extraction, which contains not more than 1.5 per cent oil and not more than 11 per cent moisture.

3. Seed cake (non–hazardous, group C), which poses a low fire risk and no particular hazards. There are no special precautions required for the carriage of this group of products.

For both the group B cargoes (UN 1386 and UN 2217), the BC Code lists the following hazards: May self-heat slowly and, if wet or containing an excessive proportion of un-oxidised oil, ignite spontaneously. Liable to oxidise, causing subsequent reduction of oxygen in the cargo space. Carbon dioxide may also be produced.

The Code also gives detailed information on pre-shipment documentation, precautions and in-transit care.

■ **Additional information from BIMCO:** At the IMO's sub-committee on dangerous goods, DSC 9 (2004), BIMCO made a submission which requested the sub-committee to clarify the definition of the seed cake entry, UN 1386 (b) in the BC Code, as well as the certificate requirements pertaining to the non-hazardous seed cake entry. The above two issues, which

remain outstanding, were referred at this session to the working group tasked to look into the BC Code amendments and its mandatory application.

BIMCO members had problems interpreting the above definition. Hence, at this working group, BIMCO requested that a clear interpretation, given in the form of an explanatory note, be inserted into the schedule. BIMCO believes that this will greatly aid users of the Code in determining whether the cargo to be carried falls under this schedule.

This was agreed by the working group and was included in the correspondence group's terms of reference for the next DSC session (DSC 12, September 2007). BIMCO accordingly forwarded an appropriate explanatory note to the correspondence group for consideration and approval at DSC 12.

BIMCO is happy to report that its submission has finally been completed and this has culminated in the following:

1. Approval at this sub-committee of BIMCO's proposed explanatory note for seed cake UN 1386(b) which will help BC code users understand better the description required under the schedule.

For ease of reference, the description of seed cake entry UN 1386 (b) is appended below together with the approved explanatory note:

'Seed cake, containing vegetable oil UN 1386

(b) solvent extraction and expelled seeds, containing not more than 10 per cent of oil and when the amount of moisture is higher than 10 per cent, not more than 20 per cent of oil and moisture combined.

This entry covers the following:

.1) all solvent extracted and expelled seed cakes containing not more than 10 per cent oil, and not more than 10 per cent moisture; and

.2) all solvent extracted and expelled seed cakes containing not more than 10 per cent oil and moisture content higher than 10 per cent, in which case, the oil and moisture combined must not exceed 20 per cent.'

2. All seed cake schedules will have a graph depiction showing the range of oil and moisture content applicable under their respective schedule.

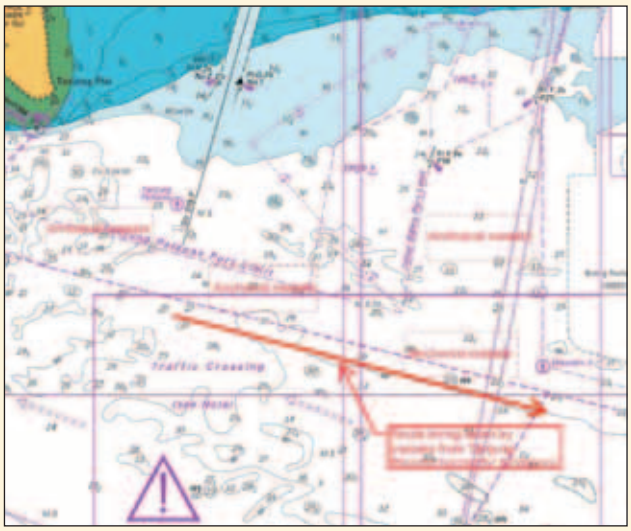
3. Approval of the final BIMCO amendments to the non-hazardous seed cake schedule based on discussion held in the correspondence group. Upon adoption of the revised mandatory BC Code, the provisions of this schedule will apply only to solvent extracted rape seed meal, pellets, soya bean meal, cotton seed meal and sunflower seed meal, containing not more than 4 per cent oil and 15 per cent oil and moisture combined and being substantially free from flammable solvents.

MARS 200903
Traffic hazards off Singapore

There are routine transgressions of Colregs Rule no.10 (traffic separation schemes) in the Singapore Straits. On arrival at Tanjung Pelepas, I noted that due to the number of vessels at anchor in the inshore traffic zone north of the westbound lane (Singapore Western Boarding Ground Alpha (WBGA) to Tanjung Piai (BA Chart 4038), the inshore traffic zone is effectively closed to larger vessels proceeding eastbound from Tanjung Pelepas and Singapore.

Many vessels occupy the Tanjung Pelepas general anchorage and the inshore zone to the south of this, as well as the anchorage area to the south and east of Johor Bahru port limits. The area of anchored vessels actually extends into the westbound traffic lane. Accordingly, vessels that transit eastbound between Tanjung Pelepas and Singapore WBGA routinely call the vessel traffic information system (VTIS) and request to proceed the wrong way eastbound against the traffic flow in the westbound lane. This situation inevitably leads to head on encounters with westbound traffic and alterations of course by each vessel to port, so that eastbound vessels occupy the northern limits of the lane and westbound vessels move towards the centre of the lane. My point is that, in following this seemingly routine procedure, if a vessel should be involved in any incident, the legal repercussions would be particularly great for the eastbound vessel. Note that vessels undertaking this procedure are without pilots onboard.

It would be prudent for masters of eastbound vessels between Tanjung Pelepas and Singapore to plan the passage only after carefully scanning the main strait by ECDIS/radar. Should the inshore traffic zone appear congested, then instead of risking a hazardous direct passage of some six miles to WBGA, it would be safer to follow the TSS by crossing the west bound lane, entering the east bound lane, going south of 'Delta' buoy and Takong Kecil beacon and exiting at Raffles light house in order to rejoin the west bound lane – in all some 37 miles of steaming.



▲ Singapore traffic zones

Editor's note: The convenience of a direct course and a shorter transit time must not justify the selection of a route that plainly contravenes the Colregs. If the volume of eastbound traffic between TPP and Singapore justifies it, shipping lines and agents may take up the issue with the authorities of both the ports to ensure that anchorage area limits are clearly marked and complied with and that a clear corridor is available for safe eastbound transits through the inshore zone.

MARS 200904

Crude oil leak from COW system

A release of crude oil occurred during the pressure testing of the crude oil washing (COW) system prior to arrival at the discharge port. The vessel was on her maiden voyage and this was the first occasion that the system had been operated by the crew since the commissioning test by shipyard personnel during sea trials.

The incident

After sailing from the load port, the crew isolated the COW system cargo oil heater by rotating the spectacle blanks to ensure no oil could enter the heater. Just before arrival at the discharge port, pressure-testing of the COW line began, using cargo oil and the stripping pump. As the COW line was slowly pressurised, a crew member noticed an oil leak in the pumproom where the heater was located. The operation was suspended immediately and a clean-up operation was quickly completed without any environmental pollution.

What went wrong

During the ship's construction, the COW system's cargo oil heater outlet pipe was provided with a connection to accept a temperature probe. Due to a mismatch between the threads of the connection and the probe, an additional connection with the correct thread to which the temperature probe was fitted was made by the yard. The original redundant fitting was however left in place, but was not shown in the COW system drawings and data. Its isolating cock, which did not have any position indicator, inadvertently remained in the open position. The investigation also revealed that the planning process did not include a proper assessment of the risks and no risk assessment was documented.

Root cause

Lack of planning was determined to be the root cause of this incident in that there was a lack of appreciation that the ship sailed from the shipyard with an unknown flaw in the cargo piping system that could potentially compromise environmental safety.

What went right

A pre-operation meeting was held and sufficient members of staff were placed to monitor the operation. This led to an early detection of the leakage, quick response and averted a pollution incident.

Lessons learned

1. Close inspection of the vessel's cargo transfer system, including the crude oil washing line, must be carried out by ship's staff following delivery by the shipyard and valve orientation observed.

2. Where possible, all cargo pipelines should be pressure tested with water prior to first load port to establish that pipeline integrity is as expected and leak free.

Corrective actions

1. Fleet and ship management team should clearly establish priority tasks in preparing the ship for first loading and discharging to minimise the risk of pollution.

2. Company procedures are to be improved to ensure appropriate planning and risk management processes are completed. A checklist of critical pre- and post-delivery tasks to be completed will be made available within the management system.

▲ Close-up view showing redundant probe connector with isolating cock and second probe connector in use.