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FIRES INVOLVING CONTAINERISED CARGOES OF CHARCOAL

BY

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Fires involving containerised cargoes of charcoal

In recent months, Burgoynes has investigated several fires involving containerised cargoes of charcoal. The charcoal cargoes were in the form of circular tablets, which are commonly used with hookahs or so-called "water pipes" to heat tobacco, and can also be used with incense burners. Some illustrative photographs of the charcoal tablets we have seen recently are shown below. The tablets are usually wrapped in foil, in tubes of around 10 tablets, and then several of these foil wrapped tubes are packaged inside branded cardboard boxes. In addition to tablets, our investigators have also previously seen fires involving charcoal briquettes.

Photographs 1 & 2 – Examples of typical charcoal tablets.

Hazards

Charcoal is essentially pure carbon and can undergo oxidation by reacting with oxygen in the air, which produces heat. The carbon used in charcoal tablets is porous, which provides a large surface area of exposed carbon that increases its susceptibility to oxidation. If the charcoal is sufficiently active, or if it is warm or hot when stowed, then the oxidation process can proceed at a rate at which more heat is generated through oxidation than can be lost through natural cooling. This causes the temperature of the charcoal to rise. The rate of oxidation of charcoal increases as temperature increases, so, as the temperature of the charcoal rises, so does the rate of oxidation. This, in turn, increases the rate of heat production and raises the temperature of the charcoal even more and, eventually, this process can result in the material becoming so hot that ignition occurs. This type of process is commonly referred to as self-heating.

Owing to the nature of the self-heating process, ignition does not occur immediately. Depending on the circumstances in question, ignition can occur hours, days, or more after the charcoal has been stowed. The self-heating process can be promoted if charcoal cargoes are closely packed together inside a container without adequate separation between boxes to allow any heat generated by the cargo to dissipate. The incidents we have investigated have typically involved containers that were almost entirely filled with boxes of charcoal tablets, so there was very little separation provided.

Given that the rate of oxidation of charcoal increases with increasing temperature, another factor to consider is the exposure of a cargo of charcoal to external heat sources. In this regard, prolonged exposure to direct sunlight on the quayside, or the container being stowed on a vessel in an exposed position on deck, could promote self-heating. In addition, depending on the stowage position, a container could be exposed to other external heat sources on a ship, such as hot machinery and/or heated fuel tanks. Therefore, the manner in which the container has been handled and stowed warrants investigation.

Photograph 3 – A container of charcoal tablets that caught fire.

Charcoal burns in a smouldering fashion and this type of combustion typically progresses slowly. Indeed, we have seen charcoal cargoes still smouldering several days and even weeks

after the fires were discovered and the containers had been discharged. In addition, self-heating would be expected to initiate towards the centre of the stow, where the thermal mass is highest, and this area would be largely inaccessible from outside the container. As such, extinguishing a fire involving a containerised cargo of charcoal can be a challenging task.

In our experience, the best course of action is normally to discharge the affected containers without delay and extinguish them on the quayside. Whilst the ship's fixed firefighting systems might be used in an attempt to contain the fire as the vessel proceeds to the nearest port, one of the most effective methods for extinguishing the fire is to land the affected container, remove the burning charcoal, spread it out and douse it with water.

Cargo declaration

Charcoal is classified under the IMO Dangerous Goods Code (IMDG Code) in Division 4.2, substances liable to spontaneous combustion. The applicable entry in the IMDG Code is UN1361, which has the proper shipping name "***CARBON animal or vegetable origin***". The entry describes the material as:

"***Black material originating from organic sources. Particularly includes carbon blacks, other non-activated carbon materials and charcoal produced from materials such as bone, bamboo, coconut shell, jute and wood. Liable to heat slowly and ignite spontaneously in air. The material offered for shipment should be cooled down to ambient temperatures before packing.***"

It is noteworthy that UN1361 allows, *via* Special Provision 925, exemption from the provisions of the IMDG Code if a cargo can be shown to have undergone the relevant test for self-heating substances reflected in the UN Manual of Tests and Criteria and to have exhibited no self-heating behaviour in that test. The relevant test is UN Test N4, which can be used to determine the ability of a substance to undergo oxidative self-heating by exposure of a sample of the substance to air at elevated temperatures in a test oven.

The first stage of the test involves exposure of a sample, packed into a 100 mm wire mesh cube, to a temperature of 140°C in the test oven for a period of 24 hours. If the internal temperature of the sample does not exceed the oven temperature by more than 60°C during

the test period, then the sample is deemed to have passed the test and should not be classed as Division 4.2. In the event that the internal temperature exceeds the 60°C limit, then the substance should be classed as Division 4.2 and a series of additional tests are conducted to determine the packing group.

Photograph 4 – Charcoal briquettes arranged in a 100 mm wire mesh cube basket for testing to UN Test N4.

Special Provision 925 outlines that, in order to meet the criteria for exemption from the IMDG Code, a cargo must be accompanied by a certificate from a laboratory accredited by the competent authority that states: (i) the cargo has been correctly sampled by trained staff from that laboratory; (ii) the sample was correctly tested; and (iii) that the sample has passed the test. Therefore, carriers should ensure that such documentation is provided with a cargo of charcoal not declared as Division 4.2 prior to accepting the shipment.

However, in reality, it is not always that straightforward as the cargo might not be described as charcoal and thus the true nature of the cargo might not be readily apparent. In this regard, the names we have seen used to describe charcoal cargoes include “hookah accessories”, “water pipe accessories”, “tablets for water pipe” and “bamboo piece fahm” (fahm being the English spelling of the Arabic word for “coal”). Whilst such descriptions are not entirely false given the intended use of charcoal tablets, they do not accurately reflect the nature of the cargoes and are not proper shipping names. In the majority of the cases we have seen, cargoes described in this manner were not accompanied by the required test certificate to

exempt the cargoes from the provisions of the IMDG Code. Consequently, there was a strong case to be made that those cargoes were mis-declared.

Significantly, Burgoynes also has experience of fires involving charcoal cargoes that were accompanied by a test certificate outlining a sample of the cargo had passed UN Test N4 and the shipper had relied on this certificate to exempt the cargo from the provisions of the IMDG Code. In those cases, subsequent testing to UN Test N4 of samples we recovered from the affected containers demonstrated the cargoes did in fact exhibit self-heating behaviour and, on that basis, should have been classed as Dangerous Goods in Division 4.2. Given these test results, one could question the reliability of the test certificate provided by the shipper in those cases and make an argument that the cargo had been mis-declared. For example, the test certificate provided might not have related to the particular batch of charcoal that was shipped.

Stowage and handling guidelines

The Cargo Incident Notification System (CINS) and the International Group of P&I Clubs (IGP&I) published the document "Guidelines for the Carriage of Charcoal and Carbon in Containers" in 2017.[1] In light of the comments above, it is noteworthy that these guidelines include a recommendation for shippers to declare to carriers any shipments of charcoal/carbon that are not subject to the provisions of the IMDG Code (*i.e.* shipments where Special Provision 925 applies). This is primarily for safety reasons, as the crew would then be aware that such cargo is on board and the risk of unsafe stowage and handling could be reduced.

In relation to stowage and handling, there is a recommendation in the CINS paper that shipments of charcoal/carbon where Special Provision 925 applies should meet the requirements for container selection, packaging, stuffing, inspection, stowage and segregation set out in the IMDG Code for shipments of charcoal/carbon that are classified as Dangerous Goods, *i.e.* that some of the provisions of the IMDG Code should still apply, even when the Special Provision has exempted a particular cargo from those provisions. The

[1] See for example: https://www.westpandi.com/publications/news/new-cins-ig-guidelines-for-the-carriage-of-charcoa/

instructions in the IMDG Code for charcoal (entry UN1361) outline that the container should be protected from sources of heat and kept as cool as reasonably practical. This is of relevance when considering the earlier comments about how exposure of containers to sunlight and other heat sources can promote self-heating, as such scenarios should in theory be avoided if the stowage and handling instructions for UN1361 from the IMDG Code are followed.

The instructions in the IMDG Code also outline that containerised cargoes of charcoal can be stowed on deck or under deck. However, in this regard, the CINS and IGP&I guidance document outlines that stowage ON DECK and ACCESSIBLE is strongly recommended. This recommendation would seem to be warranted given the challenges of extinguishing a fire amongst a charcoal cargo that were discussed earlier.

Photograph 5 – Discharge of a container in which there was an ongoing fire amongst a cargo of charcoal tablets.

In the event of a fire at sea, stowage in an accessible location on deck should allow easier access to the container for firefighting, as compared to if the container was stowed below deck inside one of the cargo holds. This should afford the opportunity for more direct firefighting measures to be employed that could reduce the chance of a serious incident developing. Such measures might not be possible if the container was stowed below deck inside a cargo hold. Another benefit of stowage in an accessible location on deck is that the

container can be easily monitored during the voyage for any signs of self-heating and, if required, the container can be discharged promptly once the vessel comes alongside. We would recommend that expert advice be sought in circumstances where on board firefighting is being considered, and our marine chemists are available to provide technical guidance in this regard.

Summary

Fires involving containerised cargoes of charcoal typically arise due to the propensity of charcoal to self-heat. Burgoynes has seen several such incidents recently and the cargoes in those cases were inaccurately described and had not been declared as Dangerous Goods.

When such incidents occur, there are many factors that need to be considered that would warrant the involvement of a suitably experienced fire expert. The first priority is to manage the incident on board effectively to ensure the safety of the vessel and crew and to allow the vessel to come alongside to discharge the affected containers. This may involve advice on management of an ongoing fire, boundary cooling arrangements and other firefighting strategies, particularly once the containers have been landed. Investigations into the cause of the incident can then commence, which will involve gathering evidence to assist with determining the nature of the cargo and whether it had been properly declared.

Please contact one of our experts in your local Burgoynes office if you would like to obtain more details or discuss potential instructions.

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