

Case Study

IFIC INTERNATIONAL FIRE
INVESTIGATORS AND
CONSULTANTS LTD

Report into the Origin and Cause of the Explosion and Fire Aboard
the MT SAN SEBASTIAN On Friday May 2, 2003.





Background

IFIC's professional experience in investigating fires and explosions matches the scale and diversity of its client base which extends across the world. Where sea vessels are concerned, IFIC delivers professional investigative skills. A case which drew on IFIC's expertise in this area was the explosion and fire aboard The San Sebastian tanker which, sailing south through the Red Sea in May 2003, experienced an explosion in her No. 5 port cargo oil tank. A fire ensued on deck which was quickly suppressed using the deck foam system and the fire was reported extinguished at 0900 hours.

Dr James F Lygate, Principal Investigator, was instructed by Healy & Baillie of New York who represent the ship owners and their P&I Club, Steamship Mutual, to attend the vessel and opine as to the origin and cause of the explosion on board the vessel.

Origin of the Explosion

It is difficult to say with certainty where this explosion first occurred from an analysis of the damage to the deck and tank bulkheads given the complexity of the damage patterns.

However it is possible to rule out the No. 4 port and starboardwater ballast tanks and the No. 5 centre cargo oil tank as being the source of the explosion and, therefore, likely that the explosion originated in either tank No. 4 centre or No. 5 port or No. 5 starboard.



Cause of the Explosion

In order for there to have been an explosion, three conditions need to have been satisfied concurrently: firstly that there was flammable mixture, secondly that there was some failure of the inert gas system either because the inert gas system was not there or had been allowed to escape, and thirdly that there was a competent ignition source capable of igniting the flammable mixture in the tank which first exploded.

Flammable Gas

The cargo being carried, carbon black feed stock, is similar to residual fuel oil. It is a mixture of the oil remaining from the refining process and as such contains a mixture of light and heavy hydrocarbons and will include some dissolved gases such as methane, ethane, propane and butane. These gases dissolve in solution and are emitted when the cargo is heated. It was noted from our examination of the post-incident gas readings that they were in excess of 100 % of the lower explosive limit.

Cargo samples were analysed but I have not seen the results of those analyses. Even if one cargo was slightly more flammable than the others, the explosion requires the other two preconditions -- that of a failure of the inert gas system and an ignition source -- to be satisfied. Therefore it is unlikely that this explosion arose as a result of any inherent vice in the cargoes



carried.

Failure of the Inert Gas System

The gas measurements recorded in the ship's log indicate an oxygen concentration in the tanks after loading of approximately 3 %, which is insufficient to support combustion and thereby the ullage spaces of the cargo tanks were rendered safe.

Following the explosion the inert gas system was used by Salvors to inert undamaged tanks. It is therefore reasonable to conclude that the inert gas system was working and capable of inerting the tanks. There is no indication of a failure to inert the No. 5 port, No. 5 starboard, or No. 5 centre tanks. Indeed the damage patterns suggest that the tanks were partially inerted and the flammable atmosphere was of a limited quantity. This supports the hypothesis that the tanks were inerted, as do the recorded gas measurements in the ship's log. It was apparent that there was a breach in the inert gas system as a result of the hole cut in the IG line to the No. 5 starboard tank.

Ignition Sources

In order for an explosion to have occurred there requires to have been a flammable atmosphere at the ignition source. For there to have been an explosion in the tank, the flammable atmosphere has to have extended from the source of ignition into the tank or the ignition source been inside the tank.



No competent electrical source of ignition was observed on deck and I think it highly unlikely that a flammable atmosphere could have extended to an electrical source of ignition. Therefore I am satisfied that this explosion was not caused by an electrical source.

Smoking is strictly prohibited on the deck of tankers and smoking is only permitted in designated areas of the accommodation. Crews of tankers are well acquainted with the hazards and danger that result from the misuse of smoking materials. During the course of my inspection I found no indication of illicit smoking on deck, such as discarded cigarette ends.

I am therefore of the view that the ignition source in this incident is to be associated with hot work since it is evident that hot work was being performed on the inert gas pipe serving the No. 5 starboard cargo oil tank. The hole in the pipe appears to have been cut by flame, either an oxypropane or oxyacetylene torch. On examining the opening to the pipe I observed that two supports had been welded in place to the underside of the inside wall of the pipe at about top dead centre. It appears that these supports have been arc welded in place. There is no evidence that the explosion took place as the plate was being welded into position as there were no signs of a partially completed weld on the edge of the hole.

Conclusions and Recommendations

- I conclude a flammable atmosphere came to exist in the No. 5 port tank because the hole cut in the No 5 starboard IG line allowed inert gas to escape from and air to be admitted into the No. 5 port tank.
- I conclude that there was an ignition of a small flammable atmosphere at the forward end of the No. 5 port cargo oil tank in way of the inert gas inlet when a gas cutting torch was applied to the No. 5 port IG line.
- I conclude that the explosion vented into the No. 4 centre tank, propagated in the aft-most part of the ullage space of No. 4 centre and vented by the failure of the deck seam above the No. 4 centre and No. 5 starboard tanks.
- I conclude that there was a partial flammable atmosphere within the No. 4 centre tank, perhaps due to the admission of air by the rupture of the deck.
- I conclude it to be unlikely that this explosion arose as a result of any inherent vice in the cargoes carried.
- Hot work had been performed on the No. 5 starboard IG pipe but in my opinion it was not the source of ignition of the explosion. I cannot with certainty identify the source of ignition but it is probable that it is associated with hot work, possibly conducted on the No. 5 port IG line. I reserve the right to amend or amplify this report based upon review of additional evidence.

United States District Court, Northern District of Georgia Atlanta Division found that:

'Plaintiffs failed substantially to meet their burden of proof in this case. Accordingly, and based on the court's Findings of Fact and Conclusions of Law that judgement was entered in favour of defendant, Oilmar Co Ltd. It was further ordered that the attached freights, paid into the court's registry in the amount of \$580,000.00, together with the interest that has accrued, be released to Oilmar.'

William S Duffey, JR. United States District Judge.

Written and Approved by:

Dr J F Lygate - Principal Consultant

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