

**MARINE OCCURRENCE REPORT**

**TUNNEL FIRE**

**ON THE SELF-UNLOADING BULK CARRIER  
"H.M. GRIFFITH"  
ALONGSIDE AT HAMILTON, ONTARIO  
07 AUGUST 1995**

**REPORT NUMBER M95C0033**

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

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Tunnel Fire  
on the Self-unloading Bulk Carrier "H.M. GRIFFITH"  
Alongside at Hamilton, Ontario  
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### **Summary**

On 07 August 1995, while the "H.M. GRIFFITH" was unloading a cargo of Pocahontas No. 3 Seam coal at the Stelco Hilton Works in Hamilton, a flash fire occurred in the port tunnel of the self-unloading bulk carrier. The three tunnelmen who were working in the port and starboard tunnels at the time suffered minor burns to their hands and upper bodies. Two were treated and released from hospital, but the third required hospitalization. There was no pollution.

*Ce rapport est également disponible en français.*

## Other Factual Information

### Particulars of the Vessel

Name	"H.M. GRIFFITH"
Port of Registry	Collingwood, Ont.
Flag	Canadian
Official Number	346833
Type	Great Lakes self-unloading bulk carrier
Gross Tonnage	22,775
Length	222 m
Built	1973, Collingwood, Ont.
Propulsion	Two ten-cylinder Crossley engines, (6,620 kW)
Owners	Canada Steamship Lines Inc., Montreal, Que.

The "H.M. GRIFFITH" was on her fiftieth coal-carrying voyage of the 1995 shipping season.

The "H.M. GRIFFITH" departed Sandusky, Ohio, U.S.A., on 06 August 1995, bound for Hamilton with a cargo consisting of 19,745.55 tons of Southern High Volatile grade coal loaded in the Nos. 1, 2 and 4 holds, and 10,084.65 tons of Pocahontas No. 3 Seam coal loaded in the Nos. 3 and 5 holds. No Cargo Declaration describing the characteristics and recommended safe handling procedures for the Pocahontas No. 3 Seam and Southern High Volatile coals was offered to or requested by the master.

During the voyage, the atmosphere in the tunnels was checked using a CMX 412 - 4 range gas monitor. Reportedly, the worst readings obtained indicated that 20.1 per cent oxygen was present and a LEL (Lower Explosive Limit, an indication of the presence of methane) of 0.2 per cent. The voyage from Sandusky to the Stelco Hilton Works in Hamilton was uneventful.

Before unloading began, the tunnel ventilation system, consisting of two supply fans located forward and two exhaust fans located aft on the spar deck, was put in operation.

With the boom positioned over the shore-side reception area, unloading commenced. The vessel's draught was 8.0 m forward and 8.0 m aft. First, a dip (a quantity of cargo) was taken from each of the holds to be unloaded, and then the unloading and manual cleaning of the holds was carried out according to a discharge plan prepared in advance.

During the unloading, a tunnelman is assigned to operate the hopper gates and vibrators along the length of each of the three conveyor belts. The head tunnelman relieves the tunnelmen periodically and inspects the conveyor belt systems continuously. The ship's electrician monitors the unloading from the cargo control room, and signals the tunnelmen via a light system if too much or too little coal is being discharged onto the conveyor belts. The tunnelmen adjust the flow of coal onto the belts by adjusting the hopper gate openings or the number of open gates.

Unloading commenced at 1625 on 07 August, with the Southern High Volatile coal in the Nos. 4, 2 and 1 holds being dipped in that order. The Southern High Volatile coal was then completely unloaded.

At 1935, the vessel was shifted aftward to position the boom over the Pocahontas No. 3 Seam coal pile and discharge commenced at 1945.

A dip was taken out of the No. 3 hold followed by a dip from the No. 5 hold. At approximately 2030, during the dip at the No. 5 hold, the port tunnelman, satisfied that the coal was running well onto the port conveyor belt, attempted to light a cigarette. When he ignited the disposable butane lighter, he noticed that the flame looked somewhat different from normal. Fearing that the lighter had malfunctioned, he threw it down. At that point, a flash fire occurred.

A loud report followed by shaking was heard and felt by those on deck and elsewhere in the accommodation of the vessel. Clouds of dark brown smoke were seen by those on the spar deck and on the bridge, emanating from the tunnel exhaust vents located aft on the spar deck and from the upper loop belt/boom transfer casing. Doors at the upper loop belt/boom transfer casing were forced open and the tunnel-exit weathertight door on the spar deck forward was reportedly seen to slam shut. The third officer reported seeing the cargo pile in the No. 5 hold fall down at the time of the loud report. The unloading equipment was shut down immediately and the general alarm sounded.

Two of the tunnelmen escaped, unaided, through the loop belt casing to the spar deck aft. The third tunnelman escaped, unaided, by way of the forward tunnel-access stairway to the spar deck. On arriving on the spar deck, they were assisted by other crew members and were given first aid until they were transported to hospital.

The crew, most of whom were involved in the unloading operation, responded quickly and efficiently to the general alarm.

Cargo unloading was suspended following the flash fire and did not resume until the vessel's crew, company shore staff from St. Catharines, Ont., and the Stelco fire department carried out a preliminary investigation and inspection of the tunnel and equipment, and determined that it was safe to do so.

Post-occurrence testing of the tunnel atmosphere did not indicate the presence of methane.

The port tunnelman, who was the closest to the flash fire, received the worst injuries. These consisted of first-degree burns affecting 5 to 6 per cent of his body surface area, primarily on the face, neck and upper chest. He sustained second-degree burns and blistering over approximately 1 per cent of his body, mostly on the face, although minor blistering was found on the knuckles and fingers of his right hand. His face and lips were swollen and his hair singed.

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All times are EDT (Coordinated Universal Time (UTC) minus four hours) unless otherwise stated.

Some time after being admitted to hospital, he was found to have signs of minimal airway damage, and was kept for observation for several days.

The other two tunnelmen were in the starboard tunnel, separated from the port tunnel by the centre conveyor. One sustained first-degree burns to the face and chest, with small blisters under an area touched by the zipper of his coveralls, while the other had only first-degree burns to his face. After several hours of observation and treatment, both men were released from hospital and they returned to work shortly thereafter.

There was no damage to the cargo unloading equipment or structure of the "H.M. GRIFFITH" as a result of the flash fire.

Minor damage found in the immediate area included rippling of the clear plastic cover of a fluorescent light fixture in the port tunnel, heat damage to plastic sheeting stored above the cable-way near the No. 8 port gate beneath the No. 5 hold, and heat damage to rain gear hanging on the port and starboard pillars in way of the No. 5 hold. It was noted that the ends of paint flakes on the hopper sides in the port tunnel in the immediate area were somewhat charred. A rag hanging from an alarm horn at the No. 8 gate of the No. 4 hold was seen to be smouldering following the occurrence.

Company Safety Guidelines clearly recognize the hazards associated with careless smoking in the presence of explosive dust atmospheres and cargoes which emit flammable gas.

The investigation revealed that no instructions had been given to the tunnelmen prohibiting smoking in the tunnels during unloading, and that no safety notices prohibiting smoking were posted in the tunnels.

It was the general opinion of those on board that the grades of coal carried did not give off methane, and that this type of cargo frequently had been handled without incident this season and in past seasons, and so did not present a hazard.

Both the *IMO Code of Safe Practice for Solid Bulk Cargoes* and the *Canadian Coast Guard Notice to Shipmasters Loading Coal* require, in part, that "... before and during loading and while the coal remains on board smoking and the use of naked flames shall not be permitted in the cargo areas and adjacent spaces", and further that "... appropriate warning notices shall be posted in conspicuous places."

Post-occurrence testing for the presence of methane in the air space above the cargo in each hold was carried out during a voyage to Hamilton on 31 August 1995 with a coal cargo similar to that carried at the time of the occurrence. Air sampling to determine the amount of coal dust and methane present in the tunnel and transfer/loop belt was carried out during the unloading of Pocahontas No. 3 Seam coal on 01 September 1995.

The TSB Engineering Branch was requested to assist during the

investigation, and Laboratory Report No. LP 118/95, Flash Fire Analysis, is available upon request.

### **Analysis**

A flash fire is defined by the NFPA 921, *Guide for Fire and Explosion Investigations*, 1995 edition, as "a fire that spreads rapidly through a diffuse fuel, such as dust, gas, or the vapours of an ignitable liquid, without the production of damaging pressure".

When the port tunnelman lit his lighter in a pocket of methane, it initiated the flash fire. Sufficient methane was being given off from the open gates of the centre conveyor to allow the flame front to propagate into the starboard tunnel. The very minor heat damage to the clear plastic light cover coupled with the lack of sustained burning of combustible material in the area suggests that the heat generated during the flash fire was localized and of short duration. Once the methane had been consumed, the fire was extinguished. There was insufficient energy available to ignite the coal dust present in the vicinity of the No. 8 gate below the No. 5 hold or in the transfer area aft of that point.

Based on the tests conducted and eyewitness accounts of the conditions in the tunnel prior to the flash fire, a reasonable conclusion is that the amount of coal dust present in the area of the No. 8 gate on the port side under the No. 5 hold did not, in itself, present an explosion hazard.

Methane readings were taken at the forward and aft open access-hatchways to all of the holds during transit of the Welland Canal. No detectable methane was found in the Nos. 1, 2, and 4 holds, which held Southern High Volatile grade coal. Readings of approximately 15 per cent Lower Flammability Limit (LFL) were noted at the Nos. 3 and 5 holds, which held Pocahontas No. 3 Seam coal.

No detectable methane was found in the tunnel atmosphere before unloading commenced, and no measurable concentrations of methane were detected during the unloading of the Southern High Volatile grade coal.

Testing indicated the presence of transient pockets of methane gas of sufficient concentrations to be an explosion hazard at the open gates during the unloading of the Pocahontas No. 3 Seam coal. The gas pockets were detected randomly at all of the open gates of the Nos. 3 and 5 holds at one time or another during unloading. Low levels of methane were also detected in the loop belt casing at various times.

### **Findings**

1. No Cargo Declaration describing the characteristics and recommended safe handling procedures for the Pocahontas No. 3 Seam and Southern High Volatile coals loaded on 06 August 1995 were offered to or requested by the master.

2. The *IMO Code of Safe Practice for Solid Bulk Cargoes* regarding the safety requirements and other precautions to be followed during loading, carriage and discharge of coal cargoes was not followed.
3. Company Safety Guidelines, in place at the time of the explosion, prohibiting smoking in the tunnels of self-unloading vessels, were not followed.
4. The flash fire resulted from the ignition of a pocket or pockets of methane gas when the port tunnelman attempted to light a cigarette.
5. Personal protective equipment provided a measure of protection for the tunnelmen against the effects of the flash fire.
6. The crew believed that the Pocahontas No. 3 Seam coal did not give off methane and was thus not dangerous to handle.
7. Tests conducted during the unloading of a subsequent cargo of Pocahontas No. 3 Seam coal showed that methane was present in the air space above the coal at average concentrations of 15 per cent of the Lower Explosive Level (LEL).
8. Tests conducted during the unloading of a subsequent cargo of Pocahontas No. 3 Seam coal showed that methane exceeding 100 per cent of the LEL was present in the tunnels, in transient pockets.
9. The crew were well-trained and reportedly responded quickly and efficiently to the emergency.
10. There is no material safety data sheet available for coals.

#### **Causes and Contributing Factors**

The flash fire in the tunnel of the "H.M. GRIFFITH" resulted from the ignition of a pocket or pockets of methane gas when the port tunnelman attempted to light a cigarette.

Contributing to the occurrence was the belief that this type of coal did not give off methane and was thus safe to handle. The fact that no safety notices prohibiting smoking were posted in the tunnels, that the ship's crew did not comply with Company Safety Guidelines, and the disregard by the ship's officers, shore terminal operators and company personnel of the *Notice to Shipmasters Loading Coal* (TP 10944) and of the *IMO Code of Safe Practice for Solid Bulk Cargoes* also contributed to the occurrence.

#### **Safety Action Taken**

Following this occurrence, TSB Marine Safety Advisory No. 1/96 was forwarded to TC Marine Safety concerning the lack of knowledge of crews of the hazards of handling coal cargoes. In response, TC issued Ship Safety Bulletin No. 04/96 on the potentially hazardous

properties and characteristics of coal cargoes on ships. The Bulletin also reminds ship personnel of basic fire prevention procedures to be followed, and urges them to follow the recommendations contained in the *IMO Code of Safe Practice for Bulk Cargoes* (BC Code) and in the *Notice to Shipmasters Loading Coal* (TP 10944). TC further indicated that TP 10944 will be amended:

- a) to require that cargo and adjacent spaces on Canadian ships loading in ports outside of Canadian waters be monitored for the presence of methane gas; and
- b) to incorporate the recently amended coal entry in the BC Code, and that it will be widely circulated when completed.

*This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson Benoît Bouchard and members Maurice Harquail and W.A. Tadros, authorized the release of this report on 26 September 1996.*