Marine Safety Investigation Report

VERY SERIOUS MARINE CASUALTY | **May 2025**

Sophia Z
Electrocution on 30 August 2024

The Bahamas Maritime Authority

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What happened

On the afternoon of 30 August 2024, the Bahamas flagged bulk carrier, Sophia Z, was on passage in the Indian Ocean with a cargo of phosphate rock. Shortly after a coffee break, a member of the crew found the bosun unconscious on the deck in the forecastle store, holding on to an electrical cable and portable lamp.

The crew responded to the subsequent call for help but the bosun could not be revived.

Why it happened

A post-mortem identified that the cause of death was electrocution. Burns on the victim's wrist/forearm matched the position of the lamp when the victim was found by the deck rating. Neither the extension cable's residual current device, nor the ship's circuit breakers protected the victim.

The source of current leakage was not confirmed by laboratory tests but the lamp's electric cable was constructed of two different diameter cables that had been jointed in a way that adversely affected protection.

What we can learn

Poorly maintained equipment is a major cause of electrical accidents involving portable equipment. At least three seafarers have been electrocuted by portable cargo lamps in a two year period.

Portable equipment is likely to be subjected to, and more vulnerable to, physical damage and wear. The most vulnerable item of any portable equipment is often the cable.

There is no regulatory mandate, in The Bahamas or internationally, to test portable electrical equipment – operators need to put appropriate controls in place to ensure equipment with the potential to cause injury is maintained in a safe condition.

Effective maintenance of portable electric equipment may be achieved by a combination of checks by the user, formal visual inspections by a competent person and, where necessary, a combined inspection and test, also known as a portable appliance test, by an electrically competent person.

The human drive to help those who may be hurt is incredibly strong but can prove fatal: the first responder received an electrical shock when he touched the victim. Before approaching a casualty, you must first check for danger to yourself.

Narrative

All times in this report are local time (UTC+8)

On the afternoon of 30 August 2024 The Bahamas flagged bulk carrier, Sophia Z, was in the Indian Ocean - on passage from Las Palmas, Canary Islands, to Taichung, Taiwan, loaded with a cargo of phosphate rock. The weather was good and the sea state was slight to moderate, allowing for work on deck.

During the chief officer's morning meeting with the deck crew, works scheduled as part of the vessel's planned maintenance as well as non-routine tasks were discussed and assigned. Afterwards, the bosun, an able seafarer (AB) and a junior deck rating made their way down to the deck to start work.

The bosun instructed the AB to chip and prepare the deck crane's base plate ready for painting, whilst the deck rating would work with the bosun, finishing a painting job in the bosun's store (in the forecastle).

The chief officer also asked the bosun to test the weathertight doors to the bosun's store, replace any worn or damaged rubber packing and, if necessary, adjust the doors to make a tight seal. The bosun's method of checking the packing was to close the door and visually check if any light was visible, then that area would be marked and the rubber packing would be replaced.

Work continued on deck throughout the day and into the afternoon when, at around 15:00, the crew went for their afternoon break. During the break, the bosun left the mess and walked back to the bosun's store. The crew continued with their break until they left to restart work at around 15:30.

The deck rating walked to the bosun's store in order to locate the bosun and ask about the next task. Entering the store shortly after 15:35, he found the bosun lying on his back, on the deck - holding a portable lamp and extension cable in his left hand.

The deck rating went to see if the bosun was OK and, when he touched him, he received an electric shock. He then quickly went to the bulkhead and unplugged the extension cable and then left to get help. On deck he met the chief officer, who rushed to the ship's office to raise the alarm using the public address system, he then took oxygen from the hospital and returned to the bosun's store.

With the chief officer away, the deck rating managed to remove the cable and lamp from the bosun's hand and, when assistance arrived, the crew moved the bosun outside and started cardiopulmonary resuscitation and, when it arrived, administered oxygen.

Cardiopulmonary resuscitation continued whilst moving the bosun towards the ship's hospital between repetitions. At around 15:55 they arrived at the ship's hospital where the chief officer attempted to use an Automated External Defibrillator, but no heart activity was found. At 16:00 the bosun was declared deceased.

Vessel and Crew

Sophia Z was a five hold, geared bulk carrier with a deadweight of 57,700 tonnes. The bosun's store was under the forecastle deck, accessed from main deck level. The vessel was last subject to a port state control inspection on 01 June 2024 and a flag state annual inspection on 12 August 2023. Neither identified any deficiencies.

The Bosun was a 48 year old Filipino who had been onboard for 6 months. He had over 12 years' experience in rank and 24 years with the Company. He was on day work (nominally 07:00-18:00) and had a full night's rest before the casualty.

Legislation and guidance

The Bahamas Maritime Authority's Marine Notice 36: Management of Occupational Health & Safety describes the general duties of employers and employees in relation to health and safety, in line with Merchant Shipping (Health and Safety – General Duties) Regulations 1984.

Marine Notice 36 does not provide specific guidance on working safely onboard ships but states that the shipowner shall comply fully with the International Labour Organization's Code of Practice "Accident prevention on board ship at sea and in port" or other recognised Codes of Practice including the United Kingdom's Maritime & Coastguard Agency's "Code of Safe Working Practices for Merchant Seafarers".

Code of Safe Working Practices for Merchant Seafarers (2024) Chapter 18.15 provides guidance on portable power operated tools and equipment.

Previous similar cases

Drawsko (2023) Malta
During night time cargo operations, an ordinary seafarer was tasked with rigging up portable lights in a cargo hold when he was electrocuted. The investigation determined that the portable light's power plug had been incorrectly wired, resulting in the electrocution when he picked up the metal frame of the portable light.
https://msiu.gov.mt/wp-content/uploads/2024/09/MV-Drawsko_Final-Safety-Investigation-Report.pdf

Cosco Wuyishan (2022) Hong Kong
Whilst preparing cargo holds for the next cargo, an able seafarer was using a portable cargo light to look in to a bilge well when he suddenly collapsed, electrocuted by the light he was holding.
www.mardep.gov.hk/filemanager/en/share/publications/pdf/reports/mai220815_f.pdf

Atlantic Dawn (2017) Netherlands
Whilst painting in a tank, a bosun was electrocuted by a home-made portable lamp.
https://onderzoeksraad.nl/wp-content/uploads/2023/11/8a23d852303d20172585_b_rapport_atlantic_dawn_en_170823.pdf

Analysis

The purpose of the analysis is to determine the contributory causes and circumstances of the casualty as a basis for making recommendations to prevent similar casualties occurring in the future.

A post-mortem, conducted when the victim's body was landed at Singapore, identified that the cause of death was electrocution with the presence of partial to full thickness burns[1] and blistering over the victim's left wrist/forearm.

Source of electrocution

The portable lamp the victim was carrying was a 50 Watt light emitting diode (LED) floodlight that was labelled to have accepted an alternating current of 85-265 Volts at 50-60 Hertz. Its internal LED driver was rated IP67[2]. No records were available to indicate the origin of the lamp.

The lamp had a power supply cable that was approximately five meters long and was fitted with a two pin plug, (which was not compatible with the vessel's power sockets). The lamp had been adapted with a double steel hook to enable it to be hung from the hatch coaming, rung or railing. The burns on the victim's left wrist/forearm matched the position of the lamp's hook when the victim was found by the deck rating.

Portable lamp and cable

At the time of the casualty, the portable lamp was plugged into an extension cable reel that was fitted with a residual current device[3], designed to trip with a current leakage of 30 milliamps. The extension cable reel was designed to accept two pin plugs. It in turn was plugged into a power supply in the bosun's store using a three pin plug (that was compatible with the vessel's power sockets).

[1] A severe burn injury, also known as a third-degree burn, where all three layers of skin, underlying fatty tissue, nerves and tendons are damaged.
[2] Ingress Protection rating. IP 67 means a product is designed to be dustproof and withstand submersion in water up to 1 metre for up to 30 minutes.
[3] Residual current devices do not prevent an electric shock but are able to limit the duration of some shocks by being able to cause rapid disconnection of the electricity supply if there is a relatively low current flowing to earth.

Extension cable reel. Detail of residual current device

The deck rating received an electric shock when he touched the victim - neither the residual current device nor any circuit breaker tripped during the casualty. There was no record of an alarm on the vessel's earth system.

Post-casualty, the lamp and extension cable were subject to a rudimentary inspection onboard but were not preserved for testing in a laboratory environment. This inspection identified a joint in the lamp's electrical cable that had been wrapped in electrical tape. The extension cable reel's residual current device was not subject to effective testing.

Cable joint wrapped in tape. Same joint, exposed

The cables that were joined together were of differing diameters. The joint was a simple soldered connection.

Without testing in a controlled environment, the source of current leakage cannot be confirmed. If the earth connection was lost there was a possibility of the exterior of the equipment becoming live. In any event, the joining of a larger diameter cable (at the supply end) to a smaller diameter cable would increase resistance at the joint. The method of jointing would have significantly reduced the effectiveness of the cable insulation.

Damp skin reduces a person's resistance, which facilitates electrical conduction. At the time of the casualty, the outside temperature was 30°C with high humidity. The victim was damp with sweat and wearing thin cotton gloves.

People who receive an electric shock often suffer muscle spasms. This loss of muscle control often means the person cannot 'let go' or escape the electric shock. When discovered, the victim's hands were both cramped, the deck rating reported he struggled to get the electrical cable free after isolating it.

Managing electrical risks

The UK's Code of Safe Working Practices for Merchant Seafarers provides guidance on managing electrical risk from a fire safety and personal safety perspective:

> 5.2.6 Inspect portable electrical appliances, including lights, before every use and isolate them from their source of electrical supply after use. Consider measuring their insulation resistance before first use and regularly thereafter, depending on the location of use/risk of damage.

> 18.15.1 The following guidelines apply for portable power-operated equipment:
> - Portable powered equipment is dangerous unless it is properly maintained, handled and used. Only competent people should operate it.
> - The flexible cables of electric tools should comply with the relevant British or international standard.
> - Before work begins, ensure that power supply leads and hoses are in good condition, laid safely clear of all potentially damaging obstructions, and do not obstruct safe passage
>
> 18.15.2 The risk of electric shock is increased by perspiration and locations that are damp, humid or have large conductive surfaces. In these conditions operate power tools from low voltage supplies; no more than 50 volts AC with a maximum of 30 volts to earth or 50 volts DC.
>
> 18.15.3 The risk associated with portable electric tools also applies to portable electric lamps. The supply to these should not exceed 50 volts.
>
> 18.15.4 When it is not practicable to use low voltages take other precautions. These could include a local isolating transformer supplying one appliance only, or a high-sensitivity earth leakage circuit breaker (also known as a residual current device), that trips at 30 milliamperes (mA) residual current or less.

Onboard risk assessments were generic and limited. The risk assessments relating to electrical risks were focused on safety of high voltage, fixed equipment. There was no assessment of risks or hazards associated with portable electrical equipment.

PREVAIL SHIPMANAGEMENT SA. **RISK ASSESSMENT FORM** Code: **RA-532** Version 0

Vessel:	**Task Category:** ALL / ENGINE	**Work Activity:** Electrical equipment inspection	**Issue Date:** SEPTEMBER 2021

Risk Assessment Conditions	**Important Instructions**
Work Authorization Work has been authorized ☑ Y ☐ N	Work Activity is High Risk: ☐ YES ☐ NO
No Fatigue Staff is adequately rested ☑ Y ☐ N	**Relevant SMS Sections:** See relevant SMS Sections
Use of proper PPE Staff is using proper PPE ☑ Y ☐ N	***Relevant SMS* Form(s) to be used :** Relevant Form to be used
Experienced staff Staff has task experience ☑ Y ☐ N	

Analysis of expressions used to calculate Risk

(S)	Severity	(L)	Likelihood		Risk Rating
1	Negligible	1	Improbable	SxL=	RF
2	Minor	2	Remote	RF	Risk
3	Significant	3	Possible	L	Low
4	Critical	4	Likely	M	Medium
5	Catastrophic	5	Certain	H	High

How to assess Risk : ❶ Select Severity expression that applies to hazard WITH NO Controls ❷ Select appropriate likelihood with NO Controls ❸ Apply controls and RECALCULATE risk

Risk Rating	LIKELIHOOD (L) 1	2	3	4	5
SEVERITY(S) 1	1	2	3	4	5
2	2	4	6	8	10
3	3	6	9	12	15
4	4	8	12	16	20
5	5	10	15	20	25

No	HAZARD DESCRIPTION (Assume NO CONTROLS to initially assess risks)	Risk Rating (SxL = RR) S	L	RR	Risk L/M/H	CONTROL MEASURES TO BE TAKEN (To Reduce the Risk and calculate the residual/FINAL Risk Rating)	Risk Rating (SxL = RR) S	L	RR	Risk L/M/H
1	Lack of proper tools/materials	3	3	9	Medium	All necessary tools, consumable materials and spares to be prepared in advance and be readily available.	3	1	3	Low
2	Darkness	3	3	9	Medium	Ensure ample lighting natural or artificial is provided throughout the whole area and duration of works.	3	1	3	Low
3	High voltage power	5	3	15	High	Prior to work commencement power supply to be isolated, a safeguard against inadvertent supply and a warning placard be provided. Also switchboard's function to be rendered un-necessary for the duration or works. Necessary precautions to be taken to avoid danger.	5	1	5	Medium
4	Safety Routines not followed	4	3	12	Medium	Documented Procedures, Chief Engineers Standing Orders - Instructions, Warning-signs, Engineer Officer in charge.	4	2	8	Medium
5	Electric Shock from humidity/wetness	3	2	6	Medium	Chief Engineers Standing Orders - Instructions, Maintenance Reports, Engineer Officer in charge.	3	1	3	Low
6	Electric Shock from not removed fuses and closed circuits while conducting maintenance	3	2	6	Medium	Chief Engineers Standing Orders - Instructions, Maintenance Reports, Engineer Officer in charge.	3	1	3	Low

The Fleet Instruction manual provided some guidance but vessel's safety management system did not include a system for control or testing of portable electrical equipment.

> *Safety lamps and extension cords must be kept in good order. They must be checked for bad insulation and cracked or broken protection globes. The cord shall not be used if it is defective. Take care and avoid wrapping the cord around arms or any part of the body. Avoid standing in water when using the cord.*

The crew were not aware of the provenance of the portable light (the type and design of which differed from the remainder of the vessel's cargo lights) and there was nothing to indicate that the lamp had been subject to inspection or testing by competent person whilst it had been onboard.

Conclusions

The bosun was electrocuted when he came into contact with electricity through the portable lamp he was carrying. The extension cable's residual current device did not operate, nor did the ship's system protect the bosun from the current leakage.

The source of current leakage was not confirmed by laboratory tests but the lamp's electric cable was constructed of two different diameter cables that had been jointed in a way that adversely affected protection.

There was no formal assessment of risks associated with portable electrical equipment and the vessel's safety management system did not include a system for control or testing of portable electrical equipment.

The first responder received an electrical shock when he touched the victim and was fortunate to have not to have been injured.

At least three seafarers have lost their lives through electrocution from portable cargo lights in a two year period.

Action taken

As a result of the casualty, Saint Michael Shipping Co. Ltd. has:

- Replaced portable floodlights with low voltage equivalent (36V AC)
- Conducted a fleet-wide inspection of all portable electrical lighting systems
- Incorporated inspection of electrical cables and insulation resistance tests into their Planned Maintenance System
- Provided safety training on electrical hazards and the use of portable electric tools

Recommendations

The investigation found that there is no regulatory mandate to test portable electrical equipment and available guidance is limited in scope. Therefore, it is recommended that The Bahamas Maritime Authority:

- Incorporate verification of the safe management of portable electrical equipment into the BMA's fleet inspection program.
- Propose to the International Maritime Organization, together with other interested States, the introduction of standards to ensure the safety of portable electrical equipment used onboard ships.

Vessel particulars	
Vessel name	Sophia Z
Vessel type	Bulk carrier
Flag / IMO number	Bahamas / 9445708
Registered owner	Calm Ocean Shipping SA
Manager	Saint Michael Shipping Co. Ltd.
Classification Society	Nippon Kaiji Kyokai
Built	2009. Dalian, China
Length / breadth / moulded depth	190m / 32.26m / 18.5m
Gross / net tonnage	33,280 / 19,342
Minimum safe manning	14
Authorised cargo	Bulk cargoes

Voyage Particulars	
Departure port	Las Palmas
Arrival port	Taichung, Taiwan (via Singapore for bunkers)
Distance / duration	11,000 nautical miles / 40 days
Cargo information	47,000 tonnes of phosphate rock
Crew	21

Marine Casualty Information	
Severity of casualty	Very serious marine casualty
Date / time	15:30LT / 30 August 2024
Geographical location	03° 03’S 084° 22’E
Place onboard	Forecastle store
Injuries / fatalities	One fatality
Damage / environmental impact	None
Ship operation	On passage
Stage of passage	Deep sea
External environment	Daylight. Air temperature: 30°C. Clear skies, good visibility, moderate seas, wind: SE’ly Force 5.
Internal environment	Well lit, high humidity.