SUT, MASTS & D'Arcy Thompson Forum

Session 3:

Environmental Impact & Emergency Response

WHERE MINDS MEET

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December 2023

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Plastic Nurdles & Environmental Impact

- The risks to the marine environment from plastic pellets (nurdles) has been highlighted by several shipping incidents.

- Carriage of plastic pellets (nurdles) in freight containers and the action taken within the maritime industry through IMO.

Nurdles

- Nurdles are small, lentil shaped, plastic pellets (about 2-5mm diameter)
- Ubiquitous in plastic production; they are the base material for almost everything made of plastic.
- Generally transported at sea in shipping containers.
- Although/because they are tiny, their potential to have an adverse environmental impact is huge when they enter the marine ecosystem.
- Pervasive and persistent in the marine environment.

Nurdle Numbers

600

nurdles required to make up one small plastic bottle

1,680 tonnes

of nurdles released from the X-Press Pearl

230,000 tonnes

of nurdles estimated to be lost to the environment annually

1 million

nurdles in a typical 25kg bag

58-70 million

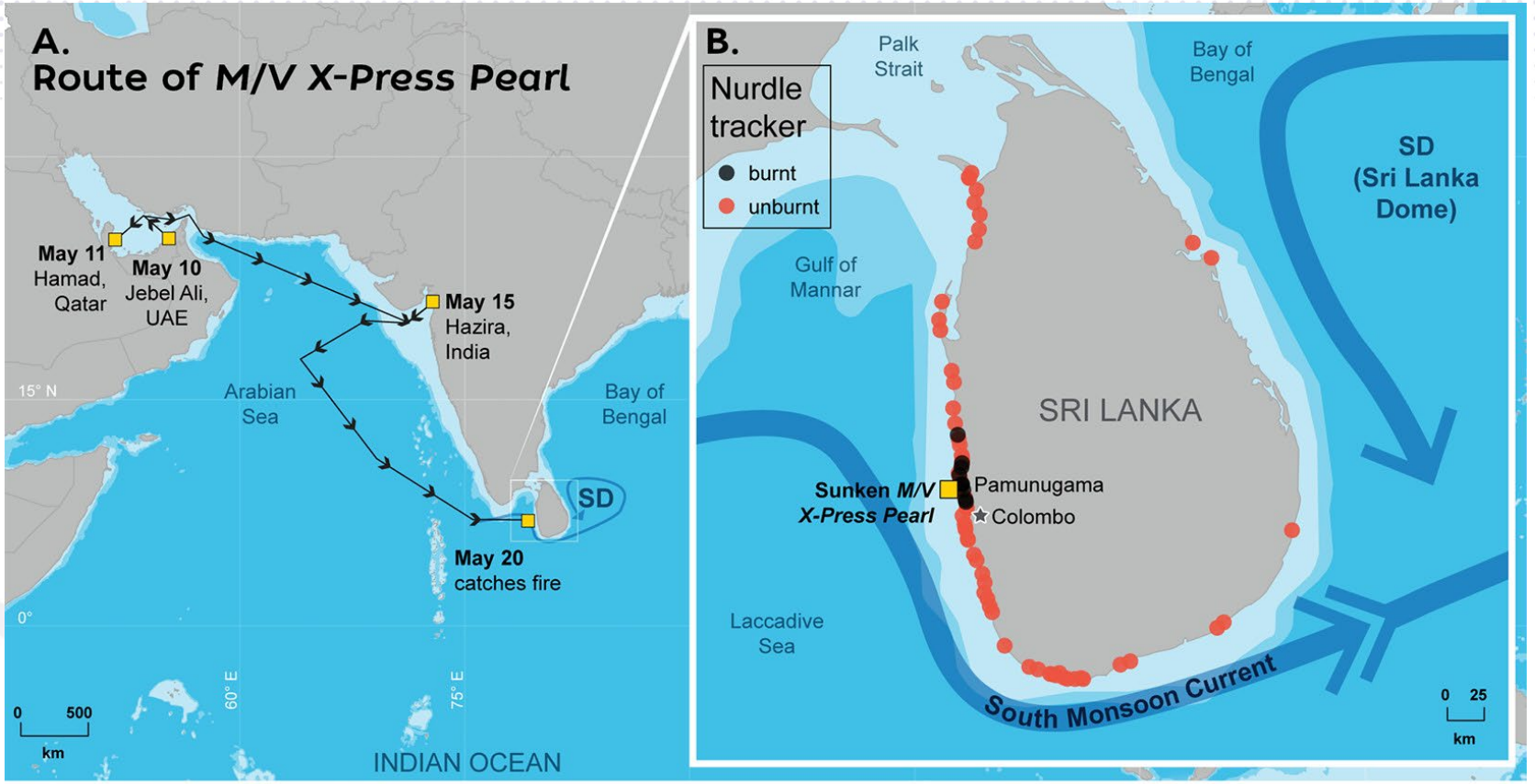
tonnes of nurdles annual production in the EU

9.2 trillion

nurdles estimated to enter the oceans annually

X-Press Pearl Incident

X-Press Pearl Incident



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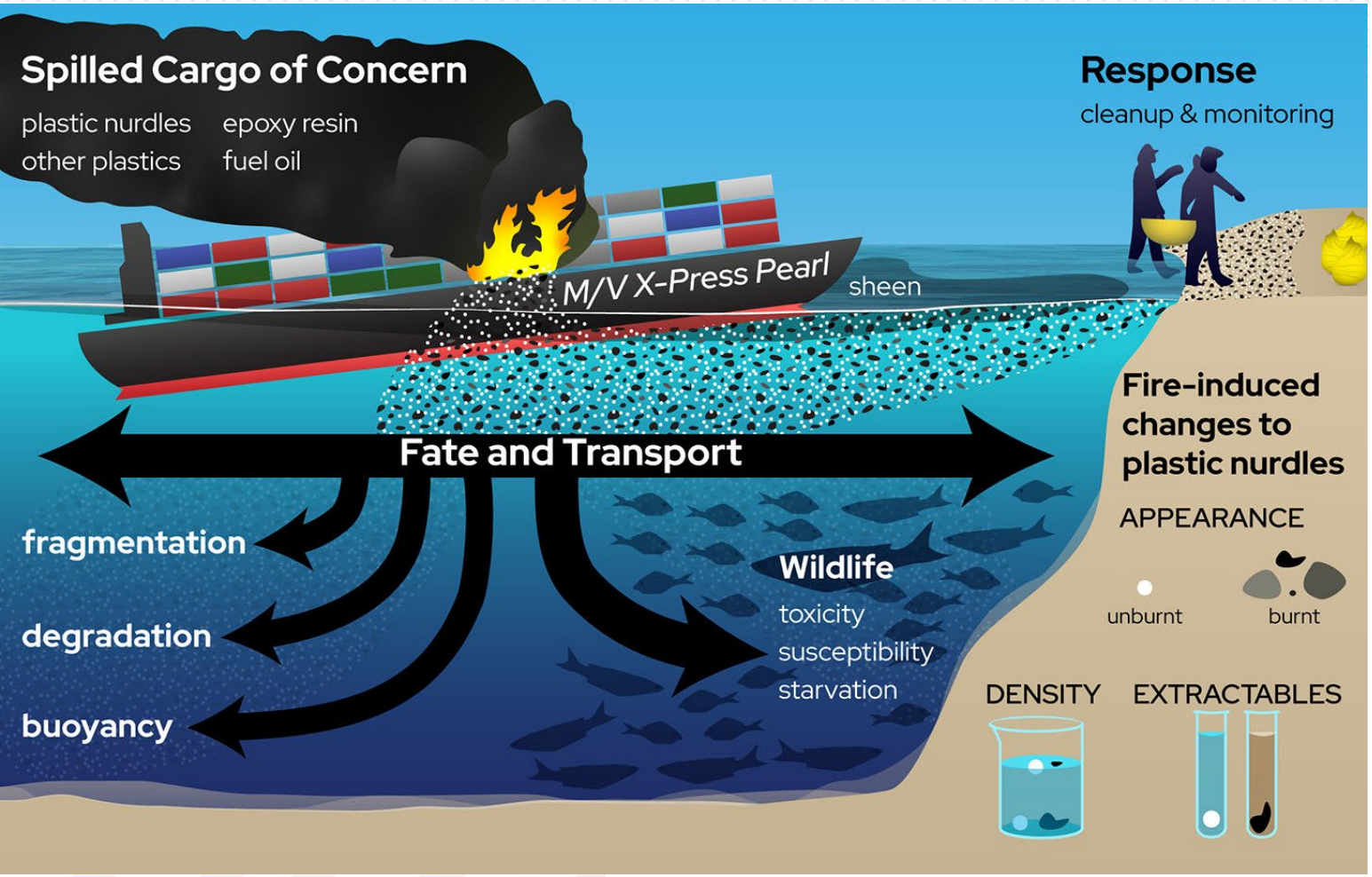
Environmental Impact



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IMO Actions

- Sub-Committee on Pollution Prevention and Response (PPR 10), 24-28 April 2023 (imo.org)
- Marine Environment Protection Committee (MEPC 80), 3-7 July 2023 (imo.org)
- Sub-Committee on Carriage of Cargoes and Containers (CCC 9), 9th session, 20-29 September 2023 (imo.org)

IMO Actions

The PPR sub-committee proposed a two-stage approach to reducing the environmental risk associated with the maritime transport of plastic pellets in freight containers:-

1. The development of a draft circular with recommendations for sea transport of plastic pellets in freight containers addressing **packaging, notification, and stowage,** with a view to approval by MEPC 81 in 2024.
2. The development of amendments to appropriate **mandatory** instruments, which could be informed by the experience gained from the implementation of the voluntary measures.

The MEPC noted that the PPR Sub-Committee has agreed that plastic pellets should not be carried in bulk – **and this is rather good news!**

PPR Sub-Committee Draft Recommendations

Notification – transport information *should* clearly identify those freight containers containing plastic pellets. In addition, the shipper *should* supplement the cargo information with a special stowage request.

Packaging - pellets *should* be carried in good quality packaging which *should* be strong enough to withstand the shocks and loadings normally encountered during transport.

Stowage - freight containers containing plastic pellets *should* be stowed: under deck wherever reasonably practicable; or inboard in sheltered areas of exposed decks.

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DO NOT OPEN
K-PRESS PEARL
SRI LANKA
2021


NOT OPEN
PEARL
LANKA
2021

Lithium-Ion Batteries

Addressing the risks from Li-ion batteries

Lithium-ion (Li-ion) batteries are increasingly impacting shipping safety with a number of fires in shipping containers and onboard roll-on roll-off (Ro-ro) vessels where batteries were a contributing factor.

Decarbonization and electrification are increasing the number of shipping goods that contain Li-ion batteries, from electric vehicles to a wide range of consumer and electronic goods. The global Li-ion battery market is expected to grow by over 30% annually from 2022 to 2030, according to McKinsey.[13] The number of electric vehicles (EVs) is also growing at a fast pace: Nearly 10%[14] of global car sales were electric in 2021, four times the market share in 2019.

The main hazards of Li-ion batteries are fire, explosion, and 'thermal runaway', a rapid self-heating fire that can cause an explosion. They can also produce irritating, corrosive or poisonous gases that cause an explosion in a confined space. The main causes of Li-ion fires are substandard manufacturing or damaged battery cells or devices, over-charging, and short circuiting.

Fires in EVs with Li-ion batteries can burn more ferociously, are very difficult to extinguish, and are capable of spontaneously reigniting hours or even days after they have been put out. Most ships lack the suitable fire protection, firefighting capabilities, and detection systems to tackle such fires at sea, which has been made more difficult by the dramatic increase in ship size.

"Li-ion batteries on their own are not new, and the risks are well documented," says **Captain Randall Lund, Senior Marine Risk Consultant at Allianz Global Corporate & Specialty (AGCS).** "But the explosion of demand for these batteries is flooding the market with new manufacturers, raising questions around quality control. We have seen many fires where the cause has been traced to malfunctioning or damaged batteries."

AGCS has warned about the risks associated with Li-ion batteries in shipping for a number of years, first highlighting this issue in 2017. Its latest report highlights a full list of loss prevention measures to consider.

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Electric vehicles on car carriers and within freight containers

The maritime industry continues to be concerned by fires on board vessels that are associated with Li-ion batteries in electric vehicles (EVs). Studies show that some of the common causes of fires in EVs with Li-ion batteries may be related to internal manufacturing defects, physical damage or substandard quality, internal electrical failure (over-charge, over-discharge, short circuit), and thermal runaway issues. Li-ion batteries are a relatively new technology and there is not yet a consensus on the best design and construction methods for their use in EVs.

Summary

With quickly evolving technology and a lack of consistent regulation, evaluation of the risks of Li-ion battery usage will need to develop over time. In this bulletin we have not addressed the transporting of used (privately owned) vehicles with Li-ion batteries, for example, or the transporting of used/expired or waste batteries. As we experience the life cycle of this battery type, both will need to be further addressed.

If the maritime industry is to improve its incident record related to the transport of these battery types, all parties involved in the supply chain must understand the hazards involved, the most common causes and problems associated with transporting in commerce.

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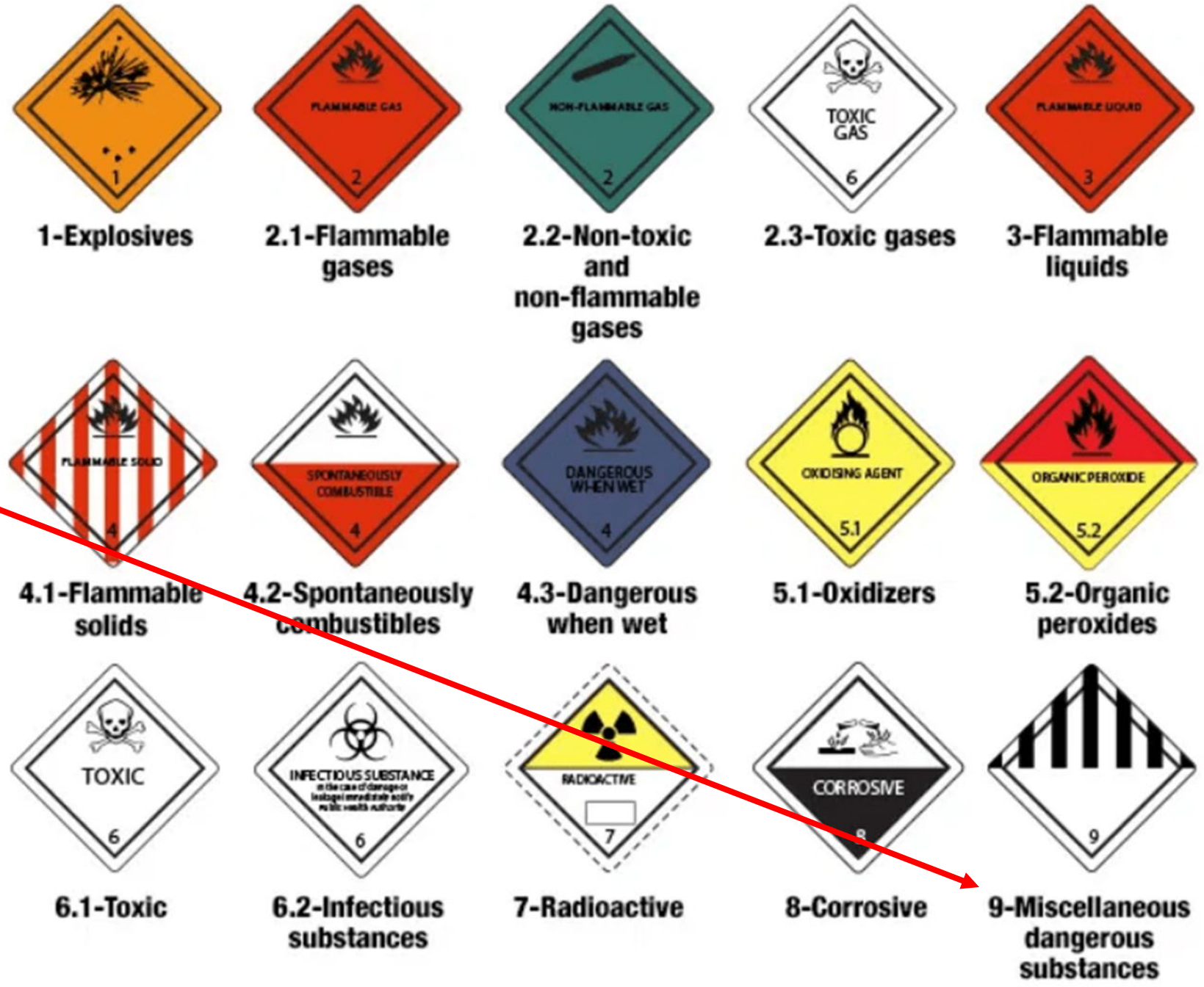
Class 9 Miscellaneous



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Lithium-Ion Batteries

UN 3480 Batteries

UN 3481 Batteries in equipment

UN 3171 EV vehicles

UN 3536 Cargo transport units

Thermal Runaway

- **Mechanical abuse**

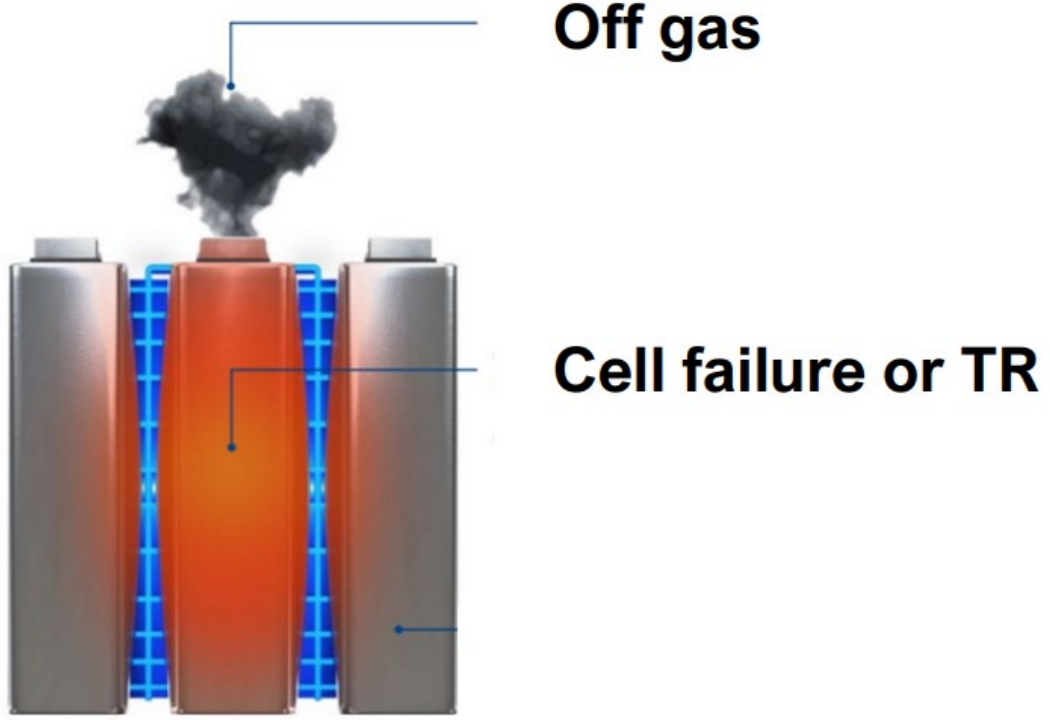
  i.e., puncture

- **Electrical abuse**

  i.e., overcharging.

- **Thermal abuse**

  i.e., next to an external fire



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EV Safe – Australia – facts from around the world

From an emergency responder perspective, thermal runaway looks & sounds like this

Popping - gunshots
Hiss/whistle - gas venting
'Cherry bubblegum' smell
Projectiles - cell debris

Dark vapour cloud,
light vapour cloud
(it's NOT smoke)

At this point, one of two things will occur

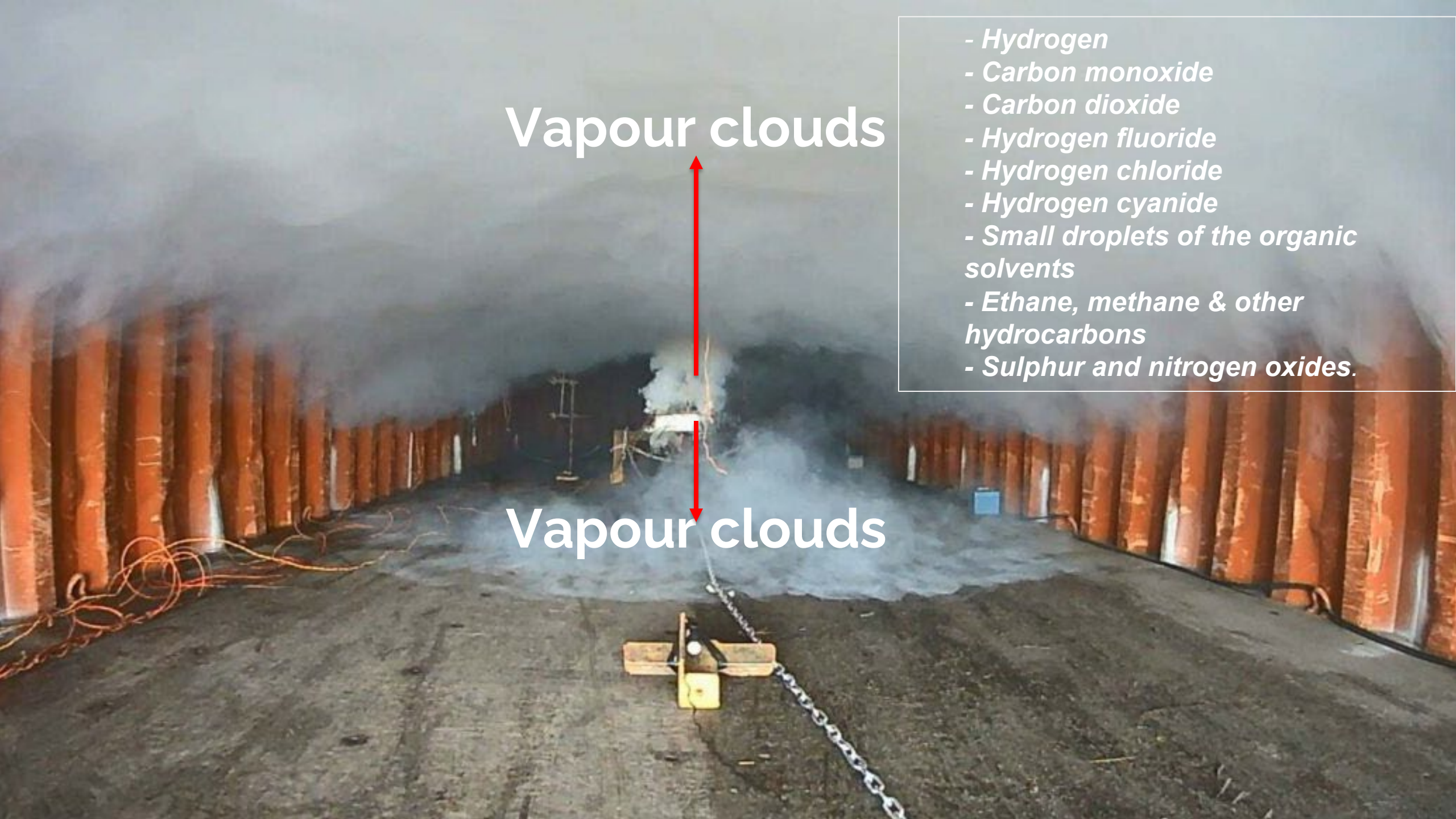
Ignition
Jet like, directional flames

~95%

Vapour cloud explosion
Violent deflagration

~5%

Jet Flame



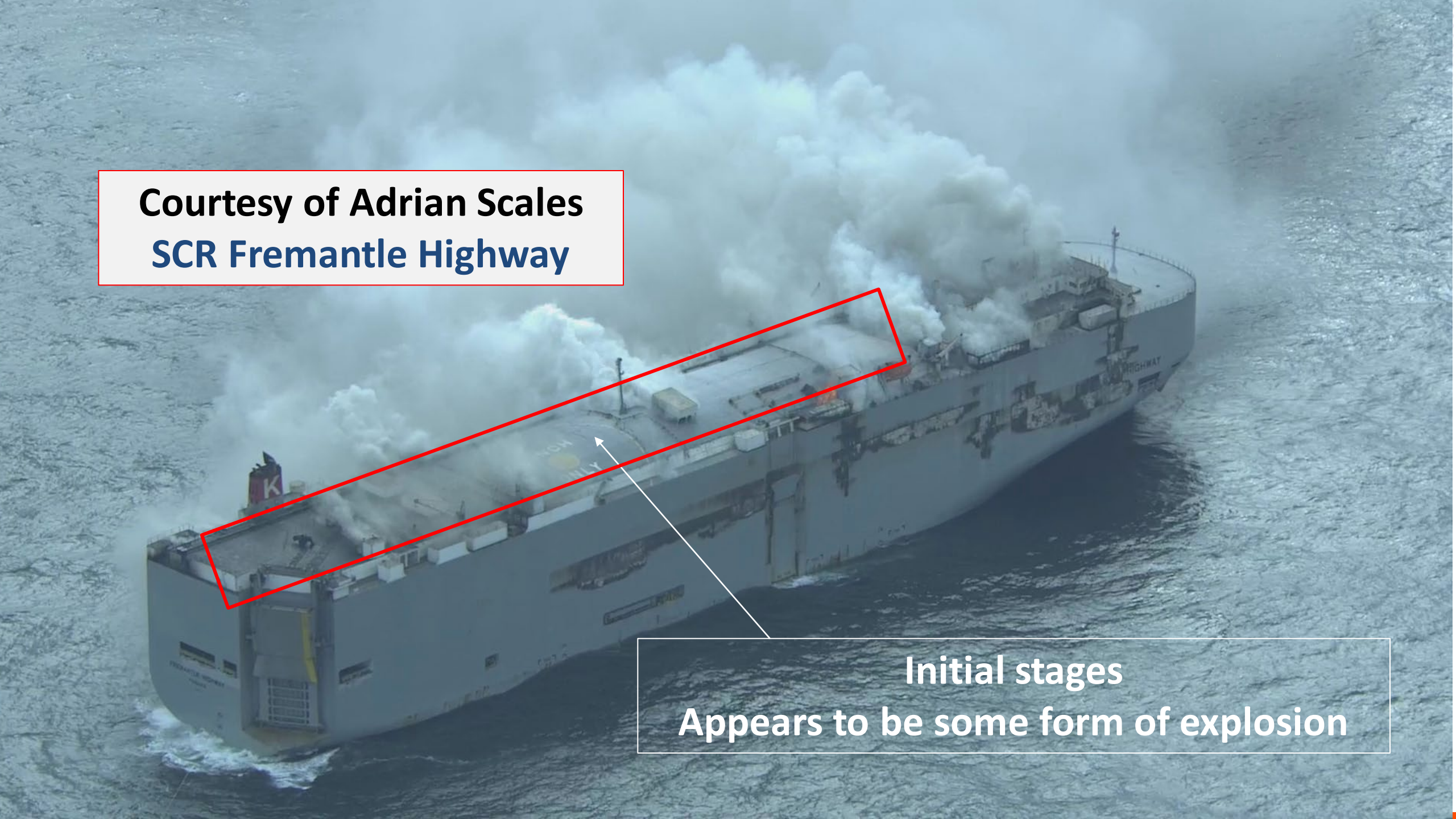
- *Hydrogen*
- *Carbon monoxide*
- *Carbon dioxide*
- *Hydrogen fluoride*
- *Hydrogen chloride*
- *Hydrogen cyanide*
- *Small droplets of the organic solvents*
- *Ethane, methane & other hydrocarbons*
- *Sulphur and nitrogen oxides.*

Vapour Cloud Explosion

CINS September 2021

EV Cars

LIB into containers


Courtesy of Adrian Scales
SCR Fremantle Highway
Initial stages
Appears to be some form of explosion


Internal blast damage


Molten Alloy
stalagmites


Contamination
19.10.2023 15:24


JAC
VAN DER FLIER
VAN DER FLIER
EEMSKRANT.NL

Fixed installations

Discussion on types and impact on LIB fire

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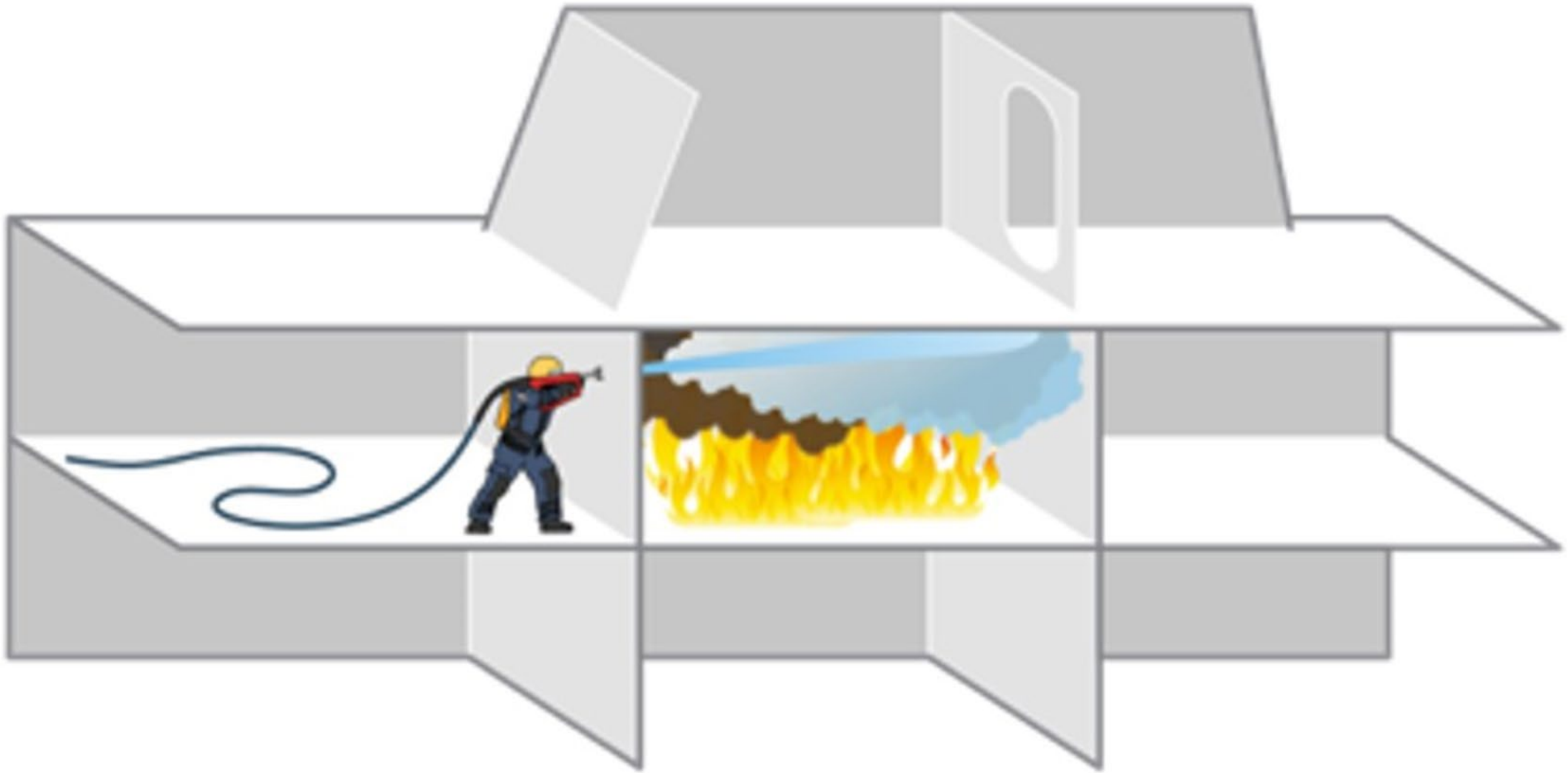
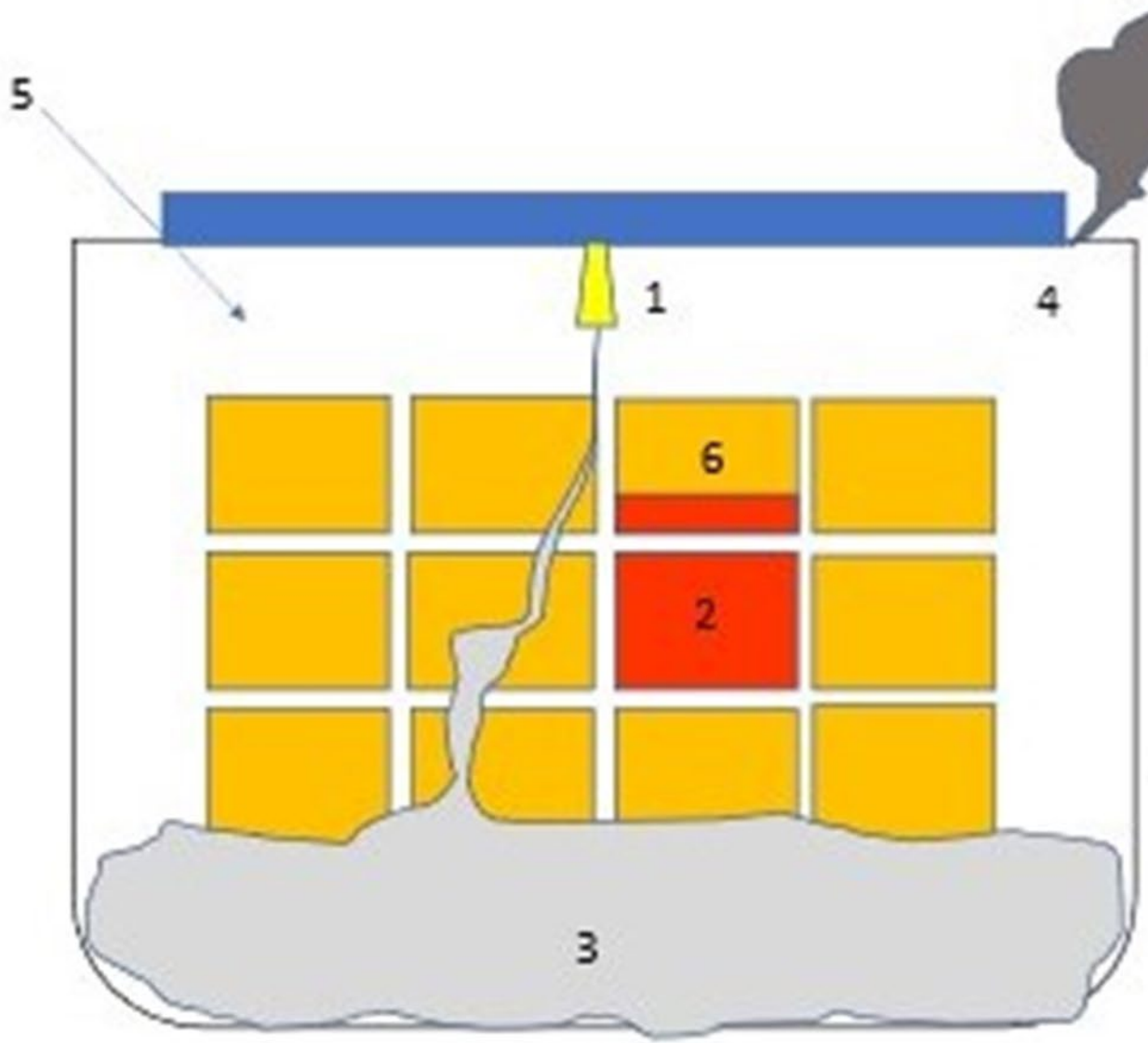
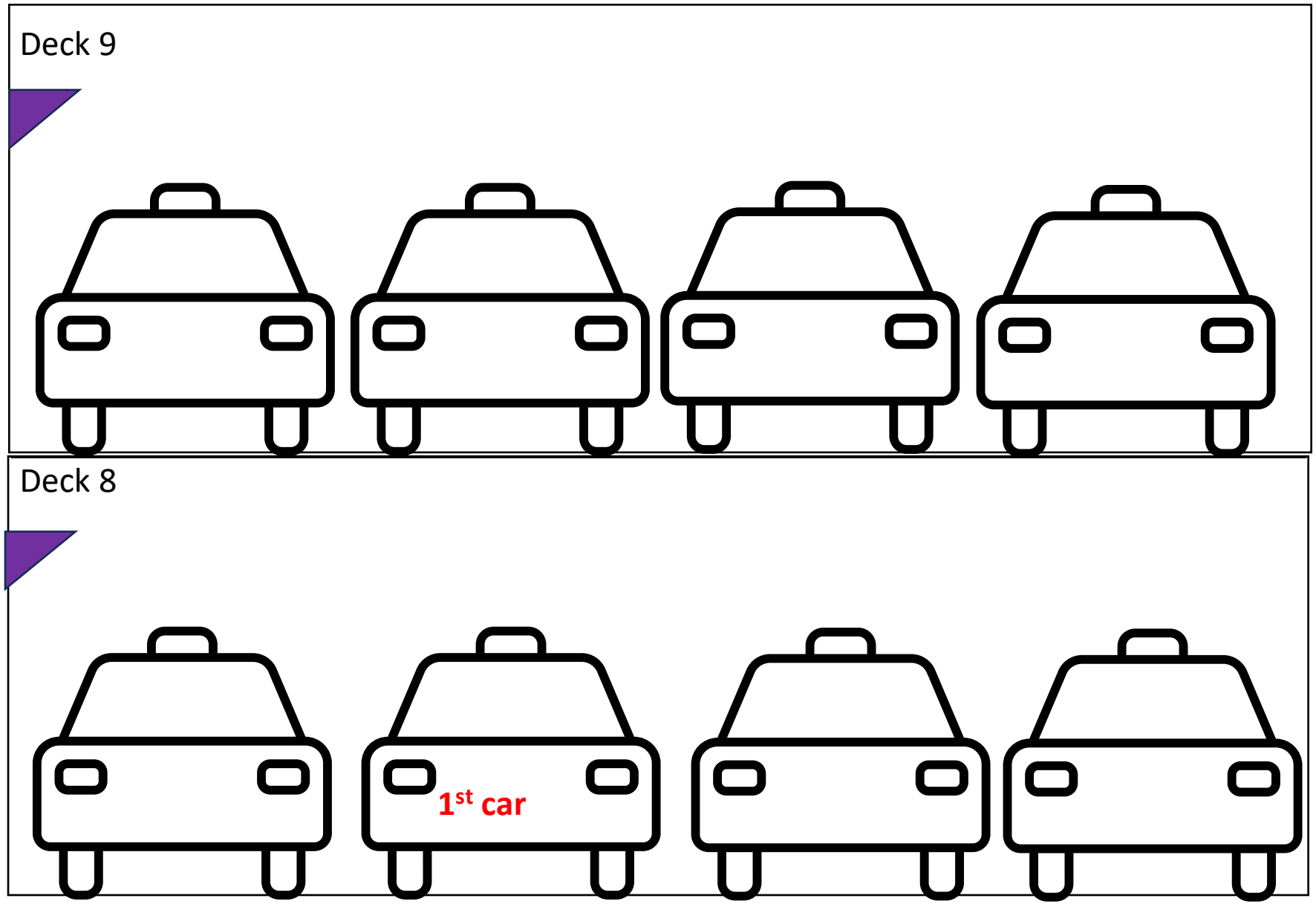


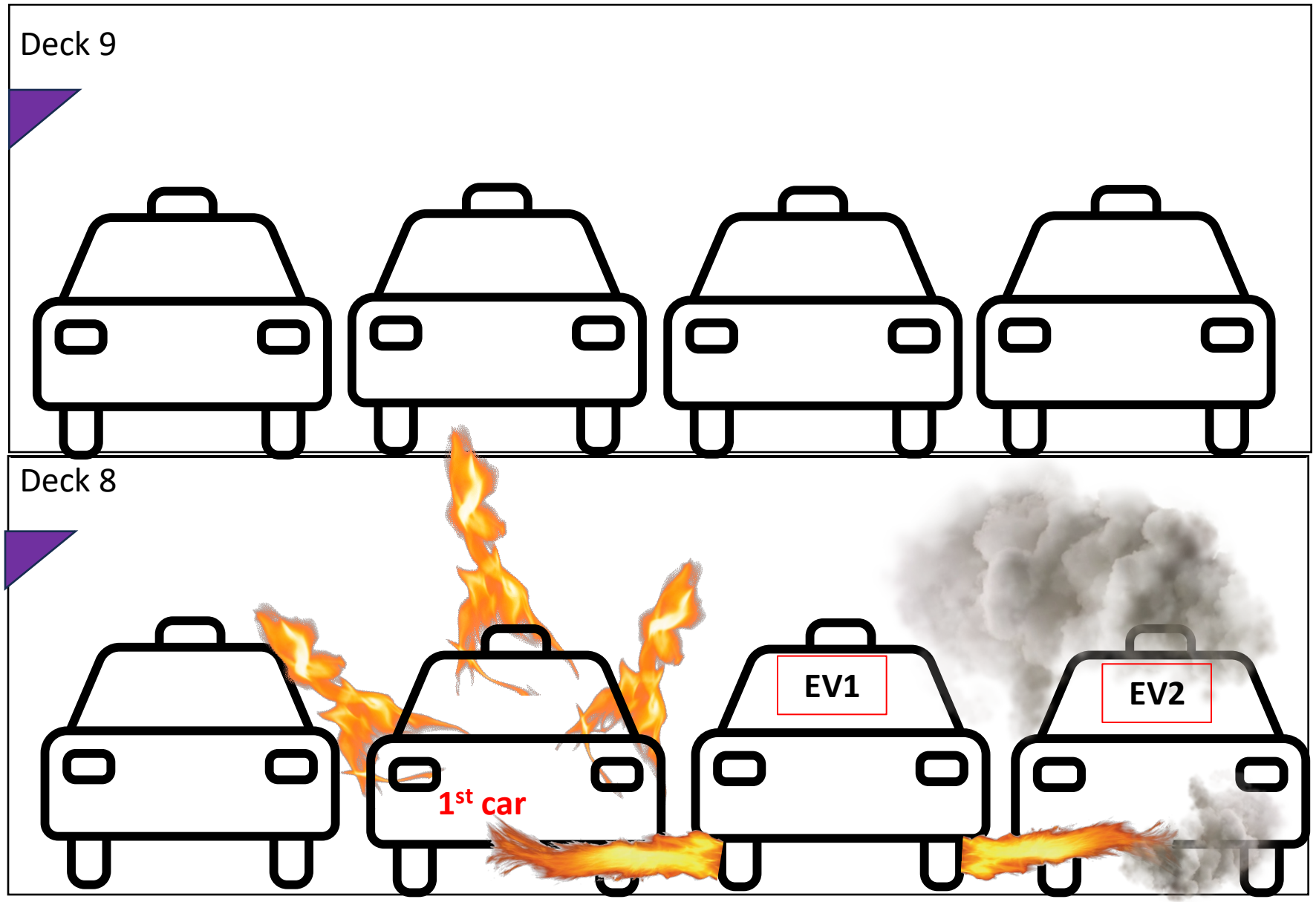

6 sides - boundary cool
Contain & Maintain

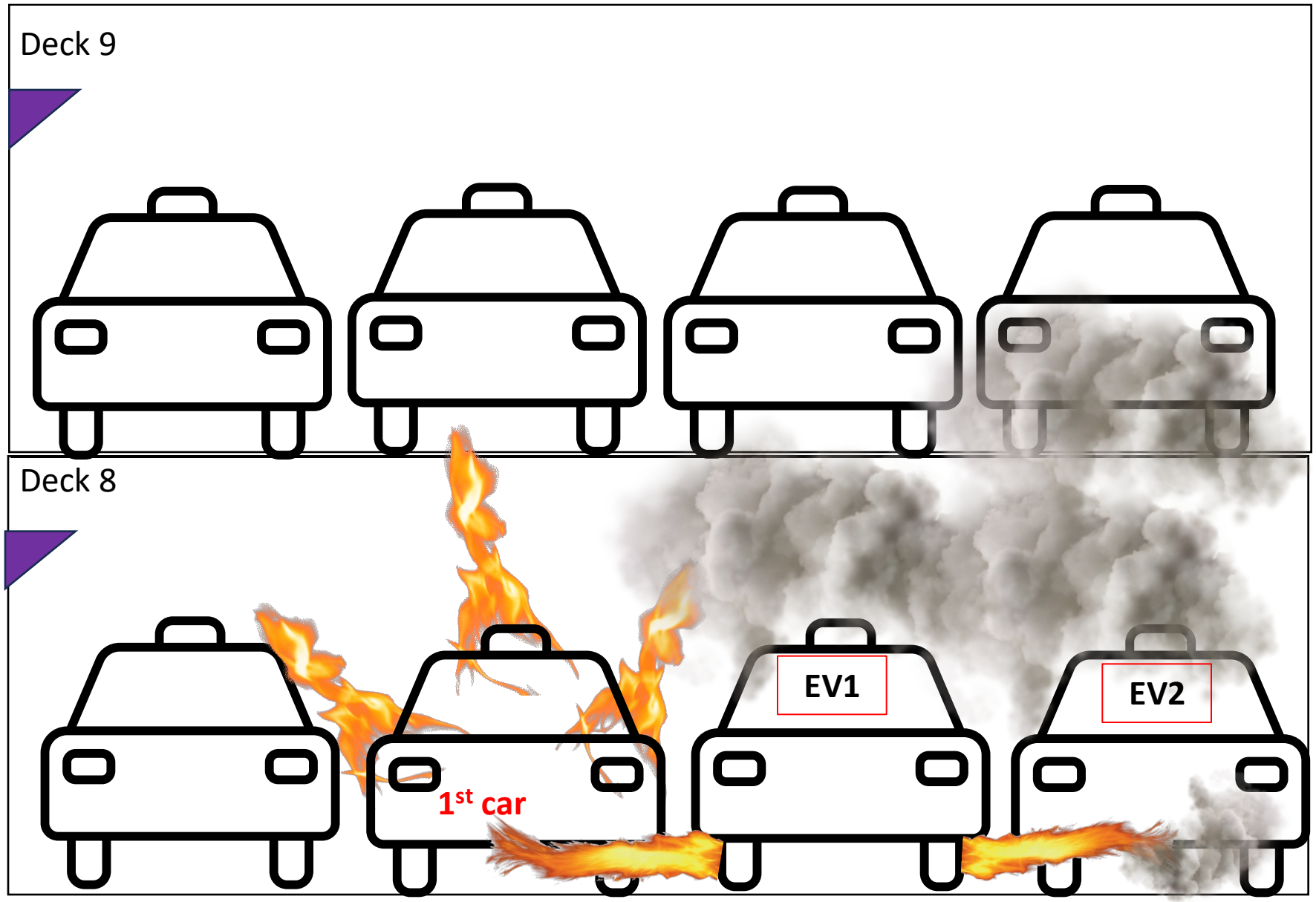
CO_2 in Containerships



1. CO_2 drops to bottom
2. CO_2 doesn't penetrate container
3. CO_2 remains low
4. Smoke escape out hatch
5. Air enters via hatch
6. Heat spreads


Deck 9
Deck 8
1st car


Deck 9
Deck 8
EV1
EV2
1st car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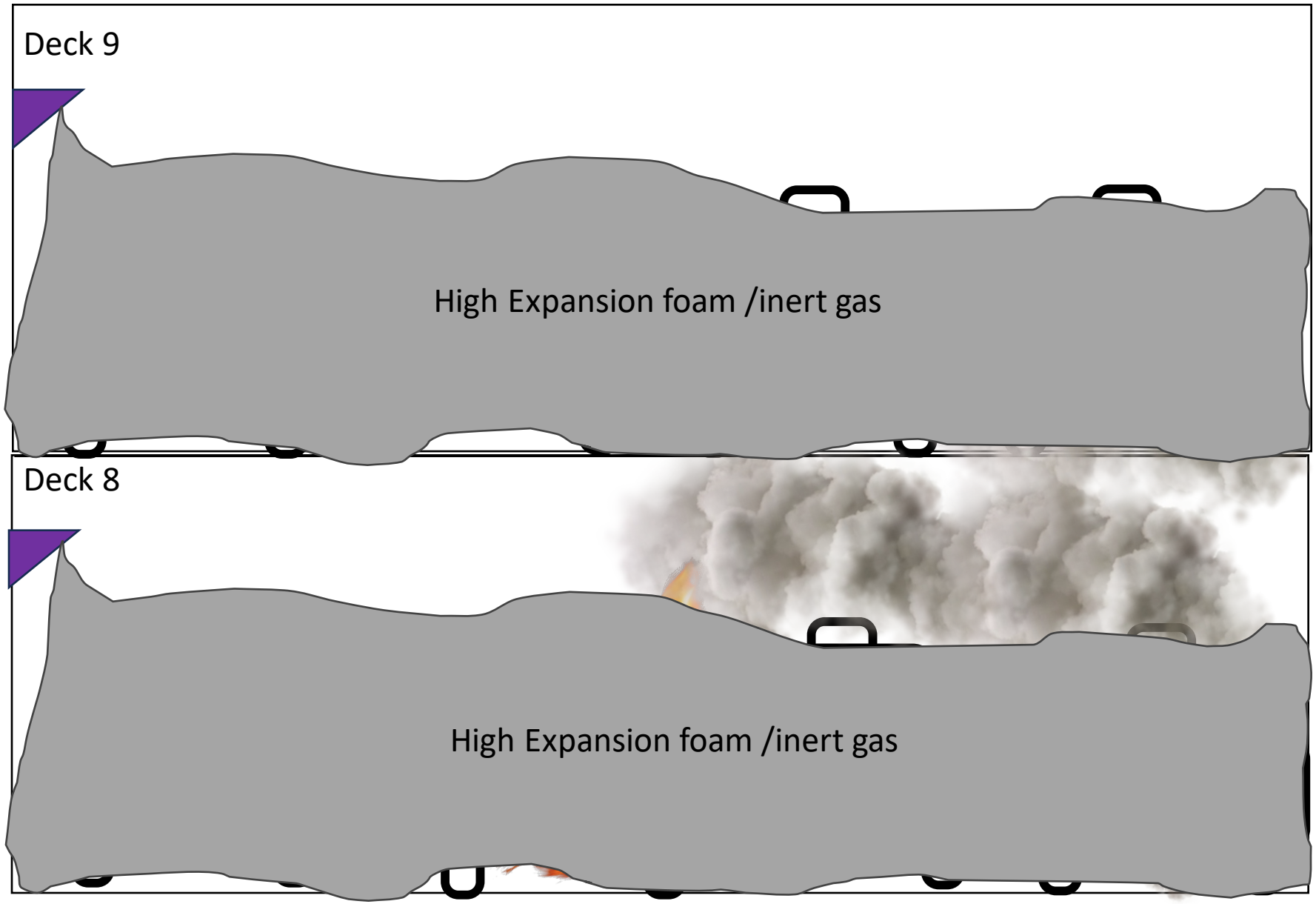
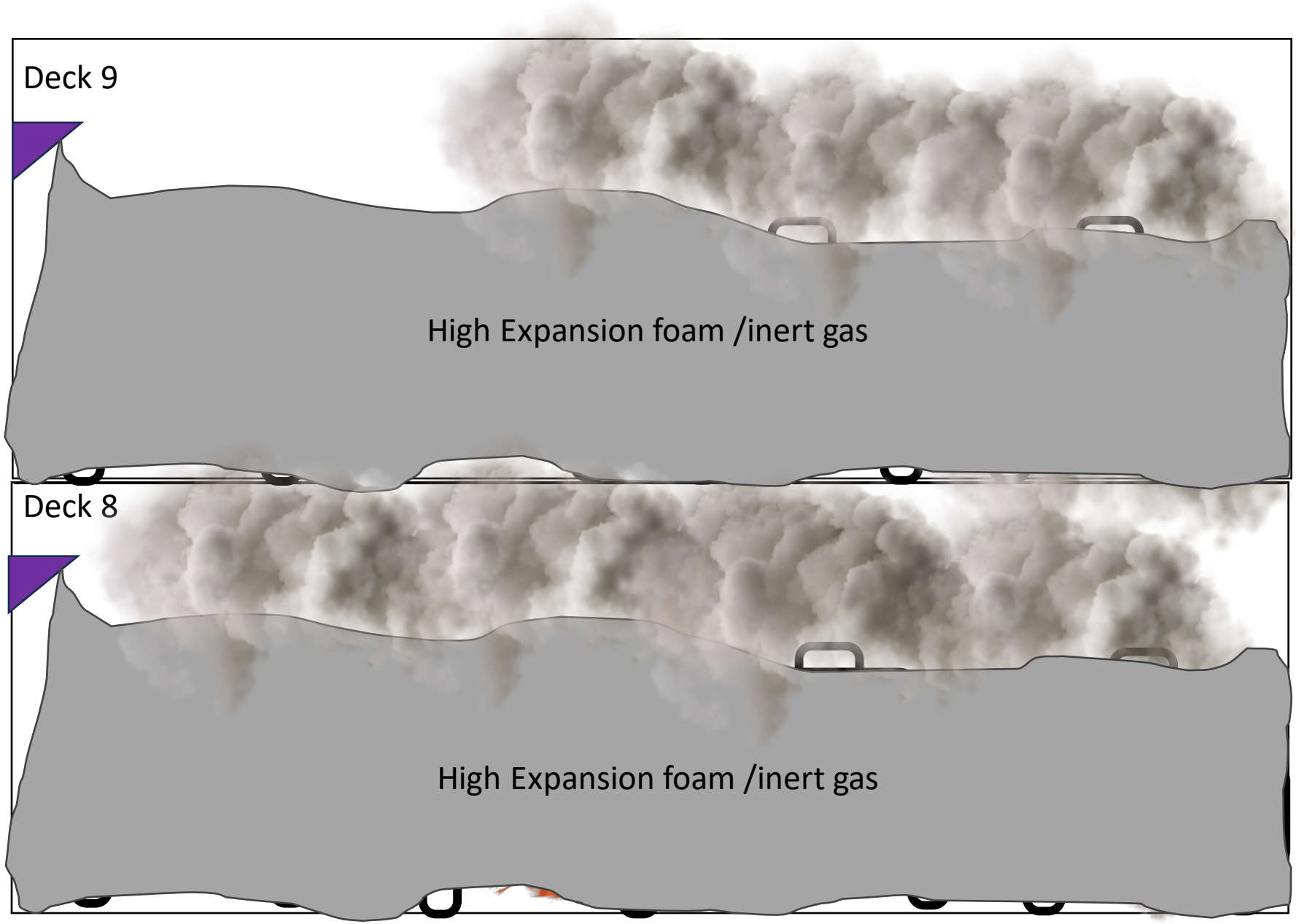

Deck 9
High Expansion foam /inert gas
Deck 8
High Expansion foam /inert gas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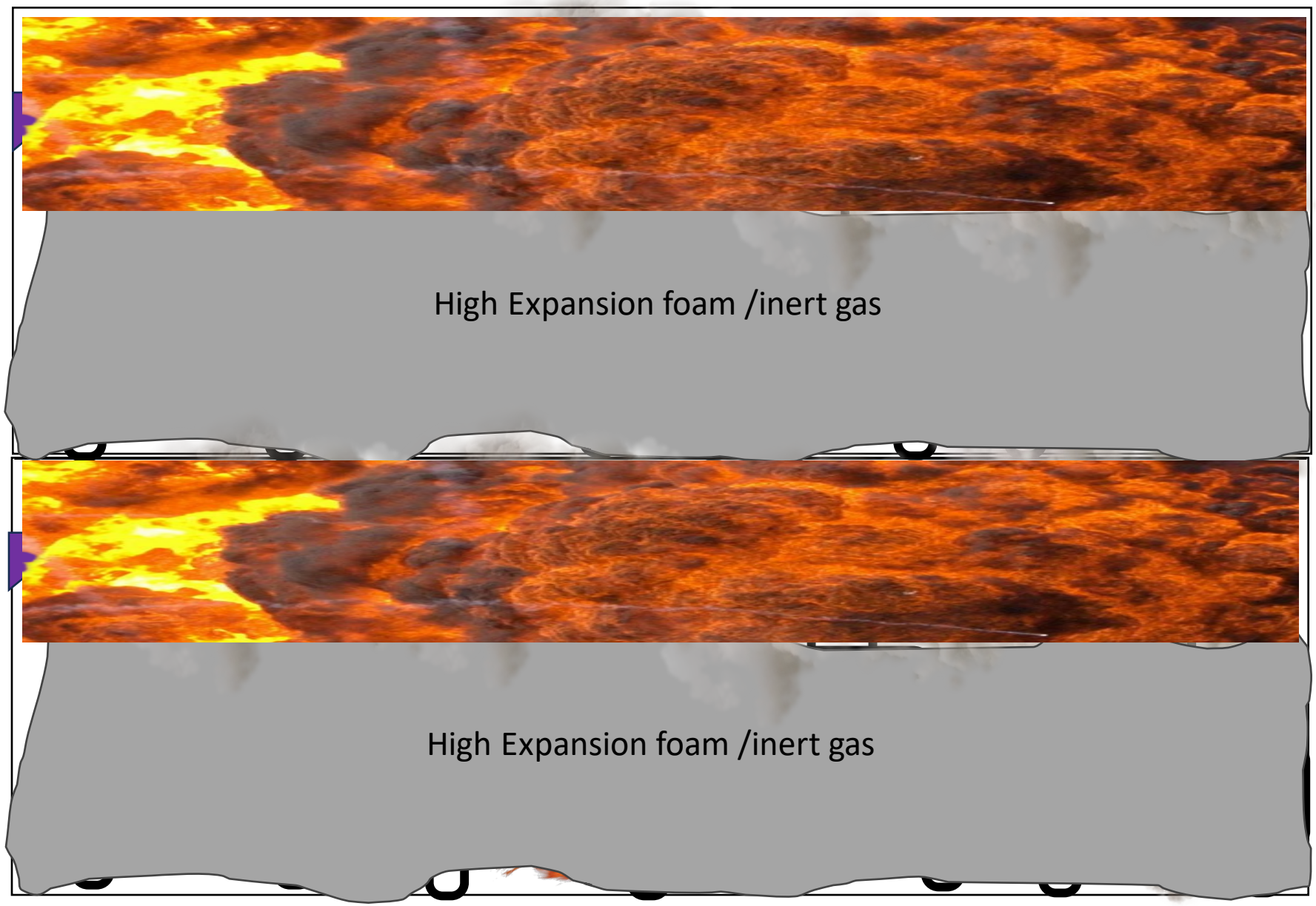
High Expansion foam /inert gas
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QUESTIONS ?

Thank you.

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