Dropsafe®

Drops Prevention Technology

April **2019**

SLIPPING THROUGH THE CRACKS

WHY COST SHOULD NOT BE A BARRIER TO DROPPED OBJECT PREVENTION

CONTENTS

FOREWORD

For those of us working in HSE-focused roles, a common phrase like ‘you can’t put a price on safety’ is distinctly unhelpful.

On the one hand, this implies a refusal to acknowledge that the budget of an HSE manager is finite. On the other, it fails to recognise that health and safety is more than just an expense; it is an investment with a value that extends far beyond the simple fact of keeping personnel safe.

Across numerous industries, from Oil and Gas exploration and extraction to Power Generation, Mining and Maritime, the challenge of mitigating dropped object (DO) risks is being met admirably, often in the face of considerable financial pressure.

HSE decision makers on tight budgets recognise that there is no ‘one-size-fits-all’ solution to the problem. Consequently, a wide range of prevention mechanisms have been adopted to mitigate DO risks. These include nets to prevent loose fixtures falling from height, tethers to secure handheld tools, and more recently barriers to stop objects falling down stairwells or from elevated walkways.

Not all of the products and solutions available are created equally however. While most of the technologies on offer provide a suitable short-term means of mitigating the safety threat posed by Dropped Objects – and the financial and reputational impacts an incident may entail – not all of them constitute a suitable long-term investment.

The problem is that, while there is slow progress towards standardisation of DO prevention mechanisms across industries, HSE decision makers often lack a clear benchmark for assessing the quality and lifetime cost of the available options. It can be difficult to answer the question ‘how much should I be spending on DO mitigation?’ More transparency is needed in this respect to support informed procurement and empower HSE decision makers to adopt innovative and cost-effective solutions that not only ‘do the job’, but deliver long-term value.

This whitepaper has been developed with this challenge in mind; looking in depth at one particular DO prevention technology - the barrier. We provide a critical assessment of how our own product, the Dropsafe Barrier, stacks up against the other most commonly used solutions in the market in terms of upfront cost, quality and long-term maintenance requirements.

In doing so, we are not showing that ‘you can’t put a price on safety’, but that cost is not a *barrier* to effective Dropped Object mitigation.

As ever, we invite you to get in touch with your queries, feedback and comments.

All the best,

Mike Rice

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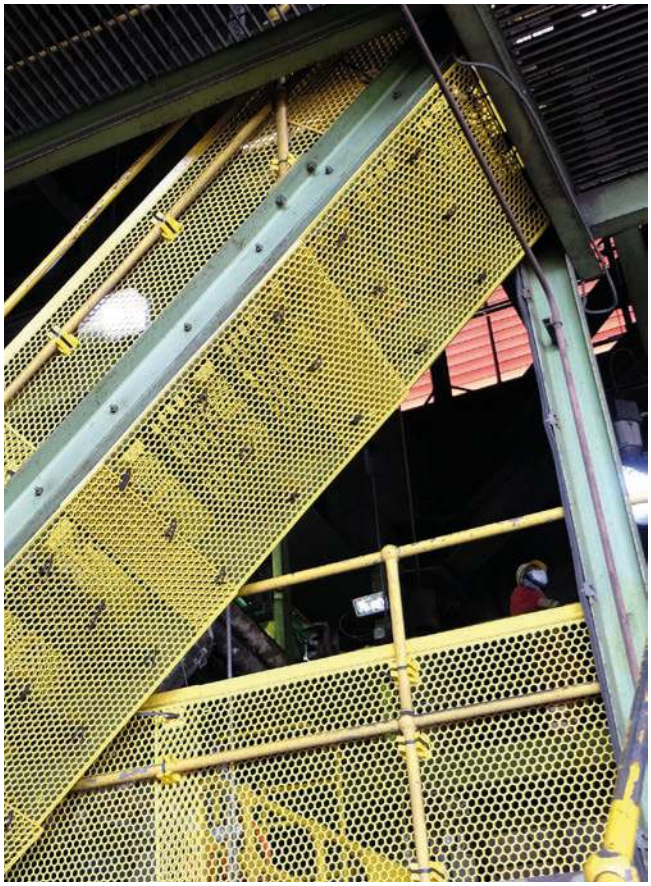
BARRIERS: THE BASICS



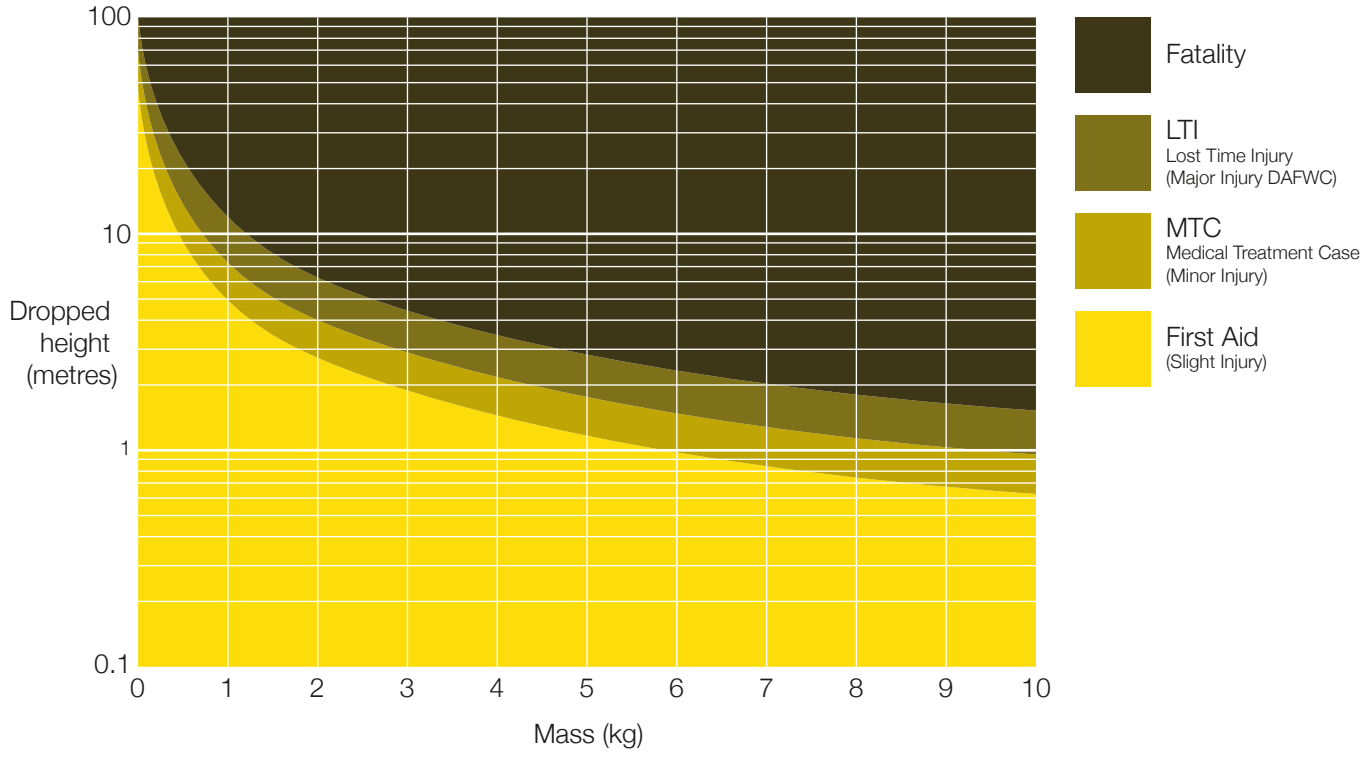
WHAT EXACTLY IS A ‘BARRIER’ AND WHAT DOES IT DO?

For complete clarity, when we refer to a ‘barrier’, we mean a system which attaches to the guardrailing upon elevated walkways, stairways and access ways of either permanent or temporary structures to prevent loose items falling from height. These items include tools, handheld devices and other items. DROPS defines a DO as any item that falls from its previous position. This covers all items, materials or objects of any mass / density. DOs may be classified as static or dynamic[1].

[1] *http://www.dropsonline.org/frequently-asked-questions/*

Classification of DOs by drop height and object mass

Reproduced from DROPS Calculator.
For full details see http://www.dropsonline.org/assets/documents/DROPS-Calculator-Metric-A4.pdf



CASE STUDY 1:

HAMMER IS KICKED FROM WORK BASKET ON DRILLING RIG

/ INDUSTRY

Oil & Gas

/ INCIDENT

A 2.3 kg hammer falls 10 feet to the Driller's side of a substructure on a drilling rig, where it strikes an employee on the hard hat. The hammer creates a pinch point between the hard hat and safety glasses thus resulting in a laceration below his left eyebrow.

/ CIRCUMSTANCES

An employee operates a work basket inside the substructure using the shop hammer to break out the annular hydraulic lines. He drops the hammer to the bottom of the work basket and whilst moving about the basket to arrange the chain hoist, accidentally kicks the hammer out of the basket.

/ IMPACT

Employees were reminded of the importance of tethering/securing any tools when working overhead, even when working in a work basket. Additionally, the work plan for operating in a work basket must be reviewed to include the importance of keeping the lift basket orderly.

/ ANALYSIS

This incident could have been prevented if a robust barrier system was installed on the work basket so that in the case of the hammer being dropped to the man-basket floor, if kicked, it wouldn't fall from the platform.

WHY IS THIS IMPORTANT?

Elevated walkways and stairways are particularly high-risk areas for DO incidents due to the large gaps between railings and the fact that there are often personnel walking below. A DO incident, in simple terms, occurs where equipment damage, personnel injury or fatality is caused by an item falling from height.

This DO risk is certainly not industry exclusive. As highlighted by organisations such as DROPS, IADC and IMCA, it is now becoming a focal point for HSE professionals in numerous industries. These include upstream oil & gas facilities, refineries, chemical plants, power stations and marine; any sector where working at height or on elevated platforms is common practice.

It is also a global issue; Safe Work Australia[2] reported that a total of 227 people died between 2003 and 2012 as a consequence of being hit by a falling object, making up about 9% of total fatalities in the workplace.

Furthermore, the Health and Safety Laboratory[3] reported that in 2009, DOs were the most significant direct cause of incidents in the UK offshore sector, accounting for 30 incidents out of 67. Subsequent industry reports widely acknowledge that DOs are one of the largest single causes of injuries and fatalities in the global offshore industry.

Reliable incident reporting remains a significant challenge for the HSE sector, and this impacts the quality of data available. Many DO incidents and near misses simply go unreported. Despite this, a number of case studies and incident reports exist in the public domain where objects falling through gaps in railings have struck and caused injury to personnel. Here we include two examples.

DO incidents such as these not only constitute a safety risk to personnel and equipment; they also threaten severe financial, reputational and legal consequences. To date there remains a lack of standardisation when it comes to recommended DO prevention technology, and an absence of clear-cut regulation. Across multiple sectors, this has put the emphasis on leading businesses and their HSE decision makers to 'self-regulate' with their use of DO prevention systems.

Investing in robust barriers is an essential part of a proactive DO mitigation strategy. Those who install barriers early on, particularly prior to commencing operations or maintenance periods, are best placed to avoid a serious incident.

[2] https://www.safetysolutions.net.au/content/height/article/stop-the-drops-658165180
[3] Dropped Objects in the UK Offshore Sector – Underlying Causes of Offshore Incidents FP 09/21 – UK HSE Hoare. J, Johnson, M – 2009

CASE STUDY 2:

SWIVEL COUPLER DROPPED FROM SCAFFOLD PLATFORM STRIKES CREWMAN

/ INDUSTRY

Marine

/ INCIDENT

A crewman ascending a ladder to reach the access/egress of a scaffold platform, is struck on his right arm by a dropped object. The object, a swivel coupler (scaffold material), strikes the crewman then falls down, under the scaffold platform.

/ CIRCUMSTANCES

The crewman stops working, informs a nearby foreman and asks other crewmen working in the vicinity if they witnessed the incident. As no one saw exactly what happened, the origin of the dropped object is unknown.

/ IMPACT

The foreman made a fresh visual risk assessment of the scene which included proper housekeeping (swivels stored on the boards next to gate/access) and discussion of the potential consequences of dropped objects.

/ ANALYSIS

This incident could have been prevented had a barrier system been installed. The temporary stored swivel couplers were stored too close to the ladder access/entrance of the platform. This is a common set up for scaffolding and, without a barrier system in place on the scaffold platform, there is a high risk that objects stored on these platforms fall through openings. While this particular incident occurred in the maritime sector, scaffolding is used across a wide range of sectors, meaning that this could have happened almost anywhere.

UNDERSTANDING BUDGET PRESSURES

Although using barrier solutions to mitigate DO risks may seem at face value like an obvious choice in high-risk industries worldwide, it is important to acknowledge the commercial pressures that inform HSE procurement decisions. Indeed 'boom and bust' cycles in the global energy and commodities markets have had a direct impact on the way DO risks have been tackled to date.

Looking at the offshore Oil & Gas market as an example, despite a gradual increase in global demand, drilling contractors and oil producers are cautious of over-investing in infrastructure while margins are tight. In real terms, this means that bringing oil rigs back online is being done with one eye firmly on cost.

For HSE decision makers, this presents conflicting challenges. The immediate priority is to ensure a safe environment for personnel as they return to work. Many rigs have spent a number of years 'stacked' offshore, exposed to the elements and with limited maintenance. During this time, fixtures and fittings may have corroded, increasing the risk that they will fall from height and pose a threat upon their return to service. A robust long-term DO mitigation strategy would successfully tackle this risk during rig reactivation.

This is particularly critical, since workforce expansion and rotation during an industry upturn may see the introduction of inexperienced personnel onto rig fleets, who may lack specific safety training.

DOs are not the only on-site risk however, and working with a limited budget HSE decision makers must pick their battles and choose solutions that are financially viable in the short term. This could mean assigning funds to an entirely different area, or more commonly making compromises and seeking cost savings during the procurement process for DO prevention mechanisms.

This, coupled with a lack of industry-wide standardisation, has resulted in a wide array of solutions being adopted. While self-regulation from the major players continues to drive up standards, there is still substantial variation in quality. Some solutions do not provide a suitably robust means of DO mitigation, and many, while coming in at a low upfront cost, require extensive ongoing maintenance that leads to substantial long-term labour and parts expenditure.

These cost pressures are not exclusive to Oil & Gas; Mining, Marine and other industries see this kind of cyclical boom and bust, and therefore stand equipment down in leaner times.

When it comes to barriers, solutions deployed across these sectors range from welded expanded metal, to bolted metal grating, and clipped-on polymer guards. Each solution has its immediate advantages and disadvantages, but, when it comes to financial decision making, it is important to understand that installing a barrier is not a one-off solution, but a long-term investment.

LEADING BARRIER PRODUCTS: LIFECYCLE COST COMPARISON

Price is not the only factor influencing the procurement of DO prevention technology. Each of the most commonly deployed barrier systems on the market has unique technological and practical pros and cons – many of which depend on the circumstances and environment in which they are being utilised.

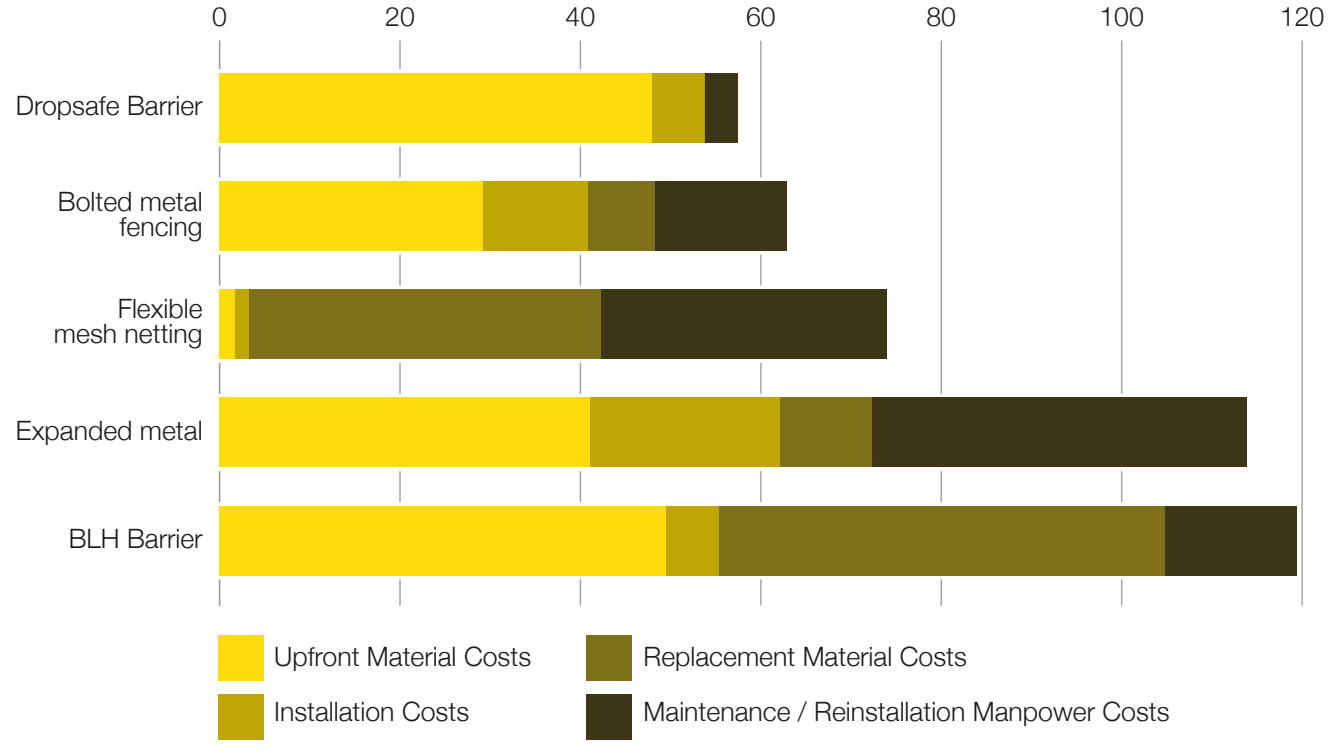
As we have already mentioned, however, cost remains an important consideration for buyers of HSE systems. In this context, it can be easy to seek a short-term fix for a long-term challenge by adopting the product with the lowest upfront cost.

While this approach may reduce immediate capital expenditure, it can have a knock-on effect on long-term operational costs. It is important, therefore, not to look at the initial barrier installation in isolation, but to consider the cumulative costs of using the product over a given period.

Indeed, with most barriers in use over a period of multiple years – and subject to degradation throughout this time – costs associated with partial or full replacement, maintenance and the associated manpower may far outweigh the upfront material and installation costs. This can significantly tip the balance in favour of more robust, versatile and ultimately *safer* solutions that have a higher upfront cost, but require no replacement and minimal maintenance over their lifecycle.

To demonstrate this, we undertook a lifecycle cost comparison of the 5 most popular barrier types currently used in harsh environments, including the Dropsafe Barrier. This analysis is based on the installation and use of 300 metres of barrier for a period of 5 years on a typical site. It shows that, while the upfront cost of the Dropsafe Barrier is greater than some of the other options, it is the most cost-effective choice over this 5-year period.

Safety barrier competitive cost comparison over 5 years (USD thousands)



THE COST OF DOWNTIME

This analysis does not take into account missed revenues incurred as a result of asset downtime. In sectors where availability is a core metric, the cost of downtime may far outweigh equipment, installation and maintenance costs.

Taking the offshore Oil and Gas sector as an example, the typical day rate for a drilling rig is, at the time of writing, 75k-$250k USD per day. As a rule, solutions which require labour-intensive installation, such as hot works, alongside regular reinstallation and maintenance, also lead to the greatest amount of downtime. Hot works cannot be undertaken in the vicinity of hydrocarbons or personnel, adding further potential downtime.

Due to the fire risk involved in undertaking hot works in the vicinity of hydrocarbons, the area in question must often be cleared of personnel.

5-YEAR TOTAL COST ANALYSIS

(Lowest to highest cost)

Dropsafe Barrier
The Dropsafe Barrier has the second highest upfront material cost but the second lowest installation cost. While most other products will require partial or full replacement during the 5-year period, the Dropsafe Barrier is guaranteed under warranty to last for the full 5 years without replacement, therefore has the lowest maintenance and reinstallation costs.

Bolted Metal Fencing
Bolted metal fencing is a robust solution with the second lowest upfront material cost but second highest installation cost. It requires no full replacement during 5 years of operation but does require regular long-term maintenance. The components used for attaching the system also pose a significant DO risk.

Flexible Mesh Netting
Flexible mesh netting has both the lowest upfront material and installation costs but is a low-grade temporary solution that is subject to swift degradation due to environmental factors, therefore requiring regular replacement. As such, despite low initial costs, it has the second highest replacement and maintenance and reinstallation costs.

Expanded Metal
Expanded metal barriers have variable upfront material costs, but all require welding and ‘hot works’, resulting in the highest installation cost of any solution. Furthermore, they require significant manpower to inspect, paint and keep fully operational long-term, with the highest maintenance costs.

BLH Barricading
The BLH barrier solution has comparable upfront material and installation costs to the Dropsafe Barrier. Crucially, however, it experiences swift degradation when subjected to UV exposure and is only covered under warranty for 2 years. This means it must be uninstalled and fully replaced before the end of the 5-year period, doubling the total cost.

LEADING BARRIER PRODUCTS: KEY ATTRIBUTES

In this section we will detail the wider attributes, pros and cons of the most commonly adopted DO prevention barriers. While each of these solutions has its strengths, it is important to weigh them up against each other to ensure that your HSE investment is well-placed.

DROPSAFE® BARRIER

The Dropsafe Barrier consists of robust high-grade polymer panels that are secured along the inside of guard railings, using a universal attachment system. The solution has been engineered to tackle many of the common challenges experienced with other barrier systems on the market.

In particular, while metal barriers may corrode, and other non-metal systems are subject to relatively swift degradation as a result of UV and weather exposure, the Dropsafe Barrier retains its rated impact resistance and structural integrity for a minimum of 5 years – backed by a 5-year warranty.

At the time of writing, it is the only DO barrier to have achieved Type Approval from the American Bureau of Shipping (ABS) under the DOPP+ certification scheme[4]. This certification verifies the manufacturing quality of the product and enables users to demonstrate a commitment to upholding the highest safety standards. Additionally, the product is fully recyclable, reducing its overall environmental impact.

KEY ATTRIBUTES

/ LIFETIME

- 5+ years, backed by a 5-year warranty

/ INSTALLATION

- Fully supported through specifically tailored online training programme
- Universal attachment system with minimal components.
  No hot works required in installation, which can be conducted by rig crew
- Minimal tools required for installation

/ PERFORMANCE

- Small honeycomb aperture (19 mm / 0.75”) suitable for 250 km/h (155 mph) winds – enough to withstand a Category 5 hurricane
- Withstands 5 years of UV exposure
- UL94V0 fire resistance
- High chemical resistance
- Wide operating temperature range

/ OTHER

- Certified by the American Bureau of Shipping under DOPP+ Type Approval
- Unique ability to test a ‘sacrificial section’ of the barrier for degradation at the end of warranty

[4] *https://ww2.eagle.org/en/Products-and-Services/offshore-energy/exploration/dropped-objects-prevention-program.html*

BOLTED METAL FENCING

Bolted metal barriers are retro fitted to existing guardrail of platforms, stairs and walkways, attaching to a compatible bracket design. Typically, using this type of barrier involves the installation of a frame upon which it can attach. These barriers provide coverage along the total length of a handrail system including the internal and external corners. Bolted metal fencing is often used for security fencing but can be used as a barrier for walkways and platforms at height. It is subject to corrosion and thus requires long-term maintenance.

KEY ATTRIBUTES

/ LIFETIME

- Can have up to 5 years warranty and can be used for 5+ if maintained effectively

/ INSTALLATION

- Power and hand tools required for installation
- Potential hazard of components becoming dropped objects (e.g. bolts) during and after installation

/ PERFORMANCE

- High impact rating
- V0 fire resistance
- Requires a high level of maintenance post-installation, including painting and coating when used in harsh offshore environments
- Deforms on impact
- Risk of accelerated corrosion due to galvanic reaction with metal railings

/ OTHER

- Ability to cover and fit complex shapes and structures
- Not compliant with offshore best practice

FLEXIBLE MESH NETTING

Flexible Mesh Netting is the least robust solution to dropped object risk, made of connected strands of fiber, or other flexible or ductile materials and attached to rails on walkways at height. It is quick and simple to procure and install but is easily damaged in harsh environments, such as offshore.

KEY ATTRIBUTES

/ LIFETIME

- Up to 12 months in low UV environments

/ INSTALLATION

- No tools required to install
- Minimal number of attaching components, however typically attached using cable ties

/ PERFORMANCE

- Low UV resistance
- Low impact and heat resistance

/ OTHER

- Readily available, with limited procurement time

EXPANDED METAL

An expanded metal barrier is a commonly deployed solution, formed of a type of sheet metal which has been cut and stretched to form a regular pattern (often diamond-shaped) of metal mesh-like material. During manufacturing, it is never completely cut and reconnected, allowing the material to retain its strength.

Expanded metal is a widely-adopted solution to dropped object hazards across industries such as aerospace, automotive and construction.

KEY ATTRIBUTES

/ LIFETIME

- Variable – dependent on user's maintenance programme

/ INSTALLATION

- Installation requires specialist tradesmen and a high level of labour, including hot works and painting
- Minimal number of attaching components

/ PERFORMANCE

- Weldment installation enables expanded metal barriers to take withstand high impact from all directions
- High level of degradation due to lack of corrosion resistance - requires regular maintenance, including painting or coating
- Profile will cause excessive loading on guardrailing in high winds

BLH BARRICADING

The BLH Barricade is a clipped-on plastic system. The modular BLH system can be installed on various configurations of guardrailing. The system has been third-party tested for category 3 winds. It is covered under warranty for a period of 2 years.

KEY ATTRIBUTES

/ LIFETIME

- 2 years, backed by a 2-year warranty

/ INSTALLATION

- Simple attachment system with wide range of components. No hot works
- Minimal tools required for installation

/ PERFORMANCE

- UV sensitive 2 years after installation
- Wind resistance of 180 km/h (110 mph), minimal wind loading on installed structures
- Wide operating temperature range

/ OTHER

- Compliant with a range of international safety standards

CHOOSING YOUR BARRIER: PROCUREMENT CHECKLIST

The economic and safety arguments for installing a robust and versatile barrier system are clear. However, it is important to acknowledge that HSE decision makers must not only present a business case to senior management, but also hold suppliers to account during procurement discussions to ensure that the solution they install effectively meets their long-term needs.

With this in mind, the checklist here contains a number of the key questions HSE decision makers should ask their barrier supplier.

PROCUREMENT CHECKLIST

WHAT SHOULD I ASK MY BARRIER SUPPLIER?

INSTALLATION

Installation is a key constituent of the total lifetime cost of using a barrier, particularly if the system is set to be removed and / or reinstalled. Understanding this cost should be a critical part of procurement decision making.

How many hours of manual labour will be required to install and remove the barrier?	
Are specialist tools required to install the barrier?	
Is adequate training provided for installation and removal?	
Is there a dropped object risk during installation?	
Can the barrier be installed as a permanent or temporary measure?	
Can the barrier be installed with minimal attaching components?	

PERFORMANCE AND DURABILITY

Knowing how long a barrier system can withstand the elements, particularly in offshore applications, is essential to understanding the impact of long-term maintenance costs on HSE budgets. The duration of manufacturer warranties is an indication of how long the product can be safely used.

Will the product require maintenance post-installation?	
Will the barrier still be fully effective 5 years after installation?	
How long is the product under warranty?	
What is the impact resistance of the product?	
What is the chemical resistance of the product?	
What is the fire resistance of the product?	
What is the wind resistance of the product?	
How many years of UV exposure can the product sustain?	
What is the rated temperature range?	

WHY CHOOSE DROPSAFE? COMMERCIAL CASE STUDIES

COMMERCIAL CASE STUDY 1
ROLLOUT ACROSS A GLOBAL O&G DRILLING FLEET

A major offshore drilling contractor has set an industry benchmark for DO mitigation with its fleet-wide rollout of the Dropsafe Barrier.

Following on from the successful installation of 700 metres of Dropsafe Barrier panels on a vessel stationed in Singapore – a process which was conducted in just 7 days – the system has now become an integral part of the firm's HSE strategy. The Barrier is now the recommended solution for DO risk mitigation on walkways across the company's fleet of drill ships and platforms.

KEY DRIVERS

- **Speed of installation**: The Dropsafe Barrier proved much more efficient to install than other products on the market, with 700 metres fitted within one week
- **Versatility**: Existing steel mesh barriers were difficult to remove for cleaning and access, elevating long-term maintenance costs
- **Performance**: The Dropsafe Barrier showed that it could stand up both to the harsh offshore environment and the heat of Singapore

COMMERCIAL CASE STUDY 2

ESSENTIAL MAINTENANCE AT A MAJOR POWER STATION

A leading energy operator has undertaken a major installation of the Dropsafe Barrier at a power station in Hong Kong. The system has been installed to mitigate DO risk during essential maintenance operations - with technicians working at height to conduct vital inspections and repairs on furnaces and boilers.

Initially, 3000 meters of the barrier was installed – enough to safeguard two out of a total of eight furnaces on site. Following the success of this initial installation, the barrier is now being rolled out across the whole facility.

KEY DRIVERS

- **Universal attachment system**: When conducting such a large-scale rollout, ease of installation was a crucial attribute, requiring minimal training and saving time for the installation team

- **Installation cost**: This versatility ensured the initial installation cost came in at a level far below competitor products

- **Manufacturing quality**: The certified manufacturing quality of the Dropsafe Barrier means that the power station owner has confidence that no compromise is being made on long-term safety

ABOUT DROPSAFE

Dropsafe is the leading provider of dropped object prevention solutions for the global Oil & Gas, Mining, Marine and industrial sectors, with a range of innovative and patented products including its pioneering mesh-safety products.

Dropsafe has come to set the industry standard for Drops prevention in the onshore and offshore energy sectors, collaborating with industry professionals to lead the market in enabling customers to improve workplace safety. This involves the development of customised safety solutions to tackle project-specific challenges.

Dropsafe's track record in the industry is illustrated by its global customer base encompassing exclusive fleet-wide agreements with the largest Oil & Gas drilling contractors.

To find out more, visit: **www.dropsafe.com**

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