

Dropped Objects Prevention

A BEST PRACTICE

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About Energy Safety Canada

Energy Safety Canada is the oil and gas industry's advocate and leading resource for the continuous improvement of safety performance. Our mission is to help companies achieve their safety goals by providing practices, assessment, training, support, metrics and communication.

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Preface

PURPOSE

This best practice is designed to provide industry and companies with an established framework and strategies on how to manage and prevent dropped objects. Every company's risks of dropped objects will vary. As such, each one's control strategies may be slightly different to reflect the work environment and associated risks and challenges but should take into consideration the various components discussed in this document.

HOW TO USE THIS DOCUMENT

This best practice is intended to assist in the development, maintenance and on-going improvement of dropped object prevention.

Dropped objects prevention includes a variety of components that may already be addressed in a company's programs such as working at height, cargo securement, dangerous tree control, etc. As such, the prevention of dropped objects is an umbrella approach that encompasses all these components. It is not the approach of this best practice to re-work these components, but rather to bring them together in a comprehensive approach to prevent dropped objects.

PROJECT SCOPE AND LIMITATIONS

This best practice has been prepared to provide general guidance. A variety of work has already been completed on dropped objects by DropsOnline.org. The intention of this best practice is to leverage the successes of the DropsOnline program while creating a resource that is inclusive of the specific needs of the onshore Canadian work environment.

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Introduction

This best practice is designed to assist companies in the development, maintenance and on-going improvement of dropped objects prevention. Dropped objects are often more prevalent in relation to offshore exploration and production and onshore drilling and construction activities as these sectors have more risk factors. However, the risk of dropped objects exists in all facets of the industry. This document is an opportunity to establish a broader, risk-based focus on the prevention and management of dropped objects and the serious incidents that could result.

Serious incidents from dropped objects are usually associated with personal safety, meaning the focus is on injury to workers. One of the top categories of worker fatalities within the oil and gas industry is “contact with objects and equipment” and this category is dominated (60%) by the sub-category “struck by object” which is most often a falling object. The most up-to-date fatality data is available at EnergySafetyCanada.com.

A potentially serious incident (PSI) is any event where a reasonable and informed person would determine that under slightly different circumstances, there would be a high likelihood for serious injury to a person. Within the Alberta OH&S Oil and Gas PSI data, “struck by falling object” is one of the top categories. For more information on PSIs, visit EnergySafetyCanada.com.

A focus on incidents rather than injury, and persons rather than workers is inclusive of process safety incidents. Process safety is concerned with managing and preventing the release of hazardous substances that can lead to catastrophic incidents. A dropped object has the potential to damage infrastructure and result in the release of hazardous substances such as crude oil, natural gas, etc.

1.1 DEFINITION

A dropped object is defined as an object that falls from a height and either causes or has the potential to cause an injury, asset damage or process safety event. This object can be of any size or mass, can fall from any height and may be dropped unintentionally or intentionally.

Dropped objects are often defined when the drop occurs above some defined height, for example above the height of an average worker (i.e. higher than 2 m or 6 ft.). It is important to note that although this criterion may be convenient, it is often not in line with risks and what is observed in the workplace.

For example, a large section of pipe that rolls off a work bench can represent significant risk of injury if it impacts a worker’s legs or feet but may only be just over 1 m (4 ft.) off the ground. Similarly, workers conducting work below grade, such as in a caisson or in the cellar of a drilling rig, are at risk for dropped objects from above.

Dropped objects are typically grouped into one of two categories based on the type of energy involved in the drop. Static dropped objects fall because of gravity. Dynamic dropped objects fall because of other hazardous energy, and then gravity takes over. Those other hazardous energies include:

- Motion
- Mechanical
- Electrical
- Pressure
- Chemical
- Biological
- Sound
- Radiation
- Temperature

1.2 ACTIVITIES

Many activities are associated with dropped objects, including:

- Working at height
- Use of hand tools
- Mechanical lifting
- Cargo securement
- Unloading and loading
- Working near a dangerous tree (dead, prone to drop, etc.)
- Product and material storage
- Construction
- Simultaneous operations
- Facility turnarounds
- Helicopter longlining

It is not the intent of this best practice to rework existing control strategies or regulatory requirements, but rather to leverage existing programs and controls under the umbrella of dropped object prevention.

1.3 LIFE SAVING RULES - INDUSTRY ACCEPTED STANDARD

In the fall of 2018, Energy Safety Canada released an industry accepted standard on Life Saving Rules. This standard consists of 10 rules, two of which relate directly to dropped objects:

Line of Fire

Keep yourself and others out of the line of fire

- I position myself to avoid:
 - Moving objects
 - Vehicles
 - Pressure releases
 - Dropped objects
- I establish and obey barriers and exclusion zones
- I take action to secure loose objects and report potential dropped objects



LINE OF FIRE

Working at Height

Protect yourself against a fall when working at height

- I inspect my fall protection equipment before use
- I secure tools and work materials to prevent dropped objects
- I tie off 100% to approved anchor points while outside a protected area



WORKING AT HEIGHT

Other Life Saving Rules with an indirect connection to dropped objects are Safe Mechanical Lifting, Bypassing Safety Controls and Fit for Duty, which reference barriers and exclusion zones, prohibit walking under a suspended load and ensuring that workers are in a state to perform work safely.

Energy Safety Canada's [Life Saving Rule Explanation Guide](#) provides additional guidance and information about the roles and responsibilities of supervisors and workers.

1.4 "ARE YOU IN THE LINE OF FIRE?" PROGRAM

Energy Safety Canada's "[Are You in the Line of Fire?](#)" program includes the Life Saving Rules (unsafe behaviours) as well as other unsafe conditions not covered by the rules. Those who sign up for the program also have access to several resources in relation to dropped objects such as activity packages and inspection sheets.



2.0 Roles and Responsibilities

Responsibilities for dropped object prevention span a diverse group within organizations and industry.

2.1 PRIME CONTRACTOR/OWNER

The prime contractor is responsible for:

- Ensuring that a dropped objects program is in place.
- Communicating potential hazards and dropped object requirements (pre-qualification, contract and work planning requirements, etc.) to employers and self-employed persons.
- Ensuring the activities of multiple employers (simultaneous operations) do not create dropped object hazards.
- Ensuring compliance with the applicable Occupational Health and Safety legislation, including incident reporting.

2.2 EMPLOYERS

Employers are responsible for:

- Implementing a dropped objects program commensurate with the risks in their operations.
- Ensuring compliance with the applicable Occupational Health and Safety legislation, including incident reporting.
- Identifying and assessing the risks associated with dropped object hazards.
- Implementing a hierarchy of controls for elimination or control of hazards.
- Communicating potential dropped object hazards.
- Building capacity within the system of controls to prevent dropped objects and resulting serious injury and fatalities.
- Providing adequate training and guidance to workers and supervisors on how prevent dropped objects.

2.3 SUPERVISORS

Supervisors are responsible for:

- Ensuring the necessary planning, equipment, safeguards, work procedures and work execution are undertaken to prevent dropped objects.
- Ensuring all incidents are investigated and corrective action is taken.
- Being competent in the company programs and legislative requirements.
- Ensuring workers under their direction are competent and aware of all hazards, including dropped objects.

2.4 WORKERS

Workers have a duty to themselves, other workers, members of the public and their employer. As such, workers are responsible for:

- Notifying their employer of any dropped object hazards or near misses.
- Following all dropped object program requirements.

2.5 THIRD-PARTY INSPECTORS/AUDITORS

Third-party inspectors are responsible for:

- Conducting inspections or audits considering the risk factors identified in this best practice.
- Supporting companies and clients in the prevention of dropped objects.

3.0 Risk Factors

Risk is a combination of likelihood and consequence.

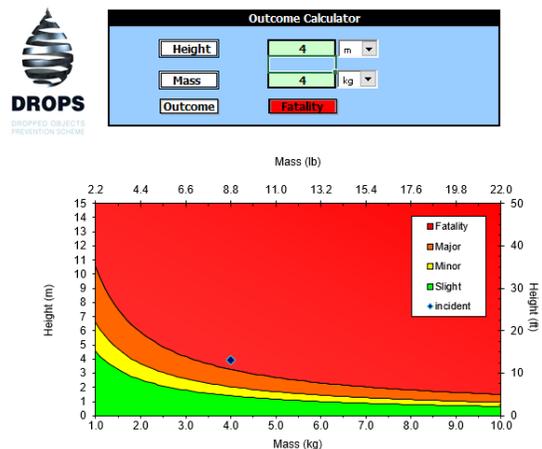
3.1 CONSEQUENCE

The dropped object calculator provided by DropsOnline.org provides an easy way to assess the consequence of personal injury from a falling object based on its mass and the height of the drop. The calculator can be downloaded at DropsOnline.org.

The DROPS Calculator assumes the following:

- A blunt object is dropped
- Standard personal protective equipment (PPE) is worn
- The height of the worker is included in the calculation (i.e. do not subtract the height of the individual)

Figure 2. DROPS Calculator



In addition to personal injury, dropped objects can result in process safety incidents leading to the release of hazardous substances such as toxic and flammable process chemicals. This can occur either because the dropped object is a chemical (e.g. a drum of flammable/toxic material that falls off a storage shelf), or because the dropped object impacts infrastructure containing chemicals (e.g. small-bore piping).

Dropped objects may also be an ignition source (e.g. sparks and slag that fall during hot work or dropping an object that creates a spark upon impact).

3.2 LIKELIHOOD

The factors contributing to the likelihood of an object falling are grouped into three categories: activities, fixed items and structures, and occupancy.

Activities:

Working at Height or Below Grade - When work is conducted at height adjacent to workers or when work is conducted at least 2 m (~6 ft.) below grade. This category includes the use of hand tools.

Line of Fire - When work is conducted at height and workers are in the direct path of a potential dropped object.

Lifting Activities - Lifting activities may introduce materials and equipment overhead, which creates the potential for dropped objects. Lifting activities include the use of cranes, pickers, forklifts, hoists or helicopters for lifting and unloading activities.

Fixed Items and Structures:

Fixed items and structures have many risk factors that influence their likelihood to drop. These risk facts are detailed in Table 1 below.

Table 1: Fixed Items and Structure Risk Factors

RISK FACTOR	TYPE AND DESCRIPTION
Vibration	Equipment that is regularly transported.
	Vibrations are part of routine operations.
	Located in an area where earthquakes in excess of 5.0 on the Richter scale are prevalent.
Corrosion	Use of dissimilar metals in direct contact (e.g. aluminum in contact with steel).
	Located in an elevated corrosive environment (elevated chlorides) such as on or near the ocean, adjacent to acid storage, downwind from acidic fugitive emissions, etc.
Weather	Exposure to outdoor elements (i.e. wind, rain, snow, etc.)
	Ice or snow build-up creating potential dropped objects.
Equipment	There is no access to conduct inspections or preventative maintenance.
	Equipment that is temporary in nature.
	Third-party equipment.
	Foreign objects (i.e. dirt, rocks, birds' nests, etc.)
	Not fit for purpose or properly secured.

Occupancy:

In relation to fixed items and structures, if an item becomes loose and drops, the risk of impacting a person depends on how likely it is that a person is present. For example, the risk is comparatively higher on a multi-tiered facility or offshore platform that has a high occupancy versus standing near or under a light stand once in a year (see Table 2 for descriptions of occupancy categories).

Table 2: Occupancy Factors

FREQUENCY CATEGORIES	DESCRIPTIONS
High Occupancy	Personnel are expected to be in the area frequently, e.g. continuously or numerous times per hour.
Medium Occupancy	Personnel may be in area occasionally, e.g. once a day to once a week.
Low Occupancy	Personnel are not typically in the area, e.g. once a month to once a year.

3.3 CHANGE TRIGGERS

Change is a contributing factor in most incidents, and this is true for dropped objects.

Change triggers associated with increases in potential for a dropped object are:

- Equipment added or removed from the at-height inventory
- Shift change
- Collisions
- Overload conditions (e.g. jarring)
- Excessive vibrations
- Severe weather (e.g. tornado, hurricane, hailstorm)
- Equipment is not maintained as required by Original Equipment Manufacturer (OEM)
- Dropped object incidents (indication of weakness in safeguards)

For some operations, certain events may occur more frequently and, therefore, are more likely to be encountered. In such cases, there should be established procedures. An example is post-jarring procedures on drilling rigs. Organizations should calculate the risk of potential change events and create procedures to manage those that present an unacceptable risk.

4.0 Risk and Hazard Assessment

4.1 FORMAL RISK ASSESSMENT

The dropped objects calculator combined with the risk factors discussed above helps provide an understanding of the likelihood of risk and the consequence in any given situation.

In general, data that companies accumulate can be useful for assessing likelihood. However, this is a reactive approach and is only of value to companies that have accumulated enough data to provide meaningful trends.

4.2 FIELD LEVEL HAZARD ASSESSMENT

Field level hazard assessments (FLHAs) identify site-specific hazards and ensure adequate controls are in place. They are not designed to replace work planning and formal hazard assessment. FLHAs should include dropped objects either as its own item or as a component of line of fire of Life Saving Rules.

5.0 Safeguards (Controls)

5.1 PRE-JOB PLANNING

Many workplace incidents stem from a failure to adequately plan. Often, workers are relied on to refuse unsafe work or are left to make unsafe decisions when they do not have the adequate equipment, materials or competencies to safely conduct the work.

A pre-job planning tool is provided in Appendix A to assist companies in assessing their work activities and equipment. This tool should be used to encourage a conversation with the project team while there is still time to adjust and accommodate input. Ideally, this is days or weeks before the day of work execution.

5.2 HUMAN AND ORGANIZATIONAL PERFORMANCE

People are fallible—they make mistakes, experience lapses in judgement, and do not always execute tasks perfectly. As a result, safeguards—also known as controls or barriers that rely on people never making a mistake—lack the capacity to handle a failure or ability to fail safely. Human and Organizational Performance is a philosophy about the interaction of processes, equipment, people, work systems and environments. The goal is to make it easier to be safe and harder to be unsafe so that the capacity to handle a failure such as a human error increases and the severity and likelihood of serious incidents are reduced.

Human and Organization Performance is based on the following five principles¹:

- Error is normal.
- Blame fixes nothing.
- Learning and improving are vital. Learning is deliberate.
- Context influences behaviour. Systems drive outcomes.
- How you respond to failure matters. How leaders act and respond counts.

There are three types of performance modes², that relate to why people make errors:

- **Skill-based performance mode** - A familiar task likely performed “automatically”, such as driving. Error is typically due to inattention and has an error rate of one in several tens of thousands. To prevent these types of errors, minimize distractions, use alarms to alert the worker, etc.
- **Rule-based performance mode** - Using known rules or a series of steps such as reading the procedure on how to change a flat tire. This mode represents a moderate level of familiarity and attention. Errors are often misinterpretations and are typically in the order of one in a thousand. To prevent these types of errors, have a series of clearly defined steps for workers, have workers talk through the steps, have workers point to the steps as work is conducted.
- **Knowledge-based performance mode** - An unfamiliar task that must be performed with a high degree of focus such as changing a flat tire for the first time without a procedure (owner’s manual). These errors occur because the person has the wrong view or understanding of the situation. They have a high error rate of up to one in ten. To prevent these types of errors, workers must stop and obtain assistance.³

Aspects of preventing error are covered in Energy Safety Canada’s [Fit for Duty Program Development Guideline](#) as well as the Fit for Duty Life Saving Rule.

¹Conklin, Todd E, PhD. The 5 Principles of Human Performance: A Contemporary Update of the Building Blocks of Human Performance for the New View of Safety. Santa Fe, NM, PreAccident Media, 2019.

²Reason, James. Managing the Risk of Organizational Accidents. New York, NY, Routledge, 2016.

³Chevron USA Inc., Human Performance pocket guide, 2017

Fit for Duty

Be in a state to perform work safely

- I will be physically and mentally in a state to perform my assigned duties
- I commit to not being under the influence of alcohol or drugs
- I will inform a supervisor immediately if I or a co-worker may be unfit for work



FIT FOR DUTY

Just as it is important for workers to be fit for duty, it is equally important to build capacity into a system of safeguards so that if one safeguard fails, a worker is not at risk of a serious injury or death. Ensuring this capacity is about understanding where vulnerabilities exist in the system, either because there are not enough safeguards between the threat and the consequence or because the quality of those safeguards is low. This concept is well-addressed in the bowtie risk assessment methodology.

5.3 BOWTIE

A bowtie is a way to show the risk presented by threats that can lead to an event and resulting undesirable consequences. Within the bowtie methodology, safeguards are referred to as barriers. Barriers are represented by black-outlined boxes. For more information on bowties, refer to Energy Safety Canada's guideline, [A Barrier Focused Approach](#).

Companies are encouraged to use the bowtie methodology or similar risk processes to uncover system vulnerabilities and address them before incidents occur. An example of a dropped object bowtie is provided in Appendix B.

5.4 SAFEGUARD CATEGORIES

There are numerous safeguard categories (listed below), and each situation needs multiple safeguards in place to ensure capacity to fail safe.

5.4.1 RELIABLE SECURING

Reliable securing reduces the probability and the consequence of a drop. As per DropsOnline, there are three types of reliable securing:

- **Primary Fixing** - The primary method by which an item is installed, mounted and secured to prevent the item from falling (e.g. bolted connections, screws, pins, buckles, clips, welds).
- **Secondary Retention** - The engineered method for securing the primary fixing to prevent loss of clamping force or displacement of fastening components (e.g. locking washers such as helical-spring washers, locking wire, split pins/cotter pins).
- **Safety Securement** - An additional engineered method applied to or around the item and secured to the main structure. Designed to restrain the item should the primary fixing fail (e.g. rated steel or synthetic nets, baskets, wires, slings). Safety securing is necessary in situations where secondary retention is not feasible.

DropsOnline's, [Reliable Securing: Best Practice Recommendations](#), discusses how to use secondary retention and safety securing to prevent dropped objects including bolts, grating, lighting, tools, etc.

It is worthwhile to consider replacing certain components on original equipment manufacturer (OEM) equipment and tools with more reliable securing; however, caution is advised as this may create other risks with the operation of that equipment and may void warranties. As such, any such replacement must be conducted in concert with manufacturers.

5.4.2 EQUIPMENT AND PARTS INVENTORIES

Having a detailed account of every bolt, pin, washer, strut, etc. with equipment or infrastructure is a significant undertaking and, depending on the risk factors, may not be appropriate in all instances. This includes having tool sign-out/sign-in programs and customized tool cases with pre-formed tool slots that make missing tools easily identifiable. An inventory allows for inspections to be conducted with confidence and should include a visual reference library so workers can easily identify the equipment or part. This also ties into preventative maintenance.

5.4.3 PREVENTATIVE MAINTENANCE

Lapses in preventative maintenance, which is required for most equipment, are often associated with static dropped objects. Companies need to ensure that equipment is maintained in accordance with OEM requirements and inspected as indicated. Under no circumstances should any part or materials where a risk of serious injury could exist with a drop be allowed to run to failure.

5.4.4 PROHIBITED TOOLS, ITEMS AND FASTENERS

A list of prohibited tools, items and fasteners should be established pertaining to a company's specific operations and tasks. For example, the use of wooden handle hammers is often prohibited because the wood shrinks, and the head can fly off when the hammer is swung.

Water bottles are a commonly prohibited item because they are prone to being dropped, cannot be reliably secured with a tether, and are deceptively hazardous given their mass. It is worth noting that adequate hydration is key to being fit for duty and, therefore, there must be an alternate arrangement.

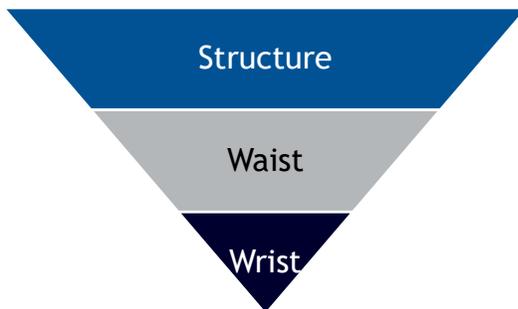
One type of fastener prohibited at height when a vibration risk is present is double nut bolts as they are known to loosen over time and, therefore, become potential dropped objects.

5.4.5 TOOL TETHERS AND ATTACHMENT ANCHORS

Tool tethers and attachment anchors are lanyards or other materials designed to secure tools. [Recommended Guidelines for the Safe Use of Tools and Equipment at Height](#) is provided by DropsOnline. Tethers must be rated to the load they are designed to restrain and, as such, the rating of the tether and the length of the tether are interconnected.

The design of tethers is critically important for their success in arresting a dropped object's fall. Therefore, only tethers and other containers designed in accordance with established methods or standards—such as the American National Standards for [Dropped Object Prevention Solutions \(ANSI 121-2018\)](#)— should be used.

Figure 3. Tether Attachment Point Hierarchy



The attachment point for tethers should follow the hierarchy depicted in Figure 3 where attachment to structures is preferred and attachment to the worker's body is less desirable.

When tools are anchored to a worker's body, maintain the weight below approximately 2 kg (4.4 lbs) so if the tool is dropped it does not harm or destabilize the worker. Ideally, this tethering should be attached to the worker's harness via a carabiner to minimize entanglement hazards.

5.4.6 TOE BOARDS

Toe boards are a critical control on elevated work platforms, walkways, etc. and should always be present. They prevent tools, materials and other foreign objects from being kicked or pushed over the edge.

5.4.7 PROTECTIVE MESH

Protective mesh systems may be applied to reduce the potential for items to fall through guard rails, stairwells and other elevated platforms. According to DropsOnline, these meshes should be of "suitable materials, incorporate appropriate securing features and be installed and maintained in accordance with manufacturer's recommendations."

5.4.8 MOBILE ELEVATED WORK PLATFORMS

Mobile elevated work platforms should include toe boards and safety mesh (protective screens) around the perimeter of the interior to prevent work materials and tools from falling or deflecting outside of the work platform. This mesh or screen must be affixed in such a manner as to not permit dropped objects from slipping through such as at the top or at the base. Additionally, it must be fit for purpose to not create any unacceptable risk, such as being blown over by wind. DropsOnline's, [Reliable Securing: Best Practice Recommendations](#) provides additional guidance on mobile elevated work platforms.

5.4.9 SAFETY NETTING

Safety netting can be used in certain situations to prevent tools and materials from hitting workers below. Safety nets should have safety hooks or shackles of drawn, rolled or forged steel with a tensile strength of no less than 22.2 kilonewtons (kN). The net should extend beyond the work area enough to ensure that protection is afforded around the perimeter of the work area. Wire mesh should be fabricated of wire at least 1.6 mm in diameter and spaced to reject a ball 40 mm in diameter.

5.4.10 STORAGE RACKS

Improper storage of equipment, tools and materials is a frequent cause of dropped objects and, when chemicals are involved, represents the potential for both personal injury and process safety events.

Risk assessments should consider the use of crates over pallets when possible to provide additional securement as well as using restraint cables and providing weight indicators. In the case of chemicals stored at height, the risk assessment should consider a fall resulting in the loss of containment (e.g. barrel breaks open) and a potential source of ignition (e.g. spark).

5.4.11 CARGO SECUREMENT AND LOADING AND UNLOADING

Cargo securement in North America is based on the North America Cargo Securement Standard, which is part of the [National Safety Code](#). If cargo is not properly secured, there is potential for dropped objects that put workers and the public at risk.

More often, dropped object incidents are associated with the loading and unloading of cargo. This is often the result of using loading and unloading equipment that is not fit for purpose, such as a forklift to remove drilling tubules instead of a picker truck or crane, or workers being in the line of fire and handling objects rather than using tag lines.

Loading and unloading activities must be assessed specifically for dropped objects potential before conducting work.

5.4.12 LIFTING ACTIVITIES

Lifting activities such as the use of cranes, hoists, rigging, helicopters, etc. can create opportunities for potential dropped objects. Understanding the implications of centre of gravity is critical for a safe lift. Loads should be packaged with the centre of gravity known and marked.

Lifting activities with helicopters such as longlining can present risk in relation to a potential dropped object. As such, careful planning, risk assessment, equipment selection and inspection are required. The Helicopter Association of Canada provides a best practice on [Helicopter Guidelines for Canadian Onshore Seismic Operations](#) that may be of assistance.



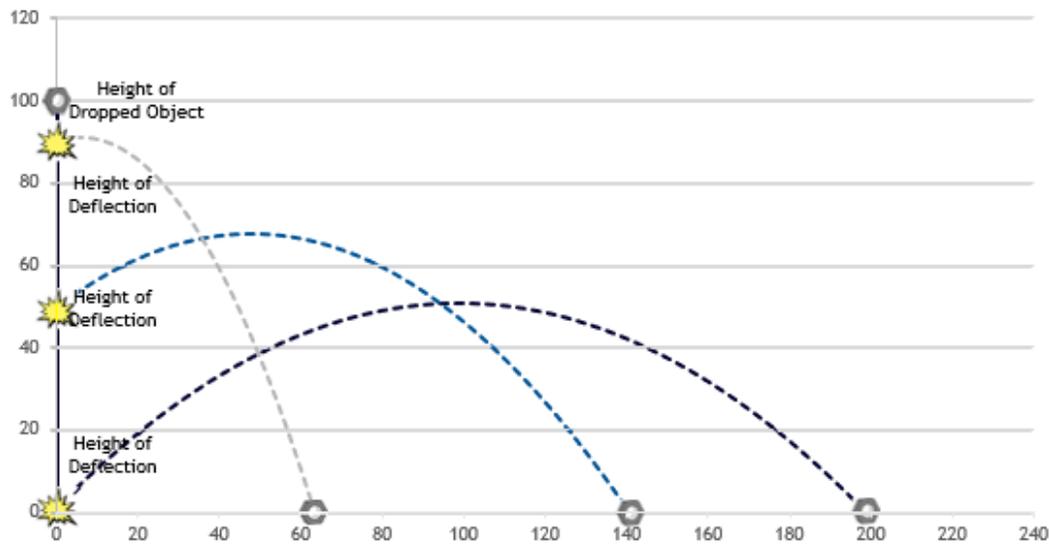
**SAFE
MECHANICAL
LIFTING**

5.4.13 EXCLUSION ZONES

It is important to recognize that exclusion zones (i.e. restricted access areas or red zones) are used for several line of fire hazards, including dropped objects. DropsOnline offers [Recommended Guidelines for the Use of Restricted Access Areas \(Red Zones\)](#).

One limitation to be aware of when using exclusion zones with dropped objects is deflection. Deflection of dropped objects is a common occurrence and has resulted in many incidents because personnel are not aware of how far a dropped object can deflect. Deflection of a static dropped object with no energy loss can be up to twice the distance that an object falls, as indicated in Figure 4. This knowledge is not intuitive and often leads personnel to believe their exclusion zones are adequate to accommodate a deflection, when in fact they may not be.

Figure 4. Dropped Object Maximum Deflection Distances



The likelihood of a deflection depends on several factors, including the size and shape of the dropped object, type of surface impacted, number or density of potential impact surfaces (e.g. one scaffolding beam located below versus 20 to 30 pipes, beams and other structures located below), etc. As a result, if a dropped object occurs, the likelihood of a deflection may be very high in some workplaces and low in others. Regardless, the goal should be to build capacity within the system of safeguards so that dropped objects are prevented and if an object is dropped it cannot hit an individual or a critical asset.

Energy Safety Canada developed a [Dropped Objects Exclusion Zone Tool \(Final Draft\)](#) to assist industry in understanding these limitations. By knowing the height of a potential dropped object and the height of a potential deflection, the exclusion zone tool provides conservative horizontal distances where potential objects may land and probabilities. This tool has been designed around a steel object deflecting off a round-steel surface such as scaffolding tubing or handrails and therefore its use with other objects or surfaces may not be appropriate. A view of this draft tool is presented in Appendix C.

The tool will remain as a final draft until such time as the mathematics and assumptions are published in a peer-reviewed journal. At that time, the link to the journal will be added to the tool and this document.

In many instances, the exclusion zone needed to eliminate or limit risk if a deflection occurs is very large and may not be practical. As a result, other preventative controls such as tool tethers, mesh, netting etc. are needed to ensure capacity in the safeguards to handle a failure.

An example scenario using this draft tool is provided in Appendix D.

5.4.14 UNATTENDED WORKSITES AND HOUSEKEEPING

Unattended worksites combined with poor housekeeping, unsecured items and weather conditions routinely create dropped objects and result in serious injuries or fatalities. Before a worksite is left unattended, an inspection should be conducted to verify there is no unsecured equipment, tools or materials that could become a dropped object.

5.4.15 SNOW, ICE AND FOREIGN OBJECT REMOVAL

Every winter, workers are injured because of falling snow, ice or foreign objects (e.g. dirt and rocks underneath mine haulage vehicles). Falling snow, ice and dirt and rocks often result from changing weather conditions (e.g. large winter storm or chinooks that bring warmer temperatures and wind). Companies should have dedicated snow, ice and foreign object removal programs as indicated by a risk assessment so all the hazards of removing snow, ice and foreign objects are planned out and controlled in advance.

The source of ice may be from venting, such as steam or other chemicals from process equipment. Companies are encouraged to consider the drops potential of ice as a component of their risk assessment when designing equipment where venting may occur.

5.4.16 DANGEROUS TREE CONTROL

A dangerous tree is a tree that is dead or prone to drop. A dangerous tree is a potential hazard anywhere trees are present at height and where workers may be present. Common areas and activities for dangerous tree encounters include the following: seismic activities, road and lease construction activities, pipeline right of ways, perimeters of wellsites and facilities, etc. For guidance on dangerous tree control please refer to Energy Safety Canada's [Dangerous Tree Control Guideline](#).

5.4.17 REDUCED OCCUPANCY

While it plays an integral role, it is important to understand that reduced occupancy is a secondary control focusing on reducing the likelihood of an injury, rather than on the prevention of a dropped object. For example, on a drilling rig when pipe is added or removed from the well (tripping), a worker will be in the monkey board at the top of the derrick. Workers should minimize their time on the drill floor during this process—even if reliable securing is in place and tools are tethered—in case of a dropped object. This time will often be tracked to fully understand the workers' exposure to this risk.

6.0 Inspections and Audits

Inspections and audits are broken into three levels in this best practice as per DropsOnline:

- **Level 1: Self-Verification** – Completed by site personnel, these typically take place as part of routine business. The frequency can be anywhere from daily to monthly and may also be triggered due to a change such as shift change or a recent incident in the company or industry.
- **Level 2: Company Verification** – Completed by company representatives independent of operations who are regarded as subject matter experts in drops or the specific operation. This level of inspection is typically scheduled quarterly or yearly and may also be used when more systemic issues are suspected, for example after a series of minor incidents or following a potentially serious incident (PSI).
- **Level 3: Independent Verification** – Independent inspection performed by external representatives. This level of inspection is a significant undertaking in terms of time and money. They are often used when an established baseline of performance does not exist, following a significant incident, or when Level 1 and 2 inspections have not been effective in the prevention of incidents.

The level and frequency of inspections or audits depends on the risk (risk factors present, recent incidents, leading indicators, etc.). As such, there is no one-size fits all approach but, in general, as risk increases so should the frequency and level of inspections and audits.

A basic inspection checklist that can be adapted is provided in Appendix E. DropsOnline also offers a helpful resource entitled, [Common Guidelines for Independent Dropped Object Surveys](#).

7.0 Competency

Competency is a key component in a dropped object prevention program. Energy Safety Canada has resources dedicated to competency, including:

- [Supervisor Competency - A How to Guideline](#)
- [Competency Management Systems - A Program Development Guide](#)
- [Supervisor Competency - A Program Development Guideline](#)

Specific to dropped object prevention, workers should be evaluated for competency in the following:

- [Line of Fire](#)
- Tether and attachment anchor selection and use
- [Life Saving Rules](#)
- Recognizing change
- Equipment inspection
- Use of the [DROPS Calculator](#)
- Use of the [Dropped Object Exclusion Zone Tool \(Final Draft\)](#) (see Appendix C)

Supervisors should be evaluated for competency in the items listed above **and these additional items:**

- Preventative maintenance requirements
- Reliable securing requirements
- Managing change

8.0 Key Performance Indicators

Collection and reporting of key performance indicators (KPIs) for drops are key to learning and predicting where additional safeguards are needed. Data collection can range from actual incidents, potentially serious incidents (PSI), hazard identifications, unsafe observations, etc.

The following details should be collected for all dropped object incidents:

- Mass of the object and the height from which it fell
- Potential severity using [DROPS Calculator](#)
- Location and whether the incident occurred in an exclusion zone
- Proximity of personnel
- Whether the incident was a PSI
- Whether the incident involved non-compliance with a Life Saving Rule
- Whether it was a dynamic or static dropped object
- What risk factors were present (vibration, corrosion, weather, working at height, mechanical lifting, etc.)
- Description of the dropped object (structural component, equipment, hand tools, work materials, environmental debris, etc.)

Several Life Saving Rules connect to dropped objects, either directly or indirectly. Therefore, non-compliance with the following rules should be tracked and reported:

- Line of Fire
- Working at Height
- Bypassing Safety Controls
- Safe Mechanical Lifting

Adapted leading indicators recommended by DropsOnline include:

- Inspections completed per schedule
- Number of exclusion zone non-compliances
- Number of DROPS inspection findings



- Change in the number of entries in overhead tool logs
- Number of overdue and deferred actions related to DROPS inspection findings
- Degree of implementation of DROPS controls

Incident rates in relation to dropped objects are an important KPI, but it is equally important to understand that many companies may have different thresholds for what is reported as an incident. As a result, caution must be exercised when making direct comparisons. Metrics should include:

- Dropped object incident rate (includes all dropped objects regardless of consequence)
- Dropped object lost-time injury rate
- Yearly counts of dropped object PSIs (NOTE: incident rates are **not recommended** as they will negatively reduce reporting)
- Counts of dropped object fatalities

Dropped Objects Data Sharing is an important component for learning and continuous improvement of the industry. Companies are encouraged to share data and learnings around dropped objects with Energy Safety Canada.

One way companies can share learnings is through Energy Safety Canada's [Safety Alert process](#). An inventory of Energy Safety Canada's dropped object-related safety alerts is provided in Appendix F.

Appendix A: Pre-Job Planning Tool

DESCRIPTION						
Date Started:	/ / Year Month Date			Date Completed:	/ / Year Month Date	
Main Purpose for the Inspection:						
Employee Name:				Checked By:		
Function Area:				Associated Areas:		
DROPPED OBJECTS						
Y - Yes, N - No, U - Unknown, N/A - Not Applicable (Conduct follow-up on all "Yes" or "Unknown" responses)						
No.	Item Description	Y	N	U	N/A	Comments
1	Do any Line of Fire hazards exist?					
2	Are at-risk activities being conducted such as:					
2a	-Mechanical Lifting?					
2b	-Work at Height or Below Grade?					
2c	-Unloading or loading?					
2d	-Simultaneous operations (SIMOPS)?					
2e	-Turnaround, upset and new construction?					
3	Is vibration a factor such as:					
3a	-Equipment that is routinely transported?					
3b	-Equipment where vibration is part of routine operations?					
3c	-Located in an area where earthquakes in excess of 5.0 are prevalent?					
4	Is corrosion a factor such as:					
4a	-Are dissimilar metals in direct contact (e.g. aluminum in contact with steel)?					
4b	-Located in an elevated corrosive environment (elevated chlorides) such as on or near the ocean, adjacent to acid storage, downwind from acidic fugitive emissions, etc.?					
5	Is weather a factor such as:					
5a	-Exposure to outdoor elements (i.e. wind, rain, snow, etc.)?					

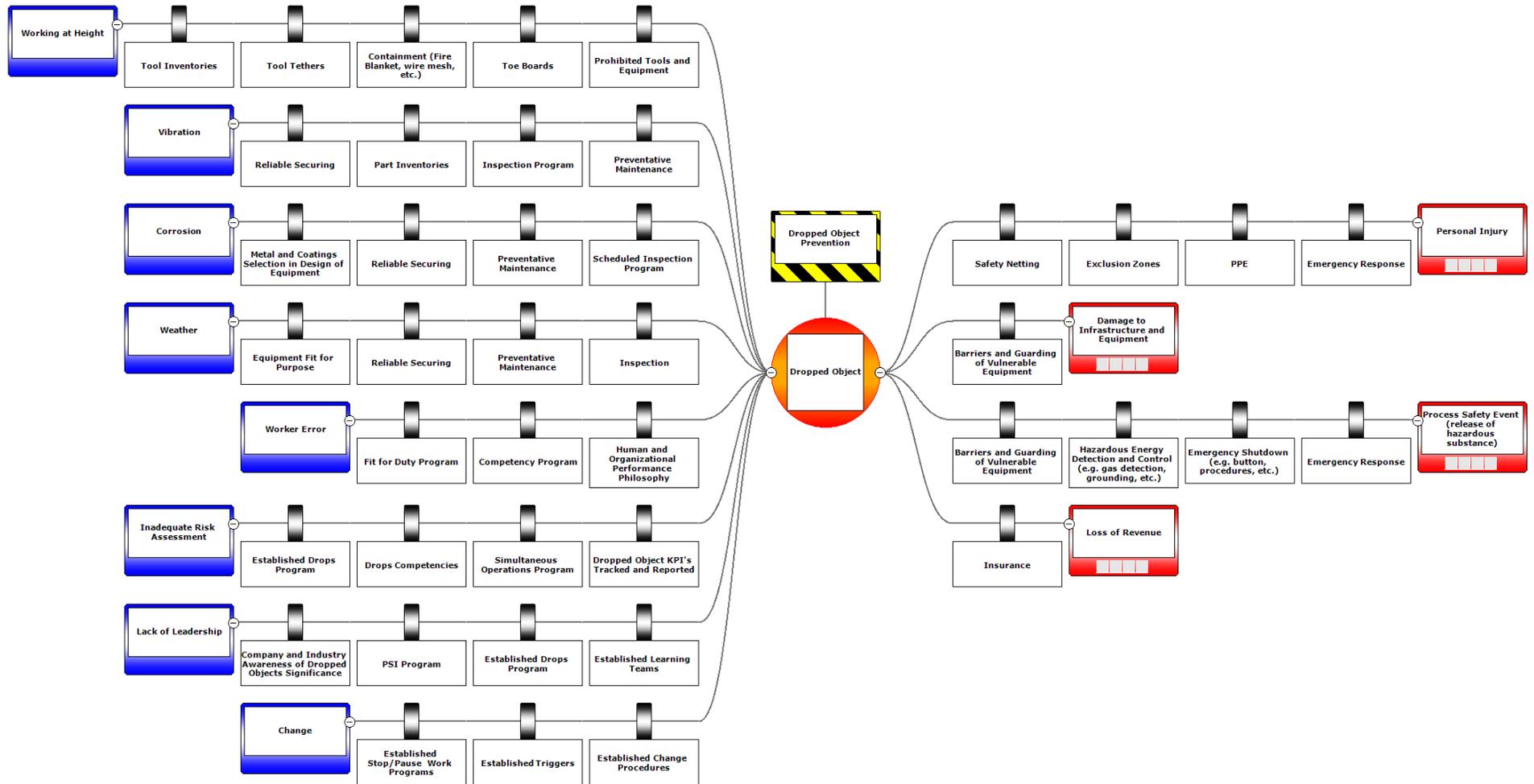
DROPPED OBJECTS (Continued)

Y - Yes, N - No, U - Unknown, N/A - Not Applicable

No.	Item Description	Y	N	U	N/A	Comments
5b	-Ice or snow build-up creating potential dropped objects?					
6	Are specific equipment factors present such as:					
6a	-There is no access to conduct inspections or preventative maintenance of the equipment?					
6b	-Equipment that is temporary in nature (< 3 months)?					
6c	-Third-party equipment?					
6d	-Foreign objects (i.e. dirt, rocks, bird's nests, etc.)?					
6e	-Fit for purpose and properly secured?					
7	What level of occupancy is present below fixed objects such as:					
7a	-High - Personnel are expected in area frequently such as continuously or numerous times per hour?					
7b	-Medium - Personnel may be in area occasionally such as once a day to once per week?					
7c	-Low - Personnel are not typically in the area such as once a month to yearly?					
8	Are changes planned for such as:					
8a	-Shift change					
8b	-Collisions					
8c	-Overload conditions					
8d	-Excessive vibrations					
8e	-Severe weather					
8f	-Dropped object incidents					
9	Is an equipment inventory available?					
10	Is a parts inventory available?					
11	Are tool tethers available and adequate?					
12	Has an inspection been conducted or planned?					
13	Are workers competent in the management of drops such as:					
13a	-Line of fire					

13b	-Tether selection					
DROPPED OBJECTS (Continued)						
Y - Yes, N - No, U - Unknown, N/A - Not Applicable						
No.	Item Description	Y	N	U	N/A	Comments
13c	-Exclusion zone					
13d	-Life Saving Rules					
13e	-Managing change					
13f	-Equipment inspection					
13g	-Use of DROPS Calculator					
13h	-Use of Exclusion Zone Tool					
14	Are supervisors competent in the management of drops such as:					
14a	-Preventative maintenance requirements					
14b	-Reliable securing requirements					
14c	-Management of change					
14d	-Dropped object risk assessment					
15	Is an adequate fit for duty policy and program in place?					
16	Has an exclusion zone that considers the likelihood of a deflected dropped object been established?					
17	Has the DROPS Calculator been used as part of the risk assessment?					

Appendix B: Bowtie Example



*Threats are represented in blue on the left with the event in the middle and consequences on the right in red. Barriers are represented by the black-outline boxes.

Appendix C: Dropped Objects Exclusion Zone Tool (Final Draft)

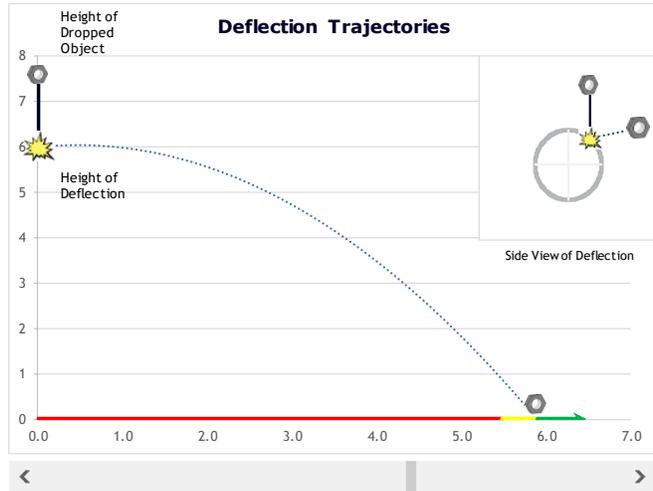
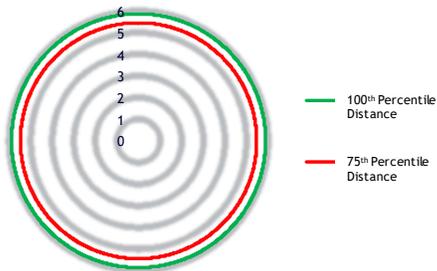


Dropped Objects Exclusion Zone Tool (Final Draft) Version 2.2

This tool has four inputs: Metric or Imperial, Height of Dropped Object and Height of Deflection (both measured from the ground). The tool predicts the horizontal distance (radius) and associated probability where a steel object will strike the ground following a static drop and deflection. See "Example" sheet tab below for an example.

Inputs		
STEP 1: Select Metric or Imperial		Metric
STEP 2: Input Height of Object (meters)		7.6
STEP 3: Input Height of Deflection (meters)		6.0
Approximate Outputs (Distance to strike the ground)		
100 th Percentile Distance (radius in meters)		5.9
75 th Percentile Distance (radius in meters)		5.5
50 th Percentile Distance (radius in meters)		4.3
25 th Percentile Distance (radius in meters)		2.5

Exclusion Zone Bullseye



Radius Percentage: 63.6% Deflection Angle: 79.0 Distance: 5.9
 *Angle in degrees relative to vertical is proportional to probability and as such all angles may not be displayed.

INTENT

This tool has been designed to educate industry on the use and limitations of exclusion zones and the need for other preventative barriers to build capacity to fail safe. It is designed to work in concert with the DROPS Calculator from DropsOnline.org. This tool is ideally suited for applications where adequate exclusion zones can be established that are not limited by the design and layout of existing infrastructure or equipment such as elevated work platforms, construction scaffolding, etc. This tool does not determine the probability of a deflection (e.g. impact scaffolding), but rather the probability of where a steel object may initially strike the ground following a deflection off a round steel surface. For example, the 75th Percentile Distance means that 75% of steel objects that deflect off a round steel surface will land within this distance.

LIMITATIONS

This tool is based on the following assumptions: Impact at height occurs; object is non-rotating steel sphere; no initial vertical or horizontal motion in drop; one deflection only; surface is round steel, such as scaffolding tubing or hand rails; radius of deflection surface is small relative to drop height; no air resistance (negates terminal velocity impacts and any sailing effects); zero friction during impact; and, the projected distance represents impact with the ground and is not the final resting distance. In the case of impact on hard ground, surfaces such as metal or elastic materials such as rubber, the dropped object may bounce or slide beyond the predicted distance. Deflections of other objects or from other surfaces, such as angular steel in a drilling derrick, will generate different probability distributions; therefore, determining exclusion zones with this tool in such settings may not be appropriate. This tool accounts for energy loss based on a coefficient of restitution "e" value and assumes this value remains constant and does not decrease with increasing velocity or mass, which it would be expected to do. The "e" value used for this tool is 0.66.

DISCLAIMER

This tool is intended to be flexible in application and provide guidance to users rather than act as a prescriptive solution. Recognizing that one solution is not appropriate for all users and situations, it presents generally accepted guidelines that apply to industry situations, as well as recommended practices that may suit a company's particular needs. While we believe that the information contained herein is reliable under the conditions and subject to the limitations set out, Energy Safety Canada does not guarantee its accuracy. The use of this tool or any information contained will be at the user's sole risk, regardless of any fault or negligence of Energy Safety Canada.

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Appendix D: Exclusion Zone Example Scenario

Work is being planned to replace a light fixture in the ceiling. A mobile elevated work platform is needed to raise the worker to the fixture, which is located at 7.6 m (25 ft.), and the platform will be raised 6 m (20 ft.).

As part of the planning, a variety of controls are discussed, and an exclusion zone is suggested. However, personnel are not sure what size the exclusion zone should be in case a deflection occurs.

They use the example of dropping a metal spacer plate that is part of the light fixture and cannot easily be secured. The plate weighs 1 kg (2.2 lb.) and is at the height of the light fixture, 7.6 m (25 ft.). First, using the DROPS Calculator, they verify that such an object dropped from that height could cause an injury and they confirm a “Major Hazard” prediction if a person were struck by it. Then they consider the object deflecting off the top rail of the elevated work platform at 7.3 m (24 ft.) and again at the base of the platform at 6 m (20 ft.). Using Energy Safety Canada’s Dropped Objects Exclusion Zone Tool (Final Draft), they determine possible exclusion zones.

Inputs		
STEP 1: Select Metric or Imperial	(changes labels only)	Metric
STEP 2: Input Height of Object	(meters)	7.6
STEP 3: Input Height of Deflection	(meters)	6.0
Approximate Outputs (Distance to strike the ground)		
100 th Percentile Distance	(radius in meters)	5.9
75 th Percentile Distance	(radius in meters)	5.5
50 th Percentile Distance	(radius in meters)	4.3
25 th Percentile Distance	(radius in meters)	2.5

Inputs		
STEP 1: Select Metric or Imperial	(changes labels only)	Metric
STEP 2: Input Height of Object	(meters)	7.6
STEP 3: Input Height of Deflection	(meters)	7.3
Approximate Outputs (Distance to strike the ground)		
100 th Percentile Distance	(radius in meters)	3.5
75 th Percentile Distance	(radius in meters)	3.3
50 th Percentile Distance	(radius in meters)	2.6
25 th Percentile Distance	(radius in meters)	1.5

They decide that a recommended exclusion zone of either 5.9 or 5.5 m (19 or 18 ft.) is unachievable, but an exclusion zone of 3.5 m (12 ft.) is achievable. They proceed to have the inside of the mobile work platform installed with a fit for purpose screen and barricade a 3.5 m circular perimeter from the outside edge of the platform during the work.

Appendix E: Inspection Checklist

DESCRIPTION						
Date Started:	/	/				
	Year	Month	Date			
Date Completed:	/	/				
	Year	Month	Date			
Main Purpose for the Inspection:						
Employee Name:				Checked By:		
Function Area:				Associated Areas:		
DROPPED OBJECTS						
A - Acceptable, NI - Needs Improvement, U - Unacceptable, N/A - Not Applicable						
No.	Item Description	A	NI	U	N/A	Comments
1	The FLHA identifies drop hazards and control methods (e.g. hoisting, lowering, working at heights)					
2	Controls are in place to protect workers below (e.g. flagging, tagging, signage, ground person, netting)					
3	Items are properly secured when manually hoisted (e.g. canvas lifting bag, proper knots)					
4	Appropriate hand tool lanyards are in use					
5	Tools and materials are properly stored so that they will not vibrate off, be knocked off, or blown off from structures					
6	Power tools are tied off during use and cord tagged at power source. Other tools secured as required.					
7	Housekeeping in the area is maintained					
8	Small items are protected from falling through grating or off an edge (e.g. fire blanket, mesh, plywood, toe boards, etc.)					
9	Unnecessary equipment is not present (e.g. fasteners, plates, chains, piping)					
10	Area is free of ice, snow, dirt and rock build-up that could fall					
11	<i>(add as appropriate)</i>					

Appendix F: Safety Alert Inventory

SAFETY ALERT TITLE	DESCRIPTION
<u>Worker Fatality During Trench Box Dismantling</u>	A work crew was on location to dismantle a high arch trench box and then transport the disassembled box from one project work site to another. The disassembly process did not follow the manufacturer's instructions for the safe removal of the strut support pins holding the box together. Consequently, when the last strut support pin was removed from the box, it collapsed, causing a support arch to strike and fatally injure a worker.
<u>Worker Crushed by Pumpjack Equipment</u>	Two workers were removing an alignment bolt from an out-of-service pumpjack horse head at a storage yard. The horse head was connected to the walking beam and situated in an upright position, therefore containing stored energy. "Worker A" was positioned under the walking beam. When "Worker B" began removing the alignment bolt, the walking beam collapsed, crushing and fatally injuring "Worker A".
<u>Chain on OEM Lifting Assembly Snagged - Potentially Serious Incident</u>	A measurement-while-drilling (MWD) tool was being hoisted with an original equipment manufacturer (OEM) lifting assembly up the v-door with a derrick full of pipe. The 10m-long tool was 8m above the drill floor when it fell injuring a worker.
<u>Dropped Object - Potentially Serious Incident</u>	During a pre-move inspection of a stacked snubbing rig, an unsecured slip die fell. The slip die had been left behind and was lying on an access hatch. The slip die fell when the hatch was opened and could have severely or fatally injured workers on the ground.
<u>Failed Hitch Results in Potentially Serious Incident</u>	Workers departed a work site towing a portable air compressor. While driving on a major highway, the trailer fell to the ground behind the vehicle. The mounting plate on the pintle hitch had broken in half along the upper bolt holes. The driver managed to bring the trailer under control and safely pulled over.
<u>Equipment Damage - Tubing String Falls Before Slips Are Latched</u>	Setting plate on 40-ton MYT elevator found to be broken after a tubing string fell 8m. As a result of rapid lifting before the slips were fully set, the pipe collar was dropped onto the slip setting ring, and the full weight of the pipe damaged the elevators. While only equipment was damaged, this incident could have potentially caused serious injury to rig personnel and damage other equipment.
<u>Worker Fatality During Snubbing Operations</u>	A worker was running diagnostics, but the equipment was not locked out. The worker was struck and killed when the equipment fell from a suspended position.
<u>Shoulder Eye Bolt Failure During Equipment Lift</u>	A fracturing ("frac")/ wellhead assembly was lifted approximately half an inch to adjust a support (levelling jack) stand. The lift was conducted using the horizontally - attached shouldered eyebolts on the equipment. The orientation of the eyebolts required an angular lift. The lift took place and the eyebolt shanks sheared off. The wellhead equipment was secured, and no other damage occurred.
<u>Personnel Basket Assembly Securement Pin Failure</u>	The failure of a pin securing personnel (man) basket assembly on a knuckle boom crane. A worker was in the man basket and suffered bruising when the assembly pin sheared, and man basket fell to the ground.

Tank Cradle Arm Failure

A 1,000-barrel tank was being moved into place when the cradle arm bracket failed. The bracket was held in place by the main mast pin, which was secured with a cotter pin. The cotter pin broke, allowing the main mast pin to slide out of place. As a result, the tank slid off the cradle, fell to the ground, and landed on its side, damaging the tank. No injuries occurred.

Access Matting Debris

A service company received several calls from the regulator and members of the public regarding debris falling from loads of access (swamp) matting being hauled on public roadways. The debris included clumps of mud, rocks and chunks of wood creating a hazard for road users including the public.

Dropped Drill Collar

On a drilling rig, a non-magnetic drill collar (NMDC) was lifted from the hydraulic catwalk with a third-party pickup sub. The elevators and pickup sub were 6-7 meters above the rig floor at approximately a 70-degree angle when the pickup sub slipped through the elevators. The non-magnetic drill collar slid and bounced out of the trough and landed halfway down the catwalk. There were no injuries.

Broken Boom Block Pin Discovered

During a pipeline construction project, half of a broken pipelayer pin was located on the ground at the worksite. After locating the appropriate pipelayer, it was determined that a pin from a 572 pipelayer had been used in the place of the appropriate 583 pin.

Hoist Line Failure

A sideboom being used in a pipe stringing operation was lifting a joint of heavy wall pipe off the bed of a transport trailer when the wire rope hoist line failed.

Sideboom Stick Collapse

An operator started a sideboom to warm it up, locked out the sideboom, and left it running after putting an umbrella on the seat. However, the bolts on the lockout mechanism were loose, and the lockout mechanism failed due to the position of the umbrella. Half an hour later, a crew observed the load line slowly spooling in, causing the stick to break and the stick, hook and blocks to fall into the cab.

Snatch Block Sheave Fall

An incident occurred while pulling tubing out of hole with a service rig. The snatch block failed and the sheave from the snatch block fell to the rig floor, landing 3-4 feet from the floorhand's position. The snatch block in use was rated for 1 tonne while previously an 8-tonne block had been used based on the calculated loads.

Service Rig Pull Over Incident

A service rig and well site pumping unit sustained extensive damage when the rig was pulled over onto its side. The incident occurred when the driver of a tractor trailer picker unit drove over the service rig's escape line and anchor. The driver's side front hydraulic stabilizer ram snagged the 9/16-inch escape line.

Top Drive Counter Weight Falls From Derrick

The crew was preparing to lay the mud motor out the V-door when the winch snapped, striking the motor hand in the right shoulder.

Picker Mount Failure

Turret bearing mount tore off of picker truck causing crane to collapse.

[Object Falls from Height](#) Bolts that secure locking plate in crown housing became loose resulting in washer falling onto drill floor.

[Unsupported “A” Leg Upset](#) During rig-up of a drilling rig an ‘A’ leg fell over resulting in damage.

[Dropped Pipe from Side Door Elevator](#) While pulling and laying down tubulars, a worker closed and secured the elevators with the verification pin and the Operator hoisted the tubing up. Once the connection was landed in the slips, the tongs were engaged and the connection broke. A crew member was in the process of asking the Operator to hoist the tubing back up when it fell down to the stabbing mat and came to rest against the rig floor.

[Equipment Bucket Fell on Worker - Failure to follow Proper Procedure - Lost Time Incident](#) A team of workers was tasked with changing the bucket of an excavator. This excavator had hydraulic lines that required removal as well as the wedge in order to remove the bucket. While the bucket was curled inwards to expose the lines a worker was unhooking the hydraulic lines of the bucket, while other workers removed the wedge, at the same time. The bucket rocked forward hitting the lone worker on the back of his head and left shoulder blade, knocking the worker down and forward.

[Worker Struck By Falling Equipment - Fatality](#) A worker turned toward a falling tub and was hit in the chest area. He managed was not crushed but died from the force of the impact.

[Drill Line Contact with Retainer Bolt](#) At the time of the incident, the driller was working the drill string and was about to make a connection. He heard a noise coming from the drawworks; the rig manager was in the doghouse and went to investigate the noise. He noticed that the retainer bolt for the dog nut anchor plate on the TSM 7000 drawworks had backed out. Eventually, the bolt was out far enough that it produced friction on the drilling line causing two of the six strands to break.

[Wireline Control Valve Tips Over Onto Worker](#) A wireline crew was preparing to lift a wireline BOP control valve onto the well head. The control valve had been secured to a frame structure on the ground by means of two ratchet straps to prevent it from falling over. A new worker was assigned the task of hooking the valve to the crane hook by means of a lifting sling. The worker was seriously injured, when the wireline control valve fell over and knocked him to the ground.

[Worker Fingers Crushed By Dump Bailer Landing Plate](#) The landing plate carrying the load of the bailer sections dropped down, crushing a wireline worker’s fingers between the landing plate and top of the wireline BOP’s.

[Dropped Bottom Hole Assembly Strikes Worker](#) A service rig crew had removed a full tubing joint from the Bottom Hole Assembly (BHA) with tongs. The BHA was standing with one end resting on ground, through the rig floor beside the BOP’s. The BHA suddenly fell from the sling, contacting the worker with a glancing blow to the right arm.

[Drilling Rig Proportional Brake Fails](#) The top drive crept down 1 meter, then free fell 1 meter until the elevators struck the floor.

[Overturn Of A Freestanding Mobile Double Service Rig](#) A rig overturned fatally injuring a worker.

Glossary

TERM	DESCRIPTION
At Height	1.8 m (6 ft.) above ground level or within 1.5 meters (-5 feet) horizontally to a descent to a lower level of 1.8 meters or more.
Below Grade	6 feet (1.8 meters) below grade.
Barrier	A safeguard planned to prevent or mitigate undesired events or incidents.
DropsOnline	A collaborative industry organization that supplies supporting materials and recommended practices for managing dropped object hazards. This may refer to the organization itself or its endorsed principles.
Dropped Object	Any item that falls from its original position and has the potential to cause injury, death, equipment or environmental damage, or release of hazardous energy.
Fail Safe	A design or system of controls that enables a failure of a component or worker to occur without resulting in an incident.
Incident	An unplanned event that has or could have resulted in harmful consequences such as injuries, illnesses, property damage and/or environmental impact.
Leading Indicator	A proactive, preventative and predictive measure that monitors and provides current information about the effective performance, activities and processes of a health, safety and environment management system. Leading indicators drive the identification and subsequent elimination or control of risks that could cause incidents.
Lagging Indicator	Measure the impact of workplace incidents after they have occurred. Examples of lagging indicators include number of fatalities, number of injuries and severity rates.
Primary Fixing	Principle method by which an item is installed, mounted and secured to prevent it from falling (e.g. bolted connections, screws, welds).
Safety Securing	An additional mechanism for securing an item to the main structure that restrains it or its components from falling (e.g. rated steel netting, wires, slings, lanyards).
Simultaneous Operations	Simultaneous operations (SIMOPS) are those where two or more potentially conflicting activities are executed in the same location at the same time.

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[Drops Online Recommended Guidelines for Use of Restricted Access Areas \(Red Zones\)](#)

[DropsOnline Recommended Guidelines for the Safe Use of Tool and Equipment at Height](#)

[Energy Safety Canada's Dangerous Tree Control Guideline](#)

[Energy Safety Canada's Dropped Object Exclusion Zone Tool \(Draft\)](#)

[Energy Safety Canada's Life Saving Rules and Life Saving Rules Explanation Guide](#)

[Energy Safety Canada's "Are You in the Line of Fire?" Program](#)

[Energy Safety Canada's Potentially Serious Incident \(PSI\) Program](#)

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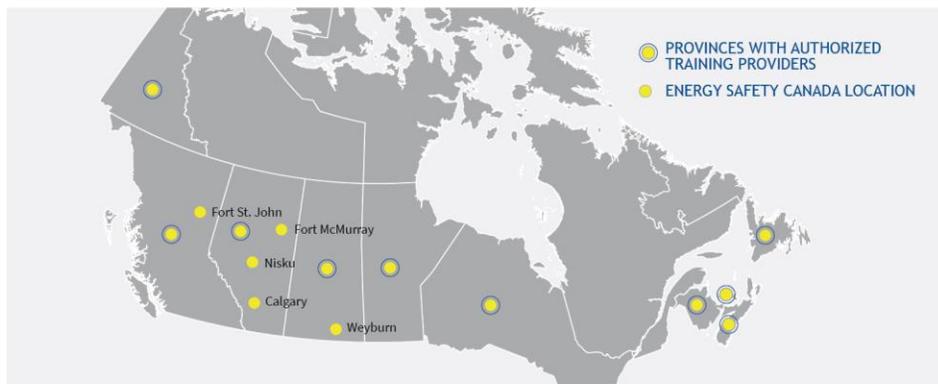
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