

TIC Council

Metals and Minerals Committee

Safety Code

Part 1: Field Inspection

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1. Introduction

Independent inspection carries a unique set of safety risks. In addition to the relatively well recognised hazards associated with the products involved, inspectors are often working alone at all times of day and night at storage facilities or on-board vessels which they may not be familiar with.

Ensuring that risks are assessed and mitigated in these circumstances requires not only training and awareness on the part of the inspectors and their management but also cooperation and understanding from facilities and vessel personnel and also from the Client(s) - the clients who have contracted the inspection company to carry out the work. It should be noted that the Client, while having a commercial interest in the cargo which is the subject of the inspection, may not have any direct control or contractual arrangement with the facility or the vessel involved.

TIC Council Member Companies have developed training programmes which provide their employees with the necessary knowledge and awareness to enable them to work under these conditions, the basic components of which are mandated as part of the TIC Council IFIA Certification Programme (ICP).

This document provides additional detail which can be included in training programmes and also presents the agreed industry view of the issues involved and the safety training which is necessary for inspectors and which can be audited by relevant authorities.

Information, issues and data relating to safety have been shared between TIC Council Member Companies for many years and Clients also hold regular safety meetings to exchange information and address specific issues with inspection companies. As a further development in this cooperative process, a joint safety conference was organised by TIC Council in October 2018 involving TIC Council Member Companies, Clients and other interested parties. One of the outcomes was universal support for TIC Council to develop this Safety Code.

This document sets out the expectations which TIC Council Member Companies should meet with regard to safety conduct and also the responsibilities which other parties involved are expected to fulfil in order to ensure that inspection work continues to be carried out in a safe manner.

Key safety issues are each addressed with requirements and recommendations clearly stated. The document provides safety guidance for inspection companies, facilities, vessels and Clients and can be used as part of training for personnel in each of these groups.

The document has been reviewed and contributed to by companies and other involved parties and will be subject to regular review and updates to accommodate changes in technology, cargo characteristics and working practice.

It should be noted that TIC Council has published the IFIA Code of Practice for the Inspection of Mineral Commodities and also publishes and maintains technical bulletins, a number of which address safety issues. These are available for download at <http://www.tic-council.org/publications>.

2. Responsibilities

TIC Council Member Companies are responsible for ensuring that their personnel are trained, equipped and competent to perform the tasks to which they are assigned, not

only in terms of technical requirements but also from a safety standpoint. Key safety topics which inspectors will be familiar with are presented below. All safety incidents are to be reported.

Inspectors are also trained to be aware of the safety of others working around them and will intervene where others are seen to be acting in an unsafe manner.

Facilities are expected to provide safety training to all visitors and contract personnel, including inspection personnel. Training should cover all local safety requirements and procedures, including general site orientation, and typically runs to a half or one day classroom course, supplementing the detailed training provided by employers.

Inspectors are normally working alone and, unlike most contractors, are frequently required to move around the site, inspecting storage bins, weighing equipment, material flows or conveyor-belt systems, barges, vessels, etc. While it is not seen as practical for inspectors to be accompanied at all times by site personnel, this is preferred.

The risks when working on board a ship or barge (vessel) are seen to be greater than when working on shore as the inspector is unlikely to be familiar with the particular vessel concerned and the potential or need for entry to confined spaces or inadvertent conflicts with shipboard operations is greater. Inspectors should therefore be accompanied by a responsible member of the vessel's crew at all times. This crew member will be responsible for the opening and closing of any holds or hatches required as part of the inspection work.

Whether working in a facility or on board a vessel, the facility or vessel personnel are responsible for providing a safe working environment for the inspector, including safe access to the various locations where sampling or other inspection work is required, and, of course, safe access to and from the vessel itself.

An important element of ensuring that the work is carried out safely is the "key meeting" which should be arranged before any work begins. This will involve the inspector along with responsible facility and vessel personnel and must cover not only the technical and operational requirements of the work but also relevant safety issues including product safety information (SDS), accompanying personnel, communications, access, equipment and any aspects where a risk assessment may be needed.

Where any of the key personnel change during the work (e.g. shift changes) sufficient time must be provided for hand-over of the information from the key meeting.

3. Key Safety Issues

3.1 Personal Protective Equipment (PPE)

Whilst this is the last barrier in the Hierarchy of Health and Safety controls for any activity, PPE is vitally important for the protection of the individual.

The wearing of PPE is **Mandatory** and shall include:

- Personal identification / Pass
- High visibility clothing
- Safety boots with toe protection
- Hard hat

Where defined by risk assessment or client requirements additional PPE may include (but not be limited to);

- Goggles or safety spectacles
- Emergency life-saving apparatus (ELSA) or other breathing apparatus (BA) to allow safe evacuation.
- Cartridge-type filter masks where there is risk of relatively low-level exposure to airborne contaminants.
- Life jacket or personal floatation device where there is risk of a fall into water.
- High visibility cold/wet weather jacket.
- Lanyards or descenders when working at height
- “Man down” devices (or regular radio checks) for lone workers.
- Oxygen/CO monitors
- Dust masks
- Task specific suitable gloves
- Ear defenders to be carried wherever there is risk of exposure to noise

In addition, and subject to a Permit to Work (PTW), Powered air-purifying respirator (PAPR) may be required but this must only be worn by fully trained personnel and with all aspects of the PTW complied with.

Additional environmental considerations in some locations, such as extreme heat and extreme cold, need to be addressed by risk assessment.

3.2 Driving and Journey Planning

Road traffic regulations and local legislation shall be observed at all times as a minimum requirement.

Seatbelts must always be worn by drivers and both front and rear seat passengers. This is a legal requirement in many countries.

Use of mobile phones while driving is hazardous. Mobile/cell phones should therefore ideally be turned off when driving. However, minimum use of hands-free phones is acceptable when this is important for the operation. Conversations should be very short and arrangements made to call back when parked. Any other use of mobile phones while driving, such as texting or emailing is prohibited.

Regular breaks should be taken during all long journeys. These should be built into the journey plan and taken at least every 2 hours or more frequently if fatigued. Journey plans do not typically need to be documented but can be part of the dynamic risk assessment for the work assignment (see 3.3 below). The journey plan should consider: the route, potential traffic congestion, duration of travel, and planned breaks. If journeys become extended or fatigue sets in, then the individual (inspector) should stop and rest.

Checks should be performed at least annually to ensure drivers are still permitted to drive legally. If personal vehicles are used for business, then the personal insurance documents should be verified to ensure these cover business use.

Motor vehicles shall be well maintained. Road worthiness checks should be performed regularly and include tyres, oil, water, screen wash and lights. Servicing shall be carried out in accordance with manufacturers recommendations. Similar road worthiness checks also apply to bicycles where these are used inside facilities to ensure they are working correctly.

When transporting hazardous goods in a vehicle, local hazardous goods regulations must be followed. Vehicles should be fitted with suitable fixed containment for samples, e.g. sample “coffins”, DOT boxes or UN specified packaging. A sample manifest and copies of the Safety Data Sheets should be carried in the vehicle.

3.3 Risk Assessments and Hazard Awareness

There are two types of risk assessment:

3.3.1 Formal risk assessment (FRA)

These are led by the employer (TIC Council Member company), undertaken by people who are suitably qualified and competent and are used to explain to the personnel engaged in the work activity what the hazards are and how the associated risks should be controlled so that they are as low as reasonably practicable (ALARP).

Standing or generic risk assessments should be carried out for regular activities where hazards are present and should be documented and available to all staff. However, the hazards do not always remain constant and these assessments should be reviewed and updated regularly as required.

There will also be a need for FRAs to be performed for new or non-standard activities which are seen as potentially hazardous. Again, these should be formal and documented.

3.3.2 Dynamic risk assessment (DRA)

A DRA (sometimes referred to as Job Hazard Awareness, Job Safety Analysis or Last-Minute Risk Assessment) should be carried out by the inspector before starting (possibly using a check list) and then continuously reviewed throughout the work. Through application of the DRA process the inspector should be able to identify hazards, to control associated risks and to respond to any new hazards or changes in risk level as the work proceeds.

The aim is to maintain risks so they are As Low As Reasonably Practicable (ALARP) and to ensure the continued safety, not only of the inspector but also of other personnel who may be present.

Although a checklist may be used at the start of the work, DRA is a continuous process and will not be documented.

Using the principals of ALARP, chronic unease, hazard and situational awareness the inspector should apply DRA through:

Sense checks – a thought process that is structured and promotes an awareness of hazards and potential risks at each stage of the work. Various approaches are used, for example; ‘think twice’, ‘take two’, ‘take five’.

Checklists – filled out as a pre-work document. Where checklists are used they must be completed as fully as possible. One limitation with a checklist that must be appreciated is that there may always be sources of risk that are not included.

To rationalise the DRA process a traffic light system may be used:

- If hazards are uncontrolled, the risk is unacceptable and cannot be reduced then this is a red-light situation. Work must NOT proceed and a Stop Work Authority (SWA) should be implemented.
- If hazards are present but appear to be controlled, then this is considered as an amber-light situation. Work can proceed with caution, reviewing the controls until the risk is seen as being As Low As Reasonably Practicable (ALARP).
- A green-light situation exists only when the work situation is considered safe. Work can proceed but hazard awareness and the DRA approach should continue; re-assessing the risk throughout.

3.4 Intervention and Stop Work Authority (SWA)

SWA Definition:

“The right and responsibility to stop any operation, which has imminent hazard to safety, health, equipment, and/or the environment.”

Where a TIC Council Member Company employee believes that the task or the working conditions involve risk of harm to personnel, and/or the environment, he or she has full authority to refuse to start or to refuse to continue the task. This is commonly referred to as exercising “Stop Work Authority”. In such circumstances the task shall not be undertaken until those responsible for controlling the conditions have addressed the issues raised and an assessment confirms that it is safe to proceed.

TIC Council Member Companies will provide training for their personnel, including but not limited to guidance on recognition of common hazards and the assessment of associated risks. These hazards include, but are not limited to: confined space entry, engulfment, and exposure to hazardous substances. Personnel will be trained to exercise appropriate good judgement in a sense check and to exercise a SWA when appropriate.

Clients will be advised when SWA has been used and is causing a delay in the operation.

In case the use of a SWA is disputed by other parties involved in the operation, the issue will be escalated to the Client for their intervention. TIC Council Members expect that their Clients will support inspectors in these situations.

3.5 Slips, Trips and Falls

3.5.1 General

Slips, trips and falls are the most common causes of workplace injury.

- Slips occur when there is too little traction or friction between the shoe and walking surface. For example, when walking on wet, oily or icy surfaces.
- Trips occur when a person’s foot contacts an object or drops to a lower level unexpectedly, causing them to be thrown off-balance. A trip most often results in a person falling forward, while a slip most often results in the person falling backward.
- A fall occurs when a person is too far off-balance usually as a result of a slip or trip or through leaning or reaching too far.

There are many contributing factors to slips, trips, and falls including environmental conditions, insufficient or inadequate lighting, changes in elevation, and housekeeping issues in working and walking areas. These factors are outside the control of inspection

personnel and it is the responsibility of the vessel or facility to provide a clean, clear and well-lit working environment.

To reduce risks further, personnel should face the steps when using ladders or stairways and use three points of contact (i.e. both feet on rungs/steps and one hand on the railing).

TIC Council Member companies advise their employees to:

- be vigilant regarding warning signs, barriers, etc.
- always maintain three points of contact when using ladders and stairways;
- if necessary, walk more than once to and from the job location to keep at least one hand free when transferring equipment or samples on ladders or stairways;
- face the steps when descending stairs or ladders;
- ensure that adequate lighting is available on stairways and walkways;
- watch for changes in elevation caused by bumps, cracks and potholes in the walking surface;
- be vigilant for slippery surfaces, caused by spills or (winter) weather conditions;
- always wear a hard hat, to avoid head injuries walking under low objects, pipe-racks, etc.
- wear clean safety footwear with sufficient tread profile on the sole
- Ensure emergency exits are free of obstacles.

Walkways in office environments shall be kept clear of electrical cords, boxes and other obstacles. Cables in the walkways shall be taped down.

3.5.2 Ships and barges (vessels)

As noted above, slips, trips and falls are the most common causes of workplace injury. The risk of such incidents is greater in the marine environment due to the configuration and motions of a vessel.

Generally, on a horizontal surface there is less risk of slips and falls. However, the floors or decks on a vessel are rarely horizontal. There is almost always some trim, list or camber involved in addition to the motion of the vessel itself. There are also frequently structural deformations created during and after construction, leading to uneven surfaces and, finally, the presence of water in working areas is more common than with land-based facilities. Where the amount of water is substantial hydroplaning can occur.

The key to prevention of slips and falls in the marine environment is that of traction. Appropriate footwear is vital and it should be noted that levels of traction that are appropriate for non-marine environments are not necessarily sufficient for the marine environment.

The risk of trips and falls on vessels is increased due to the many obstacles on deck, especially when vessels are in port. These include such things as mooring lines and other ship handling equipment in addition to permanently mounted obstacles such as cleats, eyebolts, etc. all of which are trip hazards.

Mooring ropes and lines must never be stepped over and loading hoses should never be walked under. Ducking under or climbing over deck piping and other obstacles should be avoided, using marked walkways where provided.

Inspectors and other personnel need to be made aware that while getting onboard a marine vessel can be a challenge in itself the deck and other areas on-board present a

very different environment to land based facilities and one that requires care and conscious effort to navigate safely.

3.6 Lifting and Carrying

More than a third of all workplace accidents reported are related to lifting and carrying loads. Hazards are increased when these activities are carried out repetitively and/or under dynamic environmental conditions which is often the case during cargo inspection work.

The maximum weight of samples to be carried by an inspector at any given point should not exceed 20 kilos (approx. 45 lbs). Eliminating unnecessary samples and/or pre-reduction of samples will help to reduce the weight. Some operations will require more than one journey and/or inspector to be in attendance. This is particularly the case where operations need to be completed quickly, such as early departure procedures for vessels, where a single inspector does not have time to transport equipment and samples safely.

3.7 Vessel Access (On and Off Shore)

3.7.1 General

Minimising risks associated with vessel access, particularly offshore, is a key issue. Clients, charterers and vessel owners need to be involved and alerted when risks are noted.

TIC Council Member companies provide training in the proper use of ladders and gangways to embark/disembark vessels and barges. In addition, inspectors who are assigned to perform activities offshore must, as a minimum, be able to swim and have the physical fitness to climb pilot ladders.

Transfers to vessels at anchor are inherently hazardous and should be avoided. Where possible, clients should consider delaying cargo inspection until vessels are at berth. Transfers should be avoided during the hours of darkness.

In case of transferring during the dark period, the place of reception and disembarkation of the inspector should be illuminated. The light source shall not dazzle the boatmaster when approaching the side and the inspector when boarding the vessel.

Vessel crew members should be available to assist at all times and in particular with transfer of equipment (sampling equipment, samples, etc.).

During boarding and disembarkation, the ladder should have a lifebuoy with a lifeline, and a sailor on duty to supervise embarkation and disembarkation and ready to provide immediate assistance if necessary. The length of the lifeline should not be less than twice the height at which it is stowed above water in lightest sea going conditions, or 30 meters, whichever is greater.

For transfers FRAs (Formal Risk Assessments) will probably be available for all or part of the transfer process and all precautions identified by these should be implemented. However, the whole operation must be also subject to DRA (Dynamic Risk Assessment), ensuring particularly that the following factors are taken into account immediately before and throughout the transfer process:

- Wind Speed and Direction
- Sea state including swell height and direction
- Tide speed and direction
- Weather conditions; rain, snow, ice, fog, etc.

Risk assessment methodology must be applied throughout.

Rough sea conditions, wind or other adverse weather conditions offshore can present additional risks and challenges to personnel needed to board or depart from vessels.

TIC Council Member inspectors should only consider embarking or disembarking a vessel which is either stationary or manoeuvring at a significantly reduced speed such that a safe lee is created in order to ensure the safest vessel access/egress condition possible. Under no circumstances should an attempt be made to board or leave a vessel that is proceeding at more than the lowest speed possible, consistent with creating a stable lee. Any request to attempt any such task shall be declined and SWA shall be invoked.

It is prohibited to board and disembark inspectors during a heavy rain or snowstorm while on the road.

The ultimate decision to proceed with a transfer at sea remains with the inspector involved. If in the opinion of the inspector the transfer cannot be done in a safe manner, SWA should be exercised.

3.7.2 Gangways and ladders

The passage from the ship to the berth, shore (board of another ship) and back should be carried out by ladders and gangways that meet the safety requirements for the general arrangement, devices and equipment of sea vessels.

Facilities and vessel owners are responsible for providing appropriate and well-maintained equipment for safe transfer on and off the vessel and/or launch.

It is forbidden to get off or enter the vessel on ladders and gangways before they are secured, as well as to stand on bulwarks, fenders, bollards, and also to enter or leave the ship board bypassing the gangway or gangway.

3.7.3 Transfers by launch

Responsibility for ensuring safety when sailing on any floating craft rests with the masters of vessels, boat commanders and heads of organizations conducting activities on the water, as well as the owners of floating crafts, who are obliged to strictly comply with the requirements of the rules of conduct and safety measures.

The party organising the transfer should ensure that safety requirements and labour protection are met.

If the crews of vessels providing movement do not comply with the rules and regulations of safety and labour protection related to movement threatening the life or health of the inspector involved, the inspector has the right to use SWA until the safety violations by the relevant crew are eliminated.

The Launch - The launch should be in seaworthy condition and fully operational, with emergency equipment (water, flares, torch/flashlight, life jackets, man overboard equipment) a competent crew, and a VHF radio to communicate with Vessel/Shore.

The launch crew, inspector and vessel crew must share a common language to ensure good communications and common understanding.

The area of the boat / tug deck from which the inspector disembarks should have a non-slip coating, or laid out and fixed mats, rugs, etc.

The deck must be sufficiently clear so as to allow the inspectors to embark and disembark from an open area determined by risk assessment to have no obstructions or projections which could increase the risks of trips, snagging, collisions, etc.

The launch crew must assist during the transfer by communicating with the vessel throughout the process and physically helping the inspector during the transfer.

Transferring between Launch and Vessel by ladder - The transfer process must be agreed with all parties before starting. Shipping Industry Guidance on Pilot Transfer Arrangements must be followed, complying with IMO/SOLAS regulations. This can be obtained from the International Chamber of Shipping at: <https://www.ics-shipping.org/publication/shipping-industry-guidance-on-pilot-transfer-arrangements-third-edition/>

For Vessel freeboard above 9 metres, a Pilot Ladder / Accommodation ladder combination MUST be used. (accommodation ladder at an angle not greater than 45 degrees).

For Vessel Freeboard below 9 metres a Pilot Ladder MUST be used.

Under no circumstances should a transfer be attempted using the accommodation ladder only.

The delivery of a boat and barges / tug to the vessel is permitted only on condition that the inertia of the vessel is extinguished. If this is not possible due to navigational conditions, the moving of the vessel should be reduced to a minimum, just to ensure sufficient vessel controllability.

Boarding and disembarkation of inspectors in the roadstead can be carried out using pilot lifts, storm ladders or ship outboard ladders. The use of a faulty ladder is prohibited.

Equipment and personal baggage should be transported on or off the vessel by a heaving line. Items such as sampling equipment, bags or rucksacks must not be carried or worn during transfers.

Transferring between Launch and Vessel or Vessel and Vessel by personnel basket - Transfers by basket (Billy Pugh, Personnel Transfer Capsule) are high risk operations and should be undertaken only where transfer is essential and cannot be achieved by any other means.

Personnel baskets should be visually checked before use to ensure all parts are in working order. Tag lines must be used.

The crane and wire must be certified for personnel transfer. The operator manning the transfer must be certified.

3.7.4 Transfers by helicopter

Before any employee may use a helicopter to travel to a vessel or other installation offshore (e.g. platform; sea island), they should have received HUET (Helicopter Underwater Escape Training) or T-HUET for tropical regions only.

3.7.5 Additional PPE requirements for work over water

Personal floatation devices or lifejackets (preferably automatically inflating) with crotch straps must be provided together with high visibility clothing, whistles and water activated lights. For use offshore or in extreme conditions 275 N lifejackets should be used. For use inshore 150 N lifejackets may be used as an alternative during summertime.

Emergency personal response beacons – For work offshore or where there is a risk of being swept away by strong currents or tides a Personal Locator Beacon (PLB) should be carried.

Immersion survival suits – For work in cold water regions where there is a significant risk of falling into the water, an immersion survival suit must be worn. A lifejacket must also be worn, as stated above. This is normally defined by the location.

All safety equipment must be maintained/replaced in accordance with manufacturers' instructions.

3.7.6 Bights and snap-back zones

Although inspectors are not involved in mooring operations, they should be aware of the dangers of mooring lines while on quays and vessels. A loop, coil or section of a loose line can injure or kill if the line suddenly tightens. These hazards are commonly referred to as 'bights'.

The sudden tension of a line results not only in the tightening of any bights but also the rapid movement of the line towards the line of tension. This may result in any rope positioned off this line moving rapidly in that direction, lifting anyone or anything in its path.

A snap-back is the sudden recoil of a mooring line as a result of its failure under tension. A snap-back zone on a mooring deck is the space where it is anticipated that the failed mooring line could recoil with great velocity, possibly resulting in injury or even death to crew present within this zone.

TIC Council Member Companies employees should:

- Perform DRAs (Dynamic Risk Assessment),
- assure good communication with the crew of the vessel and crane, as hauling and crane operations tension the lines,
- never stand in a bight of a line, nor allow body parts to be caught in a bight or stand near a line that is coming under tension,
- avoid entering snap-back zones.

3.8 Flammability

3.8.1 Explosive limits and ignition sources

TIC Council Member Companies frequently conduct their activities in hazardous areas where ignitable concentrations of flammable dust and fine particles are likely to occur under normal operating conditions.

Explosive limits specify the concentration range of a material in air which will burn or explode in the presence of an ignition source. There are two types of explosive limits: lower explosive limit (LEL) and upper explosive limit (UEL). The explosive limits are usually given as the percent by volume of the material in the air (i.e., 5%) in section 9 of a safety data sheet (SDS).

Lower explosive limit (LEL): the lowest concentration of gas or vapour which will burn or explode if ignited.

Upper explosive limit (UEL): the highest concentration of gas or vapour which will burn or explode if ignited.

From the LEL to the UEL, the mixture is explosive. Below the LEL, the mixture is too lean to burn. Above the UEL, the mixture is too rich to burn. However, concentrations above the UEL are still very dangerous because, if the concentration is lowered (for example, by introducing fresh air), it will enter the explosive range.

Regulatory Implications of Explosive Limits

Exposure limits are only required for materials that may end up in air to cause an explosion. Such materials may include gas, vapour and dusts (i.e., metal powder). Engineering control measures need to be taken to reduce the concentration of such materials in air to avoid potential explosion.

Flammability should be tested using an explosimeter.

There are many possible ignition sources including sparks from electrical equipment, hot work, or metal to metal contact, vehicle exhausts and static electricity.

Considering dust explosions and spontaneous combustion, it must be stated that metal, coal, and biofuel dust is highly combustible, for which confined space such as port side facilities or warehouses present risks of explosion. Dust explosions can cause damage to equipment, reduced work time, and injury or death.

Five basic elements must be present for a dust explosion to occur: fuel, oxygen, confinement, dispersion and an ignition source:

- Fuel: dust particles from metal, coal, and biofuel that are suspended in the air, or layers of metal and coal dust in a confined space.
- Oxygen: normal oxygen levels and a continuous air supply.
- Confinement: areas of confined space such as silos or bins, conveyor belt tunnels or enclosed warehouses/storage facilities.
- Ignition source: short circuits, static electricity, lit cigarettes or lighters, overheated bearings, friction, flames or sparks, lightning etc.
- Dispersion (or concentration): Metal and mineral dusts suspended in the air with a concentration within explosive limits.

Most metal, coal, and biofuel dust explosions occur at transfer points, where its movement causes its suspension in the air. The suspended dust may also collect in areas/surfaces and pose a risk of explosion.

TIC Council Member Companies employees should always follow the safety procedures of the vessel or facility they are attending and report any observations/concerns to the respective safety representative of the facility as well as to their company.

3.8.2 Static electricity

Static electricity is the result of an imbalance in electrical charge between two objects. Charges of static electricity can arise from contact or friction of solid materials, crushing or pouring of homogeneous and dissimilar non-conductive materials.

To prevent the possibility of accumulation of static electricity charges on equipment, as well as on people, the following protection measures must be provided:

- Grounding equipment, communications and containers in which charges arise and can accumulate;
- use of materials that increase the electrical conductivity of the medium (graphite, soot, magnesium oleic acid, etc.);
- general and local humidification in hazardous areas of premises (70% relative humidity and above) or humidification of the surface of an electrifying material;

In fire and explosion hazardous areas, all equipment must be grounded if this type of protection is sufficient. Equipment and piping must be a continuous earthed circuit. Personnel are to be provided with anti-static and flame resistant or retardant work clothing.

3.9 Substances Hazardous to Health

3.9.1 General

The harmful effects of substances depend on the chemical properties and the level of exposure. The level of exposure depends on the concentration of the hazardous chemical and on the period of contact time.

A substance may have acute and chronic effects. Both acute and chronic conditions can result in permanent injury; acute effects occur immediately after a short exposure. Chronic effects involve repeated exposure and a delay between the first exposure and the appearance of adverse health effects which then worsen over time.

Exposure to Hazardous substances products may cause contact dermatitis, headache or nausea. These effects can be acute and temporary. However, exposure can also lead to chronic effects and irreversible, permanent, injury to the nervous system.

The chemical properties of a substance varies with its composition and therefore it is vitally important to review the SDS (Safety Data Sheet) for a particular product before considering sampling or other activities which may involve contact with the product or associated vapour. The SDS will contain details of the composition and the associated hazardous properties.

There are four modes or routes through which a substance can enter the body, namely inhalation, skin or eye absorption, ingestion and injection. The SDS will explain the

exposure mode(s) and the type of PPE to be worn when there is a risk of exposure to the specific substance concerned.

TIC Council Member clients must ensure that accurate SDSs are provided to inspection companies and personnel for products which are being inspected. SDSs shall be of recent date and meet mandatory legal requirements. Field staff should consult the SDS for the product they are inspecting to have knowledge of the dangers involved with the specific product and the action to be taken in case of an emergency/spill.

TIC Council Member companies assess the risk of exposure to toxic substances and, together with clients, shall have procedures in place detailing the operational controls necessary to minimise hazardous exposure, using the following risk control hierarchy:

- Minimise emission, release and spread
- Consider routes of exposure
- Choose control measures proportionate to the risk
- Choose effective control options
- Personal protective equipment – the final control option
- Review the effectiveness of controls
- Provide information and training

3.9.2 Dust and silicate materials

Hazardous airborne dust can be found in almost any activity. Dust can contain a large range of materials such as sand, dirt, pollen, minerals, wood, and micro-organisms. Exposure to dust can occur in various activities: filling or emptying bags, cutting materials (wood logs, metal), conveying cargo, grading, milling, grinding, cleaning and maintenance work, recovering spillages, etc.

Dust may be composed of large particles falling to the ground, or of small particles that could become airborne and be inhalable, affecting upper respiratory system or breathed into lungs. The harmful effects of dust can vary according to the chemical/physical properties of the material of which it is composed. It can cause attacks of coughing, wheezing and chest tightness, runny or stuffy nose, allergies, skin ulceration, irritation, dermatitis, eye damage or irritation, lung inflammation, cancer, breathing impairment, and others.

Health effects of exposure can take years to develop and symptoms may not appear until severe, irreversible changes have taken place.

Control measures can involve changes in the process to emit less dust (enclose the process so that dust does not escape), minimise the number of workers that are at risk, reduce the length of time of exposure, use personal protective equipment (PPE) such as gloves, coveralls, eye protection, safety footwear, masks, respirator. Visible dust on surfaces may indicate the presence of airborne dust, thin particles may not be visible under normal lighting conditions and a dust lamp could be used as a quick method to show whether dust is present or not.

3.9.3 Oxygen and carbon monoxide

Oxygen (O₂) is consumed by self-heating / combustion processes, e.g., a self-heating coal should show decreasing O₂ levels. Without O₂, self-heating cannot occur.

Wheat absorbs O₂ and excretes carbon dioxide (CO₂). Respiration may cause life-threatening CO₂ concentrations or O₂ shortages in the holds.

Carbon monoxide (CO) is produced when self-heating or combustion occurs at low oxygen levels. Carbon monoxide is produced from incomplete combustion of fuels, and decomposition of vegetable oils under strong heat can lead to its formation as well.

CO is colourless, odourless, tasteless, non-irritant. Symptoms of exposure copy many common illnesses and can easily be confused with flu or simple tiredness. At low levels it may cause poor concentration, memory and vision problems, loss of muscle coordination. At higher levels, it may cause headaches, fatigue, vomiting, nausea. CO is a 'silent killer' because it binds to haemoglobin in the blood, shutting down blood oxygen, and can kill within a matter of hours.

TIC Council inspectors should be aware of the symptoms and signs of overexposure; report promptly complaints of dizziness, drowsiness or nausea.

Access to the headspaces via the gas sampling ports enables assessment of the gas levels without opening the hatch covers. It is important to know which gases are being checked, why and for controlled atmosphere the carriage instructions should inform the recommended gas levels. Ventilation and gas measurements must be carried out before anyone enters the hold.

3.10 Confined Space Entry

A confined space is a place which has limited or restricted means of entry or exit; is large enough for a person to enter to perform tasks; and is not designed or configured for continuous occupancy. Serious injury can occur from hazardous substances or conditions within the space or nearby e.g. lack of oxygen.

Confined space entry should only take place under a Permit to Work (PTW) with identified controls in place. Closer collaboration with facilities and vessels is needed to ensure that this process is followed.

It is the responsibility of vessel(s) and facility personnel to identify confined spaces and to establish procedures for safe entry. Pump rooms, deck tunnels, vessel holds, cofferdams, or any enclosed space may be subject to oxygen deficiency as well as the presence of hydrocarbon or other toxic gas.

Inspectors must consult the responsible vessel officer or facility operator to determine whether entry into such confined spaces is permitted and shall be accompanied by a representative of the vessel and/or the facility, as appropriate, at all times.

Suitable notices should be prominently displayed to inform personnel of the precautions to be taken when entering tanks or other confined spaces and of any restrictions placed upon the work permitted there.

Extra care should be taken when moving around inside holds as surfaces may be slippery and lighting may be poor.

Entry into confined spaces shall only commence on the production of a valid permit issued by responsible facility or vessel personnel. The entry permit should confirm that the atmosphere has been tested to be safe on all occasions immediately prior to entry. In addition to the entry permit the responsible person should ensure that:

- The appropriate atmosphere checks have been carried out and the PTW has been signed by the responsible person and the actual date and time of the check is recorded.
- Effective ventilation will be maintained continuously while personnel are in the enclosed space.
- Lifelines and harnesses are ready for immediate use. Where possible, pump room lifelines should be already rigged and an unobstructed direct lift provided.
- Approved breathing apparatus and resuscitation equipment are ready for use at the entry to the confined space.
- Appropriate PPE is worn.
- Where possible, a separate means of access is available for use as an alternative means of escape in an emergency.
- A member of the crew/facility personnel is in constant attendance outside the confined space in the immediate vicinity of the entrance and in immediate contact with the responsible person in the control room.
- Where possible, the attendant outside the confined space should be in permanent visual contact with the personnel inside.

In the event of an emergency, under no circumstances should the attendant enter the confined space before help has arrived. The lines of communication for dealing with emergencies should be clearly established and understood by all concerned.

Pump rooms and deck tunnels, by virtue of their location, design and operation, constitute a particular hazard and therefore necessitate special precautions. No-one should enter a pump room or deck tunnel at any time without first obtaining the permission of a responsible officer.

It is the duty of the responsible vessel's officer in charge of cargo operations to ensure that there is adequate ventilation of the pump room or deck tunnel and that the atmosphere is suitable for entry. Approved breathing apparatus and resuscitation apparatus should be available in an accessible location. At no time should a cargo inspector enter a pump room or deck tunnel unless accompanied by a responsible member of the vessel's crew.

To further assist, please find a simple checklist as Annex A

3.11 Working at Height / Road Trucks and Rail Wagons

Working at height constitutes work in any place where, if no precautions are taken, a person could fall a distance liable to cause personal injury.

Fixed barriers or edge protection should be installed at locations where routine inspection activities are carried out.

Non-routine activities of any kind, carried out on top of rail wagons, road trucks and other rolling stock, are subject to potential falls from height. Risk assessments shall be made to avoid or reduce risk for persons, carrying out these activities, and the safest practicable solution shall be devised, based on the below hierarchy of access methods:

- Avoidance of truck and rail wagon top activity
Usually require specific equipment, as weigh bridges and inline samplers
- Gantry rails fully surrounding the work area with access by stairs
Used at busy locations, but requiring suitability to object type

- Mobile gantry with integral stairs and pulpit providing fully surrounding railing
Used at sites where there may be a large number of loading/discharge points, none frequently used
- Object with built-in access ladder, truck and rail car top walkway with fall protection fencing and fall restraint system, with self-retracting lifeline.
Used at remote sites where no gantry is available, but overhead anchor point is available
- Object with built-in access ladder, with fall arrestor, shock absorbing lanyard and tested anchor point.
Used at remote sites, like rail yards and parking places. Harnesses attached to untested anchor points are not to be used. This step is to be taken after all others have been exhausted.

If none of above conditions are met, the TIC Council inspection company will advise its clients that the activities cannot be carried out in a safe manner and that Stop Work Authority is being used.

Working in situations where rolling stock is moving is not recommended and can result in the use of Stop Work Authority.

3.12 Human Factors

For the Inspector in the field it is of vital importance that they have the necessary physical and mental ability to perform their work activities, and the cognitive skills to organize, and apply information in the making of decisions and solving of problems. Physical and/or mental ability can be impaired, for example, by illness, fitness levels, hydration and nutrition, drugs and alcohol, the use of some prescription medicines, and fatigue.

Work related fatigue can be caused by long work hours; prolonged periods of physical or mental activity; insufficient break time between shifts; inadequate rest; excessive stress; or a combination of these factors. Fatigue can cause a multiplicity of effects on an individual such as: physical weakness, slowed reflexes and responses, and impaired decision-making and judgement. This affects the individual's ability to perceive risk and their behaviour.

In view of the above it will be necessary for member companies to have processes in place to verify the fitness of Inspectors; to manage hours of work, rest periods and meal breaks, and welfare facilities; have policies to deal with Drug and Alcohol abuse and to manage prescription medicines; to ensure a suitable working environment and support the use of Stop Work Authority; provide work equipment and personal protective equipment that is as ergonomically designed as possible; and the ability to detect any adverse indication demonstrated by the Inspector and act on it as necessary.

As stress at work is a contributory factor to fatigue it will be necessary for TIC Council Member Companies to have a positive supportive Health and Safety Culture embracing the principles embodied in this Safety Code which will help to reduce the stress levels experienced by the Inspectors.

3.13 Heat and Cold Exposure

At times, inspectors might work in extreme temperatures, which can cause severe health damage. Furthermore, accidents seem to occur more often in extreme temperature environments. The inclination to rush a job to get into a more suitable environment greatly increases the opportunity for careless behaviour and resulting injury.

Risk factors and hazards vary between cold and hot environments:

Cold Environments - A cold environment can reduce the temperature of the body and cause shivering, reduced mental alertness, and sometimes even loss of consciousness. When conduction, convection, evaporation, radiation, cold air temperatures or fast air movement occurs, the hazard of cold stress illness is present.

Frostbite and hypothermia are the two major hazards when working in cold temperatures. Cold environments also include physical hazards such as ice, snow (including snow blindness) and skin injuries from cold metal contact.

Hot Environments - A hot environment can lead to heat stress illnesses when the body cannot cool itself enough to maintain a healthy temperature. Contributing factors are high temperatures, humidity, direct sunlight, exposure, no wind, insufficient liquid intake, physical labour, work rate and pre-existing medical conditions.

Heat-related illnesses include heat cramps, heat exhaustion, heat rash, or heat stroke, each with its own symptoms and treatments. Symptoms can range from profuse sweating to dizziness, and to loss of consciousness. Without prompt treatment, heat related illness can lead to heatstroke, a life-threatening condition.

A worker who is properly protected and takes reasonable precautions can function efficiently and safely in cold and hot environments.

TIC Council Members Companies should consider the risk of exposure to such conditions, include appropriate controls in their risk assessments and develop safe work procedures. Inspectors should be provided with adequate information and training on action in such conditions. Further appropriate operational planning, scheduling and job instructions are essential to maintain inspectors safety.

3.14 Engulfment / Sampling Stockpiles

Sampling stockpiles raises several potential safety and health hazards. As part of the work order review and before any physical sampling activities are performed, a sampling plan incorporating a location specific risk assessment should be included in the field work instructions for all field staff attending site. These documents must consider all relevant local laws, client / site safety rules, and programs. The following hazards are pointed out:

Engulfment - Some commodities can stick together, forming piles. Piles can collapse or cave in and engulf people. This may lead to death from suffocation, as the mass of the material on or around the chest can prevent individuals from expanding their lungs. People become buried in material due to two actions: sloughing of the pile that covers a person in the same way as an avalanche, or the person falls through a stable arch in a pile.

All piles are inherently unstable, and particularly so when feeders under it are used to reclaim material. The slope of the material in the pile is a function of the sizes and geometry of its particles, and of the moisture content of the pile. When a pile is formed on a solid base, the angle of repose is stable for the material at the time it is deposited. However, the stability of the angle can change if the moisture of the pile increases (rain or snow) or decreases (dries out in sunny weather).

A stockpile with an angle from the horizontal of more than 40° is considered dangerous. The angle of repose for a specific commodity may be lower than 40° and should be measured using applicable tools prior to approaching the stockpile. For example, published angles of repose for coal are 40° but, for coke as low as 23°.

High walls – Loading operations, excavations, or removal of material from a stockpile can lead to the creation of high walls.

High walls are extremely dangerous, as the material they are made of is standing in a highly unstable condition. Anyone within a distance equal to the height of the high wall is endangered, as the wall can fail at any time and will engulf a person within the distance it flows. Note that a person cannot outrun a collapsing high wall. Individuals caught by a collapsing high wall are highly likely to be knocked down and covered with an amount of material that would only reach their knees or waist if they were standing, becoming trapped and suffocating.

The risks of Stockpile collapse and of High Walls can be minimized by:

- Not allowing individuals to approach a high wall and fresh cut on foot within the danger zone equal to the height of the high wall. The danger zone shall be considered based on the minimum angle of repose the material can assume under the worst conditions. It shall be forbidden to sample such stockpile.
- Agreeing a safer sampling method, where a Loader takes scoops from the stockpile and delivers it near to the sampling station outside the danger zone of the main stockpile.
- Establishing a sampling station outside the stockpile danger zone.
- Forbidding inspectors from walking on top of a high wall. The high wall should not be approached from above, keeping a minimum distance back from it equal to the height of the high wall.
- Never walking on, or sampling, a stockpile that is located over a feeder that, when being operated, can cause the stockpile to cave in. Samplers must never go onto piles with bottom withdraw feeders, even if the feeders are off. Open voids often form over these types of feeders, risking people walking on top of the pile to punch through into them and become buried and suffocating.

Moving vehicles and heavy mobile equipment – During stockpile sampling, moving vehicles and heavy mobile equipment pose risks to inspectors. This category includes cargo tracks when offloading cargo at site and heavy mobile equipment moving the cargo on/off the stockpile.

Moving vehicles and heavy mobile equipment present particular risks to samplers due to the constantly changing nature of hazards. This includes, but is not limited to, multiple participants (drivers) changing in rapid sequence, the relatively large size of vehicles, the elevated position of drivers/operators' station, the moving direction of the vehicles, and the high level of dust in the area. Samplers are comparatively small, poorly visible and unprotected against the risk posed by vehicles or equipment.

These risks can be minimized by:

- not allowing samplers to approach and work in the same areas where the load tracks and heavy mobile equipment are normally operating. This is achieved by segregation the work of samplers and vehicles/equipment either by time and/or by distance.
- Agreeing a safer sampling method, where a loader takes scoops from the stockpile and delivers it near to the sampling station outside the danger zone of the main stockpile.
- Establishing a sampling station outside defined passage ways of vehicles and manoeuvre area of heavy mobile equipment. Field staff shall remain within the station except for short moments of drawing a sample from a loader.
- Marking / cordoning off the sampling station with high visibility cones and tapes, and flashing lights/diodes at darkness.
- Ensuring that the field staff monitors the changing situations and adjusts the position of sampling stations to keep a safe distance at all times.
- Always making eye contact with equipment operators.

3.15 Sampling Around Conveyor Belts / Rolling and Moving Equipment

Inspectors are often required to take samples from a moving stream of material on a conveyor belt during operations on the quay or at intake warehouses.

Conveyor belts present significant hazards due to the high speed rolling cylinders upon which the conveyor belt moves. The risk of getting grabbed or touched by these cylinders is not unlikely and utmost care needs to be taken by inspectors to keep a safe distance between from the rolling cylinders

The risks of sampling around conveyor belts can be minimized by:

- Verifying that no other sampling point can be agreed (quay, at intake warehouse, installation of automatic sampling device...).
- Asking the stevedore/silo owners to install a safety cage which is protecting the inspector from getting too close towards the rolling cylinders.
- Making sure there is a safety “rope” and line management to ask to the terminal management about the yearly test of this safety rope.
- Making sure there are no loose endings at the level of the inspectors clothing.
- Asking whether possible to stop operations in order to allow sampling in safe conditions

3.16 Working Around Railcars

Railroad marshalling yards and container yards are potentially dangerous places to work in and around. There are existing safe practices for protection of personnel from hazards that can arise when working on and /or around rail cars and tracks.

As best practices for inspectors when working around railcars/wagons the following should be applied:

Before entry into the railyard

- Review the facilities railyard orientation (if any) and wear the applicable PPE.

Track securement

- Ensure the track or work area has a visible warning system which indicates that workers are in the vicinity of rail equipment.
- Ensure track isolation has been provided by an activated and locked de-rail to avoid any rail movement or a locked switch aligned to re-direct accidental movement.
- Ensure that the assigned cars or tanks have been cleared to work on.

Railcar securement – before assessing any railcar

- Ensure the railcar has chocks applied to it.
- Ensure the railcar has hand brakes applied.
- Ensure proper grounding in cases where the railcar contains hazardous or dust producing products.

Walking in the Railyard

- Never walk in-between the rails of a track or on the track ties (sleepers).
- Only cross tracks at a perpendicular angle, looking both ways and listening for potential movement.
- Never step on a rail, switch or frog, as they are usually oily and extremely slippery
- Never crawl underneath a railcar.
- Never sit or stand still on the rails of a track.

Working around railcars

- Only cross in-between unsecured railcars if separated by more than 10 meters of space.
- Only cross in-between secured railcars if separated by more than 2 meters of space. As a general rule, crossing is prohibited if both couplers can be touched.
- Do not cross under a string of coupled railcars. If it is necessary to cross a string of coupled railcars, the cross over should be at the end sill of one of the railcars, as long as the track is secure, and using the stirrups, grab irons and 3-point contact.
- Never operate machinery or equipment associated with railcars or tanks. Ask for assistance if required.
- Ensure that you close any hatches or other opening used in the course of work. Also, any equipment or cleaning materials are to be removed. Unsecured objects could fly off when the railcar is moving at high speed.

4. Conclusions

This Code has been prepared by TIC Council Member Companies with support from several client companies and following cooperation over many years aimed at reducing the risks involved in independent inspection activities.

It is an expectation that TIC Council Member Companies and their clients together with facility and vessel owners and operators will follow the spirit of this code.

The Code is a living document and will be reviewed on a regular basis as safety techniques, technology and the requirements of the work continue to develop.

Feedback from users is welcome and should be addressed to:

secretariat@tic-council.org

ANNEX A - CONFINED SPACE ENTRY CHECKLIST

The below checklist can be used to compliment a Permit to Work system to ensure all aspects are verified.

Task	Yes	No	N/A	Comments
Has a Permit To Work (PTW) been issued by the installation or vessel				
Have atmosphere checks been performed on the space to enter?				Result:
Is there enough lighting available within the confined space?				
Is ventilation maintained continuously whilst personnel are in the confined space?				How will this be maintained?
Are harnesses available and worn at all times with lifelines available?				
Are lifelines already rigged and an unobstructed direct lift provided?				
Is appropriate PPE being worn? (Coveralls, shoes, hard hat, gloves, safety glasses, gas monitor)				
Is approved breathing apparatus ready for use at the entrance to the confined space?				
Is resuscitation equipment ready for use at the entrance to the confined space?				
Is there an alternative means of access and escape in an emergency?				
Is a member of the crew/installation personnel in constant attendance outside the confined space and in constant communication with the personnel inside?				
Are they in immediate contact with the responsible person in the control room?				
Is emergency squad trained in extraction present?				
Have all pumps and lines been isolated?				

Inspector

Installation / Vessel