

Workplace Fatalities in 1H2024 Involving Hazardous Materials and Machines, or in Unsafe Environments

In the first half of 2024, four workers died in three separate incidents: working with pyrotechnics, operating a food production machine, and doing tank cleaning works.

The WSH Council calls on all companies undertaking similar work activities to review their risk assessments and work procedures, and ensure the necessary risk controls are in place and checked effective before allowing the work to proceed.

Worker died after pyrotechnics explosion

On 6 March 2024, two workers were removing fuses from confetti bags containing pyrotechnics meant for disposal when an explosion occurred. Both workers were sent to the hospital with severe burn injuries. One of the workers died on 4 April while the other survived.

There was no method statement for the dismantling of the confetti bags.



Figure 1: Overview of the accident scene.

Worker caught in food production machine

On 16 March 2024, a worker reached into a food production machine used for loading metal trays onto racks while the machine was still in operation. The upper half of his body got trapped between a metal tray and a loading module which lowered onto him. A co-worker managed to stop the machine and free him. The worker was sent to the hospital where he passed away.

There was a “DO NOT ENTER” sign with two horizontal bars to prevent access to the rear of the machine. There was no guarding at the opening of the machine where the worker had reached into.

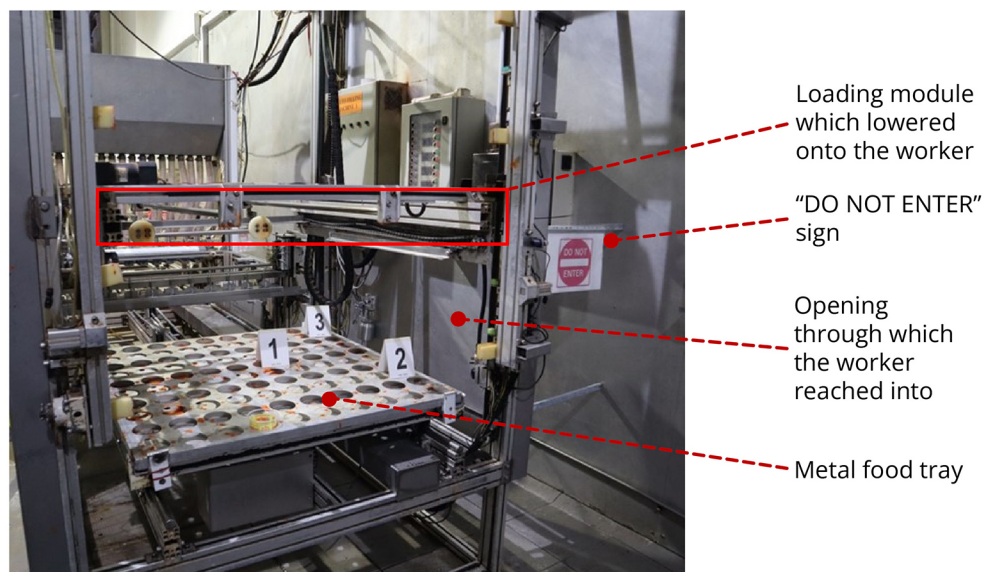


Figure 2: Scene of the accident.

Workers overcome by hydrogen sulphide

On 23 May 2024, three workers entered a service tunnel to carry out routine tank cleaning works. When closing the hand valves after draining a water treatment tank of its contents, they were overcome by hydrogen sulphide (H₂S) gas and became unconscious. All three workers were sent to the hospital, where one worker passed away the same day and another five days later.

The service tunnel was identified as a confined space. The H₂S gas was likely produced from the residual sludge inside the water treatment tank.



Figure 3: Overview of the accident scene inside the service tunnel.

What companies should do

Companies should assess and ensure that their WSH management system covers the following measures:

Working with pyrotechnics

Pyrotechnics contain explosive substances that ignites easily. Handling of pyrotechnics is a dangerous task which requires specialised training, equipment and safety precautions. Companies are advised to plan for and conduct a WSH risk assessment before handling any product containing pyrotechnics.

- **Identify the hazard:** Check the product label and/or its Safety Data Sheet (SDS) to determine if it contains an explosive substance. Note down all the recommended safety precautions. Provide workers with a copy of the SDS to refer to onsite.
- **Remove ignition sources:** Ensure the work area where pyrotechnics are handled is free of ignition sources including open flames, lighted cigarettes and hot surfaces. Use only explosion-proof electrical equipment and tools designed for handling pyrotechnics in the work area.
- **Safe work procedure:** Obtain from the product manufacturer/supplier the method statement or safe work procedure for the safe handling of pyrotechnics. Strictly handle the product as per the manufacturer's instructions.
- **Competent worker:** Only deploy workers who have completed specialised training on pyrotechnic safety, handling techniques and have sufficient practical experience. Familiarise workers with the product-specific SDS and necessary safety precautions before any work involving pyrotechnics.

- **Safe storage:** Store undischarged or expired pyrotechnics in a cool, dry, well-ventilated area and away from flammable materials and sources of ignition. The use of a locked fire-rated storage cabinet is recommended. Minimise and/or spread out the stock of pyrotechnics to limit the impact of an explosion and possible fire spread.
- **Safe disposal:** Disposal of pyrotechnics requires a special licence/permit. Never try to dismantle or modify products containing pyrotechnics without a licence, manufacturer's consent or instruction, or proper training. Disposal must be carried out by a licenced disposal operator/service provider at a designated disposal site with safety provisions in place.
- **Personal protective equipment (PPE):** Provide each worker handling pyrotechnics with PPE such as fire-resistant clothing, safety goggles and gloves. Supervise the workers to ensure the PPE is worn before handling the pyrotechnics.
- **Emergency response plan (ERP):** Develop an ERP covering firefighting, evacuation and first-aid. Provide workers with a list of emergency contacts and conduct drills to ensure they know what to do in an emergency. Provide firefighting equipment and a first-aid box onsite and train workers on their use.

For more information, refer to the WSH (Risk Management) Regulations, Arms and Explosives Act 1913, Arms and Explosives (Explosives) Rules, Dangerous Fireworks Act 1972, and Dangerous Fireworks (Exemption) Notification 2018. Get more information of [explosive licence matters](#) on the Singapore Police Force's website, and the use of pyrotechnics at events in the WSH Council's [WSH Guidelines on Event Management](#).

Working with machines

Unguarded moving machine parts present an unsafe work environment for workers. Companies carrying out machine operations are advised to review their risk assessments and implement risk controls to protect workers from unguarded moving machine parts.

- **Safe machine by design:** Select machines that are designed to be inherently safer or where there are automatic safeguards to prevent injury. For example, where the forces exerted by moving parts are limited to reduce harm to the operator or designed with no access to moving parts.
- **Machine safeguarding:** In cases where access to moving parts is still possible, install fixed or adjustable guards to physically prevent workers from coming into contact with the moving parts. Put in place interlocking guards at all machine access points (e.g. at a machine door or cover) such that the machine will shut down automatically once any access point is opened.
- **Use of technology:** Install presence-sensing devices (e.g. a light curtain) that can detect the presence of a person once any part of his or her body enters the identified hazard zone. Once presence is detected, the machine can be programmed to raise an alarm, reduce the speed of its moving parts, or be shut down automatically.

- **Machine safety verification:** Verify the safety of each machine at the workplace by putting them through an inspection programme. The inspection programme verifies that machines used meet the requirements of SS 537: 2008 Code of Practice for Safe Use of Machinery – Part 1: General Requirements and the relevant WSH legislation. Read more about the Ministry of Manpower's [inspection programme for safe machines](#).
- **Safe work procedure (SWP):** Establish and implement an SWP for work involving a machine. Instruct workers never to enter or reach into a machine unless it has been de-energised and locked out.
- **Working training and supervision:** Allow workers to operate a machine only if they have been trained for the specific make and model of machine. Conduct toolbox briefings to remind workers of the onsite machine hazards. Provide supervision to ensure that the SWP is strictly followed.
- **Hazard communication:** Place warning signs on the machine to alert workers to the presence of moving machine parts.

For more information, refer to the SS ISO 12100: 2024 Safety of Machinery – General Principles for Design – Risk Assessment and Risk Reduction, SS 537: 2008 Code of Practice for Safe Use of Machinery – Part 1: General requirements, as well as the WSH Council's [WSH Guidelines on Safe Use of Machinery](#), and [6 Basic WSH Rules for Working with Machines](#).

See the Annex of the WSH Guidelines on Safe Use of Machinery for sample checklists for Acquisition; Installation; Commissioning; Use; Maintenance; and Disposal of Machines.

Companies may wish to share the following animation with workers during toolbox briefings:



Download [here](#)

Working in a confined space

Confined spaces may have hazardous atmospheres, for example, due to the lack of oxygen and/or presence of a toxic substance exceeding the permissible exposure levels specified in the First Schedule of the WSH (General Provisions) Regulations. Companies are advised to review and manage the risks of confined space entry by putting in place the necessary measures to ensure a safe work environment for workers.

- **Mechanical ventilation:** Provide continuous ventilation to maintain oxygen levels and prevent the accumulation of toxic gas/vapour in any confined space accessed by workers. Push-pull ventilation is important to introduce fresh air into the confined space and dilute the concentration of any hazardous gas/vapour. For long confined spaces (e.g. a service tunnel), consider deploying a series of fans/blowers.
- **Air monitoring:** Before sending workers into a confined space, a confined space safety assessor must conduct air monitoring to ensure that the atmosphere is safe for persons to enter. This includes monitoring the oxygen level and detecting the presence of flammable and toxic gas vapour. For water treatment plants, hydrogen sulphide (H₂S) is a known toxic gas that can arise from anaerobic decomposition of sludge. The selected gas detector(s) must therefore be able to detect the presence of H₂S (including near the floor as H₂S is denser than air). For service tunnels, consider deploying multiple fixed gas detectors along the tunnel (e.g. at both chest and knee height) for H₂S detection. Equip at least one worker entering the confined space with a handheld or body-worn continuous multi-gas detector.
- **Confined space entry permit:** Implement a permit-to-work system for entry into a confined space. Entry permits may be issued only when atmospheric risk controls (e.g. mechanical ventilation, air monitoring) and work activity risk controls are in place and checked to be effective. Companies are reminded to conduct risk assessments for each work activity to be carried out within the confined space (e.g. operating hand valves), as the work activity could cause the atmosphere in the confined space to become hazardous.
- **Competent workers:** For confined-space work, verify workers are trained (e.g. completed the Workforce Skills Qualifications (WSQ) Perform Work in Confined Space Operation course) before deployment.
- **Safe work procedures (SWP):** Develop SWPs for work activities carried out within confined spaces and communicate it to workers (e.g. during daily toolbox meetings). As the release of a toxic gas (e.g. H₂S) upon valve opening is a foreseeable risk, the SWP should list the necessary steps to reduce this risk. For example, the SWP should include the procedure for hand valves to be cracked open (i.e. opened by less than 5%) and the atmosphere tested for possible release of toxics. Instruct workers to fully close the valve, stop work and immediately evacuate the confined space once an alarm from any gas detector sounds.

- **Personal protective equipment (PPE):** Should work in the hazardous atmosphere be required, equip each worker entering/re-entering the confined space with respiratory protection such as a self-contained breathing apparatus.
- **Emergency response plan (ERP):** Allow entry into a confined space only if an ERP and rescue equipment are in place. Onsite rescue personnel must be trained in rescue operations and first-aid, and provided with PPE for rescue and suitable reviving apparatus. Station an attendant outside the confined space to maintain communications with those working inside and alert rescue personnel in the event of an emergency.
- **Use of technology:** Explore the use of remotely-operated drain valves to eliminate/reduce the need for sending workers into the service tunnel.

For more information, refer to the WSH (Confined Spaces) Regulations 2009, WSH (General Provisions) Regulations, SS 568: 2011 Code of Practice for Confined Spaces, as well as the WSH Council's [Technical Advisory on Working Safely in Confined Spaces](#), [Confined Space Safety Guidebook for Supervisors and Workers](#) and [6 Basic WSH Rules for Confined Space Entry](#).

Under the WSH Act, first-time corporate offenders may be sentenced to the maximum fine of \$500,000 whilst individuals can either be sentenced to the maximum fine of \$200,000 and/or an imprisonment not exceeding 2 years. Read more on the [WSH Act penalties](#).

Information on the accidents are accurate as of time of publication. This may be subject to change as investigations are still on-going. Please also note that the recommendations provided here are not exhaustive and are meant to enhance workplace safety and health so that a recurrence may be prevented. The information and recommendations provided are not to be construed as implying liability on any party nor should it be taken to encapsulate all the responsibilities and obligations under the law.

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