Example entry

Category one – Best solution to an identified work health and safety issue

1: Describe the work health and safety issue and how it was identified.
Context - Brisbane Motorway Services employs 74 staff to manage high speed motorways responsible for the safe passage of over 320,000 motorists per day, averaging 800 traffic incidents per month. The company provides Traffic Incident Management Services (Refer https://youtu.be/sIXJPJIbkuY). Staff work in an open road, high speed and therefore, high risk environment, exposed to live traffic conditions 24/7.

Issue - Since commencing operations in 2018 BMS has conducted over 10,000 tows to safety. This requires the recovery of a broken-down vehicle with the use of a single tilt tray and driver, often deployed as a single resource with no cover vehicle. The driver works between the rear of the tilt tray and the front of the broken-down vehicle often within a few metres of 40 tonne vehicles travelling past at 100km/h. At times the driver has to pull a 20m, 42kg wire cable from the tilt tray winch and climb underneath the vehicle to secure it. It is at this stage the driver loses all situational awareness and the ability to react and evade any upstream hazards.

Knowledge - In August 2019, BMS reviewed a risk register containing all relevant high-risk activities and their risk ratings relating to Traffic Incident Management Service provisions. The activity of operating a tilt tray in and working around live traffic was the highest rated. Furthermore, the risk control methods were somewhat limited, and these only reduced the residual rating to a “high-risk” level. Even with the controls, operating the tilt tray for vehicle recovery was still the most dangerous high-risk activity undertaken daily by BMS workers. On 22nd November 2019, the field exercise Operation Knightsbridge was developed with the purpose of identifying safety gaps in incident management, specifically critical incidents involving vehicle recovery.

The exercise was conducted at Quality Street located at BMS’s Illaweena Street Depot in Stretton, QLD. The exercise involved key stakeholders, including MROs, Incident Response Management Team, HSEQ, HR, and the BMS Executive Leadership Team.

The field exercise identified the need to come up with a solution to remove the MRO from the high-risk areas of a vehicle recovery scene during the recovery process of a vehicle.

Impacts - Most towing industry providers averages a civil damage claim once every 400 tows. BMS averages one every 2000 tows. Injuries from failed tow bridals and winch cables are a regular occurrence in the tow industry. Damage claims average between $700 to $4,700. Methods used to identify, measure and evaluate issues and impacts included;
1. Client feedback
2. Staff Surveys
3. Incident safety data trending
4. Complaint management
5. Investigations

ICAM investigation methodology - On Saturday at 1107hrs 11th December 2021, a BMS MRO attended an Abandoned Vehicle situated on the westbound, left-hand shoulder of the Logan Motorway. She commenced the loading process of the abandoned vehicle in accordance with procedure TQORN-RO-PR-07_Rev1.0_Operating a Recovery Vehicle (Tilt Tray). During the recovery process the tow bridle snapped causing the MRO to suffer a fractured 5th digit on her left hand.

The resulting ICAM recommended the expedited production of Project Aardvark.

2: Explain the solution that was developed to address this issue.
Project Aardvark – Autonomous Recovery Device for broken down Vehicles (Refer https://youtu.be/NKuSkbC8eml).

In collaboration with C2R, BMS has manufactured an innovative device that will revolutionise the general towing industry and the TIMS industry for high-speed open road networks. Project Aardvark eliminates all manual handling in the vehicle recovery process during tilt tray operations as well as protecting the tilt tray operator being exposed to high-risk work areas, improving situational awareness. (Australian and international patents apply)

The innovation originated from a mind mapping exercise after a number of risk reviews and field exercises in 2019 identified some safety issues. A master's student from Robotics and Engineering faculty at QUT was then engaged on a 12 week workplace internship to design a proof of concept. This was an intentional strategy to retain all intellectual property rights to the final solution. During 2020 and 2021 the proof of concept was then reviewed and transitioned to full CAD drawings for engineering assessment. The BMS sustainability program required local supply chain involvement, so C2R from Murarrie QLD were engaged for the final design and construct.

The Aardvark project eliminates the need for the tilt tray operator to place themselves in any position where they are in danger. To do this, a method to isolate the operator from the hazard was designed. The final design is very adaptive and capable of adjusting to fit a variety of vehicles and weights. The Aardvark is capable of retrieving and restraining the vehicle from the roadside and then securely docking back with the tilt tray. Aardvark is suitable for high-speed motorway environments.

The Aardvark system is powered by a 100 Volt 140Ah battery array that runs the four vertical drive motors and the 20kW motor to run hydraulic pumps. The drive system is capable of carrying a combined load of 5.6tonne at a max speed of 8Km/h and produce over 2000Nm of torque. The 20kw motor runs the hydraulic pump that powers the Aardvark's 20 hydraulic rams.

The lifting rams are designed to lift a 3.2-tonne car 200mm off the ground in under 4 seconds. The Aardvark restraint systems relies on three points of contact with the towed vehicle's four wheels to prevent it from falling off during retrieval or transport.

This is achieved with the two lower lifting tines that fold under the vehicle either side of the wheels. The top pressure plate is then inserted between the top of the wheel and wheel arch, then pressure is applied by a hydraulic ram locking the wheel in place. This is done to prevent the vehicle from moving during transport that may result in vehicle damage. The automated docking system relies on a series of hooks that are lowered from the underside of the Aardvark system, attaching to locking points on the tilt tray.

Costs associated with Program coding was the most significant challenge. Project budget was restricted to $300k. Some aspects of automatic coding were replaced with remote control functions to keep within budget. COVID caused four-month production delays.

3: Outline the success of the solution and how it improved work health and safety.
There was a supposition that there was extremely limited evidence at a global level that there was a device or innovation from any industry that could be marketable and transferable to the Traffic Incident Management Services industry to support the core service of broken down and abandoned vehicle recovery.

This hypothesis was the starting point of our testing and evaluation which resulted in a tangible product. Project Aardvark reduced the overall risk of the operator being struck by a vehicle during towing activities to "Medium".

Testing, monitoring, evaluation were based on the following key project deliverables.

- Unlock from the tilt tray
- Travel down a 12.5-degree slope off the tilt tray
- Be able to negotiate a 40mm step
- Travel along uneven and rough surfaces
- Position itself around the vehicle without impeding into adjacent lanes
- deploy the lifting mechanism
- Lift vehicles up to 3 tonnes by using its four wheels as lifting points
- Lock vehicle to the system with an OSAS approved locking mechanism
- Travel back to the tilt tray with vehicle onboard over uneven and rough surfaces
- Travel up tilt tray with vehicle
- Secure itself to tilt tray for transport

The following subject matter experts in design and construction were engaged to identify any adjustments.

1. Mechanical Engineering Design - QUT Robotics and Engineering faculty
2. Civil Engineering – Civil 2 resources Pty Ltd
3. Electrical Engineering – Sage Pty Ltd
4. WorkSafe QLD
5. DTMR

Under its ISO 9001 certification BMS possesses a plant test plan and execution register. There are over 10 individual ITPs associated with Aardvark. Static Wearhouse testing was applied during the manufacturing stage. Field testing also featured in a controlled training environment. A selection EOI process was adopted to restrict the evaluation and testing phase to two operators only as reward. The communication and collaboration process was in compliance with ISO45001.

Adjustments and learnings.

1. Licensing and Regulatory Interventions from Workplace Health and Safety Queensland deemed device did not require plant item registration.
2. DTMR Land Transport Safety and Regulation Branch recommended compliance with strip plate requirements as per vehicle carrier National Code of Practice VSB 12 – Version 2.2
3. Extra locking pin at the front of the device, as an extra precaution. The device has hydraulic brakes incorporated and a fail-system if the pressure drops
4. Modified the design for the winch mounting point so a D shackle / hook can be used

5. Re-designed Wheel Drive Reduction boxes from a local supplier with a shorter lead time

In 2021 BMS recorded the following LAG indicators:
- Medical treatment Injury x 1 (broken hand)
- First aid injury x 1 (rolled ankle)
- Near miss x 3 (Slips/trips/falls)
- Damage claim x 1

So far in 2022 there have been zero recordable incidents.

The solution can be applied and adapted in other workplaces such as tow truck industry, traffic control, plant and logistic warehousing, carpark agistment. BMS is so confident in its marketability and transferability that BMS has gone to the great expense of registering a national and international patent for the design.