International Oil and Gas Operational Safety

Unit IOG1 - Management of International Oil and Gas Operational Safety

SAMPLE MATERIAL

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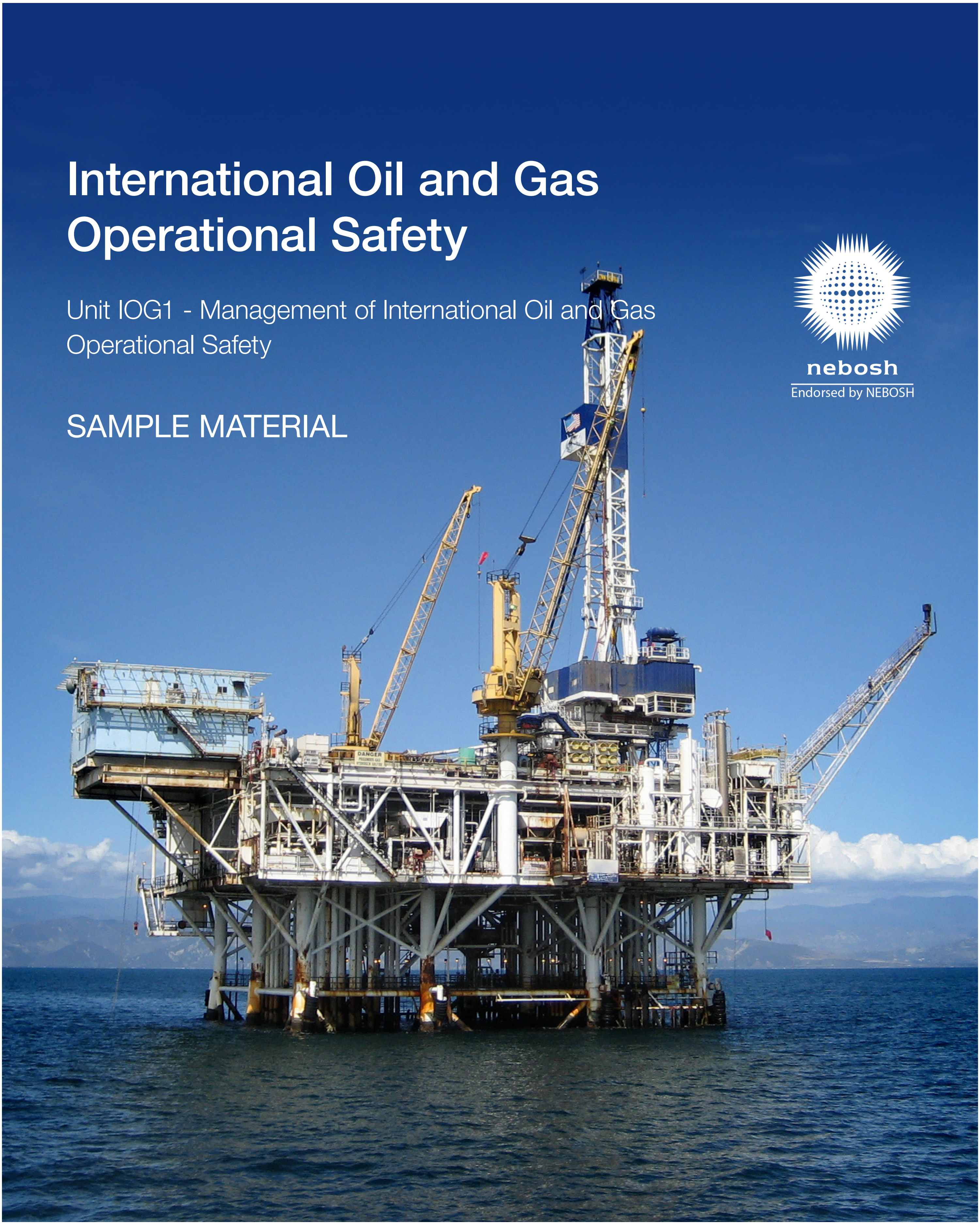

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1.1 - Learning from incidents

Accident/incident causation and investigation

TYPES OF INCIDENT

Accident/incident:

An unplanned, uncontrolled event that results in injury, ill health, damage to plant or equipment, or some other loss.

Near miss:

An unplanned, uncontrolled event that had the potential to cause injury, ill health, damage to plant or equipment, or some other loss.

Dangerous occurrence:

A specified event that has to be reported to the relevant authority (for example, major release of a flammable substance).

ACCIDENT AND INCIDENT CAUSATION

Some years ago a study of 1,750,000 accidents in 21 industry sectors, led by Frank Bird, showed that there is a fixed ratio between losses of different severity (and accidents where no loss occurred, i.e. near misses). This can be demonstrated with a pyramid model:

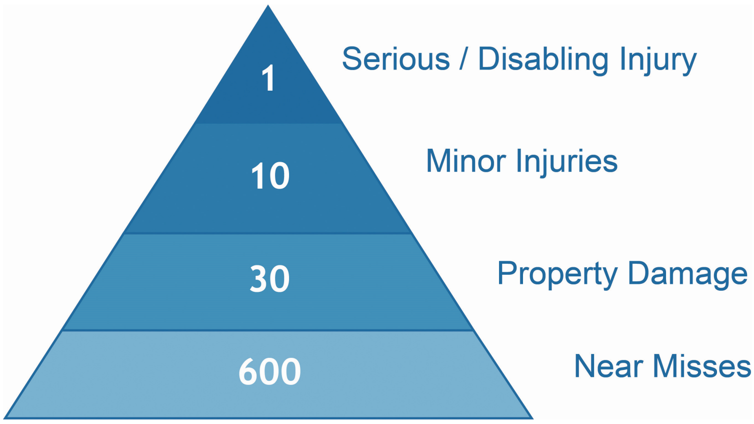

Figure 1-1: Accident ratio study. *Source: Frank Bird - ILCI.*

The model illustrates that if limited interest is taken in the full range of events that occur, such that only those resulting in injury are considered, many opportunities to learn about what goes wrong are being missed. If near misses are also studied they can provide more opportunities to learn and possibly prevent some of the events that result in injury. The Bird model includes property damage in addition to near misses and, if measured, analysed and acted on, this will help to prevent the injury events. The model helps to convince people of the value of reporting a wide range of events and show that there are usually more near misses than injury events, which provide more opportunities to learn and improve health and safety.

THE DOMINO THEORY

HW Heinrich, an American safety engineer, proposed one of the first coherent theories of accident/incident causation in the mid-1920s. He suggested that accidents/incidents were not 'acts of God' but were caused by the failures of people. His domino theory suggested that the series of events which led to an injury or some other loss were a succession of events which followed a logical pattern. Further research by Frank Bird of the International Loss Control Institute (ILCI) into accident/incident causation led them to put forward a modified domino theory.

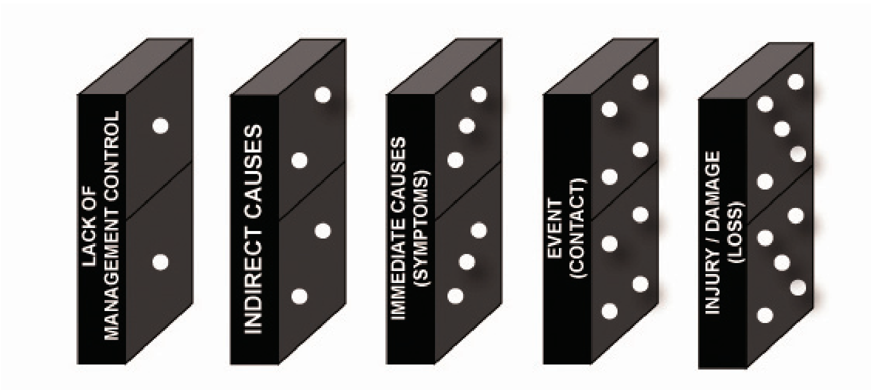

Figure 1-2: Accident causation domino. *Source: Frank Bird - ILCI.*

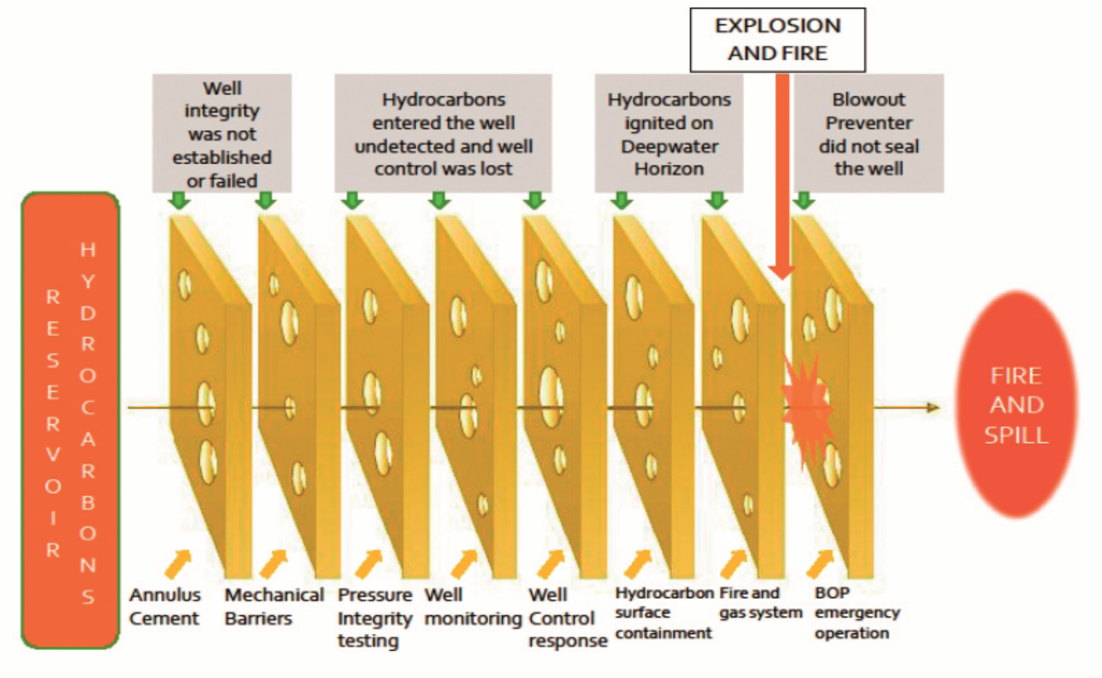

Figure 2-6: Swiss cheese model. *Source: The Bly Report.*

The holes in the cheese slices represent individual weaknesses in individual parts of the system, and are continually varying in size and position in all slices. The system as a whole produces failures when all of the holes in each of the slices momentarily align, permitting 'a trajectory of accident opportunity', so that a hazard passes through all of the holes in all of the barriers, leading to a failure.

If the layers are set up with all the holes lined up, this is an inherently flawed system that will allow a problem at the beginning to progress all the way through to adversely affect the outcome. Each slice of cheese is an opportunity to stop an error. The more barriers you put up, the better. Also the fewer the holes and the smaller the holes, the more likely you are to catch/stop errors that may occur.

Maintenance, inspection and testing

MAINTENANCE

In order to ensure equipment does not deteriorate to the extent that it may put people at risk it should be maintained in an efficient state, in efficient order and in good repair.

The factors that may help to determine the frequency and nature of maintenance include:

- The manufacturer's recommendations.
- The intensity of use.
- Operating environment (for example, the effect of temperature, corrosion and weathering).
- The risk to health and safety from any foreseeable failure or malfunction.

SCE's of equipment may need a higher and more frequent level of attention than other aspects. This should be reflected within the maintenance programme.

MAINTENANCE STRATEGIES

Maintenance is any activity carried out on an asset in order to ensure that the asset continues to perform its intended functions, or to repair any equipment that has failed, or to keep the equipment running, or to restore to its favourable operating condition. Over the years, many new strategies have been developed and implemented, with the intention of overcoming the problems related to equipment breakdown.

Some of the common maintenance strategies are as follows:

Corrective maintenance

Corrective maintenance refers to action only taken when a system or component failure has occurred. It is thus a retro-active strategy. This will not be suitable for SCE.

Preventive maintenance

Equipment is repaired and serviced before failures occur. The frequency of maintenance activities is pre-determined by schedules. Preventive maintenance aims to eliminate unnecessary inspection and maintenance tasks, to implement additional maintenance tasks when and where needed and to focus efforts on the most critical items. The greater the consequence of failure, the greater the level of preventive maintenance that is justified.

solutions. Decommissioning occurs when oil or gas production from a field is exhausted or when an installation reaches the end of its useful life.

For drilling and production installations, there are three principal stages:

1) Cessation of production.
2) Plugging and abandonment (P&A) of wells and making them safe.
3) Removal and disposal of redundant facilities as appropriate.

The owner/operator will normally be required to prepare, for approval by the national regulator, a Decommissioning Programme which identifies the decommissioning options, evaluates the technical feasibility, assesses the environmental and societal impacts, and minimises the risks to human health and safety. The principal method of small platform removal and that proposed for larger platforms would be to lift the topsides onto a heavy lift vessel (HLV) and then lift all or part of the jacket also using a HLV.

Figure 3-25: Heavy lift vessel. *Source: EMAS.com.*

Such operations are weather-dependant. In addition, the world HLV fleet is small, with some nearing the end of their working lives.

Management of simultaneous operations (SIMOPS)

SIMOPS (simultaneous operations) may be described as the potential clash of activities that could cause harm to people, damage to plant and equipment, or both. SIMOPS often involve multiple contractor companies with large multi-disciplined workforces, carrying out a wide range of routine and none routine maintenance, construction and commissioning tasks.

The risks associated with SIMOPS can be eliminated, minimised or managed through proper planning, communication and supervision. When SIMOPS are involved, it is crucial that all parties involved should meet to discuss all activities undertaken, and how they will impact on each other.

The meeting should:

- Identify the main hazards associated with the activities.
- Summarise the control measures to be applied.
- Identify time frames for the activities.
- Identify responsibilities, and nominate the responsible person for each party.
- Identify communications methods for the activities.
- Agree, develop contingency/emergency plans.

It is important that interface documentation is developed for the SIMOPS activities. The document(s) should detail the covered activities, and may include a SIMOPS matrix, to identify which activities are permissible when conducted simultaneously.

The document will include:

- Scope of the activities covered by the document.
- Details of roles and responsibilities.
- SIMOPS risks and mitigation measures.
- Procedures and controls.
- Contingency plans.
- Details of communications processes.
- Permit-to-work details.

SIMOPS will often be managed by a single permit-to-work system, co-ordinated by the person in overall charge of the activities (for example, the client's representative). Regular meetings should take place during the work, as should regular communication between all parties involved in the activities.

Once the SIMOPS have been completed, it is good practice to conduct a close-out review. This should capture any lessons to be learnt for future SIMOPS activities.

3.5 - Fire hazards, risks and controls

Lightning

Lightning is a form of static electricity; it has extremely high electrical potentials and energy and can generate extremely high temperatures. It tends to strike the tallest object on the ground in the path of its discharge.

Figure 4-2: Catalytic gas detector. *Source: J.Hind.*

Figure 4-3: Toxic gas detector. *Source: J.Hind.*

Leak detection

Leak detection may not be considered to be part of the fire and gas detection system. Leak detection is often regarded as a supervisory or maintenance facility, or an adjunct to the fire and gas system by using them in conjunction with other detection methods.

ULTRASONIC LEAK DETECTORS

Devices are available for detecting the sound of leaks at ultrasonic frequencies and have more general application. They do not detect a specific gas but detect the characteristic sound of gas or vapour leaking from the plant (for example, a flange, joint, valve). Time delays are built into the detection system or detectors to aid in differentiating between normal process emissions and leaks.

Ultrasonic gas detectors are mainly used for outdoor environments where weather conditions can easily dissipate escaping gas before allowing it to reach gas leak detectors that require contact with the gas in order to detect it and sound an alarm. These detectors are commonly found on offshore and onshore oil/gas platforms, gas compressor and metering stations, gas turbine power plants.

Figure 4-4: Point leak detector. *Source: J.Hind.*

Fire detection

Fires can be detected from flame, smoke or heat. A combination of devices may be needed for best results. There is no perfect fire detector.

INFRARED (IR) FLAME DETECTORS

The detector relies on infrared radiation produced by flames. The level and wavelength of infrared radiation varies depending on the fuel of the flame being detected. The detector detects a flame within a cone of vision.

The shape and length of the cone of vision varies between different models and manufacturers of flame detectors.

In some detectors, more than one wavelength of infrared radiation is used. Background infrared radiation can lead to reduced sensitivity and reduced effective detection distances. Careful placement is needed.

ULTRA-VIOLET (UV) FLAME DETECTORS

These detectors rely on the effective detection of ultra-violet radiation produced by flames. This is the original type of flame detector and has been largely superseded by other technologies. Detection of hydrogen fires, which used to mandate UV detectors, can also now be done by some infrared flame detectors.

Smoke detection

Smoke detection technology ranges from the battery-powered detectors on sale generally to sophisticated visual, camera-based detection systems.

UN Class	Dangerous Goods	Classification
4	Flammable solids	Flammable solid
		Spontaneously combustible substance
		Substance which in contact with water emits flammable gas
5	Oxidising substances	Oxidising substance
		Organic peroxide
6	Toxic substances	Toxic substance
		Infectious substance
7	Radioactive material	Radioactive material
8	Corrosive substances	Corrosive substance
9	Miscellaneous dangerous goods	Miscellaneous dangerous goods

Figure 5-24: Classes of dangerous goods. *Source: ADR.*

Consignors must identify the hazardous substance that they are transporting. To assist in emergency the driver is responsible for ensuring that the correct paperwork for the load is to hand.

For dangerous goods a Dangerous Goods Note should detail:

- Nature and quantity of dangerous goods.
- UN number or identification number.
- Proper shipping name.
- Class or division (subsidiary risk).
- Packing group (if required).
- All other required information.

This has usually been accomplished through special marking and labelling to indicate the hazards of the consignment on the vehicle and inclusion of relevant information in the transport documents and also by the pleading and labelling displayed on the transport unit.

Warning signs are used to alert emergency services and other road users that a vehicle is carrying dangerous goods which pose a greater risk to people, property and the environment than ordinary loads.

Additional safety precautions will be needed to handle any incident involving the vehicle.

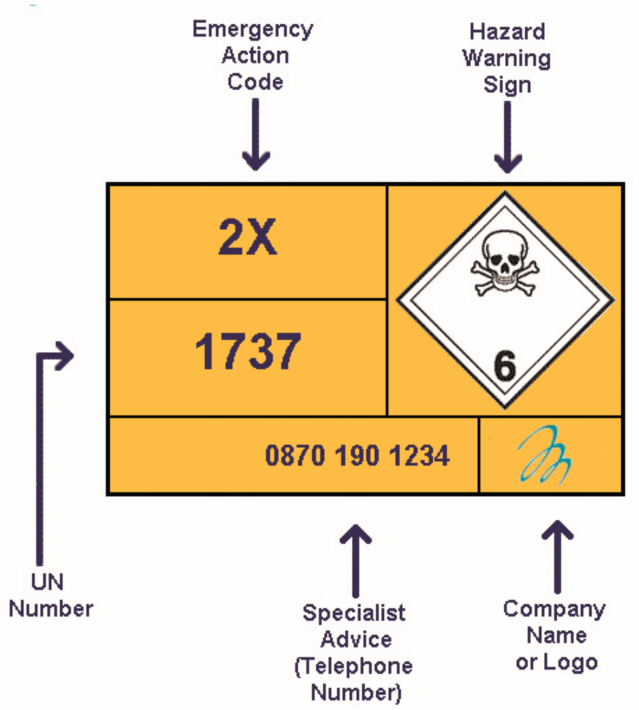

Figure 5-25: Dangerous Goods Note. *Source: NCEC.*

Drivers of tankers and tank containers must be in possession of sufficient written information to ensure they know the nature of the dangers involved in transporting the dangerous substance and the emergency action to be taken if such dangers arise.

The 'Transport Emergency Card (Road)', known more commonly as a ***Tremcard*** must be kept in the vehicle cab, so that this 'information in writing' can be easily located by the emergency services in the event of an accident.

A ***Tremcard*** relating to the previous load should be put into a securable compartment or container, which is clearly marked and capable of remaining closed even in the event of a vehicle roll-over.

PROTECTION OF PLANT AGAINST VEHICLE STRIKE

Storage tanks and other vulnerable equipment should be protected from collision damage by vehicles. This is usually achieved through the use of fixed metal barriers, such as those used on motorway networks. Generally concrete tank bunds are not designed for collision damage and should be similarly protected.

DRIVER TRAINING

ADR requires that drivers of tankers carrying dangerous goods must be suitably trained and certificated (by examination). This certificate/licence has to be updated at specified intervals.

