Example question paper and Examiners' feedback on expected answers (IC)

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NEBOSH INTERNATIONAL DIPLOMA IN OCCUPATIONAL HEALTH AND SAFETY

UNIT IC: INTERNATIONAL WORKPLACE AND WORK EQUIPMENT SAFETY

CONTENTS

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Introduction

NEBOSH (The National Examination Board in Occupational Safety and Health) was formed in 1979 as an independent examining board and awarding body with charitable status. We offer a comprehensive range of globally-recognised, vocationally-related qualifications designed to meet the health, safety, environmental and risk management needs of all places of work in both the private and public sectors.

Courses leading to NEBOSH qualifications attract around 50,000 candidates annually and are offered by over 600 course providers, with exams taken in over 120 countries around the world. Our qualifications are recognised by the relevant professional membership bodies including the Institution of Occupational Safety and Health (IOSH) and the International Institute of Risk and Safety Management (IIRSM).

NEBOSH is an awarding body that applies best practice setting, assessment and marking and applies to Scottish Qualifications Authority (SQA) regulatory requirements.

This report provides guidance for candidates which it is hoped will be useful to candidates and tutors in preparation for future examinations. It is intended to be constructive and informative and to promote better understanding of the syllabus content and the application of assessment criteria.

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General comments

Many candidates are well prepared for this unit assessment and provide comprehensive and relevant answers in response to the demands of the question paper. This includes the ability to demonstrate understanding of knowledge by applying it to workplace situations.

There are always some candidates, however, who appear to be unprepared for the unit assessment and who show both a lack of knowledge of the syllabus content and a lack of understanding of how key concepts should be applied to workplace situations.

Course providers and candidates will benefit from use of the *'Guide to the NEBOSH International Diploma in Occupational Health and Safety'* which is available via the NEBOSH website. In particular, the Guide sets out in detail the syllabus content for unit IC and tutor reference documents for each Element.

Some candidates may over rely on knowledge of health and safety gained through their own work experience. While practical experiences can sometimes be helpful they are not a substitute for tuition and study of the syllabus content, to the breadth and depth indicated in the Guide referred to above.

In order to meet the pass standard for this assessment, acquisition of knowledge and understanding across the syllabus are prerequisites. However, candidates need to demonstrate their knowledge and understanding in answering the questions set. Referral of candidates in this unit is invariably because they are unable to write a full, well-informed answer to one or more of the questions asked.

Some candidates find it difficult to relate their learning to the questions and as a result offer responses reliant on recalled knowledge and conjecture and fail to demonstrate a sufficient degree of understanding. Candidates should prepare themselves for this vocational examination by ensuring their understanding, not rote-learning pre-prepared answers.

Candidates should therefore note this Report has not been written to provide 'sample answers' but to give examples of what Examiners are expecting and more specifically to highlight areas of underperformance.

Common weaknesses and suggestions to assist providers and candidates

It is recognised that many candidates are well prepared for their assessments. However, recurrent issues, as outlined below, continue to prevent some candidates reaching their full potential in the assessment.

Weakness in examination technique

- Many candidates fail to apply the basic principles of examination technique and for some candidates this means the difference between a pass and a referral.
- Candidates need to plan their time effectively. Some candidates fail to make good use of their time and give excessive detail in some answers leaving insufficient time to address all of the questions.
- In some instances, candidates do not attempt all the required questions or are failing to provide complete answers. Candidates are advised to always attempt an answer to a question even when the question is on an unfamiliar topic. At the risk of stating the obvious, an unattempted question will gain no marks. Questions or parts of questions missed can also indicate a weakness in time management.
- Some candidates fail to answer the question set and instead provide information that may be relevant to the topic but is irrelevant to the question and cannot therefore be awarded marks. The comment below about rote learning may be relevant also.

- Some candidates fail to separate their answers into the different sub-sections of the questions. These candidates could gain marks for the different sections if they clearly indicated which part of the question they were answering (by using the numbering from the question in their answer, for example). Structuring their answers to address the different parts of the question can also help in logically drawing out the points to be made in response.

Candidates benefit from the chance to practice answering questions in examination like conditions. This should assist them to become familiar with the need to read questions carefully, consider, plan their answer and then begin to write. By examination like conditions, practicing their answers within appropriate time limits should help candidates with time management within the examination.

Feedback to candidates on their answers to questions is a key part of these practice activities.

Lack of attention to command word

- Many candidates fail to apply the command words (eg describe, outline, etc). Command words are the instructions that guide the candidate on the depth of answer required. If, for instance, a question asks the candidate to 'describe' something, then few marks will be awarded to an answer that is an outline. Similarly, the command word 'identify' requires more information than a list.
- The most common weakness is the provision of too little content in an answer to meet the requirement of the command word. This is an unfortunate error as it can mean that a candidate, who knows the topic, and correct points to include in their answer, misses out on marks.

There is good guidance available to candidates and providers *"Guidance on command words and question papers"* which can be accessed on the NEBOSH website. This guidance will assist candidates to see and understand what is required in an answer when the different command words are used in questions. Some candidates miss out on marks by spending too long writing about one or two points when the answer requires more points to be covered. The chance to practice questions with a range of command words and to receive feedback on the quality of their answers will benefit candidates.

Failing to read the question/memorising answers

- Some candidates appear to have answered a question they hoped to see in the question paper rather than the question actually asked. This error can lead to all the available marks for a question being missed which can significantly impact on the likelihood of achieving the pass standard.

Other weaknesses observed

- Candidates should be aware of the need to make their handwriting as legible as possible.
- Candidates should note that it is not necessary to start a new page in their answer booklet for each section of a question.
- Candidates do not need to write the question out before answering it, they just need to indicate in the top right hand corner of the page which question is being answered. In some cases valuable time is lost doing this rather than focusing on the answer needed.

UNIT IC – International workplace and work equipment safety

Section A – *all questions compulsory*

Question 1 *An organisation (an estate agency) manages residential and commercial properties on behalf of others.*

An estate agency worker accompanies potential buyers when viewing a property. The worker is responsible for unlocking the property, showing potential buyers around the property and then locking the property once the viewing is finished.

(a) ***Identify*** *hazards to the lone estate agency worker while at a property.* ***(3)***

(b) ***Explain*** *how the organisation can manage the risks to the lone workers from this activity.* ***(7)***

This question related to learning outcome IC1.6 of the syllabus. It concerns identifying the hazards of lone working and explaining how the risks can be managed. Candidates and course providers should note that IC1.6 is a consideration of personal safety going wider than the violence and aggression topics covered in Unit B, Element 8 'Psycho-Social Agents'.

This scenario is loosely based around the very real dangers of lone working for this type of worker as illustrated by the disappearance of the 25-year-old estate agent Suzy Lamplugh in 1986. However, candidates did not need to know the details of this case in order to be able to answer the question. The question also guided non-UK candidates on the terminology of 'estate agent' by giving a broad description of the activity.

Part (a) required candidates to give the hazards without any further detailed descriptions. Foremost among these hazards is the worker having to meet strangers and unknown applicants and thereby being exposed to the potential for physical harm and threats of violence. Environmental hazards within the building also exist and these include slips, trips and falls but also extends to pests and vermin. A popular response was 'snakes'.

Fires and incidents while waiting at the property, together with structural hazards/structure collapsing were also valid answers.

Hazards travelling to and from the site were not required, as the question specifically said 'while at a property'.

Part (b) used the command word 'explain', that is, to make an idea or relationship clear. Examiners were looking for candidates to link how they manage the risk with the reasons why. So for example, making appointments with known/identified/ authenticated/background checks would help manage the risk of meeting strangers and being able to verify their identity. Other acceptable answers in context and with an explanation included having high reliability (good reception) mobile phones or lone worker units; a logging-in system on leaving and returning to the office; a requirement that clients first visit the office prior to arranging an accompanied visit; workers having personal safety alarms; doubling-up on visits, where the risk justifies it.

Some candidates wrongly interpreted the question as referring to a 'fixed' site and incorrectly talked about adding fixed CCTV and alarm systems together with having security guards. Candidates need to answer the question in the context that it was asked, rather than putting down an unrelated set of points that relate to lone working generally.

Question 2

(a) ***Outline*** *the principles of a boiling liquid expanding vapour explosion (BLEVE)* ***AND give*** *examples of actual incidents to support your answer.* ***(8)***

(b) ***Outline*** *the effects of a BLEVE.* ***(2)***

This question concerned boiling liquid expanding vapour explosions (BLEVEs).

Some candidates, perhaps due to the industries in which they are employed, found this straightforward, while others struggled. This meant there was a wide-range in the number of marks awarded.

Part (a) was essentially looking for an account of how a BLEVE occurs. That is, some external fire or heat source directly heats a vessel under pressure storing liquid petroleum gas. The internal liquid absorbs the heat and the liquid then begins to boil. This increases the internal pressure to the point where the relief valve lifts and vents flammable vapour. As it vents it expands (typically to 200 times its volume in the liquefied state (the expanding vapour). Further heating can thin and rupture the metal vessel. A source of ignition then causes this expanding vapour to explode.

Examples of BLEVE's include Mexico City (1984), San Carlos de la Rapita (Spanish campsite) (1978) and Palermo (1996). Exact dates were not required in order to gain the marks.

Among the biggest confusion was the difference between a BLEVE and an unconfined vapour cloud explosion (UVCE). This was illustrated by many candidates incorrectly citing Flixborough and Buncefield.

Part (b) required candidates to outline the effects of a BLEVE and an understanding of actual incidents would have assisted in formulating an answer. These include the rapid spread of boiling liquid and vapour and the ensuing fireball, together with the spread of debris, personal injury and structural damage, thermal radiation and domino effects (eg San Juanico and San Carlos de la Rapita).

Question 3

A number of residents of a care home own electrically-operated mobility scooters. The mobility scooters have to be charged from the mains electricity supply. The residents want to store and charge these mobility scooters in the communal areas of the care home.

The care home has agreed to build a dedicated charging area for the scooters.

(a) ***Outline*** *how the storage and charging of the mobility scooters could affect the fire safety of the residents.* ***(4)***

(b) ***Explain*** *how the care home could manage fire safety risks associated with the storage and charging of mobility scooters.* ***(6)***

This question considered the fire hazards posed by electric mobility scooters in care homes. Care homes have been used in the stems of previous questions on this Unit, electric mobility scooters have not. Most candidates appeared to understand the scenario.

Part (a) asked for an outline of how the scooters could affect fire safety. The majority of candidates appreciated that the batteries and chargers on mobility scooters could be a potential source of ignition. Many candidates understood that the plastic body and tyres and fabric seats could be both a source of fuel and a source of toxic smoke.

Only a few candidates went on to look at the issues of how the mobility scooters might block fire escapes and impede access for the emergency services and rescuers.

Part (b) was not answered well for two reasons. Firstly, candidates did not apply the command word, which was 'explain'. Secondly, candidates assumed it was a question on portable appliance testing and therefore provided answers to a different question, so marks were unable to be awarded.

The question was clear in asking candidates to explain how a care home could manage fire safety risks associated with the storage and charging of mobility scooters.

Examiners were looking for an explanation of how the care home managed the risks of blocked escape routes, storage and charging in dedicated areas away from protected exits.

Reducing the risks caused by charging could be dealt with by ensuring that scooters are properly maintained, electrically tested (portable appliance tested) and not left on charge overnight.

The care home would also need to manage the increased risk of fire and smoke through automatic fire detection and suppression systems and in areas with adequate fire protection/compartmentation given the potential life-risk in a home with frail and elderly residents.

Eliminating the risk by storing and charging scooters outside of the main building might also be considered.

Question 4 *A designer is working on a safety-critical, electrical control system that consists of a number of components arranged in series. One of the components is a detector that has a reliability of 0.96. The designer is considering installing two identical detectors in parallel to improve the reliability of the system.*

(a) ***Calculate*** *the improvement in reliability that would be achieved by using two identical detectors in parallel.* ***(3)***

(b) ***Outline*** *factors that should be considered when assessing whether to install the second detector.* ***(3)***

(c) *The designer has been warned that the assumptions of improved reliability from two detectors in parallel might be undermined by common mode failure.*

Outline *the meaning of 'common mode failure'* ***AND outline*** *how it may affect the reliability calculations.* ***(4)***

This question asked candidates to calculate the reliability of two components in parallel. Most candidates' responses were limited and some candidates did not attempt to answer the question.

This topic has been on the current syllabus since August 2011 (having formerly been on Unit A) but appeared to be a surprise question to many candidates.

For part (a) the reliability of the parallel arrangement can be calculated as follows:

Reliability = 1 – [(1 – 0.96)(1 – 0.96)] = 0.9984 or 99.84%.

The improvement can be expressed as either a **relative** or **absolute** improvement:

Relative improvement = $\frac{0.9984 - 0.96}{0.96}$ = 0.04 or 4%

Absolute improvement = 0.9984 – 0.96 = 0.0384 or 3.84%

For part (b), factors that should be considered when assessing whether to install the second detector include the probability of system failure; the consequences of system failure; industry codes of practice and guidance; any legal requirements/risk acceptance criteria. Other considerations include the cost of additional detectors and the ongoing cost of maintenance and inspection.

Part (c) asked candidates to outline the meaning of common mode failure as a type or cause of failure that could affect more than one component at a time.

Calculations can be undermined by the fact that reliability calculations for components in parallel assume *independent* failures and this means that the actual reliability is less than calculated. A failure of the power supply affecting all the components is a typical 'common mode' failure.

The syllabus also requires an understanding of 'holistic' and 'reductionist' approaches to the analysis of systems failures, together with examples.

Question 5

(a) ***Identify*** *hazards associated with the use of mobile elevating work platforms (MEWPs).* ***(5)***

(b) ***Outline*** *control measures that should be taken when using MEWPs.* ***(5)***

Candidates were generally well prepared for this question.

Part (a) required candidates to 'identify' the hazards associated with mobile elevating work platforms (MEWPs) and this was handled quite competently. Most candidates applied the command word and identified the hazards citing instability of the equipment, contact with proximity hazards such as high voltage cables, contact with objects vertically above the MEWP, trapping hazards and the possibility of vehicle strikes/collisions.

Part (b) concerned the control measures required to operate MEWPs safely and this was also handled well by most. Some candidates recognised the different types of MEWPs (vertical/boom and either static/mobile) and incorporated appropriate controls into their answers. Examples of some of the control measures that were given included having properly trained and competent operators; appropriate guards on scissor mechanisms (where relevant); having the equipment correctly positioned, on stable ground and using outriggers; appropriate fall prevent and arrest; cordoning-off the work area using barriers/signs; and having appropriate (and named) PPE.

Some candidates wasted time by giving control measures in part (a) and then repeating them in part (b).

Question 6 ***Outline*** *precautions that should be taken when construction work is to take place under or near overhead power lines that will remain live during the work.* ***(10)***

This was a popular question and there were many reasonable answers to this question although some confused overhead services with underground services. Many candidates wanted to turn off or re-route the cable despite being told in the question that *'power lines will remain active during the work'*.

There were many plausible answers to this question and some of the more obvious answers included consulting the local electricity supply company for advice about precautions; finding out the routes of all overhead lines on the site; finding out details of maximum working heights permitted/horizontal distances; finding out maximum height/vertical reach of machines and those used by contractors, and so on.

An essential element in determining what precautions would be appropriate is information gathering. This is necessary in order to be able to come up with a safe system of work. Candidates then went on to cite, among other points, creating alternative crossing points; using barriers and goal posts; briefing employees, contractors and sub-contractors; having emergency procedures and workers trained in using them; and having strict supervision with banksman/signallers, and so on.

Section B – *three from five questions to be attempted*

Question 7 *An organisation has been appointed as the Principal Contractor for a large refurbishment project for 150 residential properties situated on a former chemical factory site. The properties are located close together on the edge of a large city and within easy access of public services.*

Outline *the contents of the health and safety plan.* ***(20)***

This question concerned the contents of a health and safety plan for a construction site. This was another topic that was historically in Unit A but, along with reliability and other topics, was moved into the Unit C syllabus and has been examinable since July 2012. Both candidates and course providers should by now have understood this change and anticipated that this was an examinable topic on this Unit.

Most responses gave examples of arrangements such as consultation/ communication-related issues and some more practical risk controls. Many candidates missed the opportunity to gain marks by adding the need to describe the project itself and the parties who would be involved in it.

Better answers were characterised by a structured approach and by tailoring the answer to the scenario, as set out in the question stem.

First among those topics would be a description of the project and how it was to be managed. This would include a project description with programme details and key dates. Also, details of who the client/co-ordinator/designer/principal contractor/ consultants were. A review of existing records/plans relevant to health and safety on site; the management structure and responsibilities; health and safety goals monitoring and review of health and safety performance.

A similar approach needed to be applied by candidates to the headings of 'arrangements' and 'controlling significant site risks'.

Many candidates misunderstood the concept of a 'health and safety plan' and wrote about policy, or what a sub-contractor would have to do, rather than considering management controls.

Question 8 *In 2004, nine people were killed and 45 seriously injured at ICL Plastics Glasgow by an explosion in the unventilated basement of a building. Liquefied petroleum gas (LPG) had leaked from a crack in a corroded, unprotected underground pipeline that had been laid 35 years earlier. The LPG leak had migrated into the building.*

(a) ***Describe*** *how corrosion occurs in buried LPG metal pipework.* ***(6)***

(b) ***Outline*** *how buried LPG metal pipework can be protected against corrosion.* ***(4)***

(c) *Other than corrosion protection,* ***outline*** *factors that should be considered to help prevent the recurrence of an explosion in similar LPG pipework installations.* ***(10)***

Question 8 was very unpopular with candidates. This was a technical question concerning corrosion in an underground LPG pipeline. It crossed a number of topic areas on the syllabus and was highly structured, in three parts, in order to guide candidates through the scenario.

Part (a) required candidates to understand the mechanism of corrosion and to describe it in the context of an underground LPG pipeline. Key elements were the presence of a corrosion cell (anode/cathode/electrical contact/electrolyte due to moisture in soil) together with the factors that promote/accelerate the rate of corrosion such as contaminants in soil. Also, the influence of the parent material together with its thickness.

Pipeline protection in part (b) centred around wrapping pipelines with protective tapes; providing protective coatings (bitumen/paint); galvanising; sleeving/dry enveloping; other protection through cathodic protection and the use of sacrificial anodes.

Part (c) appeared to be the most challenging aspect of this question for those candidates who did answer it. Examiners were looking for structured answers around the following points:

Identifying 'at risk' installations and prioritising
Factors that would indicate 'at risk' installations would include the presence of unventilated voids; hazardous features that arise from the design and layout of the building; inherent hazards in the layout or the condition of installation and pipework; the age of the installation; those less well maintained systems; and those located in the most corrosive soils.

Inspection and maintenance
A prerequisite is having accurate plans and drawings, together with pipeline maintenance records. Where information is unavailable then physical excavation and inspection may be required, mindful of the fact that disturbing pipework may increase the risk of leakage.

Monitoring
Additional monitoring may be required at those installations awaiting replacement.

Replacement
A systematic programme needs to be in place for the replacement of metallic pipelines with polypropylene ones.

Like many topics in Unit IC, an understanding of relevant case studies is helpful in appreciating the practical applications and to integrate knowledge. These case studies should form part of candidates' wider reading and preparation for this subject.

Candidates and course providers wishing to find out further information about this disaster are directed to the website www.theiclinquiry.org. This is the homepage of Lord Gill's inquiry and contains useful resources such as the final inquiry report.

Question 9 *A plastics injection moulding machine has been supplied to a workplace.*

Outline** the 'essential health and safety requirements' that you would expect to have been addressed in the technical file for the machine in order to demonstrate that the machine is safe.* ***(20)

This was another question that proved to be unpopular with candidates.

Examiners were looking for candidates to consider the functional safety requirements (the safety goals to be achieved) in the context of a plastic injection-moulding machine.

A particular concern was that many of those candidates who did answer this question seemed to be unaware of the concept of safety integration. This includes eliminating and reducing risks throughout the lifecycle of the machinery; the principles of elimination and reduction; instructions taking account use and foreseeable misuse; taking account of operator constraints; and machinery supplied with essentials for operation and maintenance.

Structured answers covering controls, protection against mechanical hazards, protection against other hazards and maintenance were being sought.

Taking one of those, there were a substantial number of marks available to cover stability of the machine; the risk of break-up during operation; the durability of materials of construction; the machine's inspection requirements; the risks due to falling or ejected objects; the risks due to the machine's surfaces and edges; the effectiveness/choice and characteristics of guards and protection devices and so on.

Examiners formed the impression that candidates were put off by a lack of understanding of what a plastic injection machine was. The syllabus requires candidates to be able to apply their knowledge to a wide range of machines including mechanical and hydraulic presses. Some practical appreciation of how a variety of workplace machines operate is a necessary part of preparing for this element. There are many good introductory texts available for those without a technical background.

Question 10

(a) ***Outline*** *the effects of over temperature in fired tube boilers.* ***(4)***

(b) ***Outline*** *safety device failures and the associated causal factors that would be involved in the following hazardous boiler occurrences:*

(i) thermal shock; ***(4)***

(ii) combustion explosions; ***(4)***

(iii) over pressurisation of shell. ***(4)***

(c) *For* ***TWO*** *of the material defects that can arise in fired tube boilers,* ***identify*** *an appropriate non-destructive test (NDT) technique that would help to detect such defects* ***AND****, in* ***EACH*** *case,* ***identify*** *the defect being examined.* ***(4)***

This was an unpopular question that covered most aspects of element 11, focusing on learning outcome 11.4, the failure of pressure systems.

In part (a) Examiners were expecting to see some understanding that overheating could cause the metal tubes to reach melting point and could be caused by the boiler operating at very low water conditions. A sudden tube rupture could then happen resulting in a loss of water containment, turning to steam with the loss of boiler pressure.

Part (b) required candidates to outline the failures in protective devices that would have to occur for there to be thermal shock, a combustion explosion and shell over pressurisation.

For **thermal shock** some appreciation was required that it is a sudden thermal change occurring within the boiler and caused by rapid and uneven expansion and contraction. It can contribute to boiler stress and eventual cracking.

A **combustion explosion** occurs as a result of some problem with fuel powering the boiler. Plausible answers include an ignition source that ignites the gases within the confined space of the firebox; poor combustion leading to the presence of unburned fuel in the firebox; the result of repeated failed lighting attempts, etc.

Over pressurisation of shell could (for example) occur as a result of excessive steam building up and which exceeds the design pressure of the vessel, causing an explosive breach of the boiler shell; creep or corrosion; failure below the vessel's design limit due to wrong material of construction/or ineffective construction method (eg below standard welding).

Part (c) required candidates to identify an appropriate NDT method for specific identified boiler defects. Linking the NDT method and the defect being assessed were essential in order to gain the marks. Some acceptable answers included acoustic emission to detect embrittlement due to thermal shock; acoustic emission to detect hydrogen embrittlement; magnetic particle testing to detect fatigue cracks; eddy current testing to detect stress corrosion cracking; ultrasonic thickness measurement to detect corrosion thinning of the boiler shell.

Fire tube boilers (the most common sort) seemed to be familiar to those few candidates who did attempt this question. Part of the reason for its unpopularity may be that this is another 'technical' subject. However, it was a highly structured question that led candidates through the individual component parts. Each part could be answered independently of the others so candidates had a chance to at least attempt those aspects that they were familiar with.

Question 11 ***Outline*** *measures that should be considered in order to help reduce risks associated with the movement of vehicles in a workplace.* ***(20)***

This question was very popular. It was based around a very general scenario of reducing the risks arising from workplace vehicle movements.

Control measures were generally well understood, with many competent answers being given.

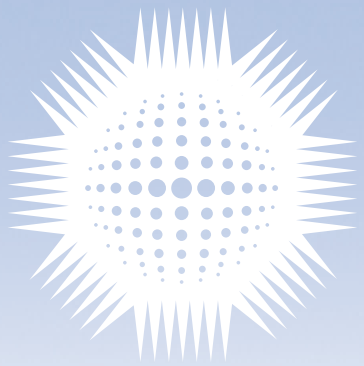
Better answers were structured, rather than being a collection of disconnected points. Typically, these were based around:

Traffic routes: having sufficient width/headroom; being smooth stable ground; minimising sharp bends blind corners; having mirrors at corners; minimising gradients, etc.

Movement of vehicles: having a safe area with sufficient space; fitting warning devices; using visibility aids and vehicle cameras; appropriate use of high-visibility clothing, etc.

Separation of people and vehicles: having separate routes; with passing places/refuges for pedestrians; appropriate floor markings of traffic routes; use of barriers/guard rails; having clearly marked crossing places, etc.

Having appropriate procedures in place: having appropriate selection/health screening/drug and alcohol screening/eyesight testing in place for drivers; controlling visitors and employees; training/certificating drivers; having suitable maintained vehicles that are fit for purpose, etc.



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